SANTIAM CANYON SCHOOL DISTRICT

MECHANICAL UPGRADE PROJECT

BID DOCUMENTS

HMK COMPANY

January 14, 2022

PROJECT MANAGER:	Steve Earle, Sr. Project Manager HMK Company PO Box 1176 Albany, OR 97321 Phone: 503 – 484 – 0085 Email: steve.earle@hmkco.org
DESIGN PROFESSIONAL:	Marlene Gillis, Principal Soderstrom Architects 1200 NW Naito Parkway, Suite 410 Portland, Oregon 97209 Phone: 503 – 228 – 5617 Email: marleng@sdra.com
SCHOOL DISTRICT:	Todd Miller, Superintendent Santiam Canyon School District PO Box 197 Mill City, Oregon 97360 Phone: 503 – 897 – 2321 Email: todd.miller@santiam.k12.or.us
PROJECT:	Santiam Canyon Elementary School Mechanical Upgrade Project
LOCATIONS:	450 SW Evergreen Street Mill City, OR 97360

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THE SANTIAM CANYON SCHOOL DISTRICT
SANTIAM CANYON ELEMENTARY SCHOOL
MECHANICAL UPGRADE PROJECT
Bids Due 2:00 PM, February 9, 2022

INVITATION FOR BIDS

NOTICE IS HEREBY GIVEN bids will be accepted via **ELECTRONICALLY** by Steve Earle, Sr. Project Manager, HMK Company until **2:00 PM** Local Time, **February 9, 2022** at which time and place bids will be closed. A public bid opening will be held via a Teams Meeting at **2:01PM on February 9, 2022.** A link to the meeting will be emailed to those firms that are listed on the Pre-Bid Meeting sign-in sheet prior to the time of bid.

The work consists of: Santiam Canyon Elementary Schools HVAC, Controls, and Electrical Service Upgrade.

The following deadlines and restrictions are applicable to the project: Project start date **June 20, 2022**. Contract must meet a Substantial Completion date of **August 31, 2022.**

A MANDATORY Pre-Bid Meeting will be held at 9:00 AM on January 20, 2022 at the Santiam Canyon Elementary School located at **450 SW Evergreen St, Mill City, OR 97360**. Representatives of the Contractors will meet with the Owner and Project Manager for review of the project specifications and then visit the site for a walk of the facility.

All bids must be submitted on the proposal forms furnished to the bidders. Each bid proposal shall be submitted **ELECTRONICALLY,** and the subject line as follows: **"SANTIAM CANYON SCHOOL DISTRICT – MECHANICAL UPGRADE PROJECT"** and show the name and business address of the bidder. Each bid must be accompanied by an unconditional cashier's check, certified check or surety bond of the bidder in the amount of ten percent (10%). Unsuccessful bidders will have their security refunded to them when the contract has been awarded.

Bid documents may be obtained from HMK Company web site https://www.hmkco.org/bid-documents/

Any objections to or comments upon the bid specifications must be submitted in writing to the attention of Mr. Steve Earle, Sr. Project Manager, HMK Company, PO Box 1176, Albany, OR 97321. To be considered, such objections or comments must be received at least FIVE (5) working days before the bid closing date.

No bid for a construction contract shall be received or considered by the public contracting agency unless the bidder is licensed by the Construction Contractors Board of the State of Oregon as required by ORS 701.035 and 701.055. Each bid must identify whether the bidder is an Oregon resident bidder, as defined in ORS 279A.120.

Bidder's attention is directed to compliance with ORS 279C.370 regarding submission of the First-Tier Subcontractor Disclosure Form. If the contract amount exceeds $100,000.00, the First-Tier Subcontractor Disclosure Form will be required and may be submitted either with the bid or within **two (2)** hours after the bid closing time and date at the bid site address. Failure to provide the First-Tier Subcontractor Disclosure Form may result in bid rejection.

The District reserves the right to reject any or all bids, to waive formalities, and to postpone the award of the contract for thirty (30) days. All bids and all prices quoted in bids shall be firm for a period of thirty (30) days after the bid closing date.

Dated this January 14, 2022

Steve Earle, Sr. Project Manager
on behalf of:
Santiam Canyon School District

PART 1 – GENERAL

1.1 GENERAL

A. The Work contemplated under this contract with Santiam Canyon School District, (also referred to as the Owner or the District), includes all labor, materials, transportation, equipment and services necessary for, and reasonably incidental to, the completion of all Work in connection with the project described in the bidding documents.

B. A brief summary of the Work to be completed for the District is as follows:

The project is: HVAC and Electrical Service upgrade for the existing Elementary School building. This includes a new chiller to be mounted at grade and replacement air handlers added to the mechanical spaces. Electrical upgrades support new mechanical equipment and controls.

1.2 EXAMINATION OF SITE AND CONDITIONS

A. Prior to submitting a bid, the bidder shall examine the District facilities, and ascertain all of the physical conditions in relation thereto. The bidder shall also make a careful examination of the drawings, specifications and other contract documents and shall fully inform himself as to the quantity of materials and the sources of supply of the materials. Failure to make these precautions will not release the successful bidder from entering into a contract or excuse him from performing the Work in strict accordance with the terms of the contract.

B. The Owner will not be responsible for any loss or any unanticipated costs that may be suffered by the successful bidder as a result of such bidder's failure to fully inform himself in advance with regard to all conditions pertaining to the Work and the character of the Work required. No statement made by any officer, agent or employee of the Owner in relation to the physical conditions pertaining to the site of the Work will be binding on the Owner.

1.3 INTERPRETATION OF CONTRACT DOCUMENTS

A. If any person contemplating submitting a bid for the proposed contract finds discrepancies in, or omission from, or is in doubt as to the true meaning of any part of the drawings, specifications or form of contract documents, he may submit to the Architect a written request for an interpretation thereof to be received in the office of the Architect no later than **7 calendar days before bid, before 2:00 PM** local time. The person submitting the request will be responsible for its delivery prior to the time of closing.

B. Any official interpretation of the drawings, specifications, and conditions of the contract or forms of contract documents will be made only by subsequent addenda issued by the Project Manager. The Owner will not be responsible for any other explanation or interpretation of the proposed documents.

1.4 SPECIFIED PRODUCTS AND SUBSTITUTIONS

A. Bids must be based upon the use of items and manufacturers named in the specifications, or approved equals issued by addenda during the bidding period. Approval of equals or substitutions must not be assumed.

B. If a prospective bidder or supplier seeks approval of a particular manufacturer's material or product other than the material, product and / or manufacturer designated in the specifications, he may submit a written request for such substitute material, product and / or manufacturer. Substitution requests are to be submitted using the Substitution Request Form included in this project manual. Substitution requests must be received in the office of the architect no later than **7 calendar days before bid, before 2:00 PM** local time. The person requesting the substitution will be responsible for delivery of the substitution request form prior to the time of closing. **Emailed Substitution Request Forms will be accepted.**

C. Approval of substitution requests will be made only by addenda issued by the Project Manager during the bidding period. The Owner will not be responsible for any other approval of a particular manufacturer's materials.

1.5 PRE-BID MEETING

A. A MANDATORY Pre-Bid Meeting will be held at Santiam Canyon Elementary School on January 20, 2022 at 2:00 PM. Representatives of the Contractors will meet with the Owner and Project Manager at the site for review of the project specifications and site walk of the facility.

B. Contractors intending to submit proposals for this project must attend this pre-bid meeting. No other meeting will be held.

1.6 GENERAL STATUTORY PROVISIONS CONCERNING PUBLIC CONTRACTS

A. In accordance with the provisions of Oregon Revised Statues (ORS) 279C.530, it is agreed that the Contractor shall make prompt payment, as due, to all person supplying to the contractor labor or materials for the prosecution of the Work provided for herein, pay all contributions or amounts due the State Industrial Accident Fund from the Contractor incurred in the performance of the contract herein, not permit any lien or claims to be file or prosecuted against the District on account of any labor or material furnished, and to pay the State Tax Commission all sums withheld from employees pursuant to ORS 316.169, ORS 316.189 and ORS 316.167.

B. Pursuant to ORS 279C.515, it is agreed that if the Contractor fails, neglects or refuses to make prompt payment on any claim for labor or services furnished to the Contractor by any persons in connection with this agreement as such claim becomes due, the proper officer of officers representing the District may pay such claim to the person furnishing the labor or service and charge the amount of the payment against the Contractor. The payment of a claim in the manner authorized in this paragraph shall not relieve the Contractor or his surety from obligation with respect to any unpaid claims.

C. Pursuant to ORS 279C.520, it is a condition of this agreement that no person shall be employed by the Contractor for more than eight (8) hours in any one (1) day, or forty hours in any one (1) week, except in cases of necessity, emergency or where the public policy absolutely requires it, and in such cases, the person shall be paid at least time and a half pay for all overtime in excess of eight (8) hours in any one (1) day and for Work performed on Saturdays and legal holidays.

D. Pursuant to ORS 279C.525 the Contractor shall comply with the provisions of all federal, state and local statues, ordinances and regulations dealing with the prevention

of environmental pollution and the preservation of natural resources that affect the project.

E. Pursuant to ORS 279C.530, it is an express condition of this agreement that the Contractor shall, promptly, as due, make payment to any person, co-partnership, association or corporation furnishing medical, surgical and hospital care or other needed care and attention, incident to sickness or injury, to the employees of such Contractor, or all sums which the Contractor may or shall have deducted from their wages of his employees for such services pursuant to the terms of ORS 279B.230, and any contract entered into pursuant thereto, or collected or deducted from the wages of its employees pursuant to any law, contract or agreement for the purposes of providing or paying for such service.

F. The hourly rate of wage to be paid by the Contractor (and incorporated in his subcontracts) shall not be less than provided in ORS 279C.800 to ORS 279C.870, and as hereinafter included in Section 00 7343-BOLI Wage Rate Requirements.

G. Pursuant to ORS 645.001 et seq. OAR Chapter 437, Div. 3 and OAR Chapter 437-002-0320 through OAR Chapter 437-002-0325, the Contractor shall comply with the following conditions under any contract to provide the District with goods or services.

1. Contractors and their employees shall comply with the requirements of the above cited Laws, Rules, Policies and Regulations

2. The Contractor shall review the Material Safety Data Sheets filed by the District to determine if there are any chemicals stored at the site of Work which the Contractor or any subcontractors will use, or could be exposed to in an emergency

3. Workers shall inform the executive officer at the location where services are being performed of all hazardous chemicals which they or their sub-contractors bring upon education facility property, and upon request, provide the District with M.S.D.S. for such chemicals

H. Each bid shall identify whether the bidder is an Oregon resident bidder, as defined in ORS 279A.120.

I. Pursuant to ORS 279C.830 (3), the contractor and every subcontractor must have a public works bond filed with the Construction Contractors Board before starting work on the project, unless exempt under ORS 279C.836 (4), (7), (8) or (9).

1.7 BID SECURITY

A. No bid will be considered unless accompanied by a cashier's check or bid bond executed in favor of the District and associated facility for an amount equal to at least ten percent (10%) of the base bid and shall accompany the bid as evidence of good faith and as guarantee that if awarded the contract the bidder will execute the contract and provide a performance bond and payment bond as required. The successful bidder's check or bid bond will be retained until he has entered into a satisfactory contract and furnished a 100% performance bond and payment bond. The Owner reserves the right to hold the bid security as hereinafter noted.

B. The bid bond shall be furnished by a bonding company licensed to do business in the State of Oregon.

C. Should the successful bidder fail to execute and deliver the signed agreement and a satisfactory payment bond and performance bond within ten (10) days after the bid has been accepted by the Owner, the cashiers check or bid bond may be forfeited as liquidated damages at the option of the Owner. The date of acceptance of the bid and the award of the contract as contemplated by the contract documents shall mean the day on which the Owner takes official action in making the award.

1.8 EXECUTION OF THE BID FORM

A. The bid form invites bids on definite drawings and specifications. Only the amounts and information asked for on the bid form furnished will be considered as the bid. Each bidder shall bid upon the Work exactly as specified and provided in the bid form. The bidder shall include in a sum to cover the cost of all items contemplated by the bidding documents.

B. The bid form included in the project manual as Document 00 4100 is the official bid form that will be used in submitting a bid. Only the official bid form may be used in submitting a bid.

C. All blank spaces in the official bid form shall be filled and numbers shall be stated both in writing and in figures. If the bid is made by a partnership, it shall contain the names of each partner and shall be signed in the firm name, followed by the signature of the partner signing for the firm. The address of the bidder shall be typed or printed on the bid form.

D. Bids which are incomplete, or which are conditioned in any way, or which contain erasures or alterations may be rejected.

1.9 SUBMISSION OF BID

A. The bid proposal shall be emailed to Steve Earle, **Sr. Project Manager, at** steve.earle@hmkco.org, the subject line should be as follows:
SANTIAM CANYON SCHOOL DISTRICT – MECHANICAL UPGREADE PROJECT BID DOCUMENTS

B. Bids will be received up to **2:00 pm**, local time **February 9, 2022** at the email listed above.

C. Bids shall be considered late if received any time after **2:00 PM Local time on February 9, 2022.** Bids received after the specified time shall be rejected. It is the responsibility of the Contractor to ensure that bids have been received by contacting **Steve Earle, Sr. Project Manager, at 503 – 484 - 0085**

D. The First Tier Subcontractors list **MUST** be emailed to **steve.earle@hmkco.org** **by 2:00 PM on February 9, 2022.**

E. The following attachments are the only items to be included with your Bid Package for the Mechanical Upgrade Project.

a. Attachment 1: Bid Form

b. Attachment 2: Bid Bond
c. Attachment 3: First Tier Sub Contractors List
d. Attachment 4: Reference's
e. Attachment 5: Checklist

F. All items need to be submitted individually. There are to be **NO** additional items included with your Bid. This checklist **MUST** be signed and dated to make your bid complete.

1.10 OPENING OF BIDS

A. A public bid opening will be held via a Teams Meeting at **2:01PM on February 9, 2022.** A link to the meeting will be emailed to those firms that are listed on the Pre-Bid Meeting sign-in sheet.

1.11 DURATION OF BID PROPOSALS

A. The base bid shall be irrevocable for a period of sixty (60) days from the date and time of bid opening.

B. The base bid may be adjusted for alternate prices and / or unit prices for a period of sixty (60) days from the date and time of bid opening.

1.12 CONTRACT AND BOND

A. Within ten (10) days after receipt of Notice of Award, any bidder to whom a contract is awarded shall execute a formal written contract and shall furnish corporate surety bonds with a surety company satisfactory to the District in an amount equal to the full contract sum based upon the estimated quantities of items covered by the contract for the faithful performance of said contract and all provisions thereof; provided, the formation of said contract shall not be completed and the District shall not be liable thereon until said formal written contract has been executed both by the successful bidder and by the District and a performance bond and a payment bond, properly executed has been delivered and accepted by the District.

B. The cashiers check or bid bond of the bidder with whom a contract is entered into will be returned when said contract has been properly executed by the bidder and said performance and payment bond, properly executed, has been delivered to and accepted by the District. The cashiers check or bid bond to each bidder who was not awarded a contract will be returned promptly after the contract and bond of the successful bidder, properly executed, has been delivered to and accepted by the District.

C. Any bidder to whom a contract is awarded and who shall default in executing said formal written contract or in furnishing a satisfactory performance and payment bond within the time and in the manner required by these specifications shall be liable to the District for whatever damages, including expenses and attorney's fees as may be incurred by the District in recovering to another bidder whether by a single action or by successive actions, shall not operate to release any defaulting bidder from said liability. The parties agree that the cashiers check or bid bond amount is fair determination of the amount of damages which the District would incur as a result of any such failure on the part of the bidder and the full amount will be forfeited as liquidated damages and will not constitute a penalty. In the event competent tribunal finds that this amount

does not properly represent an award of liquidated damages, expenses and attorney's fees incurred by the District as a result of the bidder's default, then the final determination of the tribunal shall be deemed to represent the damages, expenses and attorney's fees incurred by the District as a result of the bidder's default.

1.13 SUBSTANTIAL COMPLETION AND LIQUIDATED DAMAGES

A. Substantial Completion shall occur at **August 31, 2022.**

B Should the building not be ready for occupancy by the time and date listed above, liquidated damages to be paid by the Contractor to the Owner for each calendar day of delay, shall be included in the terms of any contract awarded hereunder in lieu of a penalty. The amount of liquidated damages shall be $1,000.00 per day.

1.14 DISTRICT PERSONNEL EXCLUDED FROM THE CONTRACT

A. No officer, agent or employee of the District shall be permitted any interest in the contract.

1.15 RESERVATIONS

A. The Board of Directors of Santiam Canyon School District, expressly reserves the following rights:

1. To reject all bids

2. To waive any or all irregularities in bids submitted

3. To consider the responsibility and competency of bidders in making any award

4. In the event two or more bids shall be for the same amount for the same Work, to award the contract by lot or otherwise as it deems appropriate

5. To award contract to one Contractor with the aggregate low bid

6. To reject any bid or bids not in compliance with prescribed bidding procedures and requirements

7. To reject any bid or bids not meeting the specifications set forth herein

8. In the event any bidder to whom a contract is awarded shall default in executing said formal contract or in furnishing a satisfactory performance and payment bond within the time and in the manner herein before specified, to re-award the contract to another bidder.

9. To accept Alternates in any order or combination, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

1.16 ACCEPTANCE OF CONDITIONS

A. Each bidder by submission of a bid assents to each and every term and condition set forth anywhere in these contract documents and agrees to be bound thereby.

1.17 INTERPRETATION UPON CONTRACT DOCUMENTS

A. Only the Board of Directors of Santiam Canyon School District as represented by the Project Manager has authority to place any interpretation upon the foregoing or annexed contract documents. Any interpretation, either verbal or written, attempted to be placed thereon by any other person will not be binding upon the District.

1.18 EQUAL EMPLOYMENT

A. All bidders shall comply with the Provision of Executive Order 1246 (30 F.R. 12319-25) regarding Equal Employment Opportunity.

1.19 IMMIGRATION REFORM AND CONTROL ACT

A. All bidders shall comply with the provisions of the Immigration Reform and Control Act of 1986 regarding the verification of employment eligibility.

1.20 REFERENCES REQUIREMENTS

A. All bidders shall provide a list of three different project references for projects that the Contractor worked on within the last three years of comparable size and scope. References must be submitted with the Bid Form.

B. Bidders shall use their own form to supply their list of references. The list of project references shall include the following information:

1. Name of the Project

2. Project description

3. Project location

4. Project date

5. Dollar value of the Project

6. Name of the project contact person

7. Telephone number for contact person

8. Fax number for contact person

C. The references will be checked to determine if they are supportive of the bidder's ability to meet the requirements of this ITB.

D. The bidder must provide references that can be contacted regarding the quality of workmanship, level of service provided, timeliness of completion, and adherence to specifications.

E. The School District reserves the right to choose and investigate any reference whether or not furnished by the bidder, and to investigate past performance of any bidder with

respect to its successful performance on similar projects, its completion or delivery of service on schedule, and its lawful payment of suppliers, Subcontractors, and employees.

F. The School District may postpone the award or execution of the Contract after the announcement of the apparent successful Contractor in order to complete its investigation. The School District may reject a bid if, in the opinion of the School District the overall reference responses indicate inadequate performance of the Contractor.

G. The School District representative will make three attempts to contact the references from the list provided by the Contractor. If the reference is not contacted after three attempts that reference will be removed from the list and the bid rejected as non-responsive.

H. Each reference contacted shall be asked the same questions, including but not limited to: (1) quality of service; (2) delivery; (3) responsiveness to reported problems, including orders and billing; (4) how well the Contractor met the terms of the contract; and (5) whether or not the reference would choose to hire the Contractor again.

1.21 CRIMINAL HISTORY CHECK / PHOTO ID

A. It is the responsibility of the Contractor to submit the names of all Contractor employees and all Subcontractor employees who will be on the job site for more than one day. These employees shall fill out a criminal history form provided by the District and the Contractor must submit the completed forms to HMK Company (HMKCO). Criminal history checks will be run through the Oregon State Police as provided for in ORS 326.603. The District shall bear the cost of processing such Criminal history checks.

1. Through the signature on the criminal history form, authorization is also given to HMK Company and its representative to investigate this information. Further, with this signature, consent is given to all governmental agencies, public or private companies and individuals to release information regarding the individual to the HMK Company and to their representative. The District shall bear the cost of processing such Criminal history checks.

B. In accordance with ORS 326.603(8) the District is required to terminate the employment or contract status of any individual who refuses to consent to a criminal history check of to be fingerprinted or falsely swears to the non-conviction of any crime.

C. In accordance with ORS 326.603(7)(a) no individual found to have been convicted of any crime listed in ORS 342.143 or of an attempt to commit one of the listed crimes shall be allowed to work on any District site.

1. It is vital that employees are instructed to accurately complete criminal history forms. Crimes listed in ORS 342.143 which automatically bar an individual from employment with or contracting with the District are primarily crimes of violence, crimes against children, and sex related crimes. However, falsely swearing that you have not been convicted of a crime obligates the District to terminate employment or contract status even if the crime is not listed in ORS 342.143.

D. No Employee shall have direct contact with students.

E. All employees working on site for more than one day shall wear a Name and Photo Identification Badge. Any employee on site for less than one day shall wear a visitor badge. Badges shall be the responsibility of the Contractor to provide. Badge shall state the Santiam Canyon School District, name of the project, employee name, and company they represent.

1.22 TOBACCO FREE EDUCATION FACILITY

A. All bidders shall comply with OAR 581.021.0110 and ORS 326.051 regarding Tobacco Use on Public Grounds.

B. For the purpose of this document “tobacco” is defined to include any lighted or unlighted cigarette, cigar, pipe, clove cigarette, and any other smoking product, spit tobacco, also known as smokeless, dip, chew, snuff, in any form, nicotine or nicotine delivering devices, chemicals or devices that produce the physical effect of nicotine substances or any other tobacco substitute (e.g., e-cigarettes). This does not include FDA approved nicotine replacement therapy products used for the purpose of cessation.

C. No employee, sub-contractor, material supplier, or project visitor is permitted to smoke, inhale, dip, or chew or sell tobacco at any time, including non-education hours.

1. In any building, facility; or

2. On education facility grounds, athletic grounds, or parking lots.

END OF SECTION

DATE:_____

LEGAL NAME OF BIDDER:_____

To: Santiam School District
Board of Directors;
150 SW Evergreen Street
Mill City, Oregon 97360

The Undersigned, having examined the Contract Documents, including the Bidding and Contract Requirements, the General Requirements, the Technical Specifications entitled:

SANTIAM CANYON SCHOOL DISTRICT ELEMENTARY SCHOOL HVAC & ELECTRICAL SERVICE

As prepared by Soderstrom Architects and Santiam Canyon School District, as well as the premises and conditions affecting the Work, hereby proposes and agrees to perform, within the time stipulated, the Work, including all its component parts, and everything required to be performed, and to provide and furnish all labor, material, tools, expendable equipment, transportation and all other services required to perform the Work and complete in a workmanlike manner ready for use, all as required by and in strict accordance with the Contract Documents for the sums computed as follows:

BASE BIDS:

Project: Mechanical Upgrade Project

_____DOLLARS $_____

which lump sums are hereby designated as BASE BIDS,

TIME OF COMPLETION

The Undersigned agrees if awarded the Contract to complete all the Work in an acceptable manner in conformance with the Contract Documents and within the time specified.

ADDITIONAL REQUIREMENTS

1. The Undersigned agrees that the enclosed Bid Guarantee (bid bond, certified or cashier's check) in the amount of ten percent (10%) of the Basic Bid sum made payable to the Owner, shall be kept in escrow with the Owner; that its amount shall be a measure of liquidated damages the Owner will sustain by failure of the Undersigned to execute agreement and furnish bond, and that if the Undersigned fails to deliver the prescribed bond within ten (10) calendar days after receipt of the written notice of award, then the Bid Guarantee shall become the property of the Owner.

2. Should this proposal not be accepted within thirty (60) calendar days after the date and time of bid opening, or if the Undersigned executes Agreement and delivers bond, the Bid Guarantee shall be returned.

3. Contractor's State of Oregon Contractors' License Registration Number.
_____

4. Receipt of Addenda numbered _____ is hereby acknowledged.

5. The undersigned certifies that the Bidder is a _____ Bidder as defined in ORS 279A.120. ("Resident" or "Non-Resident", to be filled in by Bidder)

6. References are to be submitted with Bid Form as per Section 00 2113, 1.20.

SIGNATURES

_____
Legal Name of Bidder's Firm

By:_____ Title:_____

Address:_____ Telephone:_____

Email: _____

State of Incorporation, if Corporation:_____

Names of Partners, if Partnership:

_____ _____

Signed By_____

_____
Printed Name of Bidder / Firm

Company Name: _____

The following attachments are the only items to be included with your Bid Package for the Mechanical Upgrade Project. All items need to be submitted individually. There are to be **NO** additional items included with your Bid. This checklist **MUST** be signed and dated to make your bid complete. **All Bids are to be submitted electronically to steve.earle@hmkco.org by 2:00PM on February 9, 2022.**

Attachment 1: Bid Form _____

Attachment 2: Bid Bond _____

Attachment 3: First Tier Sub Contractors List _____

Attachment 4: Reference's _____

Attachment 5: Checklist _____

Signature:_____ **Date:**_____

Bids which are submitted by Bid Closing, but for which a required disclosure submittal has not been made by the specified Disclosure Deadline, are not responsive and shall not be considered for Contract award.

AGENCY SUPPLIED INFORMATION:

PROJECT NAME: **Mechanical Upgrade Project**

BID #: N/A BID CLOSING: Date: **February 9, 2022** Time: **2:00 PM**
REQUIRED DISCLOSURE DEADLINE: Date: **February 9, 2022** Time: **4:00 PM**
Deliver Form To (Agency): Santiam Canyon School District
Designated Recipient (Person): Steve Earle, Sr. Project Manager
Agency's Address: Email to: steve.earle@hmkco.org

INSTRUCTIONS:

The contracting agency will insert "N/A" below if the contract value is not anticipated to exceed $100,000. Otherwise, this form must be submitted either with the bid or within **TWO (2)** working hours after the advertised bid closing date and time;

FAILURE TO SUBMIT THIS FORM BY THE DISCLOSURE DEADLINE WILL RESULT IN A NON-RESPONSIVE BID. A NON-RESPONSIVE BID WILL NOT BE CONSIDERED FOR AWARD.

It is the responsibility of bidders to submit this disclosure form and any additional sheets, with the bid number and project name clearly marked, and must be submitted at the location specified in the Invitation to Bid on the advertised bid closing date and within two (2) working hours after the advertised bid closing time at the location indicated by the specified disclosure deadline. See "Instructions to Bidders".

List below the name of each subcontractor that will be furnishing labor or materials and that is required to be disclosed, the category of work that the subcontractor will be performing and the dollar value of the subcontract. Enter" NONE" if there are no subcontractors that need to be disclosed. (ATTACH ADDITIONAL SHEETS IF NEEDED).

BIDDER DISCLOSURE:

SUBCONTRACTOR NAME	DOLLAR VALUE	CATEGORY OF WORK
1)		
2)		
3)		
4)		
5)		
6)		
7)		

8)		
9)		
10)		
11)		
12)		
13)		
14)		
15)		
16)		

The above listed first-tier subcontractor(s) are providing labor, or labor and material, with a Dollar Value equal to or greater than:

a) Five percent (5%) of the total Contract Price, but at least $15,000. (If the Dollar Value is less than $15,000, do not list the subcontractor above);

or

b) $350,000 regardless of the percentage of the total Contract Price.

Form Submitted By (Bidder Name): _____

Contact Name: _____

Phone #: _____

Email: _____

END OF SECTION

AGREEMENT made as of the___ day of _____, 2022, between **SANTIAM CANYON SCHOOL DISTRICT (**hereinafter "the Owner") **and** _____, (hereinafter "the Contractor").

The Project is: Santiam Canyon Elementary School
Mechanical Upgrade Project

The Owner is: Santiam Canyon School District
Todd Miller, Superintendent
150 SW Evergreen Street
Mill City, OR 97360

The Architect is: Marlene Gillis, Principal
Soderstrom Architects
1200 NW Naito Parkway, Suite 410
Portland, OR 97209

The Contractor is: Name, Title
Firm Name
Firm Address
City, OR 97xxx

The Owner and Contractor agree as follows:

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, the General Conditions of the Contract, any Supplementary, or other Conditions, Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement; these form the Contract, and are incorporated by this reference herein. The Contract represents the entire and integrated agreement between the parties and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 8.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, including such construction activity as is reasonably inferable from the Contract Documents as necessary to produce the results intended by the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3.1 The date of commencement of the Work shall be the date of the date to be fixed in a notice to proceed issued by the Owner, which shall be issued no less than two (2) days prior to the date of commencement.

3.2 The Contract Time shall be measured from the date of commencement.

3.3 The Contractor shall continuously and diligently prosecute the Work and shall achieve Substantial Completion of the entire Work not later than **August 31, 2022**, subject to approved adjustments of this Contract Time as provided in the Contract Documents.

3.4. If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents, the Owner shall be entitled to recover from the Contractor as liquidated damages and not as a penalty $1,000.00 per day which shall commence on the first day following the expiration of the Contract Time and continuing until the date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable estimate of the damages the Owner will incur as a result of delay in the completion of the Work. The Owner may deduct any accrued liquidated damages from any unpaid amount due or to become due to the Contractor. Any Liquidated damages not so deducted shall be paid to the Owner upon demand together with interest as provided by Oregon law.

ARTICLE 4 CONTRACT SUM

4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's proper and timely performance of the Contract and full and final completion of the Work. The Contract Sum shall be _____ Dollars ($_____). This sum includes all general conditions, profit, overhead and all other amounts due or to become due to the Contractor for the proper and timely performance of the Contract and full and final completion of the Work. The Contract sum is subject to authorized additions and deductions as provided in the Contract Documents.

4.2 PERMITS, FEES AND NOTICES

4.2.1 The Contractor shall secure and pay for:

.1 All pertinent specialty permits. (The owner is securing and paying for the plan review, building permit, and system development fees.)

4.2.2 The Contractor will be responsible for any renewals of and penalties arising from the building permit and from all other permits and governmental or utility fees. The Contractor shall secure and pay for all other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded, including without limitation electrical, sewer, water, and plumbing permits and fees.

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

4.4 Unit prices, if any, are as follows: See Section 00 4100, Bid Form

ARTICLE 5 PAYMENTS

5.1 PROGRESS PAYMENTS

5.1.1 Based upon Applications for Payment which include all the necessary supporting documentation is received by the Owners Delegated Representative, and Owner not later than the first day of the month, and Certificates for Payment are issued by the Owners Delegated Representative, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

5.1.3 Provided that an Application for Payment and all supporting documentation, including all full and unconditional lien waivers related to the Work for which payment is requested is received by the Owners

Delegated Representative and Owner not later than the first day of a month, the Owner shall make payment to the Contractor not later than the last day following the Owners Delegated Representative's approval. If an Application for Payment is received by the Owners Delegated Representative after the application date fixed above, payment shall be as set forth below.

5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Owners Delegated Representative and any Lender may require. This schedule, unless objected to by the Owners Delegated Representative, shall be used as a basis for reviewing the Contractor's Applications for Payment, provided, however, in no instance shall the schedule of values ever exceed the reasonable value of the Work performed.

5.1.5 Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

5.1.6 Unless otherwise provided in the Owner's agreement with any Lender, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of Five percent (5%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Subparagraph 7.3.8 of the General Conditions, or as modified by the parties;

.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 the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of five percent (5%);

.3 Subtract the aggregate of 9.5 previous Payments made by the Owner; and

.4 Subtract amounts, if any, for which the Owners Delegated Representative has withheld or nullified a Certificate for Payment as provided in Paragraph 9.5 of the General Conditions.

or as modified by the parties.

5.1.7 The progress payment amount determined in accordance with Subparagraph 5.1.6 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Owners Delegated Representative, any Lender or the Owner shall determine for incomplete Work, retainage applicable to such Work and unsettled claims;

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Subparagraph 9.10.3 of the General Conditions.

5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

5.1.9 Except with the Owner's prior written approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

5.1.10 Contractor shall:

.1 Make payment promptly, as and when due, to all persons supplying to labor, materials, equipment or services;

.2 Pay all contributions or amounts due the Industrial Accident Fund from Contractor or any Subcontractor incurred in the performance of the Work;

.3 Not permit any lien or claim to be filed or prosecuted against the Owner, on account of any labor, materials, equipment or services furnished, supplied or provided;

.4 Pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167;

.5 Demonstrate that an employee drug testing program as set forth herein is in place for Contractor and all Subcontractors pursuant to ORS 279C.505;

.6 To the extent that any demolition is included as a part of the Work, salvage or recycle construction and demolition debris, if feasible and cost-effective;

.7 To the extent that any lawn or landscape maintenance is included as a part of the Work, compost or mulch yard waste material at an approved site, if feasible and cost-effective.

5.1.11 If the Contractor fails, neglects or refuses to make prompt payment of any claim for labor or services furnished to the Contractor or any Subcontractor by any person in connection with the Work as such claim becomes due, the proper officer or officers representing the Owner may pay such claim to the person furnishing the labor or services and charge the amount of the payment against funds due or to become due the Contractor by reason of this Agreement.

5.1.12 If the Contractor or a first-tier Subcontractor fails, neglects or refuses to make payment to a person furnishing labor or materials in connection with the Work within 30 days after receipt of payment from the Owner or the Contractor, the Contractor or first-tier Subcontractor shall owe the person the amount due plus interest charges commencing at the end of the 10-day period that payment is due under ORS 279C.505 and 279C.580 and ending upon final payment, unless payment is subject to a good faith dispute as defined in ORS 279C.505 and 279C.580. The rate of interest charged to the Contractor or first-tier Subcontractor on the amount due shall equal three times the discount rate on 90-day commercial paper in effect at the Federal Reserve Bank in the Federal Reserve district that includes Oregon on the date that is 30 days after the date when payment was received from the Owner or from the Contractor, but the rate of interest shall not exceed 30 percent. The amount of interest may not be waived.

5.1.13 If the Contractor or a Subcontractor fails neglects or refuses to make payment to a person furnishing labor or materials in connection with the Work, the person may file a complaint with the Construction Contractors Board, unless payment is subject to a good faith dispute as defined in ORS 279C.505 and 279C.580.

5.1.14 The payment of a claim in the manner authorized in this Agreement shall not relieve the Contractor or the Contractor's surety from obligation with respect to any unpaid claims.

5.1.15 No person shall be employed by the Contractor or any Subcontractors, which are subject to the statutory limitations of Oregon law for more than ten (10) hours in any one (1) day, or 40 hours in any one

(1) week, except in cases of necessity, emergency, or where the public policy absolutely requires it, and in such cases, the employee shall be paid at least time and a half pay:

.1 For all overtime in excess of eight (8) hours a day or 40 hours in any one (1) week when the work week is five (5) consecutive days, Monday through Friday; or

.2 For all overtime in excess of ten (10) hours a day or 40 hours in any one (1) week when the work week is four (4) consecutive days, Monday through Friday; and

.3 For all Work performed on Saturday and on any legal holiday specified in ORS 279.334.

5.1.16 The Contractor shall give notice to employees in writing, either at the time of hire or before commencement of Work on the Project, or by posting a notice in a location frequented by employees, of the number of hours per day and days per week that the employees may be required to work. The Contractor shall include an identical provision in its subcontracts and require all Subcontractors, of any tier, to include an identical provision in all subcontracts.

5.1.17 The Contractor shall promptly, as and when due, make payment to any person, co-partnership, association or corporation, furnishing medical, surgical and hospital care or other needed care and attention, incident to sickness or injury, to the employees of the Contractor, of all sums which the Contractor agrees to pay for such services and all moneys and sums which Contractor collected or deducted from the wages of employees pursuant to any law, contract or agreement for the purpose of providing or paying for such service.

5.1.18 Every Subcontractor will comply with ORS 656.017, unless it is an exempt employer under ORS 656.126.

5.1.19 The Contractor is not a contributing member to the Public Employees' Retirement System and will be responsible for any and all federal, state and local taxes applicable to payments received under this Agreement. The Contractor will not be eligible for any benefits from these contract payments of federal Social Security, employment insurance, Workers' Compensation or the Public Employees' Retirement System.

5.1.20 The hourly rate of wage to be paid by the Contractor or every Subcontractor subject to prevailing wage rates to workers, shall be not less than the prevailing rate of wage for an hour's work in the same trade or occupation in the locality where such labor is performed.

5.1.21 The Contractor and every Subcontractor subject to prevailing wage rates to employees shall keep the prevailing wage rates for that project posted in a conspicuous and accessible place in or about the project.

5.1.22 The Contractor and every Subcontractor subject to prevailing wage rates to employees and shall also provide for or contribute to a health and welfare plan or a pension plan, or both, for its employees on the Project and shall post notice describing such plans in a conspicuous and accessible place in or about the Project. The notice preferably shall be posted in the same place as the notice required under 5.1.16. In addition to the description of the plans, the notice shall contain information on how and where to make claims and where to obtain further information.

5.1.23 The Contractor represents and agrees that the specifications contain a sufficient provision stating the existing prevailing rate of wage which must be paid to workers in each trade or occupation required for such public work employed in the performance of the Work either by the Contractor or any Subcontractor or other person doing or contracting to do the whole or any part of the Work contemplated by the contract. Such workers shall be paid not less than such specified minimum hourly rate of wage.

5.1.24 The District represents and agrees that the specifications contain a sufficient provision stating that a fee is required to be paid to the Commissioner of the Bureau of Labor and Industries as provided in ORS

279C.825. The fee shall be paid to the commissioner pursuant to the administrative rule of the commissioner.

5.1.25 The Contractor or the Contractor's surety and every Subcontractor or Subcontractor's surety subject to prevailing wage rates shall file certified statements with the Owner in writing in the form prescribed by the Commissioner of the Bureau of Labor and Industries, certifying the hourly rate of wage paid each worker which Contractor or the Subcontractor has employed upon such public work, and further certifying that no worker employed upon such public work has been paid less than the prevailing rate of wage or less than the minimum hourly rate of wage specified in the contract, which certificate and statement shall be verified by the oath of Contractor or the Contractor's surety or Subcontractor or the Subcontractor's surety that the Contractor or Subcontractor has read such statement and certificate and knows the contents thereof and that the same is true to the Contractor's or subcontractor's knowledge. The certified statements shall set out accurately and completely the payroll records for the prior week including the name and address of each worker, the worker's correct classification, rate of pay, daily and weekly number of hours worked, deductions made and actual wages paid. Each certified statement required shall be delivered or mailed by Contractor or the Subcontractor to the public contracting agency. Certified statements for each week, during which the Contractor or the Subcontractor employs a worker upon the Project shall be submitted once a month, by the fifth (5^{th}) business day of the following month.

5.1.26 The Contractor or Subcontractor shall preserve the certified statements for a period of three (3) years from the date of completion of the contract.

5.1.27 Per ORS 279C.855, the Contractor represents and agrees that the Owner has fully and timely included a provision in the Contract Documents that the Contractor and any Subcontractor shall comply with ORS 279C.840 in the invitation for bids, the request for bids, the contract specifications, the accepted bid or elsewhere in the Contract Documents and that the Owner has no liability for unpaid minimum wages.

5.1.28 Owner shall make progress payments on the contract monthly as Work progresses. Payments shall be based upon estimates of Work completed that are approved by the Owner. A progress payment shall not be considered acceptance or approval of any Work or waiver of any defects therein. In instances when an invoice is filled out incorrectly, or when there is any defect or impropriety in any submitted invoice or when there is a good faith dispute, the Owner shall so notify the Contractor within 15 days stating the reason or reasons the invoice is defective or improper or the reasons for the dispute. A defective or improper invoice, if corrected by the Contractor within seven days of being notified by the Owner, shall not cause a payment to be made later than specified in this section.

5.1.29 If requested in writing by a first-tier Subcontractor, Contractor, within ten (10) calendar days after receiving the request, shall send to the first-tier Subcontractor a copy of that portion of any invoice, request for payment submitted to the Owner or pay document provided by the Owner to the Contractor specifically related to any labor or materials supplied by the first-tier Subcontractor.

5.1.30 Payment of interest may be postponed when payment on the principal is delayed because of disagreement between Owner and Contractor.

5.1.31 The Owner may reserve as retainage from any progress payment an amount not to exceed five percent of the payment. As Work progresses, the Owner may in its sole discretion reduce the amount of the retainage and the Owner may in its sole discretion eliminate retainage on any remaining monthly contract payments after 50 percent of the Work under the contract is completed if, in the Owner's sole opinion, such Work is progressing satisfactorily. Elimination or reduction of retainage shall be allowed only

upon written application by the Contractor, which application shall include written approval of the Contractor's surety; except that when the contract Work is 97-1/2 percent completed the Owner may, at its discretion and without application by the Contractor, reduce the retained amount to 100 percent of the value of the Work remaining to be done. Upon receipt of a written application by the Contractor, the Owner shall respond in writing within a reasonable time.

5.1.32 The retainage held by the Owner shall be included in and paid to the Contractor as part of the final payment of the contract price. The Contractor shall notify the Owner in writing when the Contractor considers the Work complete and the Owner shall, within 15 days after receiving the written notice, either accept the Work or notify the Contractor of Work yet to be performed on the contract.

5.1.33 The Contractor shall not request payment from the Owner of any amount withheld or retained in accordance herewith.

5.1.34 Such time as the Contractor has determined and certified to the Owner that the Subcontractor is entitled to the payment of such amount. A dispute between the Contractor and a first-tier Subcontractor relating to the amount or entitlement of a first-tier Subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to the terms hereof does not constitute a dispute to which the Owner is a party. The Owner shall not be included as a party in any administrative or judicial proceeding involving such a dispute. The Contractor shall include in each subcontract for property

or services entered into by the Contractor and a first-tier Subcontractor, including a material supplier, for the purpose of performing a construction contract:

.1 A payment clause that obligates the Contractor to pay the first-tier Subcontractor for satisfactory performance under its subcontract within ten (10) days out of such amounts as are paid to the Contractor by the Owner under such contract; and

.2 An interest penalty clause that obligates the Contractor, if payment is not made within 30 days after receipt of payment from the Owner, to pay to the first-tier Subcontractor an interest penalty on amounts due in the case of each payment not made in accordance with the payment clause included in the subcontract pursuant to subparagraph .1 of this 5.1.34. The Contractor or first-tier Subcontractor shall not be obligated to pay an interest penalty if the only reason that the Contractor or first-tier Subcontractor did not make payment when payment was due is that the Contractor or first-tier Subcontractor did not receive payment from the Owner or the Contractor when payment was due. The interest penalty shall be:

(A) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(B) Computed at the rate specified in ORS 279C.515(2).

5.1.35 The Contractor shall include in each of its subcontracts, for the purpose of performance of such contract condition, a provision requiring the first-tier Subcontractor to include a payment clause and an interest penalty clause conforming to the standards of 5.1.33 in each of its subcontracts and to require each of its Subcontractors to include such clauses in their subcontracts with each lower-tier Subcontractor or supplier.

5.1.36 If the Contractor is an employer, the Contractor is a subject employer under Oregon's Workers' Compensation Law and shall comply with ORS 656.017 and shall provide Workers' Compensation coverage for all their "subject workers" as defined in ORS Chapter 656.

5.1.37 The Contractor and all Subcontractors subject to licensing with the Oregon Construction Contractors Board shall be duly licensed therewith at the time they bid any Work, enter into any contract to perform any

Work, perform any Work and at all times under which any warranty or repair obligation applies. The Contractor and all Subcontractors performing any Work which requires any other governmental licensing, such as those with the Elevator and Electrical Board, Plumbing Board or Landscape Contractors Board, shall be duly licensed with all appropriate governmental agencies at the time they bid any Work, enter into any contract to perform any Work, perform any Work and at all times under which any warranty or repair obligation applies.

5.1.38 If federal funds are involved, federal laws, rules and regulations applicable to the grant shall govern in the event they conflict with any provision of this Agreement or other required by law. The Contractor certifies that it is not currently employed by the federal government. This provision does not preclude the Contractor from holding another contract with the federal government.

5.1.39 The Contractor shall timely provide the Owner its name, address, social security, federal employee identification number and such other information as the Department of Revenue may require or request.

5.1.40 The Contractor shall comply and require all Subcontractors to comply with the applicable requirements of all laws, codes, ordinances, regulations and statutes, including but not limited to those in ORS Chapters 279A, B and C. To the extent that ORS Chapters 279A, B and C, or any other law, code, ordinance or regulations, requires any tender or condition to be included in this Agreement, such tender or condition is hereby incorporated by this reference. Nothing contained herein shall be construed so as to require the commission of any act contrary to law, code, rule, statute, ordinance or regulation, and wherever there is any conflict between any provisions contained herein and any statute, law, code, ordinance, rule or regulation the provision of this Agreement which is affected shall be curtailed and limited only to the extent necessary to bring it within the requirements of the law, code, rule, statute, ordinance or regulation.

5.1.41 If the Contractor is a foreign Contractor and the contract price exceeds $10,000, the Contractor shall promptly report to the Department of Revenue on forms to be provided by the Department of Revenue the total contract price, terms of payment, length of contract and such other information as the Department of Revenue may require before final payment can be received on the public contract. For purposes of this A.3 I, a foreign Contractor is one who is not domiciled in or registered to do business in the State of Oregon.

5.1.42 The Contractor represents and agrees that the bid documents make sufficient specific reference to federal, state and local agencies that have enacted ordinances or regulations dealing with the prevention of environmental pollution and the preservation of natural resources that affect the performance of the contract and have allocated all known environmental and natural resource risks to the Contractor by listing such environmental and natural resource risks with specificity in the bid documents.

5.1.43 The Contractor shall not discriminate against minority, women or emerging small business enterprises in the awarding of subcontracts. The Contractor shall certify that the Contractor has not and will not discriminate against minority, women, or emerging small business enterprises in obtaining any required subcontracts.

5.1.44 The Contractor shall use recyclable products to the maximum extent economically feasible in the performance of the Contract Work set forth in this document.

5.1.45 As referenced herein, an employee drug testing policy shall be as follows:

.1 The Contractor or Subcontractor shall have in place at the time of the execution of this Contract, and shall maintain during the term of this Contract, a Qualifying Employee Drug Testing Program for its employees that includes, at a minimum, the following:

(A) A written employee drug testing policy;

(B) Required drug testing for all new Subject Employees or, alternatively, required testing of all Subject Employees every 12 months on a random selection basis; and

(C) Required testing of a Subject Employee when the Contractor or Subcontractor has reasonable cause to believe the Subject Employee is under the influence of drugs.

A drug testing program that meets the above requirements will be deemed a "Qualifying Employee Drug Testing Program." For the purposes of this section an employee is a "Subject Employee" only if that employee will be working on the Project job site.

.2 The Contractor shall require each Subcontractor providing labor for the Project to:

(A) Demonstrate to the Contractor that it has a Qualifying Employee Drug Testing Program for the Subcontractor's Subject Employees, and represent and warrant to the Contractor that the Qualifying Employee Drug Testing Program is in place at the time of subcontract execution and will continue in full force and effect for the duration of the subcontract; or

(B) Require that the Subcontractor's Subject Employees participate in Contractor's Qualifying Employee Drug Testing Program for the duration of the subcontract.

5.2 FINAL PAYMENT

5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when:

.1 A final Certificate for Payment has been issued by the Owners Delegated Representative.

5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Owners Delegated Representative's final Certificate for Payment.

ARTICLE 6 TERMINATION OR SUSPENSION

6.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of the General Conditions.

6.2 The Work may be suspended by the Owner as provided in Article 14 of the General Conditions.

6.3 The Owner shall, in addition to the Right to Stop the Work, have the right to require that the Contractor replace or remove construction personnel assigned to the Work, if, in the Owner’s sole determination, specific construction personnel are impairing or impeding the prosecution of the Work.

ARTICLE 7 MISCELLANEOUS PROVISIONS

7.1 Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

7.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

7.3 The Owner's representative is: Steve Earle, Sr. Project Manager, HMK Company. The Owner may change this representative at any time.

7.4 The Contractor's Representative is: _____.

7.5 Neither the Owner's nor the Contractor's Representative shall be changed without ten (10) days written notice to the other party.

7.6 CONTRACTOR'S CONSTRUCTION SCHEDULES

7.6.1 Within ten (10) days after issuance of the Notice to Proceed, the Contractor shall submit a preliminary schedule of the Work. Within 30 days after issuance of the Notice to Proceed, and before any progress payment need be made, the Contractor, after consultations with its Subcontractors and Suppliers of any tier, shall submit six copies of a Contractor's Construction Schedule to the Owners Delegated Representative and one copy to the Owner. Not less than ten percent of the Progress Payment may be withheld until a Contractor's Construction Schedule in a form satisfactory to the Owners Delegated Representative and Owner has been submitted. Neither the Owner nor the Owners Delegated Representative will review the substance of the Contractor's Construction Schedule.

7.6.2 The Contractor's Construction Schedule shall be based upon a critical path method ("CPM") analysis of construction activities and sequence of operations needed for the orderly performance and completion of all separable parts of the Work in accordance with the Contract and within the Contract Time. The schedule shall be a critical path method type in the form of a precedence diagram and activity listing and shall be time-scaled. It shall include the Notice to Proceed date, the Date(s) of Substantial Completion, and the Date(s) of Final Completion in accordance with the Contract Documents. The Critical Path shall be clearly indicated on the Contractor's Construction Schedule. No more than 20% of the progress activities shall be on the critical path, and no more than 30% shall have less than five days of float. The value of any single activity shall not exceed $50,000, except that 5% of the total activities may exceed this limit without prior approval. The time-scaled network diagram shall be summarized on a single sheet not to exceed 11"x 17".

7.6.2.1 The network diagram shall show in detail and in order the sequence of all significant activities, their descriptions, start and finish dates, durations and dependencies, necessary to complete all Work and any separable parts thereof. The activity listing shall show the following information for each activity on the network diagram:

.1 Description;

.2 Duration (not to exceed fifteen working days);

.3 Craft;

.4 Equipment (including hours of usage);

.5 Start and finish dates;

.6 Total float time and free float time;

.7 Dates that work must be performed and completed by other Contractors or Subcontractors to support the Work and the interfaces with such other Contractors; and

.8 Cost-loading, correlated to the Schedule of Values, which, upon approval, shall be used as a basis for determining action on progress payments throughout the Project.

7.6.2.2 A schedule for the purchase and receipt of items required for performance of the Work, showing lead times between purchase order placement and delivery dates, shall be integrated with the Contractor's Construction Schedule. The Contractor shall furnish the Owners Delegated Representative with copies of all purchase orders and acknowledgments and fabrication, production, and shipping schedules for all major items on the critical path within ten days of the Contractor's receipt of each purchase order, acknowledgment or schedule. Neither the Owners Delegated Representative nor the Owner shall be deemed to have approved or accepted any such material, or its schedule, nor deemed to have waived this requirement if some or all of the material is not received.

7.6.2.3 Milestone completion dates shall be clearly defined on the Contractor's Construction Schedule.

7.6.2.4 If abbreviations are used in the Contractor's Construction Schedule, a legend shall be provided to define all abbreviations.

7.6.2.5 The Contractor shall prepare and keep current a schedule of submittals, coordinated with the Contractor's Construction Schedule, which allows the Owners Delegated Representative at least ten (10) days to review the submittals.

7.6.2.6 The Progress Schedules shall be submitted as both a paper copy and in electronic format using the latest version of Microsoft Project. The Contractor may request to use different project management software, such as, Suretrak, but must first receive approval from the Owner, by demonstrating its capabilities. This can be accomplished by submitting a sample CPM printout of similar scope. If the alternative software is accepted, the Contractor will be required to supply the Owner an authorized copy of the software with all user support manuals.

7.6.2.7 At each monthly meeting with the Owner, the Contractor shall submit (a) a bar chart schedule showing the activities planned for the next month, and (b) a report showing actual starts and finishes from the previous month. The bar-chart schedule shall show all Work activities numbered according to the CPM, any submittal or delivery activities with less than five (5) days, one (1) float, and any permitting, testing, or inspection activities by others.

7.6.3 Within ten days after receipt by the Owners Delegated Representative, two copies of the Contractor's Construction Schedule will be returned to the Contractor with comments, following review by the Owner. Review by the Owner and Owners Delegated Representative of the Contractor's Construction Schedule shall not constitute an approval or acceptance of the Contractor's construction means, methods, or sequencing, or its ability to complete the Work in a timely manner.

7.6.4 The Contractor shall utilize and comply with the Contractor's Construction Schedule. The Contractor shall not be entitled to any adjustment in the Contract Time, the Contractor's Construction Schedule, or the Contract Sum, or to any additional payment of any sort by reason of the loss or use of any float time, including time between the Contractor’s anticipated completion date and end of the Contract Time, whether or not the float time is described as such on the Contractor’s Construction Schedule.

7.6.5 Should the Contractor fail to meet any scheduled date as shown on the current Contractor's Construction Schedule, the Contractor shall, if requested, be required at its own expense to submit within ten days of the request an updated Contractor's Construction Schedule. If the Contractor's progress indicates to the Owner that the Work will not be Substantially Completed within the Contract Time, the Contractor shall, at its own expense, increase its work force and / or working hours to bring the actual completion dates of the activities into conformance with the Contractor's Construction Schedule and

Substantial Completion within the Contract Time. The Contractor shall also submit a revised Contractor's Construction Schedule at its own expense within ten days of notice from the Owners Delegated Representative that the sequence of Work varies significantly from that shown on the Contractor's Construction Schedule. Neither the Owner nor the Owners Delegated Representative will, however, review the substance or sequence of the Contractor's Construction Schedule.

7.6.6 Schedule Float Utilization. Float belongs to the benefit of the Project for the Owner's use and no float shall be used without the Owner's written approval. Any float time to activities not on the critical path shall be used by the Contractor to optimize its construction process. Any float time between the end of the final construction activity and the final completion date shall be used by the Owner in determining if additional contract days are to be awarded for changes in the contract or for delays to the contract caused by the Owner. The Contractor will not be entitled to any adjustment in the Contract Time, the Construction Schedule, or the Contract Sum, or to any additional payment of any sort by reason of the Owner's use of float time between the end of the final construction activity and the final completion date.

7.6.7 Delays. The Contractor shall, within seven days of the event, notify the Owner and Owners Delegated Representative in writing of any proposed changes in the Contractor's Construction Schedule or the Contract Time and of any event which could delay performance or supplying of any item of the Work and shall indicate the expected duration of the delay, the anticipated effect of the delay on the Contractor's Construction Schedule, and the action being taken to correct the delay situation. In the event the Contractor is entitled to a change in the Contract Time, the adjustment to the Contract Time shall be limited to the change in the critical path of construction activities.

7.6.8 Final Completion. The Contractor shall attain Final Completion of the Work in accordance with the Contract within 60 days after the date of Substantial Completion.

7.6.9 Meetings. During the period commencing with the issuance of Notice to Proceed and ending with the date of Final Completion of the Work, the Contractor shall attend and participate in and ensure applicable Subcontractors of any tier and Suppliers attend and participate in:

.1 A pre-contract meeting;

.2 A pre-construction meeting;

.3 Regular weekly Project status meetings scheduled by the Owner or by the Owners Delegated Representative to review progress of the Work, to discuss the Contractor's progress reports, to obtain necessary Owner's or Owners Delegated Representative's approvals, and generally to keep the Owner and Owners Delegated Representative informed and involved in the progress of the Project; and

.4 Regular on-site meetings scheduled by the Owner or by the Owners Delegated Representative to review progress of the Work and other pertinent matters.

7.7 Any and all references to "Engineer" or "the Engineer" in this Agreement or in the General Conditions of the Contract shall be deemed for all purposes to mean and refer to: Owners Delegated Representative.

7.8 If any provision of this Agreement or application thereof to any extent shall be invalid or unenforceable the remainder of the Agreement or its application thereof shall not be affected thereby and the provision or application shall be enforced to the fullest extent permitted by law.

7.9 The Contractor shall not assign this Agreement without the prior written permission of the Owner. Contractor shall assign to Owner any and all rights that the Contractor now has or hereafter may acquire pursuant to a contract related to the Project which rights the Owner shall thereafter be entitled to assign to

another person or entity including without limitation any Lender, upon the request of the Owner, provided, however, until the exercise of such rights of assignment by the Owner, there shall be no privity or contractual relationship between the Owner and such persons and entities. The Contractor hereby consents to the free assignment of this Agreement in whole or in part by the Owner to any other person or entity including but not limited to any Lender.

7.10 The Contractor represents and warrants to the Owner who relies thereon as follows:

7.10.1 It and all of its Subcontractors are financially solvent, able to pay debts as they become due and have sufficient working capital to timely perform and complete all obligations related to the Project.

7.10.2 That it is able to timely and completely furnish all the labor, material, equipment and services to necessary to fully complete the Work within the Contract Time.

7.10.3 It and all of its Subcontractors are duly and properly licensed with the Oregon Construction Contractors Board and all other governmental agencies and are signatories to collective bargaining agreements.

7.10.4 It has visited the site, undertaken any and all tests it deems advisable, is familiar with the structure and that it is unaware of any potential condition with would increase the Contract Sum or Contract Time.

7.10.5 It and all of its Subcontractors possess a high level of experience and expertise in projects similar to the Project.

7.10.6 Neither Contractor nor any of its Subcontractors are "exempt" from the requirement to provide Workers' Compensation Insurance under Oregon law.

7.10.7 It is fully authorized to execute this Agreement and perform all the obligations required of it hereunder.

7.11 The representations and warranties of 7.11 are in addition to and not in lieu of any other obligation or law and survive the execution of this Agreement and final completion of the Project.

ARTICLE 8 ENUMERATION OF CONTRACT DOCUMENTS

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

8.1.1 This Agreement.

8.1.2 The General Conditions.

8.1.3 The Supplementary and other Conditions of the Contract.

8.1.4 The Specifications are those contained in the Project Manual dated January 14, 2022.

8.1.5 The Drawings are bound in the project manual.

8.1.6 The Addenda, if any, are as follows:

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 8.

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

a. Exhibits _____

This Agreement is entered into as of the day and year first written above and is executed in at least three original copies, of which one is to be delivered to the Contractor, one to the Owners Delegated Representative for use in the administration of the Contract, and the remainder to the Owner.

CONTRACTOR		**SANTIAM CANYON SCHOOL DISTRICT**	
By:	_____	**By:**	_____
			Todd Miller
Title:	_____	**Title:**	**Superintendent**
Date:	_____	**Date:**	_____
Federal ID #:	_____		

ARTICLE 1 GENERAL PROVISION

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the Agreement), the Request for Bids or Proposals. Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, and Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Consultant. Contractor acknowledges and represents that it has examined all Contract Documents and will examine all Contract Documents created after execution of the Agreement. Contractor represents that such Contract Documents are suitable and sufficient to enable Contractor to timely complete the Work for the Contract Sum within the Contract Time.

1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Consultant and Contractor, (2) between the Owner and any Subcontractor, including, but not limited to, any Sub-subcontractor, (3) between the Owner and Consultant or (4) between any persons or entities other than the Owner and Contractor. The Consultant shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Consultant's duties.

1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes any and all labor (including, but not limited to, supervision and management), transportation, materials, equipment and services provided or to be provided by the Contractor to timely fulfill the Contractor's obligations and render the Project complete and usable for its intended purpose. The Work includes all labor, material, equipment and services incidental to or which may be inferred from any of the Contract Documents. The Work may constitute the whole or a part of the Project.

1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

1.1.6 THE SPECIFICATIONS

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

1.1.7 THE PROJECT MANUAL

The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In case of any conflict in the requirements of the Contract Documents, the Contractor is deemed to have included the better Quality and larger Quantity of the Work.

1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

1.2.3 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.3 CAPITALIZATION

1.3.1 Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document or (3) the titles of other documents.

1.4 INTERPRETATION

1.4.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.5 EXECUTION OF CONTRACT DOCUMENTS

1.5.1 The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Consultant shall identify such unsigned Documents upon request.

1.5.2 Execution of the Agreement by the Contractor is a representation that the Contractor has visited the site, become fully familiar with the nature, location and character of the site and surrounding areas, weather conditions, availability of labor, materials, equipment and services, site conditions, surface conditions, subsurface conditions, the Contract Documents, existing local conditions under which the Work is to be performed, the time period for performance and completion of the Work. Contractor represents that it has performed personal observations and correlated the observations with the requirements of the Contract Documents such that the Contractor is not aware of any discrepancies, omissions, ambiguities or conflicts in or among any of the Contract Documents.

1.6 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

1.6.1 The Drawings, Specifications and other documents, including any in electronic form, prepared by the Consultant and the Consultant's consultants are documents through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any

Subcontractor, including, but not limited to, any Sub-subcontractor or material or equipment supplier shall own or claim any intellectual property rights in the Drawings, Specifications and other documents prepared by the Consultant or the Consultant's consultants. All copies of the documents, except the Contractor's record set, shall be returned or suitably accounted for to the Consultant, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Consultant and the Consultant's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, including, but not limited to, any Sub-subcontractor 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 the Owner, Consultant and the Consultant's consultants. The Contractor, Subcontractors, including, but not limited to, any Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Consultant and the Consultant's consultants appropriate to and for use in the execution of their Work under the Contract Documents only. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Consultant and the Consultant's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the any intellectual property right or other reserved rights.

ARTICLE 2 OWNER

2.1 GENERAL

2.1.1 The Owner is the entity identified as such in the Agreement and is referred to throughout the Contract Documents. The Owner may designate in writing a representative who subject to the limitations provided by law, shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Subparagraph 4.1, the Consultant does not have such authority. The term "Owner" means the Owner or the Owner's Authorized Representative.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.1 Except for permits and fees, including those required under Subparagraph 3.7, which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

2.3 OWNER'S RIGHT TO STOP THE WORK

2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Paragraph 1.1.3, or persistently fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, nor give rise to any claim for additions to the Contract Sum or Contract Time.

2.3.2 The Owner shall, in addition to the Right to Stop the Work, have the right to require that the Contractor replace or remove construction personnel assigned to the Work, if, in the Owner’s sole determination, specific construction personnel are impairing or impeding the prosecution of the Work.

2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, immediately without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate

Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Consultant's additional services made necessary by such default, neglect or failure. Such change order shall be deemed signed by the Contractor for the purposes of this Agreement even if the Contractor fails to physically sign such Change Order. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall promptly pay the difference to the Owner. The rights stated herein shall be in addition to and not in lieu of any rights afforded the Owner.

ARTICLE 3 CONTRACTOR

3.1 GENERAL

3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's Authorized Representative.

3.1.2 The Contractor shall perform and complete the Work in accordance with the Contract Documents for the Contract Sum and within the Contract Time.

3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Consultant in the Consultant's administration of the Contract, or in the performance of its obligations or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.1 Since the Contract Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner, shall take field measurements of any existing conditions, including all general reference points and interfering site conditions related to that portion of the Work and shall observe any conditions at the site affecting it and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing such activities. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, any errors, inconsistencies or omissions known, recognized or discovered by the Contractor shall be reported promptly to the Consultant in writing as a request for information in such form as the Consultant may require.

3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Consultant in writing, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity recognized discovered by or made known to the Contractor shall be reported promptly to the Consultant in writing. The accuracy of grades, elevations, dimensions, locations or otherwise of existing conditions are not warranted to be accurate. The Contractor is solely responsible for verifying the accuracy of grades, elevations, dimensions, locations or otherwise of existing conditions prior to entering in to the Contract.

3.2.3 If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Consultant in response to the Contractor's notices or requests for information pursuant to Subparagraphs 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Subparagraphs 4.3.6 and 4.3.7. If the Contractor fails to perform the obligations of Subparagraphs 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if

the Contractor had performed such obligations. Except as provided herein, the Contractor shall not be liable to the Owner or Consultant for damages resulting from errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor discovered, had knowledge of, recognized or should have recognized such error, inconsistency, omission or difference and failed to report it to the Owner and to the Consultant or accepted the responsibility to verify the same. If the Contractor performs any construction activity it knows or reasonably should have known involves an error, inconsistency or omission in the Contract Documents or reports referenced therein without such notice to the Owner and the Consultant, the Contractor shall assume responsibility for such performance and shall bear the costs attributed to the correction.

3.2.4. In addition to and not in derogation of the Contractor's duties the Contractor shall take all field measurements and verify all field conditions and shall carefully compare such field measurements and conditions with all other information known to the Contractor or included in any of the Contract Documents before commencing any construction activity for the Work. The Owner shall not be liable for any errors, inconsistencies or omissions which should have been reasonably discovered and the Contractor shall report in writing to the Consultant and Owner any errors, inconsistencies or omissions.

3.2.5. Any investigations of subsurface conditions have been made for design purposes only. The results of these investigations may be available for the convenience of the Bidders and the Sub-bidders but are not a part of the Contract Documents. While the Contractor may rely on such investigation results there is no representations or warranties, express or implied that the conditions indicated are representative of those existing at the site or that unforeseen developments may not occur. The Contractor is solely responsible for reasonably interpreting the information and extrapolating beyond the location of each individual boring, test pit, or other testing location.

3.2.6. The Contractor shall do no work without applicable Drawings, Specifications, or written modifications or, where required, Shop Drawings, Product Data, or Samples, unless instructed to do so in writing by the Consultant and Owner.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract. Contractor shall review any specified construction or installation procedure and shall advise the Owner and the Consultant in writing if the specified procedure deviates from acceptable construction practices will impact any warranty or if the Contractor has any objection thereto.

3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors, of any tier, and their agents and employees, and any other persons or entities performing portions of the Work for or on behalf of the Contractor or any Subcontractors of any tier and for any damages, losses, costs and expenses resulting from such acts or omissions.

3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

3.3.4. The Contractor shall inspect, prior to installation, all materials and equipment delivered to, installed at, or fabricated at the site and shall reject that which will not conform to the Contract Documents when fully and properly installed.

3.4 LABOR AND MATERIALS

3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, telephone, data transmission, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.4.2 The Contractor may make substitutions only with the written consent of the Owner, after evaluation by the Consultant and in accordance with a Change Order.

3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.5 WARRANTY

3.5.1 The Contractor warrants to the Owner and Consultant that the Work, including, but not limited to, any and all materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Consultant, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. In addition, the Contractor assigns to the Owner any and all warranties. The Contractor further warrants that all construction activity of the Work shall be performed on the Work so as to preserve all such warranties. To the extent that any warranty is non-assignable, Contractor warrants that it will pursue such warranty claim for the use and benefit of the Owner without cost or expense to the owner. The Contractor shall require this provision to be included in all subcontracts of any tier.

3.6 TAXES

3.6.1 The Contractor shall pay as and when due sales, consumer, property, occupational, Social Security benefits, unemployment compensation, use and similar taxes, excises, duties and assessments for the Work provided by the Contractor.

3.7 PERMITS, FEES AND NOTICES

3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received, negotiations concluded or the Contract is executed. To the extent that there is any difference in these requirements the most stringent requirements on the Contractor shall apply.

3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to performance of the Work. If the Contractor fails to comply or give such notices it will be liable for and shall to the fullest extent permitted by law defend indemnify and hold the Owner and Consultant and their respective employees, officers and agents harmless from any costs, loss, penalty or damage.

3.7.3 Except as otherwise provided herein, it is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor becomes aware, gains knowledge, recognizes or observes that

portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Consultant and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

3.7.4 If the Contractor performs Work knowing the construction activity to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Consultant and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs, loss, damages and penalties attributable to correction.

3.8 ALLOWANCES

3.8.1 The Contractor shall include in the Contract Sum any and all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

3.8.2 Unless otherwise provided in the Contract Documents:

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at-the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances;

.3 whenever 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 (I) the difference between actual costs and the allowances under Clause 3.8.2.1 and (2) changes in Contractor's costs under Clause 3.8.2.2.

3.8.3 Materials and equipment under an allowance shall be selected by the Owner in sufficient time to avoid delay in the Work.

3.9 SUPERINTENDENT

3.9.1 The Contractor shall employ an experienced and competent superintendent and necessary assistants who shall be in attendance at the Project site at all times during performance of the Work including completion of the punch list. The Contractor shall notify the Consultant and the Owners Representative as to the identity of the superintendent who shall not be changed during the course of the Work without prior written notification to the Consultant and Owner Representative. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

3.10.1 The Contractor, promptly and within ten (10) days after being awarded the Contract, shall prepare and submit for the Owner's and Consultant's information a preliminary Contractor's construction schedule for the Work consistent with the with the requirements of the Contract Documents. Prior to submitting its first Application for Payment, the Contractor, after consultation with its subcontractors, shall submit six (6) hard copies and one electronic copy of the Contractor’s construction schedule consistent with the requirements of the Contract Documents. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall

provide for expeditious and practicable execution of the Work. The construction schedule shall not be changed without the prior written consent of the Owners Representative.

3.10.2 The Contractor shall prepare and keep current, for the Consultant's review, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Owner and the Consultant reasonable time to review in accordance with the Specifications and submittal procedures. The Contractor should expect a response time of approximately 21 days from the Consultant and Consultant's consultants. Neither the Consultant nor Owner can represent or guarantee response times from governmental authorities, such as permitting agencies. Neither the Contractor's preparation, nor the Consultant's receipt or review shall modify the Contractor's responsibility to make required submittals or to do so in a timely manner.

3.10.3 The Contractor shall perform the Work in accordance with the most recent schedules submitted to the Owner and accepted by the Owner and shall promptly notify the Owner of any deviations from the schedule. Should the Contractor fail to comply with the schedule, or in the Owner's opinion fail, refuse, or neglect to supply a sufficient amount of labor, materials, equipment or services in the prosecution of the Work, the Owner shall have the right to direct the Contractor to furnish such additional labor, materials, equipment or services to comply with the schedule and all costs thereof shall be borne by the Contractor and shall not increase the Contract Sum. All schedules submitted shall be in the form acceptable to the Owner using critical path methodology (CPM) clearly showing overall Project and specific items and tasks of construction activities, dependencies and durations as well as overall and specific commencement and completions dates. The critical path activities shall be highlighted, float and non-critical activities shall be shown and the start and stop times for each activity shall be listed. Float belongs to the benefit of the Project for the Owner's use and no float shall be used without the Owner's written approval. The Contractor shall at all times monitor the progress of the Work for conformance with the CPM schedule accepted by the Owner and shall promptly advise the Owner and Consultant of any impacts or delays or potential impacts or delays. The Contractor shall also update the construction schedule to reflect actual conditions and shall propose plans in order to avoid or correct any impact or delays.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

3.11.1 The Contractor shall maintain at the site for the Owner one (1) record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record field changes and selections made during construction, and one (1) record copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be accessible to inspectors and available to the Consultant and Owner and shall be delivered to the Consultant for submittal to the Owner upon completion of the Work and before Contractor's request for final payment.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.12.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Consultant or any other

person is subject to the limitations of Subparagraph 4.2. 7. Information submittals upon which the Consultant is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Consultant without action.

3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Consultant, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Consultant without action.

3.12.6 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Consultant.

3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by any approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Consultant and Owner in writing of such deviation at the time of submittal and (1) the Consultant has given specific written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the, any person's approval thereof.

3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Consultant on previous submittals. In the absence of such written notice, any person's approval of a resubmission shall not apply to such revisions. Contractor shall submit Shop Drawings, Product Data, Samples and similar submittals in forms and in a manner reasonably acceptable to the Consultant. Contractor shall submit no less than two (2) copies or examples for review of any Shop Drawings, Product Data, Samples or similar submittals at Contractor’s sole cost and expense.

3.12.10 The Contractor shall not be required to provide professional services which constitute the practice of Architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Consultant will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Consultant. The Owner and the Consultant shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided the Owner and Consultant have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Subparagraph 3.12.10, the Consultant will review, approve or take other appropriate action on submittals only for the limited purpose of checking

for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

3.13 USE OF SITE

3.13.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. Notwithstanding anything contained in the Contract Documents to the contrary, the Contractor shall, as part of the Work, not disrupt or interfere in any manner with any of the Owner's or Owner's authorized provider's operations at the Project site or any other locations, including, without limitation any and all educational, social, athletic or recreational programs, activities, classes or events. Contractor shall not park or otherwise utilize any other area designated by the Owner or typically used by Owner's employees, staff, students, parents or visitors or local residents or businesses.

3.14 CUTTING AND PATCHING

3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work. To the extent that the Work involves renovation, alteration or repair of existing improvements, cutting and patching essential for the Project shall be successfully completed and Contractor shall perform the Work so that it is fully integrated into the existing improvements operationally and aesthetically.

3.15 CLEANING UP

3.15.1 The Contractor shall at all times keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

3.16 ACCESS TO WORK

3.16.1 The Contractor shall provide the Owner and Consultant and their employees. agents and officers access to the Work in preparation and progress wherever located.

3.17 ROYALTIES, PATENTS AND COPYRIGHTS

3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Consultant harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Consultant. However, if the Contractor has reason to believe that the required design, process

or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Consultant in writing.

3.18 INDEMNIFICATION

3.18.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Paragraph 11.2, the Contractor shall indemnify and hold harmless the Owner, Consultant, Consultant's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, any Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph 3.18.

3.18.2 In claims against any person or entity indemnified under this Paragraph 3.18 by an employee of the Contractor, Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Subparagraph 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

4.1 CONSULTANT OR OWNER'S REPRESENTATIVE

4.1.1 The term "Consultant" as used in the Contract Documents, shall mean Soderstrom Architect or "Owner's Representative", as used in the Contract Documents, shall mean HMK Company (HMKCO), and its respective personnel.

> **4.1.2.1** If a licensed Consultant is engaged by Owner who is not designated as the "Owner's Representative", the Owner shall make written directive and notification to Contractor, which shall perform any Contract Administration duties. For ease of reference and consistency, the term "Consultant" shall be used in the Contract Documents to refer to the contract administrator.

4.1.2 Duties, responsibilities and limitations of authority of the Consultant as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, and Consultant.

4.1.3 If the employment of the Consultant is terminated, the Owner shall employ a new Consultant under such terms and conditions as are agreeable between the Owner and the new Consultant.

4.2 CONSULTANT'S ADMINISTRATION OF THE CONTRACT

4.2.1 The Consultant may provide administration of the Contract as described in the Contract Documents, and may be an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Paragraph 12.2. The Consultant will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

4.2.2 The Consultant, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about

the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the Work, and (3) to determine in general if the Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Consultant will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Consultant will neither have control over or charge of, nor be responsible 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 the Contractor's rights and responsibilities under the Contract Documents, except as provided in Subparagraph 3.3.1.

4.2.3 The Consultant will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Consultant will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, any Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

4.2.4 Communications Facilitating Contract Administration. The Owner, Owners Representative and Contractor may communicate with each other through the Consultant about matters arising out of or relating to the Contract. The Contractor shall also PROVIDE THE OWNER AND OWNERS REPRESENTATIVE WITH A DIRECT COPY OF ALL WRITTEN COMMUNICATIONS TO THE CONSULTANT, including all notices, requests, Claims and potential changes in the Contract Sum or Time, but not including Shop Drawings, Product Data or Samples. Communications by and with the Consultant's consultants shall be through the Consultant. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

4.2.5 Based on the Consultant's evaluations of the Contractor's Applications for Payment, the Consultant may review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

4.2.6 The Consultant may have authority to reject Work that does not conform to the Contract Documents. Whenever the Consultant considers it necessary or advisable, the Consultant may have authority to require inspection or testing of the Work in accordance with Subparagraphs 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Consultant nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Consultant to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

4.2.7 The Consultant will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Consultant's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Consultant's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Consultant's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Paragraphs 3.3, 3.5 and 3.12. The Consultant's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Consultant, of any construction means, methods, techniques, sequences or procedures. The Consultant's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.2.8 The Consultant may prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Paragraph 7.4.

4.2.9 The Consultant may conduct inspections to determine the date or dates of Substantial Completion and the date of final completion, may receive and forward to the Owner, for the Owner's review and records,

written warranties and related documents required by the Contract and assembled by the Contractor, and may issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

4.2.10 If the Owner and Consultant designate, the Consultant will provide one or more project representatives to assist in carrying out the Consultant's responsibilities at the site.

4.2.11 The Consultant may interpret and decide matters concerning performance under and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Consultant's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Consultant shall be furnished in compliance with this Paragraph 4.2, then delay shall not be recognized on account of failure by the Consultant to furnish such interpretations until 5 days after written request is made for them.

4.2.12 Interpretations and decisions of the Consultant, if any, will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Consultant will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

4.2.13 The Consultant's decisions on matters relating to aesthetic effect may be final if consistent with the intent expressed in the Contract Documents. The terms and conditions of the Owner's agreement with the Consultant shall govern the Consultant's responsibilities.

4.3 CLAIMS AND DISPUTES

4.3.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, and extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

4.3.2 Time Limits on Claims. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Consultant and the other party.

4.3.3 Continuing Contract Performance. Pending final resolution of a Claim except as otherwise agreed in writing or as provided in Subparagraph 9.7.1 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

4.3.4 Claims for Concealed or Unknown Conditions. Except as otherwise provided herein, if conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) 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, the Contractor shall give written notice to the Owner and the Consultant promptly before conditions are disturbed and in no event later than seven (7) days after first observance of the conditions. The Consultant may promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both, consistent with the requirements of the Contract Documents. If the Consultant determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Consultant may so

notify the Owner and Contractor in writing, stating the reasons. Any claim of the Contractor arising from the Consultant's determination shall be made in accordance with the dispute resolution procedures set forth in Paragraphs 4.4 through 4.6. No adjustment in the Contract Time or Sum shall be permitted, however, if connection with any concealed or unknown condition which does not materially differ from those disclosed or which should have reasonably been discovered by the Contractor's prior visits, observations, tests or for which the Contractor assumed any responsibility to verify.

4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work, and a Claim must be made in accordance with Paragraphs 4.4 through 4.6 or it will be deemed waived. Prior notice is not required for Clams relating to an emergency endangering life or property arising under Paragraph 10.6.

4.3.6 If the Contractor believes additional cost is involved for reasons, including, but not limited to:

.1 a written interpretation from the Consultant

.2 an order by the Owner to stop the Work where the Contractor was not at fault

.3 a written order for a minor change in the Work issued by the Consultant

.4 failure of payment by the Owner

.5 termination of the Contract by the Owner

.6 Owner's suspension or

.7 other reasonable grounds, Claim shall be filed in accordance with this Paragraph 4.3.

All Claims for additional costs shall include any and all costs, including, but not limited to, any and all direct and indirect costs thereof.

4.3.7 Claims for Additional Time

4.3.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given and a Claim shall be made as provided herein. The Contractor's Claim shall include an estimate of any cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. If the delay was not caused by the Owner, the Contractor, a Subcontractor of any tier, or the Consultant, or anyone acting on behalf of any of them, the Contractor shall be entitled only to an increase in the Contract Time, in accordance with the Contract documents, but not a change in the Contract Sum. If the delay was caused by the Contractor, a Subcontractor of any tier, or anyone acting on behalf of any of them, the Contractor is not entitled to an increase in the Contract Time or in the Contract Sum.

4.3.7.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction, and that the Work was on schedule (or was not behind schedule through the fault of the Contractor) at the time the adverse weather conditions occurred. Neither the Contract Time nor the Contract Sum will be adjusted for normal inclement weather. The Contractor shall be entitled to a change in the Contract Time only if the Contractor can substantiate to the reasonable satisfaction of the Owner and Consultant that there was materially greater than normal inclement weather considering the full term of the Contract Time and using a ten-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 of the Project, and that the alleged abnormal inclement weather actually extended the critical path of the Work. IF the total net accumulated number of calendar days lost due to inclement weather from commencement of the

Work until Final Completion exceeds the total net accumulated to be expected for the same period from the aforesaid data, and the Owner grants the critical path.

4.3.8 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

4.3.9 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

4.3.10 Time is of the Essence. The parties agree that the Owner shall be entitled to recover liquidated damages at the rate stated in the Agreement, which shall commence on the first day following the expiration of the Contract Time and continuing until the date of Substantial completion.

4.4 RESOLUTION OF CLAIMS AND DISPUTES

4.4.1 In an effort to reduce the incidence and costs to all parties of extended disputes, all Claims, direct or indirect, arising out of, or relating to, the Contract Documents or the breach thereof, except claims which have been waived under the terms of the Contract Documents, shall be decided exclusively by the following alternative dispute resolution procedure unless the parties mutually agree in writing otherwise.

4.4.2 The Contractor shall submit a written notice of any Claim to the Owner and the Consultant within 14 days of the occurrence of the event giving rise to such Claim and shall include a clear description of the event leading to or causing the Claim. The Contract shall submit a written Claim as providing herein within 30 days of the notice. Claims shall include a clear description of the Claim and any proposed change in the Contract Sum (showing all components and calculations) and/or Contract Time (showing cause of and analysis of the resultant delay in the critical path) of the Claim and shall provide data fully supporting the Claim. Failure to properly submit the notice of Claim shall constitute waiver of the Claim. The Claim shall be deemed to include all changes, direct and indirect, in cost and in time to which the Contractor (and Subcontractors of any tier) is entitled. Any claim of a Subcontractor of any tier may be brought only through, and after review by, the Contractor.

4.4.3 Upon receipt of a Claim against the Contractor or at any time thereafter, the Consultant or the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Consultant or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

4.4.4 If a claim relates to or is the subject of a mechanic’s lien or construction lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines prior to resolution of the Claim by the Consultant, by mediation or by litigation.

4.4.5 Within 30 days of the Owner’s receipt of the written Claim, the Contactor may require that an officer of the Contractor, a principal of the Consultant, and the Owner’s Superintendent or designee (all with authority to settle) meet, confer, and attempt to resolve the Claim during the following 21 days. The Owner may continue the meeting to a time after it has assembled and reviewed data. If the Claim is not resolved, the Contractor may bring no claim against the Owner unless the Claim is first subject to nonbinding mediation as described in Paragraph 4.5. This requirement cannot be waived except by an explicit written waiver.

4.4.6 The Contractor agrees that the Owner may join the Contractor as a party to any litigation/arbitration involving the alleged fault of the Contractor or Subcontractor of any tier.

4.5 MEDIATION

4.5.1 Any Claim arising out of or relating to the Contract, except Claims relating to aesthetic effect and except those waived shall be subject to mediation as a condition precedent to the institution of legal or equitable proceedings by either party. This requirement cannot be waived except by an express written waiver.

4.5.2 The parties shall endeavor to resolve their claims by mediation, which unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rule of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract and with the American Arbitration Association. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation unless stayed for a longer period by agreement of the parties or court order.

4.5.3 The parties to the mediation shall share the mediator's fee and any filing fees equally. The medication 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 thereof.

4.5.4 An officer of the Contract and the Owner's Superintendent or designee must attend the mediation session with authority to settle the Claim. To the extent there are other parties in interest, such as the Consultant or Subcontractors, their representatives, also with the authority to settle the Claim, shall also attend the mediation session. Unless the Owner and the Contractor mutually agree in writing otherwise, all unresolved Claims shall be considered at a single mediation session which shall occur prior to Final Acceptance by the Owner.

4.6 LITIGATION

4.6.1 The Contractor may bring no litigation on Claims unless such Claims have been properly raised and considered in the procedures of Subparagraphs 4.4.1 through 4.4.3 above. All unresolved Claims of the Contractor shall be waived and released unless the Contractor has complied with the time limits of the Contract Documents, and litigation is served and filed within the earlier of (a) 120 days after the Date of Substantial Completion approved in writing by the Owner or (b) 60 days after Final Acceptance. This requirement cannot be waived except by an explicit written waiver signed by the Owner and the Contractor. The pendency of mediation shall toll these deadlines until the later of the mediator providing written notice to the parties of impasse or 30 days after the date of the last mediation session. Neither the Contractor nor a Subcontractor of any tier, whether claiming under a lien statute or otherwise, shall be entitled to attorneys' fees directly or indirectly from the Owner (but may recover attorneys' fees from the statutory Retainage fund itself to the extent allowable under law).

4.6.2 Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

ARTICLE 5 SUBCONTRACTORS

5.1 DEFINITIONS

5.1.1 The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1 The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner or Consultant makes reasonable objection to such substitute. The Contractor shall require bids and contracts

from Subcontractors to be submitted in a format which specifically sets for the amount of any credit that the Owner will ultimately be the benefit of, if all or any portion of any Subcontractor's Work is deleted. In no instance shall the Owner be obligated to pay any fee, profit or overheard for Work which is deleted from any Subcontractor's scope or from that of the Contractor.

5.3 SUBCONTRACTUAL RELATIONS

5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner or Consultant. Each subcontract agreement shall preserve and protect the rights of the Owner and Consultant under 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, the Contractor shall require each Subcontractor to enter into similar agreements with other Subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner or to another contractor should Owner so elect and consent, provided that:

.1 assignment is effective only after termination of the Contract by the Owner and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

5.4.2 Each subcontract shall specifically provide that the Owner (or other contractor) shall only be responsible to the subcontractor for those obligations that accrue after the Owner's or other contractor's exercise of rights under the conditional assignment required hereby.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Paragraph 4.3.

6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall

participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make without an increase in the Contract Time or Sum any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

6.2 MUTUAL RESPONSIBILITY

6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Consultant apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

6.2.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor or any Subcontractors. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, and damage to the Work or defective construction of a separate contractor.

6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor or Subcontractors to completed or partially completed construction or to property of the Owner or separate contractors as provided in Subparagraph 10.2.5.

6.3 OWNER'S RIGHT TO CLEAN UP

6.3.1 If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Consultant may allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

7.1 GENERAL

7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, solely by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Consultant; a Construction Change Directive requires agreement by the Owner and Consultant and may or may not be

agreed to by the Contractor; an order for a minor change in the Work may be issued by the Consultant alone.

7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

7.1.4 Before effectuating a change in the Work, the Owner may request the Contractor to propose the amount of change in the Contract Sum, if any, and the extent of change in the Contract Time, if any, arising from the proposed change in the Work. The Contractor shall submit its responsive proposal as soon as possible and within 14 days and shall in good faith specify the components and amounts by which the Contract Sum and/or Contract Time would change. Labor, materials and equipment shall be limited to and itemized in the manner described in Paragraph 7.5 for the Contractor and major Subcontractors. If the Contractor fails to respond within this time, the Owner may withhold some or all of a progress payment otherwise due until the tardy proposal is received. If the Owner accepts the proposal in writing, the Owner will be immediately bound, the change will be included in a future Change Order, and the change in the Work shall commence expeditiously. The Owner may reject the proposal, in which case the Owner may either not effectuate the change in the Work or may order the change through a Construction Change Directive or an order for a minor change in the Work. The Consultant may confer directly with Subcontractors of any tier concerning any item proposed to the Owner under this Article.

7.2 CHANGE ORDERS

7.2.1 A Change Order is a written instrument which may be prepared by the Consultant and signed by the Owner, Contractor and which may be signed by the Consultant, stating their agreement upon all of the following:

.1 change in the Work;

.2 the amount of the adjustment, if any, in the Contract Sum; and

.3 the extent of the adjustment, if any, in the Contract Time.

7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Subparagraph 7.3.3. Agreement on a Change Order shall constitute full and final settlement of all issues and matters related to the change in Work which is subject to the Change Order including, without limitation, any and all direct and indirect costs and all adjustments in the Contract Time and Sum. There shall be no fee due or to become due to the Contractor related to deductive Change Orders.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.1 A Construction Change Directive is a written order which may be prepared by the Consultant and signed by the Owner, and which may be signed by the Consultant, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 unit prices stated in the Contract Documents or subsequently agreed upon;

.3 cost to be determined in a manner agreed upon by the parties (accompanied by an itemized estimate of probable cost) and a mutually acceptable fixed or percentage fee; or

.4 as provided in Subparagraph 7.3.6.

7.3.4 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved. As soon as possible and within seven (7) days of receipt the Contractor shall advise the Consultant in writing of the Contractor's agreement or disagreement with the proposed adjustment or the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time. The Contractor's response shall reasonably specify the reasons for its disagreement and the adjustment or other terms that it proposes. Without such timely written response, the Contractor shall conclusively be deemed to have accepted the Owner's adjustment. The Contractor's disagreement shall not relieve the Contractor of its obligations to comply promptly with any written notice issued by the Owner or the Consultant. The adjustment shall then be determined by the Consultant in accordance with the provisions of the Contract Documents.

7.3.5 A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be incorporated into and be construed and interpreted as a Change Order.

7.3.6 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, or if cost is to be determined under Clause 7.3.3.3, the Contractor shall keep and present itemized in the categories of Paragraph 7.5 and in such form as the Consultant may prescribe, an itemized accounting together with appropriate supporting data. In order to facilitate checking of such quotations, all proposals, except those so minor that their propriety can be seen be inspection, shall be accompanied by complete itemization of costs, including labor, equipment, material and subcontract costs. Labor, equipment and materials shall be itemized in the manner described in Paragraph 7.5. When major cost items arise from Subcontractors of any tier, these items shall also be similarly itemized. Approval may not be given without such itemization. Failure to provide data within 21 days of the Owner's request shall constitute waiver of any Claim for changes in the Contract Time or Contract Sum. The total cost of any change, including a Claim under Paragraph 4.3 or 4.4, shall be limited to the reasonable value, as determined by the Consultant (subject to appeal through the dispute resolution procedure of Paragraph 4.4), of the items in Paragraph 7.5. Unless otherwise agreed in writing by the Owner, the cost shall not exceed the lower of the prevailing cost for the work in the locality of the Project or the cost of the work in the current edition of R.S. Means Company, Inc., Building Construction Cost Data as adjusted to local costs and conditions. The Consultant and the Owner may communicate directly with Subcontractors concerning costs of any Work included in a Construction Change Directive. If the Contractor disagrees with the method for the adjustment in the Contract Time, the adjustment and method shall be referred to the Consultant for determination, and any adjustment shall be limited to the change in the actual critical path of the Contractor's Construction Schedule directly caused thereby.

7.3.7 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be the largest of (1) the reasonable and prevailing value of the deletion or change; (2) the line item value in the Schedule of Values: or (3) the actual net cost as confirmed by the Consultant. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

7.3.8 Pending final determination of the total cost of a Construction Change Directive to the Owner and provided that any amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. If the Contractor adds a reservation of rights that has not been initialed b the Owner, all the amounts for the Construction Change Directive shall be considered disputed unless costs are renegotiated or the reservation is withdrawn or changed in a manner satisfactory to the Owner.

7.3.9 When the Owner and Contractor agree with the determination made by the Consultant concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

7.4 MINOR CHANGES IN THE WORK

7.4.1 The Consultant and the Owner will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out any and all such written orders promptly. If at the option of the Owner, the Consultant exercises any authority, right(s) or duty(ies) stated anywhere in this Agreement or any other Contract Document as an authority, right or duty the Consultant may perform, the Contractor shall comply with, be bound by and respond therewith and thereto, including, but not limited to, the exercise of any authority, right(s) or duty(ies) related to minor work.

7.5 PRICING COMPONENTS

7.5.1 The total cost of any changed Work or of any other increase or decrease in the Contract Sum, including a Claim, shall be limited to the following components:

.1 Basic wages: The hourly wage (without markup, fringe benefits or labor burden) not to exceed that specified in the applicable “Intent to Pay Prevailing Wage” for the laborers, apprentices, journeymen, and foremen performing and/or directly supervising the changed Work on the site. The premium portion of overtime wages is not included unless pre-approved by the Owner.

.2 Fringe benefits: Fringe benefits paid by the Contractor as established by the Oregon Bureau of Labor and Industries or contributed to labor trust funds as itemized fringe benefits, whichever is applicable. Costs paid or incurred by the Contractor for vacations, per diem, bonuses, stock options, or discretionary payments to employees are not reimbursable.

.3 Workers’ insurances: Direct contributions to the State of Oregon as industrial insurance; medical aid; and supplemental pension by class and rates established by the Oregon Bureau of Labor and Industries.

.4 Federal insurances: Direct contributions required by the Federal Insurance Compensation Act (FICA); Federal Unemployment Tax Act (FUTA); and State Unemployment Compensation Act (SUCA).

7.5.2 Direct material costs: This is an itemization, including material invoice, of the quantity and cost of additional materials reasonable and necessary to perform the change in the Work. The unit cost shall be based upon the net cost after all discounts or rebates, freight costs, express charges, or special delivery costs, when applicable. No lump sum costs will be allowed except when approved in advance by the Consultant. Discounts and rebates based on prompt payment may be included, however, if the Contractor offers but the Owner declines the opportunity.

7.5.3 Construction equipment usage costs: This is an itemization of the actual length of time that construction equipment appropriate for the Work will be used solely on the change in the Work at the site times the applicable rental cost as established by the lower of the local prevailing rate published in The Rental Rate Blue Book by Data Quest, San Jose, California, or the actual rate paid to an unrelated third party as evidenced by rental receipts. Actual, reasonable mobilization costs are permitted if the equipment is brought to the Site solely for the change in the Work. If equipment is required for which a rental rate is not established by The Rental Rate Blue Book, an agreed rental rate shall be established for the equipment, which rate and use must be approved by the Consultant prior to performing the work. If more than one rate is applicable, the lowest rate will be utilized. The rates in effect at the time of the performance of the changed Work are the maximum rates allowable for equipment of modern design and in good working condition and include full compensation for furnishing all fuel, oil, lubrication, repairs, maintenance, and insurance. Equipment not of modern design and/or not in good working condition will have lower rates. Hourly, weekly, and/or monthly rates, as appropriate, will be applied to yield the lowest total cost. The rate for equipment necessarily standing by for future use on the changed Work shall be 50% of the rate established above. The total cost of rental allowed shall not exceed the cost of purchasing the equipment outright.

7.5.4 Cost of change in insurance or bond premium. This is defined as:

.1 Contractors' liability insurance: The cost (expressed as a percentage) of any changes in the Contractor's liability insurance arising directly from the changed Work; and

.2 Public works bond: The cost (expressed as a percentage) of the change in the Contractor's premium for the Contractor's bond arising directly from the changed Work.

Upon request, the Contractor shall provide the Owner with supporting documentation from its insurer or surety of any associated cost incurred.

7.5.5 Subcontractor costs: These are payments the Contractor makes to Subcontractors for changed Work performed by Subcontractors. The Subcontractors' cost of changed Work shall be determined in the same manner as prescribed in this Paragraph 7.5.

7.5.6 Fee: This is the allowance for all combined overhead, profit and other costs, including all office, home office and site overhead (including project manager, project engineers, project foreman, estimator, superintendent and their vehicles), taxes (except for sales tax), warranty, safety costs, quality control/assurance, purchasing, small or hand tool or expendable charges, preparation of as-built drawings, impact on unchanged Work, Claim preparation, and delay and impact costs of any kind, added to the total cost to the Owner of any Change Order, Construction Change Directive, Claim or any other claim of any kind on this Project. It shall be limited in all cases to the following schedule:

.1 The Contractor shall receive 15% of the cost of any materials supplied or work properly performed by the Contractor's own forces.

.2 The Contractor shall receive 8% of the amount owed directly to a Subcontractor or Supplier for materials supplied or work properly performed by that Subcontractor or Supplier.

.3 Each Subcontractor of any tier shall receive 12% of the cost of any materials properly supplied or work properly performed by its own forces.

.4 Each Subcontractor of any tier shall receive 8% of the amount it properly incurs for materials supplied or work properly performed by its suppliers or subcontractors of any lower tier.

.5 The cost to which this Fee is to be applied shall be determined in accordance with Paragraph 7.5.1-7.5.4.

.6 The total summed Fee of the Contractor and all Subcontractors of any tier shall not exceed 25%. None of the fee percentages authorized in this Paragraph 7.5.6 may be compounded with any other fee percentage or percentages authorized in this paragraph.

If a change in the Work involves both additive and deductive items, the appropriate Fee allowed will be added to the net difference of the items. If the net difference is negative, no Fee will be added to the negative figure as a further deduction.

ARTICLE 8 TIME

8.1 DEFINITIONS

8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

8.1.2 The date of commencement of the Work is the date established in the Agreement.

8.1.3 The date of Substantial Completion is the date certified by the Consultant in accordance with Paragraph 9.8.

8.1.4 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined. Time is expressly declared of the essence as it relates to the performance of the Contractor’s Work. Without limiting the foregoing, Contractor must complete the Project in the manner required hereby on the date required hereby. The failure to so complete the Project shall cause the Owner to incur substantial costs and expenses, including, but not limited to, those related to staffing, teachers, management, transportation, publication, communication, signage, and rental, all of which costs and expenses the Contractor shall be liable for.

8.2 PROGRESS AND COMPLETION

8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article II to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. The Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work.

8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion and Final Completion within the Contract Time.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 If the Contractor is unreasonably delayed at any time .in the commencement or progress of the Work (1) by an act or neglect of the Owner or Consultant, or of an employee of either, or of a separate contractor employed by the Owner, or (2) by changes ordered in the Work only to the extent reflected in approved Change Orders providing for specific extensions of the Contract Time, or (3) b unanticipated, abnormal weather (see Paragraph 4.3.7), or (4) by unexpected industry-wide labor disputes, fire, unusual delay in deliveries, governmental delays (including permit delays not caused by the Owner), unavoidable casualties or other causes beyond the Contractor's control, or (5) by delay authorized by the Owner pending mediation and litigation, or (6) by other causes which the Consultant determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time, limited to the change in the actual critical path of the Contractor's Construction Schedule directly caused thereby, as the Consultant may determine consistent with the provisions of the Contract Documents. In no event, however, shall the

Contractor be entitled to any extension of time absent proof of (1) delay to an activity on the critical path of the Contract Schedule, also as to actually delay the Project completion beyond the date of Substantial Completion, or (2) delay transforming an activity into the critical path of the Contract Schedule, so as to actually delay the Project completion beyond the date of Substantial Completion.

8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Paragraphs 4.3 and 4.4. That the Owner or Consultant may be aware of the occurrence or existence of a delay through means other than the Contractor's written notification shall not constitute a waiver of a timely or written notice or Claim.

8.3.3 This Paragraph 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

.1 If the delay was not caused by the Owner, the Contractor, a Subcontractor of any tier, or the Consultant, or anyone acting on behalf of any of them, the Contractor is entitled only to an increase in the Contract Time in accordance with the Contract Documents, but not a change in the Contract Sum. If the delay was caused by the Contractor, a Subcontractor of any tier, or anyone acting on behalf of any of them, the Contractor is not entitled to an increase in the Contract Time or in the Contract Sum. The Contractor shall not recover damages, an equitable adjustment or an increase in the Contract Sum or Contract Time from the Owner where the Contractor could have reasonably avoided the delay by the exercise of due diligence. The Contractor shall be able to recover an increase in the Contract Sum, consistent with the terms of the Contract Documents, only if a delay in the critical path was unreasonable and caused by the Owner. A Subcontractor is not entitled to damages, an equitable adjustment or an increase in the Contract Sum for any delay that does not increase the Contract Time.

.2 In the event the Contractor (including any Subcontractors of any tier) is held to be entitled to damages from the Owner for delay beyond the payment permitted in Subparagraph 7.5.6, it is agreed that the total combined damages to the Contractor and any Subcontractors of any tier for each day of delay shall be limited to the same daily liquidated damage rate specified in the Contract Documents due the Owner for the Contractor's delay in achieving Substantial Completion. No damages will be allowed for any time prior to 14 days before receipt of written notice of the Claim of the delay pursuant to Subparagraph 4.4.2.

.3 The Contractor shall not in any event 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 under run; 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; or similar damages.

.4 The Contractor shall not be entitled to any adjustment in the Contract Time or in the Contract Sum, or to any additional payment of any sort, by reason of the loss or the use of any float time, including time between the Contractor's anticipated completion date and the end of the Contract Time, whether or not the float time is described as such on the Contractor's Construction Schedule.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

9.2 SCHEDULE OF VALUES

9.2.1 Within seven (7) calendar days of the execution of this the Agreement and with each Application for Payment, the Contractor shall submit to the Consultant a schedule of values in a form satisfactory to the Consultant and Owner allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Consultant may require. This schedule, unless objected to by the Consultant or Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Consultant an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized and supported by such data substantiating the Contractor's right to payment as the Owner or Consultant may require, such as copies of requisitions from Subcontractors and material suppliers and reflecting Retainage if provided for in the Contract Documents.

9.3.1.1 As provided in Subparagraph 7.3.8, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives, or by interim determinations of the Consultant, but not yet included in Change Orders.

9.3.1.2 Such applications may not include requests for payment for portions of the Work for which the Contractor does not intend to pay to any Subcontractor including any material supplier.

9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's free and clear title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, be free and clear of any and all liens, claims, security interests or encumbrances in favor of the Contractor, and any all Subcontractors, including any material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

9.4 CERTIFICATES FOR PAYMENT

9.4.1 The Consultant may, within seven (7) days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Consultant determines is properly due, or notify the Contractor and Owner in writing of the Consultant's reasons for withholding certification in whole or in part as provided in Subparagraph 9.5.1.

9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Consultant to the Owner, based on the Consultant's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Consultant's

knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Consultant. However, the issuance of a Certificate for Payment will not be a representation that the Consultant has (I) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

9.5.1 The Consultant may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if, in the Consultant's opinion the representations to the Owner required by Subparagraph 9.4.2 cannot be made. If the Consultant is unable to certify payment in the amount of the Application, the Consultant may notify the Contractor and Owner as provided in Subparagraph 9.4. I. If the Contractor and Consultant cannot agree on a revised amount, the Consultant may promptly issue a Certificate for Payment for the amount for which the Consultant is able to make such representations to the Owner. The Consultant may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Consultant's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Subparagraph 3.3.2, because of:

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security is acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or another contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 Any other failure to comply with the Contract Documents or Contractor's persistent failure to carry out the Work in accordance with the Contract Documents.

9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.6 PROGRESS PAYMENTS

9.6.1 After the Consultant has received all the necessary documents and properly issued a Certificate for

Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents and may so notify the Consultant.

9.6.2 If not done previously, The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

9.6.3 The Consultant or Owner may on request, furnish to any Subcontractors or any other person or entity, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Consultant and Owner on account of portions of the Work done by such Subcontractor.

9.6.4 Neither the Owner nor Consultant shall have an obligation to pay nor to see to the payment of money to a Subcontractor except as may otherwise be required by law.

9.6.5 Payment to material suppliers shall be treated in a manner similar to that provided for Subcontractors because by the definitions of this Agreement they are a Subcontractor.

9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

9.6.7 Payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

9.7 FAILURE OF PAYMENT

9.7.1 If the Consultant does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Consultant or awarded by arbitration, then the Contractor may, upon seven additional days' written notice to the Owner and Consultant, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately, and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

9.8 SUBSTANTIAL COMPLETION

9.8.1 Substantial Completion is the stage in the progress of the Work, or portion thereof designated and approved by the Consultant and Owner, when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can fully occupy and utilize the Work, or designated portion thereof, for its intended use. All Work other than incidental corrective or punch list work and final cleaning shall have been completed, including but not limited to the following:

.1 Obtain temporary occupancy permits, pressure vessel permits, elevator permits, and similar approvals or certificates by governing authorities and franchised services, assuring the Owner's full access and use of completed Work.

.2 Submit the Contractor's punch list of items to be completed or corrected and written request for inspection.

.3 Complete final start-up, testing, and commence instruction and training sessions on all major building systems, including HVAC and controls, intercom, data communications, fire alarm, telephone, fire sprinkler, security and clocks.

.4 Make final changeover of locks and transmit new keys to the Owner, and advise the Owner of the changeover in security provisions.

.5 Discontinue or change over and remove temporary facilities and services from the project site.

.6 Advise the Owner on coordination of shifting insurance coverages, including proof of extended coverages as required.

The Work is not Substantially Complete unless the Consultant reasonably judges that the Work can achieve Final completion within 60 days, appropriate cleaning has occurred, all systems and parts are commissioned and usable, including balancing of the HVAC system, utilities are connected and operating normally, all required temporary occupancy permits have been issued and the work is accessible by normal vehicular and pedestrian traffic routes. The fact that the owner may occupy the Work or a designated portion thereof does not indicate that the work is Substantially Complete or is acceptable in whole or in part, nor does such occupation toll or change any liquidated damages due the Owner.

9.8.1.2 Date of commissioning of Critical Systems. The following systems of the Work, and any other systems designated in the Contract Documents, are considered "Critical Systems": the HVAC system, the data communication system(s), the intercom system, the life safety system(s) and the security system. When the Contractor considers that the Critical Systems are up and running and ready for normal operation as specified for each phase, the Contractor shall so notify the Consultant in writing a minimum of 14 days prior to the Date of Substantial Completion for that portion or phase as fixed in the contract Documents. The Consultant will then schedule a pre-commissioning inspection of these systems to determine whether the Critical Systems are complete and ready for normal operation. If the Consultant's inspection discloses that the Critical Systems are not Substantially Complete or that any item which is not in accordance with the requirements of the Contract Documents, the Contractor shall expeditiously, and before the Date of Commissioning, complete or correct such item upon notification by the Consultant. The Contractor shall then submit a request for another inspection by the Consultant to determine completion of the Critical Systems and pay the costs associated with the re-inspection, including fees of the Consultant and its consultants. When the Critical Systems are complete, the Consultant will notify the Owner in writing, which shall establish the Date of Commissioning. Warranties on the Critical Systems required by the Contract Documents shall commence on the Date of Commissioning, unless otherwise provided. The Date of Commissioning shall not have an effect on the duties of the parties at Substantial Completion.

9.8.1.3 Indemnification. The Contractor shall defend, indemnify, and hold harmless the Owner and the Consultant and their agents, employees, and consultants, successors and assigns from and against all claims, damages, losses and expenses of third parties, direct and indirect, or consequential, including costs, design professional fees, and attorneys' fees incurred by the owner related to such claims and in proving

the right to indemnification, arising out of or resulting from the failure of the Contractor to attain the Date of Commissioning less than 30 days prior to the Date of Substantial Completion fixed by the Contract Documents. In particular, the Contractor acknowledges that a 30-day period after the Date of Commissioning and prior to occupancy is specified during which the HVAC system is scheduled to operate under a procedure intended to dissipate out-gassing that may occur from interior and other materials.

9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Consultant and Owner a comprehensive list of items to be completed or corrected prior to final payment. The Contractor shall proceed promptly to complete and correct all items on the list. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

9.8.3 Upon receipt of the Contractor's list, the Consultant and the Owner will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Consultant's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy and utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Consultant or Owner. In such case, the Contractor shall then submit a request for another inspection by the Consultant to determine Substantial Completion. If the Owner or Consultant determines that the Work or designated portion is not substantially complete, then the contractor shall expeditiously complete the Work or designated portion, request another inspection and pay all costs associated with any re-inspection.

9.8.4 When the Work or designated portion thereof is substantially complete, the Consultant may prepare a Certificate of Substantial Completion which, upon approval of the Owner, may establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Contractor shall attach and submit with the executed Certificate or Substantial Completion a written list of each outstanding and unresolved Claim; any Claim not so submitted and identified, other than Retainage and the undisputed balance of the Contract Sum, shall be deemed waived and abandoned. If the Owner or Consultant determines that the Work or designated portion is not substantially complete, the Contractor shall expeditiously complete the Work or designated portion, again request an inspection, and pay the costs associated with the re-inspection, including Consultant and consultant fees.

9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Any items not included by the Consultant but required or necessary for Final Completion of the Contract shall be supplies and installed by the Contractor as a part of the Contract Sum, notwithstanding their not being recorded by the Consultant. Upon written acceptance of the Certificate of Substantial Completion and upon the Contractor's application, the 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 at Final Completion.

9.8.6 The Contractor shall prepare, continue to monitor with the Consultant, and cause to be completed, all punch lists with respect to the activity of each Subcontractor and report weekly to the Owner on outstanding punch list items. Beginning 90 days before the scheduled date of Substantial Completion, the Contractor

shall prepare reports weekly, identifying items to be competed in order to obtain temporary and permanent certificates of occupancy and make recommendations to the Owner with respect to effectuating the earliest possible completion.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Clause 11.3.1.5 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, Retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Consultant and Owner as provided under Subparagraph 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Consultant.

9.9.2 Immediately prior to such partial occupancy or use, the Owner and Contractor shall, and Consultant may, jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 FINAL COMPLETION.

9.10.1.1 If, at sixty (60) days after the Date of Substantial Completion, the Owner considers that the punch list items are unlikely to be completed within sixty (60) days of Substantial Completion, the Owner may, upon seven (7) days' written notice to the contractor, take over and perform some or all of the punch list items. If the Contractor fails to correct the deficiencies within the period required, the Owner may deduct the actual cost of performing this punch list work, including costs, plus 10% to account for the Owner's transaction costs from the Contract Sum.

9.10.1.2 Upon receipt of written notice from the Contractor that the Work is ready for final inspection and acceptance, the Consultant may promptly make such inspection accompanied by the Contractor and, when the Consultant finds all punch list items fully completed and the Work acceptable under the Contract Documents and the Contract fully performed, the Consultant may promptly notify the Contractor and the Owner in writing that to the best of the Consultant's knowledge, information and belief, and on the basis of the Consultant's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents. If the Consultant determines that some or all of the punch list items are not fully completed, then the Contractor shall be responsible to the Owner for all costs, including re-inspection fees, associated with any subsequent Consultant's inspection. The Consultant's final Certificate for Payment will constitute a further representation that conditions listed in Subparagraph 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

9.10.1.3 The Contractor is liable for, and the Owner may deduct from any amounts due the Contractor, all

Consultant, architect, engineer or other design consultant fees incurred by the Owner for services performed more than 60 days after Substantial Completion of all the Work, whether or not those services would have been performed prior to that date had Final Completion been achieved in a timely manner.

9.10.1.4 When the Consultant finds that the Work has been concluded, a final occupancy permit has been issued, and the Contractor has submitted all the items in Subparagraph 9.10.2.1 to the Consultant, the Contractor may submit a final Application for Payment. The Consultant will then promptly issue a final Certificate for Payment stating that the entire balance found to be due the Contractor and noted in said final Certificate is due and payable. The Consultant's final Certificate for Payment shall establish the date of Final Completion upon its execution by the Owner.

9.10.1.5 "Final Completion" will be attained when the Contractor has accomplished the following:

.1 Complete all requirements listed in Paragraph 9.8 for Substantial Completion.

.2 Complete all remaining punch list items, notify Consultant and Owner that all work is complete.

.3 Obtain permanent occupancy permits.

.4 Submit final change order and final Application for Payment.

.5 Submit recorded documents, final property survey, and operation and maintenance manuals.

.6 Deliver tools, spare parts, extra stock of material and similar physical items to the Owner.

.7 Complete final cleaning.

.8 Complete instruction and train in sessions on all major building systems including HVAC, intercom data communications, fire alarm, telephone, fire sprinkler, security and clocks.

9.10.2 FINAL ACCEPTANCE AND PAYMENT

9.10.2.1 Final payment shall not become due until after the Owner's Board of Directors has formally accepted the Project "Final Acceptance". To achieve Final Acceptance, the Consultant must have issued a final Certificate of Payment under Subparagraph 9.10.1, Final Completion must have occurred, and the Contractor must have submitted to the Consultant the following:

.1 an affidavit that any and all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied together with full and final unconditional waivers by the Contractor and all Subcontractors in a form and with content acceptable to the Owner, except for any Subcontractor claims that are specifically identified on the affidavit,

.2 a certificate 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 the Owner,

.3 a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents,

.4 consent of surety, if any, to final payment,

.5 other data establishing payment or satisfaction of or protection against 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 the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor shall furnish a bond satisfactory to the Owner to indemnify the Owner against such lien or cash deposit off such lien or claim whichever the Owner may request. Such cash deposit shall be paid with the Contractor's own funds. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees,

.6 an “Affidavit of Wages” from the Contractor and each Subcontractor of every tier certified by all required governmental authorities.

.7 a letter from the Consultant indicating that the Work is complete and recommending Final Acceptance of the Project by the Owner.

.8 certification that all materials in the Work are "lead-free" and "asbestos-free," and

.9 all warranties, guarantees, training manuals, operation instructions, certificates, spare parts, maintenance stock, specified excess material, as-built drawings and other documents or items required by the Contract Documents or local governmental entities.

9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor, and the Consultant so confirms, the Owner shall, upon application by the Contractor and certification by the Consultant, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted to the extent permitted by statute. If the remaining balance for Work not fully completed or corrected is less than Retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Consultant prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

9.10.4 If a Subcontractor of any tier or supplier refuses to furnish a release or waiver required by the Owner the Owner may (a) retain in the fund, account, or escrow funds in such amount as to defray the cost of foreclosing the liens of such claims and to pay attorneys’ fees, the total of which shall be no less than 150% of the claimed amount, or (b) accept a bond from the Contractor, satisfactory to the owner, to indemnify the Owner against such lien. If any such lien remains unsatisfied after all payments from the Retainage are made, the Contractor shall refund to the Owner all moneys that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys’ fees.

9.10.5 Release of Retainage. Retainage will be held and applied by the Owner as required by law. Release of Retainage will be processed in the ordinary course of business upon expiration of sixty (60) days following Final Acceptance of the Work by the Owner provided that no notice of lien shall have been given as provided by law, and that no claims have been brought to the attention of the Owner and that the Owner has no claims under this Contract.

9.10.6 WAIVER OF CLAIMS

9.10.6.1 Final Payment by Owner. The making of final payment shall not constitute a waiver of any Claims by the Owner.

9.10.6.2 Final Payment to Contractor. Acceptance of final payment by the Contractor, or any Subcontractors including but not limited to any material supplier shall constitute a waiver of claims by that payee except those previously timely made in writing delivered to the Owner, Consultant and identified by that payee as unsettled and attached to Contractor's final Application for Payment.

9.10.6.3 Change Orders. The execution of a Change Order shall constitute a waiver of Claims by the Contractor arising out of the Work to be performed or deleted pursuant to the Change Order, except as specifically described in the Change Order. Reservations of rights will be deemed waived and are void unless the reserved rights are specifically described in detail to the satisfaction of the Owner and are initialed by the Owner.

9.10.7 The Contractor shall maintain books, ledgers, records, documents, estimates, correspondence, logs, electronic data and other evidence pertaining to the costs incurred by the Contractor in connection with or related to the Contract ("records") to such extent and in such detail as will property reflect and fully support compliance with requirements of the Contract Documents and with all costs, charges and other amounts of whatever nature under the contract. The Contractor shall preserve such records for a period of three (3) years following the date of Final Acceptance under the contract and for such longer period as may be required by any other provision of the contract. Within seven (7) days of the Owner's requires, the Contractor agrees to make available at the office of the Contractor during normal business hours all records for inspection, audit and reproduction by the Owner or its representatives. These requirements shall be applicable to each Subcontractor of any tier and included in each Subcontract and purchase order issued with respect to the Work, except fixed-price Subcontracts where the price is $25,000 or less.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1.1 The Contractor shall use best efforts and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 The Contractor shall use best efforts to take precautions for safety of, and provide protection to prevent damage, injury or loss to:

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

10.2.3 The Contractor shall use best efforts to erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities and to protect adjacent property and improvements from any damage. Any damage to such property or improvements shall be promptly remedied at Contractor's sole cost and expense.

10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel and notify the Owner and Consultant in advance to such storage. To the extent that Owner's Operations limit the use or storage of explosives or other hazardous materials or equipment they shall not be used or stored at the Project.

10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Clauses 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, any Subcontractors, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Clauses 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Consultant or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.

10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Consultant.

10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

10.2.8 Contractor shall specifically comply with any and all laws, rules and regulations related to hazardous materials (including without limitation asbestos) and hazardous material abatement including by not limited to those relating to contracting and the performance of such work.

10.3 HAZARDOUS MATERIALS

10.3.1 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos, encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and promptly report the condition to the Owner and Consultant in writing. By executing this Contract, Contactor represents and warrants that it has no knowledge of any material or substance which would give rise to any obligation of the Owner under any provision of 10.3.

10.3.2 The Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Consultant the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Consultant will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or

Consultant has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Consultant have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. The Contract Time shall be extended appropriately, and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up, which adjustments shall be accomplished as provided in Article 7.

10.4 The Owner shall not be responsible under Paragraph 10.3 for materials and substances brought to the site by the Contractor.

10.5 EMERGENCIES

10.5.1 In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractors discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Paragraph 4.3.

ARTICLE 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by any Subcontractors, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;

.2 claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 claims for damages insured by usual personal injury liability coverage;

.5 claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

.7 claims for bodily injury or property damage arising out of completed operations; and

.8 claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18.

11.1.2 The insurance required by Subparagraph 11.1.1 shall be written for not less than limits of liability

specified in the Contract Documents or required by law, whichever coverage is greater. Coverage's, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Paragraph 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Subparagraph 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

11.2 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE

11.2.1 The Owner may also in addition to or in the alternative require the Contractor to purchase and maintain Project Management Protective Liability insurance from the Contractor's usual sources as primary coverage for the Owner's, Contractor's and Consultant's vicarious liability for construction operations under the Contract. Unless otherwise required by the Contract Documents, the Owner shall reimburse the Contractor by increasing the Contract Sum to pay the cost of purchasing and maintaining such optional insurance coverage and the Contractor shall not be responsible for purchasing any other liability insurance on behalf of the Owner. The minimum limits of liability purchased with such coverage shall be equal to the aggregate of the limits required for Contractor's Liability Insurance under Clauses 11.1.1.2 through 11.1.1.5.

11.2.2 To the extent damages are covered by Project Management Protective Liability insurance, the Owner, Contractor and Consultant waive all rights against each other for damages, except such rights as

they may have to the proceeds of such insurance. The policy shall provide for such waivers of subrogation by endorsement or otherwise.

11.2.3 The Owner may require the Contractor to include the Owner, Owners Representative, Consultant or any other persons or entities as additional insureds on the Contractor's Liability Insurance coverage under Paragraph 11.1 or as set out elsewhere in the Contract Documents.

11.3 PROPERTY INSURANCE

11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, until final payment has been made as provided in Paragraph 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Paragraph 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

11.3.1.1 Property insurance may be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage

including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, false work, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and may cover reasonable compensation for Consultant's and Contractor's services and expenses required as a result of such insured loss.

11.3.1.2 If the Owner does not intend to purchase such insurance the Owner shall so inform the Contractor. The Contractor may, then following 14 days prior written notice to the Owner by the Contractor effect such insurance which will protect the interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and if approved by the Owner in its discretion and in writing before the purchase thereof the costs thereof may be charged to the Owner.

11.3.1.3 If the property insurance requires deductibles, the Owner need not pay costs not covered because of such deductibles and they shall be paid by Contractor.

11.3.1.4 This property insurance, if any may at the Owner's option cover portions of the Work stored off the site, and also portions of the Work in transit.

11.3.1.5 Partial occupancy or use in accordance with Paragraph 9.9 may commence absent the insurance company or companies providing property insurance having consented to such partial occupancy or use by endorsement or otherwise.

11.3.2 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused.

11.3.3 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Subparagraph 11.3.5 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

11.3.4 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverage's required by this Paragraph 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

11.3.5 Waivers of Subrogation. The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Consultant, Consultant's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Paragraph 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Consultant, Consultant's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective

as 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.

11.3.6 A loss insured under Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Subparagraph 11.3.7. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

11.3.7 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved as provided in Paragraphs 4.5 and 4.6. The Owner as fiduciary shall, in the case of arbitration, make settlement with insurers in accordance with directions of the arbitrators. If distribution of insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

11.4 PERFORMANCE BOND AND PAYMENT BOND

11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in any of the Contract Documents.

11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING OF WORK

12.1.1 If a portion of the Work is covered contrary to the Consultant's or Owner's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Consultant or Owner, be uncovered for the Consultant's or Owner's observation or examination and be replaced at the Contractor's expense without change in the Contract Time.

12.1.2 If a portion of the Work has been covered which the Consultant or Owner has not specifically requested to examine prior to its being covered, the Consultant or Owner may request to see such Work and it shall be uncovered by the Contractor. If such Work is in full and strict accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in full and strict accordance with the Contract Documents, correction shall be at the Contractor's sole expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

12.2 CORRECTION OF WORK

12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

12.2.1.1 The Contractor shall promptly correct Work rejected by the Consultant or failing to conform to the

requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Consultant's services and expenses made necessary thereby, shall be at the Contractor's expense. If prior to Substantial Completion the contractor or any Subcontractors or anyone they are responsible for uses or damages any portion of the Work, they shall return it to “like new” condition without any increase in the Contract Time or Sum.

12.2.2 AFTER SUBSTANTIAL COMPLETION

12.2.2.1 In addition to the Contractor's obligations under Paragraph 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Subparagraph 9.9.1, or by terms of an 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, the Contractor shall correct it promptly (but in no event later than seven days) after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a full and final written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work promptly during that period after receipt of notice from the Owner or Consultant, the Owner may correct it in accordance with Paragraph 2.4.

12.2.2.2 The one-year period for correction of Work 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.

12.2.2.3 The one-year period for correction of Work shall be extended by corrective Work performed by the Contractor pursuant to this Paragraph 12.2.

12.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

12.2.4 The Contractor shall bear the sole cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

12.2.5 Nothing contained in this Paragraph 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the one-year period for correction of Work as described in Subparagraph 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

12.3 ACCEPTANCE OF NONCONFORMING WORK

12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract

Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

13.1.1 The Contract shall be governed by the law of the State of Oregon.

13.2 SUCCESSORS AND ASSIGNS

13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents.

13.2.2 The Owner may, without consent of the Contractor, assign the Contract to any person or entity. In such event, they shall assume the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

13.3 WRITTEN NOTICE

13.3.1 Written notice shall be deemed to have been duly served if 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 at or sent by registered or certified mail to the last business address known to the party giving notice. Notice by e-mail or facsimile shall not constitute written notice unless the Owner shall otherwise agree.

13.4 RIGHTS AND REMEDIES

13.4.1 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.

13.4.2 No action or failure to act by the Owner, Consultant or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

13.5 TESTS AND INSPECTIONS

13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall timely make all arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. Except as otherwise provided herein, the cost of private-independent tests by third-parties to this Agreement shall be at Owner's expense. The Contractor shall give the Consultant and Owner timely notice of when and where tests and inspections are to be made so that the Consultant and Owner may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

13.5.2 If the Consultant, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Subparagraph 13.5.1, the Consultant may, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Consultant and Owner of when and where tests and inspections are to be made so that the Consultant and Owner may be present for such procedures. Such costs, except as provided in Subparagraph 13.5.3, or otherwise in the Contract Documents shall be at the Owner's expense.

13.5.3 If such procedures for testing, inspection or approval under Subparagraphs 13.5.1 and 13.5.2 reveal 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 the Consultant's and Owner's services and expenses shall be at the Contractor's sole cost and expense.

13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Consultant.

13.5.5 If the Consultant is to observe tests, inspections or approvals required by the Contract Documents, the Consultant will do so reasonably and, where practicable, at the normal place of testing.

13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

13.6 INTEREST

13.6.1 Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1 As between the Owner and Contractor any applicable statute of limitations shall accrue as provided by law in all events before substantial completion, between substantial completion and final certificate for payment, after final certificate for payment and otherwise.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or any Subcontractors, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 issuance of an order of a court or other public authority having jurisdiction which requires all Work to be stopped:

.2 an act of government, such as a declaration of national emergency which requires all Work to be stopped; or

.3 because the Consultant has not issued a Certificate for Payment and has not notified the

Contractor of the reason for withholding certification as provided in Subparagraph 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents following 30 prior written notice to the Owner.

14.1.2 If one of the reasons described in Subparagraph 14.1.1 exists, the Contractor may, upon seven days' written notice to the Owner and Consultant, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including agreed reasonable overhead and profit.

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1 The Owner may terminate the Contract if the Contractor:

.1 persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

14.2.2 When any of the above reasons exist, the Owner, upon certification by the Consultant that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor (but not the construction equipment owned, operated and used by Subcontractors in the performance of their Work);

.2 accept assignment of subcontracts pursuant to Paragraph 5.4; and

.3 finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

14.2.3 When the Owner terminates the Contract for one of the reasons stated in Subparagraph 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Consultant's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Consultant, upon application, and this obligation for payment shall survive termination of the Contract. Contractor hereby fully, finally and unconditionally waives any and all other claims, including but not limited to those for lost or anticipated profits or overhead.

14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Subparagraph 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination as provided in 14.4.4,

14.4.4. Upon on such termination Contractor shall recover as its sole remedy payment for Work properly and timely performed and installed prior to the effective date of the termination and for items properly and timely fabricated off the site and delivered and stored in accordance with the Owner’s instructions prior to the effective date of termination. Contractor hereby fully, finally and unconditionally waives any and all other claims, including but not limited to those for lost or anticipated profits, or overhead. Owner shall be credited for payments previously made and claims the Owner has.

END SECTION

PAYMENT BOND

Bond No. _____

The undersigned, _____ as Principal and _____ as Surety, a corporation organized and existing under the laws of the state of _____, are held and bound unto Santiam Canyon School District and its heirs, executers, administrators, and assigns as Obligee, for the use and benefit of all persons or entities that provide labor, materials, equipment or supplies for use under the Contract described below, in the penal sum of_____ Dollars ($_____), lawful money of the United States of America, for the payment of which Principal and Surety bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally.

WHEREAS Principal has entered into a Construction Contract ("Contract") dated _____, 2022 with Obligee for the Mechanical Upgrade Project ("Project"), which Contract is made a part hereof as if fully incorporated herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION are such that if Principal shall promptly make payment to all persons or entities that provide labor, material, equipment or supplies for use under said Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect. In the event that Principal shall be, and declared by Obligee to be in default under the Contract, the Surety, at the request of the Obligee, shall promptly remedy the default in a manner acceptable to the Owner.

In any event, this obligation shall remain in full force and effect for the applicable period of limitations or repose, whichever is longer.

Surety acknowledges that Obligee does not owe any duty to Surety to advise, notify or consult with Surety on any matters relating to the Principal or the Project, including, but not limited to, Principal's payments to Architect, Subcontractors or Principal's use of Project funds.

Principal and Surety hereby jointly and severally agree that any person or entity that provides labor, material, equipment or supplies for use under said Contract and has not been paid in full, and any other party entitled to make claim on the bond under ORS 279C, if notice is given within the applicable time period set forth in ORS 279C.605 may sue on this bond for the use of such person or entity, prosecute the suit to final judgment for such sums as may be justly due and owing claimant and have execution thereon. Obligee shall not be liable for the payment of any damages, costs or expenses (including attorney fees) awarded in any such suit.

No prepayment or delay in payment and no change, extension, assignment, addition or alteration of any provision of said Contract and no forbearance on the part of Obligee shall operate to relieve Surety from liability on this bond, and Surety hereby consents to any such changes, extensions, additions and alterations without further notice to or consent by Surety.

In the event arbitration, litigation or any other proceeding is brought upon this bond by Obligee and judgment or award is entered in Obligee's favor, Surety shall pay all of Obligee's costs incurred in such arbitration, litigation or other proceeding, including any attorney and expert witness fees.

Nonpayment of the bond premium will not invalidate this bond, nor shall any Obligee be obligated for the payment of any premiums.

This bond is given and received under authority of ORS Chapter 279C, the provisions of which hereby are incorporated into this bond and made a part hereof.

Executed this _____ day of _____, 2022.

_____
PRINCIPAL

_____
Title

_____
Address

_____
SURETY

_____
Title

_____
Address

COUNTERSIGNED:

_____
Resident Agent

_____
Address

PERFORMANCE BOND

Bond No. _____

The undersigned, _____ as Principal and _____ as Surety, a corporation organized and existing under the laws of the state of _____, are held and bound unto Santiam Canyon School District and its heirs, executers, administrators, and assigns as Obligee, in the penal sum of _____ Dollars ($_____), lawful money of the United States of America, for the payment of which Principal and Surety bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally.

WHEREAS Principal has entered into a Construction Contract ("Contract") dated _____, 2022 with Obligee for Mechanical Upgrade Project ("Project"), which Contract is made a part hereof as if fully incorporated herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION are such that if Principal shall faithfully, punctually and completely perform and abide with the covenants, terms, conditions and provisions of said Contract and any extensions thereof in all respects and within the time prescribed therein, including, but not limited to, the terms of any warranty and guarantee required under the said Contract; shall pay all laborers, mechanics, subcontractors, material and equipment suppliers and all persons supplying to Principal or its subcontractors and suppliers at any tier labor, materials, supplies or equipment for the prosecution of the work or any part thereof; shall fully defend, indemnify and hold Obligee harmless from all cost and damage that Obligee may suffer by reason of Principal's failure to do so; and shall in all respects perform said Contract according to applicable law, then this obligation shall be null and void; otherwise, it shall remain in full force and effect. In the event that Principal shall be, and declared by Obligee to be in default under the Contract, the Surety, at the request of the Obligee, shall promptly remedy the default in a manner acceptable to the Owner.

In any event, this obligation shall remain in full force and effect for the applicable period of limitations or repose, whichever is longer.

Surety acknowledges that Obligee does not owe any duty to Surety to advise, notify or consult with Surety on any matters relating to the Principal or the Project, including, but not limited to, Principal's payments to Subcontractors or Contractor's use of Project funds.

No prepayment or delay in payment and no change, extension, assignment, addition or alteration of any provision of said Contract and no forbearance on the part of Obligee shall operate to relieve Surety from liability on this bond, and Surety hereby consents to any such changes, extensions, additions and alterations without further notice to or consent by Surety.

In the event arbitration, litigation or any other proceeding is brought upon this bond by Obligee and judgment or award is entered in Obligee's favor, Surety shall pay all of Obligee's costs incurred in such arbitration, litigation, or other proceeding, including any attorney and expert witness fees.

In the event there is an arbitration clause in said Contract, Surety agrees to participate in and to be bound by any such arbitration to the same extent Principal is bound.

Nonpayment of the bond premium will not invalidate this bond, nor shall any Obligee be obligated for the payment of any premiums.

This bond is given and received under authority of ORS Chapter 279C, the provisions of which hereby are incorporated into this bond and made a part hereof.

Executed this _____ day of _____, 2022.

_____
PRINCIPAL

_____
Title

_____
Address

_____
SURETY

_____
Title

_____
Address

COUNTERSIGNED:

_____
Resident Agent

_____
Address

PART 1 GENERAL

1.01 MINIMUM WAGE RATES

A. The minimum wage rates to be paid all crafts and labor on this contract shall be the prevailing wage for the individual crafts involved in the Marion area during the life of the contract and as determined by the Commissioner of the Oregon Bureau of Labor and Industries, or in the case of a Federal-Aid project, the wage determination decision of the Federal Secretary of Labor, along with conformance to ORS 279C, as may be applicable to the supplying of the services and/or materials called for in the bid.

B. Every contractor and subcontractor shall pay workers not less than the specified minimum hourly rate of wage for each trade or occupation in each locality. When a public works project is subject to Davis-Bacon Act (40 U.S.C. 3141 et seq) that would otherwise be subject to state prevailing wages, if the state prevailing rate of wage is higher than the federal prevailing rate of wage, the contractor and every subcontractor on the project shall pay at least the state prevailing rate of wage.

C. Each worker in each trade or occupation employed in the performance of the contract either by the contractor, subcontractor or other person doing or contracting to do or contracting for the whole or any part of the work on the contract, must be paid not less than the applicable state prevailing rate of wage in accordance with ORS 279C.383 and 279C.840, or the applicable federal prevailing rate of wage, whichever is higher.

1.02 GENERAL REQUIREMENTS

A. If a dispute arises as to what the prevailing wage rate for any class of worker is, and if the dispute cannot be settled by the parties involved, it may be referred to the Commission of the Bureau of Labor and Industries, State of Oregon, for final determination. The Wage Rates are minimum rates only and the Owner will not consider any claims or additional compensation because of payment made by Contractor or a Sub-Contractor of any wage rate in excess of the prevailing rate.

B. Prevailing Wage Rates:

1. Pursuant to ORS Ch. 279C.800 - 279C.870, "Prevailing Wage Rates for Public Works Contracts in Oregon," effective January 1, 2022, and amendments, if any, are bound hereinafter and are included as a part of this Specification.

C. Other requirements related to Prevailing Wage are listed in Section 00 5000 – Agreement for Stipulated Sum.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

ARTICLE 11 - INSURANCE AND BONDS

Revise 11.1.2: Add the following:

The insurance required by 11.1.1 shall be written for not less than the following limits, or greater if required by law and underwritten by an insurance company rated A or A+ by A.M. Best & Co.

1. **Workers' Compensation:** Statutory

2. **Comprehensive General Liability** (**including Premises-Operations:** Independent Contractor's Protective; Products and Completed Operations; Explosion, Underground & Collapse; Broad-Form Property Damage, Blanket Contractual Liability, Personal Injury with Employment Exclusion Deleted):

   (a) Bodily Injury

$2,000,000	Each Occurrence
$4,000,000	Annual Aggregate

   (b) Property Damage

$2,000,000	Each Occurrence
$4,000,000	Annual Aggregate

   (c) Products and Completed Operations to be maintained for two (2) years after final payment.

   (d) Property Damage Liability Insurance shall provide X, C and U coverages.

3. **Comprehensive Automobile Liability:**

   (a) Bodily Injury

$1,000,000	Each Person
$1,000,000	Each Occurrence

   (b) Property Damage

$1,000,000	Each Occurrence

4. The Owner shall be named as the Certificate Holder.

5. In addition, furnish true umbrella coverage, which provides excess limits over the primary layer and broader scope, in an amount not less than $2,000,000.

6. Insurance shall be written by a firm licensed to do business in the State of Oregon and as approved by the Owner. The Owner's specification or approval of this insurance or of its amount shall not relieve or decrease the liability of the Contractor under the Contract Documents or otherwise.

11.1.3: Add the following:

The Contractor shall furnish one copy of the General Liability and Automobile Liability policy. The policies shall name the Santiam Canyon School District and its members, partners, officers, directors, agents, and employees, and the successors in interest of the foregoing, as Certificate Holder, using ISO additional insureds endorsement CG 20 10 11 85 or a substitute providing equivalent coverages within ten (10) days after the Owner issues a "Notice of Intent to Award Contract". The Contractor shall furnish to the Owner copies of any subsequently issued endorsements amending, modifying, altering, or restricting coverage or limits.

END OF SECTION

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Mechanical Upgrade Project

B. Owner's Name: Santiam Canyon School District.

C. Architect's Name: Soderstrom Architects.

D. The Project consists of the construction of HVAC and Electrical Service upgrade for the existing Elementary School building. This includes a new chiller to be mounted at grade and replacement air handlers added to the mechanical spaces. Electrical upgrades support new mechanical equipment and controls.

1.02 CONTRACT DESCRIPTION

1.03 WORK BY OWNER

A. Items noted OFOI (Owner-Furnished, Owner-Installed) will be supplied and installed by Owner before Substantial Completion. Some items include:

B. Items noted OFCI (Owner-Furnished, Contractor-Installed) will be supplied by the Owner for installation by Contractor before Substantial Completion. Some items include:

C. Items noted OFOICC (Owner Furnished, Owner Install, Contractor Coordinated) will be supplied by the Owner, installed by the Owner's contractor, but the responsibility of the Contractor to coordinate installation before Substantial Completion.

1.04 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Except as otherwise stipulated herein, Contractors will have complete use of the Premises within the boundaries of the project as shown on the Drawings for the execution of the Work.

B. The possession, use, or distribution of illicit drugs and alcohol on the Owner's premises is prohibited. Prescription medications brought to the project site shall be in the original container bearing the name of the drug, the name of the physician and the prescribed dosage.

C. TOBACCO FREE INSTITUTION: All bidders shall comply with OAR 581.021.0110 and ORS 326.051 regarding Tobacco Use on Public Grounds. For the purpose of this document "tobacco" is defined to include any lighted or unlighted cigarette, cigar, pipe, clove cigarette, and any other smoking product, spit tobacco, also known as smokeless,

dip, chew, snuff, in any form, nicotine or nicotine delivering devices, chemicals or devices that produce the physical effect of nicotine substances or any other tobacco substitute (e.g., e-cigarettes). This does not include FDA approved nicotine replacement therapy products used for the purpose of cessation. No employee, sub-contractor, material supplier, or project visitor is permitted to smoke, inhale, dip, or chew or sell tobacco at any time, including non-education hours.

1. In any building, facility; or
2. On education facility grounds, athletic grounds, or parking lots.

D. Tools and building materials shall never be left out when an unsecured work area is vacated.

E. Ladders and scaffolding will be taken down when an unsecured work area is vacated.

F. Open holes and other tripping hazards shall be fenced or barricaded when an unsecured work area is vacated.

G. "Secured Work Area" is defined as an area having a perimeter cyclone fence at least 6 feet in height, with gates which close and lock so that no casual entrance is possible by unauthorized personnel.

H. Operations resulting in vapors, emissions or flying objects shall be conducted in such a way as to prevent exposure to any unprotected parties or property.

1.06 WORK SEQUENCE

1.07 DUST PROTECTION AND SAFETY BARRIERS

A. The Contractor shall erect temporary Dust and Safety Barriers around all of the Construction Operations to keep dust and debris within the localized work area, and to protect the owner, staff, and the public from construction activities. Additional requirements may be required if airborne dust is judged by the Owner to be a problem.

B. The Contractor shall take precautions to protect existing smoke detectors from damage or deterioration from dust caused by work of this contract.

1.08 OVERTIME WORK

A. The Contractor shall notify the Owner in writing, at least 48 hours in advance of any overtime work, including nights, weekends, and holidays. Do no overtime work without Owner's prior approval.

B. The Contractor shall reimburse the Architect and Owner for any expenses incurred by them because of Contractor's overtime work.

1.09 WORK IN PUBLIC RIGHT-OF-WAY

A. The Contractor shall obtain any required Permits, pay Permit Fees, arrange for inspections by Regulatory Agencies, and comply with governing Regulatory Agency requirements.

1.10 PROTECTING EXISTING UTILITIES

A. Original Building Drawings and Site Survey Drawings indicate approximate location of any known, concealed Utility Lines. Before starting work, Contractor shall determine exact location of any of these Lines that could be damaged by Contract Work.

B. Contractor shall assume that other unknown Utility Lines do exist, and Contractor shall proceed with caution when working in areas that could conceal unknown Utilities.

C. If such Utility Lines are encountered, immediately request disposition instructions from Architect.

D. If Utility Lines are damaged; remove, repair, or replace Lines as directed. Additional compensation and/or extension of time, if any, caused by removing, repairing, or replacing Lines will be determined in accordance with General Conditions.

1.11 PROTECTING EXISTING LANDSCAPING & TREES

A. Protect existing Trees, not designated for removal, against damage caused by work of this contract.

B. Provide necessary Fencing and Barricades. Erect prior to Work, and unless otherwise instructed, remove after Work completion.

C. Prohibit Earth stockpiling, Material storage, and Vehicle Parking and Traffic within Drip-line of Trees.

D. Prohibit dumping of Refuse, Chemicals, and other Materials and puddling or running Water which may injure Plant growth including Root systems.

E. Prohibit Foot and Vehicle Traffic which may compact Soil over Root Systems.

F. Prohibit any unnecessary cutting, breaking and skinning of Branches and Roots, and prohibit skinning and bruising of Bark. All tree pruning activities shall be conducted by a certified arborist.

G. Prohibit all cutting, breaking, and skinning of branches and roots, and skinning or bruising of bark of any trees within the street Right of Way. Consult with a certified arborist and the Authority havign jurisdiction prior to starting and construction activities that may threaten to damage street trees.

H. Prohibit Fires, High-heat and Smoke adjacent to Trees.

I. Repair or replace with plants of equal size, any material damaged by Construction Operations.

J. Where damaged Trees cannot realistically be repaired or replaced, pay Owner, as Liquidated Damage, value of Trees as determined by Council of Tree & Landscape Appraisers and as distributed by International Society of Arborculture. Copies can be obtained from Society at Box 71, Urbana, IL 61801.

1.12 PROTECTING EXISTING SUBGRADE

A. Contractor shall protect against damage, existing Subgrade and Earthwork provided under this Contract.

B. Where necessary to accomplish required protection, provide additional Temporary Fill or other approved Cover over Work to be protected.

1.13 PROTECT EXISTING STRUCTURES

A. Contractor shall protect against damage, existing building parts not scheduled for repair or remodel under this contract.

B. Where necessary to accomplish required protection, provide additional Temporary barricades, cushioning, or other approved Cover over material to be protected.

1.14 HAZARDOUS MATERIALS

A. Building Materials Containing Asbestos and Lead have been found in this building in the past. The Owner has previously removed or encapsulated most of the asbestos. By this notice, the Contractor and the Sub-contractors, and their workers, are asked to be aware of the possible presence of Asbestos Bearing Materials, lead and other hazardous materials and if found, or even suspected, to immediately stop work in the area, and notify the Architect and the Owners Project Mnager of the location and condition. A separate independent contract will be issued by the Owner to have the suspected material tested and if needed removed or encapsulated.

B. The Contractor and Sub-contractors, and their workers shall be extremely careful when working around any asbestos or encapsulated asbestos materials, and take any necessary precautions to avoid disturbing the asbestos or the encapsulation materials. If the asbestos or the encapsulation is disturbed, immediately stop work in the area, and notify the Engineer and the Owners Facility Manager of the location and condition.

1.15 CRIMINAL HISTORY CHECK / PHOTO ID

A. The names of all Contractor and all Subcontractor employees who will be on the job site for more than one day must be submitted to the District. These employees shall fill out a criminal history form provided by the District. Criminal history checks will be run through the Oregon State Police as provided for in ORS 326.603. The District shall bear the cost of processing such Criminal history checks.

1. Through the signature on the criminal history form, authorization is also given to HMKCO and its representative to investigate this information. Further, with this signature, consent is given to all governmental agencies, public or private companies and individuals to release information regarding the individual to the HMKCO and to their representative. The District shall bear the cost of processing such Criminal history checks.

B. In accordance with ORS 326.603(8) the District is required to terminate the employment or contract status of any individual who refuses to consent to a criminal history check of to be fingerprinted or falsely swears to the non-conviction of any crime.

C. In accordance with ORS 326.603(7)(a) no individual found to have been convicted of any crime listed in ORS 342.143 or of an attempt to commit one of the listed crimes shall be allowed to work on any District site.

1. It is vital that employees are instructed to accurately complete criminal history forms. Crimes listed in ORS 342.143 which automatically bar an individual from employment with or contracting with the District are primarily crimes of violence, crimes against children, and sex related crimes. However, falsely swearing that you have not been convicted of a crime obligates the District to terminate employment or contract status even if the crime is not listed in ORS 342.143.

D. All employees working on site shall wear a Name and Photo Identification Badge. The Contractor shall provide all Photo ID badge. Badge shall state Santiam Canyon School District, name of the project, employee name, and company they represent.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

F. Schedule of Values.

G. Payments for products stored off site.

1.02 RELATED REQUIREMENTS

A. Section 00 5000 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.

B. Section 00 6000 - General Conditions and Document 00 8000 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.

C. Section 00 7343 - Prevailing Wage Rates.

1.03 SUBMITTALS

A. Submit a preliminary draft to the Consultant 3 weeks prior to the submittal for the first Application. The purpose preliminary draft is to confirm the level of detail required by the Design Team. The Contractor is to make adjusted requested by the Consultant. The level of detail may include values as separate lines (entities) for each Specification Section. The Consultant will not review any Application submitted until changes requested by the Consultant to the preliminary draft have been incorporated.

1.04 SCHEDULE OF VALUES

A. Form to be used: AIA G703 or equivalent.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Consultant for approval.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

1. The purpose of the preliminary draft is to confirm the level of detail required by the Design Team, and the Contractor is to make adjustments as requested. The

Consultant will not review any Application submitted until changes requested by the Consultant to the preliminary draft have been incorporated.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify the following.

1. Each major Work Item.

2. Each subcontracted Work Item. For each major Subcontract (i.e. mechanical, electrical and plumbing), list products and operations of that Subcontract as separate line items. List labor and materials seperately for each major subcontractor.

3. Any Products to be stored, for which separate payments will be requested.

F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

G. Revise schedule to list approved Change Orders, with each Application For Payment.

H. Round off values to nearest dollar.

I. Sum of values listed shall equal total Contract Sum.

J. Substantiating Data: When requested by Consultant, submit justifying Substantiating Data and Line Item Amounts in question.

1.05 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Monthly.

B. Form to be used: AIA G702 and G703.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Consultant for approval.

D. Forms filled out by hand will not be accepted.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work. Include individual line items for change orders involving multiple items.

H. Submit one digital copy in PDF format of each Application for Payment.

I. Include the following with the application:

1. Construction progress schedule, revised and current as specified in Section 01 3216.

2. Payment for materials and equipment stored off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner.

J. When Consultant requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

K. Submit Applications for Payment to Consultant at times stipulated below.

L. When Consultant finds Application properly completed and correct, Consultant will transmit 3 copies of Certificate for Payment to Owner for approval of payment, with one copy to Contractor, and one retained for files.

1.06 ALTERNATE CONSTRUCTION PAYMENT MANAGEMENT SYSTEMS:

A. Nothing contained herein would prohibit the Contractor from proposing the use of a Construction Payment Management System that substantially complies with the requirements of this section. The contractor shall pay all additional fees associated with the Owner and Consultant's use of this system.

1.07 PAYMENT FOR PRODUCTS STORED OFF THE PROJECT SITE

A. When delay or added cost to Owner can be avoided by storing Products off Site, Owner will make payment to Contractor for said Products provided that

B. Contractor shall:

1. Locate Storage Facilities within 20 miles of the Consultant's Office or the Project Site.

2. Make Storage Facilities available for Consultant's visual inspection.

3. Segregate and label Stored Products for specified Project.

4. Assume all risk for loss.

5. Assume responsibility for exceeding Product "Shelf-Life".

6. Protect Stored Products and provide applicable Insurance against their damage, discoloration, and theft, listing the Owner and any Mortgagee as Additional Named Insured.

7. Submit itemized Inventory and Schedule of Values for Stored Products together with Certificate of Insurance.

8. Submit payment requests to Owner as part of Contractor's regular Progress Payment Request. Payment requests can only be for the actual invoiced amount to the contractor or sub-contractor by their respective material supplier. Provide copies of invoice to justify amount requested.

9. Reimburse Owner for damages sustained if Stored Products are not delivered to Jobsite when needed.

10. Submit to Owner, with copy to Consultant, a written Waiver of Lien insuring Owner against claims for unpaid Storage Costs.

11. Upon receipt of payment from Owner, prepare and issue to Owner, with a copy for Consultant, and any Mortgagee, a Bill of Sale for Stored Products.

1.08 PREVAILING WAGE PAYMENT CERTIFICATION

A. Submit Prevailing Wage Payment Certification Forms as required by Section 00 7343.

1.09 APPLICATION PAYMENT SCHEDULE

A. Within 15 Days, following Owner's approval of payment of in-order Application for Payment, the Owner will:

1. Until Substantial Completion, pay Ninety-Five Percent (95%) as defined in General Conditions during the previous month, as estimated by Consultant.

B. After execution of Certificate of Substantial Completion, and within 15 days, following Owner's approval of payment of the next in-order Application for Payment, the Owner will pay:

1. Balance due under Contract, excluding a Retainage Amount of at least $1,000, or double the estimated value of uncompleted and/or unacceptable portions of Work, whichever is the greater amount.

C. Thirty (30) days after final inspection and acceptance by Owner, and within 15 days following Owner's approval of payment of final in-order Application for Payment, the Owner will pay:

1. Balance due under Contract, provided Work be then fully completed and Contract be then fully performed.

1.10 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.

B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Consultant will issue instructions directly to Contractor.

C. For other required changes, Consultant will issue a Construction Change Directive document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.

1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.

2. Promptly execute the change.

D. For changes for which advance pricing is desired, Consultant will issue a Proposal Request document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 calendar days.

E. Contractor may propose a change by submitting a request for change to Consultant, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

1. For change requested by Consultant for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.

2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Consultant.

3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

4. For change ordered by Consultant without a quotation from Contractor, the amount will be determined by Consultant based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.

1. On request, provide the following data:

a. Quantities of products, labor, and equipment.

b. Taxes, insurance, and bonds.

c. Overhead and profit.

d. Justification for any change in Contract Time.

e. Credit for deletions from Contract, similarly documented.

2. Support each claim for additional costs with additional information:

a. Origin and date of claim.

b. Dates and times work was performed, and by whom.

c. Time records and wage rates paid.

d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: Consultant will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

K. Promptly enter changes in Project Record Documents.

1.11 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:

1. All closeout procedures specified in Section 01 7000.

2. Submit final Application for Payment with unconditional lien releases and supporting documentation not previously submitted and accepted in accordance with requirements of General Conditions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Submittals for review, information, and project closeout.

D. Number of copies of submittals.

E. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 6000 - General Conditions.

B. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.

C. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 7800 - Closeout Submittals: Project record documents.

1.03 CONSTRUCTION ORGANIZATION & START-UP

A. Responsible Parties:

1. Immediately following Contract execution, Owner will and Contractor shall identify who, within their respective organizations, will be responsible for Project Coordination.

B. The Contractor shall establish on-site Lines of Authority and Communications including the following:

1. Schedule attendance at Preconstruction Meeting and schedule and conduct Progress Meetings as specified in Section 01 3000.

2. Establish procedures for Intra-project Communications including:

a. Submittals.

b. Reports & Records.

c. Recommendations.

d. Coordination Drawings.

e. Schedules.

f. Resolution of Conflicts.

3. Technical Documents Interpretation:

a. Consult with Consultant to obtain interpretation.

b. Assist in resolution of questions or conflicts which may arise.

c. Transmit written interpretations to Subcontractors and to other concerned parties.

4. Permits & Approvals:

a. Verify that Subcontractors have obtained required Permits and Inspections for Work and for Temporary Facilities.

5. Control use of Site:

a. Supervise Field Engineering and Project Layout.

b. Allocate Field Office Space and Work and Storage Areas for use of each Subcontractor.

1.04 COORDINATING SUBCONTRACTORS' WORK

A. Coordinate the Work of all Subcontractors and make certain that, where the Work of one Trade is dependent upon the Work of another Trade, the Work first installed is properly placed, installed, aligned, and finished as specified or required to properly receive subsequent Materials applied or attached thereto.

B. Direct Subcontractors to correct defects in Substrates they install when Subcontractors of subsequent Materials have a reasonable and justifiable objection to such surfaces.

C. Do not force Subcontractors to apply or install Products to improperly placed or improperly finished Substrates that would result in an unsatisfactory or unacceptable finished Product.

1.05 COORDINATING WORK WITH WORK OF OWNER OR OTHER CONTRACTS

A. Coordinate, and make certain that, where Work of either party is dependent upon the other party, the Work first performed is properly placed, installed, aligned, and finished as required to permit the proper installation of the Work following.

B. If the Owner's Work in any way interferes with the Contractor's Work, so notify the Owner sufficiently in advance so that the Owner has reasonable time to make necessary adjustments.

C. If the Contractor's Work in any way interferes with Owner's Work, so notify the Owner as soon as possible. If the Contractor's Work must be modified to accommodate the Owner's Work, except as described elsewhere in this Specification, the Contract Sum and/or the Contract Time will, when necessary be adjusted by a Change Order.

D. Mechanical & Electrical Equipment start-up:

1. Coordinate check-out of Utilities, Operational Systems, and Equipment.

2. Assist in initial start-up and testing.

3. Record starting dates of Systems and Equipment operation.

E. At completion of Work of each Subcontract, conduct inspection to assure that:

1. Work is acceptable.

2. Specified cleaning has been accomplished, and Temporary Facilities and Debris has been removed from Site.

F. Substantial Completion: See Section 002113 1.13

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.

B. Attendance Required:

1. Owner.

2. Consultant.

3. Contractor.

4. Contractor's Superintendent.

5. Major Subcontractors.

C. Agenda:

1. Introductions.

2. Execution of Owner- Contractor Agreement.

3. Submission of executed bonds, insurance certificates and background checks.

4. Description of Project

5. Distribution of Contract Documents.

6. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.

7. Designation of personnel representing the parties to Contract, Owner and Consultant.

8. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

    a. Written Change Order requests required

    b. Supporting back-up will be required for all Change Orders

    c. Describe Contractor's procedure for review and oversight in the preparation of Change Orders

    d. Mark-up limitations on Change Orders (See General Conditions Article 7.1.4)

    e. Processing time required

    f. Applications for Payment

        1) Use AIA documents G702 and G703 latest edition

        2) Provide 4 signed and notarized copies

        3) Wage certifications to be attached

9. Scheduling, start date and date of substantial completion.

10. Building permit status.

11. Prevailing wage requirements.

12. Public Agency submittal of RESPONSIBILITY DETERMINATION FORM to Construction Contractor's Board.

13. Communications.

14. Role of Owner's Project Manager.

15. Employee Security Screening and Identification Badging.

16. Submittals required per Contract Documents.

17. MSDS Information

18. Erosion control procedures

19. Waste management procedures

20. Environmental quality requirements

21. Hazardous materials

22. Construction activities, working hours, use of site and building.

23. Staging and parking areas.

24. Temporary facilities and utilities.

25. Request for information and clarification of design

26. Correction of Defects.

27. Weekly on-site progress meetings.

28. Safety and Emergency Procedures.

29. Verify that Contractor's Mandatory Drug Testing Program is in place.

30. Daily Clean-up

31. Project Closeout, substantial completion, final completion.

32. Record drawings and Operations and Maintenance Manuals

33. Tour of Project by Owner's staff and guests (if applicable)

34. Additional Comments

D. Consultant will record minutes and distribute copies within [five] days after meeting to participants, with digital copies to Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at weekly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:

1. Contractor.

2. Owner.

3. Consultant.

4. Contractor's Superintendent.

5. Major Subcontractors.

D. Agenda:

1. Review minutes of previous meetings.

2. Review of Work progress.

3. Field observations, problems, and decisions.

4. Identification of problems that impede, or will impede, planned progress.

5. Review of submittals schedule and status of submittals.

6. Review of off-site fabrication and delivery schedules.

7. Maintenance of progress schedule.

8. Corrective measures to regain projected schedules.

9. Planned progress during succeeding work period.

10. Coordination of projected progress.

11. Maintenance of quality and work standards.

12. Effect of proposed changes on progress schedule and coordination.

13. Other business relating to Work.

E. The Owner's Project Manager will record minutes and distribute copies within five days after meeting to participants, with digital copies to Contractor, Owner, participants, and those affected by decisions made.

3.03 PRE-INSTALLATION CONFERENCES

A. When required in individual specification sections, the Contractor shall convene a pre-installation meeting prior to commencing work of that section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Consultant minimum four days in advance of meeting date.

D. The Contractor shall be responsible to prepare agenda and preside at meeting:

1. Review conditions of installation, preparation and installation procedures.

2. Review coordination with related work.

E. The Contractor shall be responsible to record minutes and distribute copies within four days after meeting to participants, with copies to Consultant, Owner's Project Manager, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 3216

3.05 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:

1. Product data.

2. Shop drawings.

3. Samples for selection.

4. Samples for verification.

5. Other information required in individual specification sections.

B. Submit to Consultant for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Product Data:

1. Clearly mark each copy to identify pertinent Products.

2. Show performance characteristics and capacities.

3. Show dimensions, field dimensions, and required clearances.

4. Show wiring and piping diagrams, and controls.

5. Show standard schematic drawings and diagrams:

a. Modify to delete information not applicable to Work.

b. Supplement standard information to provide information specifically applicable to Work.

c. Assure that any photo copied material is clearly legible or provide all original material.

D. Samples will be reviewed only for aesthetic, color, or finish selection.

E. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.06 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:

1. Design data.

2. Certificates.

3. Test reports.

4. Inspection reports.

5. Manufacturer's instructions.

6. Manufacturer's field reports.

7. Other information required in individual specification sections.

8. Other types indicated.

B. Submit for Consultant's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout:

1. Project record documents.

2. Operation and maintenance data.

3. Warranties.

4. Bonds.

5. Other information required in individual specification sections.

6. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; two of which will be retained by Consultant.

1. After review, produce duplicates.

2. Retained samples will not be returned to Contractor unless specifically so stated.

3. Show full range of color, texture & pattern.

3.09 SUBMITTAL PROCEDURES

A. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.

2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.

B. Transmit each submittal with a copy of approved submittal form.

C. Transmit each submittal with a transmittal form that clearly describes submittal contents and the quantity of items delivered.

D. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

E. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

F. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

G. Deliver submittals to Consultant at business address.

H. Schedule submittals to expedite the Project, and coordinate submission of related items.

I. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

J. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

K. Notify Consultant in writing, at submission time, of any deviations in Submittals from Contract Document requirements.

L. Provide space for Contractor and Consultant review stamps.

M. When revised for resubmission, identify all changes made since previous submission.

N. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

O. Submittals not requested will not be recognized or processed.

P. Submit Shop Drawings, Product Data, and Samples only for those Items specifically required. The Consultant will not be obligated to review Shop Drawings, Product Data, or Samples other than those required by the Contract Documents.

Q. Perform no Work or Fabrication requiring Submittal until Consultant approves Submittal.

END OF SECTION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Related Requirements

B. General Requirements

C. Definition of Schedule Documents and Submittal Requirements

D. Contractor's Schedule Management

E. Coordination

F. Schedule Format Requirements

G. Weather Impacts and Delays

H. Schedule Updates and Schedule (Network) Revisions

I. Time Impact Analysis for Changed Conditions

J. Recovery Schedule

K. Timeliness of Schedule Document Submittals

L. Owner Review of Schedule Submittals

1.02 RELATED REQUIREMENTS

A. The General Provisions, and General Requirements of the Specifications apply to the work specified in this Section.

B. Section 00 0120 – Bidder-Designed Items and Deferred Submittals

C. Section 01 6300 – Approval For Substitution and Product Options

1.03 GENERAL REQUIREMENTS

A. The Schedules (and schedule documents) described herein are for the following purposes:

1. To define the Contractor's Baseline Plan (including logic and use of resources) for completing the Work

2. To report progress in completion of the Work

3. To evaluate any changes to the Contractor's Baseline Plan and subsequent updated plans

B. In addition, the schedule documents shall serve as a communication tool between the Owner and the Contractor, and the Contractor and its subcontractors. The Owner

encourages the Contractor to use the Schedule to establish an understanding with all parties of the assumptions regarding the Work, and the various constraints and opportunities that are possible within the plan. As the work progresses, the Contractor and the Owner's Representative will use the Schedule to assess impacts and to formulate the best methods to complete the Work on, or ahead of the contractual completion dates. The schedule documents will also be used by the Contract Administrator to evaluate the Contractor's monthly progress payment requests.

C. The Work shall be scheduled and performed pursuant to the provisions of the Contract including any specific dates for Contract completion milestones, phase completion and the like or requirements included in the General Conditions, the Owner-Contractor Agreement, or elsewhere in the Contract documents. All Contract milestone and completion dates listed in these specifications, or elsewhere in the Contract documents, represent only interface dates or major items of the Work. The Contractor is responsible for completion of all aspects of the Work in accordance with the Contract.

D. At any time throughout the course of the Work, the Owner reserves the right to require additional activities to be added to the Schedule to further define the Contractor's plan and intentions regarding the execution of the Work. In each instance, such activities or changes shall be made by the Contractor at no cost or delay to the Owner. The Owner's Representative suggestions would not waive the contractor's right to establish its means and method or its obligation to execute the project in a timely and efficient manner.

E. Should the Contractor desire or intend to complete the Work, or any portion of the Work, earlier than the specified Contract milestone, phase, or similar dates or the overall Contract completion date, the Owner will not be liable to the Contractor for any costs or other damages should the Contractor be unable to complete the Work before Contractor's earlier milestone or completion dates. The duties and obligations of Owner to the Contractor shall be consistent with and applicable only to the completion of the Work on the specified Contract milestone dates or the Contract completion dates unless the Owner and the Contractor otherwise agree in writing, formalized by a change order. The Contractor may finish early but shall not make any claims for additional time-related costs before the expiration of the specified Contract milestone, phase, or similar dates or the overall Contract completion date.

F. The services provided by the Owner's Representative, the existence of schedules, networks or any other charts or services prepared or performed by the Owner's Representative, shall in no way relieve the Contractor of the responsibility for complying with all of the requirements of the Contract documents, including, but not limited to, the responsibility for completing the Work within the Contract Time and the responsibility of planning, scheduling, and coordinating the Work.

G. It is understood that during the prosecution of certain aspects of the work, i.e., phasing; commissioning; work with possible impacts to facilities and/or tenant operations; or utility shutdowns, a separate detailed scheduled will be required. The Contractor shall prepare these schedules in a timely manner as required for distribution by the Owner's Representative to all affected parties. The Contractor shall provide these schedules at no additional cost.

H. In addition to requirements specified herein, schedules shall include the following activities specific to Owner:

1. Delivery of Operational and Maintenance Training Manuals.

2. Submittal and expected approval of manufacturer's recommended spare parts list.

3. System inspection and punch list preparation.

I. The Contractor, including his Project Manager and Superintendent shall hold an orientation meeting with Owner, wherein the Contractor presents his approach to planning the work, developing the schedules, and meeting the requirements of this Section. This orientation meeting shall be held prior to submittal of the Baseline Schedule. The Contractor shall not delay preparation of the required schedules and schedule documents prior to this meeting; however, the Contractor shall be responsible for any changes or corrections to his scheduling as a result of this meeting.

1.04 DEFINITION OF SCHEDULE DOCUMENTS AND SUBMITTAL REQUIREMENTS

A. The following outlines the schedules and schedule documents required by this section to be submitted by the Contractor. Details on each item (and all items) to be submitted are provided in further paragraphs in this Section and in referenced sections.

1. Preliminary (4-Month) Schedule: This schedule is to detail all Contractor work, including procurement activities, mobilization, submittals, and construction activities for the first four months following the date of Notice to Proceed, and be used while the Contractor is developing his baseline schedule. All critical or completion dates required in the contract shall be incorporated into this schedule. The following submittal requirements apply to the preliminary schedule:

a. The Preliminary Schedule shall be submitted in a format and with content acceptable to the Owner's Representative and shall be submitted to the Contract Administrator no later than 10 calendar days after Notice to Proceed.

b. For purposes of this Preliminary Schedule, the Contractor is to assume that construction activities will occur within 30 calendar days after Notice to Proceed.

c. Allow five (5) working days for initial review and five (5) working days for resubmittal reviews by the Contract Administrator.

2. Baseline Schedule: This is a detailed schedule including a narrative of schedule status developed using the Critical Path Method (CPM). It represents the Contractor's plan for the Work from the date of award of the Contract and will be used to make the first Progress Schedule.

a. Submittal requirements: The Baseline Schedule shall be submitted in Primavera P6 format and with content acceptable to the Owner's Representative. The Contractor shall obtain (1) perpetual license of

Primavera P6 EPPM for use by the District PM and (1) license for use by the contractor during the contract duration.

b. Narrative of Schedule Status: This is a narrative that describes the key aspects of the submitted schedules. The Baseline Schedule narrative

shall define the key aspects of the Contractor's plan for the Work that includes the following key sections. The narratives submitted with the Baseline Schedules are required to be stand-alone documents that do not require Baseline Schedules to be attached in order to be comprehensible:

(1) The layout and logic used in the Schedule

(2) Critical submittals

(3) Long-lead equipment and material procurement.

(4) The critical path

(5) An overall float analysis

(6) Any interface concerns with Owner

(7) Costs to date

c. Activities: The schedule shall be grouped by the following work activities:

(1) Mobilization Activities

(2) Procurement Activities

(3) Manufacturing Activities

(4) Quality Control Activities

(5) Installation Activities

(6) Testing Activities

(7) Commissioning Activities

(8) Demobilization Activities

3. Master Summary Schedule: The cost-loaded Master Summary Schedule shall be developed by the Contractor and submitted to the Contract Administrator with the Baseline Schedule and each monthly Progress Schedule.

a. The Master Summary Schedule shall show the sequence in which Contractor proposes to perform the Work, all completion dates and critical dates indicated in the Contract Documents, and the dates on which Contractor plans to start and finish major portions of the Work. The Contractor shall include enough activities in the Master Summary Schedule, so that all significant portions of the Work, critical interfaces, coordination with Owner and milestone and completion dates are addressed.

b. The Summary Schedule shall be cost-loaded, at a high level, to develop a cash flow curve.

4. Critical Path Schedule: This schedule shall show the critical path derived first from the Baseline Schedule and subsequently from the current Progress Schedule. This is a time-scaled network logic diagram, showing only the current critical path of the Work along with its current progress. In the event of near critical path work (less than 10 days of float), the Owner's Representative may request the near critical paths also be shown. The following submittal requirements apply to the Critical Path Schedule:

   a. Submittal Requirements:

      (1) Submit with Baseline Schedule.

      (2) Update and submit with the Progress Schedule.

      (3) Export Primavera P6 schedule data to the client in live file format for all submissions.

5. Progress Schedule: This is a detailed schedule, developed using the Critical Path Method (CPM), which is derived from the Baseline Schedule. The first Progress Schedule is the initial monthly progress update of the Baseline Schedule. Subsequent Progress Schedules will be submitted on a monthly basis that updates the previously issued Progress Schedule. The Progress Schedule will also be used to compare percent complete requested by the Contractor in the monthly progress payment applications, to analyze delays and impacts in all Time Impact Analyses (TIA), and to determine whether a Recovery Schedule is needed from the Contractor.

   a. Submittal requirements: Progress schedules are due monthly to coincide with the progress payment requests. The updated progress schedule will be targeted against the approved baseline and will include baseline start, finish, float, and original duration.

   b. Narrative of Schedule Status: This is a narrative that describes the key aspects of the submitted schedules. The Progress Schedule narrative shall define the key aspects of the Contractor's plan for the Work that includes the following key sections. The narratives submitted with the Progress Schedules are required to be stand-alone documents that do not require Progress Schedules to be attached in order to be comprehensible:

      (1) Progress in Last Period

      (2) Critical Path Progress and Concerns

      (3) Potential Delays and Time Impact Analyses

      (4) Submittal Status (focus on critical submittals and concerns)

      (5) Equipment and Material Delivery Status

(6) Quality Control Status

(7) Manufacturing Status

(8) Costs to Date

6. Weekly Short Interval Schedule: This is a three-week Look-Ahead Schedule for use in the weekly schedule review meetings. The weekly interval schedules shall include the current activities from the Progress Schedule and all other schedule information deemed necessary.

   a. Submittal requirements:

      (1) Provide the schedule in a format acceptable to the Owner's Representative.

      (2) Submitted no later than 24 hours before the weekly schedule review meeting.

      (3) Distribute the final weekly interval schedule to all field supervision no later than the next workday following the weekly schedule review meeting.

7. Recovery Schedule: This schedule will be required from the Contractor in the event that certain conditions exist such that critical or milestone dates are in jeopardy of being delayed. Recovery Schedule requirements are defined in later paragraphs of this section.

   a. Submittal requirements: Submit five (5) working days after notice from the Contract Administrator that a Recovery Schedule is required.

8. Time Impact Analysis: This schedule analysis shall be part of the back-up data required from the Contractor in the event the Contractor claims that Contract changes delayed or impacted the Work and shall be included in any change proposal claiming increase in time. The Time Impact Analysis requirements are defined in later paragraphs of this section.

   a. Submittal requirements: Formal submittal of the Time Impact Analysis shall be within 15 calendar days of occurrence of the delay. Failure to submit within the 15 calendar days waives the Contractor's right to claim additional costs or time as a result of such delay.

9. Schedule of Submittals: Submit per the following table:

Deliverable	Hard Copies	Electronic Copies	Submittal Due	Remarks
Preliminary (Four-Month) Schedule	2 color copies of each sort	1	10 calendar days after the Notice to Proceed	One-time submittal. Submit using same format requirements as the Baseline Schedule
Baseline Schedule	2 color copies of each sort	1	30 calendar days after the Notice to Proceed	Acceptance is prerequisite to issuance of NTP. Critical Path Schedule is integral to Baseline Schedule. **Also, see Note (1).**
Progress Schedule		1	Monthly	Critical Path Schedule is integral to Progress Schedule. **Also, see Note (1).**
Master Summary Schedule		1	With the Baseline Schedule, then Monthly	One-time submittal. Submit with the Baseline Schedule and each Progress Schedule
As-Built Schedule	Include color copy in project O&M	1	Within 30 days of substantial completion	Project schedule shall be considered as-built for work completed and updated with each progress billing. Final document shall be included in O&M
Weekly Look-Ahead Schedule	Sufficient copies for weekly meeting attendees	1	1 Electronic copy 24 hours before weekly schedule review meeting, harmonize with sufficient copies for attendee's color copies presented at OAC Meeting	
Recovery Schedule	2 color copies	1	Within 5 days of notice to submit	
Time Impact Analysis	2 color copies	1	Within 15 days of date of delay claimed	Submit with all changes requesting time extensions

Note (1) Includes Master Summary Schedule, Narrative of Schedule Status, Manpower Loading Curve, and Subcontractor Log.

1.05 CONTRACTOR'S SCHEDULE MANAGEMENT

A. Scheduling Organization: The Contractor shall provide a Contractor's Scheduling Manager (CSM) to the implementation and management of the scheduling requirements of the Contract documents. The CSM (who may be the Contractor's Project Manager, Superintendent, or other qualified staff person) shall be on site at all times during the progress of the work, or as otherwise authorized in writing by the Contract Administrator.

B. Qualifications of Contractor's Scheduling Manager:

1. The CSM shall demonstrate acceptable professional familiarity with P6 software, hardware, and/or other scheduling systems and experience necessary to implement all scheduling requirements of the Contract in a timely and expeditious manner.

2. The Owner's Representative will monitor the performance of the CSM. The CSM's performance will be judged on the timeliness and completeness of Contractor's compliance with the scheduling requirements of the Contract documents. If the CSM fails to perform in accordance with the scheduling requirements of the Contract documents, the CSM shall, at the direction of the Contract Administrator, be replaced at no cost to Owner or delay allowable to the project.

1.06 COORDINATION

A. The Contractor shall coordinate the Work with that of Owner contractors, Owner Operations, and Owner tenants, and shall cooperate fully with the Owner's Representative in maintaining an orderly progress toward completion of the Work as scheduled.

B. A Time Impact Analysis (TIA) shall be required to support any claim by the Contractor for delay caused by failure of Owner-furnished equipment and materials to arrive as scheduled, or failure of other Owner interface work or tenants to meet their schedules. The TIA shall be based on Owner activities having the same level of predecessor and successor logic to display delay impacts as the Contractor's Work.

C. The Contractor shall inform its subcontractors of the delivery status of Owner-furnished equipment and material, and of the progress of other interfacing Owner construction work while the Work is underway.

1.07 SCHEDULE FORMAT REQUIREMENTS

A. Unless otherwise specified, the Baseline and Progress Schedules shall be produced utilizing the Microsoft Windows based Primavera P6 Project Management of the most current version.

B. The Baseline and Progress Schedules shall employ the Critical Path Method (CPM) using retained logic for the planning, scheduling and reporting of the work to be performed under this Contract. The type of schedule shall be Precedence Diagramming Method (PDM).

C. The Baseline and Progress Schedules shall include but not be limited to:

1. All Critical, Milestone, and Completion dates defined in the Contract, as well as Owner-provided equipment delivery dates.

2. Date of Contract Award, Notice To Proceed, Mobilization, Substantial Completion, and Overall Beneficial Occupancy, Completion of each Phase, Pre-final Inspections, Final Inspections, and Final Acceptance.

3. Critical procurement and submittal activities including: shop drawings and sample submittals, Owner review of submittals, re-submittals and Owner review of re-submittals, fabrication and delivery for all key, critical path, near critical path and long-lead equipment and material. Owner reserves the right to require the Contractor to add procurement activities to the schedule for any key or long-lead equipment, materials or submittals it deems necessary to monitor the Contractor's schedule for this work.

4. Quality Control Activities, Testing, Pre-Installation Activities, Commissioning, training and closeout activities.

5. Offsite activities that interface with the Contractor's Work, including work by Owner and Owner contractors, delivery of Owner-furnished materials, utilities, agencies, critical Owner operations, Owner tenants, and other similar activities.

D. Activity Descriptions and Setup

1. The description of work by activity and activity coding shall contain the specific type of work to be done and the physical area of the work to which the activity pertains.

2. Activity boundaries shall be easily measurable, and descriptions shall be clear and concise. Activity descriptions should not be prefaced with "Begin" or "Complete." The beginning and end of each activity shall be readily verifiable, and physical progress shall be quantifiable.

3. In general, each critical path and key activity shall be associated with a single performing organization (subcontractor). For other activities, where there is similar type work in an area, organizations (subcontractors) may be grouped for a single activity. Where deemed necessary to define critical, key or unusual work, Owner reserves the right to require additional activities be added to the Contractor's schedule to provide that an activity be associated with each organization (subcontractor). The organization related to the activity shall be identified in a background sort code, such that reports sorted by organization can be made using the scheduling software. Construction Specifications Institute (CSI) codes relating to the division of the work shall be assigned to activities in the same manner described above for organizations. CSI codes are also to be assigned to background sort codes that allow reports by CSI code to be made using the scheduling software.

4. Activity durations over fifteen (15) working days shall be kept to a minimum and shall be used only for non-construction activities, such as shop drawing and sample submittals, fabrication and delivery of materials and equipment, concrete curing, and General Conditions activities. Exceptions to this shall be accepted in

writing by the Contract Administrator. The duration of activities shall be in workdays.

5. Activity costs shall be limited to a maximum of Two-Hundred-Fifty-Thousand Dollars ($250,000), excluding major equipment and materials. Exceptions to this shall be accepted in writing by the Contract Administrator.

6. For critical path and near critical path activities, Contractor shall use Finish-to-Start relationships to the extent possible. Contractor shall use more activities if necessary, to use Finish-to-Start relationships in preference to use of Start-to-Start relationships. The Owner reserves the right to require the addition of activities to further define critical path and near critical path work in the Schedule.

7. Activities that constitute the controlling operations or critical path will be identified by use of color (red). The critical path is defined as activities with total float less than one day. Near critical is defined as total float in the range of one to ten days. The critical path and near critical activities shall be less than 25 percent of the total activities in the Baseline Schedule.

8. Imposed completion dates for events other than the Milestone Dates or Completion Dates are generally not permitted. Artificial constraints (imposed start dates) are generally not permitted, except possibly for use in Owner- furnished materials, Owner interface dates and the like. Upon creating a new project schedule in the software, the option planned start and planned completion dates should be appropriately inserted. This will allow the schedule calculations to identify negative float when projected dates slip past the planned completion date. All Owner-furnished materials and Owner interface dates shall have an early start/finish and late start/finish range. All Owner dates shall be related to the Contractor's Work with predecessor and successor logic such that float is correctly calculated on Owner-furnished materials and Owner interface dates.

9. Activity numbering shall be spaced (or gapped) to allow inclusion of new activities between existing activities while still maintaining a similarity of numbering for like activities. Numbering by area, level, etc. is encouraged to assist in analysis. The numbering may be alphanumeric to allow easier identification of areas, etc. At a minimum, the following code fields should be included:

   a. RESP – Responsibility (Owner, Owner's Representative, Sub Consultants, Jurisdictions, Key Third Parties, Contractors, Sub Contractor and, Vendors)

   b. PHAS – Phases

   c. AREA – Locations

   d. STEP – Steps or Sub AREAs

   e. ITEM – Specification Section Numbers

   f. CONO – Change Order Numbers

10. Activities that have started and are in progress shall be "scheduled" on each

submitted schedule. Planned durations for remaining work and planned completions of remaining work on activities shall be used. Activities shall not "ride" the data date line, with scheduled completions being the remaining durations, unless the Contractor actually plans to complete work within the remaining duration. Schedules submitted with activities "riding" the data date line will not be accepted by Owner.

11. The work breakdown and coding structure (WBS) should, at a minimum, incorporate the following:

    a. Milestones/Hammocks

    b. Deferred Approvals (by CSI, including Agency Approvals)

    c. Submittals (by CSI)

    d. Quality Control Activities, Pre-Installation Activities, Commissioning, Designer of Record Observations, Mock-ups

    e. Work

        i. mobilization

        ii. Grading/Underground Utilities

        iii. Foundations

        iv. Structures

        v. Exterior Skin and Roof

        vi. Interior Construction:

            a. By Floor

            b. By Major Unique Functional Area

            c. Electrical and MEP Equipment

            d. Unique Elements

            e. Equipment, including OFCI, OFOI and OFOICC

            f. Start-Up, Commissioning and Test & Balance (by system and element)

            g. Fire and Life-Safety and Systems Pre-Tests (by system and element)

            h. Fire and Life-Safety Jurisdictional Tests and Inspections (by system and element)

            i. Final Sign Offs by the Design Team and Jurisdictions

E. Schedule Layout and Sequence of Activities

1. The schedule layout shall be consistent with the Project Conditions and milestones set forth in the Contract documents. Work to complete each milestone shall be easily identifiable in the Contractor's overall schedule.

2. The layout shall be consistent with the Work required to meet the Contract milestone dates. In general, it is desired to have the Work needed to meet the Contract milestones be detailed activities that summarize, or roll-up to provide plan and status information reported for the milestone. The summarized overall schedule shall allow reporting of physical progress, cost, and manpower loading for the entire work. Owner intent will be to use the Contractor's schedule for milestones to summarize activities in Owner Master Schedule for all projects.

3. The Schedule layout shall be arranged to allow easy physical progress monitoring of physical areas. Essentially, each level and area within level or area and level within area or the like shall be broken down within the Schedule. These areas and levels shall summarize (or rollup) for reporting purposes. The Contractor shall establish the layout that is needed to meet his Contract responsibilities. The Contractor shall use his selected layout to coordinate with the Contractor's submitted progress payment applications, such that the Schedule, physical progress, the progress payment application and physical progress can be compared to determine the actual progress payments to be made to the Contractor.

4. The calendar is established including agreed working times and holidays. The calendar should not be altered during the project unless the Owner's Representative expressly agrees.

5. Only activity types such "Start Milestone," "Finish Milestone," and "Task" will be allowed with prior authorization by the Owner's Representative. Level of effort (LOE) activities may be used to summarize work as needed to produce summary level schedules for presentation purposes.

6. All activities should have both predecessor and successor logic ties that accurately represent the sequence and interdependence of all related activities except Project Start (which would not have any predecessors) and the last Contract Milestone (which would not have any successors).

7. Negative lags may not be used (there will be no exceptions to this requirement). FS – Finish-to-Start with zero (0) duration logic ties are preferable.

8. SF – Start-to-Finish logic ties are not acceptable.

F. Formats of Schedules Submitted to Owner's Representative

1. The formats of schedules (and schedule documents) shall be submitted to the Owner's Representative are described below. The formats described are solely for reporting information and analysis use with Owner and are not intended to direct the Contractor in his own methods of scheduling. The Contractor may use any schedule format needed for his own use in performing his responsibilities in the Contract.

2. All schedules (and schedule documents) shall be submitted with clear identification of Owner and Contractor's job numbers, schedule names, descriptions, plot dates, data dates, file numbers, issue numbers and the like.

3. All Baseline, Progress and Summary Schedules submitted shall be formatted in a fixed sequence of summary and detail activities for the Contract duration for ease of reference in progress updates. This sequence shall be established by the Contractor and acceptable to the Owner's Representative. The sequence shall be set up in the software such that re-sequencing or reorganizing of the Schedules is not required to generate Owner required schedules and reports. This allows a one to one comparison of each Schedule issued with previous Schedules for analysis purposes, including the As-built Schedule.

4. All Baseline, Progress, and Summary Schedules shall be submitted with the activity description data listed from left to right, as follows: Activity ID, Activity Description, Original Duration, Remaining Duration, Total Float, Percent Complete, Early Start, and Early Finish. The early start and finish dates shall display an "A" after the dates if started (and finished). The Baseline Schedule shall also have the late start and late finish dates to the right of the early finish dates. The Owner reserves the right, at no cost, to require the Contractor to add the late start and late Finish dates to the Progress and Summary Schedules at any time.

5. The status bars on all schedules shall display the physical percent complete of progress. This same physical percent complete shall also be used in the data field. The percent complete of activity duration to show progress shall not be used.

6. The Baseline and Progress Schedules shall be submitted as color plotted time-scaled logic diagrams, with sufficient calendar and spacing to allow activity description information, bars and logic to be easily read. For each submitted schedule, a color plotted time-scaled logic diagram of just critical path activities shall be submitted. The fixed format, as described above, shall be used for all time-scaled logic diagram submittals throughout the duration of the project.

7. The Baseline, Progress, and Summary Schedules shall be submitted in bar chart format with activity data on the left side and bars on the right side. Logic shall not be displayed. Activity descriptions shall be displayed in the bar area. These bar chart schedules shall be 11" x 17" in size, and readable.

8. The Progress Schedule shall be submitted in an additional bar chart format that displays the previous month's Progress Schedule as a "Target" schedule for comparison use. The first Progress Schedule shall use the Baseline Schedule as the "Target" schedule. The "Target" bars shall be of smaller size, of different color, and below the current schedule's bars. Two color copies shall be submitted. The size shall be 11" x 17".

9. The Baseline and Progress Schedules shall be submitted in a bar chart format, as described above, but shall contain only the critical path activities. In the event that the Contractor's schedule has more than 25 percent of the activities as critical path or near critical path, the Contractor shall submit an additional bar chart schedule containing both the critical path and near critical path (as previously defined) activities.

10. The Baseline and Progress Schedules shall be submitted with a tabular report that displays the activity data previously listed in this subsection, sorted by Activity Number. Owner reserves the right to request up to two additional tabular reports, in a format requested by the Owner's Representative, with any schedule submittal, Time Impact Analysis, or Recovery Schedule, at no additional cost to Owner.

11. The Baseline and Progress Schedules shall be submitted with a predecessor and successor report in 8-1/2" x 11", black and white format, displaying the activity data previously listed in this subsection and the predecessors and successors for each activity. This shall be in the fixed activity format.

12. All schedules and schedule documents submitted to the Owner's Representative shall be in hard copy, as described above, and in the submitted format via electronic transmission that contains the schedule data files.

1.08 WEATHER IMPACTS AND DELAY

A. The Contractor agrees that he shall not be entitled to a time extension due to normal inclement weather, which can be expected at the project locale due to precipitation, snow, temperature, or other weather conditions. Normal inclement weather shall be defined as the most recent five-year average of accumulated record mean values from climatological data compiled by the US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) monitoring station nearest to the project site. The Contractor shall include in its Baseline Schedule and all Progress Schedules, allowances for normal inclement weather. Agreed rain days will be tied to specific activity sequences in specific seasons.

B. The Contractor shall only be entitled to an extension of Contract time, if the Contractor can substantiate that the severity of the weather was in excess of the normal inclement weather, and such weather conditions actually delayed the critical path of the Work. Time extensions will not be allowed for weather delays to non-critical path portions of the Work. Approved time extensions for abnormal weather conditions shall be deemed excusable and non-compensable.

C. No extension of time will be made for abnormal inclement weather after the portions of the Work in progress at the time are enclosed, except for site work. Site work delays at that time will be allowed only if the abnormal weather causes a critical path delay to the Contract Time or milestone date related to that site work. For the purpose of this paragraph, the term enclosed is defined to mean when the Work in an area of a structure or building is sufficiently closed in (portions of exterior walls up and portions of roof in place), so as to permit adequate conditioning of the air to allow the various trades to perform the Work.

D. The Contractor is responsible for providing any temporary weather enclosures necessary for Work to proceed without weather delays.

1.09 SCHEDULE UPDATES AND SCHEDULE (NETWORK) REVISIONS

A. During the course of the Work and issuance of the Progress Schedules, updating to reflect actual progress shall not be considered revisions to the Schedule. Such updating shall include revisions to activity durations and certain sequences on a monthly basis. Included

B. in the Progress Schedule updates shall be activities and changes that have already been reviewed and accepted by Owner such as the effect of accepted Owner changes, the agreed duration of delays caused by acts of God or other conditions or events which have affected the progress of the Work. The Progress Schedules, when formally submitted, shall display current progress, as well as displaying the forecast or projected Work to the end of the Project.

C. On all Progress Schedule submittals, the Contractor shall submit a printed list of all schedule logic changes along with the reason for each change. This list is an integral part of the Schedule submittal. This list shall be generated from the scheduling software and be the same logic included electronic transmission. Owner shall accept this list as part of its overall Progress Schedule submittal review and acceptance process.

D. Should the Contractor, after Owner acceptance of the Baseline Schedule and any Progress Schedules, desire to change the logic of its plan of construction, the Contractor shall submit in writing its requested revisions to the Owner's Representative. The request shall include a written narrative of the reasons for the activity and logic changes, a description of the logic for rescheduling the work, and the methods of maintaining adherence to critical and milestone dates. In addition, for changes affecting sequences of the Work, the Contractor shall provide a time-scaled logic diagram that compares the original sequence of work to the requested revised sequence of work. The Contractor shall submit the requested revision in a timely manner such that Owner may review the request submittal the same time frame and manner as required for other schedule submittals. Upon Owner acceptance of the request, the Contractor shall include the revision in the next upcoming Progress Schedule.

E. Neither the updating or revision of the Contractor's Progress Schedule, nor the submittal, updating, change or revision of any schedule (or schedule document) for the Owner's review and acceptance shall have the effect of amending or modifying, in any way, the Contract Time, any Contract completion date, or Contract milestone dates or of modifying or limiting in any way Contractor's obligations under this Contract.

1.10 TIME IMPACT ANALYSIS FOR CHANGED CONDITIONS

A. If delays are experienced that the Contractor believes are caused by Owner, the Contractor shall submit a formal written Time Impact Analysis (TIA). The TIA shall define the impact of each change or delay to the current accepted Progress Schedule. The TIA shall include a written narrative of the impact of such delays, and a schedule in time-scaled logic diagram format that depicts how the changed or delayed work affects other activities in the current accepted Progress Schedule.

B. In addition to the Contractor's presentation of the impact in the TIA, the Contractor shall include in the TIA, a mitigation plan that reduces or eliminates the claimed delay. The mitigation plan shall include specific Owner and Contractor actions as well as the cost to the Contractor to proceed with the mitigation.

C. In the event that the Contractor requests a Contract time extension, the time impacts to critical path activities in the current accepted Progress Schedule shall be clearly shown on a schedule in time-scaled logic diagram format. Extensions of time will be granted only to the extent that such changes or delays cause the time for the changed activity and related activities to exceed the total float along the affected path of activities at the time of Owner directive to proceed with the change or the actual commencement of the delay included in the TIA.

D. Schedule float is not for the exclusive use or benefit of either the Contractor or Owner. Neither Owner nor the Contractor "owns" the float. The project or Work "owns" the float. Liability for delay to Contract or milestone dates rests with the party whose action (or inaction) caused the delay beyond the float that was available at the time of the delaying action (or inaction).

E. Each formal TIA shall be submitted as an integral element of the Contractor's change order proposal.

F. A copy of Owner accepted TIA will be incorporated in the change order signed by Owner and the Contract Administrator for such change. Any changes to the Schedule will be incorporated into the next update of the Progress Schedule following the Owner's acceptance of the TIA.

G. The Contractor shall be responsible for all costs associated with the preparation of the TIA and the incorporation of accepted TIA's, or portion of TIA's, in the Progress Schedule.

H. If agreement is not reached on a TIA, or a portion of a TIA, the Progress Schedule, including any time extensions, shall be revised only to the extent accepted by Owner. For any TIA, or portion of a TIA, that is not accepted by Owner, the Contractor may submit a claim in accordance with the Conditions of the Contract.

1.11 RECOVERY SCHEDULE

A. Should any conditions exist, such that certain activities shown on the Contractor's Progress Schedule fall behind schedule to the extent that any of the mandatory critical dates or milestone completion dates are at risk of being delayed, the Contractor shall be required, at no cost to Owner, to prepare and submit to the Owner's Representative a supplementary Recovery Schedule. The Recovery Schedule shall be in a form and detail appropriate to the need, to explain and display to the Owner's Representative how the Contractor intends to re-schedule those activities to regain compliance with the last previously accepted Progress Schedule.

B. After determination by the Owner's Representative of the requirement for a Recovery Schedule, the Contractor shall, within five (5) calendar days, submit to Owner's Representative, the Recovery Schedule. The Recovery Schedule shall represent the Contractor's best judgment as to how the Contractor's work shall be reorganized such that the work may return to the accepted Progress Schedule within the maximum one-month period. The Recovery Schedule shall be prepared at a similar level of detail as the Progress Schedule and shall be based on the accepted Progress Schedule.

C. The Owner's Representative will have seven (7) calendar days to review the Recovery Schedule submittal. Any revisions that result from the Owners Representative's review shall be resubmitted within three (3) workdays by the Contractor for acceptance by the Contract Administrator. The accepted Recovery Schedule shall then be the Schedule that the Contractor shall use in planning, organizing, directing, coordinating, performing and executing the Work (including all activities of subcontractors, equipment vendors and suppliers) that is included on the Recovery Schedule. All other Work shall proceed per the accepted Progress Schedule.

D. No later than five (5) calendar days prior to the expiration of the Recovery Schedule, the Owner's Representative and Contractor will meet to determine whether the Contractor

has regained compliance with the accepted Progress Schedule. At the direction of the Owner's Representative, one of the following will occur:

1. If, in the opinion of the Owner's Representative, the Contractor is still behind schedule, the Contractor shall prepare another Recovery Schedule, at the Contractor's expense, to take effect for a maximum of one additional month from the start of the new Recovery Schedule.

2. If, in the opinion of the Owner's Representative, the Contractor has sufficiently regained compliance with the Progress Schedule, the use of the Progress Schedule shall be resumed.

1.12 TIMELINESS OF SCHEDULE DOCUMENT SUBMITTALS

A. The Schedule (and schedule documents) shall be submitted in a timely manner, as required by this Section. Failure to submit the Schedule and schedule documents on time

and in an acceptable format shall result in withholding of payments and other remedies.

1.13 OWNER REVIEW OF SCHEDULE SUBMITTALS

A. All schedule documents shall be formally submitted and will be reviewed by Owner and returned to the Contractor with the required acceptance or action noted.

B. In providing review comments on schedule (and schedule document) submittals, and in this section, Contract Administrator may use the word "accepted", "not accepted" or variations thereof in conveying its review comments to the Contractor. At any time, the "accepted" or similar wording is used, such wording shall have no different meaning than similar wording, such as "no exceptions taken."

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. References and standards.

C. Testing and inspection agencies and services.

D. Control of installation.

E. Mock-ups.

F. Tolerances.

G. Manufacturers' field services.

H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 00 6000 - General Conditions: Inspections and approvals required by public authorities.

B. Section 01 3000 - Administrative Requirements: Submittal procedures.

C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).

B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2014a.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.

G. OSSC - Oregon Structural Specialty Code, latest edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Consultant's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Consultant and to Contractor.

1. Include:

a. Date issued.

b. Project title and number.

c. Name of inspector.

d. Date and time of sampling or inspection.

e. Identification of product and specifications section.

f. Location in the Project.

g. Type of test/inspection.

h. Date of test/inspection.

i. Results of test/inspection.

j. Conformance with Contract Documents.

k. When requested by Consultant, provide interpretation of results.

2. Test report submittals are for Consultant's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Consultant, in quantities specified for Product Data.

1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Consultant.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Consultant's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

G. Erection Drawings: Submit drawings for Consultant's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

2. Data indicating inappropriate or unacceptable Work may be subject to action by Consultant or Owner.

1.05 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Consultant before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Consultant shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Consultant before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Consultant will use to judge the Work.

C. Integrated Exterior Mock-ups: construct integrated exterior mock-up as indicated on Drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

D. Notify Consultant fifteen (15) working days in advance of dates and times when mockups will be constructed.

E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

H. Obtain Consultant's approval of mock-ups before starting work, fabrication, or construction.

I. Accepted mock-ups shall be a comparison standard for the remaining Work.

J. Where mock-up has been accepted by Consultant and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Consultant.

K. Where possible salvage and recycle the demolished mock-up materials.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Consultant before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections and the current building code for testing and inspection required.

B. Testing Agency Duties:

1. Provide qualified personnel at site. Cooperate with Consultant and Contractor in performance of services.

2. Perform specified sampling and testing of products in accordance with specified standards.

3. Ascertain compliance of materials and mixes with requirements of Contract Documents.

4. Promptly notify Consultant and Contractor of observed irregularities or non-conformance of Work or products.

5. Perform additional tests and inspections required by Consultant.

6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.

3. Agency may not assume any duties of Contractor.

4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

3. Provide incidental labor and facilities:

a. To provide access to Work to be tested/inspected.

b. To obtain and handle samples at the site or at source of Products to be tested/inspected.

c. To facilitate tests/inspections.

d. To provide storage and curing of test samples.

4. Notify Consultant and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Consultant.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Consultant 30 days in advance of required observations.

1. Observer subject to approval of Consultant.

2. Observer subject to approval of Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary telecommunications services.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Project identification sign.

H. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 01 5100 - Temporary Utilities.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:

1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.

2. Telephone Land Lines: One line, minimum; one handset per line.

   a. Cell phone service with voice mail for the project superintendent is an acceptable alternative to a fixed telephone device for this project.

3. Internet Connections: Minimum of one; DSL modem or faster.

4. Email: Account/address reserved for project use.

5. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

a. This service may reside at the Contractor's office for this project if someone in the office can regularly check the device for messages.

C. Provide a digital camera at the site capable of taking pictures of job conditions and sending.jpg images via e-mail to Owner and Architect.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. Provide barriers to protect workers on the site and the public against injury.

B. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

C. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

D. Provide protection for plants designated to remain. Replace damaged plants.

E. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

F. Traffic Controls: Provide as required to maintain safe working environment for Owner and Contractor personnel using the site.

1.07 TEMPORARY FIRE PROTECTION

A. Provide and maintain necessary facilities and equipment to safeguard Project against Fire Damage.

1.08 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.09 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.11 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.12 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Existing parking areas may be used for construction parking.

H. Do not allow vehicle parking on existing pavement.

I. Use designated drop off and delivery areas for short term parking only.

J. Do not use Owner's Parking Lots for overnight vehicle storage.

K. Designate one parking space for Owner and Architect use.

L. Repair existing facilities damaged by use, to original condition.

M. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

1.13 MATERIAL STORAGE SPACE

A. Maintain within Project Limits in accordance with Architect's and Owner's instructions. Do not block exitways or overload structure.

1.14 WASTE REMOVAL

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Encourage the separation of waste materials and sorting and disposal at a local recycling center.

C. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

D. Provide containers with lids. Remove trash from site periodically.

E. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

F. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.15 PROJECT IDENTIFICATION

A. A project sign is not required for this project.

B. No other signs are allowed without Owner permission except those required by law.

1.16 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture and storage space for drawings and all project documents.

B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

C. Provide office within 15 days from Notice to Proceed, maintain, and remove prior to Substantial Completion or as agreed by Owner.

D. Contractor shall provide a field office, minimum 8’x20’ for Owners Rep: Weathertight, with lighting, electrical outlets, internet, heating, cooling equipment, and equipped with sturdy furniture and storage space for drawings and all project documents. Provide separate keyed lock.

1. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

2. Provide office within 15 days from Notice to Proceed, maintain, and remove prior to Substantial Completion or as agreed by Owner.

3. Provide Utilities: power and internet.

1.17 VISITOR PERSONAL PROTECTION EQUIPMENT

A. Provide six sets of Personal Protection Equipment (PPE) for use by official visitors to the project site during construction. Visitor PPE shall include as a minimum, hard hat and protective eye goggles. Provide high visibility garments when moving vehicles are in use on the construction site. Store in Field Office and reserve for use by visitors to the project site.

B. Maintain in good condition through the course of the project and replace equipment that does not meet personal safety requirements.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls:

1. Temporary telecommunications services for administrative purposes.

2. Temporary sanitary facilities required by law.

1.03 CONSERVATION

A. It is the Owner's practice to utilize natural resources responsibly. Exercise appropriate energy and water conservation measures at all times.

1.04 TEMPORARY ELECTRICITY

A. Cost of Labor, Material and Energy: By Contractor.

B. Provide power service required from utility source.

C. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.

D. Provide main service disconnect and over-current protection at convenient location and meter.

E. Permanent convenience receptacles may be utilized during construction.

F. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be utilized during construction.

1.06 TEMPORARY HEATING

A. Cost of of Labor, Material and Energy: By Contractor.

B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.07 TEMPORARY COOLING

A. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

B. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.08 TEMPORARY VENTILATION

A. Existing ventilation equipment may not be used.

1.09 TEMPORARY WATER SERVICE

A. Cost of Labor, Materials, and Water Used: By Contractor.

B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

C. Connect to existing water source.

1. Exercise measures to conserve water.

D. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 REFERENCE STANDARDS

A. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus; 2007.

B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).

C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2011.

D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.

E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.

F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002 (Reapproved 2009).

1.03 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of state and local jurisdictions for erosion and sedimentation control.

B. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

C. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

1. An erosion control permit is required. The Owner shall apply, pay for, and secure the permit. The contractor shall comply with the construction erosion control permit.

2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.

D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.

1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.

1. Control movement of sediment and soil from temporary stockpiles of soil.

2. Prevent development of ruts due to equipment and vehicular traffic.

3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.

1. Prevent windblown soil from leaving the project site.

2. Prevent tracking of mud onto public roads outside site.

3. Prevent mud and sediment from flowing onto sidewalks and pavements.

4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

J. Open Water: Prevent standing water that could become stagnant.

K. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.04 WORK INCLUDED BUT SPECIFIED ELSEWHERE

A. Erosion control products and construction work within any jurisdictional right-of-way shall conform to the requirments of that jurisdiction, in addition to the requirements herein and those shown on the private improvement drawings.

B. Erosion control products and construction work within the any jurisdictional right-of-way shall conform to the requirments of that jurisdiction, 1990 Standard Specifications for Public Works Construction published by the Oregon Chapter of APWA (Amended in 1996) and to the requirements herein and those shown on the private improvement drawings.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:

1. Submit within 2 weeks after Notice to Proceed.

2. Include:

a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.

b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.

c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.

d. Schedule of temporary preventive measures, in relation to ground disturbing activities.

e. Other information required by law.

f. Format required by law is acceptable, provided any additional information specified is also included.

3. Obtain the approval of the Plan by authorities having jurisdiction.

4. Obtain the approval of the Plan by Owner.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:

1. Straw or hay.

2. Wood waste, chips, or bark.

3. Erosion control matting or netting.

4. Polyethylene film, where specifically indicated only.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Bales: Air dry, rectangular straw bales.

1. Cross Section: 14 by 18 inches, minimum.

2. Bindings: Wire or string, around long dimension.

D. Bale Stakes: One of the following, minimum 3 feet long:

1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.

2. Wood, 2 by 2 inches in cross section.

E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:

1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.

2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491.

3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355 after 500 hours exposure.

4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.

5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.

6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D4533.

7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

F. Silt Fence Posts: One of the following, minimum 5 feet long:

1. Softwood, 4 by 4 inches in cross section.

G. Gravel: See Section 32 1123 for aggregate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.

1. Width: As required; 20 feet, minimum.

2. Length: 50 feet, minimum.

3. Provide at each construction entrance from public right-of-way and where noted on drawings.

4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.

1. Provide linear sediment barriers:

a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.

2. Space sediment barriers with the following maximum slope length upslope from barrier:

a. Slope of Less Than 2 Percent: 100 feet..

b. Slope Between 2 and 5 Percent: 75 feet.

c. Slope Between 5 and 10 Percent: 50 feet.

d. Slope Between 10 and 20 Percent: 25 feet.

e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:

1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.

2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

G. Soil Stockpiles: Protect using one of the following measures:

1. Cover with polyethylene film, secured by placing soil on outer edges.

2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.

I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

A. Traffic-Bearing Aggregate Surface:

1. Excavate minimum of 6 inches.

2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.

3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:

1. Store and handle fabric in accordance with ASTM D4873.

2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.

3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.

4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.

5. Install with top of fabric at nominal height and embedment as specified.

6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.

7. Fasten fabric to wood posts using one of the following:

   a. Four nails per post with 3/4 inch diameter flat or button head, 1 inch long, and 14 gage, 0.083 inch shank diameter.

   b. Five staples per post with at least 17 gage, 0.0453 inch wire, 3/4 inch crown width and 1/2 inch long legs.

8. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

C. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.

2. Install bales so that bindings are not in contact with the ground.

3. Embed bales at least 4 inches in the ground.

4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.

5. Fill gaps between ends of bales with loose straw wedged tightly.

6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Mulching Over Large Areas:

1. Dry Straw and Hay: Apply 2-1/2 tons per acre; anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.

2. Wood Waste: Apply 6 to 9 tons per acre.

3. Erosion Control Matting: Comply with manufacturer's instructions.

E. Mulching Over Small and Medium Areas:

1. Dry Straw and Hay: Apply 4 to 6 inches depth.

2. Wood Waste: Apply 2 to 3inches depth.

3. Erosion Control Matting: Comply with manufacturer's instructions.

F. Temporary Seeding:

1. When hydraulic seeder is used, seedbed preparation is not required.

2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.

3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.

4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.

5. Incorporate fertilizer into soil before seeding.

6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.

7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.

8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:

1. Promptly replace fabric that deteriorates unless need for fence has passed.

2. Remove silt deposits that exceed one-third of the height of the fence.

3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:

1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.

2. Remove silt deposits that exceed one-half of the height of the bales.

3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality after completion of construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.

1. Cleaning of ductwork is not contemplated under this Contract.

2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.

1. Furnish products meeting the specifications.

2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Testing and inspection services.

B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.04 REFERENCE STANDARDS

A. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2009.

B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.

C. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; April 1990.

D. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; January 1999.

E. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.05 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.

1. Submit not less than 60 days before enclosure of building.
2. Identify potential sources of odor and dust.
3. Identify construction activities likely to produce odor or dust.
4. Identify areas of project potentially affected, especially occupied areas.
5. Evaluate potential problems by severity and describe methods of control.
6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Describe cleaning and dust control procedures.

C. Air Contaminant Test Plan: Identify:

1. Testing agency qualifications.
2. Locations and scheduling of air sampling.
3. Test procedures, in detail.
4. Test instruments and apparatus.
5. Sampling methods.

D. Air Contaminant Test Reports: Show:

1. Location where each sample was taken, and time.
2. Test values for each air sample; average the values of each set of 3.
3. HVAC operating conditions.
4. Certification of test equipment calibration.
5. Other conditions or discrepancies that might have influenced results.

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See Section 01 6116.

B. Low VOC Materials: See individual sections for specific requirements for materials with low VOC content.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:

1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.

2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.

3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. HVAC equipment and ductwork may NOT be used for ventilation during construction:

1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.

2. Exhaust directly to outside.

3. Seal HVAC air inlets and outlets immediately after duct installation.

E. Do not store construction materials or waste in mechanical or electrical rooms.

F. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.

1. Inspect duct intakes, return air grilles, and terminal units for dust.

2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.

3. Clean tops of doors and frames.

4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.

5. Clean return plenums of air handling units.

6. Remove intake filters last, after cleaning is complete.

G. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

H. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.02 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:

1. All construction is complete.

2. HVAC systems have been tested, adjusted, and balanced for proper operation.

3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.

4. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.

1. Obtain Owner's concurrence that construction is complete enough before beginning flush-out.

2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.

3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.

4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:

a. Begin ventilation at least three hours prior to daily occupancy.

b. Continue ventilation during all occupied periods.

c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.03 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before occupancy.

C. Do not start air contaminant testing until:

1. All construction is complete, including interior finishes.

2. HVAC systems have been tested, adjusted, and balanced for proper operation.

3. New HVAC filtration media have been installed.

D. Indoor Air Samples: Collect from spaces representative of occupied areas:

1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.

2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet; take samples from areas having the least ventilation and those having the greatest presumed source strength.

3. Collect samples from height from 36 inches to 72 inches above floor.

4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.

5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.

6. When retesting the same building areas, take samples from at least the same locations as in first test.

E. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

F. Analyze air samples and submit report.

G. Air Contaminant Concentration Limits:

1. Formaldehyde: Not more than 27 parts per billion.

2. PM10 Particulates: Not more than 50 micrograms per cubic meter.

3. Total Volatile Organic Compounds (TVOCs): Not more than 500 micrograms per cubic meter.

4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: Allowable concentrations listed in Table 4-1.

5. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.

H. Air Contaminant Concentration Test Methods:

1. Formaldehyde: ASTM D5197, EPA 625 Method TO-11A, or EPA 600 Method IP-6.

2. Particulates: EPA 600 Method IP-10.

3. Total Volatile Organic Compounds (TVOC): EPA 625 Method TO-1, TO-15, or TO-17; or EPA 600 Method IP-1.

4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625 Method TO-1, TO-15, or TO-17.

5. Carbon Monoxide: EPA 600 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.

I. Air Contaminant Concentration Determination and Limits:

1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.

2. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.

3. Formaldehyde: Not more than 50 parts per billion.

4. Formaldehyde: Measure in micrograms per cubic meter, in relation to outside air; not more than 20 micrograms per cubic meter higher than outside air.

5. Total Volatile Organic Compounds (TVOC): Not more than 500 micrograms per cubic meter.

6. Total Volatile Organic Compounds (TVOC): Measure in micrograms per cubic meter, in relation to outside air; not more than 200 micrograms per cubic meter higher than outside air.

7. Particulates (PM10): Not more than 50 micrograms per cubic meter.

8. Total Particulates (PM): Measure in micrograms per cubic meter, in relation to outside air; not more than 20 micrograms per cubic meter higher than outside air.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations and procedures.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Document 00 2113 - Instructions to Bidders: Product options and substitution procedures prior to bid date.

B. Section 01 4000 - Quality Requirements: Product quality monitoring.

C. Section 01 6023 - Substitution Request Form

D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

E. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

1.03 REFERENCE STANDARDS

A. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at www.greenguard.org.

B. GreenSeal GS-36 - Commercial Adhesives; Green Seal, Inc.; 2000.

C. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products that comply with the specifications and are proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit within 15 days after date of Subcontract Award Notice.

2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specifies process and time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in that section.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request on Form 01-6023 with complete data substantiating compliance of proposed substitution with Contract Documents. **Include a point by point comparative analysis in matrix form.**

D. Substitutions

1. Notify Architect when Contractor is aware of materials, equipment, or products that meet the aesthetic and programmatic intent of Contract Documents, but which are more environmentally responsible than materials, equipment, or products specified or indicated in the Contract Documents.

E. A request for substitution constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension that may subsequently become apparent.

F. Substitutions will not be allowed post bid.

G. Each request for substitution approval shall include:

1. Identity of Product for which substitution is requested; include Specification Section.

2. Identity of substitution; include complete Product description, drawings, photographs, performance and test data, and any other information necessary for evaluation.

3. ~~Identify compliance with any described LEED product requirements~~.

4. Quality comparison of proposed substitution with specified product.

5. Changes in other Work required because of substitution.

6. Effect on construction progress schedule.

7. Cost of proposed substitution compared with specified product.

8. Any required license fees or royalties.

9. Availability of maintenance service.

10. Source of replacement materials.

H. Architect will be sole judge of acceptability of any proposed substitution.

3.02 SUBSTITUTIONS AFTER CONTRACT AWARD

A. Approval will be granted only when:

1. Specified Product cannot be delivered without Project delay, or

2. Specified Product has been discontinued, or

3. Specified Product has been replaced by superior Product, or

4. Specified Product cannot be guaranteed as specified, or

5. Specified Product will not perform properly, or

6. Specified Product will not fit within designated space, or

7. Specified Product does not comply with governing codes, or

8. Substitution will be clearly in Owner's interest.

B. Architect will issue Change Order authorizing approved substitutions and revising Contract Sum where appropriate.

3.03 CONTRACT COMPLIANCE

A. Substitution approval does not relieve Contractor from responsibility for proper execution of the Work and for compliance with other Contract requirements.

3.04 OWNER-SUPPLIED PRODUCTS

A. See Section 01 1000 for identification of Owner-supplied products.

B. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.

2. Arrange and pay for product delivery to site.

3. On delivery, inspect products jointly with Contractor.

4. Submit claims for transportation damage and replace damaged, defective, or deficient items.

5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.

2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.

3. Handle, store, install and finish products.

4. Repair or replace items damaged after receipt.

3.05 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.06 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SUBSTITUTION REQUEST: DATE SUBMITTED _____

1.01 SUBMIT TO: Marlene Gillis, Principal, marleng@sdra.com

1.02 PROJECT: Mechanical Upgrade Project

1.03 SPECIFIED ITEM:

A. SECTION NAME AND NUMBER: _____

B. PRODUCT TYPE AND NAME AND MODEL: _____

C. PARAGRAPH AND PRODUCT DESCRIPTION: _____

1.04 PROPOSED SUBSTITUTION:

A. MANUFACTURER AND MODEL NUMBER(S): _____

B. PRODUCT DESCRIPTION: _____

C. Attached data includes product description, specifications, drawings, photographs, performance, test data and **point by point comparative matrix** adequate for evaluation of request including identification of applicable data portions. Attached data also includes description of changes to Contract Documents the proposed substitution requires for proper installation.

D. It is the responsibility of the requestee to assemble a comparative matrix outlining key elements of proposed substitution.

1.05 UNDERSIGNED CERTIFIES FOLLOWING ITEMS, UNLESS MODIFIED BY ATTACHMENTS, ARE CORRECT:

A. Proposed substitution does not affect dimensions shown on the drawings.

B. Undersigned pays for changes to building design, including engineering design, detailing, and construction costs caused by proposed substitution.

C. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.

D. Maintenance and service parts are available locally or readily obtainable for proposed substitution.

1.06 UNDERSIGNED FURTHER CERTIFIES FUNCTION, APPEARANCE, AND QUALITY OF PROPOSED SUBSTITUTION ARE EQUIVALENT OR SUPERIOR TO SPECIFIED ITEM.

1.07 UNDERSIGNED FURTHER CERTIFIES THAT THE MANUFACTURER OF THE PROPOSED SUBSTITUTION IS AWARE OF THIS SUBSTITUTION REQUEST AND AGREES TO THE STATEMENTS NOTED ABOVE.

1.08 UNDERSIGNED AGREES THAT THE TERMS AND CONDITIONS FOR SUBSTITUTIONS FOUND IN BIDDING DOCUMENTS APPLY TO THIS PROPOSED SUBSTITUTION.

1.09 SUBMITTED BY:

A. PRINT NAME: _____

SIGNATURE:_____

B. FIRM NAME: _____

C. FULL MAILING ADDRESS: _____

City: _____ State: _____ Zip:_____

D. PHONE: _____ E-MAIL: _____

1.10 FOR USE BY ARCHITECT OR ENGINEER

A. APPROVED OR APPROVED AS NOTED BY: _____

B. NOT APPROVED BY: _____

C. RECEIVED TOO LATE: _____

D. REMARKS: _____

E. DATE OF RESPONSE: _____

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirement for installer certification that they did not use any non-compliant products.

B. VOC restrictions for product categories listed below under "DEFINITIONS."

C. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

C. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.

D. Section 01 5721 - Indoor Air Quality Controls: Procedures and testing.

E. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:

1. Adhesives, sealants, and sealer coatings.
2. Carpet.
3. Carpet tile.
4. Resilient floor coverings.
5. Paints and coatings.
6. Insulation.
7. Gypsum board.
8. Acoustical ceilings and panels.
9. Cabinet work.
10. Wall coverings.
11. Composite wood and agrifiber products used either alone or as part of another product.
12. Other products when specifically stated in the specifications.

B. Interior of Building: Anywhere inside the exterior weather barrier.

C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.04 REFERENCE STANDARDS

A. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Carpet and Rug Institute; Current Edition.

B. GreenSeal GC-03 - Anti-Corrosive Paints; Green Seal, Inc.; 2007

C. GreenSeal GS-11 - Paints; Green Seal, Inc.; 1993.

D. GreenSeal GS-36 - Commercial Adhesives; Green Seal, Inc.; 2011.

E. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition; http://www.aqmd.gov/

F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov

G. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Evidence of Compliance: Submit for each different product in each applicable category.

C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

D. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.

1. Definition: This provision applies to gunnable, trowelable, and liquid-applied adhesives, sealants, and sealant primers used anywhere on the interior of the building inside the weather barrier, including duct sealers and fire stopping.

2. ~~LEED:~~ Not Used

3. Certification: Require each installer to certify compliance and submit product data showing product content.

    a. Evidence of Compliance: Acceptable types of evidence are:

        1) Report of laboratory testing performed in accordance with requirements.

        2) Published product data showing compliance with requirements.

        3) Certification by manufacturer that product complies with requirements.

        4) SCAQMD limits for specific product categories:

            a) Architectural ApplicationsVOC Limit g/L less water

                1. Indoor Carpet Adhesives 50

                2. Carpet Pad Adhesives 50

                3. Outdoor Carpet Adhesives 150

                4. Wood Flooring Adhesive 100

                5. Rubber Floor Adhesives 60

                6. Subfloor Adhesives 50

                7. Ceramic Tile Adhesives 65

                8. VCT and Asphalt Tile Adhesives 50

                9. Dry Wall and Panel Adhesives 50

                10. Cove Base Adhesives 50

                11. Multipurpose Construction Adhesives 70

                12. Structural Glazing Adhesives 100

                13. Single Ply Roof Membrane Adhesives 250

            b) Specialty Applications VOC Limits g/L less water

                1. PVC Welding 510

                2. CPVC Welding490

                3. ABS Welding 325

4. Plastic Cement Welding250
5. Adhesive Primer for Plastic 550
6. Computer Diskette Manufacturing350
7. Contact Adhesive 80
8. Special Purpose Contact Adhesive250
9. Tire Retread 100
10. Adhesive Primer for Traffic Marking Tape150
11. Structural Wood Member Adhesive140
12. Sheet Applied Rubber Lining Operations850
13. Top and Trim Adhesive250

c) Substrate Specific ApplicationsVOC Limit g/L less water

1. Metal to Metal 30
2. Plastic Foams 50
3. Porous Material (except wood) 50
4. Wood 30
5. Fiberglass 80

d) Sealants VOC Limit g/L less water

1. Architectural 250
2. Marine Deck 760
3. Nonmembrane Roof 300
4. Roadway 250
5. Single-Ply Roof Membrane 450
6. Other 420

e) Sealant Primers VOC Limit g/L less water

1. Architectural Non Porous250
2. Architectural Porous775
3. Modified Bituminous 500
4. Marine Deck 760

5. Other 750

C. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.

1. ~~LEED:~~ Not Used

2. Certification: Require each installer to certify compliance and submit product data showing product content.

a. Evidence of Compliance: Acceptable types of evidence are:

1) Current GreenSeal Certification.

2) Report of laboratory testing performed in accordance with GreenSeal GS-36 requirements.

3) Published product data showing compliance with requirements.

3. GreenSeal limits for specific product categories:

a. Aerosol AdhesivesVOC Weight g/L minus water

1) General purpose mist spray65% VOCs by weight

2) General purpose web spray55% VOCs by weight

3) Special purpose aerosol adhesives (all types)70% VOCs by weight

D. Paints and Coatings:

1. Definition: This provision applies to paints and coatings used anywhere on the interior of the building inside the weather barrier, including all primers and sealers.

2. Provide coatings that comply with the most stringent requirements specified in the following:

a. Architectural Paints and Coatings: Do not exceed VOC content limits established in GreenSeal GS-11.

b. Anti-Corrosive and Anti-Rust Paints: Do not exceed VOC content limits established in GreenSeal GS-03.

c. Clear Wood Finishes, Floor Coatings, Stains, Primers and Shellacs: Do not exceed the VOC content limits established in SCAQMD Rule No. 1113.

3. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

4. This provision is applicable to LEED Credit EQ 4.1; submit LEED Prohibited Content Installer Certification Forms and all support material per section 01 35 16.07.

5. Certification: Require each installer to certify compliance and submit product data showing product content.

    a. Evidence of Compliance: Acceptable types of evidence are:

        1) Report of laboratory testing performed in accordance with requirements.

        2) Published product data showing compliance with requirements.

6. Limits for specific product categories:

    a. Architectural paints, coatings and primers applied to interior walls and ceilings per GreenSeal GS-11

        1) Flats: 50 g/L

        2) Non-Flats: 150 g/L

        3) Primers 50 g/L

    b. Interior Anti-Corrosive and Anti-rust paints, coatings and primers per GreenSeal GS-03, Anti-Corrosive Paints

        1) 250 g/L

    c. All other coatings, paints and sealers per SCAQMD Rule #1113, Architectural Coatings

        1) Coating CategoryVOC Limit g/L

            (a) Bond Breakers 350

            (b) Clear Wood Finishes275

            (c) Varnish275

            (d) Sanding Sealers275

            (e) Lacquer275

            (f) Clear Brushing Lacquer275

            (g) Concrete-Curing Compounds100

            (h) Concrete-Curing Compounds For Roadways and Bridges350

            (i) Dry-Fog Coatings150

            (j) Fire-Proofing Exterior Coatings350

            (k) Fire-Retardant Coatings Clear 650

            (l) Fire-Retardant Coatings Pigmented 350

(m) Flats50

(n) Floor Coatings50

(o) Graphic Arts (Sign) Coatings 500

(p) Industrial Maintenance (IM) Coatings100

(q) High Temperature IM Coatings 420

(r) Zinc-Rich IM Primers100

(s) Japans/Faux Finishing Coatings350

(t) Magnesite Cement Coatings450

(u) Mastic Coatings300

(v) Metallic Pigmented Coatings500

(w) Multi-Color Coatings250

(x) Nonflat Coatings50

(y) Nonflat High Gloss50

(z) Pigmented Lacquer 275

(aa) Pre-Treatment Wash Primers420

(ab) Primers, Sealers, and Undercoaters100

(ac) Quick-Dry Enamels 50

(ad) Quick-Dry Primers, Sealers, and Undercoaters100

(ae) Recycled Coatings250

(af) Roof Coatings50

(ag) Roof Coatings, Aluminum100

(ah) Roof Primers, Bituminous350

(ai) Rust Preventative Coatings100

(aj) Shellac Clear 730

(ak) Shellac Pigmented 550

(al) Specialty Primers100

(am) Stains100

(an) Stains, Interior 250

(ao) Swimming Pool Coatings Repair340

(ap) Swimming Pool Coatings Other340

(aq) Traffic Coatings100

(ar) Waterproofing Sealers100

(as) Waterproofing Concrete/Masonry Sealers100

(at) Wood Preservatives Below-Ground350

(au) Wood Preservatives- Other 350

(av) Low-Solids Coating 120

E. Carpet and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Current Green Label Plus Certification.

b. Report of laboratory testing performed in accordance with requirements.

F. Carpet Tile and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Current Green Label Plus Certification.

b. Report of laboratory testing performed in accordance with requirements.

G. Composite Wood and Agrifiber Products and Adhesives Used for Laminating Them: Provide products having no added urea-formaldehyde resins.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Current SCS "No Added Urea Formaldehyde" certification; www.scscertified.com.

b. Published product data showing compliance with requirements.

H. Other Product Categories: Comply with limitations specified elsewhere.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Requirements for forming openings in existing construction for all work including mechanical and electrical work.

D. Pre-installation meetings.

E. Cutting and patching.

F. Surveying for laying out the work.

G. Cleaning and protection.

H. Starting of systems and equipment.

I. Demonstration and instruction of Owner personnel.

J. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

K. General requirements for maintenance service.

L. Substantial completion

M. Final Completion

N. Additional fees for delays in completing work

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

G. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

H. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

1. On request, submit documentation verifying accuracy of survey work.

2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.

3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:

1. Structural integrity of any element of Project.

2. Integrity of weather exposed or moisture resistant element.

3. Efficiency, maintenance, or safety of any operational element.

4. Visual qualities of sight exposed elements.

5. Work of Owner or separate Contractor.

6. Include in request:

a. Identification of Project.

b. Location and description of affected work.

c. Necessity for cutting or alteration.

d. Description of proposed work and products to be used.

e. Effect on work of Owner or separate Contractor.

f. Written permission of affected separate Contractor.

g. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1. Minimize amount of bare soil exposed at one time.

2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.

2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

3. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate work of alterations and renovations to expedite completion sequentially and to accommodate occupancy requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.08 CONTRACTOR'S FULL TIME SUPERVISION OF THE WORK

A. Contractor shall provide an on-site project superintendent to be present full time whenever work is occurring on site.

B. Contractor's Superintendent shall maintain a Daily Log of work activities at the site during construction.

1. Submit copies of the Daliy Logs to the Owner on a weekly basis.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect seven days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation and installation procedures.

2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. The stability and integrity of the existing structure during demolition and selective demolition shall be maintained at levels generally acceptable within the construction industry by the use of temporary bracing, shoring, and underpinning until the proposed structure modifications are completed. In no case shall the existing structure be allowed to become unsafe during construction.

B. The design, installation, and removal of shoring and bracing systems required to provide temporary support of the existing structure during construction shall be the responsibility of the Contractor and shall be designed to support the dead, live, soil, earthquake, and wind loads that may be imposed on the structure during construction in accordance with industry standards and generally accepted engineering principals. Provide the services of a registered professional engineer to design these systems when required by Oregon State Statute and the building code.

C. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as shown.

2. Report discrepancies to Architect before disturbing existing installation.

3. Beginning of alterations work constitutes acceptance of existing conditions.

D. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

2. Provide appropriate temporary signage including signage for exit or building egress.

E. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.

2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

F. Comply with regulatory requirements for Alteration Work:

1. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

2. Obtain required permits from authorities.

3. Do not close or obstruct egress from any building exit or site exit.

4. Do not disable or disrupt building fire or life safety systems without 3 days' prior written notice to Owner.

5. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered. Stop all work in the area and notify the Owner's representative.

a. Owner will provide verification, abatement, and removal as required to complete the Work.

G. Remove existing work as indicated and as required to accomplish new work.

1. Remove items indicated on drawings.

2. Relocate items indicated on drawings.

3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.

4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible

H. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.

1. Notify affected utility companies before starting work and comply with their requirements.

2. Mark location and termination of utilities.

3. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.

4. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Owner. Provide temporary services during interruption of existing utilities, as acceptable to the Owner

5. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

6. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

a. Disable existing systems only to make switchovers and connections; minimize duration of outages.

b. Provide temporary connections as required to maintain existing systems in service.

7. Verify that abandoned services serve only abandoned facilities.

8. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

I. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.

2. Perform cutting to accomplish removals neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.

4. Cover finish floors to remain.

5. Use only rubber tired vehicles for conveying materials in building.

J. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.

2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

K. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

L. Refinish existing surfaces as indicated:

1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.

2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

M. Clean existing systems and equipment.

N. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

O. Clean remaining structure, equipment and facilities of all dirt, dust, and debris caused by demolition work. Return areas to conditions existing prior to the start of the work.

P. Do not begin new construction in alterations areas before demolition is complete.

Q. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:

1. Complete the work.

2. Fit products together to integrate with other work.

3. Provide openings for penetration of mechanical, electrical, and other services.

4. Match work that has been cut to adjacent work.

5. Repair areas adjacent to cuts to required condition.

6. Repair new work damaged by subsequent work.

7. Remove samples of installed work for testing when requested.

8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Sawcutting:

1. Employ experienced sawcutting contractor to make all holes, or slab and pavement cutting shown in drawings for architectural, structural, mechanical and electrical work.

2. Do not use water saws in occupied areas, unless otherwise approved.

3. Cut openings square and plumb with sharp edges. Minimize overcutting at corners.

4. Verify location of existing utilities in work area and make proper precautions to protect, disconnect and relocate, or terminate services as directed.

K. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

2. Match color, texture, and appearance.

3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

L. Maintain adequate Temporary Support necessary to assure structural integrity of affected Work.

M. Protect other portions of Project Work against damage and discoloration.

N. Protect Work exposed by cutting against damage and discoloration.

O. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

P. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

Q. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

3.13 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean interior floors in accordance with flooring manufacturer instructions.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

3.15 SUBSTANTIAL COMPLETION

A. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

B. Complete all required maintenance work prior to the date of substantial completion.

C. When Contractor considers Work substantially complete, as defined in General Conditions, submit to the Architect:

1. Written notice that Work, or designated portion thereof, is substantially complete.

2. List of Items to be completed or corrected.

3. Copy of Final or Temporary Occupancy Permit.

D. Architect will, as soon as possible thereafter, make an observation visit to the site to determine completion status.

E. Should Architect determine that Work is not substantially complete:

1. Architect will promptly notify Contractor in writing, giving reasons therefore.

2. Contractor shall remedy Work deficiencies, and send second notice of substantial completion to Architect.

3. Architect will review the corrected work.

F. When Architect concurs that Work is substantially complete, Architect will:

1. Prepare Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected, as verified and amended by Architect.

2. Submit Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

G. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

H. Notify Architect when work is considered finally complete.

I. Complete items of work determined by Architect's final inspection.

J. See: ***General Conditions of the Contract for Construction*** for additonal requirements.

3.16 FINAL ACCEPTANCE

A. When Contractor considers Work complete, submit written certification that:

1. Contract Documents have been reviewed.

2. Contractor has inspected Work for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and Systems have been tested in presence of Owner's Representative and are operational.

5. Work is complete and ready for final inspection.

B. Architect will, as soon as possible thereafter, make an observation visit to the site to determine completion status.

C. Should Architect consider Work incomplete or defective:

1. Architect will promptly notify Contractor in writing, listing incomplete or defective Work.

2. Contractor shall immediately remedy deficiencies, and send second written certification to Architect that Work is complete.

3. Architect will review the corrected Work.

D. When Architect finds Work acceptable under Contract Documents, Architect will request Contractor to make closeout submittals.

E. See: ***General Conditions of the Contract for Construction*** for additonal requirements.

3.17 ADDITIONAL FEES FOR DELAYS IN COMPLETING THE WORK

A. Architect will make 2 visits to the project site, one at Substantial Completion and one at Final Completion.

B. Should Architect be required to make more than the stated 2 final site visits due to Contractor's failure to correct specified deficiencies:

1. Owner will compensate Architect for additional services.

2. Owner will deduct Architect's compensation amount from Contractor's final payment as follows:

a. Principal's time at their contracted hourly rate.

b. Employees' time at their contracted hourly rate.

c. Consultant employees and Others at 1.1 times the direct cost incurred.

d. Charges will be made for necessary travel time, commercial air fare, auto expense computed at current allowable IRS mileage rate, room and board, and all other expenses incurred in making inspections.

END OF SECTION

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:

1. Aluminum and plastic beverage containers.

2. Corrugated cardboard.

3. Wood pallets.

4. Clean dimensional wood: May be used as blocking or furring.

5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.

6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

7. Fluorescent lamps (light bulbs).

E. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

G. Methods of trash/waste disposal that are not acceptable are:

1. Burning on the project site.

2. Burying on the project site.

3. Dumping or burying on other property, public or private.

4. Other illegal dumping or burying.

5. Incineration, either on- or off-site.

6. Use of Owner's trash receptacles.

H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local

requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

C. Waste Management Plan: Include the following information:

1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.

2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).

3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.

D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.

1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.

2. Submit Report on a form acceptable to Owner.

3. Landfill Disposal: Include the following information:

a. Identification of material.

b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.

c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.

d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

4. Recycled and Salvaged Materials: Include the following information for each:

a. Identification of material, including those retrieved by installer for use on other projects.

b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.

c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.

d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.

5. Material Reused on Project: Include the following information for each:

a. Identification of material and how it was used in the project.

b. Amount, in tons or cubic yards.

c. Include weight tickets as evidence of quantity.

6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Spill Response Planning - Establish spill prevention and cleanup procedures. Identify all potential spill areas and develop procedures for avoiding and responding to spills should they occur.

C. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

D. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

E. Meetings: Discuss trash/waste management goals and issues at project meetings.

1. Pre-bid meeting.

2. Pre-construction meeting.

3. Regular job-site meetings.

F. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

1. Provide containers as required.

2. Provide adequate space for pick-up and delivery and convenience to subcontractors.

3. If an enclosed area is not provided, clearly lay out and label a specific area on-site.

4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

G. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

H. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

I. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

J. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. ***Section 00 6000 General Conditions of Construction Contract*** for additonal requirements.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Substantial Completion will not commence before the Operations and Maintenance Manuals, Warranties, and the Record Drawings are submitted in accordance with Section 01 7000.

B. Project Record Documents: Submit documents to Consultant Prior to Substantial Completion.

C. Operation and Maintenance Data:

1. Submit one paper copy of preliminary draft or proposed formats and outlines of contents before start of Work. Consultant will review draft and return the one copy with comments.

2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.

3. Submit one copy of completed documents 30 days prior to scheduled date of substantial completion.. This copy will be reviewed and returned, with Consultant comments. Revise content of all document sets as required prior to final submission.

4. Submit three digital copy in PDF file format on CD or DVD discs, and three paper sets of revised final documents in final form prior to date of Substantial Completion.

5. Either the draft copy or the final copy of the O&M manuals must be on the project site during any of the operator training scheduled for the project.

D. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.

2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

4. Submit three digital copies in PDF file format on CD or DVD discs, and [three] paper sets of final documents prior to date of Substantial Completion.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications to the Contract.

B. Maintenance of documents and samples.

1. Store in Contractor's Field Office apart from Documents used for Construction.

2. Provide Files, Shelving and Cabinets necessary to safely and securely store Documents and Samples.

3. Maintain Documents in a clean, dry, legible, and good order.

4. Do not use Record Documents for Construction Purposes.

5. Make Documents available at all time for Consultant's inspection

C. Ensure entries are complete and accurate, enabling future reference by Owner.

D. Store record documents separate from documents used for construction.

E. Record information concurrent with construction progress.

F. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.

G. Record Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish first floor datum.

2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

4. Field changes of dimension and detail.

5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

1. Product data, with catalog number, size, composition, and color and texture designations.

2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. In addition to requirements called for in other sections of this manual, provide the following:

B. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.

2. Identify function, normal operating characteristics, and limiting conditions.

3. Include performance curves, with engineering data and tests.

4. Complete nomenclature and model number of replaceable parts.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

D. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

E. Include color coded wiring diagrams as installed.

F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

G. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

H. Provide servicing and lubrication schedule, and list of lubricants required.

I. Include manufacturer's printed operation and maintenance instructions.

J. Include sequence of operation by controls manufacturer.

K. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

L. Provide control diagrams by controls manufacturer as installed.

M. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

N. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

O. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

P. Include test and balancing reports.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Digital O&M Manuals: In addition to binders described below, prepare manuals as PDF documents organized similar to the printed manuals. Copy to one or more properly labeled CD or DVD discs.

1. Searchable PDF files are preferred when possible. Table of Contents and any divider pages in these PDF files must be searchable.

2. Digital copies of O&M Manuals must be organized by section.

F. Paper & 3 Ring Binder O&M Manuals: Binders to be Wilson Jones #344 Series of equivalent, as approved by the Owner. Minimum ring size 1”. When multiple binders are used, correlate data into related consistent groupings. Do not overfill binders.

G. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

H. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Consultant, Consultants, Contractor and subcontractors, with names of responsible parties.

I. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

J. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

K. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

L. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

M. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.

2. Table of Contents, of all volumes, and of this volume.

3. Operation and Maintenance Data: Arranged by system, then by product category.

a. Source data.

b. Operation and maintenance data.

c. Field quality control data.

d. Original warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and when required have been are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Binders to be Wilson Jones #344 Series of equivalent, as approved by the Owner. Minimum ring size 1”. Do not overfill binders.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.07 EVIDENCE OF PAYMENTS & RELEASE OF LIENS

A. Contractor shall submit the following:

1. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G-706 or equivilant form.

2. Contractor's Affidavit of Release of Liens, AIA Document G-706A or equivilant form, including the following:

a. Consent of Contractor's Surety to Final Payment, AIA Document G-707, or equivilant form.

b. Contractor's Release or Waiver of Liens.

c. Separate releases or waivers of lien for Subcontractors, Suppliers, and others with lien rights against Owner's Property, together with list of those parties.

3. Duly sign and execute all Submittals, before delivery to Consultant.

3.08 CONTRACTOR'S CLOSEOUT SUBMITTALS TO CONSULTANT

A. Wage Certification: Section 00 7343 and 01 2000.

B. Building Official's Certificate of Mechanical & Electrical Inspections.

C. Building Official's Certificate of Occupancy.

3.09 SPARE PART & MAINTENANCE MATERIAL SUBMITTALS TO OWNER

A. All spare parts and extra material are to be delivered to the owner prior to the date of substantial completion. Provide written confirmation of delivery, noting quantity and description as well as storage location. Obtain written acceptance from Owner for receipt of stored items.

B. Specific Requirements: See Specifications Sections.

C. Products: Identical to those included in Project Work.

D. Storage Location: Where directed by Owner.

E. Required Submittals: See Specification Sections.

3.10 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit final statement of accounting to Consultant, including the following:

1. Original Contract Sum.

2. Additions and deductions resulting from:

a. Previous Change Orders.

b. Adjustments to Cash Allowances

c. Other adjustments.

d. Deductions for uncompleted Work.

e. Deductions for Reinspection Payments.

3. Total Contract Sum, as adjusted.

4. Previous Payments.

5. Sum remaining due.

B. Consultant will prepare and issue final Change Order, reflecting approved adjustments to Contract Sum not previously made by Change Orders.

3.11 FINAL APPLICATION FOR PAYMENT

A. Follow procedures specified in Section 01 2000.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:

1. All software-operated systems
2. HVAC systems and equipment
3. Plumbing equipment
4. Electrical systems and equipment
5. Conveying systems
6. Landscape irrigation
7. Items specified in individual product Sections

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals

B. Other Specification Sections: Additional requirements for demonstration and training

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority
2. Submit one copy to the Commissioning Authority, not to be returned
3. Make commissioning submittals on time schedule specified by Commissioning Authority
4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Submit to Commissioning Authority for review and inclusion in overall training plan.
2. Submit not less than four weeks prior to start of training.
3. Revise and resubmit until acceptable.
4. Provide an overall schedule showing all training sessions.
5. Include at least the following for each training session:

a. Identification, date, time, and duration.

b. Description of products and/or systems to be covered.

c. Name of firm and person conducting training; include qualifications.

d. Intended audience, such as job description.

e. Objectives of training and suggested methods of ensuring adequate training.

f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.

g. Media to be used, such a slides, hand-outs, etc.

h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.

2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.

3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:

1. Identification of each training session, date, time, and duration.

2. Sign-in sheet showing names and job titles of attendees.

3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

4. Include Commissioning Authority's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.

1. Format: DVD Disc.

2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.

2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.

3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:

1. Review the applicable O&M manuals.

2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.

4. Provide hands-on training on all operational modes possible and preventive maintenance.

5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.

6. Discuss common troubleshooting problems and solutions.

7. Discuss any peculiarities of equipment installation or operation.

8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.

9. Review recommended tools and spare parts inventory suggestions of manufacturers.

10. Review spare parts and tools required to be furnished by Contractor.

11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

Attachment A

PREVAILING WAGE RATES

for

Public Works Contracts in Oregon

Oregon Bureau of Labor and Industries

Prevailing Wage Rates for Public Works Contracts

Val Hoyle
Labor Commissioner
Rates Effective January 1, 2022

VAL HOYLE
Labor Commissioner

In this rate book are the new prevailing wage rates for Oregon non-residential public works projects, effective January 1, 2022.

Prevailing wage rates are the minimum hourly wages that must be paid to all workers employed on all public works projects. In the 2021 Legislative Session, the Legislature passed Senate Bill (SB) 493 which was signed by the Governor with the effective date of January 1, 2022. SB 493 amends state PWR law (ORS 279C.815) and provides that the prevailing rate of wage for each locality is the wage in the collective bargaining agreement that covers that occupation. If more than one collective bargaining agreement covers that occupation, the highest rate of wage among the collective bargaining agreements will prevail. Accordingly, the rates in this book are determined using wage information from current collective bargaining agreements for each trade and occupation for each of the 14 geographic regions of the state.

Thank you for your engagement in the process and commitment to Oregon law.

Our team is ready to help support you with any questions you have. We also offer regular, free informational seminars and webinars for contractors and public agencies. Contact us at PWR.Email@boli.oregon.gov or (971) 353-2416.

Val Hoyle
Labor Commissioner

More information about prevailing wage rates:

The Oregon Bureau of Labor & Industries publishes the prevailing wage rates (PWR) that are required to be paid to workers on non-residential Oregon public works projects.

A separate document, *Definitions of Covered Occupations for Public Works Contracts in Oregon,* provides occupational definitions used to classify the duties performed on public works projects. These definitions are used to find the correct prevailing wage rate.

The rate book and definition publications are available online at https://www.oregon.gov/boli as well as additional information and supporting documents and forms.

Please contact us at PWR.Email@boli.oregon.gov or (971) 353-2416, for additional information such as:

- Applicable prevailing wage rates for projects (Generally, the rates in effect at the time the bid specifications are first advertised are those that apply for the duration of the project.)
- Federal Davis-Bacon rates (In cases where projects are subject to both state PWR and federal Davis-Bacon rates, the higher wage must be paid.)
- Required PWR provisions for specifications and contracts
- Apprentice rates

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JANUARY 1, 2022

Forms necessary to comply with ORS 279C.800 through ORS 279C.870 can be found on our website at https://www.oregon.gov/boli/employers/Pages/prevailing-wage.aspx. Contractors are encouraged to use and keep on file the forms provided as master copies for use on future prevailing wage rate projects.

All of the information in this booklet can be accessed and printed from the Internet at: www.oregon.gov/BOLI

Pursuant to ORS 279C.800 to ORS 279C.870, the prevailing wage rates contained in this booklet have been adopted for use on public works contracts in Oregon.

Required Postings for Prevailing Wage Contractors and Subcontractors

PREVAILING WAGE RATES

Every contractor and subcontractor engaged in work on a public works must post the applicable prevailing wage rates for that project in an obvious place on the worksite so workers have ready access to the information.

DETAILS OF FRINGE BENEFIT PROGRAMS

When a contractor or subcontractor provides or contributes to a health and welfare plan or a pension plan, or both, for employees who are working on a public works project, the details of all fringe benefit plans or programs must be posted on the worksite.

The posting must include a description of the plan or plans, information about how and where claims can be made and where to obtain more information. The notice must be posted in an obvious place on the work site in the same location as the prevailing wage rates.

WORK SCHEDULE

Contractors and subcontractors must give workers the regular work schedule (days of the week and number of hours per day) in writing before beginning work on the project.

Contractors and subcontractors may provide the schedule at the time of hire, prior to starting work on the contract, or by posting the schedule in a location frequented by employees, along with the prevailing wage rate information and any fringe benefit information.

If an employer fails to give written notice of the worker's schedule, the work schedule will be presumed to be a five-day schedule. The schedule may only be changed if the change is intended to be permanent and is not designed to evade the PWR overtime requirements.

ORS 279C.840(4); OAR 839-025-0033(1). ORS 279C.840(5); OAR 839-025-0033(2). ORS 279C.540(2); OAR 839-025-0034.

PUBLIC WORKS BONDS

Every contractor and subcontractor who works on public works projects subject to the prevailing wage rate (PWR) law is required to file a $30,000 **"PUBLIC WORKS BOND"** with the Construction Contractors' Board (CCB). This includes flagging and landscaping companies, temporary employment agencies, and sometimes sole proprietors.

The key elements of ORS 279C.830(2) and ORS 279C.836 specify that:

- Specifications for every contract for public works must contain language stating that the contractor and every subcontractor must have a public works bond filed with the CCB before starting work on the project, unless otherwise exempt.
- Every contract awarded by a contracting agency must contain language requiring the contractor:
  - To have a public works bond filed with the CCB before starting work on the project, unless otherwise exempt; and
  - To include in every subcontract a provision requiring the subcontractor to have a public works bond filed with the CCB before starting work on the project unless otherwise exempt
- Every subcontract that a contractor or subcontractor awards in connection with a public works contract between a contractor and a public agency must require any subcontractor to have a public works bond filed with the CCB before starting work on the public works project, unless otherwise exempt.
- Before permitting a subcontractor to start work on a public works project, contractors must first verify their subcontractors either have filed the bond, or have elected not to file a public works bond due to a bona fide exemption.
- The PWR bond is to be used exclusively for unpaid wages determined to be due by the Bureau of Labor & Industries.
- The bond is in effect continuously (you do not have to have one per project).
- A public works bond is in addition to any other required bond the contractor or subcontractor is required to obtain.

Exemptions:

- Allowed for a disadvantaged business enterprise, a minority-owned business, woman-owned business, a business that a service-disabled veteran owns or an emerging small business certified under ORS 200.055, for the first FOUR years of certification;
  - Exempt contractor must still file written verification of certification with the CCB, and give the CCB written notice that they elect not to file a bond.
  - The prime contractor must give written notice to the public agency that they elect not to file a public works bond.
  - Subcontractors must give written notice to the prime contractor that they elect not to file a public works bond.
- For projects with a total project cost of $100,000 or less, a public works bond is not required. (Note this is the total project cost, not an individual contract amount.)
- Emergency projects, as defined in ORS 279A.010(f).

PREVAILING WAGE RATES

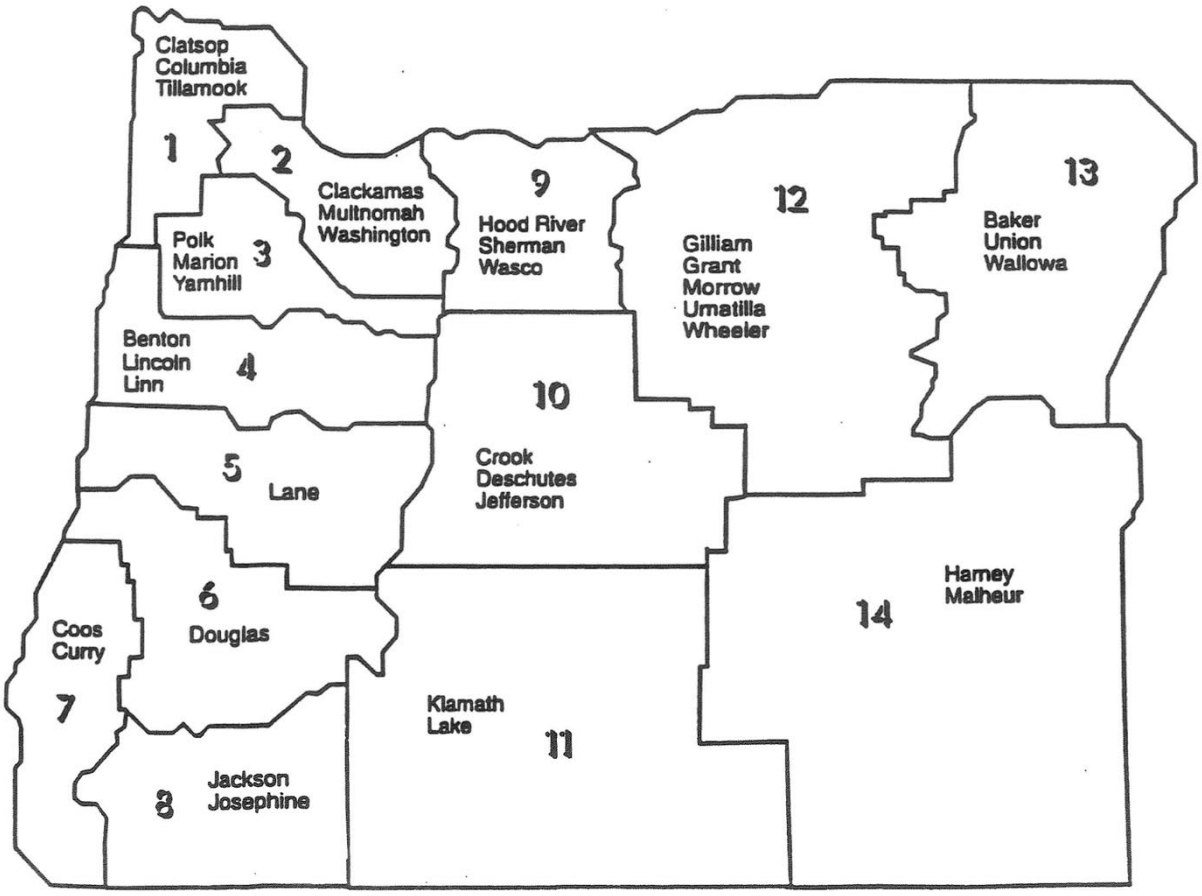
FINDING THE CORRECT PREVAILING WAGE RATE

To find the correct rate(s) required on your public works project, you will need:

- the date the project was first advertised for bid
- the county your project is in
- the duties of workers on the job

Generally, the rate you should look for is based on the date the project was first advertised for bid. (See OAR 839-025-0020(8) for information about projects that contract through a CM/GC, or contract manager/general contractor.)

The Labor Commissioner must establish the prevailing rate of wage for each region as defined in law. (See ORS 279C.800.) Each region is comprised of one to five counties. See below instructions on locating the correct prevailing wage rate for your public works project.



To find the correct rate in this rate book:

1. *Determine the duties that are being performed by each worker.* Use the booklet *Definitions of Covered Occupations* to find the definition that most closely matches the actual work performed by the worker. You can find this publication online at https://www.oregon.gov/boli/employers/Pages/occupational-definitions.aspx.

2. *Find the correct occupation in the "Prevailing Wage Rate for Public Works Contracts" below.* The prevailing wage rate is made up of an hourly base rate and an hourly fringe rate. The combination of these two amounts must be paid to each worker. Watch for possible zone differential, shift differential, and/or hazard pay. If the occupation lists different rates for different Areas of the state, locate the Area that includes the county where the project is located.

Apprentices must be paid consistent with their registered apprenticeship program standard. You can find apprenticeship rates on our website at https://www.oregon.gov/boli/employers/Pages/prevailing-wage-rates.aspx. You may also contact the agency to confirm the correct apprenticeship rate.

The "Prevailing Wage Rate Laws" handbook provides specific information and answers questions regarding prevailing wage laws and is available on our website at https://www.oregon.gov/boli/employers/Pages/prevailing-wage.aspx.

If you have any questions about any of this information, please contact the Bureau of Labor & Industries at PWR.Email@boli.oregon.gov or (971) 353-2416.

January 1, 2022

Prevailing Wage Rates by Occupations—Table of Contents

Using the booklet, Definitions of Covered Occupations, find the definition and group number, if applicable, that most closely matches the actual work being performed by the worker.

ASBESTOS WORKER/INSULATOR	**54.77**	**22.67**
Firestop Containment	**40.63**	**15.94**
BOILERMAKER	**40.46**	**30.59**
BRICKLAYER/STONEMASON	**41.83**	**23.18**

(This trade is tended by "Tenders to Mason Trades")

(Add $1.00 per hour to base rate for refractory repair work)

(Add $1.00 per hour to base rate for Terrazzo work.)

CARPENTER

Zone A (Base Rate)

Group 1	**43.80**	**18.56**
Group 2	**43.97**	**18.56**
Group 3	**46.89**	**18.56**
Group 4	**Eliminated**	
Group 5	**44.38**	**18.56**
Group 6	**44.97**	**18.56**

Zone Differential for Carpenters
(Add to Zone A Base Rate)

Zone B	**1.25** per hour
Zone C	**1.70** per hour
Zone D	**2.00** per hour
Zone E	**3.00** per hour
Zone F	**5.00** per hour
Zone G	**10.00** per hour

Zone A: Projects located within 30 miles of the respective city hall of the cities listed.
Zone B: More than 30 miles but less than 40 miles.
Zone C: More than 40 miles but less than 50 miles.
Zone D: More than 50 miles but less than 60 miles.
Zone E: More than 60 miles but less than 70 miles.
Zone F: More than 70 miles but less than 100 miles.
Zone G: More than 100 miles.

Reference Cities for Group 1 and 2 Carpenters

Albany	Goldendale	Madras	Roseburg
Astoria	Grants Pass	Medford	Salem
Baker City	Hermiston	Newport	The Dalles
Bend	Hood River	Ontario	Tillamook
Brookings	Klamath Falls	Pendleton	Vancouver
Burns	La Grande	Portland	
Coos Bay	Lakeview	Port Orford	
Eugene	Longview	Reedsport	

CARPENTER (continued)

Group 3
(Millwright)

Zones for Group 3 Carpenter are determined by the distance between the project site and **either**

1) The worker's residence; ***or***

2) City Hall of a reference city listed for the appropriate group shown, whichever is closer

Reference Cities for Group 3 Carpenters

Eugene	Medford	Portland	Vancouver
Longview	North Bend	The Dalles	

Group 5
(Bridge & Highway Carpenter)

Group 6
(Piledriver)

Zones for Groups 5 and 6 Carpenter are determined by the distance between the project site and **either**

1) The worker's residence; ***or***

2) City Hall of a reference city listed for the appropriate group shown, whichever is closer

Reference Cities for Group 5 and 6 Carpenters

Bend	Longview	North Bend
Eugene	Medford	Portland

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time--best road via Google Maps) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

Welders shall receive the following hourly premium over the base wage rate, with an eight (8) hour minimum:

Group 1	**$2.19** per hour
Group 2	**$2.20** per hour
Group 3	**$2.34** per hour
Group 5	**$2.22** per hour
Group 6	**$2.25** per hour

When working with creosote and other toxic, treated wood and steel material, workers shall receive $.25/hour premium pay for minimum of eight (8) hours.

When working in sheet pile coffer dams or cells up to the external water level, Group 6 workers shall receive $.15/hour premium pay for minimum of eight (8) hours.

CEMENT MASON
(This trade is tended by "Concrete Laborer")

Group 1	**36.72**	**22.07**
Group 2	**37.51**	**22.07**
Group 3	**37.51**	**22.07**
Group 4	**38.30**	**22.07**

See Zone Differentials on Page 8

CEMENT MASON (continued)

Zone Differential for Cement Mason
(Add to Basic Hourly Rate)

Zone A **3.00** per hour
Zone B **5.00** per hour
Zone C **10.00** per hour

Zone A: Projects located 60-79 miles of the respective city hall of the Reference Cities listed below.
Zone B: Projects located 80-99 miles of the respective city hall of the Reference Cities listed below.
Zone C: Projects located 100 or more miles of the respective city hall of the Reference Cities listed below.

Reference Cities for Cement Mason

Bend	Eugene	Pendleton	Salem	Vancouver
Corvallis	Medford	Portland	The Dalles	

When a contractor takes current employees to a project that is located more than 59 miles from the city hall of the Reference City that is closest to the contractor's place of business, Zone Pay is to be paid for the distance between the city hall of the identified Reference City and the project site.

Note: All miles are to be determined on the basis of road miles using the normal route (shortest time – best road), from the city hall of the Reference City closest to the contractor's place of business and the project.

DIVER & DIVER TENDER

Zone 1 (Base Rate)

DIVER	**93.09**	**18.56**
DIVER TENDER	**49.09**	**18.56**

1) For those workers who reside within a reference city below, their zone pay shall be computed from the city hall of the city wherein they reside.

2) For those workers who reside nearer to a project than is the city hall of any reference city below, the mileage from their residence may be used in computing their zone pay differential.

3) The zone pay for all other projects shall be computed from the city hall of the nearest reference city listed below.

Zone Differential for Diver/Diver Tender
(Add to Zone 1 Base Rate)

Zone 2 **1.25** per hour
Zone 3 **1.70** per hour
Zone 4 **2.00** per hour
Zone 5 **3.00** per hour
Zone 6 **5.00** per hour
Zone 7 **10.00** per hour

Zone 1: Projects located within 30 miles of city hall of the reference cities listed.
Zone 2: More than 30 miles, but less than 40 miles.
Zone 3: More than 40 miles, but less than 50 miles.
Zone 4: More than 50 miles, but less than 60 miles.
Zone 5: More than 60 miles, but less than 70 miles.
Zone 6: More than 70 miles, but less than 100 miles.
Zone 7: More than 100 miles.

See Reference Cities on page 9

DIVER & DIVER TENDER (continued)

Reference Cities for Diver/Diver Tender

Bend	Longview	North Bend
Eugene	Medford	Portland

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time--best road via Google Maps) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

Diver Depth Pay:

Depth Below Water Surface (FSW)	Daily Depth Pay
50-100 ft.	$2.00 per foot over 50 feet
101-150 ft.	$3.00 per foot over 100 feet
151-220 ft.	$4.00 per foot over 150 feet
Over 220 ft.	$5.00 per foot over 220 feet

The actual depth in FSW shall be used in determining depth premium.

Diver Enclosure Pay (working without vertical escape):

Distance Traveled in the Enclosure	Daily Enclosure Pay
0 – 25ft.	N/C
25 – 300 ft.	$1.00 per foot from the entrance
300 – 600 ft.	$1.50 per foot beginning at 300 ft.
Over 600 ft.	$2.00 per foot beginning at 600 ft.

DREDGER

Zone A (Base Rate)

Leverman (Hydraulic & Clamshell)	**51.46**	**16.15**
Assistant Engineer (Watch Engineer, Mechanic Machinist)	**48.30**	**16.15**
Tenderman (Boatman Attending Dredge Plant), Fireman	**46.81**	**16.15**
Fill Equipment Operator	**45.64**	**16.15**
Assistant Mate	**42.94**	**16.15**

Zone Differential for Dredgers
(Add to Zone A Base Rate)

Zone B	**3.00** per hour
Zone C	**6.00** per hour

Zone mileage based on road miles:

Zone A: Center of jobsite to no more than 30 miles from the city hall of Portland.
Zone B: More than 30 miles but not more than 60 miles.
Zone C: Over 60 miles.

DRYWALL, LATHER, ACOUSTICAL CARPENTER & CEILING INSTALLER

Zone 1 (Base Rate)

1. DRYWALL INSTALLER	**43.59**	**18.26**
2. LATHER, ACOUSTICAL CARPENTER & CEILING INSTALLER	**43.59**	**18.26**

Zone Differential for Lather, Acoustical Carpenter & Ceiling Installer

Zone mileage based on road miles:

Zone B	61-80 miles	**6.00** per hour
Zone C	81-100 miles	**9.00** per hour
Zone D	101 or more	**12.00** per hour

The correct transportation allowance shall be based on AAA road mileage from the City Hall of the transportation reference cities herein listed.

Reference Cities for Drywall, Lather, Acoustical Carpenter & Ceiling Installer

Albany	Bend	Grants Pass	Medford	Portland	Seaside
Astoria	Brookings	Hermiston	Newport	Reedsport	The Dalles
Baker	Coquille	Klamath Falls	North Bend	Roseburg	Tillamook
Bandon	Eugene	Kelso-Longview	Pendleton	Salem	Vancouver

ELECTRICIAN

Area 1 (Region 14)

Electrician	**38.49**	**17.74**
Lighting Maintenance and Material Handler	**19.95**	**10.00**

Reference County

Malheur

Shift Differential

1st Shift “day”	Between the hours of 8:00am and 4:30pm	8 hours pay for 8 hours work
2nd Shift “swing”	Between the hours of 4:30pm and 1:00am	8 hours pay for 8 hours work plus 7.5% for all hours worked
3rd Shift “graveyard”	Between the hours of 12:30am and 9:00am	8 hours pay for 8 hours work plus 15% for all hours worked.

When workers are required to work under compressed air or to work from trusses, scaffolds, swinging scaffolds, bosun’s chair or on building frames, stacks or towers at a distance, the following should be added to base rate.

50 – 90 feet to the ground	Add 1 ½ x the base rate
90+ feet to the ground	Add 2 x the base rate

Pursuant to ORS 279C.815(2)(b), the Electrician Area 6 rate is the highest rate of wage among the collective bargaining agreements for Electrician Areas 1 and 6.

ELECTRICIAN (continued)

Area 2 (Regions 12 and 13)

Electrician	**50.00**	**22.93**
Cable Splicer	**52.50**	**23.01**

Reference Counties

Baker	Grant	Umatilla	Wallowa
Gilliam	Morrow	Union	Wheeler

Add 50% of the base rate when workers are required to work under the following conditions:

1) Under compressed air with atmospheric pressure exceeding normal pressure by at least 10%.

2) From trusses, swing scaffolds, bosun's chairs, open platforms, unguarded scaffolds, open ladders, frames, tanks, stacks, silos and towers where the workman is subject to a direct fall of (a) more than 60 feet or (b) into turbulent water under bridges, powerhouses or spillway faces of dams.

Area 3 (Regions 4, 5, 6 and 7)

Electrician	**41.63**	**21.20**

Reference Counties

Coos Curry Douglas

Lane – **See Area 4** Lincoln – **See Area 4**

Shift Differential

1st Shift "day"	Between the hours of 8:00am and 4:30pm	8 hours pay for 8 hours work
2nd Shift "swing"	Between the hours of 4:30pm and 1:00am	8 hours pay for 8 hours work plus 17% for all hours worked
3rd Shift "graveyard"	Between the hours of 12:30am and 9:00am	8 hours pay for 8 hours work plus 31% for all hours worked.

When workers are required to work under compressed air or where gas masks are required, or to work from trusses, all scaffolds including mobile elevated platforms, any temporary structure, bosun's chair or on frames, stacks, towers, tanks, within 15' of the leading edges of any building at a distance of:

50 – 75 feet to the ground	Add 1 ½ x the base rate
75+ feet to the ground	Add 2 x the base rate

High Time is not required to be paid on any permanent structure with permanent adequate safeguards (handrails, mid-rails, and toe guards). Any vehicle equipped with outriggers are exempted from this section.

Area 4 (Regions 3, 4, 5, and 10)

Electrician	**49.36**	**20.20**
Cable Splicer	**54.30**	**20.35**
Lighting Maintenance/Material Handler	**22.67**	**10.08**

ELECTRICIAN (continued)

Reference Counties for Area 4

Benton	Deschutes	Lane	Lincoln
Crook	Jefferson	Linn	

Marion – **See Area 5 rate** Polk – **See Area 5 rate** Yamhill – **See Area 5 rate**

Shift Differential

1st Shift "day"	Between the hours of 8:00am and 4:30pm	8 hours pay for 8 hours work
2nd Shift "swing"	Between the hours of 4:30pm and 1:00am	8 hours pay for 8 hours work plus 17% for all hours worked
3rd Shift "graveyard"	Between the hours of 12:30am and 9:00am	8 hours pay for 8 hours work plus 31.4% for all hours worked.

Area 5 (Regions 1, 2, 3 and 9)

Electrician	**53.85**	**27.84**
Electrical Welder	**59.24**	**28.00**
Material Handler/Lighting Maintenance	**30.69**	**19.62**

Reference Counties

Clackamas	Hood River	Polk	Wasco
Clatsop	Marion	Sherman	Washington
Columbia	Multnomah	Tillamook	Yamhill

Shift Differential

1st Shift "day"	Between the hours of 7:00am and 5:30pm	8 hours pay for 8 hours work
2nd Shift "swing"	Between the hours of 4:30pm and 3:00am	8 hours pay for 8 hours work plus 17.3% for all hours worked
3rd Shift "graveyard"	Between the hours of 12:30am and 11:00am	8 hours pay for 8 hours work plus 31.4% for all hours worked.

Zone Pay for Area 5-**Electrician and Electrical Welder**
(Add to Basic Hourly Rate)

Zone mileage based on air miles:

Zone 1	31-50 miles	**1.50** per hour
Zone 2	51-70 miles	**3.50** per hour
Zone 3	71-90 miles	**5.50** per hour
Zone 4	Beyond 90	**9.00** per hour

There shall be a 30-mile free zone from downtown Portland City Hall and a similar 15-mile free zone around the following cities:

Astoria	Seaside	Tillamook
Hood River	The Dalles	

Further, the free zone at the Oregon coast shall extend along Hwy 101 west to the ocean Hwy 101 east 10 miles if not already covered by the above 15-mile free zone.

ELECTRICIAN (continued)

Area 6 (Regions 6, 8, 11 and 14)

Electrician	**38.49**	**17.74**
Lighting Maintenance and Material Handler	**19.95**	**10.00**

Reference Counties

Harney	Josephine	Lake
Jackson	Klamath	Malheur

Douglas – **See Area 3 rate**

Shift Differential

1st Shift "day"	Between the hours of 8:00am and 4:30pm	8 hours pay for 8 hours work
2nd Shift "swing"	Between the hours of 4:30pm and 1:00am	8 hours pay for 8 hours work plus 7.5% for all hours worked
3rd Shift "graveyard"	Between the hours of 12:30am and 9:00am	8 hours pay for 8 hours work plus 15% for all hours worked.

When workers are required to work under compressed air or to work from trusses, scaffolds, swinging scaffolds, bosun's chair or on building frames, stacks or towers at a distance, the following should be added to base rate.

50 – 90 feet to the ground	Add 1 ½ x the base rate
90+ feet to the ground	Add 2 x the base rate

ELEVATOR CONSTRUCTOR, INSTALLER AND MECHANIC

Area 1 (Regions 12 and 13)

Mechanic	**59.70**	**43.48**

Reference Counties

Baker	Union	Wallowa

Umatilla – **See Area 2 rate**

Area 2 (Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14)

Mechanic	**59.95**	**43.68**

Reference Counties

Benton	Douglas	Klamath	Multnomah	Deschutes
Clackamas	Gilliam	Lake	Polk	Josephine
Clatsop	Grant	Lane	Sherman	Morrow
Columbia	Harney	Lincoln	Tillamook	Wheeler
Coos	Hood River	Linn	Umatilla	Yamhill
Crook	Jackson	Malheur	Wasco	
Curry	Jefferson	Marion	Washington	

FENCE CONSTRUCTOR (NON-METAL)	**29.40**	**11.35**
FENCE ERECTOR (METAL)	**22.40**	**4.86**
GLAZIER	**47.10**	**21.12**

(Add $1.00 to base rate when employee works from a swing stage, scaffold, suspended contrivance or mechanical apparatus from the third floor up or thirty feet of free fall (whichever is less), and employee is required to wear a safety belt.)

(Add $4.00 to base rate when employee works from a bosun chair (non-motorized single-man apparatus), regardless of height.)

HAZARDOUS MATERIALS HANDLER	**27.03**	**13.18**
HIGHWAY/PARKING STRIPER	**36.47**	**14.22**

Shift Differential
Add $1.85 to base rate for shifts that start between 3:00pm and 4:00am.

IRONWORKER

Zone 1 (Base Rate):	**40.56**	**29.79**

Zone Differential for Ironworker
(Add to Basic Hourly Rate)

Zone 2 **5.63/**hr. or $45.00 maximum per day
Zone 3 **8.75**/hr. or $70.00 maximum per day
Zone 4 **11.25/**hr. or $90.00 maximum per day

Zone 1: Projects located within 45 miles of city hall in the reference cities listed below.
Zone 2: More than 46 miles, but less than 60 miles.
Zone 3: More than 61 miles, but less than 100 miles.
Zone 4: More than 100 miles.

Note: Zone pay for Ironworkers shall be determined using the quickest route per Google Maps and computed from the city hall or dispatch center of the reference cities listed below **or** the residence of the employee, whichever is nearer to the project.

Reference Cities and Dispatch Center

Medford Portland

LABORER

Zone A (Base Rate):

Group 1	**33.48**	**16.05**
Group 2	**34.71**	**16.05**
Group 3 (Flagger)	**29.04**	**16.05**
Group 4	**23.04**	**16.05**

See Laborer Hazardous Waste Removal Differential and Zone Differential page 15.

LABORER (continued)

Note: A Hazardous Waste Removal Differential must be added to the base rate if work is performed inside the boundary of a Federally Designated Hazardous Waste Site. A Group 1 base rate is used for General Laborer on such a site. For further information on this, call the Prevailing Wage Rate Coordinator at (971) 353-2416.

Zone Differential for Laborers
(Add to Zone A Base Rate)

Zone B	**.85** per hour
Zone C	**1.25** per hour
Zone D	**2.00** per hour
Zone E	**4.00** per hour
Zone F	**5.00** per hour

Zone A: Projects located within 30 miles of city hall in the reference cities listed.
Zone B: More than 30 miles but less than 40 miles.
Zone C: More than 40 miles but less than 50 miles.
Zone D: More than 50 miles but less than 80 miles.
Zone E: More than 80 miles but less than 100 miles.
Zone F: More than 100 miles.

Reference Cities for Laborer

Albany	Burns	Hermiston	Roseburg
Astoria	Coos Bay	Klamath Falls	Salem
Baker City	Eugene	Medford	The Dalles
Bend	Grants Pass	Portland	

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time, best road) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all other project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

LANDSCAPE LABORER/TECHNICIAN (Laborer Group 4) **23.04** **16.05**

LIMITED ENERGY ELECTRICIAN

Area 1 (Region 14) **33.76** **14.26**

Reference County

Malheur

Pursuant to ORS 279C.815(2)(b), the Limited Energy Electrician Area 6 rate is the highest rate of wage among the collective bargaining agreements for Limited Energy Electrician Areas 1 and 6.

Area 2 (Regions 12 and 13) **33.19** **15.16**

Reference Counties

Baker	Grant	Umatilla	Wallowa
Gilliam	Morrow	Union	Wheeler

LIMITED ENERGY ELECTRICIAN (continued)

Area 3 (Regions 4, 5, 6 and 7)	**32.16**	**18.24**

Reference Counties

Coos Curry Douglas

Lane – **See Area 4** Lincoln – **See Area 4**

Area 4 (Regions 3, 4, 5 and 10)	**36.17**	**17.26**

Reference Counties

Benton Jefferson Linn
Crook Lane Lincoln
Deschutes

Marion – **See Area 5 rate** Polk – **See Area 5 rate** Yamhill – **See Area 5 rate**

Area 5 (Regions 1, 2, 3 and 9)	**44.23**	**22.30**

Reference Counties

Clackamas Hood River Polk Wasco
Clatsop Marion Sherman Washington
Columbia Multnomah Tillamook Yamhill

Area 6 (Regions 6, 8, 11 and 14)	**33.76**	**14.26**

Reference Counties

Harney Josephine Lake
Jackson Klamath Malheur

Douglas – **See Area 3 rate**

LINE CONSTRUCTOR

Area 1 (All Regions)

Group 1	**62.40**	**23.21**
Group 2	**55.71**	**22.91**
Group 3	**33.05**	**15.49**
Group 4	**47.91**	**19.36**
Group 5	**41.78**	**16.78**
Group 6	**34.54**	**16.36**
Group 7	**19.24**	**12.42**

Reference Counties

All counties

LINE CONSTRUCTOR (continued)

Area 2 (Region 14)

Cable Splicer	**62.40**	**23.21**
Journeyman Lineman	**55.71**	**22.91**
Line Equip. Operator	**47.91**	**19.36**
Groundman	**34.54**	**16.36**

Reference County

Malheur – **See Area 1 rates**

Pursuant to ORS 279C.815(2)(b), the Line Constructor Area 1 rate is the highest rate of wage among the collective bargaining agreements for Line Constructor Area 1 and Area 2.

MARBLE SETTER	**42.83**	**23.18**

(This trade is tendered by "Tile, Terrazzo, & Marble Finishers")

(Add $1.00 per hour to base rate for refractory repair work)

PAINTER & DRYWALL TAPER

COMMERCIAL PAINTING	**28.76**	**13.84**
INDUSTRIAL PAINTING	**30.56**	**13.84**
BRIDGE PAINTING	**36.23**	**13.84**

DRYWALL TAPER

Zone A (Base Rate	**41.10**	**18.75**

Zone Differential for Drywall Taper
(Add to Zone A Base Rate)

Zone B **6.00** per hour
Zone C **9.00** per hour
Zone D **12.00** per hour

Dispatch Cities for Drywall Taper

Albany	Bend	Grants Pass	Medford	Portland	Seaside
Astoria	Brookings	Hermiston	Newport	Reedsport	The Dalles
Baker	Coquille	Klamath Falls	North Bend	Roseburg	Tillamook
Bandon	Eugene	Kelso-Longview	Pendleton	Salem	Vancouver

Zone A: Projects located less than 61 miles of the respective city hall of the dispatch cities listed.
Zone B: Projects located 61 miles to 80 miles.
Zone C: Projects located 81 miles to 100 miles.
Zone D: Projects located 101 miles or more.

Note: Zone pay is based on AAA Road Mileage.

PLASTERER AND STUCCO MASON

(This trade is tended by "Tenders to Plasterers")

Zone A (Base Rate)

Plasterer	**39.65**	**18.98**
Swinging Scaffold	**40.65**	**18.98**
Nozzleman	**41.65**	**18.98**

Zone Differential for Plasterer and Stucco Mason
(Add to Zone A Base Rate)

Zone B **6.00** per hour
Zone C **9.00** per hour
Zone D **12.00** per hour

Zone A: Projects located less than 61 miles of the respective city hall of the reference cities listed below.
Zone B: Projects located 61 miles to 80 miles.
Zone C: Projects located 81 miles to 100 miles.
Zone D: Projects located 101 miles or more.

Reference Cities for Plasterer & Stucco Mason

Bend	Eugene	Medford	Portland	Seaside
Coos Bay	La Grande	Newport	Salem	The Dalles

PLUMBER/PIPEFITTER/STEAMFITTER

Area 1 (Regions 13 and 14)	**33.00**	**16.57**

Reference Counties

Harney Malheur

Baker – **See Area 2 rates**

(Add $2.21 to base rate if it is possible for worker to fall 30 ft. or more, or if required to wear a fresh-air mask or similar equipment for 2 hours or more)

Zone Differential for Area 1
(Add to Base Rate)
Zone 1 **2.50** per hour
Zone 2 **3.50** per hour
Zone 3 **5.00** per hour

Zone mileage based on road miles:
Zone 1: Forty (40) to fifty five (55) miles from City Hall in Boise, Idaho.
Zone 2: Fifty five (55) to one hundred (100) miles from City Hall in Boise, Idaho.
Zone 3: Over one hundred (100) miles from City Hall in Boise, Idaho.

There shall be a maximum of ten (10) hours of zone pay per workday.

PLUMBER/PIPEFITTER/STEAMFITTER (continued)

Area 2 (Regions 12 and 13)	**53.00**	**33.39**

Reference Counties

Baker	Grant	Umatilla	Wallowa
Gilliam	Morrow	Union	Wheeler

Zone Differential for Area 2
(Add to Base Rate)

Zone 2 **10.62/**hr. not to exceed $80.00 day.

Zone mileage based on road miles:

Zone 2: Eighty (80) miles or more from City Hall in Pasco, Washington.

(Add $1.00 to base rate if it is possible for worker to fall 35 ft. or more, or if required to wear a fresh-air mask or similar equipment for one-hour minimum increments)

Area 3 (Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12)	**48.93**	**34.04**

Reference Counties

Benton	Deschutes	Lake	Sherman
Clackamas	Douglas	Lane	Tillamook
Clatsop	Hood River	Lincoln	Wasco
Columbia	Jackson	Linn	Washington
Coos	Jefferson	Marion	Yamhill
Crook	Josephine	Multnomah	
Curry	Klamath	Polk	

Gilliam – **See Area 2 rate** Wheeler – **See Area 2 rate**

POWER EQUIPMENT OPERATOR

Zone 1 (Base Rate)		
Group 1	**51.65**	**16.35**
Group 1A	**53.81**	**16.35**
Group 1B	**55.97**	**16.35**
Group 2	**49.74**	**16.35**
Group 3	**48.59**	**16.35**
Group 4	**45.26**	**16.35**
Group 5	**44.02**	**16.35**
Group 6	**40.80**	**16.35**

See Power Equipment Operator Zone 1 Map on page 21.

(Group 4 Tunnel Boring Machine Mechanic add $10.00/hour hyperbaric pay)

Note: A Hazardous Waste Removal Differential must be added to the base rate if work is performed inside the boundary of a Federally Designated Waste Site. For information on this differential, call the Prevailing Wage Rate Coordinator at (971) 353-2416.

(Add $0.40 to the base rate for any and all work performed underground, including operating, servicing and repairing of equipment)

POWER EQUIPMENT OPERATOR (continued)

(Add $0.50 to the base rate per hour for any employee who works suspended by a rope or cable)

(Add $0.50 to the base rate for employees who do “pioneer” work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation)

Shift Differential

Two-Shift Operations:

On a two shift operation, when the second shift starts after 4:30 p.m., second-shift workers shall be paid the base hourly wage rate plus 5% for all hours worked.

When the second shift starts at 8:00 p.m. or later, the second-shift workers shall be paid at the base hourly wage rate plus 10% for all hours worked.

Three-Shift Operations:

On a three-shift operation, the base hourly wage rate plus five percent (5%) shall be paid to all second-shift workers for all hours worked, and the base hourly wage rate plus ten percent (10%) shall be paid to all third shift workers for all hours worked.

Zone Pay Differential for Power Equipment Operator
(Add to Zone 1 Base Rate)

Zone 2	**3.00** per hour
Zone 3	**6.00** per hour

For projects in the following metropolitan counties:

Clackamas	Marion	Washington
Columbia	Multnomah	Yamhill

(A) All jobs or projects located in Multnomah, Clackamas and Marion counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 on Interstate 84 and West of Mile Post 30 on State Hwy 26 and West of Mile Post 30 on Hwy 22 and all jobs located in Yamhill County, Washington County and Columbia County shall receive Zone 1 pay for all classifications.

(B) All jobs or projects located in the area outside the *identified boundary* above, but less than 50 miles from the Portland City Hall shall receive Zone 2 pay for all classifications.

(C) All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone 3 pay for all classifications.

Reference cities for projects in all remaining counties:

Albany	Coos Bay	Grants Pass	Medford
Bend	Eugene	Klamath Falls	Roseburg

(A) All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone 1 pay for all classifications.

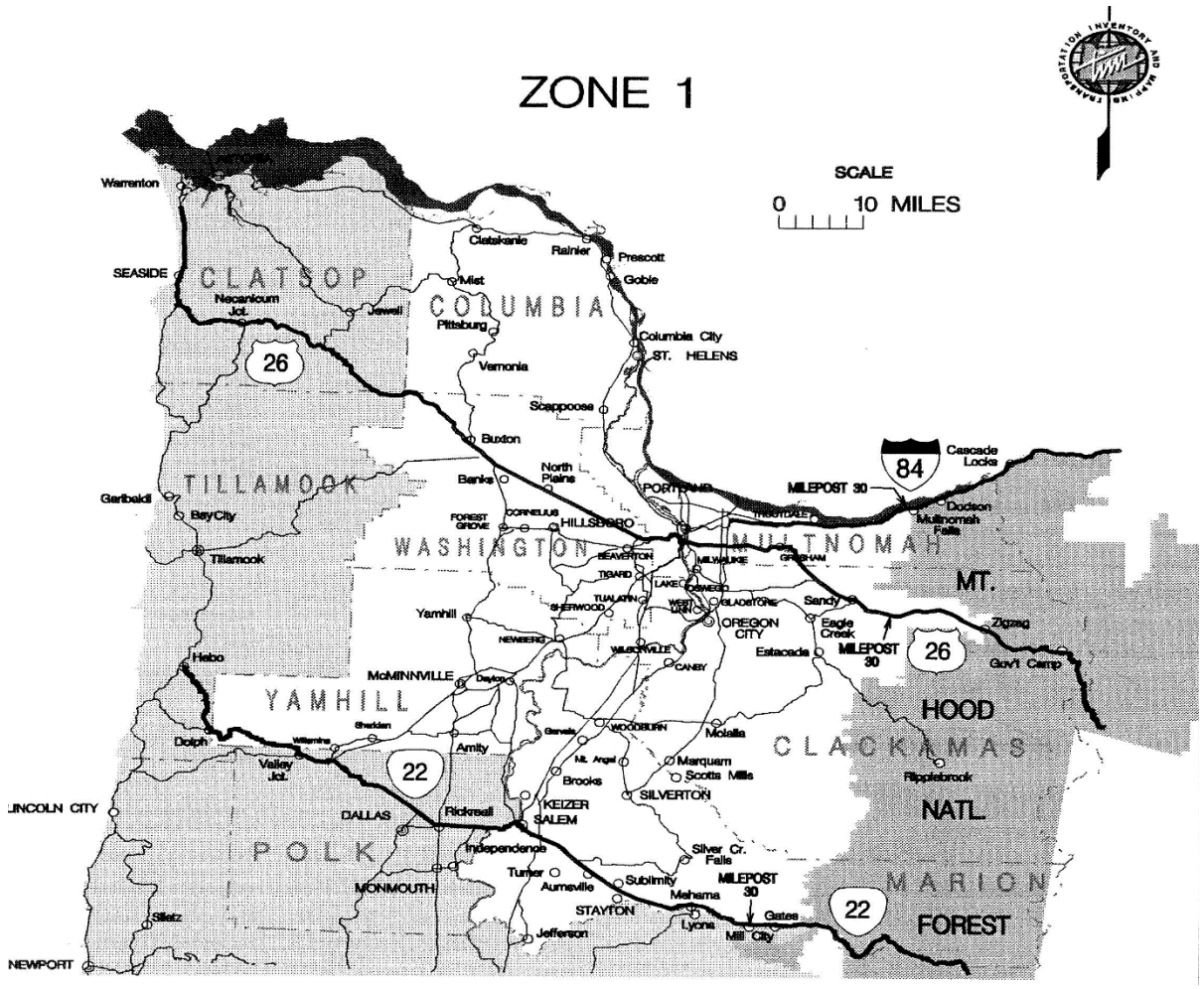
(B) All jobs or projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone 2 for all classifications.

(C) All jobs or projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone 3 pay for all classifications.

POWER EQUIPMENT OPERATOR (continued)

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time-best road) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all other project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

POWER EQUIPMENT OPERATOR MAP



ROOFER

Area 1 (Regions 1, 2, 9, 10, 12 and 13)

Roofer	**37.43**	**20.19**
Handling coal tar pitch	**41.17**	**20.19**
Remove fiberglass insulation	**41.17**	**20.19**

Reference Counties

Baker	Deschutes	Morrow	Union
Clackamas	Gilliam	Multnomah	Wasco
Clatsop	Grant	Sherman	Wallowa
Columbia	Hood River	Tillamook	Washington
Crook	Jefferson	Umatilla	Wheeler

Area 2 (Regions 3, 4, 5, 6, 7, 8, 10, 11 and 14)

Roofer	**30.05**	**18.59**
Handling coal tar pitch	**32.05**	**18.59**
Remove fiberglass insulation	**31.55**	**18.59**

Reference Counties

Benton	Harney	Lake	Malheur
Coos	Jackson	Lane	Marion
Curry	Josephine	Lincoln	Polk
Douglas	Klamath	Linn	Yamhill

Crook – **See Area 1 rates** Deschutes – **See Area 1 rates**

Area 4 (Regions 12 and 13)

Roofer	**37.43**	**20.19**
Handling coal tar pitch	**41.17**	**20.19**
Remove fiberglass insulation	**41.17**	**20.19**

Reference Counties

Umatilla Union Wallowa

Pursuant to ORS 279C.815(2)(b), the Roofer Area 1 rate is the highest rate of wage among the collective bargaining agreements for Roofer Areas 1, 4 and 5.

Area 5 (Region 12)

Roofer	**37.43**	**20.19**
Handling coal tar pitch	**41.17**	**20.19**
Remove fiberglass insulation	**41.17**	**20.19**

Reference County

Morrow

Pursuant to ORS 279C.815(2)(b), the Roofer Area 1 rate is the highest rate of wage among the collective bargaining agreements for Roofer Areas 1, 4 and 5.

SHEET METAL WORKER

Area 1 (Regions 1, 2, 3, 4, 9 and 12) **44.05** **24.28**

Reference Counties

Benton	Grant	Morrow	Umatilla
Clackamas	Hood River	Multnomah	Wasco
Clatsop	Lincoln	Polk	Washington
Columbia	Linn	Sherman	Wheeler
Gilliam	Marion	Tillamook	Yamhill

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

Area 2 (Regions 13 and 14) -------- --------

Reference Counties

Baker – **See Area 3 rate** Malheur – **See Area 6 rate**

Area 3 (Regions 12 and 13) **42.35** **23.87**

Reference Counties

Baker Union Wallowa

Morrow – **See Area 1 rate** Umatilla – **See Area 1 rate**

(Add $.45 to base rate for work performed on any swinging stage, swinging scaffold or boson chair in excess of thirty (30) feet above the ground)

(Add $1.00 to base rate for work where it is necessary to wear a chemically activated type face mask)

Area 4 (Regions 5 and 6) **36.38** **21.74**

Reference Counties

Douglas Lane

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

Area 5 (Region 7) **36.72** **22.77**

Reference Counties

Coos Curry

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

SHEET METAL WORKER (continued)

Area 6 (Regions 7, 8, 11 and 14)	**30.93**	**20.53**

Reference Counties

Harney	Josephine	Lake
Jackson	Klamath	Malheur

Curry – **See Area 5 rate**

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

Area 7 (Region 10)	**34.01**	**20.36**

Reference Counties

Crook	Deschutes	Jefferson

(Add $1.00 to base rate for work performed on any swinging platform, swinging chair or swinging ladder)

(Add $1.00 to base rate for work where a worker is exposed to resins, chemicals or acid)

SOFT FLOOR LAYER	**33.75**	**19.35**

SPRINKLER FITTER

Area 1 (Regions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14)	**42.15**	**25.30**

Reference Counties

Benton	Douglas	Klamath	Multnomah
Clackamas	Gilliam	Lake	Polk
Clatsop	Grant	Lane	Sherman
Columbia	Harney	Lincoln	Tillamook
Coos	Hood River	Linn	Umatilla
Crook	Jackson	Malheur	Wasco
Curry	Jefferson	Marion	Washington
Deschutes	Josephine	Morrow	Wheeler
			Yamhill

Area 2 (Regions 12, 13, 14)	**36.08**	**25.29**

Reference Counties

Baker	Union	Wallowa

Gilliam – **See Area 1 rate**	Malheur – **See Area 1 rate**	Umatilla – **See Area 1 rate**
Grant – **See Area 1 rate**	Morrow – **See Area 1 rate**	

TENDER TO MASON TRADES (Brick and Stonemason, Mortar Mixer, Hod Carrier)	**36.54**	**16.05**

(Add $0.50 to base rate for refractory repair work)

TENDER TO PLASTERER AND STUCCO MASON

Zone A (Base Rate)	**36.37**	**16.80**

Zone Differential for Tender to Plasterer and Stucco Mason
(Add to Zone A Base Rate)

Zone B **6.00** per hour
Zone C **9.00** per hour
Zone D **12.00** per hour

Zone A: Projects located within 60 miles of city hall in the reference cities listed.
Zone B: More than 61 miles but less than 80 miles.
Zone C: More than 81 miles but less than 100 miles.
Zone D: More than 101 miles

Reference Cities

Bend	Eugene	Medford	Salem	The Dalles
Coos Bay	La Grande	Newport	Seaside	

(Add $0.50 to base rate for refractory repair work)

TESTING AND BALANCING (TAB) TECHNICIAN

For work performed under the Sheet Metal classification, including Air-Handling Equipment, Ductwork

See SHEET METAL WORKER RATE

For work performed under the Plumber/Pipefitter/Steamfitter classification, including Water Distribution Systems

See PLUMBER/PIPEFITTER/STEAMFITTER RATE

TILESETTER/TERRAZZO WORKER: Hard Tilesetter	**35.90**	**20.40**

(This trade is tended by “Tile, Terrazzo, & Marble Finisher”)

(Add $1.00 to base rate refractory repair work)

(Add $1.00 for Terrazzo work)

TILE, TERRAZZO, AND MARBLE FINISHER

1. TILE, TERRAZZO FINISHER	**27.04**	**14.90**

(Add $1.00 to base rate for refractory repair work)

(Add $1.00 for Terrazzo work)

2. BRICK & MARBLE FINISHER	**27.04**	**14.64**

(Add $1.00 to base rate for refractory repair work)

TRUCK DRIVER

Zone A (Base Rate)

Group 1	**30.09**	**16.73**
Group 2	**30.23**	**16.73**
Group 3	**30.37**	**16.73**
Group 4	**30.67**	**16.73**
Group 5	**30.91**	**16.73**
Group 6	**31.10**	**16.73**
Group 7	**31.32**	**16.73**

Zone differential for Truck Drivers
(Add to Zone A Base Rate)

Zone B	**.65** per hour
Zone C	**1.15** per hour
Zone D	**1.70** per hour
Zone E	**2.75** per hour

Zone A: Projects within 30 miles of the cities listed.
Zone B: More than 30 miles but less than 40 miles.
Zone C: More than 40 miles but less than 50 miles.
Zone D: More than 50 miles but less than 80 miles.
Zone E: More than 80 miles.

Reference Cities

Albany	Burns	Hermiston	Madras	Oregon City	Roseburg
Astoria	Coos Bay	Hood River	Medford	Pendleton	Salem
Baker	Corvallis	Klamath Falls	McMinnville	Portland	The Dalles
Bend	Eugene	La Grande	Newport	Port Orford	Tillamook
Bingen	Goldendale	Lakeview	Ontario	Reedsport	Vancouver
Brookings	Grants Pass	Longview			

Note: All job or project locations shall be computed (determined) on the basis of road miles and in the following manner. A mileage measurement will start at the entrance to the respective city hall, facing the project (if possible), and shall proceed by the normal route (shortest time-best road) to the geographical center on the highway, railroad, and street construction projects (end of measurement). On all other project contracts, the geographical center where the major portion of the construction is located, shall be considered the center of the project (end measurement).

LIST OF CONTRACTORS INELIGIBLE
TO RECEIVE PUBLIC WORKS CONTRACTS
PUBLICATION DATE: JANUARY 1, 2022

To: All Oregon Contracting Agencies

Pursuant to ORS 279C.860, contractors on this list are ineligible to receive public works contracts subject to the Prevailing Wage Rate Law. These contractors and subcontractors, as well as any firm, corporation, partnership or association in which the contractor or subcontractor has a financial interest are ineligible to receive public works contracts until removed from this list. You can find the most current and up to date list of contractors ineligible to receive public works contracts on our website at https://www.oregon.gov/boli/employers/Pages/pwr-ineligible-contractors.aspx.

If you have questions regarding the list or for the most current information regarding persons ineligible to receive prevailing wage contracts, please contact the Prevailing Wage Rate Coordinator in Portland at (971) 353-2416.

	CONTRACTOR NAME	DATE PLACED	REMOVAL DATE
1.	**A1 Dumptruck Services LLC** 703 N Hayden Meadows Dr., #206 Portland, OR 97213 731 N Hayden Meadows Dr., #206 Portland, OR 97217 2408 NE 164th Avenue Vancouver, WA 98684	February 24, 2020	February 23, 2027
2.	**Advanced Flagging & Pilot Car Inc.** 16400 NE Las Brisas Ct., Apt. 43 Portland, OR 97230 650 NE Holladay St. Portland, OR 97232 16400 NE Las Brisas Ct. Portland, OR 97230	February 5, 2021	February 4, 2024
3.	**Barker, Michael** 32966 Tennessee Road Lebanon, OR 97355	January 5, 2021	January 4, 2024
4.	**Bell-Eddy, Kimberly** 8535 Woodard Ave. SE Salem, OR 97317	January 12, 2016	January 11, 2023
5.	**Cameron Creations** **Steven Cameron** **Nancy Cameron** PO Box 2 Lowell, OR 97452	May 25, 2000	Not to be Removed
6.	**Canell's Flagging LLC** 731 N Hayden Meadows Dr., Ste 107 Portland, OR 97217	November 24, 2020	November 23, 2023
7.	**Canell, Angela** 2416 NE 11th Avenue Portland, OR 97212 529 SE Grand #307 Portland, OR 97214	November 24, 2020	November 23, 2023
8.	**CJ Construction, Inc.** 2969 Ferguson St NW Salem, OR 97304 846 55th Ave. Salem, OR 97304	December 11, 2020	November 6, 2023

LIST OF CONTRACTORS INELIGIBLE
TO RECEIVE PUBLIC WORKS CONTRACTS
PUBLICATION DATE: JANUARY 1, 2022

	CONTRACTOR NAME	DATE PLACED	REMOVAL DATE
9.	**Covington, Timothy** **aka Tim York** 16055 NE Stanton St. Portland, OR 97230 2933 NE 11th Ave. Portland, OR 97212 12231 NE Stanton St. Portland, OR 97230	April 13, 2021	April 12, 2024
10.	**Diversified Masonry LLC** PO Box 144 Ranchester, WY 82839	January 5, 2021	January 4, 2024
11.	**Friedman, Jennifer** 2526 Ellen Lane NW Salem, OR 97304 4400 Shaw St NW Salem, OR 97304 4400 Salem-Dallas Hwy Salem, OR 97304 PO Box 5172 Salem, OR 97304	December 11, 2020	October 10, 2023
12.	**Friedman, Scott** 2969 Ferguson St NW Salem, OR 97304 4400 Dallas Hwy Salem, OR 97304 PO Box 5172 Salem, OR 97304	December 11, 2020	October 10, 2023
13.	**Graeme, Eugene** 169 SE Cody Lane Madras, OR 97741	July 3, 2017	July 2, 2027
14.	**Green Thumb Landscape and Maintenance, Inc.,** **aka Green Thumb Landscaping,** **aka GT General Contracting** 4400 Dallas Hwy Salem, OR 97304 PO Box 5172 Salem, OR 97304	December 11, 2020	October 10, 2023
15.	**Green Thumb LLC, aka Green Thumb Contracting** 4400 Salem-Dallas Hwy Salem, OR 97304 4400 Shaw St NW Salem, OR 97304 PO Box 5172 Salem, OR 97304	December 11, 2020	October 10, 2023
16.	**High-N-Shine Concrete Floors** 9024 Silver Star Ave. Vancouver, WA 98664	February 3, 2020	February 2, 2023

LIST OF CONTRACTORS INELIGIBLE
TO RECEIVE PUBLIC WORKS CONTRACTS
PUBLICATION DATE: JANUARY 1, 2022

	CONTRACTOR NAME	DATE PLACED	REMOVAL DATE
17.	**Hoang, Lisa** **aka Kim Lien Hoang,** **aka Lien Kim Hoang,** **aka Kim Hope,** **aka Lisa K Ryan,** **aka Ryan Lien Hoang,** **aka Kim L Hoang,** **aka Lien Hoang Ryan,** **aka Lien K Hoang-Ryan,** **aka Hoang K Lien,** **aka Lisa Hall,** **aka Lisa Kim Ryan,** **aka Lien Ryan,** **aka Lien Hoang Ryan,** **aka Kim Hoang Lien,** **aka K Lisa Hoang** 703 N Hayden Meadows Dr, #206 Portland, OR 97213 731 N Hayden Meadows Dr, #206 Portland, OR 97217 2408 NE 164th Avenue Vancouver, WA 98684	February 24, 2020	February 23, 2027
18.	**Kim Bell Flagging, Inc.** 8535 Woodard Ave. SE Salem, OR 97317	January 12, 2016	January 11, 2023
19.	**Miller, David** 731 NW Naito Parkway, #215 Portland, OR 97209	June 17, 2020	Not to be Removed
20.	**Nam, Sang In** **dba Cornerstone Janitorial Services** 130 NE Danbury Ave. Hillsboro, OR 97124	September 20, 2016	Not to be Removed
21.	**Nguyen, Hai T.** 9024 Silver Star Ave. Vancouver, WA 98664	February 3, 2020	February 2, 2023
22.	**NW Flagging LLC** 703 N Hayden Meadows Dr., #206 Portland, OR 97213 731 N Hayden Meadows Dr., #206 Portland, OR 97217 2408 NE 164th Avenue Vancouver, WA 98684	February 24, 2020	February 23, 2027
23.	**Oregon Building & Landscaping Services LLC** 703 N Hayden Meadows Dr., #206 Portland, OR 97213 731 N Hayden Meadows Dr., #206 Portland, OR 97217 2408 NE 164th Avenue Vancouver, WA 98684	February 24, 2020	February 23, 2027

LIST OF CONTRACTORS INELIGIBLE
TO RECEIVE PUBLIC WORKS CONTRACTS
PUBLICATION DATE: JANUARY 1, 2022

	CONTRACTOR NAME	DATE PLACED	REMOVAL DATE
24.	**Pacific NW Drywall & Acoustics LLC** **aka Pacific NW Drywall& Acoustics LLC** 731 NW Naito Parkway #215 Portland, OR 97209	June 17, 2020	Not to be Removed
25.	**Polson, Pacharee** 9024 Silver Star Ave. Vancouver, WA 98664	February 3, 2020	February 2, 2023
26.	**Regional Traffic Management LLC** 703 N Hayden Meadows Dr., #206 Portland, OR 97213 731 N Hayden Meadows Dr., #206 Portland, OR 97217 2408 NE 164th Avenue Vancouver, WA 98684	February 24, 2020	February 23, 2027
27.	**Tatom, Alan** 168 Clearwater Avenue NE Salem, OR 97301	July 10, 2015	July 9, 2025
28.	**Thomas, Antonio** 16400 NE Las Brisas Ct., Apt. 43 Portland, OR 97230 650 NE Holladay St. Portland, OR 97232 16400 NE Las Brisas Ct. Portland, OR 97230	February 5, 2021	February 4, 2024
29.	**Walker, Phillip** 580 Market Street NE Salem, OR 97301	July 10, 2015	July 9, 2025
30.	**WCI Construction LLC** 169 SE Cody Lane Madras, OR 97741	July 3, 2017	July 2, 2027
31.	**WWJD Traffic Control, Inc.** 168 Clearwater Avenue NE Salem, OR 97301	July 10, 2015	July 9, 2025

VAL HOYLE, COMMISSIONER
BUREAU OF LABOR AND INDUSTRIES

Prevailing Wage Rate Laws Handbook

The 2022 edition of the ***Prevailing Wage Rate Laws Handbook*** is now available on our website at https://www.oregon.gov/boli/employers/Pages/prevailing-wage.aspx.

In addition to providing this and other PWR publications, Oregon BOLI Labor & Industries' PWR Unit regularly offers free, informational seminars for both public agencies and contractors. The current schedule is available online at https://www.oregon.gov/boli/employers/Pages/prevailing-wage-seminars.aspx.

If you are interested in being included on our mailing lists for future seminar notifications, please contact us at PWR.Email@boli.oregon.gov or (971) 353-2416.

SANTIAM CANYON SCHOOL DISTRICT

SANTIAM CANYON ES HVAC & CONTROLS UPGRADE

TABLE OF CONTENTS

PERMIT SET

December 22, 2021

SECTION 22 05 00 - PLUMBING MATERIALS AND METHODS

PART 1 GENERAL

1.01 DESCRIPTION

A. The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the plumbing work specified in this Division.

B. The requirements of this Section apply to the plumbing systems specified in these Specifications and in other Division 22 sections.

C. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the Drawings and/or in these Specifications, including all labor, supervision, services, permits, fees, and incidentals necessary and required to provide a complete and operable facility with complete systems as shown, specified, and required by applicable codes.

D. Advise subcontractor, suppliers, and vendors involved in the work specified in this Section of the applicable requirements.

E. See Section 22 08 00 for additional requirements related to Commissioning.

1.02 QUALITY ASSURANCE

A. All work and materials shall conform to all applicable local and state codes and all federal, state and other applicable laws and regulations. All clarifications and modifications which have been cleared with appropriate authorities are listed under the applicable sections. All electrical products shall bear the label of a recognized testing laboratory such as UL or CSA.

B. Whenever the requirements of the Specifications or Drawings exceed those of the applicable code or standard, the requirements of the Specifications and Drawings shall govern.

C. Codes and Standards: Comply with the provisions of the following referenced codes, standards and specifications:
1. Federal Specifications (FS)
2. American National Standards Institute (ANSI)
3. National Electrical Manufacturer's Association (NEMA)
4. National Fire Protection Association (NFPA)
5. Underwriters Laboratories, Inc. (UL)
6. Factory Mutual (FM)
7. International Building Code (IBC) with State and Local Amendments
8. International Mechanical Code (IMC) with State and Local Amendments
9. Uniform Plumbing Code (UPC) with State and Local Amendments
10. American Society for Testing and Materials (ASTM)
11. Americans with Disabilities Act (ADA)
12. International Fire Code (IFC) with State and Local Amendments
13. Energy Policy Act (EPAct)
14. Manufacturers Standardization Society (MSS)
15. National Sanitation Foundation (NSF)
16. American Gas Association (AGA)

D. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name. Where two or more units of the same class of equipment are furnished, use product of the same manufacturer;

component parts of the entire system need not be products of same manufacturer. Furnish all materials and equipment, new and free from defect and of size, make, type and quality herein specified or approved by the Architect. All materials shall be installed in a neat and professional manner.

E. All apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.

F. The Drawings and Specifications are complementary. What is called for by one shall be as though called for by both.

G. Drawings: Do not scale drawings for roughing-in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings. See Article 3.01 for more requirements. Coordinate work with shop drawings of other specification divisions.

H. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. All equipment shall be installed in compliance with the Electrical Code and the equipment's UL listing. Bring to the attention of the Architect in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

1.03 WORK OF OTHER CONTRACTS

A. Work under this contract shall be conducted in a manner to allow for the future installations of such equipment or items listed in other sections of this Specification.

1.04 WORK OF OTHER DIVISIONS

A. Work under this Division shall be conducted in a manner to cooperate with the installation of such equipment or items as specified in other Divisions.

B. HVAC piping systems, fuel piping systems, fire suppression piping systems, and control devices and control wiring relating to the heating and air conditioning systems are specified under other Divisions of these Specifications except for provisions or items specifically noted on the Drawings or specified herein.

C. Consult all Drawings and Specifications in this project and become familiar with all equipment to be installed. Coordinate all aspects of the construction with the other trades on the job to ensure that all work and materials required to provide a complete and operational facility are included in the bid.

D. All sections of Division 22 are interrelated and shall be considered in their entirety when interpreting any material, method, or direction listed in any section of Division 22. Individual sections are not written for specific subcontractors or suppliers but for the general contractor.

1.05 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES (SUBMITTALS)

A. Submit in accordance with Division 1 full technical and descriptive shop drawing data on proposed materials and equipment as detailed in each section.

B. The Contractor shall verify that all equipment submitted can be delivered and installed within the time constraints of the construction period.

C. Include the manufacturer, type, style, catalog number, complete specification, certified dimensions, and description of physical appearance for each item and option submitted.

Reproduction of catalog data sheets shall be clean and legible to show all details, including gauge of metal used.

D. Include only information on exact equipment to be installed, not general catalogs of the manufacturer. Where sheets show proposed equipment as well as other equipment, identify proposed equipment with rubber stamp arrow or similar concise method.

E. Submit with each copy a transmittal letter verifying that all included equipment submittals have been carefully considered for quality, dimensions, function, and have been coordinated with the Drawings and Specifications. Guarantee that proposed materials will meet or exceed the quality and function of those specified.

F. Include field wiring diagrams and connection diagrams for all control and/or low voltage systems, including floor plans.

G. Submittal Review: The submittal review process is a means to provide quality control. The action noted to be taken (or where conflicts with the contract documents are not noted) shall not be interpreted by the Contractor as automatic "change orders." Approval of the data for substitution and shop drawings shall not eliminate the contractor's responsibility for compliance with Drawings or Specifications, nor shall it eliminate the responsibility for freedom from errors of any sort in the data discovered prior to or after the review process. Deviations, discrepancies, and conflicts between the submittals and the Contract Documents shall be called to the Architect's attention in writing at the time of transmittal of the data.

H. Submittals shall be in the form of PDF documents. Arrange submittals numerically with specification sections identified in tabs. All required sections shall be submitted at one time. **Partial submittals will be rejected without review.**

1.06 PRODUCT SUBSTITUTION

A. Materials other than those specified may be approved for this project providing a written request is submitted to the Architect prior to bid in accordance with Instructions to Bidders. Requests shall include complete specifications, dimensions, manufacturer and catalog number for each item for which approval is desired. If, in the opinion of the Architect, the material is not complete or if it is not an acceptable substitute, he may reject it. The Architect's evaluation will be based solely on the material submitted.

1.07 CHANGE ORDERS

A. All supplemental cost proposals by the Contractor shall be accompanied by a complete itemized breakdown of labor and materials without exception. At the Architect's request, the contractor's estimating sheets for the supplemental cost proposals shall be made available to the Architect. Labor must be separated and allocated for each item of work.

1.08 RECORD DOCUMENTS

A. Project Record (As-Installed) Drawings:
   1. Maintain a set of record drawings on the job site as directed in Division 1.
   2. Keep Drawings clean, undamaged, and up to date.
   3. Record and accurately indicate the following:
      a. Depths, sizes, and locations of all buried and concealed piping and all cleanouts, whether concealed or exposed, dimensioned from permanent building features.
      b. Locations of all valves with assigned tag numbers.
      c. Changes, additions, and revisions due to change orders, obstructions, etc. Eradicate extraneous information.
      d. Locations of tracer wire terminal points.
      e. Model numbers of installed equipment.

4. Make Drawings available when requested by Architect for review.
5. Submit as part of the required Project Closeout documents. Final submittal will be in the form of reproducible drawings.
6. Quality of entire set of project record drawings to match the quality of the contract documents; quality to be judged by Architect. Computer-aided design drafting (CADD) shall be used to complete project record drawings. Use standards set in contract documents. Note field modifications, all addenda and change order items on project record drawings. If deficiencies are found in either the quality or the accuracy of the drawings, they will be returned unapproved. Additional review of subsequent submissions shall be at the contractor's expense.

B. Operating and Maintenance Manuals: Submit Operating and Maintenance Instructions, including manufacturer's service data, wiring diagrams, and parts lists and vendors for all serviceable items of equipment, valve charts, balancing data, final control diagrams showing final set points, duct and piping pressure test reports, equipment startup records, and any additional equipment added by change order. Provide any performance curves, data, and model numbers from submittals. Comply with provisions of Division one where applicable to the mechanical work. Submittal shall be in the form of a PDF file per specification section. Arrange submittals numerically with equipment type or classification identified in tabs. Manufactures O&M manuals shall be provided as a single PDF file that can be hyper-linked by owner for reference. O&M manuals that are a series of PDF files will not be accepted.

1.09 WARRANTY

A. Furnish, prior to application for final payment, three copies of written and signed guarantee effective a period of one year from date of completion and acceptance of entire project; agree to correct, repair and/or replace defective materials and/or equipment or the results of defective workmanship without additional expense to the Owner. Where no response satisfactory to the Owner has occurred within three working days from the written report of a warranty covered defect, the contractor shall agree to pay for the cost of repair of the reported defect by a contractor of the Owner's choice.

B. Where the manufacturer's guarantee exceeds one year, the longer guarantee shall govern and include the Contractor's labor.

C. Warranty period shall begin once all phases of construction are complete.

PART 2 PRODUCTS

2.01 GENERAL

A. General: Provide all new materials and equipment, identical to apparatus or equipment in successful operation for a minimum of two years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.

B. Compatibility: Provide products which are compatible with other portions of the work and provide products with the proper or correct power and fuel-burning characteristics, and similar adaptations for the project.

C. Efficiency: Service (Domestic) Water Heating Equipment shall comply with ASHRAE Standard 90.1-2019 and the State Energy code. Where equipment efficiencies are indicated, the use of alternate or substitute manufacturer's equipment with lower efficiencies is not permitted.

D. Storage and Handling:
1. Delivery: Deliver to project site with manufacturer's labels intact and legible.

2. Handling: Avoid damage.
3. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

2.02 ACCESS PANELS

A. Manufacturers: Inryco/Milcor, Bilco, Elmdor, Karp, Potter-Roemer or accepted substitute. Inryco/Milcor Style DW, K, or M panels as required by construction.

B. Construction: Flush style, fire rated in fire rated partitions and ceilings. Provide flush key cylinder locks on all access panels less than 8' above the floor in public spaces. Turn keys over to owners at project completion. Screwdriver latches on all others. Stainless steel construction when installed in locker room shower ceilings or restroom walls.

2.03 VALVES

A. General: Provide factory fabricated valves of the type, body material, temperature and pressure class, and service indicated. Bronze gate, globe and check valves shall comply with MSS-SP-80. Ball valves shall comply with MSS-SP-110. Iron gate and globe valves shall comply with MSS-SP-70. Iron check valves shall comply with MSS-SP-71. Butterfly valves shall comply with MSS-SP-67. Valve size same as connecting pipe size.

B. Acceptable Manufacturers: Milwaukee, Crane, Grinnell, Nibco, Hammond, Stockham, Legend, Watts, and Walworth. Grooved end valves Victaulic, Gruvlock, or accepted substitute. NIBCO numbers are given except as noted. Where possible, provide valves from a single manufacturer.

C. Valve styles: Domestic hot and cold water.
1. Valves 2” and Smaller:
a. Ball: Two-piece, Lead free certified, bronze body, full port, 600 psi WOG, Fig. T/S-585-70.
b. Check: Lead free certified, Bronze body, swing check, 200 psi WOG, T/S-413B (bronze disc) or T/S-413Y (Teflon disc).

D. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

E. Selection of Valve Ends (Pipe Connections): Select and install valves with ends matching the types of pipe/tube connections.

2.04 HANGERS AND SUPPORTS

A. General: Provide factory-fabricated horizontal piping hangers, clamps, hanger rod, inserts, supports, etc., of the indicated MSS type and size. The Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry Practice SP-58 and SP-69 are referenced in this section.

B. Manufacturers: B-Line, Carpenter & Paterson, Grinnell, Michigan, Superstrut, Tolco, Erico, or accepted substitute. Grinnell figure numbers in parentheses where applicable (or other manufacturers as noted).

C. Corrosion Protection: Provide materials which are zinc plated or factory painted to prevent corrosion. Prevent electrolysis in the support of copper tubing by the use of copper hangers (copper coated is not sufficient), strut cushion, or at least 2 layers of UPC 10 mil tape.

D. Seismic Requirements: Provide seismic restraints in accordance with OSSC Section 1613. Design restraint systems in accordance with “Seismic Restraint Manual: Guidelines for

Mechanical Systems," Second Edition, 1998, SMACNA, or “A Practical Guide to Seismic Restraint” ASHRAE RP-812, 1999.

E. Horizontal Piping Hangers and Supports:
   1. Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).
   2. Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.
   3. Adjustable Swivel-Band Hanger: MSS Type 10 (Fig. 70).
   4. Clamp: MSS Type 4 (Fig. 212, 216).
   5. Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.
   6. Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle, pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-steel plate.
   7. Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or double channel as indicated on the Drawings or as required by piping and equipment weights. Grinnell "Power Strut" channel. Acceptable Manufacturers: Super Strut, Globestrut, Bee, Kindorf or Unistrut.

F. Vertical Pipe Clamps:
   1. Two-Bolt Riser Clamp: MSS Type 8 (Fig. 261).
   2. Four-Bolt Riser Clamp: MSS Type 42 include pipe spacers at inner bolt-holes.

G. Hanger Attachment:
   1. Hanger Rod: Rolled threads, zinc plated. Right hand threaded.
   2. Turnbuckles: MSS Type 13 (Fig. 230).
   3. Weldless Eye-Nut: MSS Type 17 (Fig. 290).
   4. Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
   5. Clevises: MSS Type 14 (Fig. 299).

H. Building Attachments:
   1. Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel. Acceptable Manufacturers: Michigan Hanger, Globestrut, Unistrut, Super Strut.
   2. Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87, 88), Type 25 (Fig. 227), Type 27 through 30 where applicable.

2.05 IDENTIFICATION MARKERS

A. Pipe Markers:
   1. Adhesive pipe markers of width, letter size and background color conforming to ANSI A13.1.
   2. Acceptable Manufacturers: Brady B946 with arrow banding tape or similar Seaton, Zeston, MSI.

B. Nameplates:
   1. Engraved nameplates, 1/16" thick, laminated 2-ply plastic, bottom ply white, outer ply black, letters formed by exposing bottom ply.
   2. Size: 2" by 4" nameplates with 1/4" high letters.

C. Valve Tags:
   1. 2" diameter, 18-gauge polished brass tags with 3/16" chain hole and 1/4" high stamped, black-filled service designation.
   2. Acceptable Manufacturers: Seaton, Brady, MSI.

2.06 PENETRATION FIRE STOPPING

A. Through-penetration fire stopping system tested and listed by Underwriters Laboratories. 3M, Metacaulk, SpecSeal, or approved.

B. Select system for proper application based on wall construction, type of penetrating item, wall rating, etc.

PART 3 EXECUTION

3.01 LAYOUT AND COORDINATION

A. Site Examination: Before starting work, carefully examine site and all contract Drawings. Become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions and equipment locations before proceeding with any of the work.

B. Utility Locations: The location of existing utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the Drawings and are taken from existing records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.

C. Sleeves, Inserts, Cast-in-Place Work: Provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.

D. Coordination:
   1. The Drawings are based on equipment of a certain manufacturer and may be identified as such. Where alternate manufacturers or approved substitutes are incorporated into the work, any required design changes are the responsibility of the contractor. Such changes may include changes in utility or system connection sizes, location, or orientation, service clearances, structural support or acoustic considerations.
   2. Prepare accurate AutoCAD shop drawings showing the actual physical dimensions required for the installation for piping and plumbing devices. Submit drawings prior to purchase/fabrication/installation of any of the elements involved in the coordination. Provide drawing files to other trades for coordination.
   3. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations and wiring required for installation of mechanical items.
   4. Coordinate all work with other trades and determine in advance where interfacing of the mechanical work and other work are required to be connected together. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.

E. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.

3.02 UTILITY COORDINATION

A. Utility Coordination: Coordinate all aspects of the incoming plumbing utility services indicated with the city engineer, serving utility, and the off-street improvements contractor. Requirements of the utility company which exceed the provisions made on the Drawings or covered by these Specifications shall take precedence. Provisions made on the Drawings or Specifications in excess of the utility company's requirements shall take precedence. No additional compensation will be allowed the contractor for connection fees or additional work or equipment not covered in the Drawings or Specifications which are a result of policies of the serving utilities.

3.03 MECHANICAL EQUIPMENT WIRING

A. Provide all mechanical equipment motors, automatic temperature, limit, float and similar control devices required, with wiring complete from power source indicated on Electrical Drawings.

B. Provide properly rated motor overload and undervoltage protection and all manual or automatic motor operating devices for all mechanical equipment.

C. Equipment and systems shown on the Drawings and/or specified, are based upon requirements of specific manufacturers which are intended as somewhat typical of several makes which may be approved. Provide all field wiring and/or devices necessary for a complete and operable system including controls for the actual selected equipment/system.

D. Provide all starters for mechanical motors. Review Electrical Specifications and Drawings to determine which mechanical motor starters will be provided under the Electrical Specification Sections and provide all others.

3.04 GENERAL INSTALLATION

A. Locating and Positioning Equipment: Observe all Codes, Regulations and good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment and comply with Code requirements.

B. Arrangement: Arrange piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in all areas where possible. Unless indicated otherwise, conceal all piping. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance. Give right-of-way to piping which must slope for drainage. Set all equipment level or as recommended by manufacturer. Under no conditions shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.

C. Drip Pans: Provide drip pans under all domestic hot water heaters and all above ceiling in-line pumps and cooling coils or as noted on drawings. Locate pan immediately below piping and equipment, and extend a minimum of 6" on each side and lengthwise 18" beyond equipment being protected. Fabricate pans 2" deep, of reinforced 20 gauge galvanized sheet metal with watertight seams and rolled or hemmed edges. Provide 3/4" drainage piping, properly discharged to over floor drain or as shown on the Drawings. Comply with Mechanical Code for overflow protection and pipe sizing.

D. Access Panels: Provide access panels with proper backing reinforcement for all equipment, dielectric unions, valves and items requiring service and installed above ceilings, behind walls, or in furring, complete with correct frame for type of building construction involved. Exact size, number and location of access panels are not necessarily shown on Drawings. Use no panel smaller than 12" by 12" for simple manual access or smaller than 16" x 20" where personnel must pass through.

E. Adjusting: Adjust and calibrate all automatic mechanical equipment, mixing valves, flush valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture.

F. Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by piping, hangers, conduits, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the penetrations.

3.05 VALVE INSTALLATION

A. General: Comply with the following requirements:
   1. Install valves where required for proper operation of piping and isolation of equipment, including valves in branch lines where necessary to isolate sections of piping, and where shown on the drawings. Install valves at low points in piping systems that must be drained for service or freeze protection.
   2. Locate valves in accessible spaces (or behind access panels) and so that separate support can be provided when necessary.
   3. Install valves with stems pointed up, in the vertical position where possible, but in no case with stems pointed downward from a horizontal plane.

B. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

C. Valve Access: Provide access panels to all valves installed behind walls, in furring or otherwise inaccessible.

3.06 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building structural attachments.
   1. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping, and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
   2. Prevent electrolysis in the support of copper tubing by the use of at least 2 layers of UPC listed 10 mil tape at all bearing surfaces or strut clamp cushion. Copper plated hangers alone are not sufficient.
   3. Support fire sprinkler piping independently of other piping and in accordance with NFPA Pamphlet 13.
   4. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel points only.

B. Provisions for Movement:
   1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units. Install specified seismic restraints to restrict excessive movement.
   2. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
   3. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
      a. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
      b. Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.
      c. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
      d. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.
      e. Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where exposed to view in finished areas is specified, install hard maple wood

insulation shields (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.

C. Pipe Support:
1. Vertical Spacing: Support at base, at equivalent of every floor height (maximum 10' as required by Code) and just below roof line.
2. Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	Steel	Copper
1-1/4" and smaller	7' span	6' span
1-1/2" pipe	9' span	6' span
2" pipe	10' span	10' span
2-1/2" & larger	12' span	10' span

3. Cast Iron Soil Pipe:
   a. Hubless and Compression Joint: At every other joint except when developed length exceeds 4', then at each joint.
   b. Additional Support: Provide at each horizontal branch and/or at concentrated loads to maintain alignment and prevent sagging.
4. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
5. Support Rod: Hanger support rods sized as follows:

Pipe and Tube Size		Rod Size	
Inches	mm	Inches	mm
1/2” to 4”	12.7 to 101.6	3/8”	9.5
5” to 8”	127.0 to 203.2	1/2”	12.7
10” to 12”	254.0 to 304.8	5/8”	15.9

6. Provide manufactures approved channel continuously below all horizontal PEX or other plastic pipe where hung from structure.

D. Adjust hangers and supports to bring piping to proper levels and elevations.

E. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.

F. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.

G. Installation of drilled-in concrete anchors shall comply with the manufacturer’s instructions for working load, depth of embedment, and spacing between anchors and from the edge of the slab. Use only wedge style anchors.

H. Seismic Restraints: Install restraints where recommended in SMACNA "Seismic Restraint Manual." Show analysis of supporting structure, anchorages, and restraints in accordance with OSSC Chapter 16 and reference ASCE standard. Seismic restraint system components shall be approved by the California Office of Statewide Health Planning and Development (OSHPD). Acceptable Manufacturers: Amber/Booth, Mason Industries, Tolco, or approved. Contractor shall submit calculations and shop drawings, sealed and signed by a professional engineer, showing seismic restraint design for all equipment, piping and ductwork required to be braced. Seismic importance factor for new building is 1.5. For remodeled areas seismic importance factor is 1.0.

3.07 PLUMBING SYSTEM IDENTIFICATION

A. Piping System: Indicate each pipe system by its generic name (abbreviated) as shown/scheduled/specified; except vent and drainage piping. Comply with ANSI A13.1 for marker locations, letter sizes, and colors. Include arrows to show direction of flow and "Electric Traced" signs to identify heat cable wrapped piping. Locate pipe labels in accessible areas as follows:
   1. Near each valve, meter, gauge, or control device.
   2. Near equipment such as pumps, heat exchangers, water heaters, etc.
   3. At piping branch connections.
   4. At penetrations (each side) of walls, ceilings, and floors.
   5. At access panels and doors.
   6. At 25 foot maximum intervals. Provide a minimum of 1 label above each room where lift out ceiling is installed. Reduce intervals in congested areas such as mechanical rooms.

B. Valve Identification: Tag all valves with brass disc and chain. Prepare valve charts indicating valve number, size, location, concealed or exposed, function, valve manufacture and model number, and normal position. Provide floor plan as part of record Drawings. Use no duplicate numbers in Plumbing and Heating systems. Mount glazed frames containing one set of valve charts in the building mechanical room.
   1. Include floor plan of each floor level with valve tag numbers indicated at approximate valve locations. Provide separate maps for plumbing valves and HVAC valves. Maps are to be 11"x17".
   2. Label all ceilings directly below or access panels directly in front of plumbing or HVAC valves using engraved, printed labels or hanging tags stating the valve ID as shown on the Valve Map and the Valve Tag Directory.

C. Equipment: Provide engraved plastic-laminate signs at locations of major equipment such as heat exchangers, pumps, etc. Identify equipment in field same as on drawings. Permanently mount in an appropriate and effective location.

D. Operation Tags: Where needed for proper and adequate information on operation and maintenance of mechanical systems, provide tags of plasticized card stock, either pre-printed or hand printed to convey the message; example: "DO NOT CLOSE THIS VALVE EXCEPT WHEN THE PUMP IS OFF."

3.08 EQUIPMENT CONNECTIONS

A. Provide complete plumbing connections for all items of equipment requiring such connections, including incidental piping, fittings, trim and labor necessary for a finished working installation.

B. Verify the rough-in and finish requirements for all equipment provided under other Divisions of the work and requiring plumbing connections with equipment supplier and installer prior to rough-in. Minimum branch pipe size for fixtures shall be 1/2".

3.09 PROTECTION

A. Protect all work and materials against loss or damage. Close all pipe openings with caps or plugs. At final completion, thoroughly clean and deliver all work and equipment in an unblemished new condition. Keep all motors and bearings in watertight and dustproof covers during entire course of installation.

B. Protect floors, walls, framing and sheathing where pipe cutting and threading operations are conducted with plastic sheeting under plywood sheets. Extend plastic sheeting beyond the plywood. Clean-up metal cuttings, oil, etc., daily or as necessary to prevent debris from being tracked beyond the protected area. Damages, as determined by the Architect, due to the pipe cutting/threading operation shall be repaired by the responsible trade.

3.10 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of mechanical work. Do all necessary cutting and patching of existing building and yard surfaces required for completion of the mechanical work. Patch to match finish and color of adjacent surfaces. Coordinate work in remodel and new areas to avoid cutting of new finished surfaces.

3.11 PIPE PENETRATION FIRE STOPPING

A. Install as recommended by manufacturer and in accordance with the product's UL listing. Below are the minimum installation requirements.
   1. Install specified penetrating item(s) with required annular spacing in proper size wall or floor opening. Support penetrating item(s) adequately on both sides of construction.
   2. Clean all opening and penetrating item surfaces in penetration area to remove loose debris, dirt, oil, wax, grease, old caulking, etc.
   3. If needed or required for gypsum or concrete block walls, install specified galvanized steel wire mesh or sleeve recessed and centered inside wall around penetrating item(s) so that it is snug against perimeter of opening.
   4. When required, install specified type and depth of backing material in annular space, recessed to required fill depth of fire stopping caulking.
   5. Gun, trowel, and/or pump fire stopping sealant to specified depth in annular space around penetrating item(s). Trowel sealant surfaces flush with wall or floor surfaces to a smooth, defect-free finish. Where required, apply specified size caulking bead around penetrating item(s) at zero annular contact areas and tool smooth.

B. Drawings show some, not all, of the penetration. Review architectural drawings for all fire walls.

C. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

3.12 ACOUSTIC SEALING/CAULKING

A. See details on drawings. Seal all pipe penetrations of classrooms or auditorium.

B. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products:
      a. Pecora Corporation; AC-20 FTR
      b. Tremco Incorporated; Tremflex 834.
      c. USG Corporation; SHEETROCK Acoustical Sealant.

D. Joint Backing: Round, closed cell, non-gassing foam rod compatible with sealant; ASTM C 1330 Type B, cylindrical, bi-cellular material; oversized 30 to 50 percent larger than joint width.
   1. Products:
      a. Sof Rod manufactured by Nomaco Inc.
      b. Sonolastic Soft Backer-Rod manufactured by BASF.

E. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

3.13 MECHANICAL PAINTING

A. Minimum Requirements: All mechanical equipment, piping, insulation, etc., exposed in finished areas, storage rooms and other locations except mechanical equipment rooms will be painted per 09 90 00.

3.14 PLUMBING WORK CLOSEOUT

A. General: Refer to the Division 1 sections for general closeout requirements. Calibrate all equipment requiring same. Complete each system as shown or specified herein and place in operation except where only roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of leaks, obstructions, or contamination.

B. Record Drawings: Submit record set of drawings required in Division 1 as previously specified in this Section.

C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Architect present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system, and replace dirty filters, excessively worn parts and similar expendable items of the work.

D. Operating Instructions: Conduct a walk-through instruction seminar for the Owner's personnel who are to be involved in the continued operation and maintenance of plumbing equipment and systems. Provide written instructions outlining and explaining the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of the systems.

END OF SECTION

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the insulation of plumbing systems specified elsewhere in these specifications.

B. The requirements of Section 22 05 00, Common Plumbing Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Minimum Insulation Thickness and Thermal Performance: Comply with Oregon Energy Efficiency Specialty Code.

B. Composite (Insulation, Jacket or Facing and Adhesives) Fire and Smoke Hazard Ratings: Not to exceed a flame spread of 25 or smoke development of 50 and containing less than 0.1% by weight deca-PDE fire retardant.

C. Component Ratings of Accessories (Adhesives, Mastics, Cements, Tapes, Finishing Cloth for Fittings): Same as "B" requirements above and permanently treated. No water soluble treatments.

1.03 SUBMITTALS

A. Submit catalog data and performance characteristics for each product specified.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: In addition to the requirements specified in Section 22 05 00, the following apply:
   1. Deliver insulation, coverings, cements, adhesives and coatings to the site in factory-fabricated containers with the manufacturer's stamp or label affixed showing fire hazard ratings of the products. Store insulation in original wrappings and protect from weather and construction traffic.
   2. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged insulation. Remove such insulation from project site.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Insulation Manufacturers: Johns Manville, Owens-Corning, Knauf, Certain Teed, Armstrong, Pabco, Imcoa or Nomaco. Johns Manville products are listed unless indicated otherwise.

B. Adhesive Manufacturers: Foster, 3M, Insul-Coustic, Borden, Kingco or Armstrong.

2.02 PIPING INSULATION

A. Interior and Exterior Piping Systems 32 to 180 Deg. F: Glass fiber preformed pipe insulation with a minimum K-value of 0.23 at 75 deg. F, a minimum density of 3.5 pounds per cubic foot within all-service vapor barrier jacket, vinyl or pre-sized finish and pressure sensitive seal containing less than 0.1% by weight deca-PDE fire retardant.

B. Pipe Temperatures Minus 30 to 180 Deg. F: Flexible, preformed, pre-slit, self-sealing elastomeric pipe insulation up to 2-1/8" ID, thermal conductivity of 0.27 BTU/hr. sq. ft./in. at 75

deg. F and vapor transmission rating of 0.2 perms/inch. On cold surfaces, apply in thickness necessary to prevent condensation on the surface at 85 deg. F and 70% RH. Armstrong "Armaflex 2000" or, in concealed locations, Imcoa or Nomaco also approved.

2.03 EQUIPMENT INSULATION

A. Equipment Temperatures Below 70 Deg. F: Flexible, closed cell, elastomeric sheet insulation of 5.5 #/cubic feet density and 0.27 thermal conductivity at 75 deg. F. Armstrong "Armaflex."

B. Equipment Temperatures From 70 to 450 Deg. F: Glass fiber 3 pound density insulation with a 0.23 thermal conductivity at 75 deg. F. Johns Manville "814 Spin-Glas" with "FSK" jacket containing less than 0.1% by weight deca-PDE fire retardant or finished as recommended by manufacturer.

2.04 INSULATION ACCESSORIES

A. Insulation Compounds and Materials: Provide rivets, staples, bands, tapes, adhesives, cements, coatings, sealers, welded studs, etc., as recommended by the manufacturer for the insulation and conditions specified. No staples allowed on cold water piping systems.

B. Interior Tanks and Equipment Insulation Covering: Finished metal jacket or as recommended by the manufacturer for insulation material specified.

C. PVC Protective Jacketing and Valve and Pipe Fitting Covers: Johns Manville Zeston 2000, Proto LoSmoke, or Ceel-Co Ceel-Tite 100 Series with precut fitting fiberglass insulation or approved.

D. Jacket Lap Sealing Adhesives: Foster Drion 85-75 contact cement or approved substitute.

E. Saddles and Shields: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
   1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

PART 3 EXECUTION

3.01 PIPING INSULATION

A. General: Do not insulate underground piping except at joints and fittings on preinsulated piping unless indicated otherwise. At contractor’s option and in accordance with Part 2 of this section, elastomeric insulation may be installed on domestic water piping in thicknesses equivalent to the glass fiber insulation. Installation shall comply with the manufacturer’s recommendation with joints and seams completely sealed.

B. Domestic Water Piping:
   1. Insulate with glass fiber pipe covering, 1” thick for cold water piping and for 1" and smaller hot water piping; 1-1/2" for 1-1/4" and larger hot water piping.
   2. Insulate hot water return piping same as cold water piping.
   3. Insulate all water piping exposed to outside weather and freezing temperatures with 1” thickness of glass fiber pipe covering with weather-proof metal jacket. Apply insulation after heat cable is installed.

C. Pipe Fittings:
   1. Insulate and finish all fittings including valve bodies, bonnets, unions, flanges and expansion joints with precut fiberglass insulation and preformed PVC covers sealed to adjacent insulation jacket for continuous vapor barrier covering over all fittings.
   2. Provide removable/reusable insulation covers on 4" and larger valves, unions, flanges, pump casings, strainers and similar fittings or equipment requiring periodic service.

D. Protective Covering: Install continuous protective PVC or metal covering on all piping and fittings in mechanical rooms, accessible tunnels, attic spaces, accessible ceilings, etc., where insulation may be subject to damage. Install with rivets or cement seams and joints.

E. Insulated Piping: Comply with the following.
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.9.
   2. Install MSS SP-58, Type 39 or Type 40 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
   3. Shield Dimensions for Pipe: Not less than the following.
      a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
      b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
      c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
      d. NPS 8 and NPS 14 (DN200 and DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
      e. NPS 16 and NPS 24 (DN400 and DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
   4. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
   5. Insert Material: Length at least as long as protective shield.
   6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

F. Piping Insulation Lap Seams and Butt Joints: Install insulation jacket in accordance with manufacturer's recommendation and without staples on cold water lines. Where jacket joint and lap seams have not adhered, remove affected section of insulation and reinstall or apply lap sealing adhesive in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 10 00 - PLUMBING PIPING AND PUMPS

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide pipe, pipe fittings, piping specialties, pumps and related items required for complete piping system.

B. Related Work: The requirements of Section 22 05 00, Common Plumbing Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. General: ASTM, and ANSI Standards are indicated. In addition, special standards are referenced where neither ASTM nor ANSI Standards are applicable.

B. Labeling: All piping shall be continuously and legibly labeled on each length as required by codes and standards and including as a minimum, country of origin, manufacturer's identification marking, wall thickness designation, and applicable standards and approvals. Fittings shall be labeled as required by the referenced standard. Tubular fixture traps shall be stamped with manufacturer's mark and material thickness.

C. Potable Water Valves: Potable water piping materials not limited to faucets, mixing valves, or pressure reducing valves. Valves shall meet NSF Standard 61, Section 9, for drinking water faucets and shall be brass construction. Brass components which contact water within the faucet shall be from brass which contains no more than 3 percent lead by dry weight.

D. Concealed Plastic Piping: No concealed plastic piping inside the building unless approved by Code or Governing Authorities.

E. Definitions: Where piping fluid is not indicated in the following paragraphs, provide similar piping materials for similar fluids (i.e., "make-up water" = "domestic water"; "wet stand pipe" = "fire sprinkler pipe"; "drainage piping" = "sanitary/storm sewer piping").

F. Plumbing System Disinfection shall be performed by an experienced, qualified, chemical treatment agency.

1.03 STORAGE AND HANDLING

A. Provide factory-applied end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.04 SUBMITTALS

A. Submit catalog data for each product specified.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Copper Pipe and Tube:
   1. Application:
      a. Domestic water.
      b. Priming lines.

c. Non-potable water
2. Pipe: ASTM B88. Produced by American manufacturer only. Foreign produced piping is not allowed.
   a. Above Ground Domestic Water: Type L hard temper copper with soldered joints.
   b. Underground Domestic Water and Priming Lines: Type L soft annealed with no joints or type K hard tempered copper with silver soldered joints.
3. Fittings: Wrought copper solder-joint fittings, ANSI / ASME B16.22.

B. Copper Pipe and Tube:
1. Application:
   a. Domestic water.
   b. Non-potable water
2. Pipe: ASTM B88. Above Ground Domestic Water: Type L hard temper copper.
3. Sizes ½" to 2": Press Fitting: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer.

2.02 MISCELLANEOUS PIPING MATERIALS

A. Insulating (Dielectric) Fittings: Do not use, see Section 3.3, D.

B. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.
1. Tin-Antimony Solder: ASTM B32, Grade 95TA.
2. Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.
3. Silver Solder: ASTM B32, Grade 96.5TS.
4. Flux: Water soluble paste flux.
5. Brazing filler rod: BCuP rod to suit conditions.

2.03 PIPING SPECIALTIES

A. Backflow Preventer: Where indicated on the Drawings, install a reduced pressure backflow preventer complete with shutoff valves, two separate check valves, differential relief valve, and test cocks. USC Foundation for Cross Connection Control, State Health Officials, and serving utility approved. Bronze bodies on units 2" and smaller, and cast iron bodies with bronze trim on units 2-1/2" and larger.

PART 3 EXECUTION

3.01 UTILITY SERVICE

A. Plumbing Utility Connections: Complete installation. Contact local serving utilities to determine conditions involved and make or arrange to have connection made at proper time and pay all costs involved.

B. Water Service: Connect to water system.

3.02 PIPE INSTALLATION

A. General: Install pipe, tube and fittings in accordance with recognized industry practices and plumbing code standards. Install each run accurately aligned with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings.

B. Piping Runs: Route piping close to and parallel with walls, overhead construction, columns and other structural and permanent-enclosure elements of the building. Install piping plumb and level except where pitched for drainage. If not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building or equipment and avoid diagonal runs. Wherever possible in finished and occupied spaces, conceal piping from view. Do not encase horizontal runs in solid (concrete or CMU) partitions.

C. Ensure all copper piping is protected from contact with non-copper and plated supports. Provide strut cushion below clamp or 2 layers of UPC listed 10 mil tape.

3.03 PIPING JOINTS

A. General: Provide joints of the type indicated in each piping system, and where piping and joint as manufactured form a system, utilize only that manufacturer's material.

B. Cast Iron "No-Hub": All joints in accordance with the Cast Iron Soil Pipe Institute (CISPI) Designation No. 310-97 "Installation Procedures for Hubless Cast Iron Soil Pipe and Fittings For Sanitary and Storm Drain, Waste and Vent Piping Applications." Horizontal runs of 5" and greater shall be braced as indicated in Figure 4 for "rodding" restraints. Application of couplings as follows:
   1. Standard Duty Couplings: All vent piping and all drainage and waste piping above grade.
   2. Heavy Duty Couplings: All underground waste installations and any storm drain installations 2 stories or more in height.

C. Solder Copper Tube and Fitting Joints: In accordance ANSI B 828 with recognized industry practice. Cut tube ends squarely. Copper tubing shall be cut with a wheeled tubing cutter or approved copper tubing cutting tool. The tubing shall be cut square to permit proper joining with the fittings. Remove scale, slag, dirt and debris from inside and outside of tubing and fittings before assembly. The tubing end shall be wiped clean and dry. The burrs on the tubing shall be reamed with a deburring or reaming tool. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens. "T-Drill" field formed tees may be utilized where the main is at least two pipe sizes larger than the branch.

D. Insulating (Dielectric) Fittings: Where the "joining of ferrous and non-ferrous piping", use brass valve or brass nipple with length/nominal diameter ratio of 8 or greater rather than dielectric fitting.

E. Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.

F. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.

3.04 CLEANING

A. General: Clean all dirt and construction dust and debris from all mechanical piping systems and leave in a new condition. Touch up paint where necessary.

B Disinfection of Domestic Water Piping System:
   1. Prior to starting work, verify system is complete and clean.
   2. Open all drains and fixtures valves in the building starting with the valve nearest the water service line and permit the water to run clear for 10 minutes to eliminate grease, cuttings, flux, and foreign matter.
   3. Inject disinfectant at beginning of water system to be disinfected. Introduce free chlorine in liquid form, throughout system to obtain concentration required by local Public Health Department regulations or 50 to 80 mg/L residual.

4. Bleed water from all potable water outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
5. Maintain disinfectant in system for 24 hours.
6. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
7. Flush disinfectant from system until residual is equal to that of incoming water or 1.0 mg/L.
8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C601. If any sample fails the analysis, repeat the procedure.
9. Include a copy of the bacteriological analysis in the Operating and Maintenance manuals.
10. If allowed by local jurisdiction, testing is acceptable in lieu of treatment.

3.05 TEST

A. General:
   1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
   2. Provide all necessary temporary equipment for testing, including pump and gauges. Remove control devices before testing and do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.
   3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

B. Repair:
   1. Repair piping system sections which fail the required piping test by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemical stop-leak compounds, solder, mastics, or other temporary repair methods.
   2. Drain test water from piping systems after testing and repair work has been completed.

C. Water Piping: Hydrostatic pressure of 100 psig without loss for four hours.

3.06 SUPERVISION AND START-UP

A. Adjust flush valves, pressure reducing valves, water heater thermostats, and similar equipment.

END OF SECTION

SECTION 23 05 00 - HVAC MATERIALS AND METHODS

PART 1 GENERAL

1.01 DESCRIPTION

A. The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the HVAC work specified in this Division.

B. The requirements of this Section apply to the HVAC systems specified in these Specifications and in other Division 23 sections.

C. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the Drawings and/or in these Specifications, including all labor, supervision, services, permits, fees, and incidentals necessary and required to provide a complete and operable facility with complete systems as shown, specified, and required by applicable codes.

D. The work shall include, but not be limited to, the following systems:
   1. Fuel supply system.
   2. Central heating and cooling equipment.
   3. Complete piping systems including insulation, valves, supports, etc.
   4. Air handling equipment including packaged equipment and exhaust fans.
   5. Air distribution systems including ductwork, terminal units, dampers, insulation, and air inlets and outlets.
   6. HVAC control system.
   7. Assist Commissioning Agent as required by Commissioning specification.

E. Advise subcontractor, suppliers, and vendors involved in the work specified in this Section of the applicable requirements.

F. See Section 23 08 00 for additional requirements related to Commissioning.

1.02 QUALITY ASSURANCE

A. All work and materials shall conform to all applicable local and state codes and all federal, state and other applicable laws and regulations. All clarifications and modifications which have been cleared with appropriate authorities are listed under the applicable sections. All electrical products shall bear the label of a recognized testing laboratory such as UL or CSA.

B. Whenever the requirements of the Specifications or Drawings exceed those of the applicable code or standard, the requirements of the Specifications and Drawings shall govern.

C. Codes and Standards: Comply with the provisions of the following referenced codes, standards and specifications:
   1. Federal Specifications (FS)
   2. American National Standards Institute (ANSI)
   3. National Electrical Manufacturer's Association (NEMA)
   4. National Fire Protection Association (NFPA)
   5. Underwriters Laboratories, Inc. (UL)
   6. Factory Mutual (FM)
   7. International Building Code (IBC) with State and Local Amendments
   8. International Mechanical Code (IMC) with State and Local Amendments
   9. Uniform Plumbing Code (UPC) with State and Local Amendments
   10. American Society for Testing and Materials (ASTM)
   11. Americans with Disabilities Act (ADA)

12. International Fire Code (IFC) with State and Local Amendments
13. Energy Policy Act (EPAct)
14. Manufacturers Standardization Society (MSS)
15. American Gas Association (AGA)

D. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name. Where two or more units of the same class of equipment are furnished, use product of the same manufacturer; component parts of the entire system need not be products of same manufacturer. Furnish all materials and equipment, new and free from defect and of size, make, type and quality herein specified or approved by the Architect. All materials shall be installed in a neat and professional manner.

E. All apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.

F. The Drawings and Specifications are complementary. What is called for by one shall be as though called for by both.

G. Drawings: Do not scale drawings for roughing-in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings. Coordinate work with shop drawings of other specification divisions. See Article 3.1 for more information and requirements.

H. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. All equipment shall be installed in compliance with the Electrical Code and the equipment's UL listing. Bring to the attention of the Architect in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

1.03 WORK OF OTHER CONTRACTS

A. Work under this contract shall be conducted in a manner to allow for the future installations of such equipment or items listed in other sections of this Specification.

1.04 WORK OF OTHER DIVISIONS

A. Work under this Division shall be conducted in a manner to cooperate with the installation of such equipment or items as specified in other Divisions.

B. Plumbing piping systems and fixtures and fire suppression piping systems are specified under other Divisions of these Specifications except for provisions or items specifically noted on the Drawings or specified herein.

C. Consult all Drawings and Specifications in this project and become familiar with all equipment to be installed. Coordinate all aspects of the construction with the other trades on the job to ensure that all work and materials required to provide a complete and operational facility are included in the bid.

D. All sections of Division 23 are interrelated and shall be considered in their entirety when interpreting any material, method, or direction listed in any section of Division 23. Individual sections are not written for specific Subcontractors or suppliers but for the General Contractor.

1.05 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES (SUBMITTALS)

A. Submit in accordance with Division 1 full technical and descriptive shop drawing data on proposed materials and equipment as detailed in each section.

B. The Contractor shall verify that all equipment submitted can be delivered and installed within the time constraints of the construction period.

C. Include the manufacturer, type, style, catalog number, complete specification, certified dimensions, and description of physical appearance for each item and option submitted. Reproduction of catalog data sheets shall be clean and legible to show all details, including gauge of metal used.

D. Include only information on exact equipment to be installed, not general catalogs of the manufacturer. Where sheets show proposed equipment as well as other equipment, identify proposed equipment with rubber stamp arrow or similar concise method.

E. Submit with each copy a transmittal letter verifying that all included equipment submittals have been carefully considered for quality, dimensions, function, and have been coordinated with the Drawings and Specifications. Guarantee that proposed materials will meet or exceed the quality and function of those specified.

F. Include field wiring diagrams and connection diagrams for all control and/or low voltage systems, including floor plans.

G. Submittal Review: The submittal review process is a means to provide quality control. The action noted to be taken (or where conflicts with the contract documents are not noted) shall not be interpreted by the Contractor as automatic "change orders." Approval of the data for substitution and shop drawings shall not eliminate the Contractor’s responsibility for compliance with Drawings or Specifications, nor shall it eliminate the responsibility for freedom from errors of any sort in the data discovered prior to or after the review process. Deviations, discrepancies, and conflicts between the submittals and the Contract Documents shall be called to the Architect's attention in writing at the time of transmittal of the data.

H. Submittals shall be in the form of PDF documents. Arrange submittals numerically with specification sections identified in tabs. All required sections shall be submitted at one time. **Partial submittals will be rejected without review.**

I. For adhesives and sealants used on the interior of the building (inside the waterproofing system), include printed statement of volatile organic compound (VOC) content.

1.06 PRODUCT SUBSTITUTION

A. Materials other than those specified may be approved for this project providing a written request is submitted to the Architect prior to bid in accordance with Instructions to Bidders. Requests shall include complete specifications, dimensions, manufacturer and catalog number for each item for which approval is desired. If, in the opinion of the Architect, the material is not complete or if it is not an acceptable substitute, he may reject it. The Architect's evaluation will be based solely on the material submitted.

1.07 CHANGE ORDERS

A. All supplemental cost proposals by the Contractor shall be accompanied by a complete itemized breakdown of labor and materials without exception. At the Architect's request, the Contractor's estimating sheets for the supplemental cost proposals shall be made available to the Architect. Labor must be separated and allocated for each item of work.

1.08 RECORD DOCUMENTS

A. Project Record (As-Installed) Drawings:
   1. Maintain a set of record drawings on the job site as directed in Division 1.
   2. Keep Drawings clean, undamaged, and up to date.
   3. Record and accurately indicate the following:
      a. Depths, sizes, and locations of all buried and concealed piping dimensioned from permanent building features.
      b. Locations of all valves with assigned tag numbers.
      c. Locations of all fire dampers and other airflow control devices.
      d. Changes, additions, and revisions due to change orders, obstructions, etc. Eradicate extraneous information.
      e. Model numbers of installed equipment.
   4. Make Drawings available when requested by Architect for review.
   5. Submit as part of the required Project Closeout documents. Final submittal will be in the form of reproducible drawings.
   6. Quality of entire set of project record drawings to match the quality of the contract documents; quality to be judged by Architect. Computer-aided design drafting (CADD) shall be used to complete project record drawings. Use standards set in contract documents. Note field modifications, all addenda, and change order items on project record drawings. If deficiencies are found in either the quality or the accuracy of the drawings, they will be returned unapproved. Additional review of subsequent submissions shall be at the Contractor's expense.

B. Operating and Maintenance Manuals: Submit Operating and Maintenance Instructions, including manufacturer's service data, wiring diagrams, and parts lists and vendors for all serviceable items of equipment, valve charts, balancing data, final control diagrams showing final set points, duct and piping pressure test reports, equipment startup records, and any additional equipment added by change order. Provide any performance curves, data, and model numbers from submittals. Comply with provisions of Division one where applicable to the mechanical work. Submittal shall be in the form of a PDF file per specification section. Arrange submittals numerically with equipment type or classification identified in tabs. Manufactures O&M manuals shall be provided as a single PDF file that can be hyper-linked by Owner for reference. O&M manuals that are a series of PDF files will not be accepted.

1.09 WARRANTY

A. Furnish, prior to application for final payment, three copies of written and signed guarantee effective a period of one year from date of completion and acceptance of entire project; agree to correct, repair and/or replace defective materials and/or equipment or the results of defective workmanship without additional expense to the Owner. Where no response satisfactory to the Owner has occurred within three working days from the written report of a warranty covered defect, the contractor shall agree to pay for the cost of repair of the reported defect by a contractor of the Owner's choice.

B. Where the manufacturer's guarantee exceeds one year, the longer guarantee shall govern and include the Contractor's labor.

PART 2 PRODUCTS

2.01 GENERAL

A. General: Provide all new materials and equipment, identical to apparatus or equipment in successful operation for a minimum of two years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.

B. Compatibility: Provide products which are compatible with other portions of the work and provide products with the proper or correct power and fuel-burning characteristics, and similar adaptations for the project.

C. Efficiency: Heating and cooling equipment shall comply with ASHRAE Standard 90.1-2010 and the State Energy Code. Where equipment efficiencies are indicated, the use of alternate or substitute manufacturer's equipment with lower efficiencies is not permitted.

D. Storage and Handling:
   1. Delivery: Deliver to project site with manufacturer's labels intact and legible.
   2. Handling: Avoid damage.
   3. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

2.02 STARTERS AND SWITCHES

A. Manufacturers: Cerus Industrial Model numbers are listed. General Electric, ABB, Allen Bradley, Schneider Electric, Eaton, are approved if equal. Provide starters by same manufacturer throughout project.

B. General: Provide each motor with starter or switch as approved and recommended by manufacturer of motor or equipment of which motor is a part. All starters shall include integral disconnect.

C. System Description
   1. Single Phase Starter: Starters for 115VAC single phase motors less than 1 HP shall be capable of both manual and automatic operation. Refer to Section D for single phase starter requirements.
   2. Magnetic Starters: Starters for 3-phase motors shall be magnetic starters. Refer to Section E for magnetic starter requirements.

D. Enclosed Full Voltage Non-Reversing (FVNR) Single Phase Starter
   1. Single Phase Motor Starter Control: The single phase motor starter shall consist of a manually operated quick-make toggle mechanism lockable in the "Off" position which shall also function as the motor disconnect. Additionally, the starter shall provide thermal overload protection, run status pilot light and fault pilot light. The starter must include the capability to operate in both manual and automatic control modes. In automatic mode, the starter shall have the capability to integrate with a building automation system by providing terminals for run input, run status output and fault output. All control terminals shall be integrated in the starter. At a minimum, each single phase starter shall include an interposing run relay and current sensing status output relay. Single phase motor starter shall be in a surface mount enclosure.
   2. Approved manufacturer: Cerus Industrial, model BAS-1P or approved equal.

E. Enclosed Full Voltage Non-Reversing (FVNR) Non-Combination Starter
   1. Magnetic Motor Starters shall be enclosed in a general purpose electrical enclosure with the appropriate environmental rating.
   2. Starters shall consist of a horsepower rated magnetic contactor with a minimum of 1NO and 1NC auxiliary contacts and solid state electronic overload relay. Overload relay shall protect all three phases with a wide range current setting and trip class to allow field adjustment for specific motor FLA. Overload relay shall provide phase failure, phase loss, locked rotor and stall protection.
   3. Provide a manual reset pushbutton on the starter cover to restore normal operation after a trip or fault condition.

4. Each starter shall include an installed 50VA control power transformer (CPT) with protected secondary. The CPT must accept the available line voltage and the control voltage shall not exceed 120V.
5. Installed accessories shall include Hand-Off-Auto operation switch with 22mm style operator interfaces. Include LED pilot light indicators for Hand, Off, Auto, Run and Overload conditions. All pilot devices shall be water tight and dust tight.
6. When remotely controlled by an automation system, the starter shall include remote run terminals which accept both a voltage input signal and a contact closure. The voltage run input shall accept both AC and DC signals including 24VAC, 120VAC, 24VDC and 48VDC to allow direct connection of the transistorized automation signal to the starter.
7. In applications where the motor is interlocked with a damper or valve, the actuator control must reside within the starter enclosure. The starter must provide a voltage output to operate the actuator to open the damper or valve without closing the motor circuit. The starter will only close the motor circuit and start the motor after it has received a contact closure from a limit or end switch confirming the damper or valve position.
8. Manufacturer shall provide and install tags with engraved white lettering to designate equipment served.

F. Enclosed Full Voltage Non-Reversing (FVNR) Combination Starter / Disconnect
1. Magnetic Motor Starters shall be enclosed in a general purpose electrical enclosure with the appropriate environmental rating.
2. Starters shall consist of a horsepower rated magnetic contactor with a minimum of 1NO and 1NC auxiliary contacts and solid state electronic overload relay. Overload relay shall protect all three phases with a wide range current setting and trip class to allow field adjustment for specific motor FLA. Overload relay shall provide phase failure, phase loss, locked rotor and stall protection.
3. Provide a manual reset pushbutton on the starter cover to restore normal operation after a trip or fault condition.
4. Each starter shall include an installed 50VA control power transformer (CPT) with protected secondary. The CPT must accept the available line voltage and the control voltage shall not exceed 120V.
5. Installed accessories shall include Hand-Off-Auto operation switch with 22mm style operator interfaces. Include LED pilot light indicators for Hand, Off, Auto, Run and Overload conditions. All pilot devices shall be water tight and dust tight.
6. When remotely controlled by an automation system, the starter shall include remote run terminals which accept both a voltage input signal and a contact closure. The voltage run input shall accept both AC and DC signals including 24VAC, 120VAC, 24VDC and 48VDC to allow direct connection of the transistorized automation signal to the starter.
7. In applications where the motor is interlocked with a damper or valve, the actuator control must reside within the starter enclosure. The starter must provide a voltage output to operate the actuator to open the damper or valve without closing the motor circuit. The starter will only close the motor circuit and start the motor after it has received a contact closure from a limit or end switch confirming the damper or valve position.
8. Provide and install tags with engraved white lettering to designate equipment served.
9. Enclosed combination starters shall include all of the magnetic starter requirements in addition to a disconnecting method. Acceptable disconnects include: motor circuit protectors or UL 489 circuit breakers. All disconnects shall include a lock-out mechanism when in the off position.
10. The Motor Circuit protector shall be a UL listed 508 current limiting manual motor starter with magnetic trip elements only. The breaker shall carry a UL 508F rating (up to 100A frame size) which provides for coordinated short circuit rating for use with the motor contactor and provides a minimum interrupting rating of 30,000 AIC for the combination starter.
11. Disconnect shall be UL 98 suitable for service entrance protection.
12. UL 489 breaker shall include thermal and magnetic trip mechanisms.

13. Provide over/under voltage and phase monitoring capability. Monitor shall be field adjustable for both over and under voltage levels and a delay time before returning to normal operation after a trip.

G. Quality Assurance
1. Manufacturer shall provide a five year warranty on the complete starter assembly.
2. The starter assembly shall be UL listed under UL 508A.

2.03 SOLID-STATE, VARIABLE-SPEED MOTOR CONTROLLERS

A. General: Controllers listed and labeled as a complete unit and arranged to provide variable speed of a standard NEMA Design B 3-phase induction motor by adjusting output voltage and frequency of controller. Designed and rated by the manufacturer for the type of load (e.g., fans, blowers, and pumps) used and also approved by the manufacturer for the type of connection used between the motor and load (direct connection or power transmission connection).

B. Input Line Reactors: 5% for reduction of harmonics.

C. Output Line Reactors: Specially designed and constructed for IGBT controllers and designed to protect motor from voltage spikes over 150% of the bus voltage. Required where controller to motor cable length exceeds 50 feet. Provide dV/dT filters for 460 volt motors with cable lengths in excess of 300'.

D. In lieu of providing line reactors, the drive manufacturers may submit a power system analysis demonstrating compliance with IEEE 519.

E. Ratings:
1. Output Ratings: 3-phase, 6 to 60 Hz, with voltage proportional to frequency throughout the voltage range.
2. Starting Torque: 100 percent of rated torque, or as indicated.
3. Speed Regulation: Plus or minus 1 percent.
4. Ambient Temperature: 0° C to 40° C.
5. Efficiency: 98 percent at normal power levels.

F. Isolated Control Interface: Allow the controller to follow one of the following over an 11:1 speed range:
1. Electrical Signal: 4 to 20 milliamperes at 24 V.

G. Internal Adjustability: Provide the following internal adjustment capabilities:
1. Minimum Speed: 5 to 25 percent of maximum RPM.
2. Maximum Speed: 80 to 100 percent of maximum RPM.
3. Acceleration: 2 to 22 seconds.
4. Deceleration: 2 to 22 seconds.
5. Current Limit: 50 to 110 percent of maximum rating.

H. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors.
2. Snubber networks to protect against malfunction due to system voltage transients.
3. Motor Overload Relay: Adjustable and capable of NEMA class 10 performance.
4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
5. Instantaneous Overcurrent Trip.
6. Loss of Phase Protection.
7. Reverse Phase Protection.
8. Under- and Over-Voltage Trips.
9. Overtemperature Trip.

10. Short Circuit Protection.

I. Automatic Reset/Restart: Attempt three restarts after controller fault or on return of power to the system following an interruption and before shutting down for manual reset or fault correction. Provide for restarting during deceleration without damage to the controller, motor, or load.

J. Serial Communications: The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus and BACnet MS/TP. The use of third party gateways and multiplexers is not acceptable. All protocols shall be certified by the governing authority (i.e. BTL Listing for BACnet).

K. EMI / RFI filters: All VFDs shall include onboard EMI/RFI filters. The onboard filters shall allow the entire VFD assembly to be CE Marked and the VFD shall meet product standard EN61800-3 for the First Environment restricted. No Exceptions.

L. Operation and Maintenance Features: Include:
1. Status Lights: Door-mounted LED indicators to indicate power on, run, overvoltage, line fault, overcurrent, and external fault.
2. Elapsed Time Meter.
3. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer.
4. Current-Voltage-Frequency Indicating Devices: Mount meters or digital readout device and selector switch flush in controller door and connect to indicate controller output.
5. Provide with non-fused disconnect rated for drive capacity. Disconnect shall be UL 98 suitable for service entrance.

M. For drives to be mounted outside install in a NEMA 3R enclosure with ventilation fan to control cabinet temperature below 135ºF.

N. Acceptable Manufacturers: Subject to compliance with requirements.
1. ABB Power Distribution, Inc.

2.04 ACCESS PANELS

A. Manufacturers: Inryco/Milcor, Bilco, Elmdor, Karp, Potter-Roemer or accepted substitute. Inryco/Milcor Style DW, K, or M panels as required by construction.

B. Construction: Flush style, fire rated in fire rated partitions and ceilings. Provide flush key cylinder locks on all access panels less than 8' above the floor in public spaces. Turn keys over to Owner at project completion. Screwdriver latches on all others.

C. Floor Access Doors:
1. Provided with recessed pan to receive floor material to match adjacent.
2. Frame shall be 1/4" extruded aluminum with built-in neoprene cushion and continuous anchor flange.
3. Door shall be 1/4" aluminum plate reinforced with aluminum stiffeners as required.
4. Stainless steel hinges shall be bolted to underside and pivot on torsion bars that counterbalance the door for easy operation.
5. Door shall open 90 degrees and lock automatically in that positon. A vinyl grip handle shall be provided to release the cover for closing.
6. Door shall be built to withstand a live load of 150 lbs per sq. ft. and equipped with a cylinder lock and threaded cover plug.
7. Aluminum shall be mill finish.
8. Installation shall be in accordance with manufacturer’s instructions.

9. Manufacturer shall guarantee against defects in material or workmanship for a period of five years.
10. Bilco Type TER or approved.

2.05 EXPANSION JOINTS AND LOOPS

A. Flexible Expansion/Seismic Loop: Factory fabricated assembly consisting of two 90 degree elbows, two lengths of flexible hose, and a 180 degree return bend to allow free movement in three axis. Return bend shall include attachment point for support and a drain/vent fitting. Hose shall be corrugated metal style with metal overbraid. Connections to match piping system except connection 2" and larger shall be flanged style. Metraflex "Metraloop."

2.06 METERS AND GAUGES

A. General: Install meters and gauges where shown on the plans or specified elsewhere in these specifications.

B. Pressure-Temperature Test Plugs:
1. ¼" or ½" NPT fitting of solid brass capable of receiving either an 1/8" OD pressure or temperature probe and rated for zero leakage from vacuum to 1000 psig. Neoprene valve core for temperatures to 200 deg. F., Nordel to 350 deg. F.
2. Provide for each test plug a pressure gauge adapter with 1/16" or 1/8" OD pressure probe.
3. Furnish a test kit containing one 2-1/2" dial pressure test gauge of suitable range, one gauge adapter with 1/16" or 1/8" OD probe and two 5" stem pocket test thermometers – one 0 to 220 degrees F and one 50 to 550 degrees F. Turn the kit over to the Architect.
4. Cisco "P/T Plugs," Peterson "Pete's Plug" or approved substitute.

C. Thermometers: Liquid-in-glass, adjustable stem, separable sockets, plus 40 to 240 degrees F range (unless indicated otherwise). Weiss numbers are listed. Equivalent Taylor, Trerice, Weksler or approved substitute.
1. Wide case (9") in equipment rooms and all major equipment items. Weiss "9VS" Series.
2. Narrow case (7") in all other locations. Weiss "7VS" Series.

D. Pressure Gauges: Install on suction and discharge of all pumps and where shown on Drawings 4-1/2" dial, 0-100 psig graduation pressure gauges with Ashcroft No. 1106 pulsation dampers and stop cocks. Weiss UGE-1 or equivalent Ashcroft, Marsh, Trerice, Weksler.

2.07 VALVES

A. General: Provide factory fabricated valves of the type, body material, temperature and pressure class, and service indicated. Bronze gate, globe and check valves shall comply with MSS-SP-80. Ball valves shall comply with MSS-SP-110. Iron gate and globe valves shall comply with MSS-SP-70. Iron check valves shall comply with MSS-SP-71. Butterfly valves shall comply with MSS-SP-67. Valve size same as connecting pipe size.

B. Acceptable Manufacturers: Milwaukee, Crane, Grinnell, Nibco, Hammond, Stockham, Legend, Watts, and Walworth. Grooved end valves Victaulic, Gruvlock, or accepted substitute. NIBCO numbers are given except as noted. Where possible, provide valves from a single manufacturer.

C. Valve Styles: See individual Division 23 sections for valve styles.

D. Butterfly Valve Operators: Locking lever for shut-off service; "Memory Stop" for lever handle with 10-position throttling plate for throttling service; gear operator with babbitt sprocket rim for chain-operated valves and gear operators on all 8" or larger valves.

E. Butterfly Valve Style: Lug-type with cap screws for all valves utilized for equipment isolation for servicing. Lug and grooved style valves shall be capable for use as isolation valves and recommended by manufacturer for dead-end service at full system pressure.

F. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

G. Mechanical Actuators: Provide mechanical actuators with chain operators where indicated, where valves 4" and larger are mounted more than 7' above the floor, and where manual operation is difficult because of valve size, pressure differential or other operating conditions. Drop chains to 6'-6" above the floor.

H. Selection of Valve Ends (Pipe Connections): Select and install valves with ends matching the types of pipe/tube connections.

2.08 HANGERS AND SUPPORTS

A. General: Provide factory-fabricated horizontal piping hangers, clamps, hanger rod, inserts, supports, etc., of the indicated MSS type and size. The Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry Practice SP-58 and SP-69 are referenced in this section.

B. Manufacturers: B-Line, Carpenter & Paterson, Grinnell, Michigan, Superstrut, Tolco, Erico, or accepted substitute. Grinnell figure numbers in parentheses where applicable (or other manufacturers as noted).

C. Corrosion Protection: Provide materials which are zinc plated or factory painted to prevent corrosion. Prevent electrolysis in the support of copper tubing by the use of copper hangers (copper coated alone is not sufficient), strut cushion, or at least two layers of UPC 10 mil tape.

D. Seismic Requirements: Provide seismic restraints in accordance with OSSC Section 1613. Design restraint systems in accordance with "Seismic Restraint Manual: Guidelines for Mechanical Systems," Second Edition, 1998, SMACNA, or “A Practical Guide to Seismic Restraint” ASHRAE RP-812, 1999.

E. Horizontal Piping Hangers and Supports:
1. Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).
2. Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.
3. Adjustable Swivel-Band Hanger: MSS Type 10 (Fig. 70).
4. Clamp: MSS Type 4 (Fig. 212, 216).
5. Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.
6. Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle, pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-steel plate.
7. Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or double channel as indicated on the Drawings or as required by piping and equipment weights. Grinnell "Power Strut" channel. Acceptable Manufacturers: Super Strut, Globestrut, Bee, Kindorf or Unistrut.

F. Vertical Pipe Clamps:
1. Two-Bolt Riser Clamp: MSS Type 8 (Fig. 261).
2. Four-Bolt Riser Clamp: MSS Type 42 include pipe spacers at inner bolt-holes.

G. Hanger Attachment:
1. Hanger Rod: Rolled threads, zinc plated. Right hand threaded.
2. Turnbuckles: MSS Type 13 (Fig. 230).

3. Weldless Eye-Nut: MSS Type 17 (Fig. 290).
4. Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
5. Clevises: MSS Type 14 (Fig. 299).

H. Building Attachments:
1. Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel. Acceptable Manufacturers: Michigan Hanger, Globestrut, Unistrut, Super Strut.
2. Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87, 88), Type 25 (Fig. 227), Type 27 through 30 where applicable.

2.09 IDENTIFICATION MARKERS

A. Pipe Markers:
1. Adhesive pipe markers of width, letter size and background color conforming to ANSI A13.1.
2. Acceptable Manufacturers: Brady B946 with arrow banding tape or similar Seaton, Zeston, MSI.

B. Duct Markers:
1. Adhesive duct markers 2¼”x14” with black text indicating contents on white background with directional flow arrow.
2. Acceptable Manufacturers: Brady B946 or similar Seaton, Zeston, MSI.

C. Nameplates:
1. Engraved nameplates, 1/16" thick, laminated 2-ply plastic, bottom ply white, outer ply black, letters formed by exposing bottom ply.
2. Size: 2" by 4" nameplates with 1/4" high letters.

D. Valve Tags:
1. 2" diameter, 18-gauge polished brass tags with 3/16" chain hole and 1/4" high stamped, black-filled service designation.
2. Acceptable Manufacturers: Seaton, Brady, MSI.

E. Valve Identification: Tag all valves with brass disc and chain. Prepare valve charts indicating valve number, size, location, concealed or exposed, function, valve manufacture and model number, and normal position. Provide floor plan as part of record Drawings. Use no duplicate numbers in Plumbing and Heating systems. Mount glazed frames containing one set of valve charts in the building mechanical room.
1. Include floor plan of each floor level with valve tag numbers indicated at approximate valve locations. Provide separate maps for plumbing valves and HVAC valves. Maps are to be 11"x17".
2. Label all ceilings directly below or access panels directly in front of plumbing or HVAC valves using engraved, printed labels or hanging tags stating the valve ID as shown on the Valve Map and the Valve Tag Directory.

2.10 PENETRATION FIRE STOPPING

A. Through-penetration fire stopping system tested and listed by Underwriters Laboratories. 3M, Metacaulk, SpecSeal, or approved.

B. Select system for proper application based on wall construction, type of penetrating item, wall rating, etc.

C. Sealants and Primers – General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

2.11 PENETRATION AT ACOUSTICAL PROTECTION WALLS

A. See details on Drawings.

B. Materials:
   1. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.
      a. Architectural Sealants: 250 g/L.
      b. Sealant Primers for Porous Substrates: 775 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L.
   2. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
      a. Products:
         1) Pecora Corporation; AC-20 FTR.
         2) Tremco Incorporated; Tremflex 834.
         3) USG Corporation; SHEETROCK Acoustical Sealant.
   3. Joint Backing: Round, closed cell, non-gassing foam rod compatible with sealant; ASTM C 1330 Type B, cylindrical, bi-cellular material; oversized 30 to 50 percent larger than joint width.
      a. Products:
         1) Sof Rod manufactured by Nomaco Inc.
         2) Sonolastic Soft Backer-Rod manufactured by BASF.
   4. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC content than require by South Coast Air Quality Management District Rule No. 1168.

2.12 MOTORS

A. General: Motors shall conform to UL, CSA, and NEMA MG-1 and bear a permanently attached nameplate indicating compliance and motor characteristics. Provide motors meeting UL 507 standard where applicable.

B. Manufacturers: Baldor is approved.

C. Temperature Rating: Class F insulation, except where otherwise indicated or required for service indicated.

D. Starting Capability: As required for service indicated, but not less than 5 starts per hour.

E. Phases and Current: See drawings

F. Service Factor: 1.15 for polyphase; 1.25 for single-phase.

G. Construction: General purpose, continuous duty; NEMA design "B," except "C" for high starting torque applications or as need be to match current motor being replaced.

H. Frames: For single phase motor sizes NEMA No. 48, except 56 for heavy-duty applications. NEMA "T" frames for 1 horsepower and larger polyphase motors. Special frame types as required for close coupled pumps and similar applications.

I. Bearings: Ball or roller, and design for thrust where applicable; double shielded and regreasable, except provide permanently sealed where not accessible for greasing. Sleeve-

type bearings permitted only where indicated for fractional (1/6 hp or less) horsepower motors with direct drive loads. Minimum L-10 bearing life of 40,000 hours when used with minimum pitch sheaves per NEMA Table 14-1.

J. Enclosure Type: Unless otherwise indicated, open drip-proof for normal concealed indoor use, guarded where exposed to employees or occupants. Type II for outdoor use, except weather-protected Type I where adequately housed. Totally enclosed where explosion proof motors are required.

K. Overload Protection: Built-in thermal with internal sensing device for stopping motor, and for signaling where indicated on single phase motors.

L. Speed: Match existing motor being replaced.

M. Efficiency: The manufacturer's highest (premium) efficiency motors tested under procedures recommended by NEMA MG-1 (IEEE Standard 112, Test Method B). Intermittent duty motors, operating less than 6 hours per day, shall comply with EPAct standards. Submit manufacturer's data if motor nameplate does not indicate minimum efficiency. Nominal full load efficiencies for 460 volt, 1,800 rpm motors:

HP	Efficiency %
1-1/2	87.5
2	87.5
3	88.5
5	89.5
7-1/2	91.5
10	91.5
15	93.0
20	93.5
25 and larger	94.0

PART 3 EXECUTION

3.01 LAYOUT AND COORDINATION

A. Site Examination: Before starting work, carefully examine site and all contract Drawings. Become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions and equipment locations before proceeding with any of the work.

B. Utility Locations: The location of existing utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the Drawings and are taken from existing records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.

C. Sleeves, Inserts, Cast-in-Place Work: Provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.

D. Coordination:
1. The Drawings are based on equipment of a certain manufacturer and may be identified as such. Where alternate manufacturers or approved substitutes are incorporated into the work, any required design changes are the responsibility of the contractor. Such changes may include changes in utility or system connection sizes, location, or orientation, service clearances, structural support or acoustic considerations.
2. Prepare accurate AutoCAD shop drawings showing the actual physical dimensions required for the installation for duct work, piping and mechanical devices. Submit

drawings prior to purchase/fabrication/installation of any of the elements involved in the coordination. Provide drawing files to other trades for coordination.

3. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations and wiring required for installation of mechanical items.
4. Coordinate all work with other trades and determine in advance where interfacing of the mechanical work and other work are required to be connected together. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.

E. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.

3.02 UTILITY COORDINATION

A. Utility Coordination: Coordinate all aspects of the incoming utility services indicated with the City Engineer, serving utility, and the off-street improvements Contractor. Requirements of the utility company which exceed the provisions made on the Drawings or covered by these Specifications shall take precedence. Provisions made on the Drawings or Specifications in excess of the utility company's requirements shall take precedence. No additional compensation will be allowed the Contractor for connection fees or additional work or equipment not covered in the Drawings or Specifications which are a result of policies of the serving utilities.

3.03 MECHANICAL EQUIPMENT WIRING

A. Provide all mechanical equipment motors, automatic temperature, limit, float and similar control devices required, with wiring complete from power source indicated on Electrical Drawings.

B. Provide properly rated motor overload and undervoltage protection and all manual or automatic motor operating devices for all mechanical equipment.

C. Equipment and systems shown on the Drawings and/or specified, are based upon requirements of specific manufacturers which are intended as somewhat typical of several makes which may be approved. Provide all field wiring and/or devices necessary for a complete and operable system including controls for the actual selected equipment/system.

D. Provide all starters for mechanical motors. Review Electrical Specifications and Drawings to determine starter sizes. Adjust fusing/time delay on all starters once installed.

3.04 GENERAL INSTALLATION

A. Locating and Positioning Equipment: Observe all Codes, Regulations and good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment and comply with Code requirements.

B. Arrangement: Arrange piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in all areas where possible. Unless indicated otherwise, conceal all piping. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance. Give right-of-way to piping which must slope for drainage. Set all equipment level or as recommended by manufacturer. Under no conditions shall beams, girders, footings or columns

be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.

C. Drip Pans: Provide drip pans under all above ceiling in-line pumps and cooling coils. Locate pan immediately below piping and equipment, and extend a minimum of 6" on each side and lengthwise 18" beyond equipment being protected. Fabricate pans 2" deep, of reinforced 20 gauge galvanized sheet metal with watertight seams and rolled or hemmed edges. Provide 3/4" drainage piping, properly discharged to over floor drain or as shown on the Drawings. Comply with Mechanical Code for overflow protection and pipe sizing.

D. Access Panels: Provide access panels with proper backing reinforcement for all equipment, dielectric unions, valves and items requiring service and installed above ceilings, behind walls, or in furring, complete with correct frame for type of building construction involved. Exact size, number and location of access panels are not necessarily shown on Drawings. Use no panel smaller than 12" by 12" for simple manual access or smaller than 16" x 20" where personnel must pass through.

E. Adjusting: Adjust and calibrate all automatic mechanical equipment, temperature controls, float devices, etc. Adjust flow rates at each piece of equipment or fixture.

F. Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by piping, hangers, conduits, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the penetrations.

G. Housekeeping Pads: Construct minimum 6” thick with chamfered edges using 3000 psi concrete. Provide #4 reinforcing bars 8” on center in each direction and within 4” of each edge, centered in pad thickness. Provide ½” dowel with 3” embedment into floor slab for each 2 square feet of pad area. Dowels and equipment anchor bolts shall be spaced a minimum of 6” from pad edges.

3.05 VALVE INSTALLATION

A. General: Comply with the following requirements:
   1. Install valves where required for proper operation of piping and isolation of equipment, including valves in branch lines where necessary to isolate sections of piping, and where shown on the drawings. Install valves at low points in piping systems that must be drained for service or freeze protection.
   2. Locate valves in accessible spaces (or behind access panels) and so that separate support can be provided when necessary.
   3. Install valves with stems pointed up, in the vertical position where possible, but in no case with stems pointed downward from a horizontal plane.

B. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

C. Valve Access: Provide access panels to all valves installed behind walls, in furring or otherwise inaccessible.

3.06 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building structural attachments.
   1. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping,

and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.

2. Prevent electrolysis in the support of copper tubing use of at least 2 layers of UPC listed 10 mil tape at all bearing surfaces or strut clamp cushion. Copper plated hangers alone are not sufficient.
3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel points only.

B. Provisions for Movement:
1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units. Install specified seismic restraints to restrict excessive movement.
2. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
   a. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
   b. Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.
   c. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
   d. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.
   e. Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where exposed to view in finished areas is specified, install hard maple wood insulation shields (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.

C. Pipe Support:
1. Vertical Spacing: Support at base, at equivalent of every floor height (maximum 10' as required by Code) and just below roof line.
2. Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	Steel	Copper
1-1/4" and smaller	7' span	6' span
1-1/2" pipe	9' span	6' span
2" pipe	10' span	10' span
2-1/2" & larger	12' span	10' span

3. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
4. Support Rod: Hanger support rods sized as follows:

Pipe and Tube Size		Rod Size	
Inches	mm	Inches	mm
1/2” to 4”	12.7 to 101.6	3/8”	9.5
5” to 8”	127.0 to 203.2	1/2”	12.7
10” to 12”	254.0 to 304.8	5/8”	15.9

5. Provide manufactures approved channel continuously below all horizontal PEX or other plastic pipe where hung from structure.

D. Adjust hangers and supports to bring piping to proper levels and elevations.

E. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.

F. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.

G. Installation of drilled-in concrete anchors shall comply with the manufacturer's instructions for working load, depth of embedment, and spacing between anchors and from the edge of the slab. Use only wedge-style anchors.

H. Seismic Restraints, Anchorage, and Supports: Install restraints where recommended in SMACNA "Seismic Restraint Manual" and as required by code. Show analysis of supporting structure, anchorages, and restraints in accordance with OSSC Section 16 and reference ASCE standard. Seismic restraint system components shall be approved by the California Office of Statewide Health Planning and Development (OSHPD). Acceptable Manufacturers: Amber/Booth, Mason Industries, Tolco, or approved. Contractor shall submit calculations and shop drawings, sealed and signed by a Professional Engineer, showing seismic restraint design for all equipment, piping and ductwork required to be braced. Seismic importance factor for new building is 1.5. For remodeled areas seismic importance factor is 1.0.

I. Ensure all copper piping is protected from contact with non-copper supports. Provide strut cushion below clamp or 2 layers of UPC listed 10 mil tape.

3.07 HVAC SYSTEM IDENTIFICATION

A. Piping System: Indicate each pipe system by its generic name (abbreviated) as shown/scheduled/specified. Comply with ANSI A13.1 for marker locations, letter sizes, and colors. Include arrows to show direction of flow and "Electric Traced" signs to identify heat cable wrapped piping. Locate pipe labels in accessible areas as follows:
   1. Near each valve, meter, gauge, or control device.
   2. Near equipment such as pumps, heat exchangers, water heaters, etc.
   3. At piping branch connections.
   4. At penetrations (each side) of walls, ceilings, and floors.
   5. At access panels and doors.
   6. At 25 foot maximum intervals. Provide a minimum of one label above each room where lift-out ceiling is installed. Reduce intervals in congested areas such as mechanical rooms.

B. Equipment: Provide engraved plastic-laminate signs at locations of major equipment such as heat exchangers, pumps, etc. Identify equipment in field same as on drawings. Permanently mount in an appropriate and effective location.

C. Operation Tags: Where needed for proper and adequate information on operation and maintenance of mechanical systems, provide tags of plasticized card stock, either pre-printed or hand printed to convey the message; example: "DO NOT CLOSE THIS VALVE EXCEPT WHEN THE PUMP IS OFF."

3.08 EQUIPMENT CONNECTIONS

A. Provide complete connections for all items of equipment requiring such connections, including incidental piping, fittings, trim and labor necessary for a finished working installation.

B. Verify the rough-in and finish requirements for all equipment provided under other Divisions of the work and requiring HVAC piping or duct connections with equipment supplier and installer prior to rough-in.

3.09 PROTECTION

A. Protect all work and materials against loss or damage. Close all pipe openings with caps or plugs. At final completion, thoroughly clean and deliver all work and equipment in an unblemished new condition. Keep all motors and bearings in watertight and dustproof covers during entire course of installation.

B. Protect floors, walls, framing and sheathing where pipe cutting and threading operations are conducted with plastic sheeting under plywood sheets. Extend plastic sheeting beyond the plywood. Clean-up metal cuttings, oil, etc., daily or as necessary to prevent debris from being tracked beyond the protected area. Damages, as determined by the Architect, due to the pipe cutting/threading operation shall be repaired by the responsible trade.

3.10 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of mechanical work. Do all necessary cutting and patching of existing building and yard surfaces required for completion of the mechanical work. Patch to match finish and color of adjacent surfaces. Coordinate work in remodel and new areas to avoid cutting of new finished surfaces.

3.11 PIPE PENETRATION FIRE STOPPING

A. Install as recommended by manufacturer and in accordance with the product's UL listing. Below are the minimum installation requirements.
   1. Install specified penetrating item(s) with required annular spacing in proper size wall or floor opening. Support penetrating item(s) adequately on both sides of construction.
   2. Clean all opening and penetrating item surfaces in penetration area to remove loose debris, dirt, oil, wax, grease, old caulking, etc.
   3. If needed or required for gypsum or concrete block walls, install specified galvanized steel wire mesh or sleeve recessed and centered inside wall around penetrating item(s) so that it is snug against perimeter of opening.
   4. When required, install specified type and depth of backing material in annular space, recessed to required fill depth of fire stopping caulking.
   5. Gun, trowel, and/or pump fire stopping sealant to specified depth in annular space around penetrating item(s). Trowel sealant surfaces flush with wall or floor surfaces to a smooth, defect-free finish. Where required, apply specified size caulking bead around penetrating item(s) at zero annular contact areas and tool smooth.

B. Drawings show some, not all, of the penetration. Review architectural drawings for all fire walls.

C. Sealants and Primers – General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

3.12 MECHANICAL PAINTING

A. Minimum Requirements: Comply with minimum requirements of Division 9, Painting**.** All mechanical equipment, piping, insulation, etc., exposed in finished areas, storage rooms and other locations except mechanical equipment rooms will be painted under Section 09 90 00.

3.13 HVAC WORK CLOSEOUT

A. General: Refer to the Division 1 sections for general closeout requirements. Calibrate all equipment requiring same. Complete each system as shown or specified herein and place in operation except where only roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of leaks, obstructions, or contamination.

B. Record Drawings: Submit record set of Drawings required in Division 1 as previously specified in this Section.

C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Architect present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system and replace dirty filters, excessively worn parts and similar expendable items of the work.

D. Operating Instructions: Conduct a walk-through instruction seminar for the Owner's personnel who are to be involved in the continued operation and maintenance of the HVAC equipment and systems. Provide written instructions outlining and explaining the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of the systems.

END OF SECTION

SECTION 23 05 48 - MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the vibration isolation for mechanical equipment specified elsewhere.

1.02 QUALITY ASSURANCE

A. Isolator Engineering: Selected and furnished by the equipment manufacturer. Select isolators for 98% efficiency unless indicated otherwise on the Drawings.

B. Manufacturer: Provide field installed isolation required from a single manufacturer where possible.

1.03 SUBMITTALS

A. Provide product data sheets on all vibration isolators and seismic restraints.

B. Provide itemized list showing the items of equipment or piping to be isolated, isolator type and model number selected, isolator loading and deflection, and reference to specified drawings showing frame and construction.

C. Provide manufacturer's drawings showing equipment frame construction for each item including dimensions, structural member sizes and support locations.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Amber/Booth, Mason Industries, Vibration Mountings and Controls, Kinetics Noise Control.

B. Manufacturer Model Numbers: Amber/Booth figure numbers are listed unless indicated otherwise.

2.02 VIBRATION ISOLATORS

A. Types of Isolators:
   1. Hanger with Spring and Rubber Stop: Combination neoprene element and spring hangers–Hangers shall consist of a steel frame containing a neoprene isolation element at the top and a coil steel spring seated in a neoprene cup on the bottom. Both the element and the cup shall be molded with a neoprene bushing that passes through the steel frame. The neoprene element shall be capable of an average deflection of 0.35”. The steel springs shall be capable of a minimum static deflection of 0.75” with a minimum additional travel to solid of ½”. Spring diameters and hanger box lower hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the box and short circuiting the spring. Hangers shall be factory precompressed 60% of the total deflection determined by the assigned load per hanger. Hangers shall b manufactured with provision for bolting or attaching to ceiling flat iron straps, rods or steel runners. Hangers shall be of a fail-safe design. Amber / Booth BSRA.
   2. Neoprene Pads: Neoprene pads shall be of waffle or ribbed design, 1/4” – 3/8” thick. They shall be installed as a single layer or in multiple layers with 16 gauge steel shims cemented between so that the combination of stiffness and total neoprene thickness achieves the static deflection listed in the vibration isolation schedule in conjunction with a

distributed load area that will maintain 10-50 psi. If the equipment support location does not completely cover the pads or does not consist of flat steel footing, an additional full coverage, load distribution plate of minimum 3/8 steel shall be placed between the pad and attached to the equipment support. There shall be no rigid structure between top and bottom of mount. Amber / Booth Type NR Ampad.

B. Neoprene Mounts: Neoprene mounts shall be one piece, neoprene molded assemblies with a minimum loaded static deflection of 0.25". The mount shall incorporate both rubber-in-shear and compression load characteristics. All metal surfaces shall be neoprene covered. The mount shall have friction pads both top and bottom. Bolt holes shall also be provided for both surfaces. The top bolt hole shall be threaded. There shall be no rigid structure between top and bottom supports. Amber / Booth Type RV.

C. Noise and Vibration Barrier Hanger: For ductwork and piping where indicated. Target Enterprises Inc. "ARH-1" or accepted substitute.

D. Seismic and Start-Up Restraints: Select all isolators to withstand seismic loads equivalent two times the isolator load rating applied from any direction. Mason Industries type Z-1011 on all isolated equipment not utilizing isolators with integral restraints.

E. Flexible Pipe Connectors - Type SS: All stainless steel hose and braid with carbon steel connections. Male thread ends on flexible connectors 2" and smaller, and flanged connections on 1-1/2" and larger connectors.

F. Ductwork Flexible Connections:
1. Typical connections shall be made of 30 ounce woven glass fiber, coated with neoprene, sewn together at the edges and joints.
2. The flexible connections shall be approximately 6" long and held in place with 1" wide bands of 12 gauge galvanized steel bolted to duct and to outlets and inlets of the units and fans with 1/8" stove bolts, 5" o.c.
3. It is the intent that these flexible connections shall withstand the operating air pressure, shall not permit air leakage and shall not transmit vibration.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install vibration isolators and flexible connectors as specified herein, as shown on the Drawings and as recommended by manufacturer.

B. Ductwork Flexible Connections: Install flexible duct connections on all externally spring isolated air handling units including roof mounted units down through roof curbs (and/or to unit side duct connections). Fan connections, both at inlet and discharge, shall be made with flexible materials so as to prevent the transfer of vibration from fans to ductwork connected thereto.

C. Flexible Pipe Connections:
1. Provide flexible connections on all piping to spring isolated equipment, where indicated on Drawings and for all coils mounted in spring isolated air handling units or plenums. Coils in rigid units and plenums do not require flexible connectors. Provide a flexible connection in both the supply and return connections to the coil as near the coil as possible.
2. Install connectors in a straight line as recommended by the manufacturer without offsets or twists and support pipe without any load on flexible connectors. Minimum live length shall be as follows:

Pipe Size	Minimum Live Length
1" through 1-1/2"	8"
2" through 2-1/2"	10"

3" through 4"	12"
Over 4"	18"

D. Anchorage: Anchor all isolators to the floor, wall or ceiling structure and anchor points reinforced where necessary. Anchor bolts, cap screws, etc., shall not be continuous through the isolator such that vibrations are transmitted to the structure.

E. Adjustment: Adjustable during and after installation, to ensure sufficient clearance between vibration isolation element and rigid restraining device. Do not install isolators until they have been loaded and adjusted to achieve the specified static deflection and clearances.

F. Housekeeping Pads: Construct minimum 3” thick with chamfered edges using 3000 psi concrete. Provide #4 reinforcing bars 8” on center in each direction and within 4” of each edge, centered in pad thickness. Provide ½” dowel with 3” embedment into floor slab for each 2 square feet of pad area. Dowels and equipment anchor bolts shall be spaced a minimum of 6” from pad edges.

3.02 EQUIPMENT RESTRAINTS

A. All equipment shall be anchored to resist displacement including sliding, swinging, and overturning due to seismic forces. Friction due to equipment weight shall not be considered as anchorage.

B. Contractor shall submit shop Drawings showing seismic restraint design for all equipment weighing 400 lbs. or more. Design shall show analysis of supporting structure, anchorages, and restraints in accordance with OSSC Section 16.

END OF SECTION

SECTION 23 05 90 - TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: After completion of the work of installation, test and regulate all components of the new heating, air conditioning and ventilating systems to verify air volumes and heating-cooling flow rates indicated on the Drawings.

B. Balancing Organization:
   1. Balancing of the Heating and Air Conditioning Systems: Performed by a firm providing this service established in the State of Oregon.
   2. Balancing Organization: Approval by Architect. Air Balancing Specialties, Neudorfer Engineers**,** Northwest Engineering Services, or approved.
   3. Provide all necessary personnel, equipment, and services.

C. See Section 23 08 00 for additional requirements related to Commissioning.

1.02 QUALITY ASSURANCE

A. Balancing of the Heating and Air Conditioning Systems: Agency shall be a current member of NEBB or AABC specializing in the adjusting and balancing of systems specified with a minimum of 10 years documented experience.

B. Testing, adjusting, and balancing shall be performed under direct field supervision of a Certified NEBB Supervisor or a Certified AABC Supervisor.

C. See Commissioning Specification for additional requirements.

1.03 SUBMITTALS

A. See Section in Division 1, Administrative Requirements, for submittal procedures.

B. Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.

C. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit under provisions of Section 23 05 00.
   2. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
   3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   5. Include detailed procedures, agenda, sample report forms, and copy of AABC National Project Performance Guaranty or other certifying agency prior to commencing system balance.
   6. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE 111, NEBB forms, or forms containing information indicated in Schedules.
   7. Include the following on the title page of each report:
      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 and Owner.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

D. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

E. Provide a list of equipment, air supply, return and exhaust, heating water, and chilled water systems not in compliance with tolerances subsequently specified.

PART 2 PRODUCTS

-- NOT USED --

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

3.02 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus 10 percent or minus 5 percent of design for supply systems and +/- 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent or minus 5 percent of design to space. Adjust outlets and inlets in space to within +/- 10 percent of design.

C. Hydronic Systems: Adjust to within +/- 10 percent of design.

3.03 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.04 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust noise distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.02” (12.5 Pa) positive static pressure near the building entries.

M. For variable air volume system powered units, set volume controller to air flow setting indicated. Confirm connections are properly made and confirm proper operating for automatic variable air volume temperature control. Adjust drives to maximum airflow for highest static condition (maximum amps of motor). Allow VFD to regulate airflow per specification.

N. Space pressure Control, Return Fan Speed Endpoints: For variable air volume system with terminal unit zoning, attain return fan speed control endpoints based on the following values for the given operating mode. Coordinate with the HVAC control contractor for system setup and provide values when determined.

Return Fan Speed Endpoint Values				
Mode	**Supply Fan Speed Hi/Lo Reset Limits**	**Desired Space Pressure (InH2O)**	**Economizer Position**	**Return Fan Speed**
Full Heating (All terminal units are operating at heating flow setpoints)	TBD – Noted during the full heating condition	**Ideal - 0.02** Acceptable Test Range: 0.01 – 0.03	Min-Min (25% of the minimum ventilation requirement)	Minimum Return Fan Speed-TBD
Full Cooling (All terminal units are operating at cooling flow setpoints)	TBD – Noted during the full cooling condition	**Ideal - 0.02** Acceptable Test Range: 0.01 – 0.03	Min-Max (100% of the minimum ventilation requirement)	Maximum Return Fan Speed-TBD

O. CO2 controller set points – minimum CO2 setpoint (ppm), maximum CO2 setpoint (ppm)(setting for min OSA at full occupancy).

P. Outside air intake damper settings at minimum CO_2 and maximum CO_2 setpoint.

3.05 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities. This includes domestic HVAC systems.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. 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.

G. Where automatic flow control valves are installed (Dynamic devices, not circuit setters) record listed flow rate of device based on field verification. Testing is not required.

H. Balancing contractor shall be trained on balancing procedures by certified representative of differential pressure control valves.

3.06 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Plumbing pumps
   2. HVAC pumps
   3. Air cooled water chillers
   4. Air coils
   5. Fan coil units
   6. Air handling units
   7. Fans
   8. Air filters
   9. Air terminal units
   10. Air inlets and outlets

B. Report:
   1. 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
   2. Instrument List:
      a. Instrument
      b. Manufacturer
      c. Model number
      d. Serial number
      e. Range
      f. Calibration date

C. Electric Motors:
   1. Manufacturer
   2. Model/frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave make/size/model

D. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter, and RPM
   4. Belt, size, and quantity
   5. Motor sheave diameter and RPM
   6. Center to center distance, maximum, minimum, and tested

E. Pumps:
   1. Identification/number
   2. Manufacturer
   3. Size/model
   4. Impeller
   5. Service
   6. Design flow rate, pressure drop, BHP

7. Actual flow rate, pressure drop, BHP
8. Discharge pressure
9. Suction pressure
10. Total operating head pressure
11. Shut off, discharge, and suction pressure
12. Shut off, total head pressure

F. Refrigerant Cooling Coils:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air DB temperature, design and tested
7. Entering air WB temperature, design and tested
8. Leaving air DB temperature, design and tested
9. Leaving air WB temperature, design and tested
10. Air pressure drop, design and tested
11. Saturated suction temperature, design and tested

G. Heating & Chilled Water Coils:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and tested
6. Water flow, design and tested
7. Water pressure drop, design and tested
8. Entering water temperature, design and tested
9. Leaving water temperature, design and tested
10. Entering air temperature, design and tested
11. Leaving air temperature, design and tested
12. Air pressure drop, design and tested

H. Air Moving Equipment:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and tested
7. Return air flow, specified and tested
8. Outside air flow, specified and tested
9. Total static pressure (total external), specified and tested
10. Inlet pressure
11. Discharge pressure
12. Sheave make/size/bore
13. Number of Belts/Make/Size
14. Fan RPM

I. Return Air/Outside Air:
1. Identification/location
2. Supply air flow, design and tested
3. Return air flow, design and tested
4. Outside air flow, design and tested
5. Return air temperature

6. Outside air temperature
7. Mixed air temperature, design and tested

J. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and tested
6. Total static pressure (total external), specified and tested
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

K. Duct Traverses:
1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

L. Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum air flow, design and tested
9. Maximum air flow, design and tested
10. Inlet static pressure, design and tested

M. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

3.07 DETAILED REQUIREMENTS

A. Adjusting and Balancing:

1. Adjust and balance all portions of the mechanical systems to produce indicated results within limits of minus 5 or plus 10 percent or as subsequently directed by the Architect.
2. Balancing data may be spot checked with instruments similar to that used by the balancing firm.
3. If, in the judgment of the Architect, the discrepancies warrant additional adjustment, readjust and rebalance the systems at no additional project cost.

B. Duct Pressure Test: To be conducted and/or witnessed by balancer.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the insulation of mechanical equipment specified elsewhere in these specifications.

B. Related Work: The requirements of Section 23 05 00, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Insulation Thickness and Thermal Performance: Comply with provisions of the State of Oregon Energy Code.

B. Composite (Insulation, Jacket or Facing and Adhesives) Fire and Smoke Hazard Ratings: Not to exceed a flame spread of 25 or smoke development of 50 and containing less than 0.1% by weight deca-PDE fire retardant.

C. Component Ratings of Accessories (Adhesives, Mastics, Cements, Tapes, Finishing Cloth for Fittings): Same as "B" requirements above and permanently treated. No water soluble treatments.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: In addition to the requirements specified in Section 23 05 00, the following apply:
   1. Deliver insulation, coverings, cements, adhesives and coatings to the site in factory-fabricated containers with the manufacturer's stamp or label affixed showing fire hazard ratings of the products. Store insulation in original wrappings and protect from weather and construction traffic.
   2. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged insulation. Remove such insulation from project site.

1.04 SUBMITTALS

A. Submit catalog data and performance characteristics for each product specified.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Insulating Manufacturers: Johns Manville, Knauf, Armstrong, Owens-Corning, Pittsburgh Corning, Pabco, Imcoa or Certain Teed. Johns Manville products are listed unless indicated otherwise.

B. Adhesive Manufacturers: Foster, 3M, Insul-Coustic, Borden, Kingco or Armstrong.

2.02 PIPING INSULATION

A. Interior and Exterior Piping Systems 50 to 850 Deg. F: Glass fiber preformed pipe insulation with a minimum K-value of 0.23 at 75 Deg. F, a minimum density of 3.5 pounds per cubic foot within all-service vapor barrier jacket, vinyl or pre-sized finish and pressure sensitive seal containing less than 0.1% by weight deca-PDE fire retardant.

B. Exterior Installations: Same as for interior installations except 0.016" aluminum finish jacket

C. Pipe Temperatures Minus 30 to 180 Deg. F: Flexible, preformed, pre-slit, self-sealing elastomeric pipe insulation up to 2-1/8" ID, thermal conductivity of 0.27 BTU/hr. sq. ft./in. at 75 deg. F and vapor transmission rating of 0.2 perms/inch. Apply in thickness necessary to prevent condensation on the surface at 85 deg. F and 70% RH. Armstrong "Armaflex 2000" or, in concealed locations, Imcoa or Nomaco also approved.

D. Interior Piping Systems 32 to 50 Deg. F: Glass fiber preformed pipe insulation with a minimum K-value of 0.23 at 75 deg. F, a minimum density of 3.5 pounds per cubic foot. Polymer vapor barrier jacket containing less than 0.1% by weight deca-PDE fire retardant and with pressure sensitive seal and wicking system to remove condensation from pipe surface. Owens Corning “VaporWick.”

2.03 DUCT INSULATION

A. Interior Above Grade Ductwork: Glass fiber formaldehyde-free blanket with "FSK" facing, k value = 0.31 at 75 deg. F, 0.2 perms, and UL 25/50 surface burning rating. Johns Manville "Microlite."

2.04 EQUIPMENT INSULATION

A. Equipment Temperatures Below 70 Deg. F: Flexible, closed cell, elastomeric sheet insulation of 5.5 #/cubic feet density and 0.27 thermal conductivity at 75 deg. F. Armstrong "Armaflex."

B. Equipment Temperatures From 70 to 450 Deg. F: Glass fiber 3 pound density insulation with a 0.23 thermal conductivity at 75 deg. F. Johns Manville "814 Spin-Glas" with "FSK" jacket containing less than 0.1% by weight deca-PDE fire retardant or finished as recommended by manufacturer.

2.05 INSULATION ACCESSORIES

A. Insulation Compounds and Materials: Provide rivets, staples, bands, adhesives, cements, coatings, sealers, welded studs, etc., as recommended by the manufacturers for the insulation and conditions specified except staples not permitted on chilled water lines.

B. Interior Tanks and Equipment Insulation Covering: Finished metal jacket or as recommended by the manufacturer for insulation material specified.

C. PVC Protective Jacketing and Valve and Pipe Fitting Covers: Johns Manville Zeston 2000, Proto LoSmoke, or Ceel-Co Ceel-Tite 100 Series with precut fitting fiberglass insulation or approved.

D. Jacket Lap Sealing Adhesives: Foster Drion 85-75 contact cement or approved substitute.

E. Saddles and Shields: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
   1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

PART 3 EXECUTION

3.01 PIPING INSULATION

A. General: Do not insulate underground piping except at joints and fittings on preinsulated piping unless indicated otherwise.

B. Heating Water Piping: Insulate with glass fiber or elastomeric pipe covering:

Size	Thickness
1/2" to 1-1/2"	1-1/2"
2" to 3"	2"
4" and larger	2-1/2"

C. Chilled Water Piping: Above grade insulate with glass fiber pipe covering:

Size	Thickness
1/2" to 1-1/4"	1/2"
1-1/2" and larger	1"

D. Pipe Fittings:
1. Insulate and finish all fittings including valve bodies, bonnets, unions, flanges and expansion joints with precut fiberglass insulation and preformed PVC covers sealed to adjacent insulation jacket for continuous vapor barrier covering over all fittings.
2. Provide removable/reusable insulation covers on 4" and larger valves, unions, flanges, pump casings, strainers and similar fittings or equipment requiring periodic service.

E. Protective Covering: Install continuous protective metal covering on all piping and fittings exposed to exterior conditions. Ensure all penetrations are sealed. Do not secure covering with screws, use bands. Ensure seams do not allow moisture inside the jacket. Cover insulation where insulation may be subject to damage in mechanical rooms.

F. Insulated Piping: Comply with the following.
1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.9.
2. Install MSS SP-58, Type 39 or Type 40 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
3. Shield Dimensions for Pipe: Not less than the following.
   a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 and NPS 14 (DN200 and DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 and NPS 24 (DN400 and DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
4. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

G. Piping Insulation Lap Seams and Butt Joints: Install insulation jacket in accordance with manufacturer's recommendation. Where jacket joint and lap seams have not adhered, remove affected section of insulation and reinstall or apply lap sealing adhesive in accordance with manufacturer's instructions.

3.02 DUCTWORK INSULATION

A. Ductwork: Insulate the following:
   1. All supply ductwork.
   2. All supply and return ductwork in systems routed in unconditioned spaces or exposed to the outside conditions.
   3. All outside air intake ducts.
   4. All ductwork required to be insulated by code.
   5. All relief ducts.

B. Insulation Thickness: Select board and blanket insulation of thickness required to provide the following installed R-value.
   1. All heating or cooling system supply and return ducts located on the exterior of the insulated building envelope and all outside air intake ducts.
      a. R-8
   2. All heating and cooling system supply ducts located inside of building envelope or in unconditioned spaces, R-5.
   3. All heating and cooling system return ducts located in vented spaces, R-8.

C. Fittings: Wire and duct adhesive as required. To prevent sagging on all rectangular or square ducts over 24" wide, install Gramweld or equal welding pins on the bottom. Maximum spacing 18" on center in both directions.

D. Installation: Applied with butt joints, all seams sealed with vapor seal mastic or taped with 2" wide vapor-proof, pressure-sensitive tape. Seal all penetrations with vapor barrier adhesive.

E. Internally Lined Ductwork: Where internally lined ductwork is indicated on the Drawings and/or specified, no exterior insulation is required. Select duct lining to provide the required R-value. Carefully lap the ends of the exterior insulation a minimum of 6" past the interior insulation unless otherwise shown. Seal the end of vapor barrier jacket to the duct with mastic where the vapor barrier is required. Duct lining is specified in Section 23 30 00.

3.03 EQUIPMENT ROOM ITEMS

A. Materials:
   1. 1-1/2" calcium silicate blocks applied with wire or bands as required. Finish with 1/2" thick smoothing coat of insulating cement and with glass cloth.
   2. For equipment and piping systems operating below 350 deg. F., a 3 pound per cubic foot, 1-1/2" thick spun glass fiber blanket with organic binders and aluminum sheet metal exterior jacket may be substituted for the above insulation.
   3. Install tank head finish per manufacturer's recommendations.

3.04 EXPANSION JOINTS

A. Insulation: Insulate expansion joints on heating and/or cooling piping to match thickness of adjacent piping. Build up piping insulation adjacent to the expansion joints sufficiently to allow internal clearance within the insulation for the diameter of the expansion joint. Fasten one end of the expansion joint insulation securely and provide aluminum or sheet metal on the built-up insulation at the other end to permit movement of the insulation without damage.

B. Finish: Finish as specified for adjacent piping with fireproof covering.

END OF SECTION

SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 DESCRIPTION

A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.

B. The systems to be commissioned are listed in Section 01 91 00, 1.06.

C. Commissioning requires the participation of Division 23 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 00. Division 23 shall be familiar with all parts of Division 1 and shall execute all commissioning responsibilities assigned to them in the Contract Documents (Project Manual and Commissioning Plan).

1.02 RESPONSIBILITIES

A. Mechanical, Controls and TAB Contractors: The commissioning responsibilities applicable to each of the mechanical, controls and TAB Contractors of Division 23 are as follows (all references apply to commissioned equipment only):
   1. Include and itemize the cost of commissioning in the contract price.
   2. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation and training.
   3. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.
   4. Provide additional requested documentation, prior to normal O&M manual submittals, to the CxA for development of functional testing procedures.
      a. Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority.
      b. The Commissioning Authority may request further documentation necessary for the commissioning process.
      c. This data request may be made prior to normal submittals.
   5. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
   6. Provide limited assistance to the CxA in preparing the specific Functional Acceptance Test (FAT) procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
   7. Develop a full start-up and initial checkout plan using manufacturer’s start-up procedures and the prefunctional checklists from the CxA for all commissioned equipment. Submit to CxA for review and approval prior to startup. Refer to Section 01 91 00 for further details on start-up plan preparation.
   8. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CxA.
   9. Address current A/E punch list items before functional testing. TAB shall be completed with discrepancies and problems remedied before Functional Acceptance Testing of the respective systems.

10. Provide skilled technicians to execute starting of equipment. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.
11. Provide skilled technicians to assist the CxA in the functional testing. Provide training to the CxA on operation of equipment in order for the CxA to perform the functional testing. Assist the CxA in interpreting the monitored data, as necessary.
12. Correct deficiencies (differences between specified and observed performance) as interpreted by the CxA, PM and A/E.
13. Provide training for the Owner's operating staff using expert qualified personnel, as specified.
14. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

B. Mechanical Contractor: The responsibilities of the HVAC Mechanical Contractor, during construction and acceptance phases in addition to those listed in (A) are:
   1. Provide startup for all HVAC equipment, except for the building automation system.
   2. Assist and cooperate with the TAB Contractor and CxA by:
      a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
      b. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.
   3. List and clearly identify on the as-built drawings the locations of all airflow and water flow stations.
   4. Notify the PM and CxA, when startup of each piece of equipment and TAB will occur. Be responsible to notify the PM or CxA, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CxA has the scheduling information needed to execute efficiently the commissioning process.

C. Controls Contractor. The commissioning responsibilities of the Controls Contractor, during construction and acceptance activities in addition to those listed in (A) are:
   1. Sequences of Operation Submittals: The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:
      a. An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.
      b. All interactions and interlocks with other systems.
      c. Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.
      d. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).
      e. Start-up sequences.
      f. Warm-up mode sequences.
      g. Normal operating mode sequences.
      h. Unoccupied mode sequences.
      i. Shutdown sequences.
      j. Capacity control sequences and equipment staging.
      k. Temperature and pressure control: setbacks, setups, resets, etc.
      l. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
      m. Effects of power or equipment failure with all standby component functions.
      n. Sequences for all alarms and emergency shutdowns.
      o. Seasonal operational differences and recommendations.

p. Initial and recommended values for all adjustable settings, set points and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
q. Schedules, if known.
r. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

2. Control Drawings Submittal
   a. The control drawings shall have a key to all abbreviations.
   b. The control drawings shall contain graphic schematic depictions of the systems and each component.
   c. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
   d. Provide a full points list with at least the following included for each point:
      1) Controlled system
      2) Point abbreviation
      3) Point description
      4) Display unit
      5) Control point or set point (Yes / No)
      6) Monitoring point (Yes / No)
      7) Intermediate point (Yes / No)
      8) Calculated point (Yes / No)
         a) Key:
            (1) Point Description: DB temp, airflow, etc.
            (2) Control or Set Point: Point that controls equipment and can have its set point changed (OSA, SAT, etc.)
            (3) Intermediate Point: Point whose value is used to make a calculation, which then controls equipment (space temperatures that are averaged to a virtual point to control reset).
            (4) Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.
            (5) Calculated Point: “Virtual” point generated from calculations of other point values.

         The Controls Contractor shall keep the CxA informed of all changes to this list during programming and setup.

3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.
4. Assist and cooperate with the TAB Contractor in the following manner:
   a. Meet with the TAB Contractor prior to beginning TAB to review the TAB process and determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
   b. For a given system, have all required prefunctional checklists, calibrations, startup and selected functional tests completed prior to TAB.
   c. Provide a qualified technician to operate the controls to assist the TAB Contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.
5. Assist and cooperate with the CxA in the following manner:
   a. Assist in the functional testing of all equipment specified in Section 01 91 00, 1.06 that interfaces with the building automation system. Provide sufficient training to the CxA

to enable the CxA to perform Functional Acceptance Testing in the event the Controls Contractor is absent.

b. Setup required trend logs as required by the CxA for Functional Acceptance Testing verification. These trends must be in place and recording for a minimum of one week prior to scheduled start of Functional Acceptance Testing for a given system. Trend all system inputs and outputs. These trends will be used during the Functional Acceptance Testing as an additional means of verifying morning warm-up and optimal start sequences of operation.

6. The Controls Contractor shall perform point-to-point, calibration and prefunctional checkout procedures as described in Section 01 91 00 and the Commissioning Plan document.
7. Provide a signed and dated certification to the CxA and PM upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.
8. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as specified in Section 23 09 00 Instrumentation and Controls of HVAC.
9. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air and building pressure).

D. TAB Contractor: The duties of the TAB Contractor, in addition to those listed in (A) are:
1. Prior to start of TAB, submit written work plan to CxA and GC detailing procedures and methodologies to be used in the performance of TAB.
2. Prior to start of TAB, attend TAB coordination meeting with CxA and Controls Contractor. This meeting is intended to ensure that controls functionality is sufficient to accomplish TAB in the manner described in the TAB work plan.
3. A running log of events and issues shall be kept by the TAB field technicians. Submit reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CxA and PM at least once a week.
4. Communicate in writing to the Controls Contractor all set point and parameter changes made or problems and discrepancies identified during TAB, which affect the control system setup and operation.
5. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CxA.
6. Provide the CxA with any requested data, gathered, but not shown on the draft reports.
7. Provide a final TAB report for the PM, with a copy to the CxA.
8. Assist in functional tests and checks on the original TAB as necessary.
9. The testing, adjusting, and balancing Contractor shall provide details in the TAB report that list the set conditions for each test (damper positions, unit mode, fan speeds, pump speeds, heating & cooling water valve positions, etc.). The TAB Report shall provide brief notes when a measurement is outside of specifications from design numbers and state whether the particular issue was with the design, installation, access, test condition, or other. This can be as simple as 100% OPEN/CLOSED, system low, bunched flex ducting, airflow restricted, too low of flow for measurement, pump capacity low, etc. Any major system deficiency should be communicated to the construction/design team for evaluation and/or correction.

E. Mechanical Designer: Refer to Section 01 91 00 for the responsibilities of the mechanical designer.

1.03 RELATED WORK

A. Refer to Section 01 91 00, Part 1.04 for a listing of all sections where commissioning requirements are found.

B. Refer to Section 01 91 00 Part 1.06 for systems to be commissioned.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Division 23 Contractor(s) shall provide all specialized or proprietary test equipment necessary to fulfill the testing requirements of this Division.

B. Refer to Section 01 91 00 Part 2.01 for additional Division 23 requirements.

PART 3 EXECUTION

3.01 SUBMITTALS

A. DDC Contractor shall provide submittal documentation relative to commissioning as required in Part 1 of this Section and Section 01 91 00.

3.02 STARTUP

A. The HVAC mechanical and controls Contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 01 91 00. Division 23 Contractor(s) have start-up responsibility and are required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the CxA or Owner.

B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CxA and A/E. Beginning system testing before full completion does not relieve the Contractor from fully completing the system, including all prefunctional checklists as soon as possible.

3.03 TAB

A. Refer to the TAB responsibilities in Part 1.02 above.

3.04 FUNCTIONAL TESTS

A. Refer to Section 01 91 00 Part 1.06 for a list of systems to be commissioned and to Part 3.05 for a general description of the testing requirements.

3.05 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

A. Refer to Section 01 91 00 Part 3.06 for specific details on non-conformance issues relating to prefunctional checklists and tests.

B. Refer to Section 01 91 00 Part 3.05 for issues relating to functional tests.

3.06 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.

B. Mechanical Contractor: The Mechanical Contractor shall have the following training responsibilities:
   1. The Mechanical Contractor shall provide designated Owner personnel training as described in the Project Manual.

2. The Mechanical Contractor will provide the CxA with a training plan and agenda for review prior to the training sessions as described in Section 01 91 00, Part 3.08.

C. Controls Contractor: The Controls Contractor shall have the following training responsibilities:
   1. The Controls Contractor shall provide designated Owner personnel training on the control system in this facility as described in the Project Manual. The intent is to instruct the Owner clearly and completely on all the capabilities of the control system.
   2. Training Plan and Agenda: The CC will provide the CxA with a training plan and agenda for review prior to the training sessions as described in Section 01 91 00, Part 3.08. This plan will include specific topics of training, such as use of the display, alarm and status descriptors, command execution, and trend log generation. All training materials are to be included. The CxA will review the plan and provide recommendations for correction of any deficient areas.

3.07 DEFERRED TESTING

A. Refer to Section 01 91 00, Part 3.09 for requirements of deferred testing.

3.08 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the filled out start-up, initial checkout & prefunctional checklists, point-to-point verification, sensor calibration verification, and programming verification described in Section 01 91 00, and the proposed training plan and agenda.

END OF SECTION

SECTION 23 09 23 - DDC CONTROLS

PART 1 GENERAL SYSTEM DESCRIPTION

1.01 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and other Conditions and other Division 1 – General Requirements sections, apply to the work specified in this Section.

B. Remove all electric and pneumatic control devices no longer used. This includes all cabinets, conduits, tubing, compressor and associated devices. Tubing and conduit above or within inaccessible locations may be abandoned in place. Otherwise all devices shall be removed.

C. See section 230800 for Commissioning requirements.

1.02 BASIC SYSTEM

A. Building Automation System (BAS) system shall utilize DDC to control valve and damper actuators for all mechanical equipment as specified in the sequence of operation and in the drawings for all systems.

B. The control system shall be fully integrated and installed as a complete package of controls and instruments in a manner that provides maximum benefit to the end user.

C. The system shall include all computer software and hardware, control unit hardware and software, operator input/output devices, sensors, control devices, and miscellaneous devices required for complete operation and future modifications. Documentation for all software and hardware devices shall be provided.

D. Provide engineering, installation, calibration, commissioning, acceptance testing assistance, software programming, and checkout for complete and fully operational DDC.

F. Niagara Requirement:

1. The intent of this specification is to provide a system running the Niagara N4 Framework.
2. System Architecture shall provide secure Web access using MS Internet Explorer from any computer on the owner's LAN.
3. All control devices furnished with this Section shall be programmable directly from the Niagara-N4 Workbench upon completion of this project. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable.
4. Any control vendor that must provide additional BMS server software shall be unacceptable. Only systems that utilize Niagara N4 Framework shall satisfy the requirements of this section.
5. The BMS server shall host all graphic files for the control system.
6. OPEN NIC STATEMENTS - All Niagara software licenses shall have the following NiCS: "accept.station.in=*"; "accept.station.out=*"and "accept.wb.in=*"and "accept.wb.out=*". All open NIC statements shall follow Niagara Open NIC specifications.

1.03 SCOPE OF SERVICES (OVERVIEW OF SECTION 23 09 23)

A. Work under this section of the specification shall include, but not limited to, the following:
1. Furnish and install a complete sensor, actuator, wiring and piping system for all air handling and related equipment as shown on the plans and specified in this section. Install all necessary sensors and actuators as required by the plans and specifications and equipment schedules.

2. Label all sensors, control devices, and control units.
3. Furnish and install conduit, wire, branch circuit protection, etc. as required to bring 120 VAC power to control panel locations and equipment (actuators, sensors, control devices, etc.) as shown on the drawings and described in the specifications.
4. All line drivers, signal boosters, and signal conditioners etc. shall be provided as necessary for proper data communication.
5. Coordination as required with other sections of the specification for the proper and complete installation of the wiring system, control devices, dampers, valve, actuators, etc.
6. Furnish and install Direct Digital Control Equipment (DDC) as required by the point list, plans, and specifications including, control units, software, database development, check-out, and debugging. Provide points necessary for a complete and operable system.
7. Install the sequence of operations specified in the drawings and in this section.
8. Software testing requirements shall include testing in the field of all logic sequences including actual simulation of different processes and events and observing program response to the process or event. All deviations from the requirements of the sequence as specified on the drawings or this specification shall be corrected immediately at no additional cost to the Owner.
9. Provide documentation of software system testing before acceptance testing.
10. Provide staff for acceptance testing procedures. Modify hardware and software errors/problems at no additional cost to the Owner.
11. Provide a series of training classes for Owner staff.
12. Setup trending data before and after system acceptance.
13. Attend a series of meetings with the Engineer and Owner to agree on system setup and operating parameters.
14. Provide detailed documentation of system configuration including control units and all control devices.
15. Provide all software (with hardware connections) and software license for district computer as required.
16. Read this section in its entirety for specific details.
17. If the Control Contractor cannot comply with any of these specifications, then the Control Contractor must explain in writing the reasons for non-compliance and provide an alternative approach that satisfies these requirements.
18. Provide all equipment and personnel to complete system commission per previous section and as listed further in specification.
19. Prior to any submittal being provided for review by Engineer the Control Contractor and equipment supplier shall meet. The sequence of operation shall be reviewed and the instance which the BAS shall read or write to shall be determined. The result of this meeting shall be a sequence for the integrated HVAC unit to the control system with all instances of communication noted.
20. See Commissioning specifications for addition scope.

1.04 QUALITY ASSURANCE AND SYSTEM OVERVIEW

A. The BAS system shall be designed, installed, commissioned, and serviced by qualified Contractor.
   1. Emergency service shall be available 24/7.

B. Acceptable control system contractors and manufacturers: Control systems shall be BTL listed across the line of product controllers (BACnet advanced application controller B-AAC, BACnet Building Controller (B-BC) controllers and BACnet application specific controllers) B-ASC as defined by BACnet International testing standards.

C. A Tridium JACE NAC shall provide the interface between Internet and building level BACnet MS/TP communication bus. System shall use BACnet/IP on the internet side of the controller and shall use BACnet MS/TP at the building control network side. System shall utilize web

based control and access. BACnet /IP communication to third party control devices (BACnet controllers for chillers and boilers) shall be allowed.

D. All products proposed for this contract shall have been in continuous and successful use for at least two (2) year (not including beta testing).

E. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project.

F. The control system shall be forward compatible with future versions of the manufacturer's hardware, firmware, and software. Future versions of the manufacturer's hardware, firmware, and software shall be backward compatible with the installed control system. Forward and backward compatibility shall be guaranteed for at least five (5) years from the time of system acceptance. Any hardware, firmware, or software modifications or replacements required within that period because of incompatibility with new hardware, firmware, or software installed in the same facility shall be at no cost to the Owner.
Note: Equipment (controllers and software) should be provided by single manufacturer. All other products (e.g., sensors, valves, dampers, and actuators) need not be manufactured by the control manufacturer.

G. System shall be web based.

H. Commissioning of the new mechanical devices and control system shall be completed. Coordinate with Owners Commissioning Contractor.

1.05 CONTROL CONTRACTOR/MANUFACTURER QUALIFICATIONS

A. The Control Contractor shall have WEB based programming tools required to program and modify the BAS controllers.

B. Proprietary programming tools are not allowed

C. All programming tools shall be supplied to the Owner for future use.

D. See basic system requirements (1.02) for additional requirements

E. The Controls Contractor shall have a minimum of five years' experience with the complete, turnkey installation of Controls by the same manufacturer of similar size and technical complexity. The Controls Contractor shall provide a list of five comparable projects that have Controls with the features as specified for this project. These projects must be on-line and functional.

F. The Controls Contractor shall employ specialists in the field of Controls including the following: Programming, Engineering, and Installation. Specialists shall have a minimum of five years of experience with Control Systems by the selected manufacturer.

G. No installer or programmer substitutions will be made without written approval from the Owner.

H. All materials, products, and equipment used for this contract shall be standard components that have been in full production with continuous and successful use for at least two years.

I. The Controls architecture shall consist of the products of a manufacturer regularly engaged in the production of Controls, and shall be the manufacturer's latest proven standard design. Controllers and DDC (Direct Digital Control) system components shall be current production products.

J. All other equipment shall be the products of the CONTROLS manufacturer or of an approved manufacturer regularly engaged in production of specialized Controls materials or equipment.

K. The Controls Manufacturer will provide a written guarantee to the Owner that the system and technology being provided will be supported for a minimum of ten years following the completion and acceptance of the project.

L. The Control Contractor's or Manufacturer's installer for this project shall be:
   1. Honeywell
   2. Distech

1.06 RELATED SECTIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Mechanical Special Conditions, Electrical Special Conditions and Division - 1 Specification.

B. Coordination with Other Trades:
   1. This section specifies cooperation of the Control Contractor (the combination of installer and programmer hence forth) with other trades and including balancing firm to assure proper arrangement of control items. Control valves, dampers, wiring, thermostat wells, and other control devices that are to be built into the field assembled ductwork, piping, or wiring systems shall be furnished by the Control Contractor and installed under other sections of the specification as directed by the Control Contractor and indicated in other portions of the specifications and drawings.
   2. The Control Contractor shall insure that the DDC system communicates successfully with other equipment (e.g., air handling units, packaged rooftop units, heat pumps, motors, actuators, etc.). Note: the equipment supplier is responsible for the proper performance of their equipment (assuming the proper signals are sent/received from the BAS). The Control Contractor is responsible for all system sensors, including those which are factory installed.
   3. Electrical Wiring: All wiring required for work under this section of the specification shall be provided under this section of the specification unless otherwise specified.
   4. Electrical wiring - power for control panels, control devices, and sensors
      a. Power for control units, control devices and sensors shall be coordinated with the air handling manufacturer for the project and/or the Owner.
      b. Contact locations in starter control circuits. All contacts controlling motor starters, including overload contacts, shall be located on the hot side of the coil (ungrounded control power leg). Coordinate this requirement with the air handling manufacturer for the project.
      c. Extend power to damper actuators.
         1) Actuators will be powered at 24 VAC.
         2) At each auxiliary panel location, furnish and install a 24 VAC transformer with 20 VA of capacity for each actuator installed and served from the panel.
         3) Furnish and install a fused terminal in the +24 VAC lead and a disconnecting terminal in the neutral lead of the power cable to each actuator.
   5. Testing, Adjusting and Balancing: If necessary, The Controls Contractor shall operate the BAS to assist the TAB Contractor.

1.07 QUALITY CONTROL – CODES AND STANDARDS

A. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications, As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids for the following codes:
   1. National Electric Code (NEC)
   2. Uniform Building Code (UBC), Oregon Structural Specialty Code
   3. Uniform Mechanical Code (UMC), Oregon Mechanical Specialty Code

4. Underwriters Laboratories (UL)
5. National Electric Manufacturers' Association (NEMA)
6. National Fire Prevention Association (NFPA)
7. American Society Of Heating, Refrigeration, And Air Conditioning Engineers (ASHRAE)
8. Instrument Society Of America (ISA)
9. National Institute of Standards and Technology (NIST).

B. Meet all of the local authorities and State Fire Marshal code requirements for normal operating and smoke mode functions.

1.08 SUBMITTALS

A. Shop Drawing submittals are required for the following, in accordance with Section 23 0500. The Contractor shall not start the project until the Shop Drawings have been submitted and approved. Shop Drawings shall include:
   1. All submittals should be provided on paper (with legible font type and size).
   2. All Drawings should be labeled TC (temperature control) rather than being referenced within the mechanical or electrical divisions. Sheets shall be consecutively numbered
   3. One Drawing per air handler or system (e.g., boiler plant). Drawing should include point descriptors (DI, DO, AI, AO), addressing, and point names. Each point names should be unique (within a system and between systems). For example, the point named for the mixed air temperature for AH#1, AH #2, and AH #3 should not be MAT but could be named AH #1 MAT, AH #2 MAT, and AH #3 MAT. The point names could be logical and consistent between systems and AHs. The abbreviation or short hand notation (e.g., MAT) should be clearly defined in writing by the Control Contractor. See Section 5 for Naming Standard.
   4. Floor plans depicting all BAS control devices (control units, control devices, gateways, LAN interface devices, actuators, sensors, motor control centers, etc.) in relation to mechanical rooms, HVAC equipment, and building footprint.
   5. DDC System Engineer diagram indicating schematic location of all Control Units, workstations, LAN Interface devices, gateways, etc. Indicate address and type for each Control Unit. Indicate protocol, baud rate, and type of LAN (per Control Unit).
   6. For each Drawing, include a schematic flow diagram of each air and water system showing fans, coils, dampers, valves, pumps, heat exchange equipment, control devices, etc. Label each control device with setting or adjustable range of control. Label each input and output with the appropriate range.
   7. Electrical wiring diagrams shall include both ladder logic type diagrams for motor start, control, and safety circuits and detailed digital interface panel control point termination diagrams with all wire numbers and terminal block numbers identified. Indicate all required electrical wiring. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring that are existing, factory-installed and portions to be field-installed.
   8. Show all electric connections of the controls system to equipment furnished by others complete to terminal points identified with manufacturer's terminal recommendations.
   9. Control Contractor shall provide one complete drawing that shows the equipment (fan unit, boiler, chiller, etc.) manufacturers wiring diagram with the Control Contractors wiring diagram superimposed on it. Supply hard copy.
   10. Provide sequence of operation based on sequence in these documents, as discussed with Engineer and Owner and as modified based on site conditions and normal programming protocol. Provide details such as levels controlled to and point designations. Simply copying the sequence from these documents is not sufficient.
   11. Provide complete panel Drawings that are:
      a. Clearly labeled.
      b. Drawn to scale.
      c. Show the internal and external component arrangement so that the operators can identify the components by their position if the labels come off.

   d. Wiring access routes should also be identified so that Class 1 wiring is separated from Class 2 and 3 and so high voltage wiring is segregated from low voltage wiring and tubing.
12. Cataloged cut sheets of all equipment used. This includes, but is not limited to, the following: DDC panels, peripherals, sensors, actuators, dampers, control air system components, and so forth.
    a. Range and scale information for all transmitters and sensors. This sheet shall clearly indicate one device and any applicable options. Where more than one device to be used is on a single sheet, submit two sheets, individually marked.
    b. Manufacturer's installation, operation and maintenance data for all equipment.
13. Training course outlines for each four-hour session.
14. Hardware data sheets for all operator workstations, local access panels, and portable operator terminals.
15. Software manuals for all applications programs to be provided as a part of the operator workstations, portable operator terminals, programming devices, and so forth for evaluation for compliance with the performance requirements of this Specification.
16. Initial project team Quality Assurance compliance report.
17. Bill of materials for each system with part numbers.
18. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.
19. Damper schedule should include:
    a. Action (normally open or closed)
    b. Direct or reverse actuation
    c. Manufacturer make and model
    d. Design pressure drop at full flow
    e. Leakage rate
    f. Operating range
    g. Flow rate
    h. Actuator requirements
    i. Actuator spring range
    j. Special construction features (U.L. listed smoke damper, etc.)
20. A set of drawings showing the details of the valve and valve actuator installation for each valve, required for operation and maintenance manuals only. This should include:
    a. Action (normally open or closed)
    b. Manufacturer make and model
    c. Cv
    d. Close off rating
    e. Flow rate
    f. Actuator spring range
    g. Cavitation coefficient (where applicable)
    h. Special construction features
21. Provide NiCS showing devices communicating with JACE or through it are completely open with no restrictions.
22. Shop drawings submitted are required within 21 days of contract award.

B. Record Documents:
1. Provide a complete set of control drawings with as-installed equipment and operating sequences on paper and in electronic format (AutoCAD). "As-built" (i.e., as-installed and debugged and after system acceptance) documentation shall include the following as minimum:
    a. All data specified in the shop drawings section in its final "as-built" form.
    b. Schematic outline of the overall control system for quick reference
    c. Adequate record of the work as installed, including exact location of control panels and the wiring route (using TC documents, section 1.8-3).

d. Blue prints shall include sequence of operation.
e. System hardware specification data which provides a functional description of all hardware components.
f. System engineering information which provides all of the information for the system set-up, definition and application.
g. System database information that provides the point names and application data programmed into the system.
h. All of the information, data, procedures and drawings shall be supplied in the form of manuals.

2. Provide as-installed (after system acceptance) control logic diagrams showing all points (real and virtual).
3. DDC systems that use line-based programming must reference line code number with control logic diagrams and/or with sequence of operation text. Control Contractor shall discuss final format with Owner.
4. Provide licensed electronic copies of all software for each workstation and laptop. This includes, but is not limited to: project graphic images, project database, trouble-shooting and debugging programs, project-specific application programming code and all other software required to operate and modify the programming code (including software at system level, primary control units, secondary control units, and all communication software). Any hardware devices (cables, protection devices) required to operate the software/hardware shall also be provided.
5. The Control Contractor shall document deviations from the shop drawing submittals. Documentation should include what equipment was changed and the reason for the change.
6. Provide copy of final test reports.
7. Provide within 21 days of substantial completion.
8. Documents shall be provided as a PDF file. See O & M for number of hard copies.

C. Operating and Maintenance Materials:
1. Submit three sets of each manual within three weeks (21 calendar days) of Substantial Completion.
a. Include the following documentation in the Hardware Manual:
1) General description and cut sheets for all components.
2) Detailed wiring and installation illustrations and complete calibration procedures for each field and panel device.
3) Complete trouble-shooting procedures and guidelines.
4) Complete operating instructions for all systems.
5) Maintenance Instructions: Document all maintenance and repair/replacement procedures.
b. Include the following documentation in the DDC Software Manual:
1) Sequence of Operations
2) Program Listing of Software Source Code OR Flow Chart Diagrams of Programming Objects.
3) Printed listing of controller and operator workstation database files.
4) Software Point Name Abbreviation List. Include Name, Description, Controller Where Located, Point Type and Point ID.
5) I/O Point List. Include Point Name, Controller Location, Point Number, Control Device, Range and Span.
6) Printouts of the following; Reports, Group Listings and Alarm Messages.
7) Index of all DDC point names with documentation, manual page number references.
c. Provide three copies of all manufacturers manuals covering the installed system. This shall include, as a minimum:
1) System Engineering Manual
2) System Installation Manual
3) Programming Manual

4) Engineering and Troubleshooting Bulletins
5) Operator Workstation Software Manual
6) All other pertinent manuals published by the control system manufacturer.

2. All manuals shall be provided in hard copy format and on a single Compact Disk (CD). The electronic files on the CD must be submitted in a user editable PDF format, scanned files are unacceptable. Copyrighted factory manuals may be in a PDF file.

1.09 WARRANTY

A. Warranty shall cover all costs for parts, labor associated travel, and expenses for a period of two years from completion of system acceptance.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday-Friday, 48 hours on Saturday and Sunday.

C. This warranty shall apply equally to both hardware and software.

1.10 DELIVERY AND STORAGE

A. Provide factory-shipping cartons for each piece of equipment and control device not factory installed. Provide factory applied plastic end caps on each length of pipe and tube. Maintain cartons and end caps through shipping, storage, and handling as required to prevent equipment and pipe-end damage, and to eliminate dirt and moisture from equipment and inside of pipe and tubes. Store equipment and materials inside and protected from weather.

1.11 DEMOLITION

A. Above accessible ceilings remove all control devices, tubing and wire no longer used.

B. Remove all control devices no longer used.

1.12 DISCREPANCIES

A. Any items not included in the specification but referred to in the Appendix and/or Drawings in reference to this project and any other incidentals not referred to but required as a basic element to the overall performance and/or successful completion of the work shall be installed as part of this contract.

PART 2 PRODUCTS

2.01 BASIC MATERIALS, CONTROL DEVICES, SENSORS

A. Installation of some of the equipment in this section may be the responsibility of other Contractors (see 1.5).

B. All sensors and equipment related to or connected to the DDC system shall be installed according to manufacturer's recommendations.

2.02 WIRING, CONDUIT, AND HANGERS

A. To supply, install and connect all conduits, boxes and wires between all the different components related in this section including all line voltage to the equipment.

B. Provide all necessary field wiring and devices from the point of connection indicated on the drawings. Bring to the attention of the Engineer in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

C. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications to determine voltage, phase, circuit ampacity and number of connections provided.

D. All wiring and fiber optic cable in the central plant, tunnels, and plenums to be supported by B-line Bridle rings or equal. All wiring and fiber optic cable in the hallways, rooms, and other public areas shall be in conduit unless noted otherwise in section H.

E. All wires in Bridle Rings or conduit shall follow building lines (i.e., wires in plenum space shall run within several inches of the wall and shall NOT run in the middle of the space). Those areas of the building with RA plenum ceilings where wire is routed above that wire shall be plenum rated or routed in conduit.

F. Wire:
   1. Wire and cable of the sizes and types shown on the plans and/or hereinafter specified shall be furnished and installed by the Control Contractor. All wire and cable shall be new soft drawn copper and shall conform to all the latest requirements of the National Electrical Code, IPCEA, and shall meet the specifications of the ASTM.
   2. All control wiring to be copper stranded TEW-105, with appropriate gauge in accordance with the Codes. The minimum gauge used to be 16 AWG.
   3. Input/Output Wiring: Wiring serving inputs and outputs from the BAS shall be cables consisting of single or multiple twisted individually shielded pairs. Each pair shall have an independent shield with drain wire. Cables installed without conduit shall be plenum rated and comply with NEC article 725. Where automation input/output wiring is run in cable tray furnish and install conductors or multi-conductor cable rated for use in cable trays per NEC articles 340 and/or 725. Conductors shall be minimum #18 wire gauge.
   4. Power Conductors: All feeder and branch circuit wire shall be 600 V insulated of THHN type unless shown or specified to be otherwise. No wire less than No. 12 gauge shall be used except for control circuits or low voltage wiring. Wire sizes No. 14 to No. 10 shall be solid except where otherwise indicated. Wire sizes No. 8 and larger shall be stranded. All wire sizes shown are American Wire Gauge sizes. Where power conductors are run in cable tray, furnish and install conductors or multi-conductor cable rated for use in cable trays per NEC articles 340 and/or 725.
   5. All the conductors used for signals from the Controllers and field sensors must be shielded two wire, 18 AWG. with a drain wire. Conductor model 8760 from Belden is to be used or approved alternative by Engineer.
   6. All power wiring to be copper stranded RW 90 type, with appropriate gauge in accordance with the Codes. The following color code must be applied: line voltage to be black and/or white, ground to be green.
   7. Acceptable Manufacturers: Cable and wire shall be a standard type as manufactured by General Electric Company, National Electric Company, U. S. Rubber Company, Simplex, General Cable Company, Carol, Anaconda, Rome, Southwire, Belden, Alpha, Houston Wire and Cable, or ITT Royal.

G. Wiring Installation:
   1. All wires shall be continuous from outlet to outlet and there shall be no unnecessary slack in the conductors.
   2. All wire terminations will be identified using rail terminal strips (see 5.11)
   3. All drain wires must be grounded at the source end. The other end must be protected with a dielectric material (tape).
   4. All control wiring (24 V and more) must be in a separate conduit from the shielded conductors.
   5. Pull-Box and Junction Box:

a. Pull boxes and junction boxes shall be installed where indicated on the drawings or where required to facilitate wire installation. Locate in conjunction with other trades so as to install without conflict with other materials or equipment.
b. A pull-box will be located at every 50'.
c. All switch, pull, junction boxes, etc., shall be hot dipped galvanized or sherardized, concrete tight, with interlocking ring or multiple point locking devices. Connectors shall be three piece. Indentation fittings are not acceptable.
d. In suspended ceilings, all boxes must be installed on the structure.
e. Boxes shall be attached by fasteners designed for the purpose and shall provide adequate mechanical strength for future maintenance.
f. Junction and pull boxes not dimensioned shall be minimum 4 inch square.

6. Care shall be used to avoid proximity to heat ducts and/or steam lines. Where crossings are unavoidable, conduit shall clear covering of line by at least six inches.
7. Motor Interlock Wiring: Interlock circuit wiring shall be No. 14 solid or stranded wire. Stranded wire only shall be used where wiring is used for flexible wiring harnesses. Stranded control wire shall be provided with crimp type spade terminators. Interlock circuit wiring shall be color coded or numbered using an identical number on both ends of the conductor. Wire numbers shall be installed before conductors are pulled. Where motor interlock conductors are run in cable tray, furnish and install conductors or multiconductor cable rated for use in cable trays per NEC articles 340 and/or 725.
8. All splices, taps, and terminations shall be made at outlet, junction, or pull boxes. Wire to No.6 gauge shall be spliced using Scotchlok wire nuts. No Bakelite wirenuts shall be used. Wire No. 6 and larger shall be spliced using solderness connectors as manufactured by Penn Union Company. Splices No. 6 and larger shall be insulated by taping with plastic vinyl tape as manufactured by Minnesota Mining and Manufacturing Company. Splices shall not be permitted in automation input and output wiring without specific written authorization from the Engineer. If such a splice is approved, the location of the splice shall be clearly documented on the "As Built" drawings. Splices in automation wiring, if necessary, shall be made using Thomas&Betts STA-KON connectors installed per the manufacturer's directions to maintain NEMA specified voltage drops and wire retention forces.
9. Grounding:
   a. The Contractor shall extend existing equipment grounding systems. The Contractor shall use only approved grounding clamps and connectors as manufactured by Penn-Union, Burndy or O-Z Mfg. Company.
   b. The conduit system of the 480/277 and 208Y/120 volt systems shall be continuous and shall be used as the static grounding conductor, except for circuits installed in flexible conduit. Install a green grounding conductor inside all flexible conduits and extend to the nearest outlet or junction box. Install a green grounding conductor inside all non-metallic conduits or raceways.

H. Conduit:
   1. Conduit Material:
      a. All wiring to be in E.M.T. type conduits unless in plenum or otherwise noted below.
         1) Above accessible ceilings open cable with bridle ring support is allowed.
         2) Routed in corridors or other finished spaces on top of exposed sheet metal ducts supported with open wire way devices attached to the center top of the duct is allowed. Wire shall not be visible under casual observation of the installation.
         3) 12 ft. or more above the floor in mechanical rooms where supported per specifications.
      b. All conduits to be a minimum of 1/2".
      c. All flexible conduits will not exceed 6' in length and are to be used only in areas where vibrations and/or expansion joints are present.
      d. Flexible conduit to be used for connecting any element to its conduit. The length of this flexible conduit will not exceed 24".

e. Jacketed flexible steel conduit (Sealtite) shall be used where flexible conduit connections are required outdoors and at connections to all motorized equipment and motors outdoors.
f. In damp areas, the conduit and related equipment must be suitable for the application.
g. Electrometalic tubing shall be installed for all exposed work and for all concealed work in applications where conduit is required. For exposed locations in finished spaces (halls, classrooms, offices, gym's etc.) conduit shall be powder coated. This includes all junction boxes, splice boxes, connectors, etc. Rattle can painted/site painted conduit and devices are not allowed. Provide color sample for Owner approval.
h. Conduit shall be by Allied, Triangle, Republic, Youngstown, Carlon, Rob Roy, or approved equal.
i. For exposed installations where the conduit cannot be run in ceiling spaces, wall cavities or attics, EMT is allowed. Regular EMT is permitted in mechanical spaces, attics, etc.
j. Existing conduit may be re-used if compliant with these specifications.

2. Conduit Installation:
a. All wiring in mechanical rooms at heights below 12 feet must be run in conduit. Otherwise, wiring in all other open areas must have conduit (at all heights). Existing conduit runs where compliant with these specifications may be re-used.
b. All conduits to be installed in a concealed manner where possible and shall be installed parallel to the lines of the building.
c. All exposed conduits shall be installed parallel or at right angles to the building walls or floors.
d. Conduit bends shall be made with standard hickeys of proper size; radius of bends to be at least 6 times the diameter of the conduit. Runs between outlets shall not contain more than the equivalent of three quarter bends. Conduit runs shall be continuous from outlet to outlet, outlet to cabinet, etc.
e. Conduits shall be installed with pitch toward outlet box wherever possible. All heavy wall conduits shall have two locknuts and a bushing at each termination outlet box, junction box, etc., except where terminated in a threaded hub. Fittings on electrometalic tubing shall be compression type.
f. A bushing shall be used where conduit enters a panel box. Bushing for No. 4 AWG or larger shall be insulated type with provisions for grounding as type "BL" made by O-Z Electric Company, or approved equal.
g. Expansion fittings shall be provided at all conduits across the building expansion joints. Fittings shall be Type "AX" or "TX" as made by O-Z Electric Company, or approved equal. Provide copper bonding jumper at each expansion fitting.
h. All ½'' conduit to be supported every 6', the supports will be located at the connector end of the conduit.
i. Exposed conduit shall be securely fastened in place on maximum 5 ft. intervals for 3/4" through 2-1/2 inch nominal sizes. Supports may be one hole malleable straps or other approved devices. No perforated metal straps will be permitted.

I. Wireway:
1. Furnish and install at all control panel locations a NEMA 1 lay-in wireway system to bring cable into and out of the panel as detailed on the drawings and specified in this section. Furnish 3-way wireways at each panel location: one for Class 1 wiring, 1 for Class 2 and Class 3 wiring. Panels at units to be NEMA 3R or better.
2. Wireway systems at locations where cables are to be run without conduit or in a cable tray shall consist of a connection to the control panel with a vertical extension to 8'-0" or the pipe rack or cable tray level, whichever is higher. The vertical section shall terminate in a 90° fitting with a closure plate. The closure plate shall be provided with a conduit nipple with locknuts and bushings as a wire entry point into the square duct. The conduit nipple shall be one size smaller than the wireway it is associated with.
3. Wireway systems at locations where cables are to be run in conduit shall consist of a horizontal section of wireway with a length equal to the control panel width and located

above the control panel and connected to the control panel with three conduit nipples, locknuts, and bushings; one for tubing, one for Class 1 wiring and one for Class 2 and 3 wiring. Conduits for cable runs shall terminate on the wireway.

4. The intent of the wireway configurations outlined above is to provide a method for adding input and output wiring to the control panel without having to drill directly into the electronics enclosure after the system is on-line and running and to provide sufficient area to land field conduits while maintaining appropriate circuit segregation for wire entry into the controller enclosure. The installation of wireway shall be made with this consideration in mind.

J. Hangers and Anchors:
   1. Where control system tubing is run on trapezes and/or hangers used by and or installed by other trades, supports for the trapezes shall be coordinated by all trades using the trapeze to assure that the anchor system is not overloaded and is sufficient for the load imposed including a margin of safety and seismic considerations. Under no circumstances shall a trapeze or hanger system installed by the electrical trades be used to support work by any other trade, nor shall the electrical trades use the trapezes installed by any of the other trades for the support of electrical equipment, all as required by the National Electric Code. Similarly, under no circumstances shall a trapeze or hanger system installed by the sprinkler trades be used to support work by any other trade, nor shall the sprinkler trades use the trapezes installed by any of the other trades for the support of sprinkler systems or equipment, all as required by NFPA 13, Standard For The Installation Of Sprinkler Systems.
   2. Anchors to be loaded in tension for use in existing concrete structure and anchors loaded in tension and not cast in place shall be epoxy resin set anchors installed per the manufacturers recommendations for technique, size, loading, embedment, etc. Where anchors are loaded in shear at these locations, suitably sized and installed wedge type anchors may be used.
   3. In all cases, anchor loading shall be based on hanger spacing, weight of the pipe to be supported when full and insulated, weight of any additional loads imposed upon the anchor, wind loading, seismic loading, quality of the material that the anchor is being installed in, etc. The Control Contractor shall verify in the field that the anchors used and the materials that they are being installed in are suitable for the load imposed and shall bring any problems to the attention of the Engineer in writing immediately and not proceed without direction from the Engineer.
   4. Wedge type anchors shall be Hilti Kwik Bolt II. Adhesive anchors shall be Hilti HVA.

2.03 UNIT CONTROL PANELS (INSTALLATION AND FABRICATION)

A. Enclosed cabinet type with hinged door for mounting all relays, switches, thermometers, and miscellaneous controls not requiring direct mounting on equipment such as sensing elements, valves and damper motors. Provide cabinet for each control unit adjacent to each system.

B. Each panel shall have power conditioners on electrical supply, Crucial Power Product MI Series.

C. Control panels shall be fabricated to match the approved shop drawings submitted by the Control Contractor. Fabrication shall be in a neat and workmanlike manner and shall facilitate repair, maintenance, and adjustment of the equipment contained therein.

D. Control panels shall be fabricated and laid out to incorporate the following features:
   1. Identification of all internally and cover mounted devices. Cover mounted labels shall be engraved labels as specified in this section (5.10). Labels shall be mounted adjacent to the device they are associated with so that replacement of the device does not eliminate the label. Provide laminated control diagram at each panel.

2. Electrical wiring shall enter the panel from the top, bottom, and/or side of the left side of the panel or as required by the panel supplier to meet NEC requirements.
3. All wires entering or leaving the panel shall pass through a rail terminal strip. Where the wires are part of a current loop transmission circuit, the terminals shall be the disconnecting link type. Terminals shall be identified with a number that corresponds to the terminal number on the job wiring diagram. Rail terminal strip specifications include:
    a. General: Terminal rail assemblies shall be fabricated from components selected from the product line of one manufacturer. Sizes (heights, widths, and profiles) of each terminal shall be selected to be compatible with the other terminals on the rail. Terminal units located at the end of a rail or adjacent to terminals with a different profile (for example, where disconnecting terminals are located next to resistor terminals) shall be provided with end caps to completely close off the terminal unit interior components from the local environment. End stops shall be provided for on all rails to secure the terminals located on the rail in place.
4. All internal wiring and tubing shall be run inside plastic wiring/tubing duct as manufactured by Tyton. Wire duct shall be sized to hold the required number of wires and tubes without crimping the tubes and with sufficient space to allow wiring and tubing to be traced during troubleshooting operation.
5. Wires that pass from the panel interior to cover mounted devices shall be provided with a flex loop that is anchored on both sides of the hinge. Wiring running to cover mounted devices shall be bundled using cable ties.
6. Provide strain relief type cord and cable connectors for all cables that leave the panel as individual cables not in conduit.
7. All control panels shall be provided with removable sub panels to allow the panel enclosures to be installed at the job site during rough in while the panels are fabricated off-site for later installation.
8. Provide one under cabinet type fluorescent light with switch mounted internally in the control panel. Panels with external light hoods will also be acceptable if the light will illuminate the panel interior with the door open.
9. Provide one duplex outlet mounted inside the control panel and separately fused with a non-time delay fuse at 15 A at any panel location containing electronic or electrical control components. This receptacle may be served from the control panel 120 VAC power source.
10. Each control panel shall be provided with a control power disconnect switch located and wired so as to disconnect all control power in the panel. The leaving side of this switch shall be wired to the panel and field components through a fuse or fuses sized and applied to protect both the components of the system as well as the wire and as required for code compliance.
11. Power to the following equipment will be have a fuse rated for applicable current and voltage. Fuses will be on rail terminal strips. Equipment includes:
    a. Each control unit
    b. Control devices
    c. Panel light
    d. Receptacle loads (e.g., modems, laptops)
12. All control panels containing electrical equipment shall be NEMA rated for the location in which they are installed. Cover mounted components, tubing penetration, and conduit penetrations shall be made in a manner consistent with the NEMA rating.
13. All wiring leaving the panel shall be separated by classification; i.e., Class 1 circuits shall not be run with Class 2 circuits, etc. Segregation shall be maintained inside the panel to the fullest extent possible. Where low voltage wires carrying low level ac and dc signals cross wires containing power and high level ac signals, the wires shall cross at a 90° angle.

E. Control panels shall be shop fabricated and tested prior to installation in the field. The panels shall be inspected and approved by the Engineer at the assembly location prior to installation in the field. The Engineer shall be given the opportunity to witness the testing of the panels.

F. Panel Location:
   1. Each control panel is to be located for convenient servicing.
   2. Mount panels adjacent to associated equipment on vibration isolation.

2.04 CONTROL DAMPER ACTUATORS

A. Damper Actuator Requirements:
   1. All damper actuators shall be Belimo electric actuators.
   2. Torque rating shall be based on the damper manufacturers operating torque requirements at the design flows and pressure drops or shall be based on the manufacturers required shut-off torque to achieve the design leakage rate, whichever is greater. This higher torque rating shall be doubled. An actuator with this doubled torque rating shall be installed.
   3. All damper sections which operate in sequence with each other shall have identical actuators and identical linkage arrangements to assure similar performance between all sections.
   4. Modulated actuator operation shall be industry standard 0-10V.
   5. Two or three position operation is not acceptable for economizers, multizone dampers, or any other application specifying modulated operation. OSA Dampers to be normally closed, mixed air dampers to be normally open.
   6. Spring returns on damper operators are required for OSA application.
   7. Actuator quantities for dampers shall be based on the following criteria.
      a. Actuators must be outside unit enclosure.
      b. Actuators shall be installed to maximize the linearity between actuator stroke and actuated devise travel (25% actuator stroke produces approximately 25% of the desired angular rotation required; 50% stroke produces 50% angular rotation). In addition, actuators should be installed to maximize force available for useful work over the entire stroke.
   8. Actuators for VAV boxes to be provided to VAV manufacturer for installation at the factory whenever possible.
   9. Actuators for VAV boxes are not subject to above specification Section 1, 4, and 5.

2.05 CONTROL VALVES AND ACTUATORS:

A. Provide adequate size and number of modulating or two-position action.

B. Provide positive positioning devices where shown or where sequencing cannot be accomplished by using standard spring ranges.

C. Modulating valve sizing shall be based on the following conditions.
   1. Water Valves: Size to closest flow rate but not less than that listed by manufacture.
   2. Flow rates for valve sizing shall be based upon the flow rates indicated on the equipment schedules on the drawings.
   3. Valves on heating systems to be normally open.

D. Control Valves:
   1. Leakage is Zero Percent, Close-off is 200 psi, Maximum Differential is 30 psi. Rangeability is 500:1.
   2. Valves ½ inch through 2 inches shall be nickel- plated forged brass body, NPT screw type connections.
   3. Valves ½ inch through 1 ¼ inches shall be rated for ANSI Class 600 working pressure. Valves 1 ½ inch and 2 inches shall be rated for ANSI Class 400 working pressure.
   4. The operating temperature range shall be 0° to 250° F.
   5. Stainless steel ball & stem shall be furnished on all modulating valves.
   6. Seats shall be fiberglass reinforced Teflon.

7. Two-way and three-way valves shall have an equal percentage control port. Full stem rotation is required for maximum flow to insure stable BTU control of the coil.
8. Three-way valve shall be applicable for both mixing and diverting.
9. The characterizing disc is made of TEFZEL and shall be keyed and held secure by a retaining ring.
10. The valves shall have a blowout proof stem design.
11. The stem packing shall consist of 2 lubricated O-rings designed for on-off or modulating service and require no maintenance.
12. The valves shall have an ISO type, 4-bolt flange, for mounting actuator in any orientation parallel or perpendicular to the pipe.
13. A non-metallic thermal isolation adapter shall separate valve flange from actuator.
14. One fastening screw shall secure the direct coupling of the thermal isolation adapter between the actuator and the valve. This will prevent all lateral or rotational forces from affecting the steam and it's packing O-rings.
15. Valve Sizing for Pressure Dependent Water Coil:
    a. On/Off Control Valves shall be line size.
    b. Modulating Control Valve Body Size may be reduced at most two pipe sizes form the line size or not less than half the pipe size. The BAS Contractor shall size all water coil control valves for pressure drop of no more than 3 psi differential pressure.
    c. Valve Mounting Arrangements Shall Comply to the following:
        1) Unions shall be provided on all ports of two-way and three-way valves.
        2) Install three-way equal percentage Characterized Control Valves in a mixing configuration with the "A" port piped to the coil.
        3) Install 2 1/2" inch and above, Three-way Globe Valves, as manufactured for mixing or diverting service to the coil.
        4) Two-way Valve shall be piped in the return side of the coil in order to minimize ambient heat at the coil.

E. Valve Actuators:
    1. Electronic actuators shall be manufactured by Belimo for all valves.
    2. Torque shall be rated at twice the required load.

2.06 SENSORS

A. Shall be manufactured by Johnson Controls, Mamac, Kele, Setra, Veris, or Penn only.

B. All sensing inputs shall be provided industry standard signals.

C. Temperatures, humidities, differential pressure signals, and all other signal inputs shall be industry standard variable voltage or amperage.

D. All signal inputs shall be compatible with the controllers used and with the requirement for readout of variables as specified.

E. If sensors are not linear, then software will linearize sensor output.

F. Controls and sensors for VAV boxes to be provided to VAV manufacturer for installation at the factory.

G. Minimum sensor accuracy (as compared to a test standard) and range are listed in Table. Accuracy is not the same as resolution (the ability of the DDC to measure incremental change). Resolution is specified in "Part 3, DDC Hardware."
    1. All accuracy values should be combined effect numbers taking into account thermal drift, interchangeability, hysteresis, etc.

Sensor Type	Range	Min. Accuracy

Duct/Air Handling		
Unit Temperature	40 – 130°F	± 0.5 Degree F
Room Temperature	50 – 85°F	± 1 Degree F
Outside Air Temperature	- 20 to 120°F	± 0.5 Degree F
Chilled Water Temperature	32 – 80°F	± 0.1 to ± 0.5 Degree F
Hot Water Temperature	80 – 220°F	± 0.1 to ± 0.5 Degree F
Water flow	Sized for application	± 5% of reading
Humidity	0 to 100% RH	± 3% RH
Duct Static Pressure	0 to 3″ w.c.	± 1% full scale per 50°F
Space Static Pressure	- 0.25″ to 0.25″ w.c.	± 1% full scale per 50°F
High Limit Static	0-5” w.c.	± 1% full scale per 50ºF
Steam Pressure	Sized for application	± 1% full scale
Current Sensor	Sized for application	± 1% full scale
Power (kWh)	Sized for application	± 2.5% full scale (at 0.5 PF) ± 2% full scale (at 1.0 PF)
Air flow	700 to 4,000 fpm	± 2% full scale
CO_2 sensors	0 to 2,000 PPM	± 3% full scale
Freeze Stat	34ºF to 68ºF	± 1ºF

Sensors shall not drift more than 1% of full scale per year

2.07 TEMPERATURE SENSORS/THERMOSTATS

A. All sensors shall be completely electronic.

B. Provide all sensors with blank wall plate, vandal-proof covers that are flush with wall**.** 10K OHM Type II. Mamac, Kele or approved.

C. Duct/ Air Handling Unit type temperature sensor (mixed, discharge/supply, and return air):
   1. The probe of the duct sensor shall be 12" in length, and be made of Stainless Steel. Applications where the smallest dimension of the duct is less than 24", the probe shall be sized to reach the center of the duct.
   2. Large systems above 9 square feet may require an averaging probe if sufficient mixing of the air stream is not possible.
   3. Mount the sensor far enough down stream to allow mixing of the air stream, this is most important on Hot and Cold Deck applications where the coil is placed after the fan.
   4. Sensors for mounting on insulated ducts or casings are to be equipped with brackets for mounting clear of the isolation.
   5. Do not locate sensors in dead air spaces or in positions with obstructed air flow.
   6. Provide separate duct flange for each sensing element.
   7. Temperature sensing elements shall be thermally isolated from brackets and supports.
   8. Securely seal ducts where elements or connections penetrate duct.
   9. Mount sensor enclosures to allow for easy removal and servicing without disturbance or removal of duct insulation.

D. Immersion Type Temperature Sensor:
   1. The probe of the sensor shall be constructed of stainless steel and pressure rating consistent with system pressure and velocity.
   2. The well shall be constructed of stainless steel and sized to reach into the center of the pipe. Pipes with small diameters shall have the well mounted at a 90 degree elbow to allow sufficient contact with the fluid.
   3. Locate wells to sense continuous flow conditions.
   4. Do not install wells using extension couplings.
   5. Wells shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area. Increase piping size as required to avoid restriction.

6. Provide thermal transmission material within the well.
7. Provide wells with sealing nuts to contain the thermal transmission material and allow for easy removal.

E. Room Type Temperature Sensor:
1. All thermostat locations shall be submitted for approval before installation.
2. Provide all sensors with blank wall plate, vandal-proof covers that are flush with wall. Mamac TE-205-P Series or equal. For all sensors in normally occupied spaces or with CO2 operation provide combination temperature and CO2 sensor. Alerton Ascent Microset Series or equal.
3. Coordinate sensor location with light switches, and mount 60" above the floor. Verify location before installation, so that no direct sunlight or influences from heat and cooling sources will be imposed on the sensor.
4. Unless otherwise indicated or specified, provide one discharge and one space temperature sensor for each VAV Terminal Control Unit.
5. Metal guards shall be provided at non-flatplate sensors in halls, restrooms and gyms and as shown on Drawings.
6. Insulation shall be installed between the temperature sensor and open conduit to eliminate false temperature readings due to cold drafts.

F. Outside Air Sensors
1. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
2. Sensor's exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
3. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

G. Averaging Sensors
1. For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
2. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
3. Capillary supports at the sides of the duct shall be provided to support the sensing string.

2.08 AIR PRESSURE SENSORS

A. Static Pressure and Velocity Controllers:
1. Static pressure sensors shall be of either the diaphragm or rigid element bellows, electronic type, photo helic.
2. Each sensor shall be provided with connections, i.e., stop cock and tubing, for attaching a portable pressure gauge.
3. Sensors for mounting on insulated ducts or casings are to be equipped with brackets for mounting clear of the insulation.
4. The transmitter shall be a two-wire type and provide a 4-20 mA signal which is proportional and linear over the calibrated pressure range.
5. The transmitter shall be capable of operating from an unregulated 18-30 VDC power supply.
6. The device housing shall provide 1/4" barbed brass fitting for the connection of the pressure lines. Pressure ranges shall suit the application so that normal operation will occur at mid-range of the sensor span.
7. The location of the indoor measurement shall be remote from doors and openings to the outside, away from elevator lobbies, and shielded from air velocity effects. See Drawings for location.

2.09 TRANSFORMERS

A. Transformers selected and sized for appropriate VA capacity and installed and fused according to applicable Codes.

2.10 CO_2 SENSORS

A. Self-calibrating sensors are acceptable but, sensor must easily allow field calibration with test gas. Sensors must retain accuracy for between 3 - 5 years without requiring calibration. Sensors that require annual calibration are not acceptable. Provide CO_2 sensor calibration tool with system. Sensors must be calibrated at system start-up. Calibration tool is to be turned over to Owner along with instructions for use at close-out.
   1. CO_2 sensor output shall be 4 – 20 mA or 2 – 10 VDC proportional over the specified range. Minimum sensor accuracy and range:
   2. The transmitter shall be capable of operating from an unregulated 18 – 30 VDC power supply.
   3. Acceptable Manufacturers: Veris Industries, Johnson Controls.

2.11 POWER MONITORING DEVICES

A. Current Measurement (Amps)
   1. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Controls. The status and amperage of all VFD motors for fan and pumps shall be via the VFD. For non-VFD loads use current sensor. Sensors required at all controlled motors.
   2. Current Transformer – A split core current transformer shall be provided to monitor motor amps.
      a. Operating frequency – 50 - 400 Hz.
      b. Insulation – 0.6 Kv class 10Kv BIL.
      c. UL recognized.
      d. Five amp secondary.
      e. Select current ration as appropriate for application.
      f. Acceptable manufacturers: Veris Industries.
   3. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
      a. 6X input over amp rating for AC inrushes.
      b. Manufactured to UL 1244.
      c. Accuracy: +.5%, Ripple +1%.
      d. Minimum load resistance 30kOhm.
      e. Input 0-20 Amps.
      f. Output 4-20 mA.
      g. Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).
      h. Acceptable manufacturers: Veris Industries.

2.12 TIMER SWITCH

A. Spring wound timer switch with range of 0-12 hours. Intermatic FF Series or equal.

2.13 SURGE PROTECTION

A. All equipment shall be protected from power surges and voltage transients. If failure occurs from surges and transients during the warranty period, then the Contractor shall repair surge protection equipment and other equipment damaged by the failure at no cost to the Owner.

B. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients, and shall be consistent with IEEE standards 587-1980.

2.14 FACTORY MOUNTED DEVICES

A. Sensors as required shall be provided by Control Contractor to the manufacturer for installation. All materials and labor beyond this is the responsibility of the Control Contractor.

2.15 WATER FLOW SENSOR

A. Sensing Method: Ultra Sonic.

B. Accuracy: +/-0.5% of reading at calibrated velocity. +/-1% of reading from 0.1 to 40 ft/s.

C. Liquid Operating Temperature: -4 to 140ºF.

D. Analog output.

E. Dynasonics TFX-500W with DTT J/K Series Rail and Sensors.

2.16 BOILER SYSTEM SHUT-OFF SWITCH

A. Switch to be lockable type, Square D XALK 194 or equal.

PART 3 DIRECT DIGITAL CONTROLS – HARDWARE

3.01 SYSTEM ARCHITECTURE

A. The system architecture shall consist of a multi-level Local Area Network (LAN) which supports Control Units, networked Operator Workstations, and LAN Interface Devices. The following indicates the functional description of the system structure.
   1. District Network: Used for communication between JACE Network Controller located in each building, and networked Building Level Controls located in selected building(s). This network will consist of using the World Wide Web with BACnet/IP protocol. BAS/DDC workstation(s) and the JACE Building Level Controller shall employ native BACnet /IP protocol. Niagara N4 Protocol, BACnet TCP/IP Protocol, and/or SNMP Protocol. BAS/DDC workstations shall not require third party routers, gateways or translators.
   2. Primary Controller LAN: Used to connect Primary Control Units (Primary Control Units-which generally control central plant equipment, air handler's boiler plants etc.) within a building. This LAN may be Ethernet 10BaseT (IEEE802.3) or a separate high speed peer-to-peer LAN used in conjunction with an Interbuilding LAN Interface Device. The LAN Interface Device shall employ native BACnet MS/TP on the Ethernet 10BaseT (IEEE802.3) physical layer for connection Building Controller.
   3. Secondary Controller LAN: polling or peer-to-peer LAN to support Terminal Control Units/application specific controllers and interfaces to other third party LANs is acceptable. The Secondary Controller LAN shall interconnect with the Primary Controller LAN using a LAN Interface Device which may or may not be an integral part of a Primary Control Unit.

B. The Control Contractor shall provide set-up and software for the digital control system and web access on one Owner provided computer, and one Owner provided lap top computer. Coordinate with district IT personnel for access, wiring and standards of installation if more restrictive than these specifications.

3.02 NETWORK CONTROLLER/SUPERVISOR

A. The Network Controller shall be a fully user-programmable supervisory controller. The Network Controller shall monitor and communicate the network of distributed primary, secondary, application-specific control units, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Controllers/Supervisors. Device shall be a Tridium JACE Network area controller.

B. Controllers shall be microprocessor-based with a maximum program scan rate of one (1) second. They shall be multi-tasking, multi-user, and real-time digital control processors. Controller size and capability shall be sufficient to fully meet the requirements of this Specification.

C. Each Network Controller/Supervisor shall support/communicate with a minimum of 100 control units.

D. Each controller shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control units. In addition, if memory for historical data trending is not on primary and/or secondary control units, then sufficient memory is required on the network controller to capture and record historical trending data. Memory size shall be at least 1 gigabyte.

E. Network Controller/Supervisor speed shall be between 300 bps to 115K bps.

F. Network Controller/Supervisor shall interact with printers, pagers, and host workstations.

G. The controller shall have an integrated real-time clock.

H. Error detection, correction, and re-transmission to guarantee data integrity. (Optional. Low cost is of greater importance.)

I. The NC shall provide at least one Ethernet port 10/100 mdps, one RS-232/485 port. Controllers shall allow temporary use of portable devices without interrupting the normal operation.

J. The NC shall support standard Web browser access via the Internet. It shall support a minimum of 15 simultaneous users.

K. The NC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.

L. The NC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
   1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
      a. Alarm,
      b. Return to normal,
      c. To default.
   2. Alarms shall be annunciated in any of the following manners as defined by the user:
      a. Screen message text.
      b. Email of complete alarm message to multiple recipients.
      c. Pagers via paging services that initiate a page on receipt of email message.
      d. Graphics with flashing alarm object(s).
   3. The following shall be recorded by the NC for each alarm (at a minimum):
      a. Time and date
      b. Equipment (air handler #, accessway, etc.)
      c. Acknowledge time, date, and user who issued acknowledgement.

M. Programming software and all controller “Setup Wizards” shall be embedded into the NC.

N. Controller shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The network controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

O. In the event of the loss of normal power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Nonvolatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
   1. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.
   2. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
   3. Should a controller memory be lost for any reason, the operator workstation shall automatically reload the program without any intervention by the system operators.

3.03 PRIMARY CONTROL UNITS

A. Primary control units are stand-alone units able to control HVAC equipment per the specified sequence of operation.
   1. Each controller shall be capable of performing all specified control functions independently. The primary control unit shall directly control all units, fans, and control devices. All control software shall be implemented in the primary control unit. The sequence of operation precisely identifies all points of monitoring and control.
   2. Shall monitor specific analog and digital inputs, process the data received, and produce analog or digital outputs to control the systems specified.
   3. Systems utilizing controllers that operate in a default mode only as a stand-alone will not be acceptable.
   4. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara N4 Framework, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.

B. Minimum specifications include:
   1. Microprocessor-based controllers, fully equipped with power supply, input and output terminals, internal (electronic) timeclock, and self-charging battery backup.
   2. Modular multi-tasking microprocessor based direct digital controller with minimum of 1MB of EEPROM and RAM memory.
   3. Minimum 10 bit Analog-to-Digital (A/D) converter.
   4. Minimum 12 bit Digital-to-Analog (D/A) converter.
   5. Sufficient memory for storing 288 trend values for every point (real and virtual).
   6. Controllers shall have unused physical points available for future add-ons. The number of spare points shall equal 20% of all physical points (20% AI, 20% AO, 20% BI, 20% BO) or at least two spare points of each type.
   7. Shall include all control strategies listed in “Part 4: DDC Software.”
   8. Each control loop shall be fully definable in terms of inputs and outputs that are a part of the control strategy.
   9. Each control unit shall be equipped with a communication interface connection, minimum of 16 universal analog or digital inputs and outputs, and shall communicate via the LAN to the building level controller.
   10. On board power supply for all sensors.
   11. On board sockets for plug-in resistors.
   12. Each control units shall be capable of proper operation in an ambient environment of between 32°F and 110°F and from 10% to 90% RH.

13. Control units provided for outside installation shall be capable of proper operation in an ambient environment of 0°F to 120°F, and 5 to 95% RH. If such hardware is not available, locate hardware in an accessible indoor location or as approved by the Engineer.
14. Power Failure Protection:
    a. All control panels shall be provided with automatic protection from power failure for at least 168 hours.
    b. This protection shall, at a minimum, include continuous real-time clock operation, automatic system restart upon power return, and integrity of all volatile point data.
    c. Panel outputs shall, at a minimum, be configured to remain in the last commanded state and return to the required state upon restoration of power.
15. Diagnostics: Controller shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The network controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
16. Power Failure: In the event of the loss of normal power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Nonvolatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
    a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.
    b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
    c. Should a controller memory be lost for any reason, the operator workstation shall automatically reload the program without any intervention by the system operators.
17. Certification: All controllers shall be listed by Underwriters Laboratories (UL).
    a. All controllers shall be listed by Underwriters Laboratories (UL).

C. Primary control units shall be installed on:
    1. Air handling units greater than 2,000 CFM.
    2. Air handling units with VFDs.
    3. Any application not listed in secondary and application control units.

3.04 SECONDARY CONTROL UNITS

A. Secondary control units are able to control HVAC equipment per specified by the sequence of operation.
    1. Each controller shall be capable of performing specified control functions. The secondary control unit shall directly control all units, fans, dampers and control devices. All control software shall be implemented in the secondary control unit. The sequence of operation precisely identifies all points of monitoring and control.
    2. Each controller shall monitor specific analog and digital inputs, process the data received, and produce analog or digital outputs to control the systems specified.
    3. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara N4 Framework, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.

B. Minimum specifications include:
    1. Microprocessor-based controllers, fully equipped with power supply, input and output terminals.
    2. Modular multi-tasking based direct digital controller with minimum of 2048 bytes of EEPROM and RAM memory.
    3. Minimum 8 bit Analog-to-Digital (A/D) converter.
    4. Minimum 10 bit Digital-to-Analog (D/A) converter.

5. Controllers shall have unused physical points available for future add-ons. The number of spare points shall equal 20% (20% AI, 20% AO, 20% BI, 20% BO) of all physical points or two spare points whichever is greater.
6. Shall include all control strategies listed in “Part 4: DDC Software.”
7. Each control loop shall be fully definable in terms of inputs and outputs that are a part of the control strategy.
8. Each secondary control unit shall be equipped with a USB communication interface connection, minimum of 16 universal analog or digital inputs or outputs, and shall communicate via the LAN to the network front end. Each control units shall be capable of proper operation in an ambient environment of between 32°F and 110°F and from 10% to 90% RH.
9. Control units provided for outside installation shall be capable of proper operation in an ambient environment of 0°F to 120°F, and 5 to 95% RH. If such hardware is not available, locate hardware in an accessible indoor location, in a ventilated control panel or as approved by the Engineer.

C. Secondary control unit. Secondary control units are microprocessor-based devices that are less programmable and will be used on:
   1. Small unitary equipment (flow rate less than 2,000 CFM).
   2. Fan coil units.

3.05 APPLICATION SPECIFIC CONTROL UNITS

A. Pressure Independent VAV Terminal Unit Controller
   1. General
      a. Controls shall be microprocessor based Pressure Independent Variable Air Volume Terminal Unit Controllers (VTC). The VTC shall be based on a minimum 8-bit microprocessor working from software program memory that is physically located in the VTC. The VTC controller "intelligence" shall be resident within the same enclosure that translates sensor signals into digital information.
      b. The VTC shall consist of microprocessor, power supply, enclosure, pressure transducer, field terminations, field adjustments, and operating/application system software in a single integrated package. Device shall operate remote Belimo damper actuator and valve actuator.
      c. All input/output signals shall be directly hardwired to the VTC. Troubleshooting of input/output signals shall be easily executed with a volt/ohm meter (VOM) or hand-held operator interface device or laptop.
      d. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara N4 Framework, that allow standard and customizable control solutions required in executing the “Sequence of Operation”.
   2. Non-Volatile Memory
      a. All control sequences programmed in the VTC shall be stored in non-volatile memory which is not dependent upon the presence of a battery to be retained.
      b. Power failures shall, therefore, not cause the VTC memory to be lost, nor shall there be any need for batteries to be recharged or replaced.
   3. Controller Location: To simplify controls, mechanical service and troubleshooting, all components of the VTC shall be mounted directly at the Variable Air Volume terminal box. This shall allow all controls maintenance and troubleshooting to be made while at the VTC zone location. Enclosure assembly shall be mounted and positioned so that it is easily accessible to operational personnel.
      a. The VTC shall be powered by a 24 VAC power source and shall comply with Class 2 wiring requirements.
      b. For compatibility with the environment of a VAV terminal box, the VTC shall have wide ambient ratings for specified controls, sequences, and performance. VTC shall be rated for service from 40°F to 140°F.
      c. Contractor shall submit description of location of VTC on VAV terminal box.

d. For compatibility of use in the supply or return air plenum, the VTC enclosure shall be constructed to comply with the requirements of UL-465.

4. Transducer
   a. Each VTC shall contain an integral flow transducer capable of measuring and controlling over a 0.05 to 2.00 WC range with an accuracy of +6% at full rated flow.
   b. Flow transducer shall contain an automatic recalibration circuit that eliminates transducer error due to temperature variations and long-term sensor drift.
   c. VAV box controllers not meeting this specification shall include their bid price the cost of sensor recalibration to factory tolerance on a quarterly basis for a minimum period of three years.
5. Actuator Operation
   a. Each VTC shall be capable of operating on VAV terminal boxes that require clockwise or counterclockwise primary damper operation.
   b. All actuators shall provide a proportional signal over the entire control range.
   c. Actuators shall stop automatically at end of travel and shall include a permanently lubricated gear train.
   d. Interface to the VAV terminal box shall be directly to the damper shaft or through electrical connection to an existing 24 VAC bi-directional motor operator.
   e. All actuators shall be Belimo. None others will be accepted.
6. Operational Features
   a. Each VTC shall have a discharge temperature sensor that provides data to the BAS.
   b. Each VTC shall support the setup of the minimum and maximum flow setpoints, the cooling setpoint as well as the heating or parallel fan start point setpoints without the need for a separate hand-held communications device. In addition, the configuration modes described earlier in this specification must also be definable at the VTC without requiring an external hand-held communications device.
   c. The set-up of the above parameters shall be permanent in the VTC, a power failure shall not require the reconfiguration of the VTC operating parameters.
7. BAS Communication/Control With VTC application control unit: BAS shall be in continual direct communication with the VTCs implemented in the facility. VTCs shall perform all control as specified in control functions for the respective VAV terminal box.

PART 4 DIRECT DIGITAL CONTROLS - SOFTWARE

4.01 SYSTEM SOFTWARE

A. OPEN NIC STATEMENTS – All Niagara N4 software licenses shall have the following NiCS: ‘accept.station.in=*”; “accept.station.out=*”and “accept.wb.in=*”and “accept.wb.out=*”. All open NIC statements shall follow Niagara Open NIC specifications.

B. Stand-alone Digital Controller (SDC) Software:
   1. All Stand-alone controllers shall have as a standard feature, a complete library of control algorithms for DDC, Energy Management, and Facilities Management functions. These resident libraries of algorithms shall be drawn from for the creation of the application programming of each individual controller.
   2. Contractor shall provide a blueprint documentation of the software application program for each controller. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences.
   3. For systems utilizing program listings: A program listing shall be printed onto the same blueprint, along with the program flowchart, and description of the sequence of operation. This blueprint shall be stored and maintained in each controller.
   4. System acceptance shall not be completed until this documentation is provided.
   5. The stand-alone software library shall include as a minimum, the following programs:
      a. Direct Digital Control Functions:
         1) Setpoint Reset
         2) Ramp
         7) Linear Sequencer
         8) Rotating Sequencer

3) Floating ON/OFF
4) 2-Position ON/OFF
5) PID Loop
6) Self-tune PID Loop
9) Binary Sequencer
10) High/Low Select
11) Energy Dead Band
12) Thermostat

b. Energy Management Control Functions:
1) Duty Cycle
2) Temperature Compensated Duty Cycling
3) Optimum Start/Stop
4) Electric Demand Limiting
5) Weekly Scheduling
6) Calendar Scheduling
7) Enthalpy Changeover

c. Math and Logic Functions:
1) Add
2) Subtract
3) Multiply
4) Divide
5) Square root
6) AND, OR, XOR, NAND, NOR
7) Invert
8) Averaging
9) Summation
10) Totalize
11) Pulse Count Conversion
12) Time Delay
13) Sensor Curve Fit
14) CFM Calculation
15) BTUH Calculation

d. Facilities Management Functions:
1) Analog High/Low Alarm
2) Digital Alarm
3) Trend Log Reporting
4) Daily EMS Report
5) Monthly EMS Report
6) Maintenance Time Reminders
7) BTUH Trend

e. HVAC Application Functions:
1) Constant Volume Single Zone
2) Heat Pump
3) Multizone
4) Variable Air Volume (Dual & Single Fan VAV Systems)
5) Fan Tracking VAV
6) Boiler Optimization
7) Chiller Optimization
8) MICROFLO /TM/ Interface
9) MICROZONE /TM/ Interface
10) Supply Air Optimization
11) Hot Deck Optimization
12) Cold Deck Optimization

6. Stand-alone controllers not capable of performing the above listed software programs without the host computer will not be acceptable. Programs must be maintained regardless of communication with the host computer.
7. Programs shall be provided as required to meet the sequence of operation as specified.
8. All programming resident to the stand-alone controller, including but not limited to, application programs and point database, shall be protected from loss due to power failure for a minimum of six months. Systems not providing nonvolatile memory shall provide battery backup sufficient to provide protection for six months.

4.02 SYSTEM OVERVIEW

A. The BAS Contractor shall provide system software based on server/thin-client Engineer, designed around the open standards of web technology. The BAS server shall communicate

using Ethernet and TCP\IP. Server shall be accessed using a web browser over Owner network and remotely over the Internet.

B. The intent of the thin-client Engineer is to provide the operator(s) complete access to the BAS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support Microsoft and Netscape Navigator browsers (6.0 or later versions), and Windows as well as non-Window operating systems. No special software, other than free public domain programs such as “JAVA VIRTUAL MACHINE” shall be required to be installed on PC’s used to access the BAS via a web browser.

C. The BAS server software must support at least the following server platforms (Windows, and/or Linux). The BAS server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.

D. The web browser GUI shall provide a completely interactive user interface and must offer and be configured with the following features as a minimum:
   1. Trending
   2. Scheduling
   3. Electrical demand limiting
   4. Duty Cycling
   5. Downloading Memory to field devices
   6. Real time ’live’ Graphic Programs
   7. Tree Navigation
   8. Parameter change of properties
   9. Setpoint Adjustments
   10. Alarm / Event information
   11. Configuration of operators
   12. Execution of global commands
   13. Add, delete, and modify graphics and displayed data

E. Software Components: All software shall be the most current version. All software components of the BAS system software shall be provided and installed as part of this project .BAS software components shall include:
   1. Server Software, Database and Web Browser Graphical User Interface
   2. System Configuration Utilities for future modifications to the system, and controllers.
   3. Graphical Programming Tools
   4. Direct Digital Control software
   5. Application Software
   6. Any required third party software
   7. If licensing credits are required provide a minimum of 10% additional to as built control system requires.

F. BAS Server Database: The BAS server software shall utilize a Java DataBase Connectivity (JDBC) compatible database such as: MS SQL 8.0, Oracle 8i or IBM DB2. BAS systems written to Non -Standard and/or Proprietary databases are NOT acceptable.

G. Database Open Connectivity: The BAS server database shall allow real time access of data via the following standard mechanisms:
   1. Open protocol standard like SOAP
   2. OLE/OPC (for Microsoft Client’s/Server platform only)
   3. Import/Export of the database from or to XML (eXtensible Mark-up Language)

H. Communication Protocol(s): The native protocol for the BAS server software shall be TCPIP over Ethernet. Proprietary protocols over TCP/IP are NOT acceptable.

I. Thin Client – Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:
   1. Web Browser's for PC's: Only a 5.5 or later browser (Explorer/Navigator) will be required as the GUI, and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.
   2. Secure Socket Layers: Communication between the Web Browser GUI and BAS server shall offer encryption using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper-Text Transfer Protocol (HTTP)

4.03 WEB BROWSER GRAPHICAL USER INTERFACE

A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.

B. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and password. Navigation in the system shall be dependent on the operator's role privileges, and geographic area of responsibility.

C. Navigation: Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft's Explorer program), and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment, and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.

D. Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and objects.

E. Groups View shall display Scheduled Groups and custom reports.

F. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

G. Action Pane: The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. A functional view shall be accessed by clicking on the corresponding button:
   1. Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh.
   2. Graphic pages for viewing at workstations and smart devices shall differ. Smart device graphics shall be more condensed for viewing on these types of devices. Provide an option upon entering the system from a smart device for viewing full graphics version or just the smart version.
   3. Properties: Shall include graphic controls and text for the following: Locking or overriding objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an 'accept/cancel' button.

4. Schedules: Shall be used to create, modify/edit and view schedules based on the systems geographical hierarchy (using the navigation tree).
5. Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.
6. Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling
7. Logic - Live Graphic Programs: Shall be used to display' live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.
8. Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.

H. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated .gifs or .jpg, vector scalable, active setpoint graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
   1. Display Size: The GUI workstation software shall graphically display in 1024 by 768 pixels 24 bit True Color.
   2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
   3. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective setpoints. The colors shall be updated dynamically as a zone's actual comfort condition changes.
   4. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
   5. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
      a. Each piece of equipment monitored or controlled including each terminal unit
      b. Each building
      c. Each floor and zone controlled

I. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day 'Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the 'Independence Day' Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
   1. Schedules: Schedules shall comply with the LonWorks standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
      a. Types of schedule shall be Normal, Holiday or Override.
      b. A specific date
      c. A range of dates
      d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any).
      e. Wildcard (example, allow combinations like second Tuesday of every month).
   2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of "things" to be scheduled; for example, lighting, HVAC

occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.

3. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an 'individual tenant' group – who may occupy different areas within a building or buildings. Schedules applied to the 'tenant group' shall automatically be downloaded to control modules affecting spaces occupied by the 'tenant group'
4. Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler, and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
5. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
6. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

J. Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an 'Alarms' view. Alarms, and reporting actions shall have the following capabilities:

1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report, and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
2. Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
3. Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
4. Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.
5. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
6. Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A 'network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.
7. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement, and total number of Alarms in the BAS Server database.
8. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.

9. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BAS server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
    a. Print: Alarm information shall be printed to the BAS server's PC or a networked printer.
    b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
    c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
    d. Write Property: The write property reporting action updates a property value in a hardware module.
    e. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
    f. Run External Program: The Run External Program reporting action launches specified program in response to an event.

K. Trends: Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
    1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
    2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BAS server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
    3. Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.
    4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
    5. Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and 'pan through' historical data by simply scrolling the mouse.
    6. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
    7. Copy/Paste. The operator must have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).

L. Security Access: Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Password. Access to different areas of the BAS system shall be defined in terms of Roles, Privileges and geographic area of responsibility as specified:
    1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of 'easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
        a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.

b. Edit Privileges shall comprise: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.

2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

4.04 GRAPHICAL PROGRAMMING

A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL is a method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors, etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.

B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

C. Graphic Sequence: The clarity of the graphic sequence must be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming must be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

D. GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:
1. Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
2. Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
3. Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
4. Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
5. Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
6. Parameter: A parameter shall be a value that may be tied to the input of a microblock.
7. Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain

various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.

8. Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
9. Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
10. Live Graphical Programs: The Graphic Programming software must support a 'live' mode, where all input/output data, calculated data, and setpoints shall be displayed in a 'live' real-time mode.

PART 5 SYSTEM SETUP

5.01 RESPONSIBILITIES OF INSTALLER AND PROGRAMMER

A. This section further defines the responsibilities of the installer and programmer.

B. The following features shall be incorporated into the final delivered product.

C. System shall allow up to five (5) different remote (wet base) viewers to access and modify data (level 1 access) at the same time.

D. Match District standards for passwords, point naming, alarms, trending, schedules and reports.

5.02 OVERRIDES

A. The DDC system should recognize the override and report to the screen and the printer.

B. Software shall have adjustable time limits for each override.

5.03 SAFETY CIRCUITS

A. All safety circuits shall be hard wired circuits with independent manual reset type switches.

5.04 LABELING AND IDENTIFICATION

A. All devices relating to the work or systems included herein, including controllers, valves, motors, relays, etc., shall be identified with a unique identification number or name on the submitted engineering drawings. This identification number or name, along with the service of the device (discharge air controller, mixed air controller, etc.), shall be permanently affixed to the respective device.

B. All field devices will be supplied with a nameplate indicating its name, number, address, and all other pertinent information.

C. If the field device is too small for the nameplate to be "adhered" to or on another piece of equipment near it (e.g., nameplate on air handling unit at wire penetration for mixed air temperature sensor), then attach the nameplate via nylon ties.

D. Tagging shall be computer generated. For input/output wiring, cabling, or tubing, the panel side of the terminals shall be labeled with the automation panel circuit board and terminal numbers associated with the point. The field side shall be labeled with the point number. Cable, wiring and tubing not specifically associated with an input or output shall be labeled with a number and function.

E. All wiring, tubing, and cabling both inside and outside of control panels shall be labeled at both ends using Thomas and Betts EDP printable wire and cable markers using style WSL self-

laminating vinyl. Input and output cables and wiring shall be labeled with the point number and the point description, such as:

CPDPS005
Primary Heating Water
Pump #1 On/Off Status

F. Cable and wiring not specifically associated with an input or output shall be labeled with a number and a function description such as:

120 VAC
Panel #

G. Raceway Identification. All the covers to junction and pull boxes of the control system raceways shall be painted blue, or have identification labels stating “Control System Wiring” affixed to the covers. Labels shall be typed, not hand written.

H. Wire Identification. All low and line voltage control wiring shall be identified by a number, as referenced to the associated control diagram, at each end of the conductor or cable. Identification number shall be typed and permanently secured to the conductor or cable. Wiring to all control devices shall be labeled at each end of the conductor with the point name and description.

5.05 INSTALLATION DETAILS

A. Low Differential Air Pressure Applications (Under 5” w.c.) Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent easy-to-use connection. Provide a minimum of a NEMA 1 housing for the transmitter. Locate transmitters in accessible local control panels wherever possible. Except on VAV box applications.

B. Medium to High Differential Water Pressure Applications (5” to Over 21” w.c.): Mount stand-alone pressure transmitters in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with hi and low connections piped and valved. Air bleed units, bypass valves and compression fittings shall be provided.

C. Building Differential Air Pressure Applications (-1” to +1” w.c.): Mount pressure transmitter in the local control panel. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind. The interior tip shall be inconspicuous and located within a central corridor shown on the drawings.

D. Outside Air Sensors: Outside air sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air temperatures accurately. Sensors exposed to solar radiation must be installed with solar shields. Sensor’s which are exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element.

E. Duct Temperature Sensors: Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned to be easily accessible for repair or replacement. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. For ductwork greater in any dimension that 48 inches and/or air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor with multiple sensing points. The sensor shall be mounted to suitable supports using factory approved element holders. For large plenum applications such as mixed air temperature measurements, utilize a string of sensors mounted across the plenum to account for stratification and/or air

turbulence. The averaging string shall have a minimum of 4 sensing points per 12 feet long segment.

F. Low Temperature Limit Switches: Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

PART 6 SYSTEM COMMISSIONING AND TRAINING

AIR AND WATER BALANCING SHALL BE COMPLETED (AND DISCREPANCIES RESOLVED) BEFORE CONTROL CONTRACTOR'S FINAL SYSTEM CHECK AND BEFORE THE ACCEPTANCE TEST TO BE CONDUCTED IN THE PRESENCE OF THE ENGINEER/COMMISSIONING AGENT.

6.01 CONTROL TECHNICIAN MEETING REQUIREMENTS

A. During all pre-installation meetings with Owner/Engineers and separate meetings pertaining to the commissioning process, the control technician attending the meetings must be the same technicians that are/will install and program the DDC system.

B. The Control Contractor's installer and programmer must attend all the commissioning meetings. These meetings occur throughout the design and construction process.

C. First Meeting - Discuss point naming and sequence of operation with Engineer and Owner
1. Prior to software and database installation and checkout but subsequent to software and database development, the Control Contractor shall meet with the Owner and the Engineer and review the database and program code in detail on a point by point, sequence by sequence basis. The Control Contractor (using blueprints and this specification) shall provide the project point list and sequence of operation to initiate discussion.
2. Any necessary modifications required to make the database and sequence match the intent and requirements of the contract documents shall be identified at this meeting including point names, descriptors, alarm setpoint, numeric setpoint requirements, access requirements, sequence adjustments, etc.
3. Successful completion of this review process will result in software and database approval for installation and start-up. Any software or database that is installed prior to this approval process shall be corrected to match the results of the approval process at no additional cost to the Owner.
4. The results of this meeting shall be documented in meeting minutes taken and issued by the Control Contractor. Documentation can be in the form of marked up data base forms and sequences of operation.

D. Second Meeting - graphic screen development shall be coordinated with the Owner through a series of meetings that will allow the functions described above (sequence of operation, alarms, etc.) and any other Owner's requirements to be incorporated into the graphic screens.

6.02 PRE-COMMISSIONING TESTING, ADJUSTING, AND CALIBRATION REQUIREMENTS

A. Prior to acceptance, the following steps will be used by the Control Contractor to produce a testing and pre-commissioning report by system to be submitted for approval by the Engineer/Commissioning Agent or Owner.

B. Work and/or systems installed under this section shall be fully functioning prior to Demonstration, Acceptance Period and Contract Close Out. Control Contractor shall start, test, adjust, and calibrate all work and/or systems under this contract, as described below:

1. Verify proper electrical voltages and amperages, and verify all circuits are free from grounds or faults.
2. Verify integrity/safety of all electrical connections.
3. Verify proper interface with fire alarm system.
4. Coordinate with TAB subcontractor to obtain control settings that are determined from balancing procedures. Record the following control settings as obtained from TAB contractor (and note any TAB deficiencies):
   a. Minimum outside air damper settings for air handling units and CFM values.
5. Test, calibrate, and set all digital and analog sensing, and actuating devices.
   a. Calibrate each instrumentation device by making a comparison between the DDC display and the reading at the device, using a standard traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be calibrated (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range). Record the measured value and displayed value for each device in the Pre-Commissioning Report.
   b. All analog input points are to be tested by comparing the reading obtained through the workstation and through an independent reading device (meter).
   c. Check each analogue output by making a comparison between the control command at the DDC controller and the status of the controlled device. Check each output point by making a comparison of the state of the sensing device and the Host computer display. Record the results for each device in the Pre-Commissioning Report.
      1) All analog output points are to be tested using a command from the workstation modulating the output in 10% increments and recording the associated voltage/amps sent to the controlled device.
6. Check each digital input/output point by making a comparison between the control command at the DDC controller and the status of the controlled device. Check each digital point by making a comparison of the state of the sensing/control device and the Host computer display. Record the results for each device in the Pre-Commissioning Report.
   a. ON/OFF commands from the workstation should be performed in order to verify its true operation.
7. Check and set zero and span adjustments for all actuating devices. Manually activate damper and valve operators to verify free travel and fail condition. Check valve or damper to insure that it shuts off tight when the appropriate signal is applied to the operator. Adjust the operator spring compression as required. If positioner or volume booster is installed on the operator, calibrate per manufacturer's procedure to achieve spring range indicated. Check split range positioner to verify proper operation. Record settings for each device in the Pre-Commissioning Report.
8. Verify proper sequences of operation. Record results and submit with Pre-Commissioning Report. Verify proper sequence and operation of all specified functions by adjusting input variable to determine if sequence of operation is operating as specified.
9. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the Pre-Commissioning Report. Except from a startup, maximum allowable variance from set point for controlled variables shall be as follows:
   a. Air temperature: ± 0.5 degrees F
   b. Water temperature: ± 1 degrees F
   c. Duct pressure: ± 0.05 inches wc

C. Pre-Commissioning Testing, Adjusting, and Calibration shall be completed prior to Substantial Completion.

D. Provide Pre-Commissioning Test Report for approval by the Engineer/Commissioning Agent or Owner before system demonstration.

6.03 DEMONSTRATION

A. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Control Contractor has completed the installation, started up the system, and performed its own tests (outlined in 6.1 and to be submitted in writing).

B. The tests described in this section are to be performed in addition to the tests that the Control Contractor performs as a necessary part of the installation, startup, and debugging process. The Commissioning Agent/ Engineer will be present to observe and review these tests. The Commissioning Agent/Engineer shall be notified at least 10 days in advance of the start of the testing procedures.

C. Demonstration shall not be scheduled until all hardware and software submittals, and the Pre-Commissioning Test Report are approved by the Commissioning Agent/Engineer.

D. Verifying compliance of equipment operation and sequence of operation with this specification through all modes of operation.
   1. If more than 10 percent of the demonstrated equipment operation and sequence of operation fails to operate per the submittals, the demonstration test will be rescheduled after the control contractor takes corrective action.
   2. If the Control Contractor fails to demonstrate proper equipment operation and sequence of operation in the second round of tests, the Commissioning Agent/Engineer's costs for witnessing all further demonstration may be assigned to the Control Contractor by the Owner as a deduct to their contracted price. Note: The Control Contractor will not be responsible for costs related to poor design or to other factors beyond their control, though it is expected to call any design concerns and other factors beyond their control that might cause system failure to the attention of the Commissioning Agent/ Engineer and the Owner.

E. Programming changes for correction of improperly programmed sequences will not be considered legitimate reasons for change orders.

F. Demonstration/Commissioning Software:
   1. Provide fully licensed copy of the required BAS workstation graphic software to be used by the Commissioning Agent/Engineer on a remote computer (not included in contract) for accessing the BAS network via modem. This software copy shall be used only for the purpose of commissioning this project. The Owner agrees that the commissioning BAS software license shall become null and void upon termination of the Contract Warranty Period. The software shall be returned to the Control Contractor within one year after system acceptance.
   2. Software shall be fully configured to view project specific database and shall include trend logs, specified graphic screens, alarms, and reports.
   3. Provide assistance by telephone upon request if required to assist Commissioning Agent/Engineer in setting up software on Commissioning Agent/Engineer's remote computer.
   4. Submit one complete set of programming and operating manuals for all graphics software packages concurrently with the commissioning software. This set will be returned to the Control Contractor within one year after system acceptance.

G. The Control Contractor shall provide at least two persons equipped with two-way communication, and shall demonstrate actual field operation of each controlled and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the Control Contractor.

H. As each control input and output is checked, a log shall be completed showing the date, technician's and Commissioning Agent/Engineer's initials, and any corrective action taken or needed.

I. The system shall be demonstrated following the same procedures used in Pre-Commissioning (Section 6.1)

J. Demonstrate that all points specified and shown can be interrogated and/or commanded (as applicable) from all workstations.

K. At a minimum, demonstrate correct calibration of input/output devices using the same methods specified for the pre-commissioning tests. A maximum of [10] percent of I/O points shall be selected at random by Commissioning Agent/Engineer for demonstration. Upon failure of any device to meet the specified accuracy, an additional [10] percent of I/O points shall be selected at random by Commissioning Agent/Engineer for demonstration. This process shall be repeated until 100 percent of randomly selected I/O points have been demonstrated to meet specified accuracy.

L. The Contractor shall demonstrate that the panels' response to LAN communication failures meet the requirements of these Specifications.

M. Demonstrate that required trend graphs and trend logs are set up per the requirements. Provide a sample of the data archive. Indicate the file names and locations.

N. Demonstrate successful communication of point values between the BAS and other HVAC equipment (e.g., chiller).

O. Demonstrate complete operation of Operator Interface such as graphic screens, trend logs, alarms, etc.

P. Additionally, the following items shall be demonstrated:
   1. DDC Loop Response. The Control Contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point that represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 1 second to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values (e.g., VFD frequency or Amperage). Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Control Contractor.
   2. Optimum Start/Stop. The Control Contractor shall supply a trend data output showing the capability of the algorithm. The 5 minute trends shall include the operating status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
   3. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the Commissioning Agent/Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.
   4. The DDC and HVAC systems will be shut down for 15 minutes and then re-started. Within 15 minutes, the DDC system shall start and obtain stable control of the HVAC systems without safety trips, alarms, or excessive deviations in temperature and pressure (as defined by the Engineer).

Q. System acceptance shall occur within 120 days of substantial completion. Any delay beyond this period of time shall initiate liquidated dampers unless waived by Owner. Failure or delays on Engineers / Owners part shall not be included in 120 day count.

6.04 ACCEPTANCE

A. All tests described in this specification shall have been performed to the satisfaction of both the Commissioning Agent/Engineer and Owner prior to the acceptance of the control system as meeting the requirements of this document.

B. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved.

C. The warranty period starts when the Commissioning Agent/Engineer accepts the system and provides this acceptance in written from the Owner and the Control Contractor.

D. Any tests that cannot be performed due to circumstances beyond the control of the Control Contractor may be exempt from the Completion requirements if stated as such in writing by the Commissioning Agent/Engineer. The Owner shall then perform such tests no later than 3 months after the building is occupied. The costs for these additional tests will be incurred by the Control Contractor.

6.05 SPARE PARTS

A. The Control Contractor shall provide two spare fuses of the correct size and capacity for each fuseholder located in all the installed control systems and the Control Contractor’s related equipment.

B. The Control Contractor shall provide two spare pilot lights for each control unit that contains one or more pilot lights.

6.06 TRAINING

A. Provide a minimum of four separate 4-hour on-site training sessions after system acceptance and at the Owner's request. The initial training session will occur after the as-built drawings and submittals have been provided and the Engineer has accepted the system. The other training sessions will occur up to 12 months after the first training session and at the Owner’s request.

B. Training shall be a mix of classroom instruction, test exercises, and actual keyboard entry and screen viewing at the operator’s terminal. Hands-on experience and problem solving shall be emphasized.

C. If during any training session, the trainer debugs more than two (2) items, the training session will be immediately terminated. The session will be rescheduled for another date. The re-scheduled training session will be carried out for the full four hours at no additional cost to the Owner.

D. The first training shall be oriented to making the Owner self-sufficient in the day to day use and operation of the DDC system. Additionally, the training shall include:
   1. System start-up, shutdowns, power outage and restart routines, alarms, security levels, changing setpoints, changing schedules and other parameters, overrides, freeze protection, manual operation, return to automatic operation, and resetting equipment.
   2. All screens shall be discussed (allow time for questions).
   3. Information specifically focused on showing the Owner methods of troubleshooting the mechanical systems using the BAS.
   4. Use of laptop and hand-held operator interface device.
   5. Creating, modifying, viewing, downloading, and reloading, trend logs. School District staff shall set up at least six trends during training.
   6. Remote access to the system via Web, network, and/or phone lines.

E. The other training sessions shall be oriented toward answering specific questions from Maintenance staff.

F. The trainer must be well grounded in both DDC system operation and in mechanical systems service and should be the programmer.

G. The Owner may specify another site for training if desired.

H. Factory Training: Provide training at a Manufacturer's Factory Training Center on the operation of the system for two Maintenance staff. Minimum 4 days of training. This training should be considered the level of training provided to Contractor with franchise license for the digital control system installed. Control Contractor shall pay travel, lodging and meal costs, and registrations fees. Provide all documentation from presentation for Owner's future reference.

I. Factory training shall include, at a minimum:
   1. Creating and modifying the sequence of operation.
   2. Generating graphics.
   3. Field programming
   4. Programming and operation of the JACE device.

END OF SECTION

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the sequence of operations for HVAC control systems specified elsewhere in these specifications.

B. Related Work: The requirements of Section 23 05 00, Common HVAC Materials and Methods, also apply to this Section.

PART 2 PRODUCTS

2.01 NO PRODUCTS LISTED FOR THIS SECTION

PART 3 EXECUTION

3.01 SEQUENCE OF OPERATIONS

A. Provide a complete and operational temperature control and building automation system based on the following points and sequence of operation, complete as to sequences and standard control practices. The determined point list is the minimum amount of points that are to be provided. Provide any additional points required to meet the sequence of operation.

B. Object List:
   1. The following points as defined for each piece of equipment are designated as follows:
      a. Binary Out (BO) - Defined as any two-state output (start/stop) (enable/disable), etc.
      b. Binary In (BI) - Defined as any two-state input (alarm, status), etc.
      c. Analog In (AI) - Defined as any variable input (temperature) (position), etc.
      d. Analog Out (AO) - Defined as any electrical variable output. 0–20mA, 4–20mA, 0–10VDC are the only acceptable analog outputs. The driver for analog outputs must come from both hardware and software resident in the controllers. Transducers will not be acceptable under any circumstance.

C. Occupancy and Performance Time Periods:
   1. Occupied Period is signaled automatically by adjustable settings at DDC server, Building Controller, Application Controller and also, at each zone when zone bypass timer is activated.
   2. Warm-up period occurs one hour before occupied start time or as calculated by Building Controller based on system performance history and outside air temperature.
   3. Unoccupied period occurs whenever Occupied, Warm-up, and Cool-down are not in effect.

PART 4 SEQUENCE OF OPERATION

4.01 LEVEL OF DETAIL

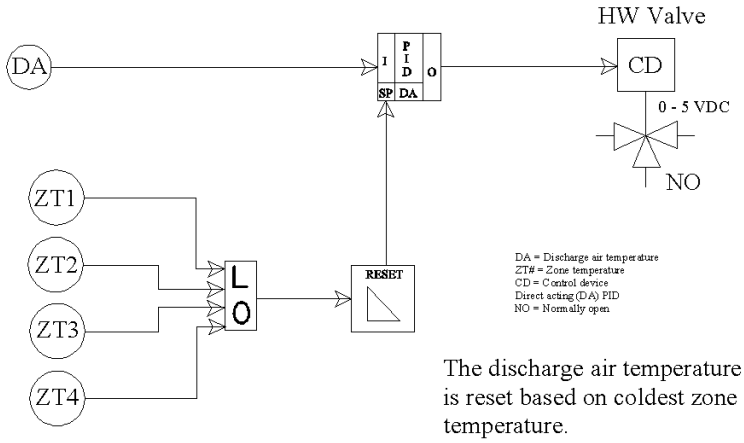
A. Major changes in provided sequence of operation must be approved of in writing by the Owner and the Engineer.

B. The Control Contractor shall provide two types of documentation for each system (e.g., boiler plant, VAV system, etc.). The two types of documentation include:
   1. Control Logic

a. Control logic shall be a series of statements providing, for each system, the following items:
   1) Identification of control process
   2) Narrative of control loop or logic algorithm
   3) Control parameters such as setpoints and differentials (e.g., throttling range, gains) reset schedules, and adjustable parameters for all points
   4) Identification of all constraints, limits, or interlocks that apply to control loop
   5) Identification of all DO, DI, AO, AI points that apply to system
   6) Identification of all communication needs (data points from outside control unit)

2. Logic Diagrams
   a. For each control logic system, a logic diagram shall show the actual interaction of the points (real and virtual) and the logic algorithm.
   b. The diagram should identify
      1) System being controlled (attach abbreviated control logic text)
      2) All DO, DI, AO, AI points
      3) Virtual points
      4) All functions (logic, math, and control) within control loop
      5) Legend for graphical icons or symbols

5



The discharge air temperature is reset based on coldest zone temperature.

4.02 STANDARDIZATION

A. All control loops will be standardized throughout the programming code.

4.03 PROGRAMMING GUIDELINES

A. All adjustable setpoints shall be developed as software points stored at memory locations so that setpoints can be changed by recommending the data stored at the memory location rather than by entering the program and changing parameters and lines in program code.

B. Where reset schedules are specified or required the schedules shall be set up so that the operator enters the following points into memory locations.
   1. Two points for the independent variable on the reset schedule.
   2. Two points for the dependent variable on the reset schedule.

   The computer system shall then use these values as input parameters to the appropriate program or programs and calculate the reset schedule based on these values.

C. Where several analog outputs are to be controlled in sequence by one control loop, software shall be arranged so that the sequence is guaranteed regardless of the spring range of the actuators and to prevent simultaneous heating and cooling.

D. Programs controlling several pieces of equipment as one system shall reside in one control unit. Where programs use data points that reside in other control units the programs shall employ logic (either in software, firmware, hardware, or a combination of all three) to detect loss of communications with the remote control units containing the required data. When such a failure is detected, the program logic shall revert to a safe operating mode that will allow the controlled systems to remain in operation until normal system communication resumes. A pilot light on the control unit shall be illuminated when such a failure mode exists. In addition, an alarm shall be sent to the HOST computers (alarm level 4). The software shall track this type of alarm and report if communication failure is higher than expected (this condition shall generate an alarm level 3, with descriptive text, at the HOST computer). All safe operating modes shall be approved by the Engineer prior to implementation.

E. Control sequences that use outdoor air conditions to trigger certain specific operating modes shall use data generated by one outdoor air temperature sensor and one outdoor humidity sensor. In other words, the data from one pair of sensors shall be shared by the entire system.

F. All safety circuits shall be hard wired circuits using standard snap acting electric or pneumatic switches as required by the function, and shall be totally independent of the DDC system controllers. This includes interlocks that return dampers and valves to some normal, fail-safe position when the system they are associated with shuts down. It is the intent of this paragraph that the systems have the capability to be operated manually complete with safeties and fail safe interlocks even if the DDC system is off line.

G. Provide hours of operation accumulation and lead/lag sequencing of equipment based on hours of operation for all equipment with proof of operation inputs.

H. Global point name changing:
   1. The system shall provide an easy means to allow the operator to change a point name such that the point will automatically be referenced everywhere in the system by the new name.
   2. If a point name is removed from the database, any program code where the name appears must show an appropriate error signal for undefined point when the program is viewed, edited, or printed.

I. Synchronization of real-time clocks between all control panels shall be provided.

4.04 GENERAL SEQUENCE OF OPERATION GUIDELINES

A. Control of all central fan systems, boilers, DX units, heaters, and pumping stations shall be based on run requests, heating requests or cooling requests from zone controls.

B. Reset of supply air temperature and hot water temperature shall be based on zone temperature conditions via the zone's percentage of heating or cooling load.

C. Unless otherwise indicated, all control loops will use PID loops. The coefficient for the derivative component is zero (0) unless otherwise indicated.

D. All HVAC system controls shall be designed such that simultaneous heating and cooling, reheating, and recooling are minimized. This applies as well to non-mechanical treatment of mixed air (e.g. outside air, heat recovery, etc.) which must then be mechanically reheated or recooled.

E. Alarms: Except as directed otherwise by the Owner, all alarms will be registered at the building operator's terminal as well as at the Maintenance Building remote operator's station. Alarms are to be registered with a message explaining the nature of the alarm and which building/location the alarm is in.

F. Whenever a set-point is referred to as "adjustable" in these standards, the set-point is to be easily and directly adjustable at the operator's terminal and Maintenance Building remote operator's station, and is not to require any code modification. This may require assigning virtual points to all adjustable set-points. Frequently adjusted points, including space temperature set-points, shall be adjustable from the graphics screen (e.g., floor plan screen).

G. There are many interlocks and limits within each control loop or algorithm that may not be obvious or stated in this specification. The Control Contractor is responsible for identifying and programming these interlocks and limits into the software. The CO_2 Demand Ventilation Control algorithm is a good example of the complexity of the control loop with interlocks and limits.

H. The Control Contractor will replace any and all equipment (actuators, chillers, etc.) that fail due to programming errors. Such errors include, but are not limited to: moving actuators a couple fractions of a degree every second or so in response to some infinitesimal change in a measured variable or repeatedly turning equipment on/off within a short time period. The Control Contractor will avoid these problems by incorporating time delays, dead bands, and other programming techniques into the sequence of operation.

I. Programmable time-of-day (start/stop) control shall be implemented for all HVAC equipment, except for:
   1. Equipment that is interlocked with other equipment under direct start/stop control (e.g. exhaust fans interlocked with an air handling unit).
   2. Equipment that must run continuously for reasons of safety.
   3. As otherwise noted in these standards.

J. Auto-tuning algorithms will not be used to initially tune control loops.

4.05 SEQUENCE OF OPERATION GUIDELINES

A. This specification is intended to refine or elaborate on the sequence of operations provided by the Engineer. Note: there are many issues that may make any of these standard sequences inapplicable to a specific situation: thus, the Control Contractor should obtain written approval by the Engineer to implement the sequence of operations contained in this specification.

B. The Control Contractor shall adhere to all applicable specifications, unless they submit written exceptions to the Owner and Engineer and such exceptions are approved in writing. Written exceptions shall state the specification's sequence of operations, the Control Contractor's proposed sequence of operations, and the reasons why the proposed sequence specifications are preferable to the sequences in this specification or those provided by the Engineer.

C. It is the Control Contractor's responsibility to improve upon these specified sequences of operations if necessary. All improvements will be provided in writing to the Engineer for his/her written approval.

D. The Control Contractor is responsible for accurately controlling and communicating with all packaged fan units or air handling units.

4.06 SEQUENCE OF OPERATION – SCHEDULING

A. The system will have the three (3) schedules that will be utilized based on the type of event selected by the building operator. The operator will be able to select the desired schedule to be

actively used and select the equipment group to be associated with each schedule (equipment selection is user adjustable).

B. Occupancy Override: The building operator shall be able to initiate occupancy (occupied operation) from the building operator's workstation (overriding any non-occupied sequences) for each individual air handling system. Override will last for eight (8) hours (adjustable) and then revert back to the current operating mode. Operator will be able to release override at any time during the override period.

C. The building operator will be able to command start of occupancy at the operator's terminal and at the Maintenance Building remote operator's station (overriding the optimal start sequence) for each individual air handling system and globally for all air handling systems in the building.

4.07 SPACE TEMPERATURE SETPOINTS

A. Default Set-points:
   1. Occupied Heating Set-point: 70 °F (adjustable)
   2. Occupied Cooling Set-point: 75 °F (adjustable)
   3. Unoccupied Heating Set-point: 55 °F (adjustable)
   4. Unoccupied Cooling Set-point: 85 °F (adjustable)

B. Space Set-point Adjustment:
   1. Adjustment (General): Set-point adjustments may be accomplished either at the operator workstation or locally at the thermostat.
   2. Adjustment Range: Set-point adjustments are limited to (+/-) 2°F (adjustable). Space temperature dead band (4 °F, adjustable) is maintained during set-point adjustments.

4.08 SEQUENCE OF OPERATION FOR VAV AIR HANDLERS

A. Supply Fan Control:
   1. This section applies to supply fans that are modulated by variable frequency drives (VFDs).
   2. Static Pressure Control:
      a. Supply fan volume is controlled to maintain the duct static pressure at setpoint as sensed at remote static pressure sensor.
      b. Ensure that the static pressure signal is communicated quickly to the control loop (and not delayed due to network timing) and that a default value is set in the event of a network failure.
      c. Control duct pressure at AHU:
         1) Initiate start fan command before signal sent to VFD
         2) Run timer should limit initial start up to 50% full power (ramp up without overshooting)
         3) Ramp-up and ramp-down incremental changes shall be equal.
         4) Use P or PI loop to control fans speed based on static pressure setpoint.
      d. Pressure Reset Control: On any (2) (adjustable) VAV box dampers at 100% (adj.) open reset discharge static pressure up by 0.010" (adj.) WC every 5 minutes. On all VAV dampers at 95% (adj.) open or less reset discharge pressure down by 0.05" (adj.) WC every 5 minutes.
   3. Variable speed drive acceleration settings, deceleration settings, minimum speeds, etc. shall be adjusted at start up in coordination with the drive supplier and installer to achieve stable control system performance.
   4. Fan speed is reset to 0 (zero) Hz when the AHU is off.
   5. Coordinate signal from fire alarm panel to duct mounted smoke detector. One signal to detector disables fan (Hz = 0), waits 15 seconds (adjustable), and starts smoke damper closing.

6. Duct High Pressure Shutdown: When the duct pressure exceeds the high limit set point (4" in H2O, adjustable at the device) the fan will shut down for three (3) minutes (adjustable) and then attempt to restart. If three (3) restart attempts occur over a period of 15 minutes (adjustable), the system shall be disabled (software). Lockout reset will occur at the operator's workstation.

B. Return Fan Control:
1. This section applies to return fans with variable frequency drives (VFDs).
2. Fan will start/stop when supply fan starts.
3. Space pressure Control, Return Fan Speed Endpoints: The return fan shall modulate based on supply fan speed and outside air damper position. The air balancing contractor will attain the return fan speed based on the following values for the given operating mode.

Return Fan Speed Endpoint Values				
Mode	**Supply Fan Speed Hi/Lo Reset Limits**	**Desired Space Pressure (InH2O)**	**Economizer Position**	**Return Fan Speed**
Full Heating (All terminal units are operating at heating flow setpoints)	TBD – Noted during the full heating condition	**Ideal - 0.02** Acceptable Test Range: 0.01 – 0.03	Min-Min (25% of the minimum ventilation requirement)	Minimum Return Fan Speed-TBD
Full Cooling (All terminal units are operating at cooling flow setpoints)	TBD – Noted during the full cooling condition	**Ideal - 0.02** Acceptable Test Range: 0.01 – 0.03	Min-Max (100% of the minimum ventilation requirement)	Maximum Return Fan Speed-TBD

4. Space Pressure Return Fan Speed Reset: During Occupied mode the return fan speed shall reset based on the following schedule.

Return Fan Speed Reset Schedule	
Supply Fan Speed	**Return Fan Speed**
Supply Fan Speed Lo Reset Limit-TBD	Minimum Return Fan Speed-TBD
Supply Fan Speed Hi Reset Limit-TBD	Maximum Return Fan Speed-TBD

5. During warm-up and night low limit, operate the unit in 100% recirculation mode.
6. Fan speed is reset to zero (0) Hz when the AHU is off.
7. Variable speed drive acceleration settings, deceleration settings, minimum speeds, etc. shall be adjusted at start up in coordination with the drive supplier and installer to achieve stable control system performance.
8. Provide separate sequences to be enable if directed by Engineer to control fan based on a set difference in fan speed between supply air and return air, using this method rather than space pressure control.

C. Discharge Air Temperature Reset:
1. Occupied Mode: The discharge air setpoint will reset based on the maximum cooling demand from the spaces. When the maximum cooling demand of any two (2) (adjustable) terminal units is greater than 95%, the discharge air setpoint shall reset down by 0.5 °F (adjustable) every five (5) minutes (adjustable). When the maximum cooling demand is less than 90%, reset discharge air setpoint up by 0.5 °F (adjustable) every five (5) minutes (adjustable). Minimum and maximum discharge air set points are 55 °F (adjustable) and

65 °F (adjustable) respectively. Initial discharge air temperature setpoint when transitioning into an occupied mode is based on the following schedule.

Initial Discharge Air Setpoint		
Maximum Terminal Unit Cooling Demand	**Discharge Air Temperature Setpoint (AHU-2 & 3)**	**Discharge Air Temperature S.P. AHU-1**
0	65	Note 1
100	55	55

2. The following discharge air setpoints are applicable for all other modes:

Discharge Air Setpoints, Non-Occupied Modes	
Mode	**Discharge Air Temperature Setpoint (Adjustable)**
Night High Limit	50
Nigh Low Limit	85
Cooling Optimal Start	50
Heating Optimal Start	85
Night Purge	50

D. Fan Enable / Optimal Start Control or Warm-Up Mode:
1. All fan systems with heating capability (in AHU and/or at terminal units) shall have this sequence.
2. The intent of this sequence is that the air handling system be started early enough so that the maximum negative deviation of space temperature from the occupied heating set point (for all within the system) is less than 0.5 °F no more than 20 minutes prior to or 10 minutes after scheduled occupancy. Spaces should not be heated up above occupied heating space temperature set points.
3. Air handling systems may be started under the optimal start mode no more than 3 hours (adjustable) prior to scheduled occupancy.
4. This optimal start sequence will be locked out when the 3 hour rolling average outdoor air temperature is greater than setpoint (initial setpoint, 55°F, adjustable). If locked out, the AHU will start 10 minutes (adjustable, maximum of 30 minutes) before occupied time period.
5. Air handling systems will be started as a function of:
   a. Outdoor air temperature
   b. Space temperature
   c. Time until start of scheduled occupancy
   d. Historical time period required to reach setpoint as a function of a, b, and c above.
6. Discharge air temperature setpoint will be set to the maximum optimal start temperature setpoint (85°F, adjustable) during this mode. (100ºF for AHU-1)
7. When the system is in heating optimal start mode, the mixed air dampers will be in full recirculation mode (i.e., outside air dampers are fully closed and the supply air volume will be limited to the return volume).
8. Unit is operating at full cooling air flow rate.
9. Exhaust fans are off and exhaust dampers are closed.
10. Mechanical cooling is disabled.

11. The building operator will be able to command start of occupancy at the operator's terminal and at the Maintenance Building remote operator's station (overriding the optimal start sequence) for each individual air handling system and globally for all air handling systems in the building.

E. Fan Enable / Optimal Start Control (Cooling Mode) – Cool Down:
1. All air handling systems with cooling capability shall have this sequence.
2. The intent of this sequence is that the air handling system be started early enough so that the maximum positive deviation from the space temperature to the occupied cooling set point (for all zones in the system) is less than 0.5 °F no more than 20 minutes prior to or 10 minutes after scheduled occupancy. Spaces should not be cooled down below occupied cooling space temperature set points.
3. Air handling systems may be started under the optimal start mode no more than 3 hours (adjustable) prior to scheduled occupancy.
4. This optimal start sequence should be locked out when the 3 hour rolling average outdoor air temperature during the scheduled unoccupied mode is less than setpoint (initial setpoint, 50°F, adjustable). If locked out, the AHU will start 10 minutes (adjustable, maximum of 30 minutes) before the occupied time period.
5. Air handling systems will be started as a function of:
   a. Outdoor air temperature
   b. Space temperature
   c. Time until start of scheduled occupancy
   d. Historical time period required to reach setpoint as a function of a, b, and c above.
6. Discharge air temperature setpoint will be set to the minimum temperature setpoint during this mode.
7. Mechanical cooling is disabled unless spaces have not achieved cool down setpoint (adjustable) 30 minutes (adjustable) before the occupancy period. Mechanical cooling will utilize economizer mode if outside air temperature is less than return air temperature.
8. Exhaust fans are on and exhaust dampers are open (unless limited by mixed air setpoint control due to outside air damper interlock).
9. Heating is disabled.
10. The building operator will be able to command start of occupancy for each individual air handling system and globally for all air handling systems in the building.

F. Cooling Operation:
1. Cooling coil shall modulate in sequence with economizer dampers to maintain discharge air temperature setpoint. Discharge air control is applicable whenever mechanical cooling is required.
2. Mechanical cooling shall remain off during warm-up and night low limit.

G. Heating Mode:
1. Discharge air control is applicable whenever mechanical heating is required.
   During occupied mode, mechanical heating is permitted when the economizer has maintained the minimum outside air position for a minimum of 5 minutes (adjustable) when ventilation demand sequences are inactive or when ventilation demand sequences are active and the discharge air temperature is more than 3°F below the setpoint for more than 5 minutes (adjustable).
2. Mechanical heating permitted only during occupied, night low limit and heating optimal start modes.
3. When mechanical heating is enabled hot water heating valve shall modulate to maintain discharge air temperature setpoint.

H. Night Low Limit Mode:
1. Night low limit mode is initiated during unoccupied times (mode), when any two (2, adjustable) terminal unit space temperature(s) falls below the unoccupied heating setpoint.

2. When all spaces served by the system are above the unoccupied heating setpoint plus the dead band setpoint (initial 5°F, adjustable), the system will revert to the unoccupied mode.
3. If the minimum hourly outside air temperature is less than 20°F (adjustable) in Western Oregon for the previous 12 (adjustable) consecutive hours, then the AHU will remain in operation during the unoccupied period. The system will maintain a setpoint temperature 10°F (adjustable) less than occupied setpoint. All outside air dampers will remain closed during the unoccupied period.

I. Night High Limit Mode:
1. Night high limit mode is initiated during unoccupied times (mode), when any two (2, adjustable) terminal unit space temperature(s) rises above the unoccupied cooling setpoint and the outside air temperature is 10°F (adjustable) less than the average space temperature.
2. When all spaces served by the system are below the unoccupied heating setpoint minus the dead band setpoint (initial 5°F, adjustable), the system will revert to the unoccupied mode.

J. Night Purge Mode:
1. This sequence is initiated before occupancy during the cooling season.
2. Night purge will be enabled when the following conditions are true:
   a. The average space temperature is above 80º F (adjustable).
   b. Outside air temperature is greater than setpoint (initial setpoint, 45°F, adjustable).
   c. Outside air relative humidity is less than 50%.
   d. Outside air temperature is at least 10°F (adjustable) less than the average space temperature
   e. Occupancy period occurs within 3 hours (adjustable).
3. Night purge will be disabled when average space temperature is within 3°F (adjustable) of the outside air temperature or the average space temperature has reach the occupied heating set point.

K. Economizer Damper Control:
1. Occupied Mode: Economizer dampers (Outside Air, Return Air and Relief Air) modulate to maintain supply air temperature set point and air quality setpoint.
2. Economizer shall operate as first stage of cooling. If discharge set-point is not satisfied for 5 minutes (above set-point) enable cooling.
3. Unoccupied, Night Low Limit, Optimal Start and Low Limit Freeze Conditions: Dampers to modulate to full recirculation (0% Outside Air).
4. Night High Limit and Night Purge: Dampers to modulate to full ventilation (100% Outside Air).
5. The outside air economizer is enabled when the outside air enthalpy is less than the return air enthalpy.
6. The outside air economizer is disabled when the outside air enthalpy is greater than the return enthalpy for greater than 2 minutes. When the economizer is disabled, the outside air damper modulates to the minimum position setpoint based on the air quality sensor.
7. Economizer Minimum Position (Air Quality Control): Economizer minimum-minimum (min-min) position value is based on 25% of the minimum ventilation requirement unless otherwise noted. The economizer minimum-maximum (min-max) position is based on the full minimum ventilation requirement. During DVC sequences, outside air damper position (outside airflow) is limited to the min-max setting. Balancer to determine actual damper positions at the min-min and min-max airflow setpoints. Control system shall use damper position setpoints for control purposes. On signal from any terminal unit that CO2 level at the zone device is at action level modulate OSA damper from min.-min. position towards min.-max. position. Step at 3 stages between min.-min. damper position and min.-max. damper position each at 10 minutes (adj.) per step. If zone CO2 level drops below action

level plus 200 ppm offset (1000 ppm action level minus 200 ppm offset = 800 ppm) return to DCV min.-min. damper position.

8. The airside economizer control shall include fault detection and diagnostics as required by ASHRAE 90.1-2016. See ASHRAE requirements for full description of sensor, monitoring and alarm requirements which are available normally due to the DDC system. Specific requirements not normally provided are listed below and required.
   a. The system shall display the status of:
      1) Free cooling available
      2) Economizer enabled
      3) Cooling enabled
      4) Heating Enabled
      5) Mixed air low limit cycle active
   b. The system shall be capable of detecting and reporting the following faults
      1) Air temperature sensor failure or fault
      2) Economizing when unit should not be economizing
      3) Not economizing when the unit should be economizing
      4) Damper not modulating
      5) Excess outside air

4.09 SEQUENCE OF OPERATION – TERMINAL UNIT CONTROL

A. Space Temperature Setpoints:
   1. Default Setpoints:
      a. Occupied Heating Setpoint: 70 °F (adjustable)
      b. Occupied Cooling Setpoint: 76 °F (adjustable)
      c. Unoccupied Heating Setpoint: 55 °F (adjustable)
      d. Unoccupied Cooling Setpoint: 85 °F (adjustable)
      e. Standby Occupied Heating Setpoint: (Occupied Heating Setpoint - 3°F (adjustable)
      f. Standby Occupied Cooling Setpoint: (Occupied Cooling Setpoint + 3°F (adjustable)
   2. Space Setpoint Adjustment:
      a. Adjustment (General): Setpoint adjustments may be accomplished either at the operator workstation or locally at the thermostat.
      b. Adjustment Range: Setpoint adjustments are limited to (+/-) 2°F (adjustable). Space temperature dead band (4 °F, adjustable) is maintained during setpoint adjustments.
   3. Damper Operation:
      a. Occupied Mode: Air flow setpoint will linearly reset based on terminal unit cooling demand as shown in the schedule below.

Air Flow Setpoint-Occupied Mode	
Terminal Unit Cooling Demand (%)	**Air Flow Setpoint (CFM)**
0-100 (space temperature is within standby setpoints)	Cooling Flow Setpoint X 0.20
0 (space temperatures are outside of the standby range)	Heating Flow Setpoint
100 (space temperatures are outside of the standby range)	Cooling Flow Setpoint

      b. Optimal Start Mode: Air flow setpoint will reset based on the schedule below. Implement dead band to prevent oscillation between cooling and heating flow setpoints.

Air Flow Setpoint – Heating Optimal Start	
Space Temperature > Occupied Heating Set Point	**Air Flow Set Point**

No	Cooling Flow Setpoint X 1.25, (Multiplier is adjustable from GUI)
Yes	Heating Flow Setpoint X 0.1, (Multiplier is adjustable from GUI)

Air Flow Setpoint – Cooling Optimal Start	
Space Temperature < Occupied Cooling Set Point	**Air Flow Set Point**
No	Cooling Flow Setpoint X 1.25, (Multiplier is adjustable from GUI)
Yes	Heating Flow Setpoint X 0.1, (Multiplier is adjustable from GUI)

c. Night High Limit, Night Purge Mode: Cooling flow setpoint shall be used during this mode. Units that did not initiate the control mode and have space temperatures above the occupied cooling setpoint shall also control to their respective cooling flow set point until the mode is canceled or the space temperature has reached the occupied cooling setpoint. Implement 1°F space temperature dead band to prevent damper oscillations.
d. Night Low Limit Mode: Cooling flow setpoint shall be used during this mode. Units that did not initiate the control mode and have space temperatures below the occupied heating setpoint shall also control to their respective cooling flow set point until the mode is canceled or the space temperature has reached the occupied heating setpoint. Implement 1°F space temperature dead band shall be used to prevent damper oscillations.
e. Unoccupied Mode: Damper modulates fully closed. Flow setpoint is 0 CFM.

4. Heating Valve Operation:
   a. Occupied Mode: Valve will modulate based on heating demand to maintain occupied heating setpoint.
   b. Optimal Start Mode: Heating Valve will modulate based on the schedule below. Implement 1°F space dead band to prevent valve oscillation.

Valve Position - Optimal Start	
Space Temperature > Occupied Heating Set Point	**Valve Position**
No	100% (Subject to discharge air temperature limiting)
Yes	0%

c. Unoccupied Mode, Night High Limit, Night Purge Mode: Valve is closed.
d. Night Low Limit Mode: Valve modulates fully open (Subject to discharge air temperature limiting). Units that did not initiate the control mode and have space temperatures below the occupied heating setpoint shall also modulate valves fully open until the mode is canceled or the space temperature has reached the occupied heating setpoint. Implement 1°F space temperature dead band to prevent valve oscillations.

B. Discharge Air Temperature Limiting (All Modes):
   1. Discharge temperature maximum is 110º F.

C. Space CO_2 Sensor:
   1. On Signal that space CO_2 values exceed set-point (1000 ppm adj.) modulate air flow damper from heating air flow to cooling air flow regardless of space demand. Disable dead band operation. Once space is below lower level set-point (800 ppm) return to normal mode. If after 30 min. (adj.) CO_2 level is not below lower level send signal to air handler.
   2. CO2 sensor fail:
      a. If the CO2 goes below 200 PPM or above 1600 PPM and remains at that level for 30 min (adj), the sensor is assumed to have failed and the CO2 control will be disabled and an alarm generated.
         1) A faulted sensor will revert to a fixed min OAD setpoint adjustable from the graphics.
      b. There will be a manual reset on graphics after CO2 controls are repaired.

4.10 MISCELLANEOUS

A. Exhaust Fans:
   1. General Exhaust (Restrooms, Custodian Rooms): Operate with associated HVAC unit based on building schedule.
   2. Kiln Hood Fan: Operate from space mounted timer switch or temperature sensor. If temperature in room exceeds 80 deg. F. (Adj.) enable the fan. Disable when below temperature minus 2 deg. F. Timer switch to enable fan regardless of space temperature.

B. IDF / MDF room cooling unit: Operate units on their own controls. Provide sensor to connect to BAS. Alarm on room temperatures above 80 deg. F. (Adj.).

C. Smoke Detectors and Fire Alarm:
   1. If smoke is detected by duct mounted smoke detector, disable operation of fan system. Enable when alarm is cleared. Report to BAS interface as an alarm.
   2. Monitor the signal from a relay mounted at the fire alarm panel. If the relay is in alarm mode disable the HVAC system. Reset to normal operation once the relay value is no longer in alarm.

D. Unit Heaters, Cabinet Unit Heaters and Convectors:
   1. Operate from sensor in space to maintain space temperature during occupied and non-occupied spaces. For units with fans cycle the fan with the demand for heat.

4.11 DOMESTIC RECIRCULATION SYSTEM

A. Enable based on BAS occupied schedule.

B. Operate tank maintenance pump to maintain tank at set-point. Set-point to match existing.

C. Operate circulation pump on when HWR temp drops 10 degs. F. (adj.) below tank set-point. Disable when temperature is within 5 degs. F. (adj.) of tank set-point.

D. Water heater to operate from its own controls.

4.12 SEQUENCE OF OPERATION – SINGLE ZONE

A. Supply Fan Control:
   1. This section applies to supply fans that are modulated by variable frequency drives (VFDs) or EC motors.
   2. Demand Based Control: Supply fan volume is controlled based on the space temperature deviation from the occupied heating and cooling space temperature set points as indicated in the schedule below. Fan speed shall linearly reset between setpoints.

Supply Fan Speed – Demand Based Control		
Cooling Deviation Temperature (Space Temperature – Occupied Cooling Setpoint)	**Heating Deviation Temperature** (Space Temperature – Occupied Heating Setpoint)	**Fan Speed**
<= (-0.5) °F (adjustable)	NA	Minimum Speed (50%, adjustable)
>= 2 °F (adjustable)	NA	Maximum Speed (100%, adjustable)
NA	>= 0.5 °F (adjustable)	Minimum Speed (50%, adjustable)
NA	<= (-2) °F (adjustable)	Maximum Speed (100%, adjustable)
Operating Non-Occupied Modes		Maximum Speed (100%, adjustable)

3. Variable speed drive acceleration settings, deceleration settings, minimum speeds, etc. shall be adjusted at start up in coordination with the drive supplier and installer to achieve stable control system performance.
4. Fan speed is reset to 0 (zero) when the AHU is off.
5. Coordinate signal from fire alarm panel to duct mounted smoke detector. One signal to detector disables fan (speed = 0), waits 15 seconds (adjustable), and starts smoke damper closing.

B. Return Fan Control:
1. Gym System: Operate RA fan in conjunction with SA fan. Balance system to operate at two conditions.
   a. When the locker room system is off RA fan shall operate at a speed to result in the Gym being slightly positive relative to outdoors based on initial air balance.
   b. When the locker room system is operating the RA fan speed is reduced from that of the ‘a’ condition above since the lockers use air from the Gym and exhaust it. Confirm fan speed with balancer to result in the gym being neutral to slightly positive relative to the outdoors.
2. Kitchen and Cafeteria systems do not include RA fans. They contain space mounted relief outlets with dampers. Provide an offset to allow space pressurization of approximately 0.02” WC positive. Offset to be determined by balancer.
3. ASU-6 System: Operate RA fan in conjunction with SA fan. Balance system to operate at a speed to result in the space being slightly positive relative to outdoors based on initial air balance.

C. Fan Enable / Optimal Start Control or Warm-Up Mode:
1. All fan systems with heating capability (in AHU and/or at terminal units) shall have this sequence.
2. The intent of this sequence is that the air handling system be started early enough so that the maximum negative deviation of space temperature from the occupied heating set point (for all within the system) is less than 0.5 °F no more than 20 minutes prior to or 10 minutes after scheduled occupancy. Spaces should not be heated up above occupied heating space temperature set points.
3. Air handling systems may be started under the optimal start mode no more than 3 hours (adjustable) prior to scheduled occupancy.
4. This optimal start sequence will be locked out when the 3 hour rolling average outdoor air temperature is greater than setpoint (initial setpoint, 55°F, adjustable). If locked out, the

AHU will start 10 minutes (adjustable, maximum of 30 minutes) before occupied time period.

5. Air handling systems will be started as a function of:
   a. Outdoor air temperature
   b. Space temperature
   c. Time until start of scheduled occupancy
   d. Historical time period required to reach setpoint as a function of a, b, and c above.
6. Discharge air temperature setpoint will be set to the maximum optimal start temperature setpoint (110°F, adjustable) during this mode.
7. When the system is in heating optimal start mode, the mixed air dampers will be in full recirculation mode (i.e., outside air dampers are fully closed and the supply air volume will be limited to the return volume).
8. Exhaust fans are off and exhaust dampers are closed.
9. Mechanical cooling is disabled.
10. The building operator will be able to command start of occupancy at the operator's terminal and at the Maintenance Building remote operator's station (overriding the optimal start sequence) for each individual air handling system and globally for all air handling systems in the building.

D. Heating Valve Control (Hot Water Heat):
   1. Occupied, Occupied Purge Mode: Heating valve to modulate to maintain space temperature heating setpoint subject to discharge air temperature limiting.
   2. Night Low Limit, Optimal Start and Low Limit Freeze Conditions: Heating valve shall modulate fully open.
   3. Unoccupied and Night High Limit Mode: Heating valve to modulate fully closed.
   4. Night Purge Mode: When night purge mode has been imitated, the heating valve shall not be enabled to operate for a minimum of 4 hours (adjustable) from the occupied time. If the space temperature is 2ºF less than the occupied heating set point during the lockout time, heating valve modulated is allowed.
   5. Heating Valve Lockout: Heating valve shall not modulate when the outside air temperature is above 65ºF (Adjustable).
   6. Considerations: Modulating the heating valve simultaneously with cooling valve and economizer operation is not permitted except during demand ventilation control. Oscillation between heating valve, cooling valve and economizer operation is also not permitted.

E. Cooling Valve Control (Chilled Water Cooling):
   1. Occupied, Occupied Purge Mode: Cooling valve to modulate to maintain space temperature setpoint subject to discharge air temperature limiting.
   2. Unoccupied, Night Low Limit, Night High Limit, Optimal Start, Night Purge and Low Limit Freeze Modes: Cooling valve to modulate full closed.
   3. Low Limit Control: If the minimum hourly outside air temperature is less than 32ºF (adjustable) and the system is unoccupied, modulate cooling valve fully open. Also see cooling system sequences regarding this sequence.
   4. Cooling Valve Lockout:
      a. Cooling valve shall not modulate when the outside air temperature is below 55ºF (Adjustable).
      b. If economizer operation is enabled cooling valve operation is not allowed until economizer is at 100% for five (5) minutes. Economizer to maintain 100% while cooling valve is operational unless it is disabled based on return air.
   5. Considerations: Modulating the cooling valve simultaneously with the heating valve operation is not permitted. Oscillation between heating valve and cooling valve modulation is also not permitted.
   6. Discharge Air Temperature Limits:
      a. Discharge Air Temperature High Limit Set Point: 85ºF (Adjustable).
      b. Discharge Air Temperature Low Limit Set Point: 53ºF (Adjustable).

F. Night Low Limit Mode:
   1. Night low limit mode is initiated during unoccupied times (mode), when any terminal unit space temperature(s) falls below the unoccupied heating setpoint.
   2. The night low flag will start boiler sequence.
   3. The fan will delay starting until there is sufficient heat to run the unit without tripping a safety to lockout.
   4. The NLL valve position will be 100 percent.
   5. The unit will operate until the Unoccupied heating SP is reached plus a 3˚deadband is reached. The fan will have a 10 minute (Adj) off delay.
   6. Sufficient heat for hot water systems: Sufficient heat will be met when HWST is 10 deg less than the active HWST set point reset.

G. Night High Limit Mode:
   1. Night high limit mode is initiated during unoccupied times (mode), when the space temperature(s) rises above the unoccupied cooling setpoint and the outside air temperature is 10°F (adjustable) less than the average space temperature.
   2. When all spaces served by the system are below the unoccupied heating setpoint minus the dead band setpoint (initial 5°F, adjustable), the system will revert to the unoccupied mode.

H. Night Purge Mode:
   1. This sequence is initiated before occupancy during the cooling season.
   2. Night purge will be enabled when the following conditions are true:
      a. The space temperature is above 80º F (adjustable).
      b. Outside air temperature is greater than setpoint (initial setpoint, 45°F, adjustable).
      c. Outside air relative humidity is less than 50%.
      d. Outside air temperature is at least 10°F (adjustable) less than the average space temperature.
      e. Occupancy period occurs within 3 hours (adjustable).
   3. Night purge will be disabled when average space temperature is within 3°F (adjustable) of the outside air temperature or the average space temperature has reach the occupied heating set point.

I. Economizer Damper Control:
   1. Occupied Mode: Economizer dampers (Outside Air, Return Air and Relief Air) modulate to maintain supply air temperature set point and air quality setpoint.
   2. Unoccupied, Night Low Limit, Optimal Start and Low Limit Freeze Conditions: Dampers to modulate to full recirculation (0% Outside Air).
   3. Night High Limit and Night Purge: Dampers to modulate to full ventilation (100% Outside Air).
   4. The outside air damper will be at minimum position during occupied mode unless another sequence (economizer cooling, CO2 control, or any safeties) require a different position.
   5. The economizer cooling function will be enabled when the OSA is 3˚F (adj) less than return air temp and disabled when OSA equals RAT. If there is no return air temperature sensor available, space temp will be used for comparison.
   6. CO2 Control:
      a. The CO2 control will keep dampers at min-max position unless there is a call for economizer cooling. Dampers will remain in that position until the CO2 concentration reaches and remains above 900 PPM (adj) for 10 minutes. Then the damper will go to min-max set point. This setpoint is determined by balancer
      b. The CO2 control will enable at 900 PPM (adj.) plus a deadband of 100 PPM (adj). When CO2 levels return to 900 PPM minus the dead-band the control will disable and release damper to min-min position.

c. If the CO2 goes below 200 PPM or above 1600 PPM and remains at that level for 30 min (adj), the sensor is assumed to have failed and the CO2 control will be disabled and an alarm generated.
   1) A faulted sensor will revert to a fixed min OAD setpoint adjustable from the graphics.
d. There will be a manual reset on graphics after CO2 controls are repaired.

7. The airside economizer control shall include fault detection and diagnostics as required by ASHRAE 90.1-2016. See ASHRAE requirements for full description of sensor, monitoring and alarm requirements which are available normally due to the DDC system. Specific requirements not normally provided are listed below and required.
   a. The system shall display the status of:
      1) Free cooling available
      2) Economizer enabled
      3) Cooling enabled
      4) Heating Enabled
      5) Mixed air low limit cycle active
   b. The system shall be capable of detecting and reporting the following faults
      1) Air temperature sensor failure or fault
      2) Economizing when unit should not be economizing
      3) Not economizing when the unit should be economizing
      4) Damper not modulating
      5) Excess outside air

4.13 BOILER OPERATION

A. System Enable/Disable: Enable boiler system and lead pump when any two (2) (adjustable) valves are open more than 20% (adjustable). Disable boiler system when all valves are closed more than 5% (adjustable) or the outside air temperature is above 60°F (adjustable).

B. Building Heating Demand Calculation: Building heating demand will be calculated by taking the sum of all the heating control valve positions, weighted by the scheduled valve flow rate and averaged by the total combined flow rate for all of the valves.

$$Heating\ \ Demand_{Building} = \frac{\sum_{i=1}^{total\ \#\ of\ valves}\left(Heating\ Valve\ Postion_i \times \frac{1}{100} \times Scheduled\ \ Flow\ Rate_i\right)}{Total\ Flow\ Rate}$$

C. Boiler Supply Water Setpoint Reset: Supply water temperature setpoint shall linearly reset based on the building heating demand as described in the following schedule:

Boiler Supply Water Reset Schedule	
Building Heating Demand (%)	Supply Water Set Point (F)
0	160
>75	200

D. Pump Disable: Main loop pumps and boiler loop pumps shall operate for five (5) minutes after boiler operation has been disabled to avoid boiler damage.

E. Pump Control: When pump is enabled, VFD shall modulate from minimum speed (25% adjustable) to maintain the system differential pressure setpoint (10 psi, initial (adjustable)). When pump is disabled, VFD speed is set to 0%.

F. Minimum System Cycle Time: Once boilers/pumps have been disabled the system shall remain disabled for a minimum of fifteen (15) minutes to prevent shot-cycling by allowing demand to build when transitioning between heating and cooling modes.

G. Pump Lead/Lag: Operate pumps based on lead/lag. On failure of lead pump, operate lag pump and send alarm. Switch lead operation every week. Lead selection shall also be selectable from the operator's workstation, resetting the current run-time when used. When switching from lead pump to lag pump allow both pumps to operate a minimum of fifteen (15) seconds before disabling the lead pump.

H. Boiler Lead/Lag: Operate boilers based on lead/lag via boiler controller.

I. System Lockout: If each pump fails three (3) times during an operational period the system shall lockout and an alarm sent to the workstation. Lockout is resettable from the operator's workstation.

J. Emergency Boiler Shutdown: Disable boiler from emergency boiler shutdown switch. Boiler shutdown switch is monitored by the control system and physically interlocked to disable the boilers.

K. Low Outside Air Temperature Loop Pre-Heat: When the outside air temperature is less than 32°F (adjustable, dead band: 3°F) and the system is not in operation (0% building heating demand) the system shall be enabled, and operate the lead boiler and lead pump to maintain 110°F. Operate in this mode until the system is enabled based on the building heating demand schedule or outside air temperatures rise above the setpoint plus the dead band.

L. Boiler Minimum Temperature Valve: Modulate valve from full bypass (to boiler) to full open (to system) based on HWR temp. Temp shall exceed 140 deg. F. prior to opening to system.

4.14 SEQUENCE OF OPERATION - CHILLER

A. Disable on signal outside air temperature is below 55º F (Adj.).

B. Enable on building time signal.

C. Start and operate chilled water pump on signal that any chilled water valve is open more than 5%. BAS to provide 0-10 volt signal to pump input connection at chiller.

D. Start and verify pump operation prior to starting chiller.

E. Operate Pump VFD to Maintain:
1. Minimum pressure at remote differential pressure sensor.
2. Minimum flow through chiller based on flow meter.

F. Operate Chiller to Maintain Discharge Temperature Per Schedule: On any (adjustable) valve open 100% for 5 minutes reduce chilled water setpoint by 2º F. On all valves open less than 75% (adjustable) increase chilled water setpoint by 2º F. Reset between 42º F and 48º F.

G. Operate chilled water pipe heat trace freeze protection on outside air temperature below 38º F.

4.15 SEQUENCE OF OPERATION – CONSTANT VOLUME MULTI-ZONE AIR SUPPLY UNIT WITH HOT AND CHILLED WATER COILS

A. Space Temperature Setpoints:
   1. Default Setpoints:
      a. Occupied Heating Setpoint: 68 °F (adjustable)
      b. Occupied Cooling Setpoint: 72 °F (adjustable)
      c. Unoccupied Heating Setpoint: 55 °F (adjustable)
      d. Unoccupied Cooling Setpoint: 85 °F (adjustable)
   2. Space Setpoint Adjustment: Setpoint adjustments shall be made at the operator workstation. Local setpoint adjustment is not applicable for this unit.
   3. Space Temperature Setpoint Change Over: When the outside air temperature falls below 60 °F (adjustable) zones shall utilize the occupied heating set point for space temperature control. When the outside air temperature rises above 68 °F (adjustable) zones shall utilize the occupied cooling set point for space temperature control. This switch over sequence shall always be active to make adjustments as outside air temperatures change.

B. Hot Deck Discharge Air Temperature Setpoint Reset: Setpoint shall linearly reset based on the maximum zone heating demand proportional/integral (PI) control value. Setpoint reset is based on the following schedule.

Hot Deck Reset Schedule	
Maximum Zone Heating Demand (%)	Hot Deck Temperature Setpoint (F)
100	110
0-10	65

C. Cold Deck Discharge Air Temperature Setpoint Reset: Setpoint shall reset based on the maximum zone cooling demand proportional/integral (PI) control value. Setpoint reset is based on the following schedule.

Cold Deck Reset Schedule	
Maximum Zone Cooling Demand (%)	Cold Deck Temperature Setpoint (F)
100	55
0-10	65

D. Mixed Air Temperature Setpoint Reset (Occupied Mode Only): Mixed air temperature set point shall reset based on the cold deck discharge air temperature setpoint. Reset mixed air temperature 2°F below the cold deck temperature setpoint.

E. Supply Fan Control:
   1. Occupied, Night Low Limit, Night High Limit, Optimal Start, Night Purge Mode: Fan turns on for continuous operation.
   2. Unoccupied Mode, Low Limit Freeze Mode and Fire Alarm (General): Fan remains off during these conditions.
   3. Low Limit Freeze Lockout: If the freeze thermostat (device automatically resets) indicates a low limit condition three (3) times (adjustable) within 10 minutes (adjustable) the fans shall lockout (software). Lockout reset shall occur at the building operators workstation.

F. Return Fan Control: Return fan shall operate based on supply fan control.

G. Heating Valve Control:

1. Occupied Mode: Heating valve shall modulate to maintain hot deck temperature setpoint.
2. Night Low Limit, Optimal Start and Low Limit Freeze Conditions: Heating valve shall modulate fully open.
3. Unoccupied and Night High Limit Mode: Heating valve to modulate fully closed.
4. Night High Limit: Valve operation permitted to prevent zones (not applicable to these modes) from falling below the occupied space temperature set point.
5. Night Purge Mode: When night purge mode has been initiated, the heating valve shall not be enabled to operate for a minimum of 4 hours (adjustable) from the occupied time. If the space temperature(s) is 2°F less than the occupied heating set point during the lockout time, heating valve modulation is allowed. Valve operation permitted to prevent zones (not applicable to these modes) from falling below the occupied space temperature set point.
6. Heating Valve Lockout: Heating valve shall not modulate when the outside air temperature is above 60 °F (Adjustable) or the maximum zone heating demand is less than 10% (adjustable).
7. When outside air temperature is below 32 deg. F. (adj.) operate heating valve open to maintain hot deck temperature at 100 deg. F. (adj.) regardless of zone demand or other sequences. This sequence is for freeze protection as the coil is served by exterior piping.

H. Cooling Valve Control:
1. Occupied Mode: Cooling valve shall modulate to maintain cold deck temperature setpoint.
2. Unoccupied, Night Low Limit, Night High Limit, Optimal Start, Night Purge and Low Limit Freeze Modes: Cooling valve to modulate fully closed.
3. Cooling Valve Lockout: Cooling valve shall not modulate when the outside air temperature is below 55 °F (Adjustable) or the maximum zone cooling demand is less than 10% (adjustable). When ambient conditions allow for economizing, cooling valve operation shall be locked out until the economizer damper position maintains 100% for five (5) minutes (adjustable) or economizer operation is disabled as described in the economizer damper control sequences.
4. Low Limit Control: If the minimum hourly outside air temperature is less than32°F (adjustable) and the system is unoccupied, modulate cooling valve fully open. Also see cooling system sequences regarding this sequence.

I. Economizer Control:
1. Occupied Mode: Economizer dampers (Outside Air, Return Air and Relief Air) modulate to maintain mixed air temperature set point.
2. Night Low Limit, Optimal Start: Economizer operation permitted to prevent zones (not applicable to these modes) from exceeding the occupied space temperature set point.
3. Unoccupied, Low Limit Freeze Conditions: Dampers to modulate to full recirculation (0% Outside Air).
4. Night High Limit, Smoke Purge, and Night Purge Modes: Dampers to modulate to full ventilation (100% Outside Air).
5. Economizer Lockout: If the outside air temperature is greater than the return air temperature, then modulate dampers to the minimum position.
6. Outside Air Damper Modulation: Outside air dampers will modulate proportionally based on the economizer control function output (PI algorithm) as described in the schedule below.
7. Provide economizer with CO_2 sensor to control as follows:
   a. On CO_2 levels below 800 PPM (adj.) minimum OSA damper position to be at 25% of minimum outside airflow rate listed in schedule (minimum-minimum).
   b. On signal of CO_2 levels above 1000 PPM (adj.) modulate economizer damper to 100% of minimum OSA flow rate listed in schedule (minimum-maximum).
   c. Standard economizer function to operate under 800 PPM operation.
   d. If the CO2 goes below 200 PPM or above 1600 PPM and remains at that level for 30 min (adj), the sensor is assumed to have failed and the CO2 control will be disabled and an alarm generated.

1) A faulted sensor will revert to a fixed min OAD setpoint adjustable from the graphics.

e. There will be a manual reset on graphics after CO2 controls are repaired.

8. The airside economizer control shall include fault detection and diagnostics as required by ASHRAE 90.1-2016. See ASHRAE requirements for full description of sensor, monitoring and alarm requirements which are available normally due to the DDC system. Specific requirements not normally provided are listed below and required.
   a. The system shall display the status of:
      1) Free cooling available
      2) Economizer enabled
      3) Cooling enabled
      4) Heating Enabled
      5) Mixed air low limit cycle active
   b. The system shall be capable of detecting and reporting the following faults
      1) Air temperature sensor failure or fault
      2) Economizing when unit should not be economizing
      3) Not economizing when the unit should be economizing
      4) Damper not modulating
      5) Excess outside air

Min OSA/OSA Damper Position		
Economizer Control Output (%)	Minimum OSA Damper Position (%)	OSA Damper Position (%)
0	0	0
20	100	0
100	100	100

J. Zone Damper Control:
   1. Occupied Mode: Zone dampers modulate based on individual space heating and cooling demands. Heating and cooling proportional/integral (PI) control loops shall be used for each zone and will control to the active space temperature set point. A single control loop with 50% bias may also be used. Designation heating and cooling demand should be interpreted accordingly for discharge air temperature reset in this case.

Zone Damper Control Schedule		
Zone Cooling Demand (%)	Zone Heating Demand (%)	Damper Position (%)
0-100	0	50% - 100%
0	0-100	50% - 0%

Note: 0% Damper Position - Fully Open to Hot Deck, closed to cold deck.

100% Damper Position - Fully Open to Cold Deck, closed to hot deck.

   2. Night Low Limit, Optimal Start Modes: Applicable zone dampers shall modulate fully open to the hot deck (designated as 0% damper position). Zones not associated with these modes shall modulate as normal to prevent spaces from exceeding the occupied space temperature set point.
   3. Night High Limit: Applicable zone dampers shall modulate fully open to the cold deck (designated as 100% damper position). Zones not associated with these modes shall modulate as normal to prevent spaces from falling below the occupied space temperature set point.
   4. Unoccupied and Night Purge Modes: Zone damper modulate fully open to the cold deck (designated as 100% damper position).

K. Optimal Start Control (Heating Mode):
   1. Optimal Start (General): The intent of the optimal start sequence is that the air handling system be started early enough so that all served spaces reach occupied heating setpoint no more than 20 minutes prior to or 10 minutes after scheduled occupancy.
   2. Air handling systems may be started under the optimal start mode no more than 3 hours (adjustable) prior to scheduled occupancy.
   3. Optimal Start Lockout: This optimal start sequence will be locked out when the 3 hour rolling average outdoor air temperature is greater than setpoint (initial setpoint, 55°F, adjustable). If locked out, the ASU will start 10 minutes (adjustable, maximum of 30 minutes) before the occupied time period.
   4. Optimal Start Calculation:
      a. Air handling systems will be optimally started as a function of:
         1) Current Outdoor air temperature
         2) Current space temperature
         3) Time until start of scheduled occupancy
         4) Historical heating performance as a function of a, b, and c above.
   5. Optimal Start Not Achieved: If the occupancy period starts and the system has not achieved the optimal start setpoint(s) then the system shall continue to operate in this mode (and with full recirculation) until the percent heating load greater than –75% (adjustable) or for 30 minutes (adjustable) at which time the system will revert to the normal occupied cycle or stand-by mode.
   6. Optimal Start Enable/Disable: The optimal start sequence shall be enabled/disabled from the operator workstation.

L. Night Low Limit Mode:
   1. Night low limit mode is initiated during unoccupied times (mode), when the space temperature falls below the unoccupied heating setpoint.
   2. When all spaces served by the system are above the unoccupied heating setpoint plus the dead band setpoint (initial 5°F, adjustable), the system will revert to the unoccupied mode.
   3. If the minimum hourly outside air temperature is less than 20°F (adjustable) in Western Oregon for the previous 12 (adjustable) consecutive hours, then the AHU will remain in operation during the unoccupied period. The system will maintain a setpoint temperature 10°F (adjustable) less than occupied setpoint. All outside air dampers will remain closed during the unoccupied period.

M. Night High Limit Mode:
   1. Night high limit mode is initiated during unoccupied times (mode), when the space temperature rises above the unoccupied cooling setpoint and the outside air temperature is 10°F (adjustable) less than the average space temperature.
   2. When all spaces served by the system are below the unoccupied heating setpoint minus the dead band setpoint (initial 5°F, adjustable), the system will revert to the unoccupied mode.

N. Night Purge:
   1. This sequence is initiated before occupancy during the cooling season.
   2. Night purge will be enabled when the following conditions are true:
      a. The average space temperature is above 80º F (adjustable).
      b. Outside air temperature is greater than setpoint (initial setpoint, 45°F, adjustable).
      c. Outside air relative humidity is less than 50%.
      d. Outside air temperature is at least 10°F (adjustable) less than the average space temperature.
      d. Occupancy period occurs within 3 hours (adjustable).

3. Night purge will be disabled when average space temperature is within 3°F (adjustable) of the outside air temperature or the average space temperature has reach the occupied heating set point.

4.16 SEQUENCE OF OPERATION – SINGLE ZONE CONSTANT VOLUME

A. Supply Fan Control:
   1. Operate during Occupied, NHL, NLL, Night Purge and OSS mode.
   2. Coordinate signal from fire alarm panel to duct mounted smoke detector. One signal to detector disables fan (speed = 0), waits 15 seconds (adjustable), and starts smoke damper closing.

B. Return Fan Control: Kitchen and Cafeteria systems do not include RA fans. They contain space mounted relief outlets with dampers. Provide an offset to allow space pressurization of approximately 0.02" WC positive. Offset to be determined by balancer.

C. Fan Enable / Optimal Start Control or Warm-Up Mode:
   1. All fan systems with heating capability (in AHU and/or at terminal units) shall have this sequence.
   2. The intent of this sequence is that the air handling system be started early enough so that the maximum negative deviation of space temperature from the occupied heating set point (for all within the system) is less than 0.5 °F no more than 20 minutes prior to or 10 minutes after scheduled occupancy. Spaces should not be heated up above occupied heating space temperature set points.
   3. Air handling systems may be started under the optimal start mode no more than 3 hours (adjustable) prior to scheduled occupancy.
   4. This optimal start sequence will be locked out when the 3 hour rolling average outdoor air temperature is greater than setpoint (initial setpoint, 55°F, adjustable). If locked out, the AHU will start 10 minutes (adjustable, maximum of 30 minutes) before occupied time period.
   5. Air handling systems will be started as a function of:
      a. Outdoor air temperature
      b. Space temperature
      c. Time until start of scheduled occupancy
      d. Historical time period required to reach setpoint as a function of a, b, and c above.
   6. Discharge air temperature setpoint will be set to the maximum optimal start temperature setpoint (110°F, adjustable) during this mode.
   7. When the system is in heating optimal start mode, the mixed air dampers will be in full recirculation mode (i.e., outside air dampers are fully closed and the supply air volume will be limited to the return volume).
   8. Exhaust fans are off and exhaust dampers are closed.
   9. Mechanical cooling is disabled.
   10. The building operator will be able to command start of occupancy at the operator's terminal and at the Maintenance Building remote operator's station (overriding the optimal start sequence) for each individual air handling system and globally for all air handling systems in the building.

D. Heating Section Control (Heat Pump Heat with Gas or Electric Back-up):
   1. Occupied Mode: Enable Heat Pump as primary heating source if space temperature falls below heating set-point minus 1 deg. F. Heat pump shall maintain a discharge temperature within range set-point by modulating / staging the compressor system. If DAT falls below lower end of range it is assumed the system is in defrost mode and back-up heating system is enabled. Back-up heating to stage or modulate to maintain space temperature heating setpoint subject to discharge air temperature limiting. DAT range shall be 85 to 110 deg. F (adj.)

2. Night Low Limit, Optimal Start and Low Limit Freeze Conditions: Heating shall modulate to full capacity (no DAT limit control).
3. Unoccupied and Night High Limit Mode: Heating is disabled.
4. Night Purge Mode: When night purge mode has been imitated, the heating shall not be enabled to operate for a minimum of 4 hours (adjustable) from the occupied time.
5. Heating Lockout: Heating shall not operate when the outside air temperature is above 65ºF (Adjustable).
6. Considerations: Modulating the back-up heating system simultaneously with cooling operation or economizer operation is not permitted except during demand ventilation control. Oscillation between DX heating and cooling operation is also not permitted.

E. Cooling Section Control (Heat Pump Cooling):
1. Occupied: Once economizer is no longer able to maintain space temperature enable mechanical cooling to maintain space temperature.
2. Unoccupied, Night Low Limit, Optimal Start, Night Purge and Low Limit Freeze Modes: Cooling is not enabled.
3. High Limit Control: If the conditions per above allow enable the cooling operation.
4. Cooling Lockout:
   a. Cooling shall not modulate / stage when the outside air temperature is below 55ºF (Adjustable).
   b. If economizer operation is enabled cooling operation is not allowed until economizer is at 100% for five (5) minutes. Economizer to maintain 100% while cooling is operational unless it is disabled based on return air.

F. Night Low Limit Mode:
1. Night low limit mode is initiated during unoccupied times (mode), when any terminal unit space temperature(s) falls below the unoccupied heating setpoint.
2. The night low flag will start boiler sequence.
3. The fan will delay starting until there is sufficient heat to run the unit without tripping a safety to lockout.
4. The NLL valve position will be 100 percent.
5. The unit will operate until the Unoccupied heating SP is reached plus a 3˚deadband is reached. The fan will have a 10 minute (Adj) off delay.
6. Sufficient heat for hot water systems: Sufficient heat will be met when HWST is 10 deg less than the active HWST set point reset.

G. Night High Limit Mode:
1. Night high limit mode is initiated during unoccupied times (mode), when the space temperature(s) rises above the unoccupied cooling setpoint and the outside air temperature is 10°F (adjustable) less than the average space temperature.
2. When all spaces served by the system are below the unoccupied heating setpoint minus the dead band setpoint (initial 5°F, adjustable), the system will revert to the unoccupied mode.

H. Night Purge Mode:
1. This sequence is initiated before occupancy during the cooling season.
2. Night purge will be enabled when the following conditions are true:
   a. The space temperature is above 80º F (adjustable).
   b. Outside air temperature is greater than setpoint (initial setpoint, 45°F, adjustable).
   c. Outside air relative humidity is less than 50%.
   d. Outside air temperature is at least 10°F (adjustable) less than the average space temperature.
   e. Occupancy period occurs within 3 hours (adjustable).
3. Night purge will be disabled when average space temperature is within 3°F (adjustable) of the outside air temperature or the average space temperature has reach the occupied heating set point.

I. Economizer Damper Control:
   1. Occupied Mode: Economizer dampers (Outside Air, Return Air and Relief Air) modulate to maintain supply air temperature set point and air quality setpoint.
   2. Unoccupied, Night Low Limit, Optimal Start and Low Limit Freeze Conditions: Dampers to modulate to full recirculation (0% Outside Air).
   3. Night High Limit and Night Purge: Dampers to modulate to full ventilation (100% Outside Air).
   4. The outside air damper will be at minimum position during occupied mode unless another sequence (economizer cooling, CO2 control, or any safeties) require a different position.
   5. The economizer cooling function will be enabled when the OSA is 3˚F (adj) less than return air temp and disabled when OSA equals RAT. If there is no return air temperature sensor available, space temp will be used for comparison.
   6. CO2 Control:
      a. The CO2 control will keep dampers at min-max position unless there is a call for economizer cooling. Dampers will remain in that position until the CO2 concentration reaches and remains above 900 PPM (adj) for 10 minutes. Then the damper will go to min-max set point. This setpoint is determined by balancer
      b. The CO2 control will enable at 900 PPM (adj.) plus a deadband of 100 PPM (adj). When CO2 levels return to 900 PPM minus the dead-band the control will disable and release damper to min-min position.
      c. If the CO2 goes below 200 PPM or above 1600 PPM and remains at that level for 30 min (adj), the sensor is assumed to have failed and the CO2 control will be disabled and an alarm generated.
         1) A faulted sensor will revert to a fixed min OAD setpoint adjustable from the graphics.
      d. There will be a manual reset on graphics after CO2 controls are repaired.
   7. The airside economizer control shall include fault detection and diagnostics as required by ASHRAE 90.1-2016. See ASHRAE requirements for full description of sensor, monitoring and alarm requirements which are available normally due to the DDC system. Specific requirements not normally provided are listed below and required.
      a. The system shall display the status of:
         1) Free cooling available
         2) Economizer enabled
         3) Cooling enabled
         4) Heating Enabled
         5) Mixed air low limit cycle active
      b. The system shall be capable of detecting and reporting the following faults
         1) Air temperature sensor failure or fault
         2) Economizing when unit should not be economizing
         3) Not economizing when the unit should be economizing
         4) Damper not modulating
         5) Excess outside air

END OF SECTION

SECTION 23 10 00 - FACILITY FUEL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the modification of the fuel line to the building.

B. Related Work: The requirements of Section 23 05 00, Common HVAC Materials and Methods, also apply to this section.

1.02 CODES AND STANDARDS

A. General

B. NFPA 30, 31

C. UL-142

1.03 SUBMITTALS

A. Required for all items.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Polyethylene Piping:
1. Application: Below grade natural gas less than or equal to 5 psi. Polyethylene (PE) 2406 meeting ASTM D2513. Fittings and joining procedures shall be compatible with the piping material specified. Curb cocks shall be polyethylene.
2. Risers: Anode-less coated steel.

B. Tracer Wire: 14 gauge, single strand, copper wire with blue insulation for water, green for sanitary and storm sewers, and yellow for gas. 3M "DBY" direct bury splice kit required at all splices.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Locating and Positioning Equipment: Observe all Codes and Regulations and good common practice in locating and installing mechanical equipment and material so that complete installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment. Installation of any equipment with less than minimum clearances shall not be accepted.

3.02 PIPE INSTALLATION

A. General: Install pipe, tube and fittings in accordance with recognized industry practiced for each indicated service without piping failure. Install each run with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections.

3.03 P.E. PIPE INSTALLATION AND TESTING

A. Preparation:
   1. Excavation: Minimum bury 30". Trench size as required for installation, inspection and backfill compaction. See Section 02200, Earthwork.
   2. Backfill bottom 12" of the trench with sand for bedding so as to provide continuous support for the pipe. Rocks, gravel, and other debris shall not be used.
   3. All PE pipe shall be field inspected for damage prior to installation. Any pipe found to have a cut, gouge, or dent with a depth exceeding 10% of the wall thickness shall be rejected.

B. Limitations:
   1. PE 2406 gas pipe installation is limited to below-ground installation, outside of structures, and between -20 degrees Fahrenheit and 100 degrees Fahrenheit ambient temperature.
   2. Exercise care to prevent incompatible materials such as mastics, primers, adhesives, etc., from coming in contact with the PE material. Adhesive tapes shall not be used on PE pipe at any time.
   3. PE pipe shall not be installed within 12" of an underground power line.

C. Installation:
   1. Install PE gas lines in size and location indicated on Drawings.
   2. PE pipe shall be snaked on the trench bottom and allowed to stabilize to ground temperature (approximately 30 minutes) prior to final tie-in.
   3. Fusion procedures used shall be in accordance with the manufacturer's recommended procedures and meet the specification as set forth in the "Minimum Federal Safety Standards," Paragraph 192.283. See Section "REFERENCES."
   4. Protection of Material and Components: Pipe and tube openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical injury. At the completion of all work, the entire system shall be thoroughly cleaned.
   5. Liquid odorant shall not be introduced into PE pipelines.
   6. Trench compaction is required under paved areas. Compaction shall be done by hand-held compactors. Hydrahammers shall not be used. Wheel rolling for trench compaction can be used only after the trench has received its final lift. Care must be taken when compacting around joints and valves to ensure well-compacted support and to protect the pipe and valves from excessive torsional and shearing loads.
   7. Tracer wire shall be placed in the trench as close as practical to the PE pipe. Tracer wire shall be accessible at grade via all services, valve boxes or curb cocks. All joints in tracer wire shall be spliced/connected by Cadweld, self-stripping connectors, or crimp connectors and coated with an electrical mastic and wrapped with an electrical tape.

D. Testing:
   1. PE pipe test pressure shall not exceed three times the maximum design pressure of the pipe nor shall the temperature of the PE exceed 100º F during testing.
   2. Testing shall not start until temperature and pressure stabilization occurs (approximately 30 minutes after the pipe has been placed in trench).
   3. Test line for 100 psig test pressure for a duration of 5 minutes per 100 feet of length but not less than 30 minutes.
   4. Repair piping sections which fail testing by disassembly and reinstallation, using new materials as required to prevent leakage. Do not use solder, mastics, or other temporary repair methods.

3.04 TEST

A. General: Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.

B. Natural Gas Piping: One half hour minimum air at 60 psig for 2 psig gas, and 15 minutes at 10 psig for 7" water gauge natural gas or as approved and certified by serving utility. Isolate building piping and meter from the test section.

END OF SECTION

SECTION 23 21 00 - HYDRONIC PIPING AND PUMPS

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the HVAC heating and cooling water systems. Provide pipe, pipe fittings, pumps, and related items required for complete piping system.

B. Related Work: The requirements of Section 23 05 00, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. General: ASTM and ANSI Standards are indicated. In addition, special standards are referenced where neither ASTM nor ANSI Standards are applicable.

B. Labeling: All piping shall be continuously and legibly labeled on each length as required by codes and standards and including as a minimum, country of origin, manufacturers identification marking, wall thickness designation, and applicable standards and approvals. Fittings shall be labeled as required by the referenced standard.

C. Concealed Plastic Piping: No concealed plastic piping inside the building unless approved by Code or Governing Authorities.

D. Definitions: Where piping fluid is not indicated in the following paragraphs, provide similar piping materials for similar fluids.

E. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied from the same manufacturer as the grooved components.
   1. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.

F. See Commissioning specification for additional requirements.

1.03 STORAGE AND HANDLING

A. Provide factory-applied end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.04 SUBMITTALS

A. Submit catalog data, construction details, and performance characteristics for all equipment.

B. Submit operating and maintenance data.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Black Steel Pipe:
   1. Applications:
      a. Heating & chilled water

2. Pipe: Schedule 40, standard black steel pipe ASTM A-106 or A-53.
3. Threaded Fittings: For above ground installations only.
   a. Banded class 120 cast iron fittings, ANSI B16.4 to 125 psi.
4. Welding Fittings: Beveled ends, seamless fittings of the same type and class of piping above.
5. Flanged Fittings: For above ground installations only.
   a. Class 125 cast iron fittings, ANSI B16.2 including bolting to 125 psi.
   b. Facing and Gasketing: Selected for service pressures and temperatures. Full-faced for cast iron and raised face for steel flanges.

B. Black Steel Pipe:
1. Applications:
   a. Chilled water above grade
   b. Heating water above grade
2. Pipe: Schedule 40, standard black steel pipe ASTM A-106 or A-53.
3. Fittings: Cold Press Mechanical Joint Fitting shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of IAPMO PS117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press ends shall have Smart Connect® feature design (leakage path). MegaPress fittings with the Smart Connect feature assure leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
4. Pipe Thread: Pipe Threads shall conform to ASTM B16.3.
5. Hangers and supports: Hangers and supports shall conform to MSS SP 58.
6. Hanger spacing: In accordance with ASME B 31.1, NFPA54, UPC, IMC other National or local codes.
7. Source Quality Control:
   a. Fittings shall be listed and approved for their intended application.
   b. Manufacture shall be Viega MegaPress or approved.

C. Black Steel Pipe:
1. Applications:
   a. Chilled water
   b. Heating water
2. Pipe: Schedule 40, standard black steel pipe ASTM A-106 or A-53.
3. Mechanical Couplings for Joining Carbon Steel Pipe.
   a. Standard Mechanical Couplings, 2 inch (DN50) through 12 inch (DN300): Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. (Gaskets used for potable water applications shall be UL classified in accordance with ANSI/NSF-61 for potable water service.) Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183, minimum tensile strength 110,000 psi (758450 kPa).
      1) Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13. Basis of Design: Victaulic Style 07.
         a) 2” (DN50) through 8” (DN200): Installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade “EHP” EPDM compound with red color code designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C). Basis of Design: Victaulic Style 107H.
      2) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at

equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source. Basis of Design: Victaulic Style 77.

a) 2” (DN50) through 8” (DN0200): Installation ready flexible coupling for direct stab installation without field disassembly. Gasket shall be Grade “EHP” EPDM compound with red color code designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C). Basis of Design: Victaulic Style 177.

b. Flange Adapters: For use with grooved end pipe and fittings, flat faced, for mating to ANSI Class 125 / 150 flanges. Basis of Design: Victaulic Style 741.
c. Grooved couplings shall meet the requirements of ASTM F-1476.
d. Gasket: Synthetic rubber conforming to steel pipe outside diameter and coupling housing, manufactured of elastomers as designated in ASTM D-2000.

4. Grooved End Fittings:
   a. Standard fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9,53 mm wall), or factory-fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153. Zinc electroplated fittings and couplings conform to ASTM B633.
   b. Fittings shall be manufactured of ductile iron conforming to ASTM A-536, forged carbon steel conforming to ASTM A-234, or factory fabricated from carbon steel pipe conforming to ASTM A-53. Fittings shall be manufactured to the dimensional standards ASME B16.9. Orange enamel coated or galvanized.
5. Tooling: Tools shall be manufactured and supplied by pipe fitting manufacturer. Use roll sets or cut groovers compatible with the pipe material and wall thickness per installation instructions.
6. Approved Manufacturers: Victaulic. For alternate manufacturers, see other end treatments listed above.

D. Copper Pipe and Tube:
   1. Application:
      a. Cooling coil condensate drain
   2. UPC approved copper fitting with EPDM o-ring.
   3. Press fit connection.
   4. Viega Pro Press approved.

E. Copper Pipe and Tube:
   1. Application:
      a. Cooling coil condensate drain
   2. Pipe: Type L hard temper copper with brazed or soldered joints, ASTM B88. Brazing required for 2" and larger lines.
   3. Fittings: Wrought copper solder-joint fittings, ANSI B16.22.

2.02 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Insulating (Dielectric) Fittings: Do not use. See Section 3.2, G.

B. Welding Materials: Provide welding materials as determined by the installer to comply with installation requirements.

C. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.
   1. Tin-Antimony Solder: ASTM B32, Grade 95TA.
   2. Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.
   3. Silver Solder: ASTM B32, Grade 96.5TS.

D. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges. Pressure and temperature rating required for the service indicated.

E. Strainers: "Y-pattern," ductile iron or bronze body (depending on pipe system) rated for pressures indicated with blow-off connection and 20 mesh stainless steel screen or perforated metal basket with 1/16" or 1/8" openings. Basis of Design: Victaulic Style 732.

F. Hot Water Valves up to 12": Model #'s listed are Nibco unless noted otherwise. Approved equal are Watts, Hammond, Appollo, and Victualic.
   1. Ball (to 2"):
      a. Two-piece, cast bronze body, full port, 600 psi WOG, T/S 585-70.
      b. Two-piece, forged brass body, standard port, 300 psi, Victaulic Series P589.
   2. Butterfly: Ductile iron body, electroless-nickel coated ductile iron aluminum bronze disc, 300 psi WOG, pressure responsive elastomer seat, and stainless steel stem that is offset from the disc centerline to provide complete 360-degree circumferential seating, suitable for water temperatures to +250 degrees F. Lugged body – LD-2000, Wafer body – WD-2000, Grooved body – Victaulic Vic300 MasterSeal.
   3. Check: Bronze or ductile iron body, spring-assisted swing check, 300 psi WOG, T/S-413B and F-918B, Grooved body – Victaulic Series 716.

2.03 HEATING WATER SPECIALTIES

A. Air Vents: Install at all system high points whether shown or not;
   1. At all locations not in mechanical rooms use manual air vents.
   2. At mechanical rooms fabricate of 2" diameter or larger pipe at least 12" long. At the high point of each main install an Armstrong No. 1AV autovent, or equivalent Bell & Gossett, Armstrong, Dunham-Bush approved substitute. Route discharge line to over floor sink.

C. Triple Duty Valve: Combination spring loaded vertical check, calibrated balancing and shut off valve with balance point memory in angle or straight pattern as required or as shown on the Drawings. Bell & Gossett, Taco, Armstrong, Thrush, Victaulic, Wheatley, Patterson or approved substitute.

D. Air Eliminator: Coalescing or centrifugal separation operation. Fabricated steel rated for 125 psi pressure with threaded, grooved, or flanged connections. Unit pressure drop shall not exceed one foot at design flow rate. Unit shall include internal air coalescing medium or galvanized steel strainer and perforated air collecting tube. Submittals shall include unit air and dirt elimination efficiencies at design flow. Include sediment collection area and bottom blowdown valve with hose connection. Install with high capacity float operated air vent. Spirovent, Bell & Gossett, Thrush, Taco, Armstrong, ELBI or approved.

E. Flow Control Valve:
   1. Install where shown on plans, flow metering fittings complete with quick disconnect, flow meter valves, with safety shut-off valves and with size and series identification tags. Install as recommended by manufacturer, Victaulic, Griswold, Pro-Hydronic Specialties or approved substitute.
   2. Valves shall be dynamic flow limiting devices sized to the nearest 0.5 gpm. Stainless steel cartridge and spring with body and ends to match piping system.
   3. Unless noted otherwise all flow control valves are flow limiting not balancing valves.

F. Circuit Setter and Balancing Valves: Globe style with calibrated handle style balancing fitting with differential pressure taps, brass or bronze body and trim. TA Hydronics STAD series, or equal Nexus, Wheatley or approved substitute. Valves shall only be used where specifically called out for balance valve, otherwise use flow control valve.

G. Chemical Shot Feeder: 2 gallon feeder rated for 125 psi working pressure complete with fill funnel and valve or cap, drain valve, air vent, and inlet and outlet connections. Griswold FB series, Vector Industries or approved

H. Differential Pressure Control Valves 1/2" through 2": Maximum differential pressure is 51 psi, maximum temperature is 248ºF for use in heating and cooling systems only. NPT threaded valve body and bonnet shall be manufactured of dezincification resistant copper alloy, O-rings, seat seal, and membrane manufactured of HBNR. Shall have adjustable differential control, single pressure temperature port, dead end service shut off capabilities, stainless steel spring, and polymide handle. Shall be capable of stabilizing ∆Pv ranges of 2.9-11.6 psi for heating water devices and 5.8-23.2 psi for chilled water valves, sizes shall be determined by factory representative based on system flows listed on drawings. Supply side valve shall be Tour and Andersson style STAD (or approved equal) with capillary tube, drain kit, and all connection fittings to match.

I. Water Meter: Multi-jet principle gear drive meter. Cast bronze body with reed switch. OMEGA FTB8000B-PT or equal. Calibrate to flow rates that would dilute treatment system.

2.04 EXPANSION JOINT

A. Stainless steel bellows type with flanged ends, controlled flexing, internal liner rated at a minimum of 28,000 average life cycles. Provide amount of expansion indicated at each joint as shown on Drawings. Carefully align joint and make proper allowance for temperature of pipe at time of installation. Flexonics, Hyspan, or approved substitute.

B. Multiple grooved flexible fittings per 2.1 C-3a-2 are allowed if installed per manufacture guidelines.

2.05 HYDRONIC COILS FOR EXISTING SYSTEM COIL REPLACEMENTS

A. Certification: Acceptable water coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer’s certification and/or the range of AHRI’s standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.

B. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5” beyond unit casing for ease of installation. Contractor must supply all coil connection grommets and sleeves.

C. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.

D. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.

E. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.

F. Coil connections shall be carbon steel, threaded connection. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the

highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.

2.06 HEAT TRACING

A. Freeze Protection Heat Cable: Self-regulating tracing cable with braided tinned copper under TPR outer jacket and all necessary accessories including controls (operate whenever OSA temperature is below 32º F), bulb-stat with 3' capillary, junction/power connection kit, pipe straps, power termination kit, end seal caps, etc. Raychem HWAT with DigiTrace EC-TS Controller or equivalent Chromacox, Thermon, Nelson, or approved substitute. System to be powered by 120 voltage power source.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. General: Install pipe, tube and fittings in accordance with recognized industry practices. Install each run accurately aligned with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings.
   1. Unions and flanges for disassembly, maintenance and/or replacement of valves and equipment are not required in installations using grooved joint couplings. (The couplings shall serve as disconnect points.)

B. Piping Runs: Route piping close to and parallel with walls, overhead construction, columns and other structural and permanent-enclosure elements of the building (pitched for drainage). If not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building or equipment and avoid diagonal runs. Wherever possible in finished and occupied spaces, conceal piping from view. Do not encase horizontal runs in solid partitions.

C. For pipes below grade backfill should be tamped compactly in place so as to assure a stable surface. Unless otherwise required by manufacture in their installation instructions install min. of 4” sand bedding with 3” of sand on each side of pipe or 2” between pipes. Provide 6” of sand over the top of the pipe. The balance of the fill above, below or beside the pipe shall not include rocks larger than 2” in diameter. Provide at least 24 inches of cover from top of pipe to grade. Where located below vehicle traffic area compacted fill shall meet H-20 Highway Loading. Install with trace wire (per these specifications on each line.

D. For below grade pipe with fusion welding Manufacturer shall provide on-site training to properly train the installing personnel in all phases of installation.

3.02 PIPING JOINTS

A. General: Provide joints of the type indicated in each piping system, and where piping and joint as manufactured form a system, utilize only that manufacturer's material.

B. Ferrous Threaded Piping: Thread pipe in accordance with ANSI 82.l; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave no more than 3 threads exposed.

C. Solder Copper Tube and Fitting Joints: In accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will draw solder full depth and circumference of joint. Wipe

excess solder from joint before it hardens. "T-Drill" field formed tees may be utilized where the main is at least two pipe sizes larger than the branch.

D. Braze Copper Tube and Fitting Joints: Where indicated, in accordance with ANSI/ASME B31.5. Pass a slow stream of dry nitrogen gas through the tubing at all times while brazing to eliminate formation of copper oxide.

E. Weld Pipe Joints: In accordance with recognized industry practice and as follows:
   1. Weld pipe joints only when ambient temperature is above 0 degrees F.
   2. Bevel pipe ends at a 37.5 degree angle, smooth rough cuts, and clean to remove slag, metal particles and dirt.
   3. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10"; 8 welds for pipe sizes up to 20".
   4. Build up welds with a stringer-bead pass, followed by a hot pass, followed by a cover of filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusion.
   5. Do not weld out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
   6. Install forged branch-connection fittings wherever branch pipe is indicated, or install regular "T" fitting at Contractor's option.

F. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gasket.

G. Insulating (Dielectric) Fittings: Where the "joining of ferrous and non-ferrous piping". Use brass valve or brass nipple with length/nominal dramatic ratio of 8 or greater rather than dielectric fitting.

H. Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.

I. Line Grades: Pitch steam piping 1" to 40' minimum to low point drips or drains.

J. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.

K. Expansion: Provide loops, swing joints, anchors, runouts and spring pieces to prevent damage to piping or equipment. Flexible hoses are not allowed.

L. Press Fittings: MegaPress Cold Press Mechanical Joint Fittings shall be installed in accordance with the manufacturer’s installation instructions. The protective corrosion coating shall be removed from the outside of the pipe end. The pipe shall be fully inserted into the fitting and the pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the pipe to assure the pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

3.03 MISCELLANEOUS PIPING EQUIPMENT

A. Floor, Wall and Ceiling Plates: Chrome plated pressed steel or brass screw locked split plates on all pipe penetrations in finished spaces.

B. Strainers: Install in a manner to permit access for cleaning and screen removal and with blow-off valve.

C. Sleeves: At all penetrations of concrete or masonry construction. PVC, 24 gauge galvanized steel or Schedule 40 galvanized steel pipe. Use steel pipe sleeves through beams, footings, girders or columns and for all penetrations of walls or floors below grade. Where floor finish is ceramic tile, terrazzo, or similar material extend standard steel pipe sleeves 1-1/2" above finished floor. Fabricate sleeves 1" diameter larger than pipe or insulation. PVC and sheet metal sleeves at non-structural penetrations only.

D. Sleeve Caulking: Grout uninsulated pipe with cement mortar or approved waterproof mastic. All caulking or grouting shall extend full depth of sleeve. Install UL sealing caulk, putty and/or system at all penetrations of fire rated walls, floors and ceiling.

E. Valves: Install valves in accordance with Section 23 05 00. Install control valves specified in other Division 23 Sections.

3.04 EQUIPMENT INSTALLATION

A. Installation and Arrangement: Install and arrange as shown on the Drawings. Comply with manufacturer's recommendations for installation connections and start-up.

B. Lubrication: Lubricate all moving and rotating parts in accordance with the manufacturer's recommendations prior to start-up.

C. Expansion Joint and Compensator Installation: Carefully align joint or compensator and make proper allowance for temperature of pipe at time of installation.

D. Air Vents: Conduct 1/4" copper tubing from high end of air chambers to accessible locations and terminate with screwdriver cock. Conduct 1/4" copper tubing from outlets of automatic air vents to floor drains indicated or to the outside when approved by Governing Authorities.

E. Pumps: Mount in a manner to allow disassembly of pump and motor without disturbing piping.

F. Mechanical Contractor and Balancing Contractor shall be trained on installation, connection, and balancing procedures by certified representative of differential pressure control valves.

3.05 FREEZE PROTECTION ELECTRIC HEAT CABLE INSTALLATION

A. Selection:
   1. For chilled water piping select cable watts/foot of pipe based upon maintaining 38 deg. F pipe temperatures with specified insulation thickness, pipe sizes and outside weather conditions of 20 degrees F and 20 mph wind.
   2. For freezer condensate drawn select cable watts/foot of pipe based upon maintaining 38 deg. F pipe temperatures with specified insulation thickness, pipe sizes and temperature at -15 degrees F and 0 mph wind.

B. Installation: Install heat cable under the insulation with the recommended number of wraps per foot of pipe and with all necessary accessories and bulb-stat with 3' capillary. Also protect all fittings and valves. Secure cable to piping with cable ties or fiberglass tape. Provide OSA or freezer temperature sensor and controls to operate based on OSA / freezer temperature.

C. Electrical: Connect to nearest available power source indicated on the Electrical Drawings. Verify electrical characteristics required.

3.06 CLEANING

A. General: Clean all dirt and construction dust and debris from all mechanical piping systems and equipment and leave in a new condition. Touch up paint where necessary.

B. Heating & Chilled Water Piping Systems:
   1. Add cleaning chemical in proper concentration to clean system of manufacturing and installation contamination and residue.
   2. Fill, vent and circulate the system with this solution at design operating temperature. After circulating for four hours, bleed out cleaning solution by the addition of fresh water to the system.
   3. Test for pH and add sufficient amount of the cleaning chemical to obtain a pH between 7 and 8.
   4. Clean all strainers and remove start-up strainers (from suction diffusers) after the system has operated for one week.

3.07 TEST

A. General:
   1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
   2. Provide all necessary temporary equipment for testing, including pump and gauges. Remove control devices before testing and do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.
   3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

B. Repair:
   1. Repair piping system sections which fail the required piping test by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemical stop-leak compounds, solder, mastics, or other temporary repair methods.
   2. Drain test water from piping systems after testing and repair work has been completed.

C. Heating & Chilled Water Piping: 75 psig hydrostatic for 30 psig systems without loss for four hours. Do not test existing coils.

D. Tanks and Equipment: Hydrostatic pressure to 1.5 times operating pressure.

END OF SECTION

SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the chemical treatment of the mechanical systems. Provide shot feeding of treatment chemicals for closed loop hydronic systems. Provide continuous treatment for open loop systems, including steam systems.

B. Related Work: The requirements of Section 23 05 00, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Regulations: Comply with all DEQ, EPA, OSHA, OSEA, local sewerage agency and Fire Marshal requirements concerning allowable amounts of each chemicals which can be disposed of through the sewer system or in proximity of personnel.

B. Codes: Comply with applicable sections of the State of Oregon Health and Safety Code, OAR Chapter 437, Div. 155, Hazard Communication.

C. Chemical treatment system design, installation, and startup shall be performed by an experienced HVAC system chemical treatment contractor. The chemical representative on site is to have no less than five years' experience. The vendor must have representation within a 200 mile radius of the site. Vendor must have local research and development facility and local in-house manufacturing.

D. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. Bring to the attention of the Architect in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

1.03 SUBMITTALS

A. Submit catalog data of chemical treatment equipment, installation details and list of likely chemicals to be used.

B. Submit all chemical Material Safety Data Sheets for each chemical.

C. Submit operating and maintenance data.

1.04 DELIVERY AND HANDLING

A. Chemical Containers Label: The following shall be included as a minimum label on chemical containers:
   1. Chemical contents.
   2. Hazard warnings prominently displayed.
   3. Manufacturer's and/or supplier's name and address.

B. Delivery: All chemical containers shall be factory sealed and unopened.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Corrosion: Provide a system to limit annual metal corrosion rates as follows:
   1. Cast iron < 0.002" per year.
   2. Copper < 0.0005" per year.
   3. Mild steel < 0.002" per year.
   4. Stainless steel < 0.0001" per year.

B. Scaling: System shall prevent no greater than 1% loss of heat transfer efficiency in any component or piece of equipment by preventing deposit formation.

C. Fouling: Recommend methods to keep fouling to a minimum. Set blow down rates and/or schedules.

D. Biological Contamination:
   1. Closed Loop Systems: Keep biological counts (algae, bacteria and fungi) to near zero readings.
   2. Open Loop Systems: Maintain total count to less than 1,000,000 per milliliter in a cyclical manner to achieve optimum control with minimum chemical consumption.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Refer to applicable Sections for Valves, Insulation, Painting, etc.

3.02 EQUIPMENT INSTALLATION

A. Installation and Arrangement: Install and arrange as shown on the Drawings. Comply with manufacturer's recommendations for installation connections and start-up.

3.03 CHEMICAL TREATMENT OF HEATING WATER AND CHILLED WATER SYSTEMS

A. General: Provide chemical treatment for the heating and chilled water systems. The treatment specialist shall recommend the proper treatment for the systems and initiate the various treatments, including the required chemicals.

B. Standards: Chemical treatment shall be in accordance with currently accepted standards for the Environmental Protection Agency (EPA). Chemicals shall be EPA registered and labeled in accordance with EPA Standards.

C. Implement the treatment and instruct the Owner's personnel in the proper care, use, and maintenance of the systems. Include testing procedures to maintain proper control and to assure adequate corrosion protection and control of water side deposits and scale.

D. Provide an initial start-up supply of chemicals, add them to the systems, and maintain the system at proper chemical level until project final completion. Following project final completion, provide a 12 month supply of chemicals for the systems.

E. Upon completion of cleaning and chemical treatment, tag each system as follows: "This piping system has been cleaned and chemically treated. Do not disturb unless authorized." Locate tag to be plainly visible.

F. Treat Chilled Water System to contain 25% Propylene Glycol for freeze protection.

END OF SECTION

SECTION 23 30 00 - AIR DISTRIBUTION

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide Air Distribution Materials as specified herein and as shown on the Drawings.

B. Material characteristics and size shall be as indicated on the Drawings.

C. Related Work: The requirements of Section 23 05 00, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Air Distribution Equipment Rating: In accordance with AMCA certified rating procedures and bearing the AMCA label.

B. See Commissioning specification for additional requirements.

1.03 SUBMITTALS

A. Submit catalog data, construction details and performance characteristics for all manufactured materials.

B. Submit operating and maintenance data.

C. For adhesives and sealants used on the interior of the building (inside the waterproofing system), include printed statement of volatile organic compound (VOC) content.

PART 2 PRODUCTS

2.01 SHEET METAL

A. Quality Assurance: Galvanized steel sheet metal except where otherwise indicated. Metal gauges, joints and reinforcement in accordance with Mechanical Code, ASHRAE and SMACNA standards. Ductwork shall be fabricated to the following pressure classifications:
   1. Return and exhaust ducts: 2” negative.
   2. Supply ducts from fan discharge to VAV box inlet: 4” positive. VAV box discharge to diffuser: 1” positive.
   3. Underfloor ductwork shall be per 2.1K unless associated with low return ducts and plenums with less than 10' of length below grade. Short runs of RA ductwork below grade may be constructed of 300 Series stainless steel with fully welded seams. Ducts to be lined per code for below grade ducts. Metal gauge shall be at least 20 gauge.

B. Acoustical Duct Lining: Line ducts with 1" thick lining (unless noted otherwise) for installation inside the building insulation envelope, and 1-1/2” for installation outside the building insulation envelope. Density shall be 3 lb / ft^3 minimum. Owens Corning, QuietR, or equal Schueller, or Certain Teed. Meeting NFPA 90A and B requirements for maximum flame spread and smoke developed. Duct liner adhesive shall conform to ASTM C916.Mechanically attach lining to sheet metal duct with fasteners conforming to SMACNA Standard MF-1-1971, Schuller Grip Nails or Gramweld welding pins. Apply fire-retardant type adhesive similar to Schuller No. 44 adhesive, Benjamin Foster 81-99, Insul-Coustic 22 or 3M equivalent on all leading edges, joints and seams.

C. Duct Sealing Tapes: Provide one of the following UL listed ductwork sealing tape systems.

1. Two-part sealing system with woven fiber, mineral gypsum impregnated tape and non-flammable adhesive. Hardcast "DT" tape and "FTA-20" adhesive, United "Uni-Cast" system, or accepted substitute.
2. For joints and seams exposed to the weather in lieu of soldering, United "Uni-Cast" system or approved.
3. Sealing systems with VOC content are not allowed.
4. Sealants and Primers – General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

D. Optional Duct Joints for Sheet Metal Ducts: "Ductmate System" by Ductmate Industries, Inc., Ward Duct Connectors, Inc., Mez Industries, or acceptable substitute. Spiramir self-sealing round duct connector system meeting Class 3 leakage standards with EPDM o-ring seal.

E. Exposed to View Spiral Seam Duct and Fittings: Round and flat oval spiral seam duct shall be manufactured of galvanized steel sheet metal with spiral lock seam. Matching fittings shall be manufactured of galvanized steel with continuous welded seams. Gauge shall be per SMACNA Duct Construction Standard third addition table for appropriate pressure, and reinforcement or at least 26 gauge.

F. Concealed Round Duct: Round and flat oval spiral seam duct shall be manufactured of galvanized sheet metal with spiral lock seam. Construction, gauges, and reinforcement in accordance with SMACNA standards. Fittings shall be manufactured of galvanized steel with spot welded or riveted and sealed seams or continuously welded seams. Snap lock longitudinal seam duct shall fully comply with SMACNA standards for duct gauge and seam type for appropriate pressure class. Adjustable elbows are prohibited.

G. Flexible Ductwork-Low Pressure: Insulated low pressure flexible duct, factory fabricated assembly consisting of a zinc-coated spring steel helix seamless inner liner, wrapped with a nominal 1" thick insulation for installation inside the building insulation envelope, and 1-1/2” for installation outside the building insulation envelope, 1 pound/cubic foot density fiberglass insulation. The assembly shall be sheathed in a vapor barrier jacket, factory vapor resistance sealed at both ends of each section. The composite assembly, including insulation and vapor barrier, shall meet the Class 1 requirements of NFPA Bulletin No. 90-A and be labeled by Underwriters Laboratories, Inc., with a flame spread rating of 25 or less and a smoke developed rating of 50 or under. The duct shall have factory sealed double air seal (interior and exterior) to assure an airtight installation. Genflex, ATCO, Wiremold, Thermaflex, Glassflex, Clevepak, Schuller, or accepted substitute.

2.02 ACCESSORIES

A. Manual Volume Dampers: Construct of material two gauges heavier than duct in which installed; single plate up to 12" wide; multiple over 12" wide. Hem both edges 1/2" and flange sides 1/2". Use Young, Duro-Dyne, MAT, or accepted substitute damper accessories. Young numbers are shown.
1. No. 605 bearing set with No. 403 regulator for dampers up to 24" long.
2. For dampers over 24" long use No. 660 3/8" rod, No. 656 end bearing and No. 403 regulator.
3. Where damper regulators are not readily accessible, use No. 660 or No. 661 rod extensions and No. 301 and No. 315 concealed damper regulators or MAT cable operated dampers as required.

Location of all volume dampers is not necessarily shown on Drawings; minimum required is one in each supply, return or exhaust main, and one in each branch.

B. Locking Connection Straps: 1/2" wide positive locking steel straps or nylon self-locking straps. Panduit or accepted substitute.

C. Access Doors In Sheet Metal Work:
   1. Hollow core double construction of same or heavier gauge material as duct in which installed. Use no door smaller than 12" by 12" for simple manual access or smaller than 18" by 24" where personnel must pass through infrequently. Use 24" by 60" minimum for filters and more frequent maintenance. Use Ventlok or accepted substitute hinges and latches on all doors.
      a. 100 Series hinges and latches on low pressure system doors up to 18" maximum dimension.
      b. 200 Series on larger low pressure system doors and 333 Series on high pressure systems.
   2. Construct doors up to 18" maximum dimension with 1" overlap, furr and gasket with 3/4" by 1/8" sponge rubber. Fit larger doors against 1-1/2" by 1/8" or angle frame and gasket with 3/4" by 1/8" sponge rubber or felt.

D. Opposed Blade Volume Damper: Install opposed blade volume damper in each zone supply duct on discharge of multi-zone units and where indicated on Drawings. Young No. 817 or accepted substitute.

E. Flexible Connections: Neoprene impregnated fiberglass connection. Ventglass, Duro-Dyne, or accepted substitute.

F. Control Dampers: Construct of aluminum frame and blades with continuous full length axle shafts and/or operating "jackshafts" as required to provide coordinate tracking of all blades. Interlocking multi-blade type, except where either dimension is less than 10", a single blade may be used. Opposed blade type on all modulating dampers and parallel blades on all two position dampers. Provide with metal jamb seal and neoprene blade seals. Damper assembly rated for maximum air leakage of 4 CFM per square foot at 1" wg pressure or less and with interconnecting blade linkages in the side channels of the frame.

2.03 GRILLES, REGISTERS AND DIFFUSERS

A. Description: Provide grilles, registers and diffusers as shown on the Drawings.

B. Finishes:
   1. Steel: Flat white enamel prime coat, factory applied on ceiling diffusers. Others are to have a baked enamel finish, color as selected by Architect.
   2. Aluminum: Anodized clear finish unless indicated otherwise.

C. Manufacturers: Carnes, Krueger, Titus, Price, Nailor, and Tuttle & Bailey are accepted substitutes where only Titus model numbers are listed. Where other manufacturer's products are listed and/or "accepted substitute" is indicated, only the products or an accepted substitute for that item shall be provided.

D. Ceiling Return and/or Exhaust Register: Perforated snap-in or concealed hinged face plate. Use in spaces containing ceiling diffusers and/or T-bar ceilings. Provide with damper except where dampered plenums are indicated. Match manufacturer of supply.

E. Sidewall Supply Grille or Register: Double deflection grille with face bars parallel to long dimension on ceiling type and horizontal on wall type; bars to be individually adjustable, spaced on 0.66" to 0.75" centers; key operated opposed blade volume damper only where branch duct / boot does not have a MVD. Blades to be extruded Aluminum with airfoil cross-section. Titus 272.

F. Sidewall or Ceiling Return or Exhaust Register: Utilized at grilles not near the floor line. Face bars parallel to long dimension on ceiling type and horizontal on wall type; bars set at 35 degrees to 45 degrees, spaced on 0.66" to 0.75" centers; key operated opposed blade volume damper where branch duct / boot does not contain a MVD. Titus 350RL Series.

G. Modular Core Ceiling Diffusers: 1 to 4-way pattern control. Pattern of distribution as indicated. Provide with opposed blade volume dampers and frame for unit as required. Titus MCD.

H. Heavy Duty, Adjustable Bars Low Return Grille: All welded construction with heavy 14 gauge, adjustable round edge steel horizontal face bars at 1/2" on centers and reinforced every 6" to 8". Titus 33 Series.

I. Steel Door Transfer Grilles and Sidewall Transfer grilles: All welded construction with 20 gauge, fixed inverted V-blades with a deflection angle of 77 so as to provide a sight proof design.

J. Music Room Ceiling Diffusers: 4-way pattern control. Titus TMSA.

K. Plaster Frames: Provide plaster frames for all diffusers, grilles or registers installed in plaster walls or ceiling. Where register face is aluminum, the plaster frame shall be aluminum. Frame to match manufacturer of register or be of compatible size of listed manufacturer. Titus TRM/TRM-S.

2.04 AIR TERMINALS

A. Variable Air Volume Terminal Box: Construct unit casings of 22 gauge galvanized steel fully lined with 1/2", 2 lb. density, neoprene coated fiberglass complying with the UL Standard 181 for erosion, and NFPA 90A for fire resistivity.
   1. Unit Inlets: Round, obround, or rectangular with double thickness gasketed damper blade mounted in self-lubricating bearings.
   2. Attenuation Section: Integral to the basic unit.
   3. ARI Certified: Test in accordance with ARI Standard 885-98 appendix E.
   4. Unit Sound Power Levels (second through seventh octave band): At minimum pressure drop, ratings shall not exceed 32 NC ducted or radiated.
   5. Pressure Independent VAV Terminals: Equip with velocity controls to control cfm independent of duct static pressure.
   6. Factory Furnished Accessories: All actuators, controls, and circuitry contained in a sheet metal enclosure.
   7. Reheat Coil: Provide heating water reheat coils of capacities indicated. Non-ferrous extended surface, counterflow serpentine type with heavy gauge galvanized steel casing suitable for mounting required. Assembled with 5/8” OD x 0.020” thick copper tubes brazed to copper headers with drain and vent tappings. Copper or aluminum fins mechanically bonded to tubes and spaced a maximum of 12 fins per inch. Construction shall allow for expansion and contraction without developing leaks. Permanently label each coil in accessible location with all operating parameters.
   8. Manufacturers: Titus, Price, Carnes, Nailor, Krueger, Envirotech, Trane, or approved substitute.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Air Handling Equipment Installation and Arrangement: Install and arrange as shown on Drawings. Comply with the manufacturer's recommendations for installation, connection, and start-up.

B. Equipment Access Panels: Locate free of all obstructions such as ceiling bars, electrical conduit, lights, ductwork, etc.

C. Filters: Install specified filters or accepted substitute temporary construction filters in supply units and systems prior to start-up or use for drying and/or temporary heat. Replace prior to acceptance of project.

3.02 INSTALLATION OF GRILLES, REGISTERS AND DIFFUSERS

A. Size and air handling characteristics shall be as shown on the Drawings.

B. Locate, arrange, and install grilles, registers and diffusers as shown on the Drawings. Locate registers in tee-bar ceilings with diffusers centered on the tile unless indicated otherwise.

3.03 DUCTWORK INSTALLATION

A. Support: Install ductwork with 1" wide strap cradle hangers not more than 8' on centers or as required by code. Support terminal units independent of adjacent ductwork. Attach to available building construction according to good practices for materials involved. Manufactured hanger system acceptable in lieu of fabricated hangers at Contractor’s option. Ductmate “Clutcher” system or approved. Support flexduct where shown to be used for lengths beyond 4’ per above requirements. Comply with SMACNA Duct Construction Standard Figure 3-9 and 3-10.

B. Fan and Air Handling Unit Flexible Connections: Install neoprene impregnated fiberglass connections in ductwork at all rotating equipment. Ventglass, Duro-Dyne or accepted substitute.

C. Elbows and Fittings: Construct elbows with throat radius equal to duct width in plane of turn or make them square and provide double wall, air foil turning vanes.

D. Fittings: Make transitions and take-offs as shown on Drawings. Provide volume dampers and splitter dampers as indicated on Drawings and as specified. Saddle tees are not allowed.

E. Acoustical Duct Lining:
   1. Acoustically line all fan unit intake and discharge plenums, all ductwork indicated as lined on the Drawings, all sheet metal ductwork specified per Section 23 07 00 as insulated, where exposed to view or subject to damage in areas such as mechanical rooms, and, at the Contractor's option, all insulated ductwork specified in Section 23 07 00 except outside air intake ducts. The duct size noted on the Drawings is the clear opening of the duct with insulation. Insulation shall not reduce duct size listed.
   2. All duct designated to receive duct liner shall be completely covered with a fire-resistant, fiber-bonding coating, or covering (composite, polymer, vinyl or neoprene) that reduces airflow resistance and controls fiber release. The duct lining shall be adhered to the sheet metal with 100% coverage of a fire retardant adhesive. The coated surface of the duct liner shall face the airstream. When width of duct exceeds 12” and also when height exceeds 24”, use corrosion resistant mechanical fasteners 12” on center maximum lateral spacing and 18” on center maximum longitudinal spacing. Start fastening within 3” of upstream transverse edge of the liner and within 3” of the longitudinal joint. Mechanical fasteners shall be either impact-driven or weld-secured and shall not pierce the duct walls. Fasteners and washers of the specified type and length shall be used assuring no greater than 10% compression of the liner thickness. Installation shall be made so that no fastener pins protrude into the airstream. No gaps or loose edges shall occur in the insulation. Top pieces shall be supported by the side pieces. Provide insulated build out frames for attaching dampers at running vanes where required.
   3. All transverse and longitudinal abutting edges of duct lining shall be sealed and lapped 3” with a heavy coat of approved adhesive, in accordance with the manufacturer’s

recommendations. All upstream transverse edges shall be installed with sheet metal nosings. All raw exposed edges of lining shall be 'buttered' with approved adhesive.

F. Manual Volume Dampers: Location of all volume dampers are not necessarily shown on the Drawings. Provide a minimum of one volume damper in each supply, return or exhaust branch. Do not install dampers closer than 3 duct diameters to the diffuser.

G. Duct Insulation: Specified in Section 23 07 00.

H. Sleeves: Provide galvanized sheet metal plaster ring around ductwork penetrating exposed finished walls. Sleeve and flash all duct penetrations through exterior walls in an air tight and weatherproof manner.

I. Plenums: Construct sheet metal plenums and partitions of not lighter than 18 gauge galvanized steel and reinforce with 1-1/2" by 1/2" by 1/8" angles as required to prevent drumming or breathing.

J. Access: Install necessary access opening and covers for cleaning, wiring or servicing motors, filters, fans, both entering and leaving air sides of coils, fire and/or smoke dampers and to other equipment located within or blocked by sheet metal work.

K. Sealing: Caulk, seal, grout and/or tape ductwork and plenums to make airtight at seams, joints, edges, corners and at penetrations. Solder all seams, joints, etc., on all ductwork exposed to the weather. Install specified tape in accordance with manufacturer's requirements using degreaser on surfaces to be taped and wiped to eliminate moisture.

3.04 NEW DUCTWORK CLEANING

A. Store all ductwork materials on pallets or above grade, protected from weather, dirt/mud and other construction dust.

B. Remove all accumulated dust, dirt, etc. from each duct section as it is being installed.

C. Clean all diffusers, grilles and registers just prior to project final completion.

D. Cover all ductwork terminations during construction to prevent accumulation of dust and debris.

END OF SECTION

SECTION 23 62 15 - AIR-COOLED LIQUID CHILLER

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

A. Microprocessor controlled, air-cooled liquid chiller utilizing scroll compressors, low sound fans, electronic expansion valve, hydronic pump system.

1.02 QUALITY ASSURANCE

A. Unit shall be rated in accordance with AHRI Standard 550/590, latest edition (U.S.A.) and all units shall be ASHRAE 90.1 compliant.

B. Unit construction shall comply with ASHRAE 15 Safety Code, UL latest edition, and ASME applicable codes (U.S.A. codes).

C. Unit shall be manufactured in a facility registered to ISO 9001 Manufacturing Quality Standard.

D. Unit shall be full load run tested at the factory.

E. See Commissioning specification for additional requirements.

F. A factory representative shall meet with Control Contractor to review sequence of operations and assist Control Contractor in generating a sequence of operation. Instances #’s from the factory controller shall be part of the sequence. See Section 23 09 23 for more information and requirements.

1.03 DELIVERY, STORAGE AND HANDLING

A. Unit controls shall be capable of withstanding 150 F (66 C) storage temperatures in the control compartment.

B. Unit shall be stored and handled per unit manufacturer's recommendations.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Manufacturer: Carrier, York (Johnson Controls), Daikin, Trane, or approved.

B. General: Factory assembled, single-piece chassis, air-cooled liquid chiller. Contained within the unit cabinet shall be all factory wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field start-up.

C. Unit Cabinet:
   1. Frame shall be of heavy-gage, galvanized steel.
   2. Exterior panels shall be galvanized steel with a baked enamel powder or pre-painted finish.
   3. Cabinet shall be capable of withstanding 500-hour salt spray test in accordance with the ASTM (U.S.A.) B-117 standard.

D. Fans:
   1. Standard condenser fans shall be direct-driven, 9-blade airfoil cross-section, reinforced polymer construction, shrouded-axial type, and shall be statically and dynamically balanced with inherent corrosion resistance.

2. Fan operation shall allow reduced sound levels during scheduled unoccupied operating periods. Manufacturers without unoccupied reduced sound capability shall submit 1/3 octave band data and sound power data as measured according to AHRI 370 as confirmation of unit sound characteristics.
3. Air shall be discharged vertically upward.
4. Fans shall be protected by coated steel wire safety guards.

E. Compressor/Compressor Assembly:
1. Fully hermetic, direct-drive, scroll type compressors.
2. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have either internal line break thermal and current overload protection or external current overload modules with compressor temperature sensors.
3. Compressors shall be mounted on rubber in shear vibration isolators.
4. Each compressor shall be equipped with crankcase heaters to minimize oil dilution.
5. Chillers with less than 4 stages of operation or not rated to operation below 25% are not allowed.

F. Cooler:
1. Cooler shall be rated for a refrigerant working-side pressure of 450 psig (3103 kPa) and shall be tested for a maximum waterside pressure of 150 psig (1034 kPa) when optional hydronic package is installed.
2. Shall be single-pass, ANSI type 316 stainless steel, brazed plate construction.
3. Shell shall be insulated with 3/4-in. (19 mm) closed-cell, polyvinyl-chloride foam with a maximum K factor of 0.28.
4. Shall incorporate 2 independent refrigerant circuits.
5. Cooler shall have optional factory-installed heater, to protect cooler from ambient temperature freeze down to 0º F.
6. Unit shall be provided with a factory-installed flow switch.
7. All connections internal to the unit shall use standard Victaulic-type fittings.
8. Cooler fluid inlet line shall have a 40 mesh strainer just ahead of the cooler.
9. Include factory freeze protection (heat trace) of water carrying components to factory pipe terminations. Provide power to devices through unit power connection.

G. Condenser:
1. Coil shall be air-cooled heat exchanger with microchannel coils and shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds.
2. Coils shall consist of a two-pass arrangement. Coil construction shall consist of aluminum alloys for fins, tubes, and manifolds in combination with a corrosion-resistant coating.
3. Tubes shall be cleaned, dehydrated, and sealed.
4. Assembled condenser coils shall be leak tested and pressure tested at 656 psig (4522 kPa).

H. Refrigeration Components:
1. Refrigerant circuit components shall include filter drier, moisture indicating sight glass, electronic expansion device, discharge and liquid service valves and complete operating charge of sides both refrigerant R-410A and compressor oil.

I. Controls, Safeties, and Diagnostics:
1. Unit controls shall include the following minimum components:
   a. Microprocessor with non-volatile memory. Battery backup system shall not be accepted.
   b. Separate terminal block for power and controls.
   c. Control transformer to serve all controllers, relays, and control components.
   d. ON/OFF control switch.
   e. Replaceable solid-state controllers.

f. Pressure sensors shall be installed to measure suction and discharge pressure for each circuit. Thermistors shall be installed to measure cooler entering and leaving fluid temperatures, outdoor ambient temperature, and suction temperature. Provision for field installation of accessory sensor to measure compressor return gas temperature.

2. Unit controls shall include the following functions:
   a. Automatic circuit lead/lag for dual circuit chillers.
   b. Hermetic scroll compressors are maintenance free and protected by an auto-adaptive control that minimizes compressor wear.
   c. Capacity control based on leaving chilled fluid temperature and compensated by rate of change of return-fluid temperature with temperature set point accuracy to 0.1° F (0.06° C).
   d. Limiting the chilled fluid temperature pulldown rate at start-up to an adjustable range of 0.2° F to 2° F (0.11° C to 1.1° C) per minute to prevent excessive demand spikes at start-up.
   e. Seven-day time schedule.
   f. Leaving chilled fluid temperature reset from return fluid and outside air temperature.
   g. Timed maintenance scheduling to signal maintenance activities for pump, condenser coil cleanings, strainer maintenance and user-defined maintenance activities.
   h. Low ambient protection to energize cooler and hydronic system heaters.
   i. Periodic pump start to ensure pump seals are properly maintained during off-season periods.
   j. Single step demand limit control activated by remote contact closure.
   k. Nighttime sound mode to reduce the sound of the machine by a user-defined schedule.
   l. Variable speed condenser fans on each circuit for capacity modulation.
3. Diagnostics:
   a. The control panel shall include, as standard, a scrolling marquee display capable of indicating the safety lockout condition by displaying a code for which an explanation may be scrolled at the display.
   b. Information included for display shall be:
      1) Compressor lockout.
      2) Loss of charge.
      3) Low fluid flow.
      4) Cooler freeze protection.
      5) Cooler set point.
      6) Chilled water reset parameters.
      7) Thermistor and transducer malfunction.
      8) Entering and leaving-fluid temperature.
      9) Compressor suction temperature.
      10) Evaporator and condenser pressure.
      11) System refrigerant temperatures.
      12) Chiller run hours.
      13) Compressor run hours.
      14) Compressor number of starts.
      15) Low superheat.
      16) Time of day:
         a) Display module, in conjunction with the microprocessor, must also be capable of displaying the output (results) of a service test. Service test shall verify operation of every switch, thermistor, fan, and compressor before chiller is started.
         b) Diagnostics shall include the ability to review a list of the 20 most recent alarms with clear language descriptions of the alarm event. Display of alarm codes without the ability for clear language descriptions shall be prohibited.
         c) An alarm history buffer shall allow the user to store no less than 20 alarm events with clear language descriptions, time and date stamp event entry.

d) The chiller controller shall include multiple connection ports for communicating with the local equipment network.
e) The control system shall allow software upgrade without the need for new hardware modules.

4. Safeties:
   a. Unit shall be equipped with thermistors and all necessary components in conjunction with the control system to provide the unit with the following protections:
      1) Loss of refrigerant charge.
      2) Reverse rotation.
      3) Low chilled fluid temperature.
      4) Thermal overload.
      5) High pressure.
      6) Electrical overload.
   b. Factory pump motor shall have external overcurrent protection.

J. Operating Characteristics:
1. Unit shall be capable of operating down to 45 F.
2. Unit shall be capable of starting and running at outdoor ambient temperatures up to 120 F (50 C) for all sizes. Unit shall additionally be able to stay online when running with a 125 F (52 C) ambient temperature.
3. Unit shall be capable of starting up with 95 F (35 C) entering fluid temperature to the cooler.

K. Fan Motors:
1. Condenser fans shall be direct-drive quiet option type, discharging air vertically upward. See drawings for unit acoustic performance.
2. All condenser fan motors shall be totally enclosed 3-phase type with permanently lubricated ball bearings, class F insulation and internal, automatic reset thermal overload protection or manual reset calibrated circuit breakers.
3. Shafts shall have inherent corrosion resistance.
4. Fan blades shall be statically and dynamically balanced.
5. Condenser fan openings shall be equipped with PVC coated steel wire safety guards.

L. Electrical Requirements:
1. Unit/module primary electrical power supply shall enter the unit at a single electrical box.
2. Unit shall operate on 3-phase power at the voltage shown in the equipment schedule.
3. Control points shall be accessed through terminal block.
4. Unit shall be shipped with factory control and power wiring installed.
5. Provide with factory installed disconnect.
6. Unit shall be listed for SCCR = 65k AIC.

M. Chilled Water Circuit:
1. Chilled water circuit shall be rated for 300 psig (2068 kPa).
2. Solid-state flow monitor with integral relay shall be factory installed and wired.
3. Brass body strainer with 40 mesh screen and ball type blow down.

N. Special Features:
1. Security Grilles/Hail Guards:
   Unit shall be supplied with factory or field-installed, louvered, sheet metal panels which securely fasten to the chiller and provide condenser coil protection against hail and other physical damage. Provide wire guards entirely covering the sides of the chiller below the coil section.
2. Vibration Isolation:
   Vibration isolation pads shall be supplied for field installation at unit mounting points. Pads shall help to reduce vibration transmission into the occupied space.
3. BACnet Communication Option:

Shall allow the integration with a BACnet MS/TP network.

4. Freeze Protection Cooler Heaters:
   Cooler heaters shall provide protection from cooler freeze-up to 0º.
5. Low Sound Package:
   Low-sound Condenser fans and compressor sound covers to provide chiller sound reduction and a resulting sound power level equal or less than listed on the drawings.
6. Compressor Suction Service Valves:
   Shall provide a suction service valve per circuit, which is in addition to the standard discharge service valve.
7. Controls: Operation shall be from BACnet Integration. See specification for sequence.

O. Hydonic Components:
   1. Pressurized Precharged Expansion Tank: Precharged bladder type hydropneumatic tank with all necessary air elimination fittings. Install with ball valve on piping connection. Amtrol, Taco, Bell & Gossett, Armstrong, Wheatley, Wessels or approved substitute.
   2. Suction Diffusers: Where indicated on Drawings provide a suction diffuser with stainless steel inlet vanes, combination diffuser-strainer orifice cylinder 20-mesh stainless steel and temporary start-up strainer on the inlet of base mounted pumps. Bell & Gossett, Taco, Armstrong, Thrush, Victaulic, Wheatley, Patterson or approved substitute.
   3. Pumps: Inline configuration with split coupling design, mechanical seals, suitable for hot or cold water service at head and capacity stated on Drawings. Cast iron casing, bronze fitted, roller bearing, 1750 rpm standard frame motor. Impeller size not to exceed 90% of largest diameter impeller which will fit pump casing. Minimum horsepower and efficiency as indicated on Drawings and not less than will be required at any point of the impeller curve. Provide pressure gauge tappings on suction and discharge flanges. Grundfos, Bell & Gossett, Armstrong, Patterson, Taco, or approved substitute. Motor shall be Baldor only. Provide coupling and shaft guard to meet requirements of State Safety Code. Provide with shaft grounding kit, Aegis or equal. Do not trim impeller where pump is operated by a VFD.
   4. Thermal Storage / Buffer Tank: ASME construction, primed carbon steel with minimum design pressure of 125 PSI at 280 deg. F. Connections for pipe means of attachment as approved. Provide with inspection access and internal baffle. Site insulation is allowed per Section 23 07 00 or provide with minimum of 1" Armaflex. Taco BTH or equal Amtrol, B&G, or approved.

P. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

Q. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary. Verify water source for compliance with manufacturer's requirements for flow and temperature. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

R. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION

CONCEPTUAL RENDERING

SCSD Elementary School HVAC & Electrical Service

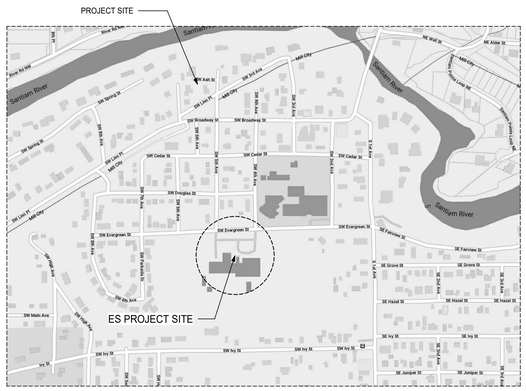
Santiam Canyon School District

Santiam Canyon Elementary School
450 SW Evergreen Street
Mill City, OR 97360

ISSUE FOR PERMIT SET
12/22/2021

Soderstrom
Architects

VICINITY MAP



PROJECT ADDRESS:

Santiam Canyon Elementary School (ES)
450 SW Evergreen Street
Mill City, OR 97360

PROJECT SUMMARY:

HVAC and Electrical Service upgrade for the existing Elementary School building. This inculdes a new chiller to be mounted at grade and replacment air handlers added to the mechanical spaces. Electrical upgrades support new mechanical equipment and controls.

PROJECT TEAM

OWNER
SANTIAM CANYON SCHOOL DISTRICT
www.santiam.k12.or.us
150 SW Evergreen Street
Mill City, OR 97360
503-897-2321
Todd Miller, Superintendent

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SODERSTROM ARCHITECTS, LTD.
www.sdra.com
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Portland, OR 97209
503-228-5617
Fax. 503-273-8584
Marlene Gillis, President

MECHANICAL / PLUMBING ENGINEERS
MFIA, INC. CONSULTING ENGINEERS
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Portland, OR 97214
503-234-0548
Scott Miller, Principal
Jose Gonzalez, Mechanical Designer

ELECTRICAL ENGINEER
LANDIS CONSULTING ENGINEERING SERVICES
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Salem, OR 97306
503.584.1576
Ben Perry, President

CIVIL ENGINEER
LOCKE ENGINEERS
www.lockeengineers.com
1375 Liberty Street SE
Salem, OR 97302
503-364-8207
Greg Locke, President
Charles Fisher, Senior Engineering Tech
Jill Bierman, Owner

DEFERRED SUBMITTALS

REFER TO SPECIFICATION SECTION 01 11 50 FOR BIDDER DESIGN REQUIREMENTS FOR BOTH AHJ REVIEW ITEMS AND NON-AHJ DEFFERRED ITEMS. SUBMITTAL DOCUMENTS FOR AHJ DEFERRED SUBMITAL ITEMS SHALL BE SUBMITED TO THE ARCHITECT OF RECORD BY THE GENERAL CONTRACTOR. ARCHITECT AND APPROPRIATE ENGINEER OF RECORD SHALL REVIEW AND RETURN. THE GENERAL CONTRACTOR SHALL THEN FORWARD AHJ SUBMITTAL ITEMS TO THE BUILDING OFFICAL FOR AHJ APPROVAL WITH A NOTATION INDICATING THAT THE DEFERRED SUBMITTAL DOCUMENTS HAVE BEEN REVIEWED AND THAT THEY HAVE BEEN FOUND IN GENERAL CONFORMANCE WITH THE DESIGN OF THE BUILDING. THE AHJ DEFERRED SUBMITAL ITEMS SHALL NOT BE INSTALLED UNTIL THEIR DESIGN AND SUBMITAL DOCUMENTS HAVE BEEN APPROVED BY THE BUILDING OFFICIAL.

AUTHORITY HAVING JURISDICTION (AHJ) DEFFERRED SUBMITTAL ITEMS:

A. FIRE SPRINKLER SYSTEM, DIVISION 21
B. FIRE ALARM, DIVISION 28

REFER TO SPECIFICATION SECTION 01 11 50 SUBMITTAL REQUIREMENTS FOR NON-AHJ BIDDER DESIGNED/ENGINEERED ITEMS.

PROJECT NOTES

1. THIS PROJECT REQUIRES PHASED CONSTRUCTION. REFER TO ALL DRAWINGS AND SPECIFICATIONS FOR PHASING RECOMMENDATION. MAINTAIN EXISTING SCHOOL FUNCTION, UTILITIES, ETC. UNTIL OWNER MOVE-IN. GENERAL CONTRACTOR SHALL PROVIDE PHASING PLAN FOR OWNER REVIEW PRIOR TO CONSTRUCITON.
2. THE CONSTRUCTION CONTRACT IS FOR THE CONSTRUCTION OF A COMPLETE AND FULLY FUNCTIONING INSTALLATION. THESE DOCUMENTS DESCRIBE THE DESIGN INTENT AND SPECIFIC REQUIREMENTS OF THE INSTALLATION. THESE DOCUMENTS DO NOT INTEND TO SHOW EVERY ITEM REQUIRED TO CONSTRUCT THE WORK. ITEMS SUCH AS FASTENERS, CONNECTORS, FILLERS, MISCELLANEOUS CLOSURE ELEMENTS, ANCILLARY CONTROL WIRING AND POWER WHERE REQUIRED FOR THE CONTROL OR OPERATION OF THE PROVIDED EQUIPMENT ARE NOT ALWAYS SHOWN BUT ARE CONSIDERED INCLUDED IN THE SCOPE OF THE WORK. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE A FULLY FUNCTIONING INSTALLATION WHICH MEETS THE DESIGN INTENT, INCLUDING THE SPECIFIC REQUIREMENTS INCLUDED IN THESE DOCUMENTS.
3. ALL ITEMS IN THESE DOCUMENTS ARE NEW UNLESS OTHERWISE NOTED.
4. THESE DOCUMENTS DESCRIBE A SINGLE CONSTRUCTION CONTRACT. THE USE OF SUBCONTRACTORS IS THE ELECTION OF THE CONTRACTOR. THESE DOCUMENTS DO NOT INTEND TO DIVIDE THE WORK AMONG THE CONTRACTOR'S SUBCONTRACTORS. WHERE THE DOCUMENTS IDENTIFY WORK WHICH IS "NOT IN MECHANICAL WORK" OR "NOT IN ELECTRICAL WORK" IT MEANS THAT WORK IS NOT FURTHER DESCRIBED OR SPECIFIED IN THE MECHANICAL OR ELECTRICAL DRAWINGS OR SPECIFICATIONS. IT DOES NOT PRECLUDE THE CONTRACTOR FROM DELEGATING THE WORK TO THE ENTITIES OF HIS ELECTION. IN ADDITION THE DIVISION OF THE CONTRACT DOCUMENTS INTO ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL AND OTHER DESIGN DISCIPLINES NEITHER DIVIDES THE WORK FOR THOSE DISCIPLINES AS SHOWN ONLY IN THOSE DRAWINGS OR SPECIFICATIONS.
5. ITEMS INDICATED IN THIS SET NOTED "BY OWNER" ARE NOT IN THE CONTRACT (N.I.C.)
6. UNLESS OTHERWISE NOTED, IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR AND THE SUBCONTRACTORS TO REVIEW ALL DRAWINGS, PROJECT MANUAL, ADDENDA, ETC. IN ORDER TO ASSURE THE COORDINATION OF ALL WORK AFFECTING EACH TRADE. FAILURE TO REVIEW AND COORDINATE ALL CONTRACT DOCUMENTS BY THE GENERAL CONTRACTOR WITH ALL THE SUBCONTRACTORS FOR APPLICABLE ITEMS OF THE WORK SHALL NOT RELIVE THE RESPONSIBLE PARTY FROM PERFORMING ALL WORK SO REQUIRED AS PART OF THE CONTRACT.
7. UNLESS OTHERWISE NOTED, THE CONTRACTOR SHALL LAYOUT AND SEQUENCE THE INSTALLATION OF THE WORK SO THAT THE DIFFERENT SYSTEMS DO NOT OBSTRUCT THE INSTALLATION OF SUCCESSIVE WORK. IN GENERAL, SYSTEMS INSTALLED FIRST SHOULD BE KEPT AS HIGH AND TIGHT TO STRUCTURE AS POSSIBLE TO LEAVE SPACE AVAILABLE FOR SYSTEMS WHICH FOLLOW.
8. REFER TO THE PROJECT MANUAL FOR SPECIFICATIONS, GENERAL INFORMATION, PRODUCTS AND EXECUTION REQUIREMENTS. REQUIREMENTS OF THE SPECIFICATIONS APPLY TO ALL ASPECTS OF THE WORK AND ARE INCLUDED AS ADDITIONAL INFORMATION FOR EACH ITEM SPECIFIED. IF DISCREPANCIES EXISTS BETWEEN THE SPECIFICATIONS AND DRAWINGS, THE MORE STRINGENT REQUIREMENTS SHALL PREVAIL. THE GENERAL CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVES OF ANY DISCREPANCIES.
9. THE GENERAL CONTRACTOR AND ALL SUBCONTRACTORS WILL VISIT THE SITE PRIOR TO BIDDING IN ORDER TO FAMILIARIZE THEMSELVES WITH THE EXISTING SITE CONDITIONS AND THE IMPACT OF THE PROPOSED NEW WORK, INDICATED ON THE DRAWINGS AND SPECIFICATIONS, ON THESE CONDITIONS. ANY QUESTIONS REGARDING THE COORDINATION OF NEW WORK OR EXISTING CONDITIONS MUST BE SUBMITTED TO THE OWNER'S REPRESENTATIVE IN WRITING PRIOR TO BID SUBMISSION AND WITH ADEQUATE TIME FOR RESPONSE TO ALL BIDDERS. THE OWNER'S REPRESENTATIVE WILL RESPOND TO QUESTIONS, SUBMITTED IN A TIMELY MANNER, WITH WRITTEN CLARIFICATIONS FORWARDED TO ALL BIDDERS.
10. THE EXISTING DIMENSIONS AND CONDITIONS SHOWN ON THESE DRAWINGS ARE ASSUMED TO BE ACCURATE BASED ON AVAILABLE INFORMATION. THE CONTRACTOR SHALL, PRIOR TO THE START OF CONSTRUCTION, VERIFY ALL EXISTING CONDITIONS, PROVIDE A COMPLETE FIELD LAYOUT ON THE JOB SITE, AND NOTIFY THE OWNER'S REPRESENTATIVE OF ANY DEVIATIONS OR CONFLICTS WITH THESE DRAWINGS.
11. THE DRAWINGS SHALL NOT BE SCALED. THE GENERAL CONTRACTOR SHALL REFER TO THE DIMENSIONS INDICATED OR THE ACTUAL SIZES OF CONSTRUCTION ITEMS. WHERE NO DIMENSIONS OR METHOD OF DETERMINING A LOCATION IS GIVEN, VERIFY CORRECT DIMENSIONS OR LOCATION WITH THE OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION.
12. THE DRAWINGS AND REFERENCED DETAILS HAVE BEEN DIMENSIONED IN ORDER TO ESTABLISH THE CONTROL AND GUIDELINES FOR FIELD LAYOUT. WHERE A DISCREPANCY EXISTS BETWEEN THE DRAWING AND THE DETAIL THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE FOR CLARIFICATION PRIOR TO INSTALLATION.
13. DIMENSIONS ARE TO FACE OF FINISH UNLESS OTHERWISE NOTED.
14. WHERE DIMENSIONS ARE NOTED TO BE VERIFIED IN THE FIELD (VIF or FV) THE DIMENSION SHOWN IS THE DESIGN BASIS, BUT MAY DIFFER FROM ACTUAL CONDITIONS. CONTRACTOR SHALL VERIFY THESE DIMENSIONS WHILE LAYING OUT THE WORK AND REPORT ANY DISCREPANCIES BETWEEN THE DESIGN BASIS AND ACTUAL DIMENSIONS TO THE OWNER'S REPRESENTATIVE PRIOR TO PROCEEDING WITH THE WORK. WHERE DIMENSIONS ARE NOTED "+/-" FIELD DIMENSIONS MAY VARY FROM THE NOTED DIMENSIONS BY MINOR AMOUNTS. IF THE CONTRACTOR IDENTIFIES DIMENSIONS IN THE FIELD THAT DIFFER BY MORE THAN 1" FROM THE +/- DIMENSIONS INDICTED IN THE DRAWINGS, THE CONTRACTOR SHOULD CONFIRM DIFFERENTIAL WITH ARCHITECTS.
15. INTERIOR DETAILS ARE KEYED TO THE PLANS AT TYPICAL LOCATIONS. TYPICAL DETAILS APPLY TO ALL LOCATIONS WHICH ARE SIMILAR BUT ARE NOT OTHERWISE DETAILED. THE CONTRACTOR AND SUBCONTRACTORS ARE RESPONSIBLE TO COORDINATE THE LOCATION OF TYPICAL DETAILS AND INSTALL THE WORK INDICATED. IF DISCREPANCIES EXIST OR QUALIFICATION IS REQUIRED, THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE FOR CLARIFICATION PRIOR TO PROCEEDING.
16. INTERIOR FINISHES ARE KEYED TO THE DRAWINGS AT TYPICAL LOCATIONS. THE FINISHES APPLY TO ALL LOCATIONS WHICH ARE SIMILAR BUT ARE NOT OTHERWISE DETAILED. CONTRACTOR AND SUBCONTRACTORS ARE RESPONSIBLE TO COORDINATE THE LOCATION ALL TYPICAL DETAILS AND INSTALL THE WORK INDICATED. IF DISCREPANCIES EXIST OR QUALIFICATION IS REQUIRED, THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE FOR CLARIFICATION PRIOR TO PROCEEDING.
17. ABBREVIATIONS ON SHEET G0.02 APPLY TO THE ENTIRE SET UNLESS OTHERWISE NOTED. REFER TO LIST OF ABBREVIATIONS ON MPE, CIVIL, LANDSCAPE AND FOOD SERVICE COVER SHEETS FOR ADDITIONAL ABBREVIATIONS.
18. WALL FIRE RATING INDICATIONS ON THE FLOOR PLANS SHOW EXTENT OF FIRE RATED PARTITION. FIRE RATING IN A PARTITION SHALL CONTINUE OVER DOOR OR WINDOW OPENING WHETHER OR NOT THEY APPEAR IN PLAN.
19. IT IS THE GENERAL CONTRACTOR'S RESPONSIBILITY TO VERIFY SIZE AND INVERT ELEVATION OF OPENINGS / SLEEVES THROUGH CONCRETE AND MASONRY WALLS AND CONCRETE FOUNDATION WALLS. OPENINGS / SLEEVES ARE NOT LIMITED TO THOSE SHOWN ON STRUCTURAL DRAWING SHEETS.
20. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO COORDINATE AND MAKE PROVISIONS FOR ALL PIPE / CONDUIT SLEEVES THROUGH CONCRETE WALLS.
21. ELEVATIONS ARE TO TOP OF CONCRETE OR OTHER HARD SURFACE MATERIAL. DO NOT SCALE DRAWINGS. USE DIMENSIONS INDICATED.
22. DETAILS ARE INTENDED TO SHOW METHOD AND MANNER OF ACCOMPLISHING THE WORK. MINOR MODIFICATIONS MAY BE REQUIRED TO SUIT JOB DIMENSIONS OR CONDITIONS AND SHALL BE INCLUDED AS PART OF THE WORK.
23. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS AND EXISTING CONDITIONS AT THE SITE BEFORE COMMENCING WORK AND REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO START OF THE WORK. IN CASE OF CONFLICT BETWEEN ARCHITECTURAL AND CONSULTANTS DRAWINGS, THE ARCHITECT WILL DETERMINE THE CORRECT INTENTION OF THE WORK.
24. THE NEW BUILDINGS SHALL BE PROVIDED WITH A FULL SPRINKLER SYSTEM COMPLYING WITH APPLICABLE CODES OF THE AUTHORITY HAVING JURISDICTION.
25. PROVIDE PEDESTRIAN PROTECTION AS NECESSARY AND AS REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
26. ALL CONSTRUCTION RELATING TO BUILDING, PARKING OR SITE DEVELOPMENT SHALL CONFORM TO STATE OF OREGON AND JURISDICTIONAL ACCESSIBILITY REQUIREMENTS.
27. THE CONTRACTOR SHALL COORDINATE ANY AND ALL REQUIREMENTS FOR OFF-SITE IMPROVEMENTS, INCLUDING BUT NOT LIMITED TO SIDEWALKS, DRIVEWAYS, CURBS, GUTTERS, UTILITIES, ETC. OFF SITE IMPROVEMENTS SHALL MEET THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION (AHJ).
28. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS. SPECIFIC NOTES ON DETAILS APPLY TO SIMILAR CONDITIONS UNLESS NOTED OTHERWISE (UNO / UON).
29. WHERE FIRE RATED OPENING PROTECTION IS REQUIRED, THE FIRE DOORS AND SMOKE AND DRAFT CONTROL ASSEMBLIES INSTALLED IN CORRIDOR OPENINGS SHALL BE TESTED AND LABELED IN ACCORDANCE WITH OSSC CURRENT EDITION SECTION 714. IN ACCORDANCE WITH THE REQUIREMENTS OF THE LISTED ASSEMBLY, THE MANUFACTURER'S INSTALLATION INSTRUCTIONS SHALL BE PROVIDED WITH EACH ASSEMBLY FOR INSTALLATION AND FOR REVIEW BY THE INSPECTION AUTHORITY.

SHEET INDEX

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Santiam Canyon School District
SCSD Elementary School HVAC & Electrical Service Upgrades
Santiam Canyon ES
450 SW Evergreen Street
Mill City, OR 97360

Project

Consultant

Revisions

No.	Description	Date

Stamp

REGISTERED ARCHITECT
4758
MARLENE R. GILLIS
PORTLAND, OREGON
STATE OF OREGON

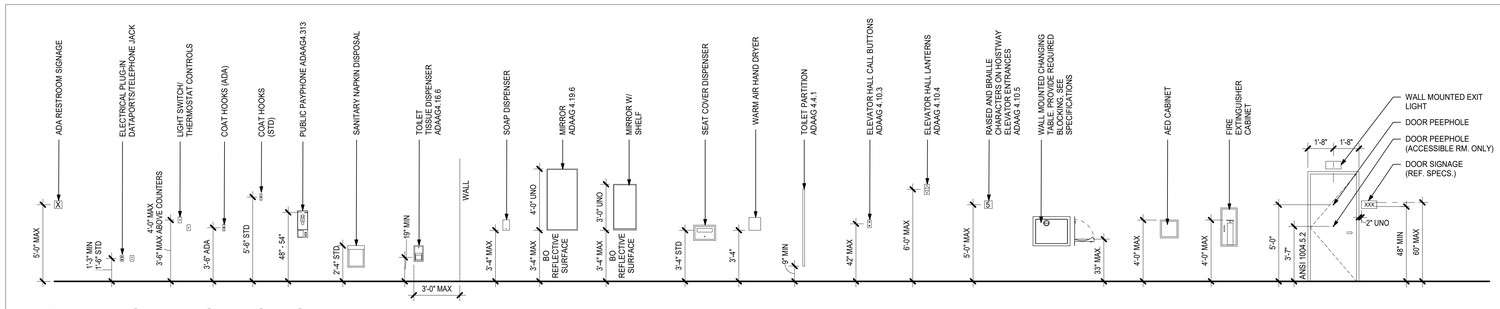
Issuance
ISSUE FOR PERMIT SET

Date
12/22/2021

Project Number
19056

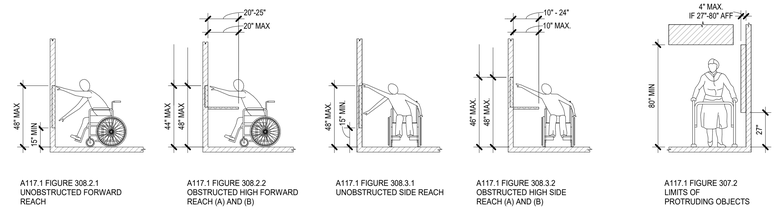
Drawing Title
PROJECT INFO

Sheet No
G0.01



TYP ADA MOUNTING HEIGHTS

1/4" = 1'-0"



A117.1 FIGURE 308.2.1 UNOBSTRUCTED FORWARD REACH

A117.1 FIGURE 308.2.2 OBSTRUCTED HIGH FORWARD REACH (A) AND (B)

A117.1 FIGURE 308.3.1 UNOBSTRUCTED SIDE REACH

A117.1 FIGURE 308.3.2 OBSTRUCTED HIGH SIDE REACH (A) AND (B)

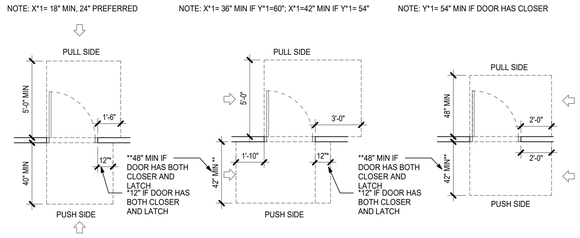
TYP REACH RANGES

1/4" = 1'-0"

A117.1 FIGURE 307.2 LIMITS OF PROTRUDING OBJECTS

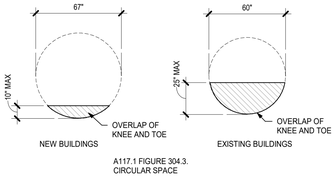
PROTRUDING OBJECTS

1/4" = 1'-0"



TYP ADA DOOR CLEARANCES

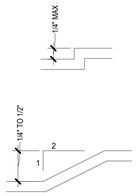
1/4" = 1'-0"



A117.1 FIGURE 304.3. CIRCULAR SPACE

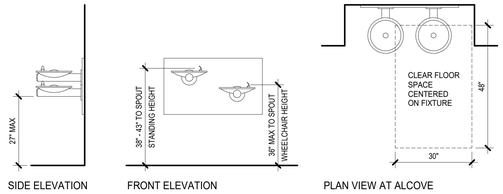
TYP TURNING RADIUS

1/4" = 1'-0"



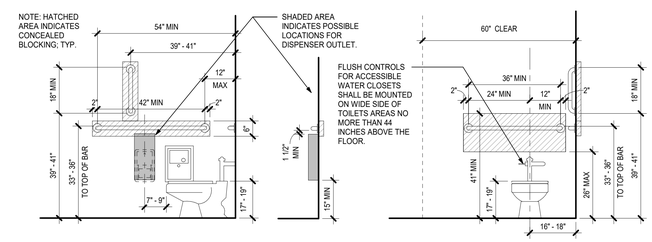
LEVEL CHANGES

1/4" = 1'-0"



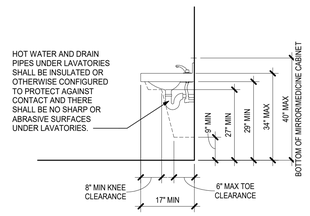
TYP DRINKING FOUNTAIN

1/2" = 1'-0"



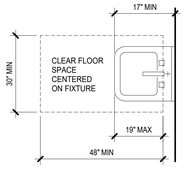
ADA WC ELEVATIONS

1/2" = 1'-0"



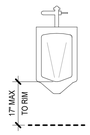
TYP LAVATORY ELEVATION

1/2" = 1'-0"



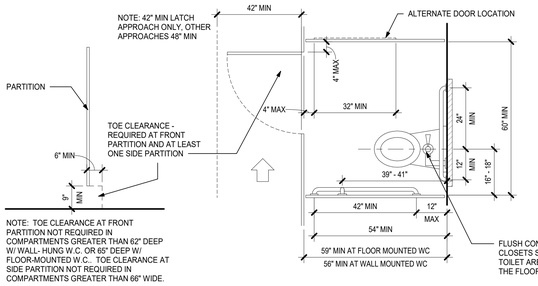
TYP LAVATORY PLAN

1/2" = 1'-0"



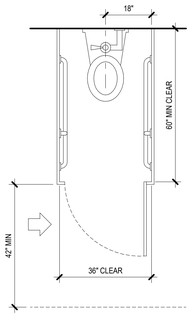
URINAL HEIGHT

1/2" = 1'-0"



ADA STALL PLAN

1/2" = 1'-0"



AMBULATORY WC PLAN

ABBREVIATIONS

#	POUND OR NUMBER
A/C	AIR CONDITIONING
AB	ANCHOR BOLT
ACT	ACOUSTICAL CEILING TILE
AD	AREA DRAIN
ADD	ADDENDUM
ADH	ADHESIVE
AFF	ABOVE FINISH FLOOR
AGG	AGGREGATE
AHJ	AUTHORITY HAVING JURISDICTION
AL(UM)	ALUMINUM
ALT	ALTERNATE
ANOD	ANODIZED
AP	ACCESS / ACOUSTIC PANEL
ARCH	ARCHITECT(URAL)
AUTO	AUTOMATIC
BATT	BATT INSULATION
BD	BOARD
BIT	BITUMINOUS
BLDG	BUILDING
BM	BENCH MARK
BO	BOTTOM OF
BOL	BOLLARD
BOT	BOTTOM
BR(N)Z	BRONZE
CB	CATCH BASIN
CCTV	CLOSED CIRCUIT TV
CEM	CEMENT
CF	CUBIC FOOT
CG	CORNER GUARD
CI	CONTINUOUS INSULATION
CJT	CONTROL JOINT
CL	CENTERLINE
CLG	CEILING
CLR	CLEAR(ANCE)
CMU	CONCRETE MASONRY UNIT
COL	COLUMN
CONC	CONCRETE
CONST	CONSTRUCTION
CONT	CONTINUE, CONTINUOUS
CONTR	CONTRACT
COORD	COORDINATE
CRS	COURSE
CS	COUNTERSINK
CSMT	CASEMENT
CT	CERAMIC TILE
CTR	CENTER
CX	CONNECTION
CY	CUBIC YARD
DEM	DEMOLISH, DEMOLITION
DEP	DEPRESSED
DF	DRINKING FOUNTAIN
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DISP	DISPENSER
DIV	DIVISION
DL	DEAD LOAD
DMT	DEMOUNTABLE
DN	DOWN
DR	DOOR
DS	DOWNSPOUT
DTL	DETAIL
DWG(S)	DRAWING(S)
DWR	DRAWER
E	EAST
EA	EACH
EB	EXPANSION BOLT
EJ	EXPANSION JOINT
EL, ELEV	ELEVATION
ELEC	ELECTRIC(AL)
EMER(G)	EMERGENCY
ENCL	ENCLOSE(URE)
EOS	EDGE OF STUD
EP	ELECTRICAL PANEL BOARD
EPDM	ETHYLENE PROPYLENE DIENEMONOMER
EQ	EQUAL
EQUIP	EQUIPMENT
EST	ESTIMATE
EX	EXIST(ING)
EXH	EXHAUST
EXP	EXPOSED, EXPANSION
EXT	EXTERIOR
FA	FIRE ALARM
FAF	FLUID APPLIED FLOORING
FD	FLOOR DRAIN, FIRE DAMPER
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF	FINISH FLOOR
FFE	FURNISHINGS FIXTURES AND EQUIPMENT
FGL	FIBERGLASS
FHC	FIRE HOSE CABINET
FHMS	FLATHEAD MACHINE SCREW
FHWS	FLATHEAD WOOD SCREW
FIN	FINISH(ED)
FL	FLOOR
FLASHG	FLASHING
FLCO	FLOOR CLEANOUT
FLR	FLOOR(ING)
FLUOR	FLUORESCENT
FND	FOUNDATION
FOC	FACE OF CONCRETE
FOF	FACE OF FINISH
FOS	FACE OF STEEL
FP	FIREPROOFING
FR	FRAME(D), FRAMING
FS	FULL SIZE, FLAME SPREAD
FT	FIRE TREATED
FTG	FOOTING
GA	GAUGE
GALV	GALVANIZED
GB	GRAB BAR, GYPSUM BOARD
GI	GALVANIZED IRON
GL	GLASS, GLAZING
GP	GALVANIZED PIPE
GSS	GALVANIZED STEEL SHEET
GWB	GYPSUM WALL BOARD
GYP	GYPSUM
GYP BD	GYPSUM BOARD
HB	HOSE BIB
HBD	HARDBOARD
HC	HOLLOW CORE
HD	HEAVY DUTY

ABBREVIATIONS

HDR	HEADER
HDW	HARDWARE
HM	HOLLOW METAL
HOR(IZ)	HORIZONTAL
HR	HOUR
HT	HEIGHT
HTG	HEATING
HVAC	HEATING, VENTILLATION, AND AIR CONDITIONING
HWD	HARDWOOD
HWH	HOT WATER HEATER
ID	INSIDE DIAMETER
INCL	INCLUDE(D), INCLUDING
INS(UL)	INSULATE(D), INSULATION
INT	INTERIOR
JAN(T)	JANITOR
JC	JANITOR'S CLOSET
JT	JOINT
LAM	LAMINATE(D)
LAV	LAVATORY
LH	LEFT HAND
MAX	MAXIMUM
MB	MACHINE BOLT
MECH	MECHANICAL
MEZZ	MEZZANINE
MFR	MANUFACTURE(R)
MGR	MANAGER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MOD	MODULAR
MP	METAL PANEL
MPP	MASS PLYWOOD PANEL
MRGB	MOISTURE RESISTANT GYPSUM WALL BOARD
MTL	METAL
MULL	MULLION
MWP	MEMBRANE WATERPROOFING
N	NORTH
NAT	NATURAL
NIC	NOT IN CONTRACT
NOM	NOMINAL
NTS	NOT TO SCALE
OA	OVERALL
OC	ON CENTER
OD	OUTSIDE DIAMETER
OPG	OPENING
OPP	OPPOSITE
OVHD	OVERHEAD
P	PAINT
P-LAM	PLASTIC LAMINATE
PAR	PARAPET
PERF	PERFORATE(D)
PJT	PANEL JOINT
PLAT	PLATFORM
PNL	PANEL
PP	PREPAINTED
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	PRESSURE TREATED
PTD	PAPER TOWEL DISPENSER
PTL	PARTIAL
PTN	PARTITION
PVC	POLYVINYL CHLORIDE
PWD	PLYWOOD
QT	QUARRY TILE
RA	RETURN AIR
RAD	RADIUS
RD	ROOF DRAIN
REF	REFER(ENCE)
REINF	REINFORCE(D), REINFORCING
REQ	REQUIRED
REV	REVISION(S), REVISED
RH	RIGHT HAND
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
S	SOUTH
SA	SUPPLY AIR
SC	SOLID CORE
SCHED	SCHEDULE
SEC	SECTION
SIM	SIMILAR
SL	SLEEVE
SPEC	SPECIFICATION(S)
SQ	SQUARE
SS	STAINLESS STEEL
STD	STANDARD
STL	STEEL
STRUCT	STRUCTURAL
SUPP	SUPPLEMENT, SUPPLY
SUSP	SUSPENDED
SV	SHEET VINYL
TB, TCKBD	TACKBOARD
TEL	TELEPHONE
TEMP	TEMPERED, TEMPERATURE
TG, T&G	TONGUE AND GROOVE
TO	TOP OF
TOC	TOP OF CURB, TOP OF CONCRETE
TOF	TOP OF FRAMING
TOP	TOP OF PARAPET
TOPL	TOP OF PLATE
TOR	TOP OF ROOF
TOS	TOP OF STEEL
TS	TUBE STEEL
TW	TOP OF WALL
TYP	TYPICAL
UON, UNO	UNLESS NOTED OTHERWISE
VB	VAPOR BARRIER
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VG	VERTICAL GRAIN
VIF	VERIFY IN FIELD
W	WEST
W/	WITH
W/O	WITHOUT
WC	WATER CLOSET
WD	WOOD
WP	WATERPROOF(ING)
WS	WATERSTOP
WWF	WELDED WIRE FABRIC
±	PLUS OR MINUS
ø	DIAMETER

SYMBOLS LEGEND

- BUILDING SECTION MARK 1=SECTION NO. A101= SHEET NO.
- WALL SECTION MARK 1=SECTION NO. A101= SHEET NO.
- EXTERIOR ELEVATION MARK 1=SECTION NO. A101= SHEET NO.
- INTERIOR ELEVATION MARK FILLED 1=SECTION NO. A101= SHEET NO.
- DETAIL SECTION MARK 1=SECTION NO. A101= SHEET NO.
- ENLARGED VIEW MARK 1=SECTION NO. A101= SHEET NO.
- PARTITION MARK (REF. PARTITION TYPES)
- DOOR TAG
- GATE TAG
- INTERIOR WINDOW MARK
- EXTERIOR WINDOW MARK
- NORTH ARROW
- LEVEL MARK
- GRID HEAD
- KEYNOTE - REFER TO LEGEND ON SHEET
- REVISION CLOUD AND MARK
- CONTROL JOINT
- GRAPHIC SCALE
- MATCHLINE
- ALIGN INDICATED PLANES

MATERIALS LEGEND

- CONCRETE
- RIGID INSULATION
- SPRAY INSULATION
- UNDISTURBED EARTH
- DISTURBED EARTH
- STEEL
- GYPSUM BOARD
- DRAINAGE FILL
- PLYWOOD
- BLANKET OR LOOSE FILL INSULATION

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Project

Santiam Canyon School District
SCSD Elementary School HVAC & Electrical Service Upgrades
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Consultant

Revisions

No.	Description	Date

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REGISTERED ARCHITECT 4758 MARLENE R. GILLIS OREGON PORTLAND, OREGON STATE OF OREGON

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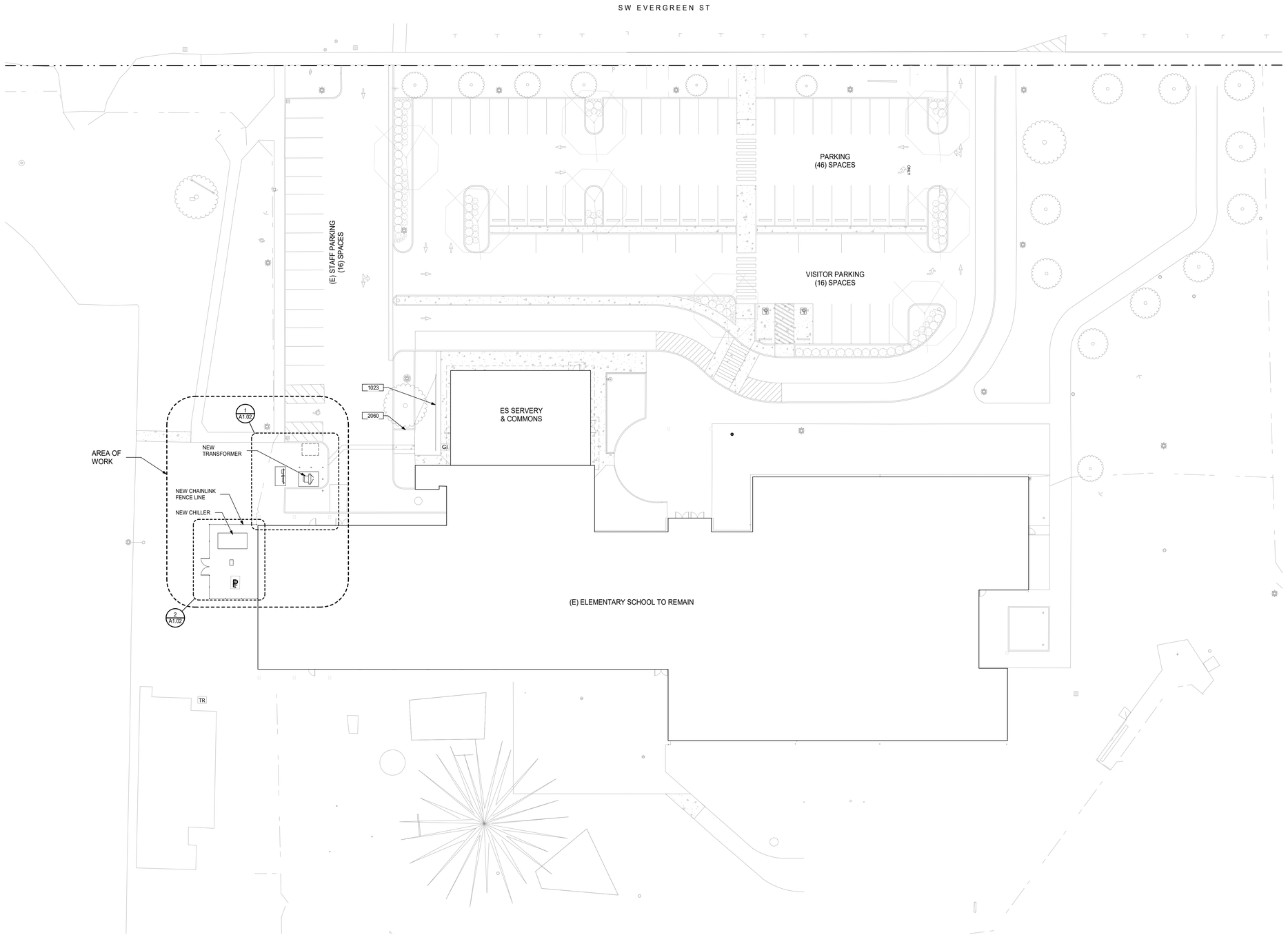
Drawing Title
SYMBOLS, LEGENDS, AND ACCESSIBILITY

Sheet No
G0.02



1 ARCHITECTURAL SITE PLAN - ELEMENTARY SCHOOL CAMPUS

1" = 20'-0"

NORTH

SHEET NOTES

1. ARCHITECTURAL SITE PLAN SHOWN FOR REFERENCE ONLY. REFER TO CIVIL AND LANDSCAPE DRAWINGS FOR SPECIFIC SITE INFORMATION. REFER TO ELECTRICAL FOR SITE LIGHTING.

LEGEND

- PROPERTY LINE
- CANOPY/WALKWAY COVER OVERHEAD
- NEW CONCRETE
- NEW BUILDING
- EXISTING BUILDING

KEYNOTES	
MARK	DESCRIPTION
1023	(E) BIKE RACK TO BE REINSTALLED IN THE SAME LOCATION
2060	(E) CURB TO REMAIN

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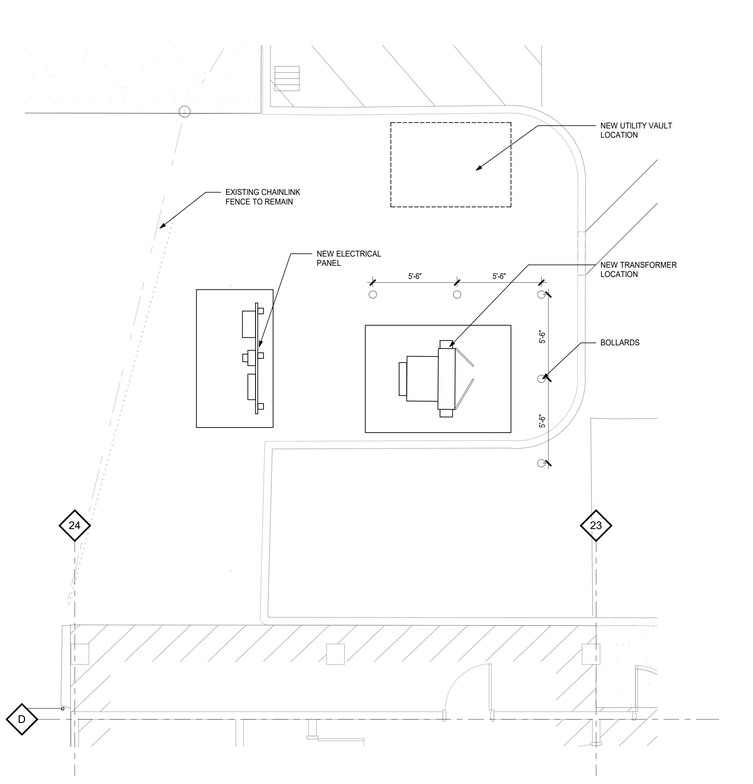
Drawing Title
ARCHITECTURAL SITE PLAN

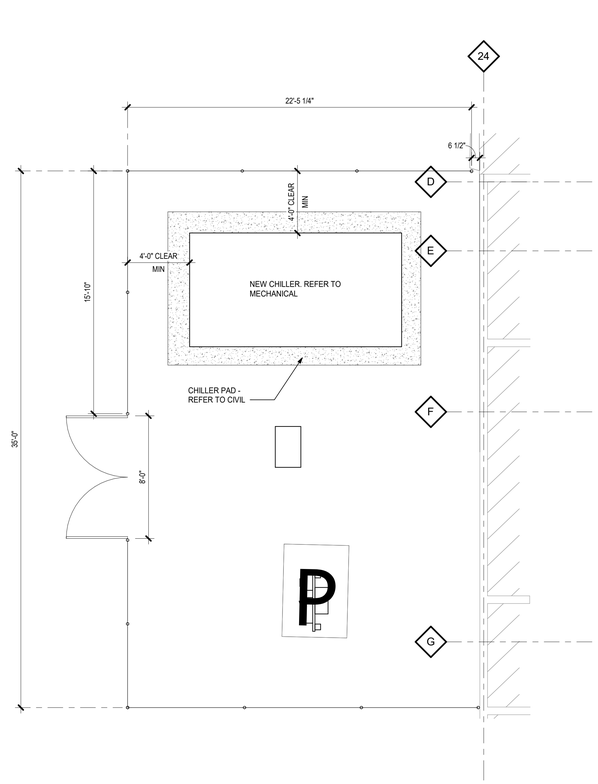
Sheet No
A1.01



1 ES SITE PLAN - TRANSFORMER ENCLOSURE

1/4" = 1'-0"

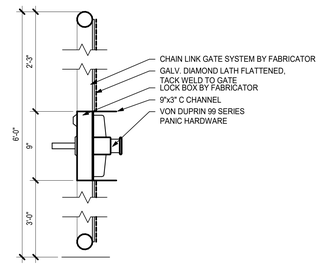
NORTH



2 ES SITE PLAN - CHILLER ENCLOSURE

1/4" = 1'-0"

NORTH



3 CHAINLINK GATE DETAIL

1 1/2" = 1'-0"

DATE
12/29/2021 1:59:44 PM
FILE PATH:C:\Users\emilyw\Documents\19056.007 SCSD ES Hvac & Controls_emilyvZE3WB.rvt

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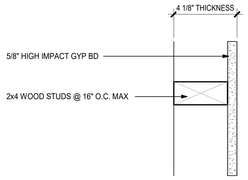
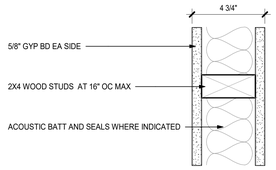
Drawing Title
ARCHITECTURAL SITE DETAILS

Sheet No
A1.02



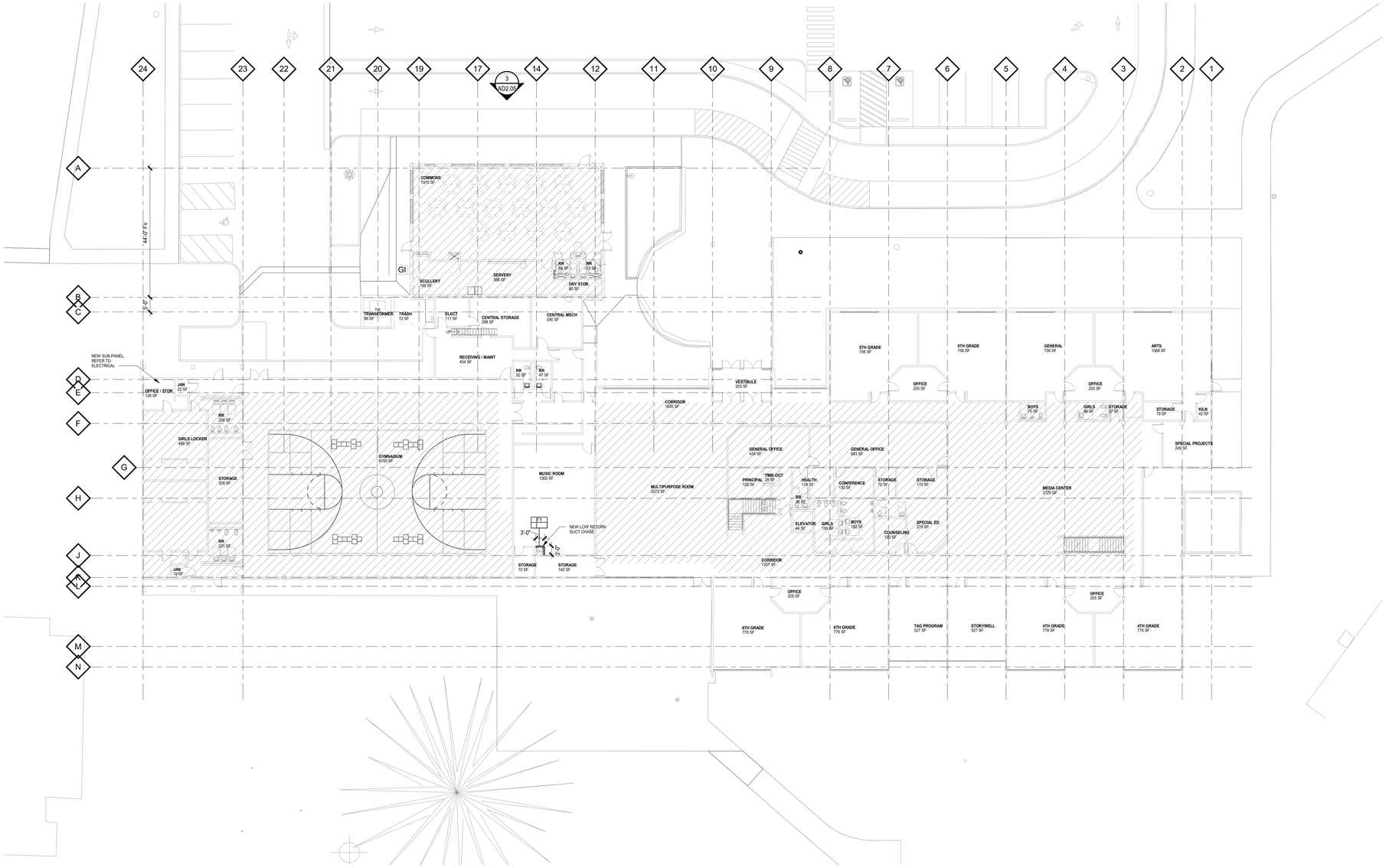
2 INT FURRED WALL ASSEMBLY - F1
3" = 1'-0"



AT RATED LOCATIONS: 1 HR - FIRE TEST: UL U419

AT ACOUSTIC WALLS: STC RATING: 47 - SOUND TEST: SA-831001

3 WALL ASSEMBLY TYPE W-1
3" = 1'-0"



1 1ST FLOOR PLAN OVERALL
1/16" = 1'-0"

NORTH

SHEET NOTES

1. PATCH AND REPAIR AT AREAS OF MECHANICAL AND ELECTRICAL WORK AS NEEDED. REFER TO ENGINEER'S PLANS.
2. ANY INTERIOR WALL NOT LABELED WITH A WALL TAG SHALL BE WALL TYPE: W1
3. ALL ACOUSTIC WALL SEPARATIONS MUST BE SEALED FOR SOUND TRANSMISSION.
4. ALL CORNER GUARDS TO BE CG-1, U.O.N.

LEGEND

- 1 / A101 SIM — ENLARGED VIEW MARK (1=SECTION NO., A101= SHEET NO.)
- XX/X / XX | X — PARTITION MARK (REF. PARTITION TYPES)
- A 1001 — DOOR TAG
- AREA OF NO WORK (NOT IN CONTRACT)
- NEW WALL
- EXISTING WALL TO REMAIN

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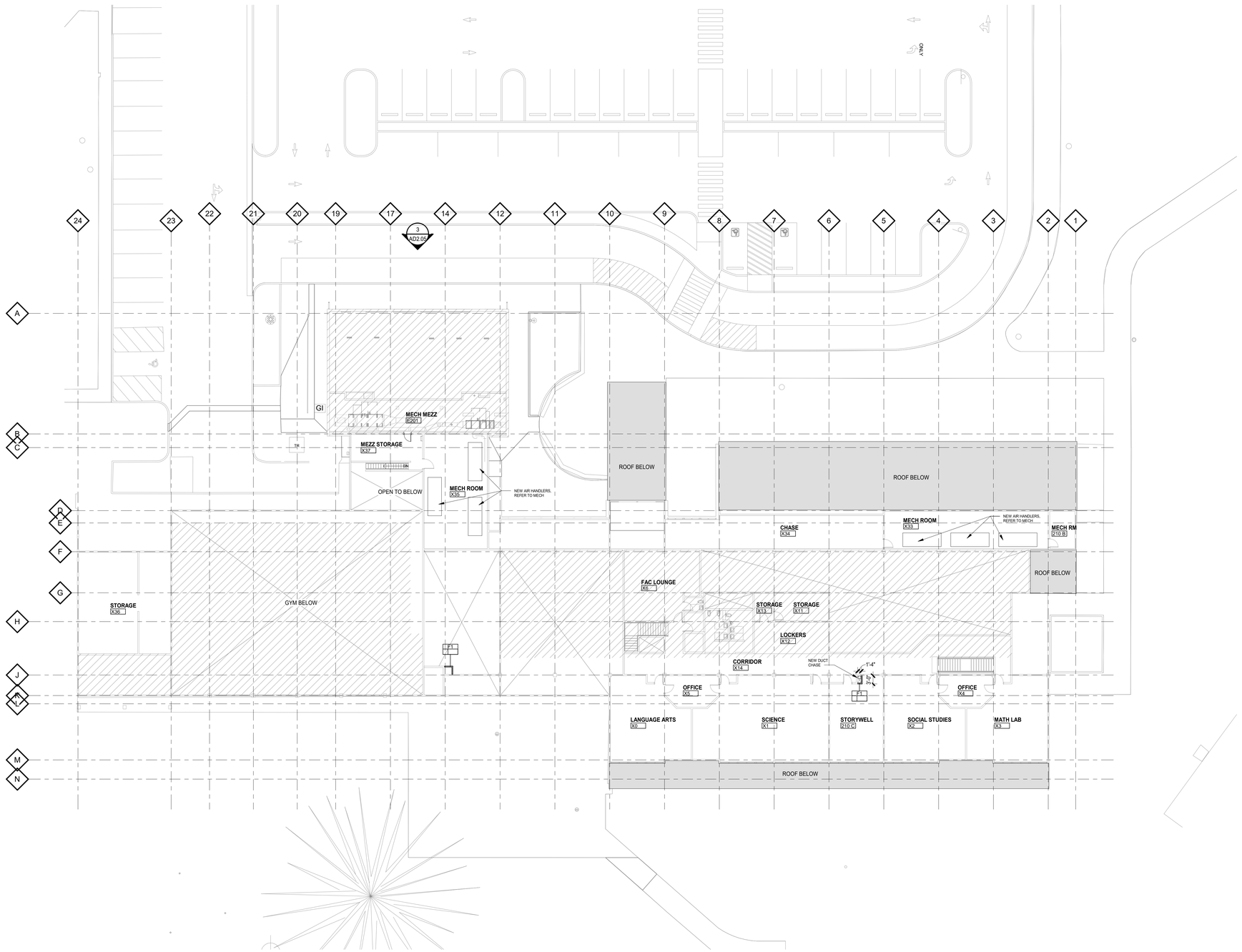
Drawing Title
FLOOR PLAN OVERALL - 1ST FLOOR

Sheet No
A2.01



1 2ND FLOOR PLAN OVERALL

1/16" = 1'-0"

NORTH

SHEET NOTES

1. REFER TO ENGINEERS' DRAWINGS FOR LIGHT SWITCHING AND SPECIFICATION, EXIT SIGN LOCATIONS, AND ELECTRICAL AND MECHANICAL SYSTEMS.
2. REPORT TO ARCHITECT ANY CONFLICTS BETWEEN ELECTRICAL, MECHANICAL, OR STRUCTURAL DRAWINGS AND THIS LAYOUT.
3. ALL VISIBLE STRUCTURE, DUCTWORK, PIPES, CONDUITS, AND OTHER ASSOCIATED COMPONENTS NOT FULLY CONCEALED BEHIND A CONTINUOUS CEILING TO BE PAINTED.
4. ALL LIGHTS AND GRIDS ARE TO BE CENTERED IN ROOM, UON.
5. EXISTING TO REMAIN, U.O.N.
6. IN AREAS OF WORK WHERE DEMOLITION OCCURS PER MECHANICAL AND ELECTRICAL ENGINEER'S DRAWINGS, FINISHES TO BE REPAIRED, REPLACED, AND/OR PATCHED BACK TO MATCH EXISTING.

LEGEND

- X'-XX" — CEILING SPOT HEIGHT
- +X'-X" — FINISH CEILING HEIGHT ABOVE FINISH FLOOR
- X'-X" B.R.F.F.T. — LIGHT FIXTURE HEIGHT ABOVE FIN FLOOR TO BOTTOM OF FIXTURE, TYP FOR ROOM UON
- GYP BD CEILING / SOFFIT
- ACOUSTIC CEILING TILE
- CEILING ACCESS PANEL
- AIR TERMINAL SHOWN FOR LOCATION ONLY - NOT ALL LOCATIONS MAY BE SHOWN; SEE MECHANICAL DRAWINGS FOR QTY
- LIGHT FIXTURE TYPES - SEE ELECTRICAL
- AREA OF NO WORK

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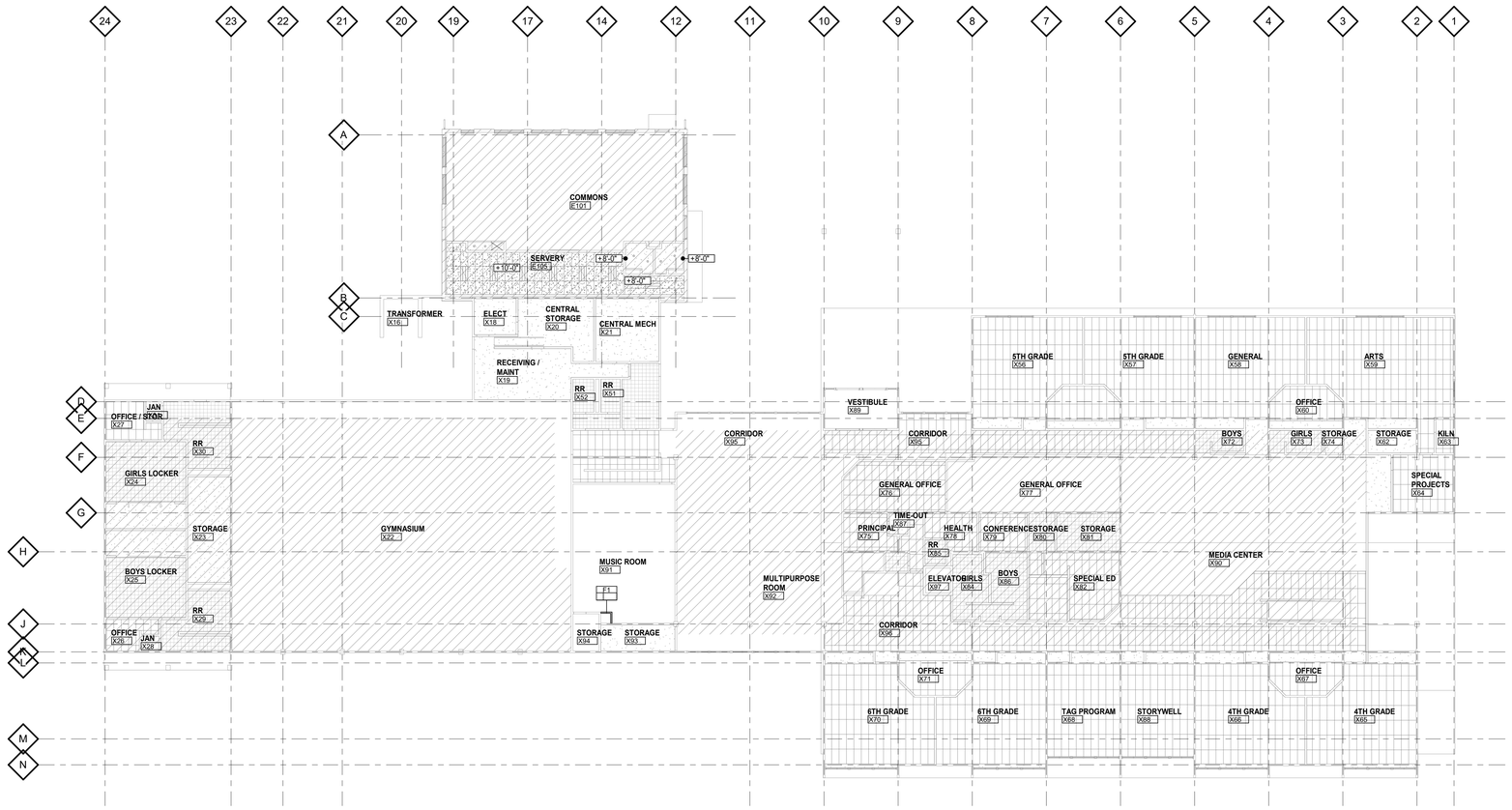
Drawing Title
FLOOR PLAN OVERALL -2ND FLOOR

Sheet No
A2.02



1 1ST FLOOR RCP
1/16" = 1'-0"

NORTH

SHEET NOTES

1. REFER TO ENGINEERS' DRAWINGS FOR LIGHT SWITCHING AND SPECIFICATION, EXIT SIGN LOCATIONS, AND ELECTRICAL AND MECHANICAL SYSTEMS.
2. REPORT TO ARCHITECT ANY CONFLICTS BETWEEN ELECTRICAL, MECHANICAL, OR STRUCTURAL DRAWINGS AND THIS LAYOUT.
3. ALL VISIBLE STRUCTURE, DUCTWORK, PIPES, CONDUITS, AND OTHER ASSOCIATED COMPONENTS NOT FULLY CONCEALED BEHIND A CONTINUOUS CEILING TO BE PAINTED.
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6. IN AREAS OF WORK WHERE DEMOLITION OCCURS PER MECHANICAL AND ELECTRICAL ENGINEER'S DRAWINGS, FINISHES TO BE REPAIRED, REPLACED, AND/OR PATCHED BACK TO MATCH EXISTING.

LEGEND

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- X'-X" B/ FIXT — LIGHT FIXTURE HEIGHT ABOVE FIN FLOOR TO BOTTOM OF FIXTURE, TYP FOR ROOM UON
- GYP BD CEILING / SOFFIT
- ACOUSTIC CEILING TILE
- CEILING ACCESS PANEL
- AIR TERMINAL SHOWN FOR LOCATION ONLY - NOT ALL LOCATIONS MAY BE SHOWN; SEE MECHANICAL DRAWINGS FOR QTY
- LIGHT FIXTURE TYPES - SEE ELECTRICAL
- AREA OF NO WORK

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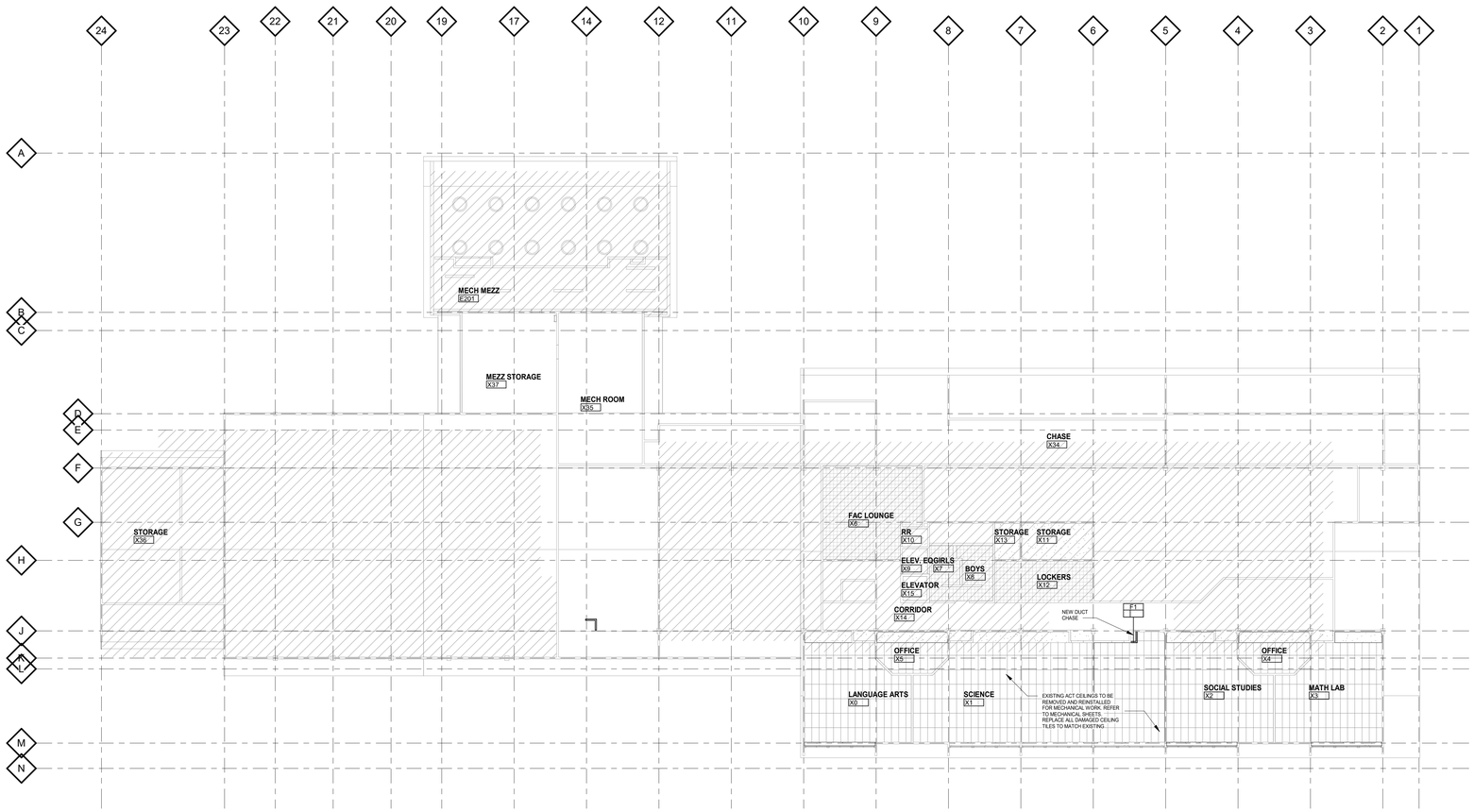
Drawing Title
OVERALL REFLECTED CEILING PLAN - LEVEL 1

Sheet No
A6.01



SHEET NOTES

1. REFER TO ENGINEERS' DRAWINGS FOR LIGHT SWITCHING AND SPECIFICATION, EXIT SIGN LOCATIONS, AND ELECTRICAL AND MECHANICAL SYSTEMS.
2. REPORT TO ARCHITECT ANY CONFLICTS BETWEEN ELECTRICAL, MECHANICAL, OR STRUCTURAL DRAWINGS AND THIS LAYOUT.
3. ALL VISIBLE STRUCTURE, DUCTWORK, PIPES, CONDUITS, AND OTHER ASSOCIATED COMPONENTS NOT FULLY CONCEALED BEHIND A CONTINUOUS CEILING TO BE PAINTED.
4. ALL LIGHTS AND GRIDS ARE TO BE CENTERED IN ROOM, UON.
5. EXISTING TO REMAIN, U.O.N.
6. IN AREAS OF WORK WHERE DEMOLITION OCCURS PER MECHANICAL AND ELECTRICAL ENGINEER'S DRAWINGS, FINISHES TO BE REPAIRED, REPLACED, AND/OR PATCHED BACK TO MATCH EXISTING.

LEGEND

- X'-XX" — CEILING SPOT HEIGHT
- +X'-X" — FINISH CEILING HEIGHT ABOVE FINISH FLOOR
- X'-X" B/ FIXT — LIGHT FIXTURE HEIGHT ABOVE FIN FLOOR TO BOTTOM OF FIXTURE, TYP FOR ROOM UON
- GYP BD CEILING / SOFFIT
- ACOUSTIC CEILING TILE
- CEILING ACCESS PANEL
- AIR TERMINAL SHOWN FOR LOCATION ONLY - NOT ALL LOCATIONS MAY BE SHOWN. SEE MECHANICAL DRAWINGS FOR QTY
- LIGHT FIXTURE TYPES - SEE ELECTRICAL
- AREA OF NO WORK

NORTH

1 LEVEL 2 RCP
1/16" = 1'-0"

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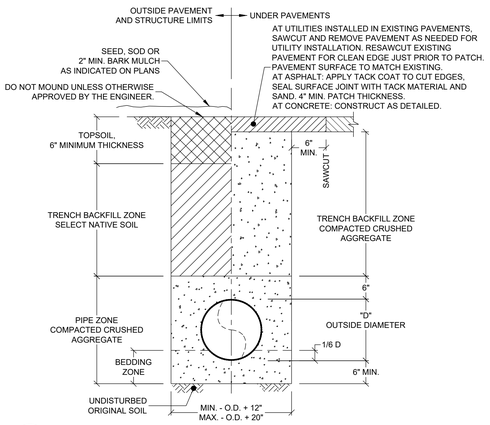
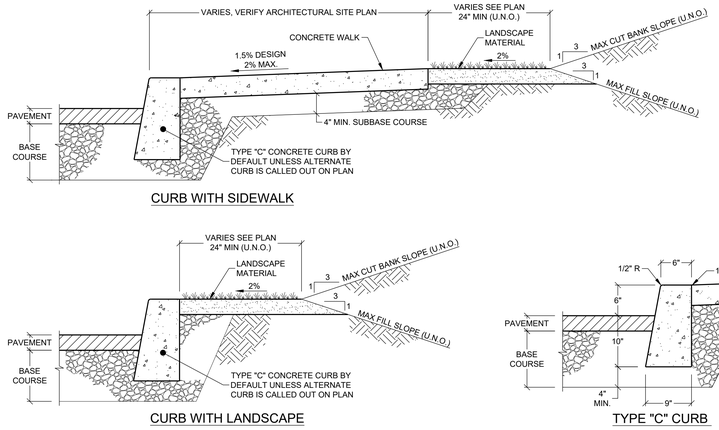
Drawing Title
OVERALL REFLECTED CEILING PLAN - LEVEL 2

Sheet No
A6.02



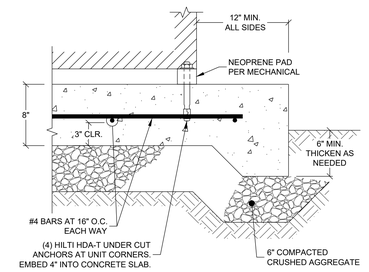
1 C1.01 TRENCH IN EXISTING DEVELOPMENT

N.T.S.



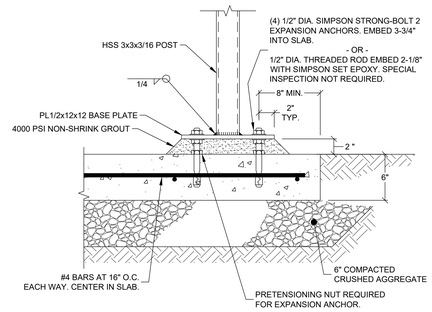
2 C1.01 STANDARD CURBS

1" = 1'-0"



3 C1.01 HVAC CHILLER ANCHORAGE

N.T.S.



4 C1.01 ELECTRICAL PANEL SUPPORT

N.T.S.

GENERAL CIVIL NOTES

GENERAL REQUIREMENTS

1. PRIOR TO START OF WORK, CONTRACTOR TO PROVIDE PRE-CONSTRUCTION RECORD DRAWING CROSS-REFERENCED WITH PHOTOGRAPHIC DOCUMENTATION OF ALL DAMAGED OR DEFECTIVE CURBS AND SIDEWALKS THAT ARE NOT SCHEDULED FOR REPAIR OR REPLACEMENT. PROVIDE ONE COPY TO THE ENGINEER, ONE TO THE OWNER AND MAINTAIN CONTRACTOR COPIES AS NEEDED. THESE DRAWINGS AND PHOTOS WILL SERVE AS THE MEANS TO IDENTIFY DAMAGE THAT OCCURRED DURING CONSTRUCTION. DAMAGE THAT OCCURS DURING CONSTRUCTION MUST BE REPAIRED TO THE SATISFACTION OF THE ENGINEER AT THE CONTRACTOR'S EXPENSE.
2. ANY CHANGE IN CONSTRUCTION AFTER PLAN APPROVAL MUST BE SUBMITTED IN WRITING AND APPROVED BY LOCAL AUTHORITY HAVING JURISDICTION PRIOR TO CHANGE AS REQUIRED BY THAT JURISDICTION'S STANDARD CONSTRUCTION SPECIFICATIONS.
3. CONTRACTOR SHALL PROCURE, PAY ALL COSTS FOR, AND CONFORM TO ALL CONSTRUCTION PERMITS REQUIRED BY THE LOCAL JURISDICTION OR APPROVING AUTHORITY. CONTRACTOR SHALL COORDINATE AND PAY ALL FEES AND COSTS ASSOCIATED WITH CONNECTING TO EXISTING WATER, SANITARY SEWER AND STORM SEWER FACILITIES, INCLUDING SERVICES AND INSPECTIONS BY THE GOVERNING JURISDICTIONS. COSTS SHALL INCLUDE AS APPLICABLE BUT NOT BE LIMITED TO FEES FOR CONNECTION, TAPPING, INSPECTION, TESTING, CHLORINATION, WATER METERS, BACKFLOW CERTIFICATIONS, OR OTHER SIMILAR OR RELATED COSTS.
4. CONTRACTOR SHALL PROVIDE ALL BONDS AND INSURANCE REQUIRED BY PUBLIC AND/OR PRIVATE AGENCIES HAVING JURISDICTION. WHERE REQUIRED BY PUBLIC AND/OR PRIVATE AGENCIES HAVING JURISDICTION, THE CONTRACTOR SHALL SUBMIT A SUITABLE MAINTENANCE BOND PRIOR TO FINAL PAYMENT.
5. CONTRACTOR SHALL PERFORM ALL WORK NECESSARY TO COMPLETE THE PROJECT IN ACCORDANCE WITH THE APPROVED CONSTRUCTION DRAWINGS INCLUDING SUCH INCIDENTALS AS MAY BE NECESSARY TO MEET APPLICABLE AGENCY REQUIREMENTS AND PROVIDE A COMPLETED PROJECT.
6. ANY INSPECTION BY THE CITY, COUNTY OR OTHER AGENCIES SHALL NOT, IN ANY WAY, RELIEVE THE CONTRACTOR FROM ANY OBLIGATION TO PERFORM THE WORK IN STRICT COMPLIANCE WITH THE CONTRACT DOCUMENTS, APPLICABLE CODES, AND AGENCY REQUIREMENTS.
7. CONTRACTOR SHALL MAINTAIN ONE COMPLETE SET OF APPROVED DRAWINGS ON THE CONSTRUCTION SITE AT ALL TIMES WHEREON HE WILL RECORD ALL APPROVED DEVIATIONS IN CONSTRUCTION FROM THE APPROVED DRAWINGS, AS WELL AS THE STATION LOCATIONS AND DEPTHS OF ALL EXISTING UTILITIES ENCOUNTERED. THESE FIELD RECORD DRAWINGS SHALL BE KEPT UP TO DATE AT ALL TIMES AND SHALL BE AVAILABLE FOR INSPECTION BY THE ENGINEER, LOCAL JURISDICTION OR OWNER'S REPRESENTATIVE UPON REQUEST. FAILURE TO CONFORM TO THIS REQUIREMENT MAY RESULT IN DELAY IN PAYMENT AND/OR FINAL ACCEPTANCE OF THE PROJECT.
8. UPON COMPLETION OF CONSTRUCTION OF ALL NEW FACILITIES, CONTRACTOR SHALL SUBMIT A CLEAN SET OF FIELD RECORD DRAWINGS CONTAINING ALL AS-BUILT INFORMATION TO THE ENGINEER SHOWING ALL LENGTHS, DEPTHS, INVERTS, AND LOCATIONS OF COMPLETED WORK. CONTRACTOR IS RESPONSIBLE FOR COORDINATION AND SECURING OF ALL SURVEYING SERVICES NECESSARY TO ACCURATELY OBTAIN "AS-BUILT" INFORMATION. ALL INFORMATION SHOWN ON THE CONTRACTOR'S FIELD RECORD DRAWINGS SHALL BE SUBJECT TO VERIFICATION.
9. VAULTS SHALL BE DESIGNED TO RESIST BUOYANCY. ASSUME GROUND WATER IS AT FINISH GROUND ELEVATION UNLESS A LOWER ELEVATION IS SUBSTANTIATED BY GEOTECHNICAL REPORT OR OTHER INFORMATION APPROVED BY ENGINEER AND/OR LOCAL JURISDICTION.

EXISTING UTILITIES AND FACILITIES

10. COORDINATION AND NOTIFICATION WITH LOCAL JURISDICTION AND UTILITY COMPANIES:
    a. THE LOCATION AND DESCRIPTIONS OF EXISTING UTILITIES SHOWN ON THE DRAWINGS ARE COMPILED FROM AVAILABLE RECORDS AND/OR FIELD SURVEYS. THE ENGINEER OR UTILITY COMPANIES DO NOT GUARANTEE THE ACCURACY OR THE COMPLETENESS OF SUCH RECORDS. CONTRACTOR SHALL FIELD VERIFY LOCATIONS AND SIZES OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
    b. OREGON LAW REQUIRES THE CONTRACTOR TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. COPIES OF THE RULES ARE AVAILABLE BY CALLING THE OREGON UTILITY NOTIFICATION CENTER AT (503) 232-1987.
    c. THE CONTRACTOR SHALL NOTIFY THE LOCAL JURISDICTION AND EACH UNDERGROUND UTILITY AT LEAST 48 BUSINESS-DAY HOURS PRIOR TO EXCAVATING, BORING, OR POTHOLING. ALL UTILITY CROSSINGS SHALL BE POTHOLED AS NECESSARY PRIOR TO EXCAVATING OR BORING TO ALLOW THE CONTRACTOR TO PREVENT GRADE OR ALIGNMENT CONFLICTS.
11. CONTRACTOR SHALL FIELD VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITIES WHERE NEW FACILITIES CROSS. ALL UTILITY CROSSINGS MARKED OR SHOWN ON THE DRAWINGS SHALL BE POTHOLED USING HAND TOOLS OR OTHER NON-INVASIVE METHODS PRIOR TO EXCAVATING OR BORING. CONTRACTOR SHALL BE RESPONSIBLE FOR EXPOSING POTENTIAL UTILITY CONFLICTS FAR ENOUGH AHEAD OF CONSTRUCTION TO MAKE NECESSARY GRADE OR ALIGNMENT MODIFICATIONS WITHOUT DELAYING THE WORK. IF GRADE OR ALIGNMENT MODIFICATION IS NECESSARY, CONTRACTOR SHALL NOTIFY THE DESIGN ENGINEER, AND THE DESIGN ENGINEER OR THE OWNER'S REPRESENTATIVE SHALL OBTAIN APPROVAL FROM THE CITY PRIOR TO CONSTRUCTION.
12. ALL FACILITIES SHALL BE MAINTAINED IN-PLACE BY THE CONTRACTOR UNLESS OTHERWISE SHOWN OR DIRECTED. CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO SUPPORT, MAINTAIN, OR OTHERWISE PROTECT EXISTING UTILITIES AND OTHER FACILITIES AT ALL TIMES DURING CONSTRUCTION. CONTRACTOR TO LEAVE EXISTING FACILITIES IN AN EQUAL OR BETTER-THAN-ORIGINAL CONDITION AND TO THE SATISFACTION OF THE LOCAL JURISDICTION AND OWNER'S REPRESENTATIVE.
13. UTILITIES OR INTERFERING PORTIONS OF UTILITIES THAT ARE ABANDONED IN PLACE SHALL BE REMOVED BY THE CONTRACTOR TO THE EXTENT NECESSARY TO ACCOMPLISH THE WORK. THE CONTRACTOR SHALL PLUG THE REMAINING EXPOSED ENDS OF ABANDONED UTILITIES AFTER APPROPRIATE VERIFICATION PROCEDURES HAVE TAKEN PLACE.
14. CONTRACTOR SHALL REMOVE ALL EXISTING SIGNS, MAILBOXES, FENCES, LANDSCAPING, ETC., AS REQUIRED TO AVOID DAMAGE DURING CONSTRUCTION AND REPLACE THEM TO EXISTING OR BETTER CONDITION.
15. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MANAGING CONSTRUCTION ACTIVITIES TO ENSURE THAT PUBLIC STREETS AND RIGHT-OF-WAYS ARE KEPT CLEAN OF MUD, DUST OR DEBRIS. DUST ABATEMENT SHALL BE MAINTAINED BY ADEQUATE WATERING OF THE SITE BY THE CONTRACTOR.

SUBMITTALS, TESTING AND INSPECTION

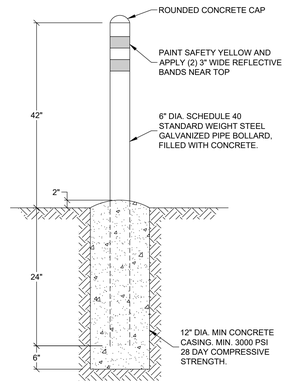
16. THE CONTRACTOR SHALL BE RESPONSIBLE TO ENSURE THAT ALL REQUIRED OR NECESSARY INSPECTIONS ARE COMPLETED BY AUTHORIZED INSPECTORS PRIOR TO PROCEEDING WITH SUBSEQUENT WORK WHICH COVERS OR THAT IS DEPENDENT ON THE WORK TO BE INSPECTED. FAILURE TO OBTAIN NECESSARY INSPECTION(S) AND APPROVAL(S) SHALL RESULT IN THE CONTRACTOR BEING FULLY RESPONSIBLE FOR ALL PROBLEMS AND/OR CORRECTIVE MEASURES ARISING FROM UNINSPECTED WORK.
17. THE SPECIFICATIONS OUTLINE THE REQUIRED SUBMITTALS AND MINIMUM TESTING AND INSPECTION REQUIREMENTS FOR THE PROJECT. THE CONTRACTOR HAS THE RESPONSIBILITY OF OBTAINING ALL NECESSARY TESTING, INSPECTIONS OR OBSERVATIONS FOR ALL WORK PERFORMED, REGARDLESS OF WHO IS RESPONSIBLE FOR PAYMENT. COST FOR RETESTING SHALL BE BORNE BY THE CONTRACTOR.

GRADING, DRAINAGE, CURBS AND SIDEWALKS

18. ALL EXISTING OR CONSTRUCTED MANHOLES, CLEANOUTS, MONUMENT BOXES, GAS VALVES, WATER VALVES AND SIMILAR STRUCTURES SHALL BE ADJUSTED TO MATCH FINISH GRADE OF THE PAVEMENT, SIDEWALK, LANDSCAPED AREA OR MEDIAN STRIP WHEREIN THEY LIE. VERIFY THAT ALL VALVE BOXES AND RISERS ARE CLEAN AND CENTERED OVER THE OPERATING NUT.
19. WHERE TRENCH EXCAVATION REQUIRES REMOVAL OF PCC CURBS AND/OR SIDEWALKS, THE CURBS AND/OR SIDEWALKS SHALL BE SAWCUT AND REMOVED AT A TOOLED JOINT UNLESS OTHERWISE AUTHORIZED IN WRITING BY THE LOCAL JURISDICTION. THE SAWCUT LINES SHOWN ON THE DRAWINGS ARE SCHEMATIC AND NOT INTENDED TO SHOW THE EXACT ALIGNMENT OF SUCH CUTS.

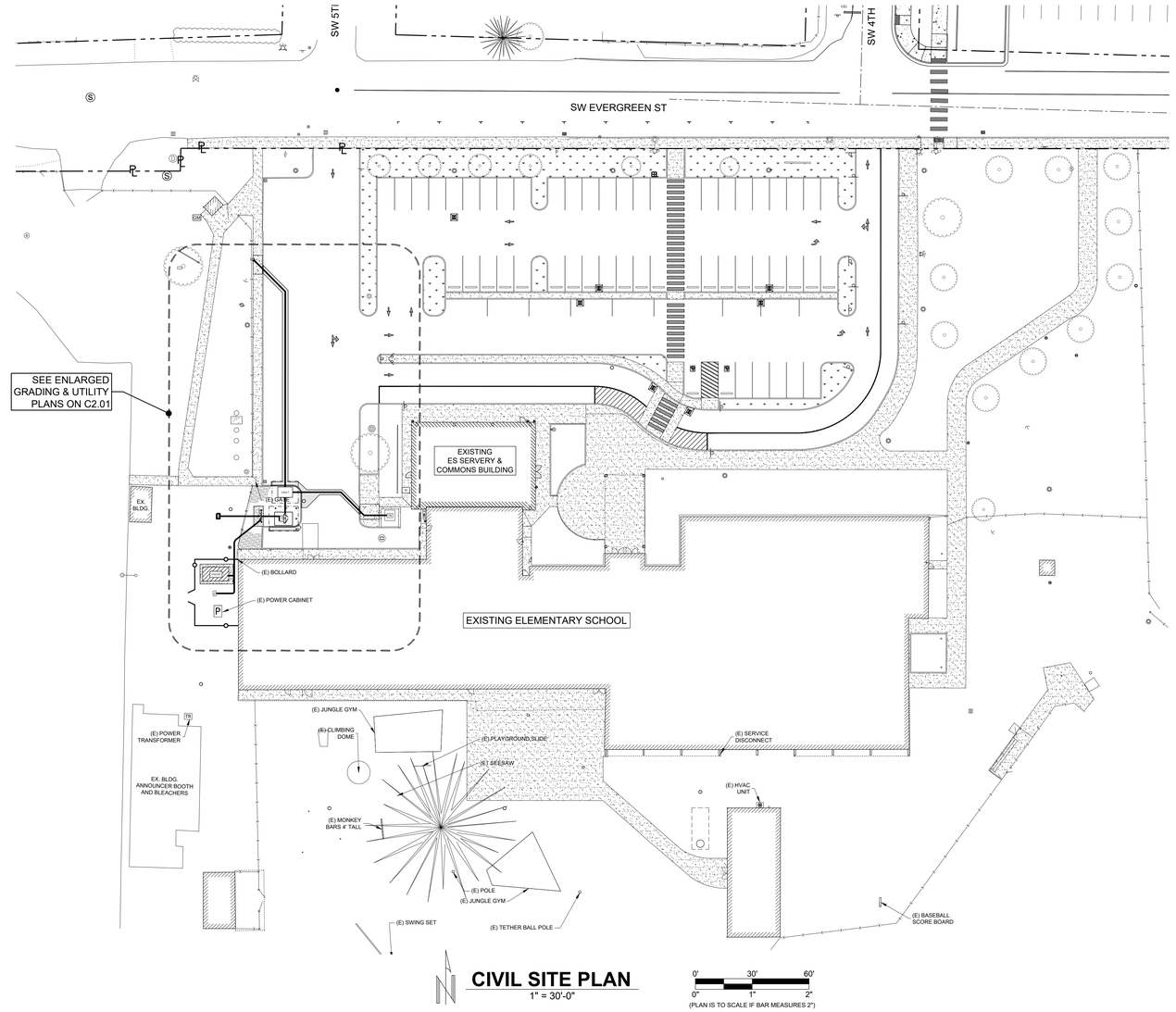
PIPED UTILITIES

20. NO TRENCHES IN SIDEWALKS, ROADS, OR DRIVEWAYS SHALL BE LEFT IN AN OPEN CONDITION OVERNIGHT. ALL SUCH TRENCHES SHALL BE CLOSED BEFORE THE END OF EACH WORKDAY AND NORMAL TRAFFIC AND PEDESTRIAN FLOWS RESTORED.



5 C1.01 TYPICAL BOLLARD

N.T.S.



CIVIL SITE PLAN

1" = 30'-0"

0' 30' 60'
0" 1" 2"
(PLAN IS TO SCALE IF BAR MEASURES 2")

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Revisions

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JULY 20, 1989
GREG D. LOCKE
EXPIRES: 12-31-2022
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Drawing Title
CIVIL SITE PLAN

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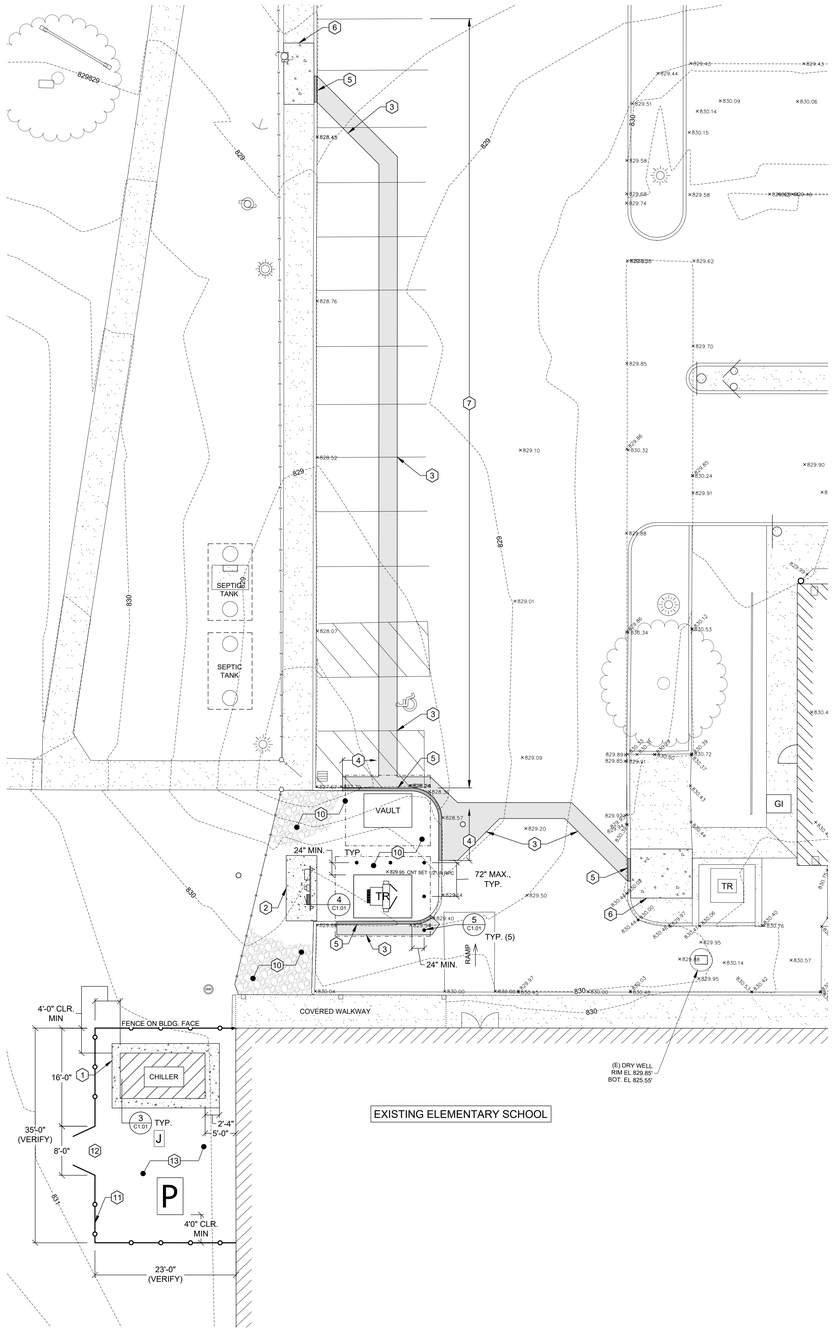
C1.01



GRADING & SURFACE REPAIR PLAN
1" = 10'-0"

0' 10' 20'
0" 1" 2"
(PLAN IS TO SCALE IF BAR MEASURES 2")

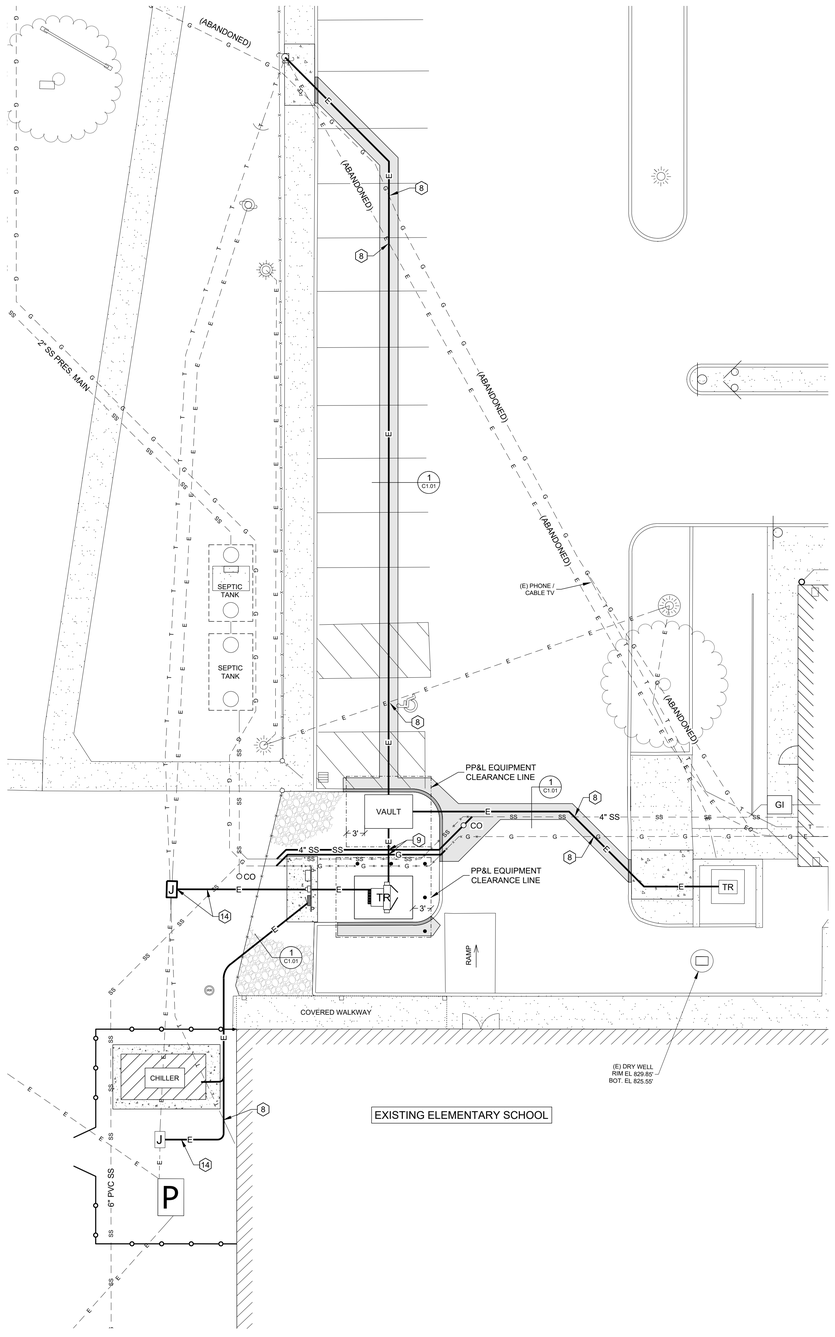
GRADING, SURFACE REPAIR AND UTILITY PLAN NOTES

GENERAL NOTES

- DEMOLITION, GRADING, SURFACE REPAIR AND UTILITY NOTES SPECIFICALLY CALLED OUT ON PLANS ARE IN ADDITION TO ANY OTHER INCIDENTAL WORK NECESSARY TO PERFORM THE REQUIRED WORK. NOT ALL REQUIRED WORK MAY HAVE BEEN IDENTIFIED. SEE PLANS OF OTHER CONSULTANTS FOR OTHER ITEMS NOT RELATED TO CIVIL DESIGN.
- LOCATION OF SAWCUTS AND EXTENTS OF PAVEMENT REMOVAL IS SCHEMATIC AND NOT NECESSARILY THE FULL EXTENT NEEDED TO PERFORM THE WORK. CONTRACTOR IS RESPONSIBLE TO INCLUDE WITHIN HIS BID, THE EXTENTS HE FEELS IS NEEDED TO PROPERLY COMPLETE THE WORK.
- PROTECT EXISTING PAVED DRIVEWAYS AND PARKING LOTS FROM DAMAGE DUE TO CONSTRUCTION ACTIVITIES. CONTRACTOR SHALL REPAIR DAMAGED SURFACE SCHEDULED TO REMAIN AT THEIR OWN EXPENSE.
- EXISTING UTILITIES ARE TO REMAIN FUNCTIONAL DURING ENTIRE PROJECT. LOCATIONS AND DESCRIPTIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE AND BASED ON FIELD SURVEY, ARCHIVE PLANS AND AVAILABLE RECORDS. TAKE PRECAUTIONS TO LOCATE AND PROTECT UTILITIES AGAINST DAMAGE. IDENTIFY AND MARK LOCATION OF WATER SHUTOFF VALVES WITH OWNER PRIOR TO START OF EXCAVATION. POTHOLE TO CONFIRM LOCATION AND DEPTH OF ALL CROSSING UTILITIES PRIOR TO START OF EXCAVATION.

KEYED GRADING, SURFACE REPAIR & UTILITY NOTES (GR) :

1. NEW CHILLER PAD: 17' x 10' x 6" THICK CONCRETE PAD OVER 6" MIN. COMPACTED CRUSHED ROCK BASE. THICKEN EDGES AS NEEDED TO PROVIDE 6" MINIMUM EMBEDMENT BELOW FINISH GRADE. SEE DETAIL 3 ON C2.01 FOR REINFORCING AND UNIT ANCHORAGE.
2. NEW ELECTRICAL PANEL PAD: 10'-8" x 5' x 6" THICK CONCRETE PAD OVER 6" MIN. COMPACTED CRUSHED ROCK BASE. INSTALL FLUSH TO FINISH GRADE. SEE DETAIL 4 ON C2.01 FOR REINFORCING AND PANEL POST ANCHORAGE.
3. SAWCUT AND REMOVE PAVEMENT AND CURB TO EXTENT NECESSARY FOR INSTALLATION OF NEW ELECTRICAL CONDUIT AND EQUIPMENT. SAWCUT AT BOUNDARY OF DEMOLISHED AREA AS NEEDED TO FORM A CLEAN DELINEATION. CONTRACTOR VERIFY AND ADJUST SIZE AND LOCATION OF SAWCUT AND REMOVAL NEEDED. RECUT ASPHALT EDGE JUST PRIOR TO PAVING. SEE DETAIL 1 ON C1.01 FOR ASPHALT PATCH.
4. SAWCUT AND REMOVE CURB TO EXTENT NECESSARY FOR INSTALLATION OF NEW ELECTRICAL VAULT. CONTRACTOR VERIFY AND ADJUST SIZE AND LOCATION OF SAWCUT AND REMOVAL NEEDED.
5. INSTALL NEW TYPE "C" CURB PER DETAIL 2 ON C1.01. CURB MAY BE CAST MONOLITHIC WITH SIDEWALK SLAB AT CONTRACTOR'S OPTION WHERE APPLICABLE. INSTALL TWO 2" DIA. WEEPS 12" APART AT LOWEST END OF REPLACED CURB.
6. REMOVE EXISTING SIDEWALK FOR EXTENTS REQUIRED FOR INSTALLATION OF NEW ELECTRICAL CONDUIT. CONTRACTOR VERIFY AND ADJUST SIZE AND LOCATION OF SAWCUT AND REMOVAL NEEDED. CUT SIDEWALK AT FIRST TOOLED JOINT BEYOND REQUIRED DEMOLITION EXTENTS.
7. REPAINT FULL LENGTH OF STALL LINES, LOADING ZONES AND ADA SYMBOL WITHIN WORK AREA. MATCH COLOR; 4" STRIP WIDTH.
8. POTENTIAL CONFLICT WITH EXISTING UTILITY. PRIOR TO START OF EXCAVATION, POTHOLE CROSSING LOCATIONS TO DETERMINE EXACT LOCATION AND DEPTH.
9. LOCATION OF EXISTING GAS AND SAN. SEWER SERVICES IS APPROXIMATE BASED ON RECENT LOCATE. AS PART OF BASE BID, POTHOLE TO DETERMINE EXACT ALIGNMENT OF BOTH UTILITIES, AND MOVE ONE OR BOTH AS NEEDED TO AVOID CROSSING THROUGH PACIFIC POWER 36" CLEARANCE ZONE AROUND TRANSFORMER AND VAULT. RECONNECT SAN. SEWER PIPE WITH FLEXIBLE COUPLERS. SEE MECHANICAL PLANS FOR RECONNECTION OF GAS SERVICE.
10. WITHIN EXTENTS SHOWN, OVER COMPACTED SUBGRADE AND SEPARATION GEGOTEXTILE, APPLY 6" THICK LAYER OF 1" OPEN-GRADED CRUSHED ROCK FLUSH TO TOP OF CURB.
11. 6' TALL CHAINLINK FENCE AROUND MECHANICAL AND ELECTRIAL EQUIPMENT.
12. PAIR OF 4' CHAINLINK FENCE SWING GATES. PROVIDE DROP ROD AND LOCKING MECHANISM. PROVIDE 12"X12"X12" DEEP CONCRETE PAD FLUSH TO FINISH GRADE. EMBED GALVANIZED PIPE OF INSIDE DIAMETER TO RECEIVE DROP ROD.
13. PERFORM TRENCH AND PAD EXCAVATION SO AS NOT TO GET SOIL ON EXISTING ROCK. RESTORE SURFACE OF EXCAVATIONS WITH 6" MINIMUM ROCK MATCHING EXISTING.
14. INTERCEPT AND REROUTE EXISTING POWER SERVING STADIUM COMPLEX. SEE ELECTRICAL PLANS FOR INSTALLATION REQUIREMENTS.



UTILITY PLAN
1" = 10'-0"

0' 10' 20'
0" 1" 2"
(PLAN IS TO SCALE IF BAR MEASURES 2")

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JULY 20, 1990
GREG D. LOCKE
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Drawing Title
GRADING & UTILITY PLANS

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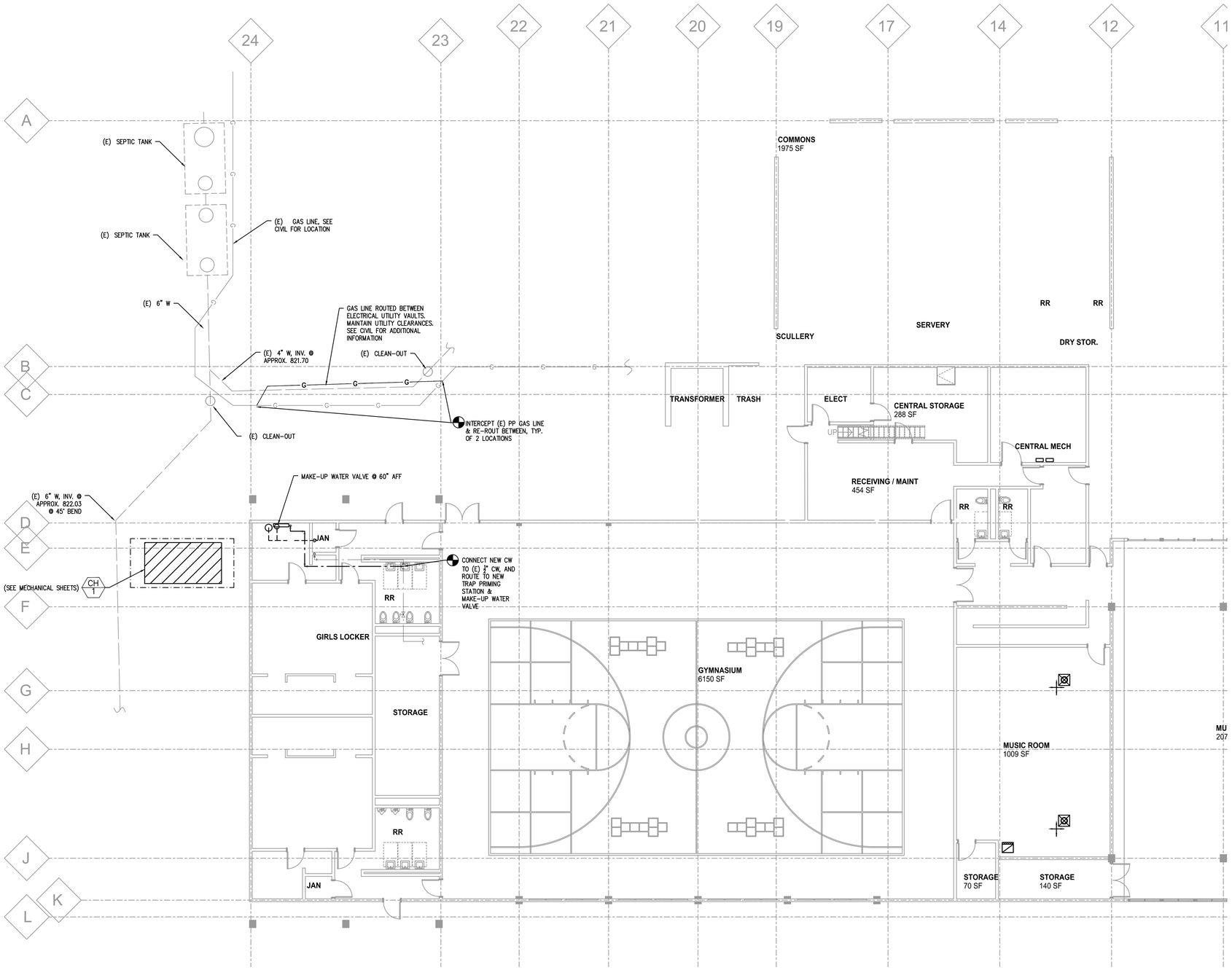
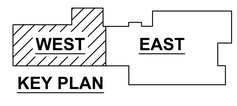


1 P2.01 PLUMBING PLAN – 1ST FLOOR WEST
SCALE: 1/8"=1'-0"



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Revisions

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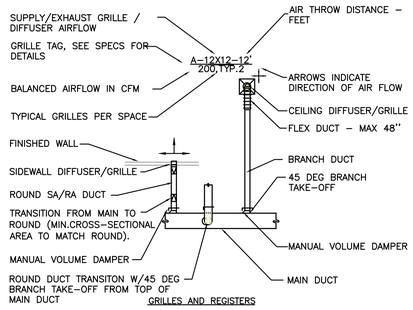
MECHANICAL LEGEND

- SUPPLY AIR DIFFUSER
- RETURN AIR DIFFUSER
- EXHAUST AIR DIFFUSER
- DIRECTIONAL AIR FLOW
- MANUAL VOLUME DAMPER
- SUPPLY AIR DUCT UP & DOWN
- RETURN AIR DUCT UP & DOWN
- EXHAUST OR OUTSIDE AIR DUCT UP & DOWN
- SUPPLY AIR DUCT UP & DOWN
- RETURN AIR DUCT UP & DOWN
- EXHAUST OR OUTSIDE AIR DUCT UP & DOWN
- VAV TERMINAL UNIT W/ REHEAT COIL
- (D) DEMOLISH
- (E) EXISTING
- CONNECT TO EXISTING
- THERMOSTAT
- TEMPERATURE SENSOR
- NOTE
- EQUIPMENT DESIGNATOR
- GATE VALVE/SHUT-OFF VALVE SEE SPECS
- CHECK VALVE
- BALANCING VALVE
- FLOW CONTROL/LIMITING VALVE
- THERMOMETER
- DIRECTION OF FLOW
- PUMP
- STRAINER W/DRAIN VALVE
- PRESSURE GUAGE
- PETE'S PLUG
- DOUBLE CHECK ASSEMBLY
- PRESSURE REDUCING VALVE
- UNION
- 2-WAY CONTROL VALVE
- 3-WAY CONTROL VALVE
- TRIPLE DUTY VALVE
- CAP
- MOTORIZED DAMPER
- BALL/SHUT-OFF VALVE (SEE SPECS)
- FIRE DAMPER
- FIRE / SMOKE DAMPER
- SMOKE DAMPER

AFF	ABOVE FINISH FLOOR
AHU	AIR HANDLING UNIT
B.D.	BOTTOM OF DUCT
BHP	BRAKE HORSEPOWER
BOG	BOTTOM OF GRILLE
BTU	BRITISH THERMAL UNITS
CFM	CUBIC FEET PER MINUTE
CONN.	CONNECTION
CONT.	CONTINUATION
CW	DOMESTIC COLD WATER
DB	DRY BULB
DIA.	DIAMETER
DIST.	DISTRIBUTION
EXH	EXHAUST AIR
EDB	ENTERING DRY BULB TEMPERATURE
EWB	ENTERING WET BULB TEMPERATURE
EWT	ENTERING WATER TEMPERATURE
FF	FINISH FLOOR
FIXT.	FIXTURE
F.O.B.	FLAT ON BOTTOM
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FT.	FEET / FOOT
GA.	GAUGE
GEXH	GREASE EXHAUST AIR DUCT
GPM	GALLONS PER MINUTE
H	HEIGHT
HP	HORSEPOWER
I.D.	INSIDE DIAMETER
IN.	INCHES
L	LENGTH
LBS.	POUNDS
LDB	LEAVING DRY BULB
LWB	LEAVING WET BULB
LWT	LEAVING WATER TEMPERATURE
MA	MAKE UP AIR
MAX.	MAXIMUM
MBH	THOUSANDS OF BTUs PER HOUR
MD	MOTORIZED DAMPER
MIN.	MINIMUM
MVD	MANUAL VOLUME DAMPER
NC	NOISE CRITERIA
N.C.	NORMALLY CLOSED
N.I.M.	NOT IN MECHANICAL
NO.	NUMBER
N.O.	NORMALLY OPEN
O.A.	OUTSIDE AIR
P	PERSON
PSI	POUNDS PER SQUARE INCH
P/T	PRESSURE / TEMPERATURE
R.A.	RETURN AIR
RECT.	RECTANGULAR
REQ'D	REQUIRED
S.A.	SUPPLY AIR
S.P.	STATIC PRESSURE
SQ.	SQUARE
TEMP.	TEMPERATURE
TYP.	TYPICAL
VAV	VARIABLE AIR VOLUME
W	WIDTH
WB	WET BULB
WPD	WATER PRESSURE DROP
ø	DIAMETER

- HWS — (HWS) HEATING WATER SUPPLY
- HWR — (HWR) HEATING WATER RETURN
- HWRR — (HWRR) HEATING WATER REVERSE RETURN
- CHS — (CHS) CHILLED WATER SUPPLY
- CHR — (CHR) CHILLED WATER RETURN
- PC — PUMPED CONDENSATE
- EQUIPMENT MAINTENANCE CLEARANCE AND ACCESS

AIR DISTRIBUTION DETAILS



GRILLES AND REGISTERS

MECHANICAL GENERAL NOTES

A. THE DRAWINGS ARE DIAGRAMMATIC. PROVIDE ALL MATERIAL (NEW AND UNDAMAGED) AND LABOR FOR A COMPLETE AND OPERABLE SYSTEM. VERIFY ALL BUILDING MEASUREMENTS DIMENSIONS AND EQUIPMENT LOCATIONS BEFORE PROCEEDING WITH ANY OF THE WORK.

B. VERIFY ALL EXISTING CONDITIONS RELATIVE TO THE SCOPE OF WORK. REPORT DISCREPANCIES BACK TO THE ENGINEER.

C. VERIFY INDICATED (E)DUCTWORK/PIPE SIZES PRIOR TO RECONNECTING NEW EQUIPMENT. EQUIPMENT SHALL NOT BE CONNECTED TO EXISTING DUCT/PIPE OF SMALLER DIAMETER THAN NEW DUCT/PIPE. REPORT DISCREPANCIES BACK TO ENGINEER.

D. DO NOT FABRICATE EQUIPMENT SUPPORTS/BASES W/O CONFIRMING SPACE EXISTS AND THE BUILDING ATTACHMENT POINTS.

E. REFER TO THE MECHANICAL SPECIFICATIONS FOR MATERIALS, EQUIPMENT, AND ADDITIONAL CONSTRUCTION INSTRUCTIONS NOT COVERED BY THESE PLANS.

F. ALL INSTALLATIONS SHALL COMPLY WITH APPLICABLE FEDERAL AND STATE CODES INCLUDING, 2019 OREGON STRUCTURAL SPECIALTY CODE (OSSC), OREGON ADOPTED FIRE CODE WITH OREGON AMENDAMENTS, 2017 OREGON PLUMBING SPECIALTY CODE (OPSC), 2019 OREGON MECHANICAL SPECIALTY CODE (OMSC), 2018 INTERNATIONAL ENERGY CONSERVATION CODE (IECC), AND NATIONAL FIRE PROTECTION ASSOCIATION (NFPA). WHERE TWO CODES DIFFER THE MORE STRICT OF THE TWO SHALL BE FOLLOWED.

G. OBTAIN ALL NECESSARY PERMITS AND INSPECTIONS REQUIRED BY THE GOVERNING AUTHORITIES HAVING JURISDICTION. SUBMIT ALL CERTIFICATES PRIOR TO ACCEPTANCE.

H. COORDINATE ALL MECHANICAL AND CONTROL WORK WITH GENERAL CONTRACTOR, CONTROL CONTRACTOR, ELECTRICAL AND ARCHITECTURAL.

I. COORDINATE OTHER TRADES FOR PATCH/REPAIR OF WALLS WHERE EXISTING SENSORS ARE REMOVED OR MODIFIED.

J. PATCH & REPAIR WALLS / FLOORS / CEILING WHERE OLD DUCTWORK/PIPES HAVE BEEN REMOVED TO MATCH EXISTING FINISHES.

K. SEE SPECIFICATIONS FOR VIBRATION ISOLATION AND SEISMIC RESTRAINTS.

L. COORDINATE WITH OTHER CRAFTS AS REQUIRED TO COMPLETE WORK IN ACCORDANCE WITH CONSTRUCTION SCHEDULE.

M. PROVIDE OWNER INSTRUCTION BY QUALIFIED PERSONNEL ON EQUIPMENT AND SYSTEMS AT OWNER'S REQUEST.

N. ALL DUCTWORK SHALL BE GALVANIZED STEEL, UNLESS OTHERWISE INDICATED, CONFORMING TO LATEST SMACNA, ASHRAE, OMSC, NFPA, AND UL STANDARDS.

O. MANUFACTURERS AND MODEL NUMBERS LISTED IN THE EQUIPMENT SCHEDULES ARE THE BASIS OF DESIGN.

P. CUT WALLS FOR PROPER EQUIPMENT, DUCT OR PIPE INSTALLATION. FILL HOLES WHICH ARE CUT OVERSIZED FOR A TIGHT FIT AROUND OBJECTS PASSING THROUGH.

Q. PROVIDE UL LISTED FIRESTOP SYSTEM TO MAINTAIN THE CODE REQUIRED F AND T RATING OF THE CONSTRUCTION ASSEMBLY AT A DUCT/PIPE PENETRATION THROUGH A RATED BUILDING CONSTRUCTION.

R. INSTALL LABELS ON ALL MECHANICAL EQUIPMENT. SEE SPECIFICATIONS FOR CRITERIA.

S. CONTROLS AND WIRING SHALL MEET ALL ELECTRICAL REQUIREMENTS OF APPLICABLE ELECTRICAL SPECIFICATIONS AND REQUIREMENTS OF OWNER, BUILDING OFFICIALS AND EQUIPMENT SUPPLIERS OF EQUIPMENT INSTALLED ON PROJECT.

T. ELECTRIC MOTORS SHALL HAVE BUILT-IN THERMAL OVERLOAD PROTECTION OR BE PROTECTED EXTERNALLY WITH SEPARATE THERMAL OVERLOAD DEVICES, WITH LOW-VOLTAGE RELEASE OR LOCK OUT AS REQUIRED.

U. ALL NEW EQUIPMENT, PIPING, CONDUIT, AND DUCTWORK SHALL BE INSTALLED PER CURRENT SEISMIC CODE REQUIREMENTS.

V. PROVIDE LOW LEAK AUTOMATIC DAMPERS ON OUTSIDE AIR, EXHAUST AIR AND RELIEF AIR CONTROL DAMPERS WHERE THESE ARE INDICATED.

W. COMMISSIONING AND FUNCTION TESTING SHALL BE PROVIDED AS REQUIRED BY SECTION C408 OF 2018 IECC. COMMISSIONING BY OTHERS, NIM.

EXISTING VAV BOX SCHEDULE - SANTIAM CANYON ES

VAV MARK NO.	EXISTING ASU	CO2 SENSOR	MAX COOLING CFM	MAXIMUM DEADBAND CFM	MAXIMUM HEATING CFM 50% or VENT	ENT AIR DEG. F	LVG AIR DEG. F	REHEAT COIL LOAD MBH	INLET WATER TEMP (F)	OUTLET WATER TEMP (F)	GPM	CONN. SIZE IN.	VALVE TYPE
501	ASU-5	YES	**780**	**156**	**390**	65	100	14.7	180	160	**1.5**	3/4	2 WAY
502	ASU-5	NO	**150**	**75**	**75**	65	100	2.8	180	160	**0.3**	1/2	2 WAY
503	ASU-5	YES	**760**	**152**	**380**	65	100	14.4	180	160	**1.4**	3/4	3-WAY
504	ASU-5	YES	**640**	**128**	**320**	65	100	12.1	180	160	**1.2**	1/2	3-WAY
505	ASU-5	YES	**650**	**130**	**325**	65	100	12.3	180	160	**1.2**	1/2	2 WAY
506	ASU-5	YES	**760**	**152**	**380**	65	100	14.4	180	160	**1.4**	3/4	2 WAY
507	ASU-5	NO	**150**	**75**	**75**	65	100	2.8	180	160	**0.3**	1/2	2 WAY
508	ASU-5	YES	**780**	**156**	**390**	65	100	14.7	180	160	**1.5**	3/4	2 WAY
509	ASU-5	YES	**830**	**166**	**415**	65	100	15.7	180	160	**1.6**	3/4	3-WAY
510	ASU-5	NO	**150**	**75**	**75**	65	100	2.8	180	160	**0.3**	1/2	2 WAY
511	ASU-5	YES	**810**	**162**	**405**	65	100	15.3	180	160	**1.5**	3/4	2 WAY
512	ASU-5	NO	**650**	**130**	**325**	65	100	12.3	180	160	**1.2**	1/2	2 WAY
513	ASU-5	NO	**1170**	**1170**	**1170**	65	100	44.2	180	160	**4.4**	1	2 WAY
514	ASU-5	NO	**150**	**75**	**75**	65	100	2.8	180	160	**0.3**	1/2	2 WAY
515	ASU-5	YES	**830**	**166**	**415**	65	100	15.7	180	160	**1.6**	3/4	3-WAY
701	ASU-7	YES	**770**	**154**	**385**	50	100	20.8	180	160	**2.1**	3/4	3-WAY
702	ASU-7	NO	**150**	**75**	**75**	50	100	4.1	180	160	**0.4**	1/2	2 WAY
703	ASU-7	YES	**750**	**150**	**375**	50	100	20.3	180	160	**2.0**	3/4	2 WAY
704	ASU-7	YES	**750**	**150**	**375**	50	100	20.3	180	160	**2.0**	3/4	2 WAY
705	ASU-7	YES	**900**	**180**	**450**	50	100	24.3	180	160	**2.4**	3/4	3-WAY
706	ASU-7	YES	**410**	**82**	**205**	50	100	11.1	180	160	**1.1**	1/2	2 WAY
707	ASU-7	NO	**380**	**380**	**380**	50	100	20.5	180	160	**2.1**	3/4	2 WAY
	TOTAL		**8280**	**2727**	**4725**			**178.6**			**17.9**		

EXISTING AIR HANLDER SCHEDULE W/ NEW COOLING COIL

EXISTING UNIT TAG	NEW COOLING COIL TAG	SERVICE	COOLING COIL CASING SIZE - NOTE (3)	EXISTING CABINET SIZE	FAN MOTOR REPLACEMENT	(E) SA MOTOR HP	NEW SA MOTOR HP	(E) RA MOTOR HP	NEW RA MOTOR HP	CFM	OUTSIDE AIR CFM	EDB	EWB	LDB	LWB	MAX. FV	GPM	COOLING MBH	MAX AIR PRESS. DROP "/WC	MAX WATER PRESS. DROP	COOLING COIL VALVE TYPE	CONN. SIZE, INCHES	EXISTING HTG COIL VALVE REPLACEMENT - TYPE	HEATING FLOW RATE
ASU-1	CC/ASU-1	MULTIPURPOSE	66x42	A-20	NO	7.5	N/A	2	N/A	7110	3505	78	64.3	54	53.5	450	46	231	0.70	8.00	3-W	2.5		12
ASU-2	EXISTING	ADMIN/STAFF	N/A	A-14	NO	1.5	N/A	0.5	N/A	2290	725	80	65	55	54.5	440	15	74	0.70	6.00	N/A	1.5	3-WAY (QTY 2)	2.5 & 4
ASU-3	CC/ASU-3	GYM	66x42	A-20	YES	7.5	7.5	1.5	1.5	8000	2313	78	64.3	54	53.5	500	52	260	0.90	10.00	2-W	2.5	3-WAY	20
ASU-4	NO COIL	LOCKERS	N/A	A-11	NO	1	N/A	-	N/A	-	-	-	-	-	-	-	-	-	-	-	N/A	N/A	2-WAY	3
ASU-5	CC/ASU-5	SOUTH CLASSROOMS	77x42	A-20/22	YES	10	10	3	3	9425	4050	78	64.3	54	53.5	500	62	306	0.90	8.00	3-W	2.5		7
ASU-6	CC/ASU-6	MEDIA CENTER	61x40	A-16	YES	5	5	1.5	1.5	5330	1081	78	64.3	54	53.5	425	35	173	0.65	6.00	2-W	2	3-WAY	8
ASU-7	CC/ASU-7	NORTH CLASSROOMS	66x40	A-16	YES	5	5	1	1	4110	2022	78	64.3	54	53.5	400	27	134	0.60	6.00	3-W	2	N/A	N/A

VAV BOX SCHEDULE - W/HOT WATER REHEAT

VAV MARK NO. VAV	UNIT	CO2 SENSOR	ZONE SQ. FT.	MAX COOLING CFM	MAXIMUM DEADBAND CFM	MAXIMUM HEATING CFM 50% or VENT	INLET IN.	OUTLET IN.	ENT AIR DEG. F	LVG AIR DEG. F	REHEAT COIL LOAD MBH	INLET WATER TEMP (F)	OUTLET WATER TEMP (F)	GPM	CONN. SIZE IN.	VALVE TYPE	MAX. STATIC LOSS *	MAX. DISCHARGE SOUND POWER LEVEL **	MAX. RADIATED SOUND POWER LEVEL **	CONTROL TYPE
516	AHU-5	NO	562	**640**	**128**	**320**	**8**	12X10	65	100	12.1	180	140	**0.6**	1/2	2 WAY	0.75	67	59	DDC
	TOTAL			**640**	**128**	**320**					**12.1**			**0.6**						

NOTES:
1. COIL AND CHILLER SYSTEMS ARE TREATED TO 25% GLYCOL.
2. CHILLED WATER INLET TEMP IS 42°F.
3. COIL INCLUDING HEADER SHALL FIT INSIDE CASING. VERIFY DIMENSIONS ON SITE PRIOR TO SUBMITTAL.

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MECHANICAL LEGEND AND SCHEDULES

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VENTILATION AIR SCHEDULE - SANTIAM CANYON ES

ROOM NUMBER AND NAME	AREA (SQ. FT.)	OCCUPANT LOAD (#/1000 SQ. FT.)	NUMBER OF OCCUPANTS	OUTSIDE AIR REQUIREMENT (CFM/P)	OUTSIDE AIR REQUIREMENT (CFM/SQ FT.)	OUTSIDE AIR REQUIRED (CFM)		ZONE OSA (CFM)	SUPPLY AIR (CFM)	PRIMARY OSA FRACTION	RETURN AIR (CFM)	EXHAUST AIR (CFM)	Zone Ventilation Efficiency	Corrected OSA CFM	AIR SYSTEMS
	Az		Pz	Rp	Ra	Vbz	Ez	Voz	Vpz	Zp			Evz		
ASU-1															
MUSIC CLASSROOM	1015	25	26	10	0.12	382	1.0	382	1400	0.27	1018	0	1.16	329	ASU-1
MUSIC STORAGE	137	0	0	0	0.06	8	1.0	8	45	0.18	37	0	1.14	7	ASU-1
MULTI-PURPOSE SPACE	2952	100	296	7.5	0.12	2574	1.0	2574	4510	0.57	1936	0	0.86	2980	ASU-1
HALL	223	0	0	0	0.06	13	1.0	13	200	0.07	187	0	1.37	10	ASU-1
SERVERY	179	5	1	5	0.06	16	1.0	16	200	0.08	184	0	1.24	13	ASU-1
WAITING AREA	356	0	0	0	0.06	21	1.0	21	300	0.07	279	0	1.36	16	ASU-1
VESTIBULE	222	0	0	0	0.06	13	1.0	13	310	0.04	297	0	1.39	10	ASU-1
TOTAL	5084		323			3028		3028	6965		3937	0	0.86	3363	
								Vou	Vps				Ev		
						CORRECTED TOTAL OUTDOOR AIR FLOW RATE				3505	CFM	Corrected OSA Fraction		Zs =	0.48
ASU-2															
BOYS RR	175	0	0	0	0	0	1.0	70	200	0.35	130	250	1.08	65	ASU-2
GIRLS RR	173	0	0	0	0	0	1.0	70	200	0.35	130	250	1.08	65	ASU-2
COUNSELING	127	5	1	5	0.06	13	1.0	13	80	0.16	67	0	1.16	11	ASU-2
SPECIAL ED	300	25	8	10	0.12	116	1.0	116	240	0.48	124	0	0.95	122	ASU-2
FACULTY LOUNGE X6	668	25	17	10	0.12	250	1.0	250	500	0.50	250	0	0.93	268	ASU-2
GENERAL OFFICE	384	5	2	5	0.06	33	1.0	33	280	0.12	247	0	1.20	27	ASU-2
PRINCIPAL	125	5	1	5	0.06	13	1.0	13	100	0.13	88	0	1.20	10	ASU-2
STORAGE	174	0	0	0	0.06	10	1.0	10	85	0.12	75	85	1.20	9	ASU-2
DARK ROOM	80	5	1	5	0.06	10	1.0	10	100	0.10	90	150	1.22	8	ASU-2
CONFERENCE	145	50	8	5	0.06	49	1.0	49	135	0.36	86	150	0.96	51	ASU-2
HEALTH	122	5	1	5	0.06	12	1.0	12	100	0.12	88	0	1.20	10	ASU-2
CIRCULATION OFFICE	365	5	2	5	0.06	32	1.0	32	270	0.12	238	0	1.20	27	ASU-2
TOTAL	2838		41			537		677	2290		1613	0	0.93	672	
								Vou	Vps				Ev		
						CORRECTED TOTAL OUTDOOR AIR FLOW RATE				725	CFM	Corrected OSA Fraction		Zs =	0.29
ASU-3															
GYM	2952	100	296	7.5	0.12	2574	1.0	2574	8000	0.32	5426	0	1.11	2313	ASU-3
TOTAL	2952		296			2574		2574	8000		5426	0	1.11	2313	
								Vou	Vps				Ev		
						CORRECTED TOTAL OUTDOOR AIR FLOW RATE				2313	CFM	Corrected OSA Fraction		Zs =	0.29
ASU-4															
GIRLS LOCKER/SHOWER	518	0	0	0	0	0	1.0	70	800	0.09	730	900	1.35	52	ASU-4
BOYS LOCKER/SHOWER	520	0	0	0	0	0	1.0	70	800	0.09	730	900	1.35	52	ASU-4
STORAGE 1	128	0	0	0	0.06	8	1.0	8	100	0.08	92	0	1.24	6	ASU-4
STORAGE 2	128	0	0	0	0.06	8	1.0	8	100	0.08	92	0	1.24	6	ASU-4
TOTAL	1294		0			15		155	1800		1645	1800	1.24	116	
								Vou	Vps				Ev		
						CORRECTED TOTAL OUTDOOR AIR FLOW RATE				125	CFM	Corrected OSA Fraction		Zs =	0.06
ASU-5															
TAG PROGRAM	555	25	14	10	0.12	207	1.0	207	650	0.32	443	0	1.12	185	ASU-5/VAV-505
6TH GRADE CR - A	771	25	20	10	0.12	293	1.0	293	780	0.38	487	0	1.06	276	ASU-5/VAV-508
6TH GRADE CR - B	815	25	21	10	0.12	308	1.0	308	760	0.41	452	0	1.03	299	ASU-5/VAV-507
6TH GRADE OFFICE	200	5	1	5	0.06	17	1.0	17	150	0.11	133	0	1.21	14	ASU-5/VAV-506
STORYWELL 1	562	25	15	10	0.12	217	1.0	217	640	0.34	423	0	1.10	199	ASU-5/VAV-504
STORYWELL 2	568	25	15	10	0.12	218	1.0	218	640	0.34	422	0	1.09	199	ASU-5/VAV-516
4TH GRADE CR - A	771	25	20	10	0.12	293	1.0	293	760	0.38	467	0	1.05	279	ASU-5/VAV-503
4TH GRADE CR - B	815	25	21	10	0.12	308	1.0	308	780	0.39	472	0	1.04	296	ASU-5/VAV-501
4TH GRADE OFFICE	200	5	1	5	0.06	17	1.0	17	150	0.11	133	0	1.21	14	ASU-5/VAV-502
LANGUAGE ARTS X0	771	25	20	10	0.12	293	1.0	293	830	0.35	537	0	1.08	270	ASU-5/VAV-515
OFFICE X5	200	5	1	5	0.06	17	1.0	17	150	0.11	133	0	1.21	14	ASU-5/VAV-514
SCIENCE X1	1397	25	35	10	0.12	518	1.0	518	1170	0.44	652	1200	0.99	522	ASU-5/VAV-513
SOCIAL STUDIES X2	771	25	20	10	0.12	293	1.0	293	810	0.36	517	0	1.07	272	ASU-5/VAV-511
MATH LAB X3	815	25	21	10	0.12	308	1.0	308	830	0.37	522	0	1.06	289	ASU-5/VAV-509
OFFICE X4	200	5	1	5	0.06	17	1.0	17	150	0.11	133	0	1.21	14	ASU-5/VAV-510
STORAGE X11/JAN X13	192	0	0	0	0.06	12	1.0	12	100	0.12	88	100	1.21	10	ASU-5/VAV-512
BOYS X8	143	0	0	0	0	0	1.0	70	175	0.40	105	225	1.03	68	ASU-5/VAV-512
GIRLS X7	145	0	0	0	0	0	1.0	70	125	0.56	55	175	0.87	80	ASU-5/VAV-512
LOCKER X12	563	0	0	0	0	0	1.0	70	250	0.28	180	80	1.15	61	ASU-5/VAV-512
TOTAL	10454		226			3333		3543	9900		6357	1780	0.87	3360	
								Vou	Vps				Ev		
						CORRECTED TOTAL OUTDOOR AIR FLOW RATE				4050	CFM	Corrected OSA Fraction		Zs =	0.34
ASU-6															
MEDIA CENTER	3741	25	94	10	0.12	1389	1.0	1389	9230	0.15	7841	0	1.28	1081	ASU-6
TOTAL	3741		94			1389		1389	9230		7841	0	1.28	1081	
								Vou	Vps				Ev		
						CORRECTED TOTAL OUTDOOR AIR FLOW RATE				1081	CFM	Corrected OSA Fraction		Zs =	0.12
ASU-7															
5TH GRADE A	766	25	20	10	0.12	292	1.0	292	770	0.38	478	0	1.06	277	ASU-7/VAV-701
5TH GRADE B	765	25	20	10	0.12	292	1.0	292	750	0.39	458	0	1.05	279	ASU-7/VAV-703
5TH GRADE OFFICE	200	5	1	5	0.06	17	1.0	17	150	0.11	133	0	1.21	14	ASU-7/VAV-702
GENERAL CR	771	25	20	10	0.12	293	1.0	293	750	0.39	457	0	1.04	280	ASU-7/VAV-704
ART	1041	25	27	10	0.12	395	1.0	395	900	0.44	505	0	1.00	397	ASU-7/VAV-705
ART OFFICE	200	5	1	5	0.06	17	1.0	17	150	0.11	133	0	1.21	14	ASU-7/VAV-707
STORAGE A	27	0	0	0	0.06	2	1.0	2	25	0.06	23	40	1.26	1	ASU-7
STORAGE B	80	0	0	0	0.06	5	1.0	5	25	0.19	20	50	1.13	4	ASU-7
BOYS	83	0	0	0	0	0	1.0	70	105	0.67	35	155	0.77	91	ASU-7/VAV-707
GIRLS	77	0	0	0	0	0	1.0	70	125	0.56	55	175	0.87	80	ASU-7/VAV-707
SPECIAL PROJECTS	265	25	7	10	0.12	102	1.0	102	410	0.25	308	0	1.19	86	ASU-7/VAV-706
TOTAL	4275		96			1413		1553	4160		2607	420	0.77	1523	
								Vou	Vps				Ev		
						CORRECTED TOTAL OUTDOOR AIR FLOW RATE				2022	CFM	Corrected OSA Fraction		Zs =	0.37

EXISTING MECHANICAL EQUIPMENT VALVE REPLACEMENT SCHEDULE

UNIT TAG	UNIT TYPE	NEW CONTROL VALVE (2-WAY OR 3-WAY)	FLOW RATE (GPM)
CUH-1	CABINET UNIT HEATER	2-WAY	0.75
CUH-2	CABINET UNIT HEATER	2-WAY	0.75
CUH-3	CABINET UNIT HEATER	2-WAY	1.5
FP-1	FIN PIPE	2-WAY	SEE FLOOR PLAN
FP-2	FIN PIPE	2-WAY	SEE FLOOR PLAN
FP-3	FIN PIPE	2-WAY	SEE FLOOR PLAN
FP-4	FIN PIPE	2-WAY	SEE FLOOR PLAN
UH-1A	UNIT HEATER	2-WAY	1
UH-1B	UNIT HEATER	2-WAY	1
UH-1C	UNIT HEATER	2-WAY	1
UH-2	UNIT HEATER	2-WAY	2.5
UH-3A	UNIT HEATER	2-WAY	1
UH-3B	UNIT HEATER	2-WAY	1
UH-3C	UNIT HEATER	2-WAY	1

CHILLER

MARK	CH
NUMBER	1
TYPE	AIR COOLED SCROLL
DESIGN FLOW (GPM)	236.1
MIN. FLOW (GPM)	115.5
TOTAL PRESSURE DROP (FT HD)	16.2
ENT/LVG WATER TEMPS	54/42
PROPYLENE GLYCOL	25%
COOLING CAPACITY - TONS	100
EER (MIN.)	10.32
IPLV EER (MIN.)	15.4
COMPRESSOR TYPE	SCROLL
ENTERING AIR TEMPERATURE	95
MINIMUM CAPACITY	25%
CAPACITY CONTROL STEPS	4 MIN.
REFRIGERANT	R410A
VOLTAGE/PHASE	460/3
SINGLE POINT ELECTRICAL	YES
SINGLE POINT POWER MCA	229 A
SINGE POINT POWER MOP	250 A
AIC	65K
PUMP HP/QTY	10.2/2
PUMP VFD	YES
PUMP NOMINAL CURRENT (AMP)	22
FLOW (GPM)	237
HEAT (FT)	44
OPERATING WEIGHT	11,700
BASIS OF DESIGN	TRANE CGAM

AIR SEPARATOR SCHEDULE

MARK NUMBER	AS 1
LOCATION	BOILER ROOM
TYPE	HYDRAULIC AIR AND DIRT
SYSTEM FLOW (GPM)	140
FLUID TYPE	WATER
SYSTEM CONNECTIONS SIZE (INCHES)	3
MAX HEAD LOSS (FT)	2
DESIGN WEIGHT (LBS)	205
BASIS OF DESIGN	SPIROVENT QUAD VDX-300
REMARKS/NOTES	1,2,3

NOTES:
1. PROVIDE DRAIN VALVE.
2. PROVIDE AIR VENT.
3. PROVIDE SEISMIC RESTRAINT AND SUPPORT FROM FLOOR.

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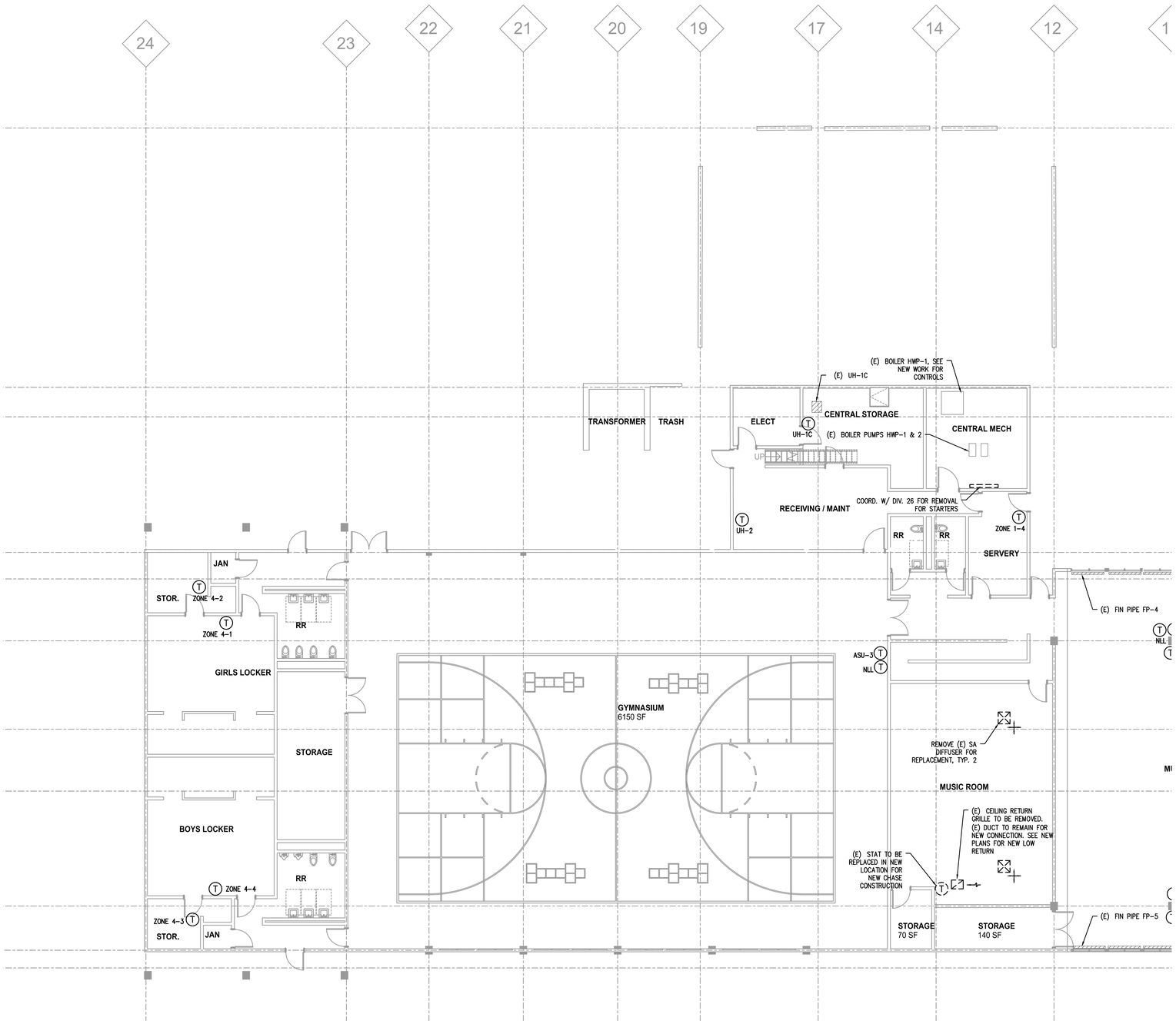
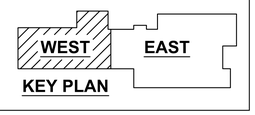
Sheet No
M0.02



1 M1.01 MECHANICAL DEMO PLAN – 1ST FLOOR WEST
SCALE: 1/8"=1'-0"

GENERAL NOTES:

- REMOVE ALL EXISTING PNEUMATIC TUBING, VALVES, COMPRESSORS AND DEVICES NO LONGER BEING USED. ABANDONING TUBING IS ONLY ALLOWED ABOVE INACCESSIBLE CEILINGS OR IN WALL CONSTRUCTION.



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OREGON
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Drawing Title
MECHANICAL DEMO PLAN

Sheet No
M1.01

DATE
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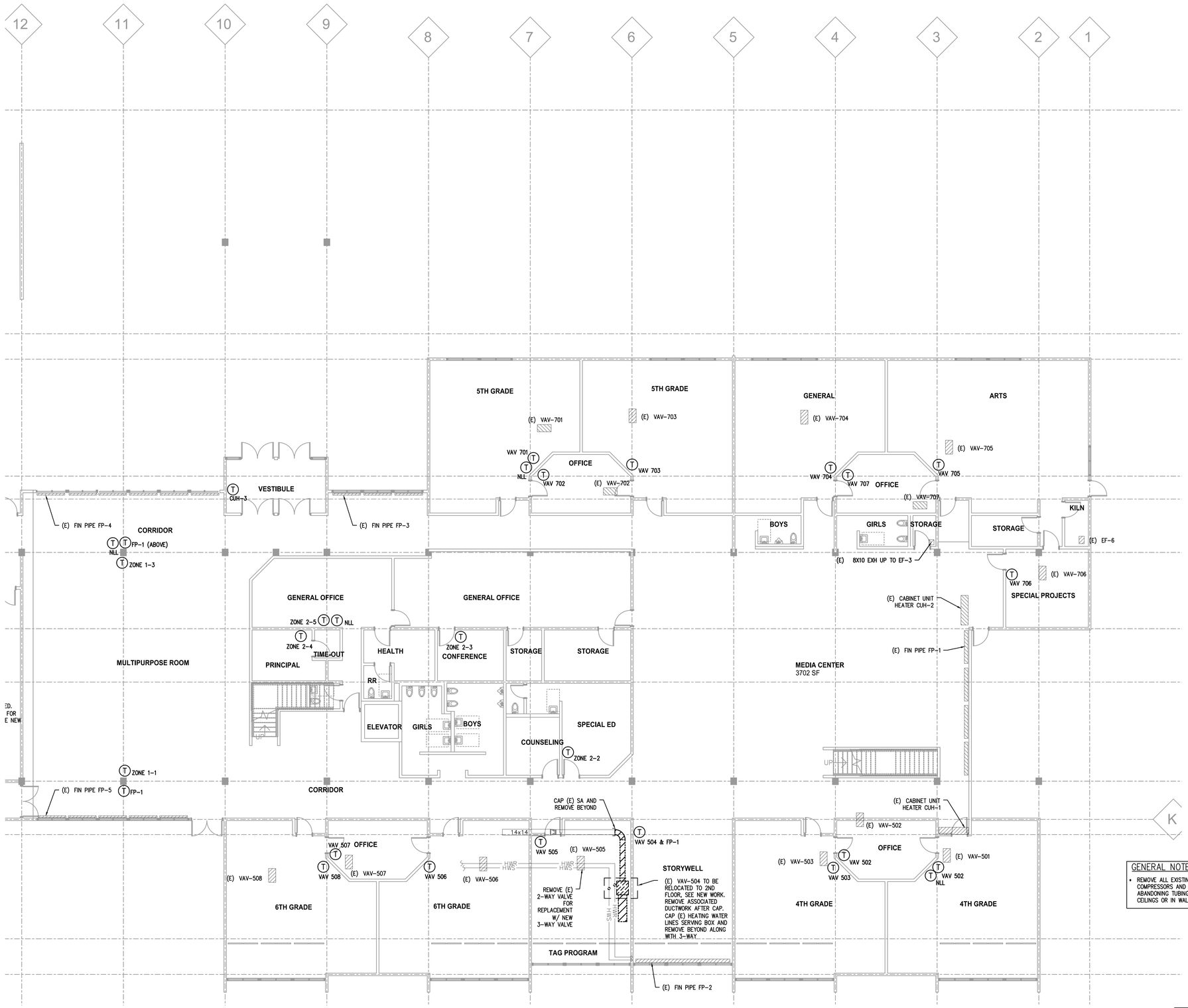

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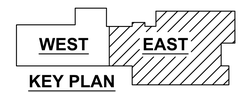
1 M1.02 MECHANICAL DEMO PLAN
SCALE: 1/8"=1'-0"



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Drawing Title
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Sheet No
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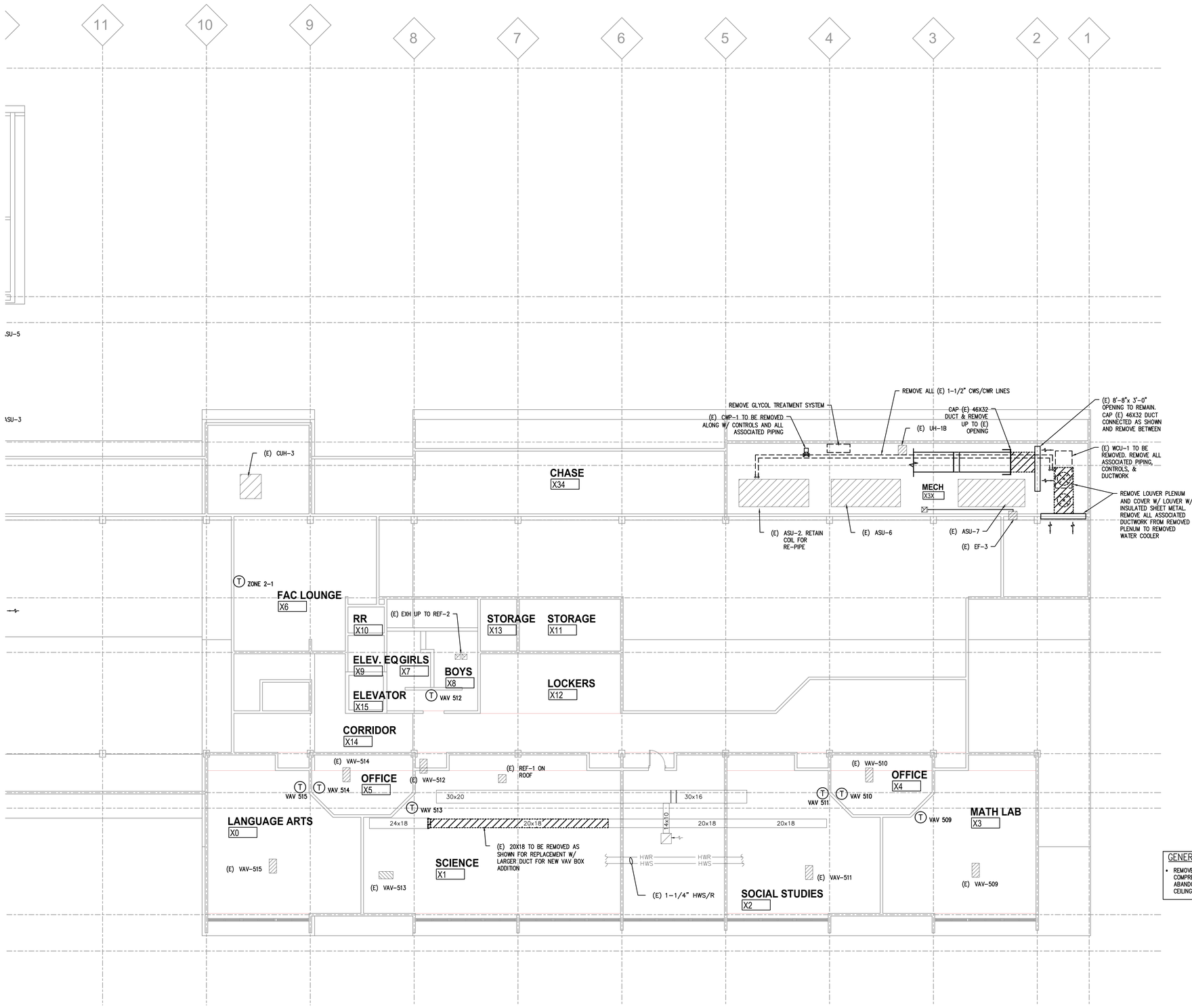

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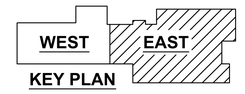
1 M1.04 MECHANICAL DEMO PLAN – 2ND FLOOR
SCALE: 1/8"=1'-0"



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MECHANICAL DEMO PLAN - 2ND FLOOR

Sheet No
M1.04

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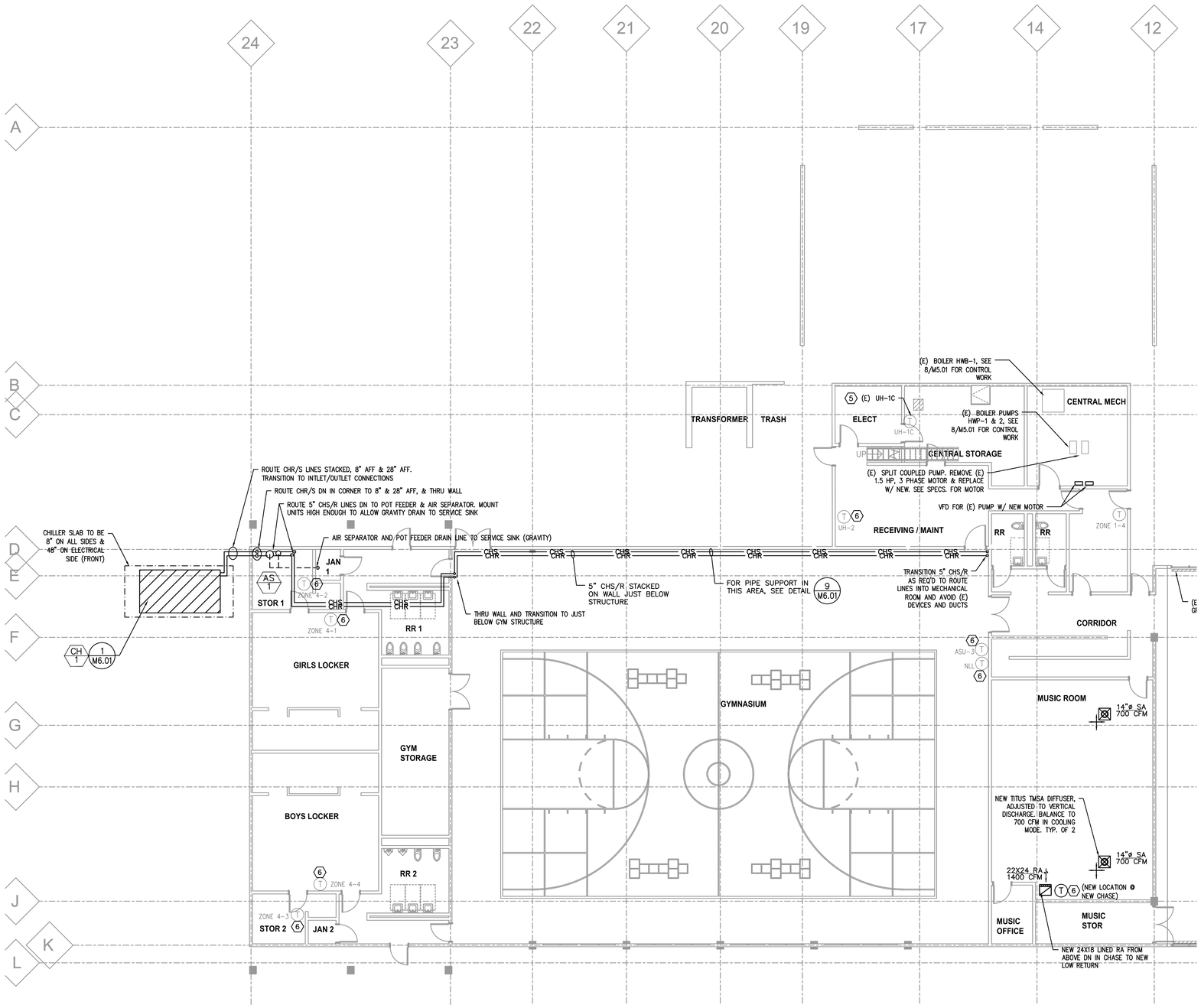
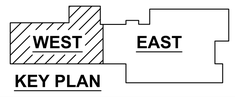


1 M2.01 MECHANICAL PLAN WEST – 1ST FLOOR
SCALE: 1/8"=1'-0"

MECHANICAL PLAN NOTES: (#)

1. REMOVE CONTROL VALVE AND REPLACE. SEE 3/M5.02 FOR CONTROL WORK.
2. REMOVE CONTROL VALVE AND REPLACE. CLEAN FLOW SENSING DEVICE. BALANCE AIRFLOW VIA TRAVERSE PER TERMINAL SCHEDULE. SEE 4/M5.02 FOR CONTROL WORK.
3. SEE 6/M5.01 FOR EXHAUST FAN CONTROL WORK. BALANCE TO AIRFLOW LISTED.
4. SEE SHEET M5.02 FOR AIR HANDLER CONTROL WORK. INSTALL CHILLED WATER COIL IN EXISTING UNIT COMPARTMENT INTENDED FOR FUTURE COIL. PROVDE CLOSE-OFF SHEETMETAL AS REQUIRED TO CLOSE AIR PATH AROUND COIL. SEE DETAIL NOTED FOR PIPING.
5. SEE SHEET M5.01 FOR UNIT HEATER CONTROL WORK.
6. EXISTING SENSOR TO BE REPLACED IN PLACE UNLESS NOTED OTHERWSE. PATCH WALL AS REQ'D OR PROVIDE S.S. COVER PLATE.
7. REPLACE EXISTING FAN MOTORS W/ NEW AND PROVIDE NEW VFD AT EACH FAN/MOTOR. MOTOR SIZE AS LISTED PER SCHEDULE.
8. EXISTING VAV BOX TO BE RE-PIPED W/ NEW 3-WAY VALVE. SEE DETAIL 3/M6.01). CONNECT NEW INLET/OUTLET DUCTWORK, SIZE AS SHOWN. CONNECT NEW HWS/R.
9. RE-BALANCE (E) DIFFUSER TO CFM LISTED.
10. SEE SHEET M5.02 FOR AIR HANDLER CONTROL WORK.
11. NEW 3-WAY VALVE TO REPLACE 2-WAY, SEE DETAIL 8/M6.01.
12. REMOVE (E) STARTERS AND DISCONNECTS AND REPLACE W/ COMBINATION VFD/DISCONNECT PER SPECS.



KEY PLAN

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MECHANICAL PLAN - FIRST FLOOR

Sheet No
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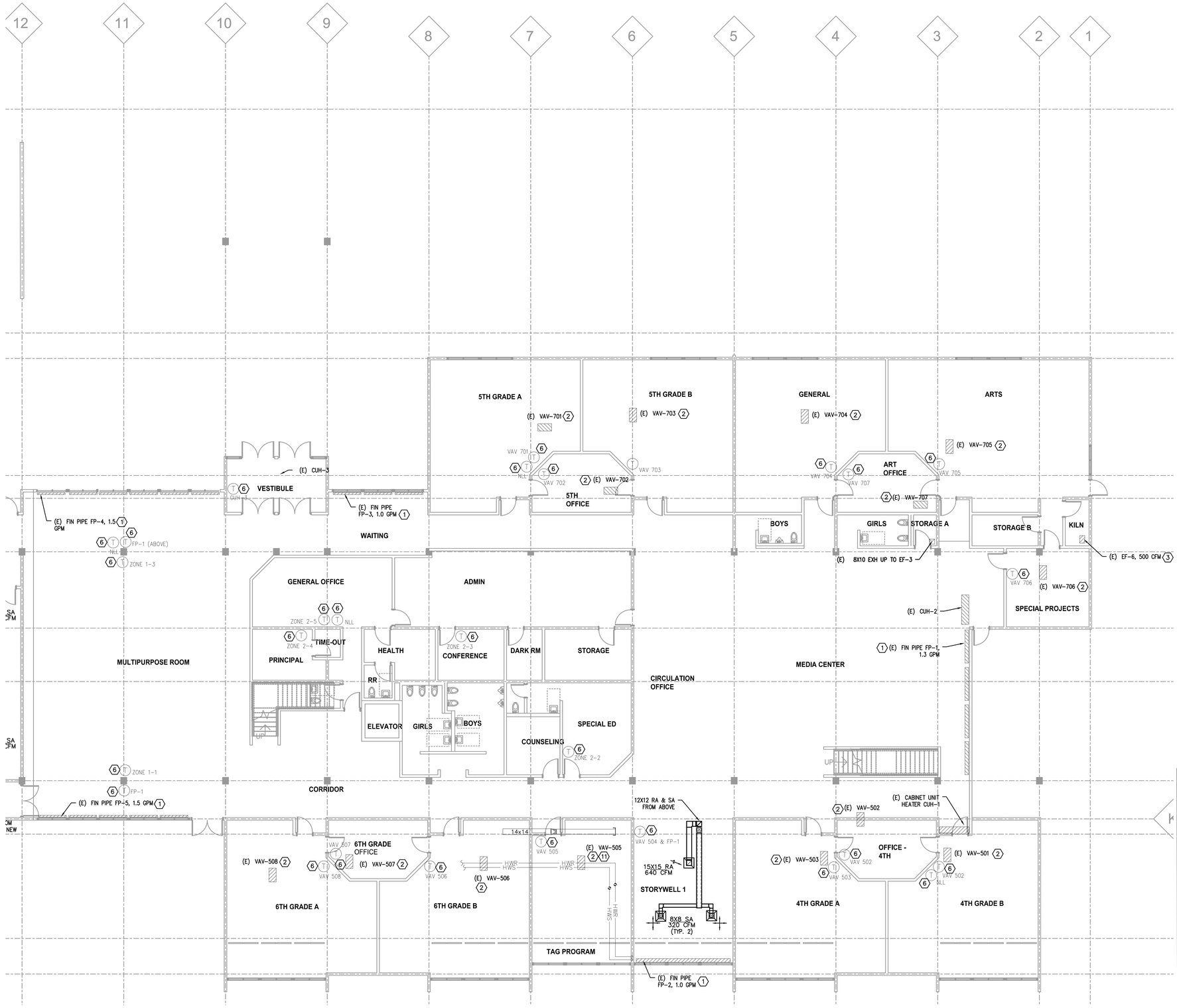

MECHANICAL PLAN NOTES: (#)

1. REMOVE CONTROL VALVE AND REPLACE. SEE 3/M5.02 FOR CONTROL WORK.
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9. RE-BALANCE (E) DIFFUSER TO CFM LISTED.
10. SEE SHEET M5.02 FOR AIR HANDLER CONTROL WORK.
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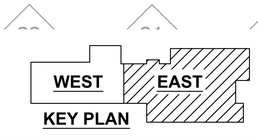
1 M2.02 MECHANICAL PLAN – 1ST FLOOR
SCALE: 1/8"=1'-0"



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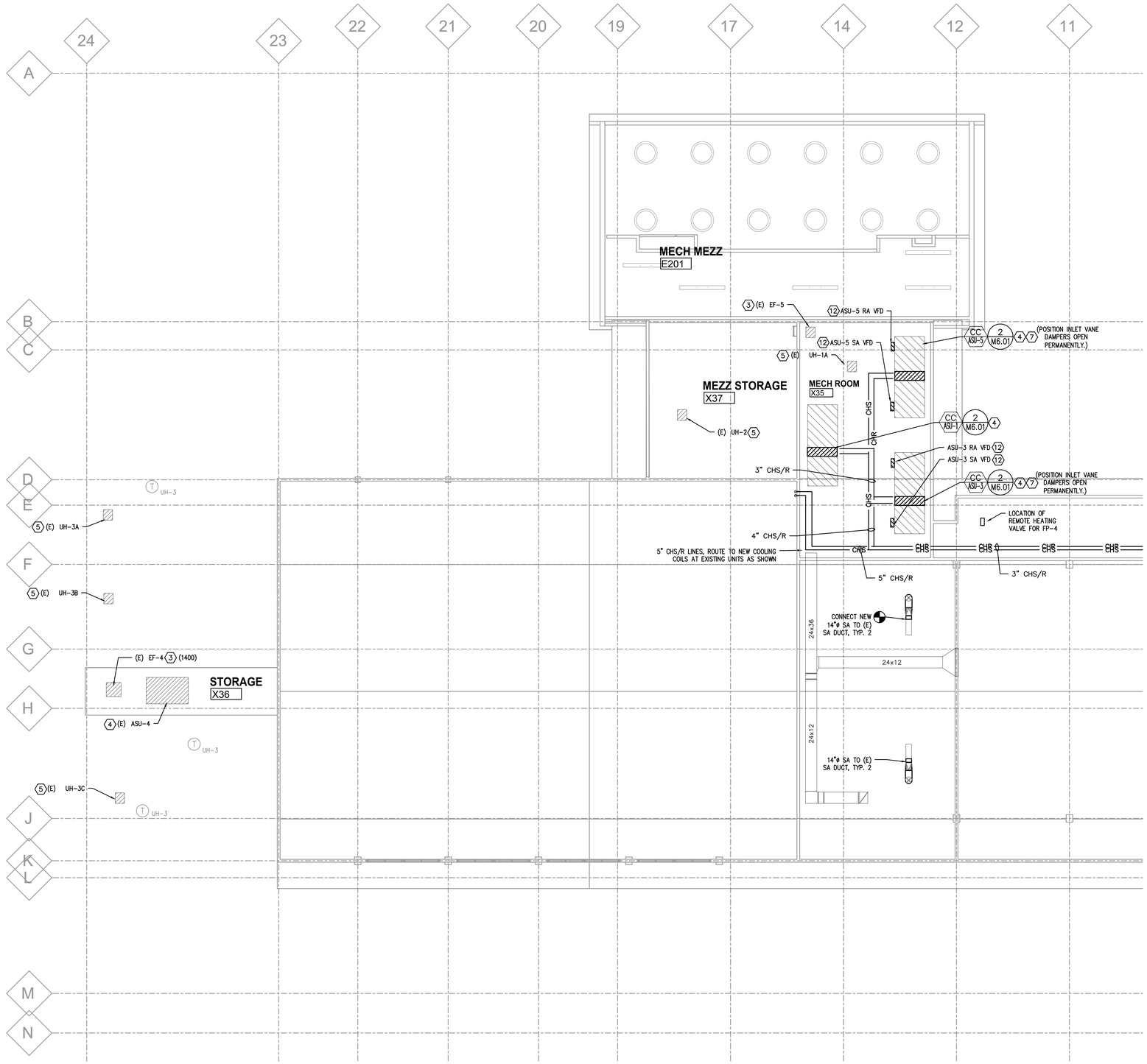
MECHANICAL PLAN - 1ST FLOOR

Sheet No
M2.02



1 M2.03 MECHANICAL PLAN WEST – 2ND FLOOR
SCALE: 1/8"=1'-0"

MECHANICAL PLAN NOTES: (#)

1. REMOVE CONTROL VALVE AND REPLACE. SEE 3/M5.02 FOR CONTROL WORK.
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WEST EAST
KEY PLAN

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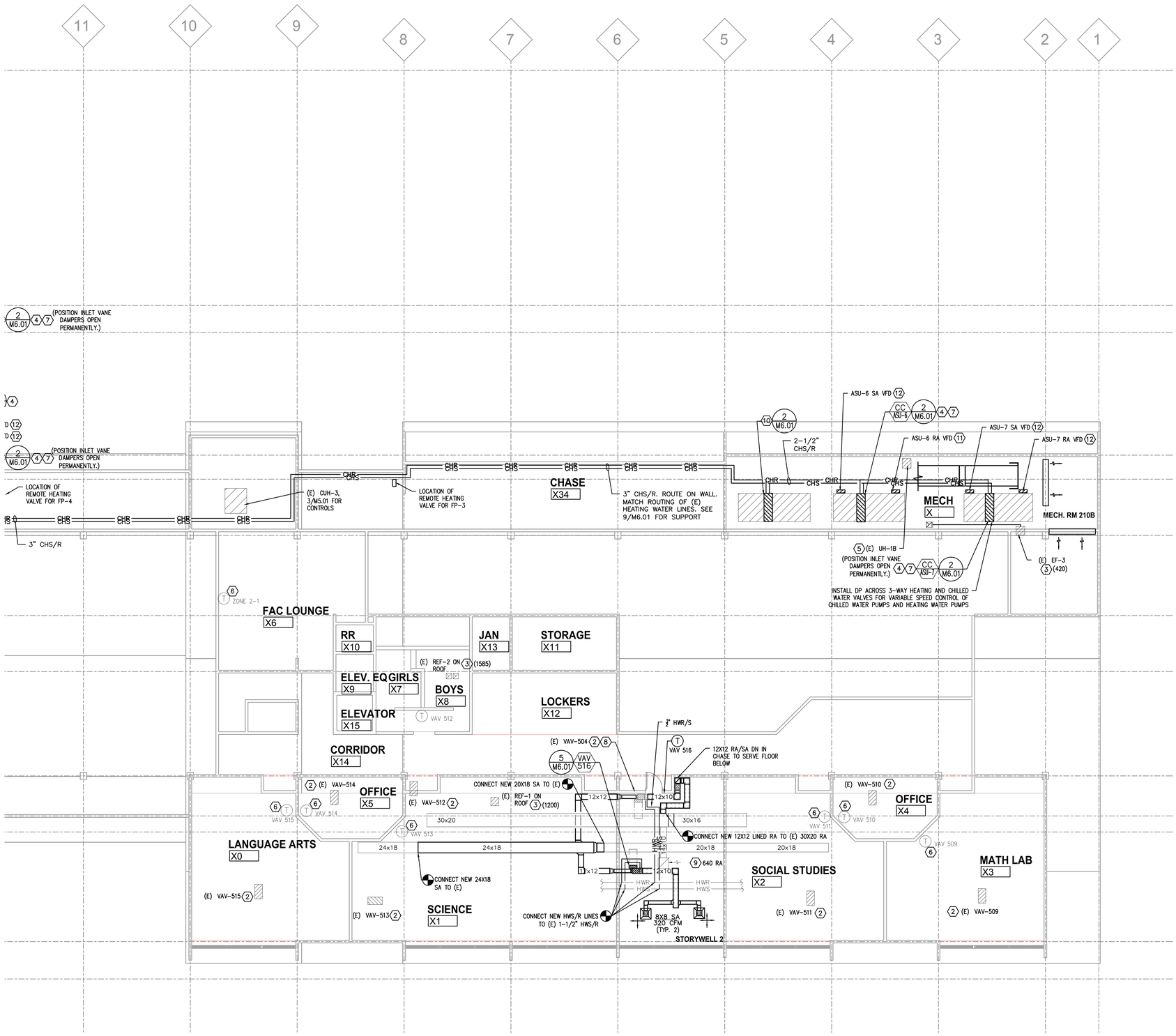
Drawing Title
MECHANICAL PLAN - 2ND FLOOR

Sheet No
M2.03



1 M2.04 MECHANICAL PLAN – 2ND FLOOR
SCALE: 1/8"=1'-0"

MECHANICAL PLAN NOTES:

1. REMOVE CONTROL VALVE AND REPLACE. SEE 3/M5.02 FOR CONTROL WORK.
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WEST EAST
KEY PLAN

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MECHANICAL PLAN - 2ND FLOOR

Sheet No
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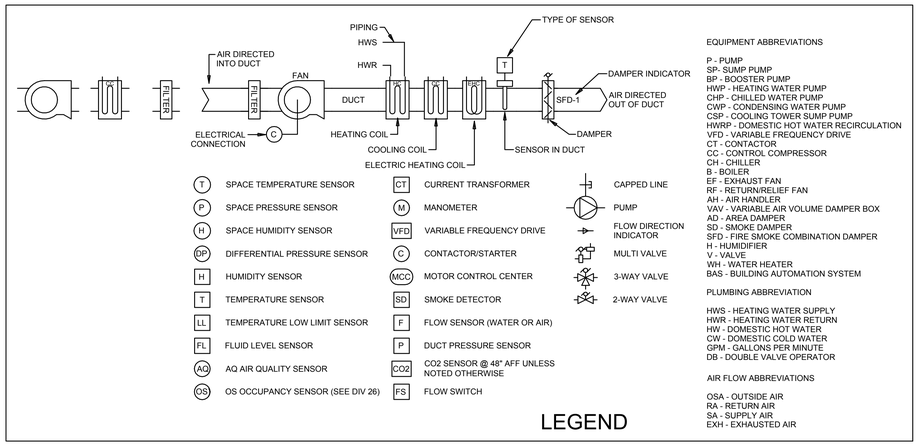


LEGEND

EQUIPMENT ABBREVIATIONS

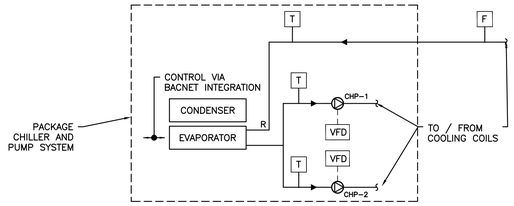
P - PUMP
SP- SUMP PUMP
BP - BOOSTER PUMP
HWP - HEATING WATER PUMP
CHP - CHILLED WATER PUMP
CWP - CONDENSING WATER PUMP
CSP - COOLING TOWER SUMP PUMP
HWRP - DOMESTIC HOT WATER RECIRCULATION
VFD - VARIABLE FREQUENCY DRIVE
CT - CONTACTOR
CC - CONTROL COMPRESSOR
CH - CHILLER
B - BOILER
EF - EXHAUST FAN
RF - RETURN/RELIEF FAN
AH - AIR HANDLER
VAV - VARIABLE AIR VOLUME DAMPER BOX
AD - AREA DAMPER
SD - SMOKE DAMPER
SFD - FIRE SMOKE COMBINATION DAMPER
H - HUMIDIFIER
V - VALVE
WH - WATER HEATER
BAS - BUILDING AUTOMATION SYSTEM

PLUMBING ABBREVIATION

HWS - HEATING WATER SUPPLY
HWR - HEATING WATER RETURN
HW - DOMESTIC HOT WATER
CW - DOMESTIC COLD WATER
GPM - GALLONS PER MINUTE
DB - DOUBLE VALVE OPERATOR

AIR FLOW ABBREVIATIONS

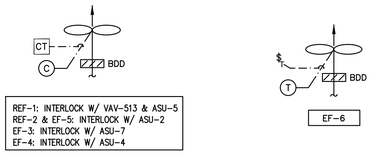
OSA - OUTSIDE AIR
RA - RETURN AIR
SA - SUPPLY AIR
EXH - EXHAUSTED AIR



SEE FLOOR PLAN FOR DP SENSOR LOCATION.

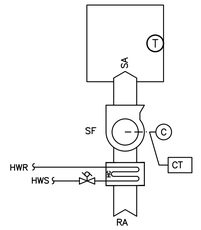
1 M5.01 CHILLER CONTROL DIAGRAM
SCHEMATIC

2 M5.01 NOT USED
SCHEMATIC

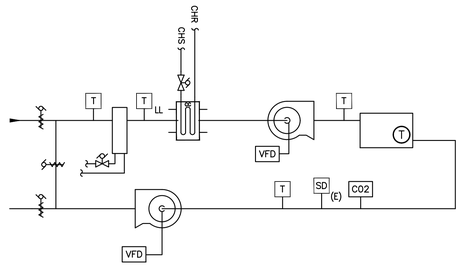


NOTE: ALL FANS ARE EXISTING UNLESS NOTED OTHERWISE

6 M5.01 EXHAUST FAN CONTROL DIAGRAM
SCHEMATIC

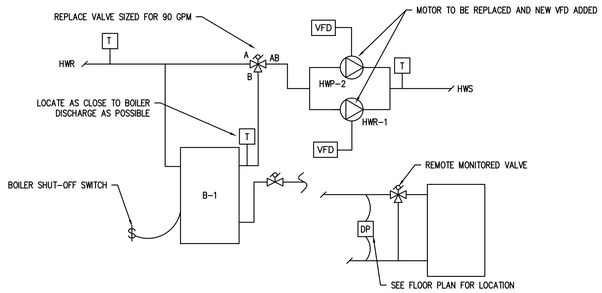


3 M5.01 UNIT HEATER/CABINET UNIT HEATER CONTROL DIAGRAM
SCHEMATIC

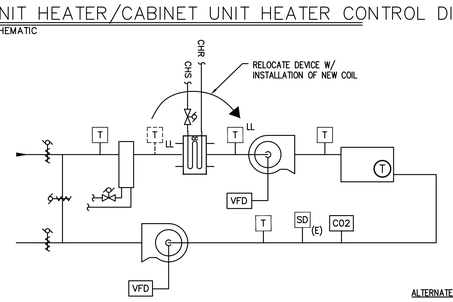


NOTE: REPLACE ALL ACTUATORS W/ NEW DEVICES

7 M5.01 KITCHEN & CAFETERIA UNIT (ALTERNATE ONLY)
SCHEMATIC

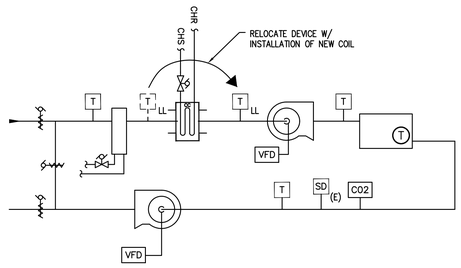


8 M5.01 BOILER SYSTEM
SCHEMATIC



NOTE: REPLACE ALL ACTUATORS W/ NEW DEVICES

4 M5.01 ASU-3 GYM CONTROL
SCHEMATIC



NOTE: REPLACE ALL ACTUATORS W/ NEW DEVICES

5 M5.01 ASU-6 CONTROL DIAGRAM
SCHEMATIC

GENERAL CONTROLS

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
FIRE ALARM PANEL	X				X
OUTSIDE AIR TEMP		X			

CONTROLS FOR CHILLER SEE 1/M5.01

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
CHILLER ENABLE/DISABLE *			X		
CHILLER RESET SIGNAL *				X	
CHILLED WATER PUMP SYSTEM START/STOP *			X		
CHILLED WATER PUMP SYSTEM STATUS *	X				X
CHILLED WATER PUMP SYSTEM SPEED				X	
CHILLER ALARM *		X			X (1)
CHILLED SUPPLY WATER TEMPERATURE *		X			
CHILLED RETURN WATER TEMPERATURE *		X			
SYSTEM DIFFERENTIAL PRESSURE		X			
CHILLED WATER FLOW		X			

* VIA BACNET INTEGRATION
(1) ALARM CODE TO BE SHOWN

CONTROLS UNIT HEATER/CABINET UNIT HEATER, SEE 3/M5.01

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
SPACE TEMP		X			X
FAN START/STOP			X		
HEATING WATER VALVE				X	X
FAN STATUS	X				

ASU-3 GYM CONTROL, SEE 4/M5.01

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
FAN S/S (2)			X		
FAN STAT (2)	X				
OSA DAMPER				X	
RA DAMPER				X	
RA TEMP		X			
MIXED AIR TEMP		X			
SA TEMP		X			
SPACE TEMP (2)		X			
SPACE COIL VALVE				X	
DAT		X			
RELIEF DAMPER				X	
LL TEMP		X			X
RA CO2		X			
MIXED AIR DAMPER				X	

CONTROLS FOR ASU-6, SEE 5/M5.01

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
SUPPLY FAN STATUS	X				X
SUPPLY FAN START/STOP			X		
SUPPLY FAN SPEED				X	X
DISCHARGE AIR TEMPERATURE		X			
MIXED AIR TEMP		X			
SPACE TEMP		X			
HEATING VALVE				X	
CHILLED WATER VALVE				X	
RETURN AIR TEMP		X			
RETURN AIR CO2		X			
OUTSIDE DAMPER POSITION				X	
RETURN AIR DAMPER POSITION				X	
EXHAUST AIR DAMPER POSITION				X	
RA FAN STATUS	X				X
RA FAN START/STOP			X		
RA FAN SPEED				X	X
COIL LOW LIMIT	X				

CONTROLS FOR EXHAUST FANS, SEE 6/M5.01

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
SWITCH POSITION	X				
FAN MOTOR STATUS (EF-6 ONLY)	X				X
START/STOP TYP OF ALL			X		
SPACE TEMP - EF-6 ONLY		X			

KITCHEN/CAFETERIA CONTROL, SEE 7/M5.01

ALTERNATE ONLY

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
FAN S/S (2)			X		
FAN STAT (2)	X				
OSA DAMPER				X	
RA DAMPER				X	
RA TEMP		X			
MIXED AIR TEMP		X			
SA TEMP		X			
SPACE TEMP (2)		X			
SPACE COIL VALVE				X	
DAT		X			
RELIEF DAMPER				X	
LL TEMP		X			X
RA CO2		X			
MIXED AIR DAMPER				X	

CONTROLS FOR BOILER SYSTEM, SEE 8/M5.01

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
HEATING SYSTEM ENABLE			X		
HWS RESET / FIRING RATE				X	
HEATING SYSTEM ALARM / FAULT	X				
HW PUMP COMMAND VFD				X	
HW PUMP STATUS VFD	X				
HW PUMP SPEED VFD			X		X
BOILER SUPPLY WATER TEMPERATURE		X			
SYSTEM SUPPLY WATER TEMPERATURE		X			
SYSTEM RETURN WATER TEMPERATURE		X			
SYSTEM DIFFERENTIAL PRESSURE		X			X
BOILER RECIRC VALVE POSITION		X			

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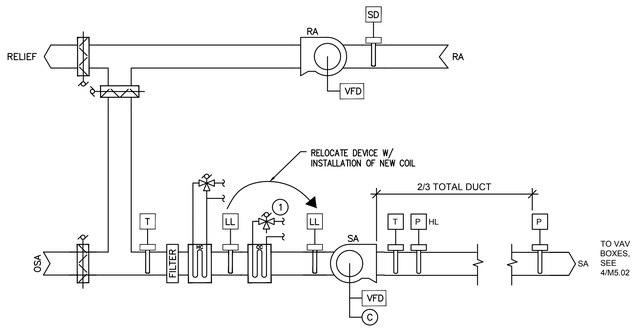
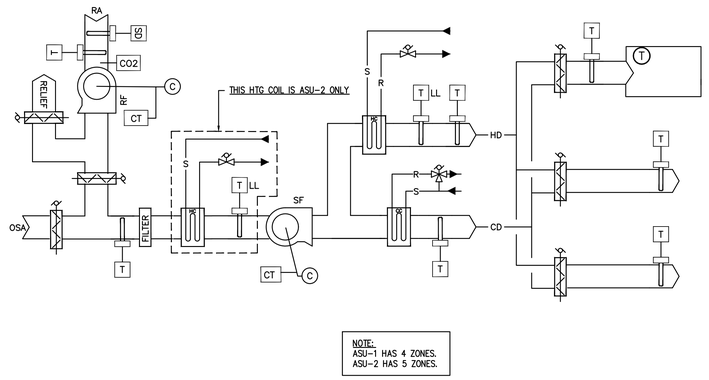
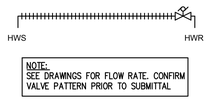


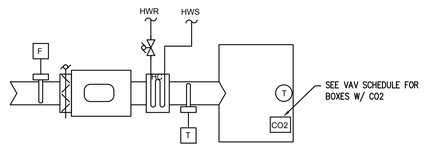
1 M5.02 ASU-5 & 7 CONTROL DIAGRAM
SCHEMATIC



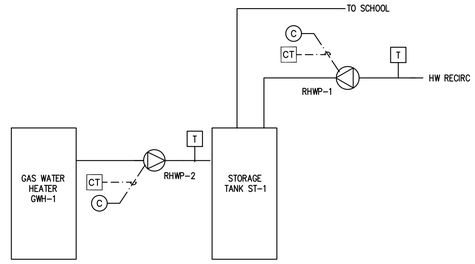
2 M5.02 MULTIZONE - ASU-1 & 2
SCHEMATIC



3 M5.02 FIN PIPE CONTROL DIAGRAM
SCALE: SCHEMATIC

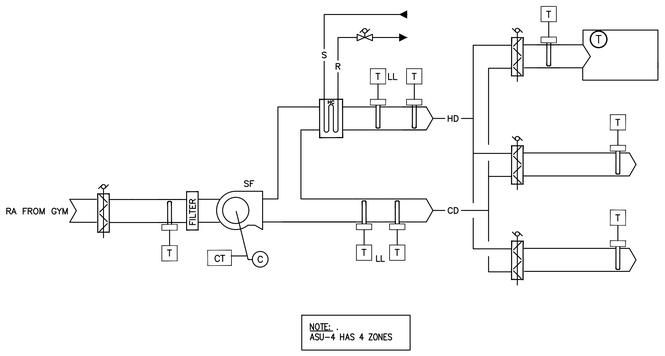


4 M5.02 VAV BOX CONTROL DIAGRAM
SCALE: SCHEMATIC



5 M5.02 DOMESTIC WATER HEATING SYSTEM CONTROL DIAGRAM
SCHEMATIC

6 M5.02 NOT USED
SCHEMATIC



7 M5.02 MULTIZONE - ASU-4
SCHEMATIC

CONTROLS FOR ASU-5 & 7, SEE 1/M5.02

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
SUPPLY FAN STATUS	X				X
SUPPLY FAN START/STOP			X		
SPACE TEMP		X			
HEATING VALVE				X	
CHILLED WATER VALVE				X	
CIRC PUMP START / STOP			X		
CIRC STATUS			X		
OUTSIDE AIR TEMP		X			
OUTSIDE DAMPER POSITION				X	
RELIEF DAMPER				X	
EA FAN STATUS	X				X
EA FAN SPEED				X	X
EA FAN START/STOP			X		
COIL LOW LIMIT	X				
HEATING WATER PUMP START / STOP			X		
HEATING WATER PUMP STATUS			X		
RETURN AIR DAMPER				X	

CONTROLS FOR ASU-1 & 2, SEE 2/M5.02

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
SUPPLY FAN STATUS	X				X
SUPPLY FAN S/S			X		
RETURN FAN STATUS	X				X
RETURN FAN S/S			X		
OUTSIDE AIR DAMPER				X	
RETURN AIR DAMPER				X	
RELIEF AIR DAMPER				X	
ZONE DISCHARGE DAMPER (TYP 4-ASU-1;TYP. 5 ASU-2)				X	
RETURN AIR TEMP		X			
MIXED AIR TEMP		X			
COLD DECK TEMP		X			
HOT DECK TEMP		X			
HEATING WATER VALVE				X	
CHILLED WATER VALVE				X	
LOW LIMIT	X				X
ZONE DISCHARGE TEMP (TYP 4 ASU-1; TYP. 5 ASU-2)		X			
SPACE TEMP (TYP. 4-ASU-1; TYP.5 - ASU-2)		X			
RETURN AIR CO2		X			

CONTROLS FOR FIN PIPE, SEE 3/M5.02

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
SPACE TEMP		X			
VALVE POSITION				X	

CONTROLS FOR VAV TERMINAL UNIT, SEE 4/M5.02

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
SPACE TEMP		X			
AIRFLOW		X			
DAMPER POSITION				X	
HEATING VALVE				X	
DISCHARGE TEMP		X			
CO2 LEVEL		X			X

* SEE VAV SCHEDULE FOR BOXES THAT RECEIVE CO2 SENSOR

CONTROLS FOR DOMESTIC HEATING WATER SYSTEM SEE 5/M5.02

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
RECIRC PUMP S/S			X		
RECIRC PUMP STATUS	X				
HW TEMP		X			
STORAGE TANK TEMP		X			
CIRC PUMP S/S			X		
CIRC PUMP STATUS	X				

CONTROLS FOR ASU-4, SEE 7/M5.02

POINT DESCRIPTION	INPUT		OUTPUT		ALARM
	DIGITAL	ANALOG	DIGITAL	ANALOG	
SUPPLY FAN STATUS	X				X
SUPPLY FAN S/S			X		
RETURN FAN STATUS	X				X
RETURN FAN S/S			X		
OUTSIDE AIR DAMPER				X	
RETURN AIR DAMPER				X	
RELIEF AIR DAMPER				X	
ZONE DISCHARGE DAMPER (TYP 4)				X	
RETURN AIR TEMP		X			
MIXED AIR TEMP		X			
COLD DECK TEMP		X			
HOT DECK TEMP		X			
HEATING WATER VALVE				X	
CHILLED WATER VALVE				X	
LOW LIMIT (TYP. 2)	X				X
ZONE DISCHARGE TEMP (TYP 4)		X			
SPACE TEMP (TYP. 4)		X			
RETURN AIR CO2		X			

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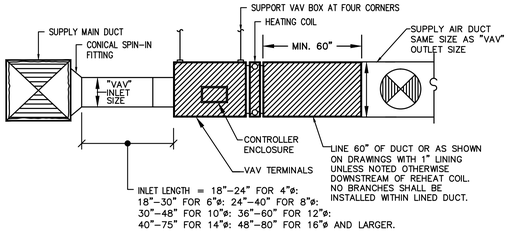
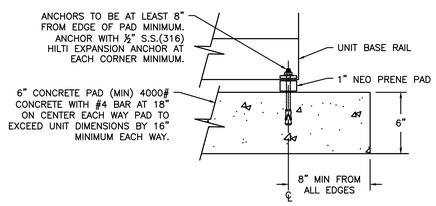
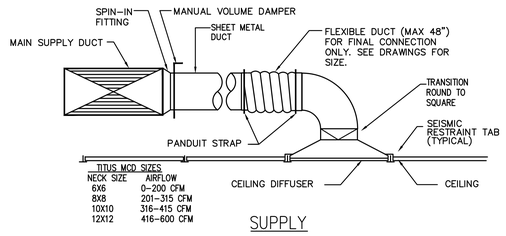


5 M6.01 VAV BOX
SCALE: DETAIL



4 M6.01 CHILLER ANCHORING DETAIL
SCALE: DETAIL



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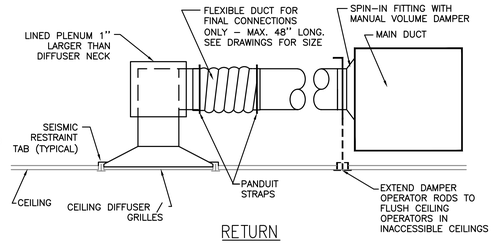
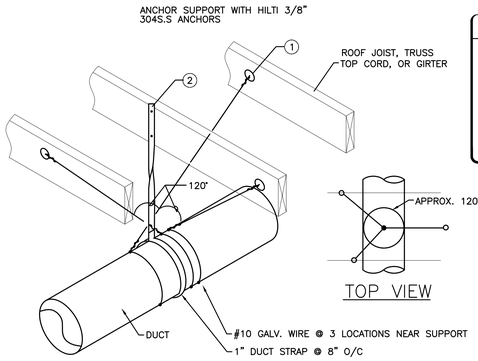


RETURN

6 M6.01 DIFFUSER DETAIL
SCALE: DETAIL



TOP VIEW

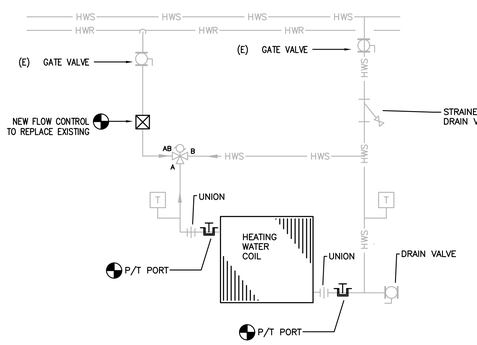
NOTES

1 – 1/4" GALV. THREADED EYE BOLT @ CENTER OF WOOD MEMBER (TYP. OF 3). FOR Z-GIRT USE MACHINE THREAD EYE BOLT W/ JAMB NUT & 1/4" WASHER @ EACH SIDE OF GIRT. FOR METAL DECK USE 12 SHEETMETAL SCREWS & 16 GA. MIN STRUT ANGLE CLIP

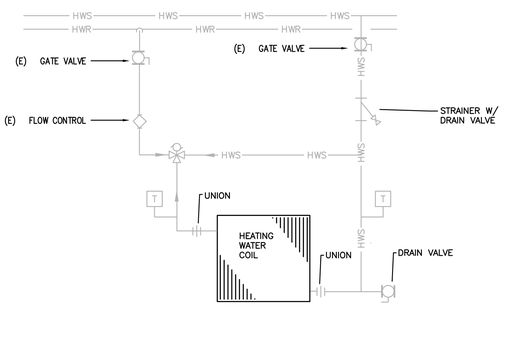
2 – ATTACH TO TOP CORD. OF TRUSS ONLY OR WOOD JOIST W/ #12 X 1-5/8 DECK SCREW @ MIN. 1" FROM WOOD MATERIAL EDGE. ATTACH TO Z-GIRT W/ (2) #12 TEK SCREWS. FOR METAL DECK USE (2) 12-14 SHEETMETAL SCREWS

- FOR SHEETMETAL DUCTS 11" TO 27" IN DIAMETER & ALL SQUARE OR RECTANGULAR DUCTS (STRAP ALONE IS SUFFICIENT FOR DUCTS SMALLER THAN 11" IN DIAMETER)
- STRAP INTERVAL MAY BE DECREASED (LESS THAN 96" O/C TO REDUCE THE NEED FOR WIRE TIES AS DETAILED. CONSULT ENGINEER OR SMACNA STANDARDS

7 M6.01 DUCT SUPPORT
SCALE: DETAIL

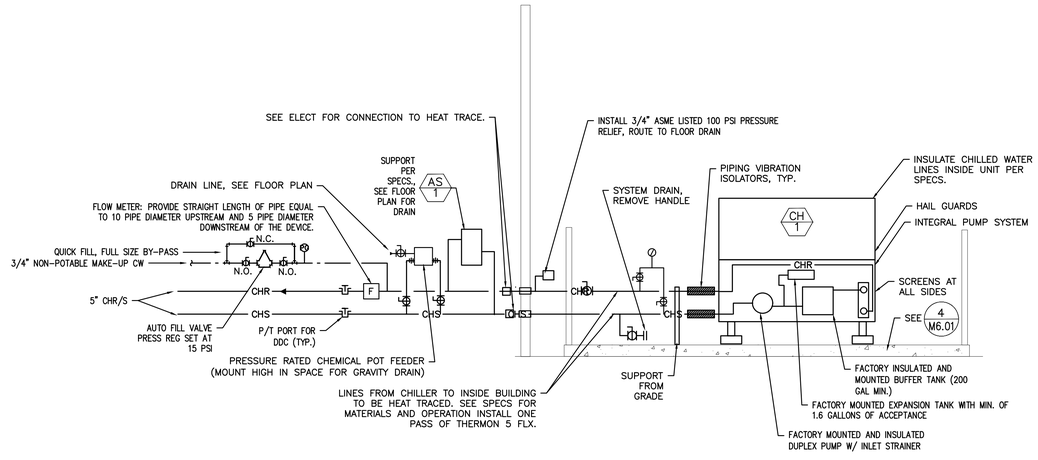


NEW COIL



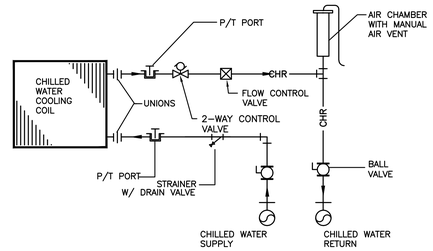
EXISTING COIL

8 M6.01 HEATING COIL 3-WAY
SCALE: DETAIL

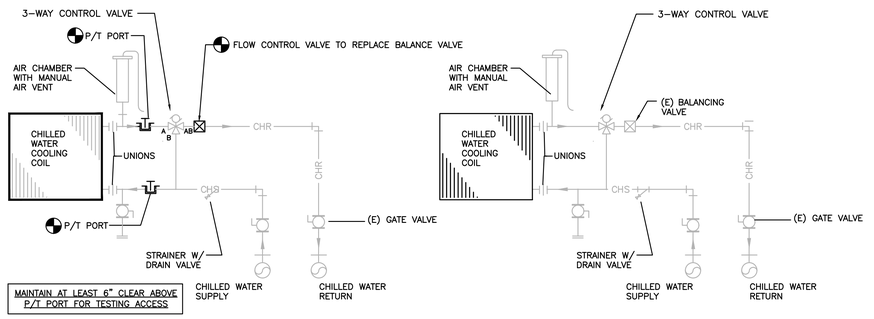


1) SYSTEM TO BE PROTECTED WITH 25% NON-TOXIC PROPYLENE GLYCOL

1 M6.01 CHILLER PIPING DIAGRAM
SCALE: DETAIL



2 M6.01 2-WAY CHILLED WATER COIL
SCALE: DETAIL

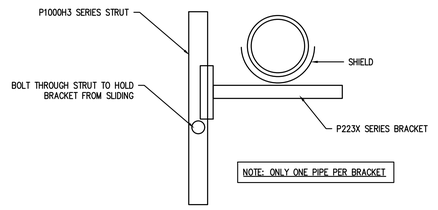


MAINTAIN AT LEAST 6" CLEAR ABOVE P/T PORT FOR TESTING ACCESS

NEW COIL

EXISTING COIL

3 M6.01 3-WAY CHILLED WATER COIL – NEW
SCALE: DETAIL



9 M6.01 PIPE SUPPORT
SCALE: DETAIL

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Electrical Abbreviations & Symbol Legend

Abbreviations

A	AMPERE
AC	ALTERNATING CURRENT, AIR CONDITIONING UNIT
AHJ	AUTHORITY HAVING JURISDICTION
AIC	AVAILABLE INTERRUPTING CAPACITY
AF	AMPERE FRAME / AMPERE FUSED
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ARMS	ARC FLASH REDUCTION MAINTENANCE SYSTEM
AT	AMPERE TRIP
AV	AUDIO / VIDEO
AWG	AMERICAN WIRE GAUGE
BAS	BUILDING AUTOMATION SYSTEM
BFG	BELOW FINISHED GRADE
BLDG	BUILDING
C	CONDUIT
CAT	CATEGORY
CB	CIRCUIT BREAKER
CFCI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED
CFOI	CONTRACTOR FURNISHED, OWNER INSTALLED
CKT	CIRCUIT
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CU	COPPER
dB	DECIBAL
DC	DIRECT CURRENT
DIM	DIMENSION
DIV	DIVISION
DTL	DETAIL
DWG	DRAWING
EL	ELEVATION
EMT	ELECTRICAL METALLIC TUBING
EOLR	END OF LINE RESISTOR
FACP	FIRE ALARM CONTROL PANEL
FF	FINISH FLOOR
FLA	FULL LOAD AMPERES
FT	FOOT, FEET
FBO	FURNISHED BY OTHERS
G, GND	GROUND
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
HH	HAND HOLE
HP	HORSEPOWER
ID	IDENTIFICATION
IDC	INITIATING DEVICE CIRCUIT
IDF	INTERMEDIATE DISTRIBUTION FRAME
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
IG	ISOLATED GROUND
IT	INFORMATION TECHNOLOGY
JB	JUNCTION BOX
KAIC	THOUSAND AMPS INTERRUPTING CURRENT
KCMIL	THOUSAND CIRCULAR MILS
KVA	KILOVOLT-AMPERE
KW	KILOWATT
LAN	LOCAL AREA NETWORK
LED	LIGHT EMITTING DIODE
LS	LIMIT SWITCH
LSI	ELECTRONIC TRIP UNIT ADJUSTABLE LONG TIME DELAY, SHORT TIME DELAY, INSTANTANEOUS TRIP
LSIG	ELECTRONIC TRIP UNIT WITH ADJUSTABLE LONG TIME DELAY, SHORT TIME DELAY, INSTANTANEOUS TRIP, AND GROUND FAULT
LV	LOW VOLTAGE
MCA	MINIMUM CIRCUIT AMPACITY
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MDF	MAIN DISTRIBUTION FRAME
MHz	MEGAHERTZ
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MOCP	MAXIMUM OVERCURRENT PROTECTION
N	NEUTRAL
NAC	NOTIFICATION APPLIANCE CIRCUIT
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NL	NIGHT LIGHT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OC	ON CENTER
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED, OWNER INSTALLED
Ø	PHASE
PB	PULL BOX, PANIC BUTTON, PUSH BUTTON
PE	PHOTO EYE
PNL	PANEL
POE	POWER OVER ETHERNET
PTZ	PAN, TILT, ZOOM
RF	RADIO FREQUENCY
RFI	REQUEST FOR INFORMATION
SPD	SURGE PROTECTION DEVICE
STD	STANDARD
SW	SWITCH
T/M	THERMAL MAGNETIC CIRCUIT BREAKER
TBD	TO BE DETERMINED
TV	TELEVISION / MONITOR OUTLET
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYP	TYPICAL
UH	UNIT HEATER
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
UPS	UNINTERRUPTIBLE POWER SUPPLY
UON	UNLESS OTHERWISE NOTED
USB	UNIVERSAL SERIAL BUS
V	VOLTS, VOLTAGE
VA	VOLT-AMPERE
VFD	VARIABLE FREQUENCY DRIVE
W	WATT, WIRE
WAN	WIDE AREA NETWORK
WAP	WIRELESS ACCESS POINT
WI-FI	WIRELESS FIDELITY
W/	WITH
W/O	WITHOUT
XFMR	TRANSFORMER
Y	WYE
1P	ONE POLE
2P	TWO POLE
3P	THREE POLE
4P	FOUR POLE

General Electrical Notes

1. ALL LIGHTING BRANCH CIRCUITS SHALL BE 2#10, 1#10G IN 3/4" CONDUIT, UON.
2. ALL 20-AMP RECEPTACLE AND HARDWIRED BRANCH CIRCUITS SHALL BE 2#12, 1#12G IN 3/4" CONDUIT, UON.
3. ALL EXIT SIGNS SHALL BE WIRED TO THE LOCAL LIGHTING BRANCH CIRCUIT AHEAD OF ALL SWITCHING, UON.
4. PROVIDE 0-10V DIMMING CONDUCTORS TO ALL LUMINAIRES WHICH ARE CONTROLLED BY 0-10V DIMMERS SHOWN ON THE DRAWINGS.

Drawing Symbol Variables

3	THREE WAY SWITCH.
4	FOUR WAY SWITCH.
#J	QUANTITY OF JACKS AND HORIZONTAL CABLES. J = CAT6, JA = CAT6A, JE = CAT5E
+XX	MOUNTING UNITS EXPRESSED IN INCHES TO CENTERLINE ABOVE FINISHED FLOOR OR GRADE.
C	MOUNTED HORIZONTALLY AT 4" ABOVE COUNTERTOP.
CL	CLOCK.
DR	DUAL RELAY.
E	RED EMERGENCY SWITCH.
EL	ELEVATOR RECALL.
ETR	EXISTING DEVICE SHALL REMAIN.
G	GLASS BREAK SENSOR.
K	KEYED SWITCH.
LF	LOW FREQUENCY.
LV	LOW VOLTAGE SWITCH.
M	MOTOR RATED TOGGLE SWITCH.
NEX	REPLACE EXISTING WIRING DEVICE AND FACEPLATE WITH NEW. BACK BOX AND CONDUIT SHALL REMAIN.
O	INTEGRAL OCCUPANCY SENSOR.
P	ADA PHONE, VERIFY HEIGHT WITH ARCHITECT / OWNER.
REX	REMOVE EXISTING DEVICE / EQUIPMENT.
TK	MOUNTED IN TOE KICK OF CASEWORK.
TV	MOUNTED ADJACENT TO TV AT 60" AFF, UON.
V	VANDAL RESISTANT.
WG	WIREGUARD.
WP	WEATHERPROOF.

Annotation

(N)	INDICATES NEW EQUIPMENT.
(E)	INDICATES EXISTING EQUIPMENT TO REMAIN.
(D)	INDICATES EXISTING EQUIPMENT TO BE DEMOLISHED.
(RR)/(RD)	INDICATES EXISTING EQUIPMENT OR DEVICE TO BE REMOVED AND REINSTALLED.
PXXX	CONDUIT & CONDUCTOR CALLOUT. REFER TO CONDUIT & CONDUCTOR SCHEDULE.
XX	KEYED NOTE CALLOUT. REFER TO CORRESPONDING SHEET KEYNOTES.
XX	KEYED NOTE CALLOUT. REFER TO CORRESPONDING SHEET KEYNOTES.
XX	KEYED NOTE CALLOUT. REFER TO CORRESPONDING SHEET KEYNOTES.
XX-XX	MECHANICAL EQUIPMENT CALLOUT. REFER TO MECHANICAL EQUIPMENT CONNECTION SCHEDULE.
X / EX.XX	DETAIL CALLOUT. REFER TO DETAIL AND SHEET AS INDICATED ON CALLOUT.
XX'-XX"	FIXTURE MOUNTING CALLOUT. HEIGHT ABOVE FINISHED FLOOR (A.F.F.)
XXXXX	EQUIPMENT CALLOUT. REFER TO NEMA CONNECTION SCHEDULE.
X / EX.XX	SECTION CALLOUT. REFER TO DETAIL AND SHEET AS INDICATED ON CALLOUT.
EX.XX	ELEVATION CALLOUT. REFER TO DETAIL AND SHEET AS INDICATED ON CALLOUT.

Fire Alarm

15	FIRE ALARM AUDIO/VISUAL - WALL MOUNTED. CANDELA RATING AS SHOWN ON DRAWING.
15	FIRE ALARM VISUAL - WALL MOUNTED. CANDELA RATING AS SHOWN ON DRAWING.
15	FIRE ALARM AUDIO/VISUAL - CEILING MOUNTED. CANDELA RATING AS SHOWN ON DRAWING.
15	FIRE ALARM VISUAL - CEILING MOUNTED. CANDELA RATING AS SHOWN ON DRAWING.
FB	FIRE ALARM BELL.
S	FIRE ALARM SMOKE DETECTOR - CEILING MOUNTED.
S	FIRE ALARM SMOKE DETECTOR - WALL MOUNTED.
H	FIRE ALARM HEAT DETECTOR - CEILING MOUNTED.
H	FIRE ALARM HEAT DETECTOR - WALL MOUNTED.
D	FIRE ALARM DUCT SMOKE DETECTOR.
TS D	FIRE ALARM DUCT SMOKE DETECTOR WITH REMOTE TEST STATION.
F	FIRE ALARM MANUAL PULL STATION - WALL MOUNTED.
TS	FIRE ALARM MANUAL TAMPER SWITCH.
FS	FIRE ALARM MANUAL FLOW SWITCH.
PS	FIRE ALARM MANUAL PRESSURE SWITCH.
MM	FIRE ALARM MONITOR MODULE.
RI	FIRE ALARM RELAY INPUT.
RO	FIRE ALARM RELAY OUTPUT.
PIV	FIRE ALARM POST INDICATOR VALVE.
SA	FIRE ALARM SURGE ARRESTOR.
IM	FIRE ALARM ISOLATION MODULE.
FAA	FIRE ALARM ANNUNCIATOR.
	FIRE ALARM MAGNETIC DOOR HOLD.

Lighting

	TROFFER LUMINAIRE, SURFACE, RECESS, OR PENDANT MOUNTED AS INDICATED ON THE DRAWINGS.
	DOWNLIGHT LUMINAIRE, SURFACE, RECESS, OR PENDANT MOUNTED AS INDICATED ON THE DRAWINGS.
	UNDERCABINET LUMINAIRE.
	EMERGENCY BATTERY PACK LUMINAIRE, WALL OR CEILING MOUNTED.
	LINEAR PENDANT MOUNTED LUMINAIRE.
	LINEAR WALL MOUNTED LUMINAIRE.
	BOLLARD LUMINAIRE.
	SITE LUMINAIRE POLE MOUNTED. NUMBER OF HEADS AS SHOWN.
	TRACK LUMINAIRE.
	SPOT LUMINAIRE.
	WALL MOUNTED LUMINAIRE.
	RING PENDANT LUMINAIRE.
	WALL WASH LUMINAIRE POINTED IN DIRECTION AS SHOWN.
	EXIT SIGN, WALL OR CEILING MOUNTED, SINGLE FACE WITH DIRECTIONAL CHEVRONS AS INDICATED ON DRAWINGS.
	EXIT SIGN, WALL OR CEILING MOUNTED, DOUBLE FACE WITH DIRECTIONAL CHEVRONS AS INDICATED ON DRAWINGS.
	HALF HATCHED LUMINAIRE TO BE WIRED TO EMERGENCY CIRCUIT
	FULL HATCHED LUMINAIRE TO BE WIRED TO NIGHTLIGHT CIRCUIT.

Switches

$	SINGLE POLE SWITCH - MOUNTED AT 42" AFF, UON.
	LOW VOLTAGE 0-10 VOLT DIMMING SWITCH - MOUNTED AT 42" AFF, UON.
M M	OCCUPANCY SENSOR - CEILING OR WALL MOUNTED.
PP	OCCUPANCY SENSOR POWER PACK.
PC PC	PHOTOCELL - CEILING OR WALL MOUNTED.
	ADA DOOR PUSHPLATE.
	EMERGENCY STOP SWITCH, MUSHROOM HEAD.
	PUSHBUTTON, SINGLE OR DOUBLE.

Low Voltage

	ETHERNET OUTLET MOUNTED AT 18" AFF, UON.
	COAXIAL OUTLET MOUNTED AT 18" AFF, UON.
	PHONE OUTLET MOUNTED AT 18" AFF, UON.
	LOW VOLTAGE OUTLET CEILING MOUNTED.
	WIRELESS ACCESS POINT CEILING MOUNTED.
	WIRELESS ACCESS POINT WALL MOUNTED.
	DIGITAL CLOCK.
	FLOORBOX DATA.
	POKETHRU DATA.
	IT RACK.
	VERTICAL WIRE MANAGEMENT.

Audio/Visual

	AV OUTLET - WALL MOUNTED AT 18" AFF, UON. SEE AUDIO VISUAL DETAILS FOR CONFIGURATIONS.
	AUDIO VIDEO OUTLET - CEILING MOUNTED.
S	AUDIO SPEAKER - WALL MOUNTED AT 96" AFF, UON.
S	AUDIO SPEAKER - CEILING MOUNTED.
P	PAGING SPEAKER - WALL MOUNTED AT 96" AFF, UON.
P	PAGING SPEAKER - CEILING MOUNTED.
	PAGING HORN - WALL MOUNTED AT 96" AFF, UON.
I	INTERCOM SPEAKER - WALL MOUNTED AT 96" AFF, UON.
I	INTERCOM SPEAKER - CEILING MOUNTED.
I	INTERCOM CALL BUTTON - MOUNTED AT 42", UON.
AE	ADMINISTRATION CONSOLE. PROVIDE ONE (1) CAT6 CABLE.
O	AV PROJECTOR - CEILING MOUNTED.
AE	AUDIO ENHANCEMENT DEVICE.

Access Control & Security

	ACCESS CONTROL - DOOR CONTACT. PROVIDE 3/4" CONDUIT FROM DOOR FRAME TO ACCESSIBLE CEILING OR SECURITY JUNCTION BOX AS SHOWN ON THE DRAWINGS.
	ACCESS CONTROL - CARD READER. PROVIDE 3/4" CONDUIT FROM DOOR FRAME TO ACCESSIBLE CEILING OR SECURITY JUNCTION BOX AS SHOWN ON THE DRAWINGS.
	ACCESS CONTROL - ELECTRIC STRIKE. PROVIDE 3/4" CONDUIT FROM DOOR FRAME TO ACCESSIBLE CEILING OR SECURITY JUNCTION BOX AS SHOWN ON THE DRAWINGS.
K	ACCESS CONTROL - KEY PAD. PROVIDE 3/4" CONDUIT FROM DOOR FRAME TO ACCESSIBLE CEILING OR SECURITY JUNCTION BOX AS SHOWN ON THE DRAWINGS.
	ACCESS CONTROL - MAGNETIC LOCK. PROVIDE 3/4" CONDUIT FROM DOOR FRAME TO ACCESSIBLE CEILING OR SECURITY JUNCTION BOX AS SHOWN ON THE DRAWINGS.
RX	ACCESS CONTROL - REQUEST TO EXIT. PROVIDE 3/4" CONDUIT FROM DOOR FRAME TO ACCESSIBLE CEILING OR SECURITY JUNCTION BOX AS SHOWN ON THE DRAWINGS.
PB	ACCESS CONTROL - ELECTRIFIED PANIC BAR. PROVIDE 3/4" CONDUIT FROM DOOR FRAME TO ACCESSIBLE CEILING OR SECURITY JUNCTION BOX AS SHOWN ON THE DRAWINGS.
S	ACCESS CONTROL - SECURITY JUNCTION BOX. SIZED AS RECOMMENDED BY SECURITY SYSTEM MANUFACTURER.
CI	ACCESS CONTROL - CAMERA / INTERCOM.
	ACCESS CONTROL - PANIC BUTTON.
	SECURITY CAMERA - CEILING MOUNTED. PROVIDE ONE (1) CAT6.
	SECURITY CAMERA - WALL MOUNTED. PROVIDE ONE (1) CAT6.
IS	INTRUSION SENSOR - CEILING MOUNTED.
IS	INTRUSION SENSOR - WALL MOUNTED.
K	INTRUSION KEYPAD.

Power Distribution

	DUPLEX RECEPTACLE, MOUNTED AT 18" AFF, UON.
	SIMPLEX RECEPTACLE, MOUNTED AT 18" AFF, UON.
	QUADPLEX RECEPTACLE, MOUNTED AT 18" AFF, UON.
	GFCI DUPLEX RECEPTACLE, MOUNTED AT 18" AFF, UON.
	GFCI QUADPLEX RECEPTACLE, MOUNTED AT 18" AFF, UON.
	TAMPERPROOF DUPLEX RECEPTACLE, MOUNTED AT 18" AFF, UON.
	TAMPERPROOF QUADPLEX RECEPTACLE, MOUNTED AT 18" AFF, UON.
	NEMA SPECIAL RECEPTACLE, MOUNTED AT 18" AFF, UON. NEMA CONFIGURATION AS INDICATED.
	SIDE HATCHED RECEPTACLE, TO BE WIRED TO SWITCHED CIRCUIT.
	CENTER HATCHED RECEPTACLE TO BE WIRED TO EMERGENCY CIRCUIT.
	RECEPTACLE MOUNTED ON CEILING.
	RECEPTACLE MOUNTED IN-COUNTER.
	DISCONNECT SWITCH.
	FUSED DISCONNECT SWITCH.
	ENCLOSED CIRCUIT BREAKER.
	COMBINATION STARTER.
	FLOORBOX COMBINATION POWER & DATA.
	FLOORBOX POWER.
	POKETHRU COMBINATION POWER & DATA.
	POKETHRU POWER.
	POWER POLE.
	PANELBOARD SURFACE MOUNT.
	PANELBOARD FLUSH MOUNT.
	MAIN DISTRIBUTION PANEL.
	UTILITY CT METER.
	UTILITY TRANSFORMER.

Area Rescue Assistance

ARA	COMMAND UNIT.
AR	SPEAKER STROBE.
ARS	AREA OF RESCUE STATION.

Raceways

	CONDUIT AND/OR CONDUCTORS INSTALLED ABOVE GRADE, CONCEALED IN WALL OR CEILING SPACE.
	CONDUIT AND/OR CONDUCTORS INSTALLED BELOW GRADE, BELOW SLAB.
	CONDUIT TURNED DOWN.
	CONDUIT TURNED UP.
	CONDUIT STUBBED AND CAPPED.
	CONDUIT DIRECT CONNECTION TO EQUIPMENT.
	FLEXIBLE CONNECTION TO EQUIPMENT.
	CONDUIT / WIRING CONTINUATION.
	HOMERUN TO PANELBOARD.
	CABLE TRAY. SIZE AND TYPE AS INDICATED ON DRAWINGS.

One-Line Diagram

	CIRCUIT BREAKER.
	DRAWOUT CIRCUIT BREAKER.
	ENCLOSED CIRCUIT BREAKER.
	MOTOR STARTER CONTACT.
	DISCONNECT SWITCH.
	ENCLOSED DISCONNECT SWITCH.
	FUSED DISCONNECT SWITCH.
	ENCLOSED FUSED DISCONNECT SWITCH.
	CURRENT TRANSFORMER METER.
	FUSE, RATING AS SHOWN ON DRAWINGS.
	GENERATOR, CONFIGURATION AS INDICATED ON DRAWING.
	GROUND ROD.
	EQUIPMENT GROUND.
	MOTOR, RATED AS INDICATED ON DRAWINGS.
	NEMA CONNECTION.
	PANEL.
	MINI POWER CENTER.
ST	SHUNT TRIP
HTR	HEATER.
RA	REMOTE ANNUNCIATOR.
BATT	BATTERY CHARGER.
	SURGE SUPPRESSION DEVICE
	DIGITAL METER
VFD	VARIABLE FREQUENCY DRIVE
SS	SOFT STARTER
	TRANSFER SWITCH, WITH FUSES OR BREAKERS AS SHOWN ON DRAWINGS.
	TRANSFORMER

Miscellaneous

J J	JUNCTION BOX (ROUND, SQUARE).
T	THERMOSTAT.
R	RELAY.
	CORD REEL.
	MOTOR / EXHAUST FAN.
	CEILING FAN.
	UTILITY POLE.
	WEATHERHEAD.
	GROUND ROD.
	GROUND ROD WITH TEST WELL.
	SURFACE RACEWAY / WIREMOLD.
	FIRE RATED BACKBOARD.
	GROUND BUS BAR.

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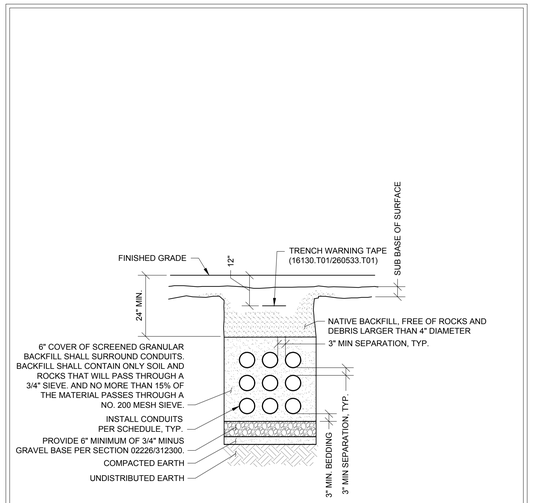
ELECTRICAL ABBREVIATIONS, SYMBOL LEGEND & GENERAL NOTES

Sheet No
E0.01



NOTES:

1.TYPICAL EXCEPT AS SPECIFIED.

2. MAINTAIN A MINIMUM OF 12" SEPARATION BETWEEN POWER CONDUITS AND CONTROL, TELECOMMUNICATION AND INSTRUMENTATION.

3. BACKFILL SHALL BE AS SPECIFIED IN SECTION 02226/312300.

NON-CONCRETE ENCASED DUCTBANK DETAIL

SCALE: NTS | DETAIL NO. 402

MECHANICAL EQUIPMENT CONNECTION SCHEDULE

EQUIPMENT	TAG	SHEET REF	ELECTRICAL								CONDUIT		CONDUCTORS			PANEL	CIRCUIT	LOCAL DISCONNECT	DISCONNECT RATING	NOTES
			VOLTAGE	PHASE	MCA	MOCP	HP	WATTS	FLA	FLA @ 125%	QTY	SIZE	UNGROUNDED	GROUNDED	GROUNDING					
CHILLER	CH-1	E1.01	480	3	229	250	-	-	-	-	1	2.5 INCH	3 - #4/0	1 - #4/0	1 - #4	4DP	-	No	-	-

NOTES:

POWER CONDUIT / CONDUCTOR SCHEDULE

CONDUIT ID NO.	CONDUIT		CONDUCTORS PER CONDUIT					FROM	TO	DESCRIPTION	NOTES
	QUANTITY	SIZE	UNGROUNDED	GROUNDED	GROUNDING	CABLE	SPARE				
P100	1	6.0 INCH	-	-	-	-	-	(E) PP&L POLE #318901	(N) UTILITY SECTIONALIZING VAULT	CONDUIT PER PACIFIC POWER ELECTRICAL REQUIREMENTS	-
P101	1	6.0 INCH	-	-	-	-	-	(N) UTILITY SECTIONALIZING VAULT	(N) UTILITY TRANSFORMER	CONDUIT PER PACIFIC POWER ELECTRICAL REQUIREMENTS	-
P102	1	6.0 INCH	-	-	-	-	-	(N) UTILITY SECTIONALIZING VAULT	(E) UTILITY TRANSFORMER #318980	CONDUIT PER PACIFIC POWER ELECTRICAL REQUIREMENTS	-
P103	2	4.0 INCH	-	-	-	-	-	(N) UTILITY TRANSFORMER	(N) UTILITY CT ENCLOSURE	CONDUIT PER PACIFIC POWER ELECTRICAL REQUIREMENTS	-
P104	1	1.25 INCH	-	-	-	-	-	(N) UTILITY CT ENCLOSURE	(N) UTILITY CT METER	CONDUIT PER PACIFIC POWER ELECTRICAL REQUIREMENTS	-
P105	2	2.5 INCH	3 - #3/0	1 - #3/0	-	-	-	(N) UTILITY CT ENCLOSURE	(N) DISTRIBUTION PANEL 4DP	-	1
P106	1	2.5 INCH	3 - #4/0	1 - #4/0	1 - #4	-	-	(N) DISTRIBUTION PANEL 4DP	(N) CHILLER	COORDINATE INSTALLATION WITH MECHANICAL CONTRACTOR AND MANUFACTURERS INSTRUCTIONS.	1
P107	1	0.75 INCH	2 - #8	1 - #8	1 - #10	-	-	(E) PANEL F SECTION 2	(N) SUB-PANEL F2		-
P108	1	3.0 INCH	-	-	-	-	-	(N) MEDIUM IN-GROUND BOX	(N) UTILITY CT METER	CONDUIT PER PACIFIC POWER ELECTRICAL REQUIREMENTS	-
P109	1	3.0 INCH	-	-	-	-	-	(N) UTILITY CT METER	(E) UTILITY IN-GROUND BOX	CONDUIT PER PACIFIC POWER ELECTRICAL REQUIREMENTS	-

NOTES:
[1] PROVIDE GRC TYPE CONDUIT.

GROUNDING SCHEDULE

CONDUIT ID NO.	CONDUIT		CONDUCTORS PER CONDUIT					FROM	TO	DESCRIPTION	NOTES
	QUANTITY	SIZE	UNGROUNDED	GROUNDED	GROUNDING	CABLE	SPARE				
G101	1	0.75 INCH	-	-	1 - #2	-	-	(N) DISTRIBUTION PANEL 4DP	GROUNDING ELECTRODE SYSTEM	-	-

NOTES:

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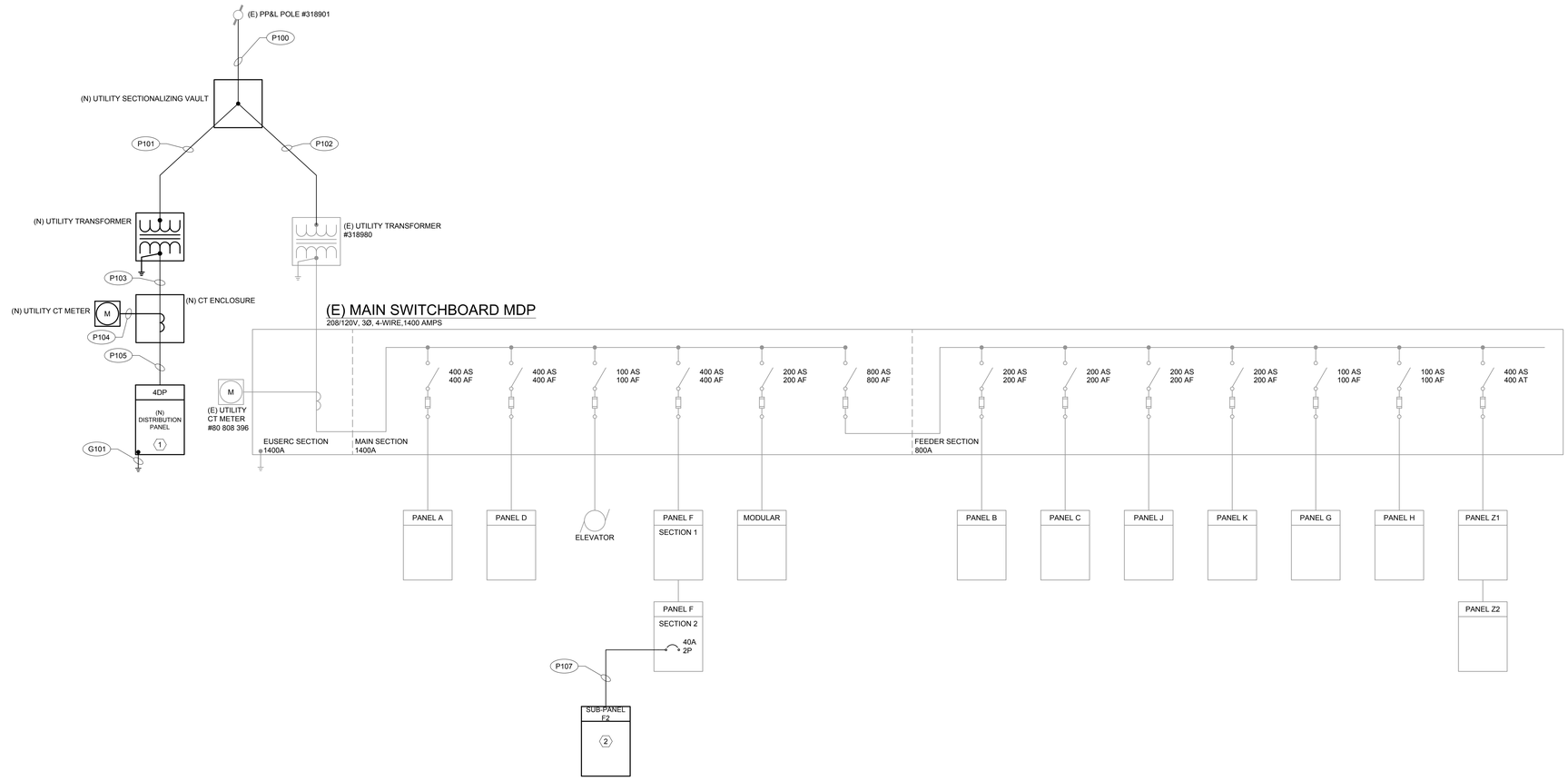
Drawing Title
ELECTRICAL DETAILS & SCHEDULES

Sheet No
E0.02

SHEET KEY NOTES

1. PANEL SHALL BE RATED 480/277V, 3-PHASE, 4-WIRE, 42,000 AIC RATING, SERVICE ENTRANCE RATED WITH 400-AMP MAIN BREAKER. PANEL SHALL HAVE 24 POLES. PROVIDE FEEDER BREAKER, RATED AS SHOWN ON THE MECHANICAL CONNECTION SCHEDULE. FOR THE CHILLER. PROVIDE 20/1 SPARE CIRCUIT BREAKERS FOR ALL UNUSED POLES. PROVIDE SURGE PROTECTION DEVICE.
2. PROVIDE LOAD CENTER TYPE PANEL (262416.P02). PANEL SHALL BE NEMA 1 CONSTRUCTION, 120/208 SINGLE-PHASE, 40-AMP BUSS, 22 KAIC WITH MAIN LUGS ONLY AND 12 CIRCUIT SPACES.



1 ONE-LINE DIAGRAM
SCALE: NTS

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SECTION 26 00 00 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section Includes
   1. General electrical requirements.

1.02 PERMITS, FEES AND SERVICE CHARGES

A. The CONTRACTOR shall obtain all electrical permits required to complete the work and pay all associated fees.

B. The CONTRACTOR shall coordinate and provide for the installation and operation of franchise utility service (including any telephone and/or leased lines specified) as required during construction, startup, testing, and operation of the work until substantial completion.

1.03 CONTRACTOR'S RESPONSIBILITY FOR FIELD VERIFICATION OF EXISTING CONDITIONS

A. The CONTRACTOR shall be responsible for performing field verification of the existing conditions prior to bidding. The nature of this work inherently requires field observation to understand the existing conditions and scope of work.

B. Failure to observe the existing conditions or ignorance of existing conditions shall the responsibility of the CONTRACTOR alone. Additional services shall not be authorized due to the CONTRACTOR'S lack of understanding of the existing conditions.

1.04 INTENT OF DRAWINGS AND SPECIFICATIONS

A. Riser and other diagrams are schematic and are intended to show the approximate location of equipment, and the general alignment of conduits and piping, and shall not be used for obtaining quantities. Dimensions given on the plans shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.

B. The electrical drawings do not show complete details of the site conditions. The CONTRACTOR shall check actual conditions.

C. The exact location of apparatus, fixtures, equipment, conduit and piping shall be ascertained by the CONTRACTOR in the field, and the work shall be laid out accordingly. Should the CONTRACTOR fail to ascertain such locations or coordinate with work performed by other trades, the work shall be changed at no additional cost to the OWNER when so ordered by the ENGINEER. The ENGINEER reserves the right to make minor changes in the location of conduit, piping and equipment up to the time of installation without additional cost to OWNER.

D. CONTRACTOR shall provide all labor, materials, equipment, machinery, and tools necessary to provide all electrical equipment specified and shown on the Drawings. All items not specified in detail or shown on the Drawings but necessary for complete installation shall be provided by the CONTRACTOR.

1.05 SUBMITTALS

A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
   1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
   2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260000.A01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
   3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Submittals shall be in accordance with the requirements of these Contract Documents and shall include the following:
   1. Submittals shall include information and literature as required for all equipment and materials provided under this and related sections.
   2. Shop Drawings: Shop drawings shall include the following along with any special requirements listed in the individual Specification Sections:
      a. Installation instructions and drawings
      b. Wiring schematics with termination point identification
      c. Motor information
      d. Materials of construction
      e. Manufacturer's name and model
      f. Manufacturer's catalog data
      g. Supplementary structural framing for electrical equipment including design loads, member size and location. When supplementary framing is indicated, verify that dimensions are suitable for the equipment furnished. Provide additional strength when equipment furnished is heavier than that specified.
   3. Manufacturers' Literature: Literature indicating the compliance of the products with the Specifications shall be included with all submittals. This shall include catalogs and other descriptive bulletins. Relevant portions of the literature shall be clearly identified by highlighting or underlining.
   4. Test Logs: The CONTRACTOR shall submit test logs as outlined below and as specified in subsequent electrical sections and drawings.
      a. A log of the complete results of tests for shorts and grounds for each circuit. All circuits and tests shall be clearly identified.
      b. A log of complete results of insulation resistance measurements of each circuit. All circuits and tests shall be clearly identified.
   5. Operation and maintenance information for all equipment furnished and/or installed.
   6. Programming instructions for any controllers or other programmable equipment. Copies of the any required software, including registration cards, shall be provided with the O&M manuals.

C. Deferred Submittals
   1. Submittals for seismic bracing/anchoring and wind loads shall be a deferred submittals. Engineering of the seismic bracing and anchoring system shall be provided by a licensed Engineer in the State of Oregon. Submittals shall include calculations and drawings, including connection types/materials/sizes, load, maximum load, dimensions, etc.

A. The CONTRACTOR shall indicate on the submittals all variances from the Specifications.

D. Record Drawings. After the completion of construction, the CONTRACTOR shall provide one set of "as-built" drawings to the ENGINEER as specified herein showing the location of buried conduits and all changes or deviations from the original drawings.

E. After the completion of construction, a printout and electronic copy of any programming and/or set-points for controllers, PLCs, meters or other programmable equipment, including VFDs.

F. Final inspection certificates shall be submitted prior to final payment.

1.06 SUBSTITUTION REQUESTS FOR MECHANICAL, HVAC, PROCESS, OR OTHER EQUIPMENT IMPACTING THE ELECTRICAL DESIGN:

A. The CONTRACTOR shall be responsible for including the cost impact to the electrical systems for substitution requests and/or value engineering for mechanical, HVAC, process, or other equipment made by other trades. The costs to the overall substitution request or value engineering solution must be included in the total number provided to the OWNER. The CONTRACTOR is responsible for coordinating the substitution requests or value engineering proposals made by other trades.

B. Any substitution request and/or value engineering solution which impacts the electrical design but does not include the costs shall be unacceptable.

C. Failure of other subcontractors to include the electrical cost impact shall not be the basis for a change order. The CONTRACTOR shall be responsible for coordinating the total costs of all substitution requests

and/or value engineering solutions prior to presenting them to the ENGINEER or OWNER. When these requests are received by the ENGINEER or OWNER to review and approve, the ENGINEER and OWNER shall assume the cost impact to electrical has been included.

1.07 COORDINATION OF WORK

A. The CONTRACTOR shall plan his work in coordination with the other trades and with the power and telephone utility authorities.

B. The CONTRACTOR shall field verify all dimensions of equipment to be installed or provided by others so that correct clearances and connections may be made between the work installed by the CONTRACTOR and equipment installed or provided by others.

C. The CONTRACTOR shall arrange all conduit runs so that they do not interfere with piping, structural members, etc.

D. All working measurements shall be taken from the sites, checked with those shown on the drawings, and if they conflict, reported to the ENGINEER at once, and before proceeding with the work. Should the CONTRACTOR fail to comply with this procedure, he shall alter his work at his own expense as directed by the ENGINEER.

E. No additional payments will be allowed where obstructions in the work of other trades, or work under this contract requires offsets to conduit runs.

F. The CONTRACTOR is responsible for all alterations in the work to accommodate equipment differing in dimensions or other characteristics from that shown or specified.

G. The CONTRACTOR shall provide all temporary power necessary for existing site equipment and for all construction needs.

1.08 EXISTING SYSTEMS

A. Existing systems within the project, whether or not they are shown on the Drawings, shall be protected and maintained during construction. The Contractor shall not damage, disrupt, or shutdown the existing systems without written approval from the OWNER.

B. Shutdowns shall be coordinated and scheduled with the OWNER.

1.09 SUPERVISION

A. The CONTRACTOR shall maintain adequate supervision of the work and shall have a responsible person in charge at the site during all times that work under this contract is in progress, or when necessary for coordination with other work.

1.10 CODES

A. Work shall conform to the National Electrical Code (NEC), and State Codes and other applicable codes, even though not specifically mentioned for each item. These shall be regarded as the minimum standard of quality for materials and workmanship.

1.11 CONTRACTOR'S RECORD DRAWINGS & AS-BUILTS

A. The CONTRACTOR shall maintain a neatly marked set of record drawings showing the locations of all buried conduits and other utilities encountered or installed during construction. The final locations of panels, field mounted instruments and panels, terminal boxes, junction boxes, receptacles, light switches and other materials included in the work shall be shown, as well as conduit routing between them to the extent it differs from the design drawings. Record drawings shall be kept current with the work as it progresses and shall be subject to inspection by the OWNER's Representative at any time. Failure to keep field record drawings current may result in the issuance of a stop work order or delay in the processing of pay requests until the record drawings are made current.

B. The CONTRACTOR shall provide one complete set of as-built electrical schematics for all panels and equipment provided, including PLC I/O schematics as applicable, panel elementary diagrams, interconnecting wiring diagrams, wire numbers, termination strip locations and numbers. These shall be in the same format and style as those in the Contract Documents and submittal requirements.

C. All information shown on the CONTRACTOR's field record drawings and as-built schematics shall be subject to verification by the OWNER's Representative. If significant errors or deviations are noted by the OWNER's Representative, new as-builts shall be completed at the CONTRACTOR's expense.

PART 2 PRODUCTS

2.01 PORTABLE OR DETACHABLE PARTS

A. The CONTRACTOR shall retain in his possession and shall be responsible for all portable and detachable parts or portions of installations such as fuses, key locks, adapters, blocking chips and inserts until completion of his work.

B. These parts shall be delivered to the ENGINEER and an itemized receipt obtained. This receipt, together with 2 copies of the final inspection certificate, shall be attached to the CONTRACTOR's request for final payment.

C. All equipment shall be demonstrated to operate in accordance with the requirements of this specification and the manufacturer's recommendations.

2.02 NEW PRODUCTS

A. All products shall be new without defects and covered by Manufacturer's warranty. Products shall be re-used only where indicated on the Drawings.

B. All products shall be listed, labeled, and certified by a testing agency approved by the state of Oregon.

C. All equipment of the same type and capacity shall be by the same manufacturer.

PART 3 EXECUTION

3.01 IDENTIFICATION

A. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.

3.02 WORKMANSHIP & COORDINATION

A. All work shall be performed by personnel skilled in the particular trade in a workmanlike manner. Workmanship shall conform to the standards of the NEC and the National Electrical Installation Standards (NEIS).

B. The ENGINEER shall be the sole judge as to whether or not the finished work is satisfactory; and if in his judgment any material or equipment has not been properly installed or finished, the CONTRACTOR shall replace the material or equipment whenever required, and reinstall it in a manner entirely satisfactory to the ENGINEER without any increase in cost to the OWNER.

C. The CONTRACTOR shall coordinate and verify the installation of all equipment furnished by him to other trades, or equipment provided and installed by other trades that is connected to the electrical or control systems. Work shall include the furnishing of all labor, materials, and equipment required for the installation of a complete and operable system as hereinafter specified and as indicated on the drawings. The Contract Documents are complementary and what is called for by any one shall be as binding as if called for by all. Unless otherwise specifically stipulated, the term "furnished and installed complete" shall be considered a part of this section.

D. Controls and systems shall be complete with transformers, switches, relays, contactors, control valves, control devices, instrument piping, fittings, valves, control wiring, thermometers, pressure gauges, thermostats, damper operators, miscellaneous control cabinets to fill the intent of the Specifications and shall provide control for the various units and systems. All control valves and motorized dampers shall be provided with position indicators.

E. Unless otherwise specified or shown on the drawings, switches or relays shall be installed in, or adjacent to the motor starter or other electrical device to which they are to be connected. Control and interlock wiring shall be included as necessary from breakers specified herein or shown on the drawings.

F. Each control schematic intended to control a series of motor operated louvers, fans, and thermostats shall contain a switch for maintenance to meet the NEC requirements regarding disconnect switches for motors. This switch shall be local if any unit controlled is out of sight of the switch. This switch shall disconnect all power to all motor operated devices within the circuit.

3.03 TEMPORARY HEATING, LIGHTING AND POWER

A. The CONTRACTOR shall provide all heat, lighting and power required to construct and protect the work until the work is placed in service by the OWNER for beneficial use of the OWNER. Temporary heaters shall be provided as required to keep the work area and all new electrical components dry.

B. The source for temporary power shall be from the electric utility or OWNER approved CONTRACTOR supplied auxiliary power units. The installation for electric power shall meet the requirements of local authorities and of OSHA.

C. The CONTRACTOR shall obtain all permits and pay all costs for connecting temporary power service at no expense to the OWNER.

3.04 SUPPORT BACKING

A. Provide any necessary backing required to properly support all fixtures and equipment installed under this contract.

3.05 CUTTING, PATCHING AND FRAMING

A. The CONTRACTOR shall determine in advance the locations and sizes of all sleeves, chases, and openings necessary for the proper installation of his work.

B. Whenever practical, inserts or sleeves shall be installed prior to covering work. Cutting and patching shall be held to a minimum. All required holes in concrete construction shall be made with a core drill and patched with non-metallic non-shrink grout.

C. Cutting, fitting repairing and finishing of carpentry work, metal work, or concrete work, and the like, which may be required for this work shall be done by craftsmen skilled in their respective trades. When cutting is required, it shall be done in such a manner as not to weaken walls, partitions, or floors; and holes required to be cut in floors must be drilled without breaking out around the holes.

3.06 ACCESS PANELS

A. The CONTRACTOR shall provide all access panels in hard ceilings to allow NEC-required access to junction boxes, pull boxes, and light fixtures. The CONTRACTOR shall submit to the ENGINEER for approval floor plans (1/8" = 1'-0" scale minimum) which clearly indicate proposed access panel locations.

3.07 TESTS

A. The CONTRACTOR shall furnish all labor, material, instruments and tools to make all connections for testing of the electrical and instrumentation installation. All equipment shall be demonstrated as operating properly prior to the acceptance of the work. All protective devices shall be operative during testing of equipment. The tests shall be made under the supervision of the ENGINEER. All deficiencies or unsatisfactory conditions as determined by the ENGINEER or inspecting authorities shall be corrected by the CONTRACTOR in a satisfactory manner at his own expense.

B. After visual inspection of joints and connections and the application of tape and other insulating materials, all sections of the entire wiring system shall be thoroughly tested for shorts and grounds. A log of results for each circuit shall be kept by the CONTRACTOR and presented to the ENGINEER.

C. A phase rotation check shall be made to demonstrate that all power receptacles, service feeders, main power feeders and auxiliary power generators have the same A - B - C phase rotation and ground relationships.

D. Equipment shall be tested by operating all electric motors, relays, controls, switches, heaters, etc., sufficiently to demonstrate proper installation and electrical connections. Control and emergency conditions shall be artificially simulated where necessary for complete system or subsystem.

3.08 CLEANING AND TOUCH-UP PAINT

A. Upon completion of work, all electrical equipment shall be cleaned.
   1. Vacuum all dirt, metal shavings, and foreign materials from all enclosures. The use of compressed air shall not be acceptable.
   2. All stains, dirt, and fingerprints shall be removed from switchboards, motor control centers, panelboards, light fixtures, enclosures, and all other electrical equipment covers.

B. Provide touch-up paint on equipment that has been scraped, scratched, or chipped during construction. Paint color shall match color of equipment.

END OF SECTION

SECTION 26 01 08 - ELECTRICAL TESTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Electrical and control testing forms and requirements.

1.02 REFERENCES

A. National Fire Protection Association (NFPA):
   1. 70, National Electrical Code (NEC).

1.03 SEQUENCING

A. ENGINEER shall issue written acceptance of the following certifications submitted by the CONTRACTOR before utility power is supplied to conductors, cables, or equipment.
   1. Megger Test
   2. Continuity Test
   3. Motor Insulation Test

B. CONTRACTOR shall verify to ENGINEER that every function of the electrical, measurement, and control systems are operating properly.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Site Tests, Inspection
   1. CONTRACTOR shall be responsible to become familiar with the test and certification requirements of the Contract Documents for this project. It is the intent of these requirements that the Work will be systematically checked to verify that the functions required or implied, work properly to insure safety for the personnel, environment, and equipment associated with the Work.
   2. CONTRACTOR shall complete the certification forms that are supplemental to this section and submit the forms to ENGINEER for approval.
   3. All site test and inspection certificates and schedules shall be contained in a 3-ring binder(s).
      a. Size 8½ inches by 11 inches.
      b. Paper: 20-pound minimum, white for typed pages.
      c. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
      d. Provide each manual with title page to include "Process Electrical Testing", typed table of contents with consecutive page numbers. Where more than one binder is used, consecutively title each with a volume number. The first binder shall be labeled Volume 1 and consecutively numbered as required to include all test documentation.
      e. Tab sections for each required section of testing and acceptance certification.
   4. CONTRACTOR shall notify ENGINEER seven days in advance of scheduled testing and facilitate the witnessing of those tests by ENGINEER.
   5. CONTRACTOR shall provide ENGINEER with current as-built documentation for electrical and measurement and control commissioning with submittal of test certification.
      a. Systems operating at or above 200-volts to ground or more shall be included in the Megger Test Certification. Minimum duration for each test shall be one minute, at 1000 VDC, and minimum acceptable results shall be 50 mega ohms.
      b. Conductors and cables shall be included in the Continuity Test Certification. No continuity to ground is the only acceptable result of the test.
      c. Conductors, cables, or equipment failing to meet the minimum requirements shall be replaced with new. Repair will not be acceptable.
      d. Each individual instrument shall have an Instrument Calibration Certificate. The calibration shall operate within the tolerances specified by the manufacturer of the instrument and the Contract Documents.

      e. Installed motors shall have a written Motor Insulation Certificate for all the motors listed in the Drawings for the Work. Motors failing test shall be tagged and locked out from operation.

3.02 SUPPLEMENTS

A. None.

END OF SECTION

SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes.
   1. The section includes the requirements for conductors and cables used to conduct potentials of 600 volts and less.
   2. All conductors and cables shall be installed in conduit or approved raceways regardless of which Division the conductors or cables are specified.

1.02 REFERENCES

A. The following is a list of Standards which may be referenced in the Section.
   1. American Society for Testing and Materials (ASTM).
      a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
   2. National Electrical Contractors Association, Inc. (NECA): National Electrical Installation Standards (NEIS).
   3. National Electrical Manufacturers Association (NEMA).
      a. WC 3, Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
      b. WC 5, Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
      c. WC 7, Cross Linked-Thermostetting Polyethylene Wire and Cable for the Transmission and Distribution of Electrical Energy.
      d. WC 55, Instrumentation Cables and Thermocouple Wire.
   4. National Fire Protection Association (NFPA). 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL).
      a. 13, Standard for Power-Limited Circuit Cables.
      b. 44. Standard for Safety Rubber-Insulated Wires and Cables.
      c. 62, Standard for Safety Flexible Cord and Fixture Wire.
      d. 510, Standard for Safety Insulating Tape.
      e. 854, Standard for Safety Service-Entrance Cables.
      f. 910, Standard for Safety Test Method for Fire and Smoke Characteristics of Electrical and Optical Fiber Cables Used in Air Handling Spaces.
      g. 1277, Standard for Safety Electrical Power and Control Tray Cables.
      h. 1581, Standard for Safety References for Electrical Wires, Cables and Flexible Cords.

1.03 SUBMITTALS

A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
   1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
   2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260519.C01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
   3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.
   1. Pursuant to Section 013300 Submittal Procedures.

   2. Manufacturer's data including materials of construction, weight, and related information for each item specified in PART 2 PRODUCTS.

PART 2 PRODUCTS

2.01 MATERIALS

A. Single Conductors Copper (260519.C01).
   1. Conductors shall be rated for 600 volts and conform to applicable requirements of NEMA.
   2. Conductors shall be stranded copper.
   3. Insulation type shall be THWN-2.
   4. Conductors shall be sized per the Drawings and the NEC, whichever is greater.
   5. Rome Cable Corporation, Southwire Company, Okonite Company, or approved equal.

2.02 ACCESSORIES

A. Colored Tape (260519.T01).
   1. Colored tape shall be used to identify individual conductors larger than # 6 AWG.
   2. 3M colored tape, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General.
   1. Reference Section 260533 Raceways and Boxes for Electrical Systems for
   2. All conductors shall be copper, unless noted specifically on the drawings or within these specifications. Provide aluminum conductors only where shown on the drawings.
   3. Conductor and cable installations shall meet or exceed the NECA National Electrical Installation Standards.
   4. CONTRACTOR shall not exceed the manufacturer's recommendations for maximum pulling tensions or minimum bending radii for respective conductors or cables.
   5. Pulling compound is recommended for all conductor or cable installations and shall be used on all installations requiring a mechanical pulling device.
   6. CONTRACTOR shall furnish and use a dynamometer on all conductor or cable installations requiring the use of a mechanical pulling device. The dynamometer shall be used to verify the maximum pulling tensions are not exceeded. Should the pulling tensions be exceeded, the conductor or cable shall be removed from the raceway and discarded. It shall not be reused under any circumstance on the project. The CONTRACTOR shall be responsible to make the alterations necessary before attempting to re-pull new conductors or cables.
   7. Immediately after pulling in conductors or cables, the pulling compound shall be completely removed from the conductors or cables, from boxes, enclosures, floors, walls, etc.
   8. Conductor and cable installations shall be continuous without splices or intermediate terminations unless specifically identified on the Drawings or prior written approval from the ENGINEER.
   9. Where conductors or cables are routed in boxes enclosures or cable tray they shall be neatly bundled with cable ties at intervals not to exceed 12 inches on center. The tension for the cable ties shall be set with a tool specifically manufactured for that purpose and of the same manufacturer as the cable tie. Side cutters, linemen pliers and similar tools shall not be used to cut the tail end of the cable tie. The CONTRACTOR shall only use the tool specifically manufactured for this purpose and of the same manufacturer as the cable tie.
   10. Conductors and cables shall not be installed until the raceway, boxes, enclosures, conduit bushings, etc. have all been installed. Where conductors or cables have been installed prior to meeting this requirement, the ENGINEER shall at their discretion elect to have the conductors or cables removed, disposed of and replaced with new product.
   11. Should the outer jacket of any conductor or cable be damaged in any way, they shall be removed, disposed of and replaced with new product.
   12. An equipment grounding conductor shall be installed in all raceways. Size shall be as identified on the Drawings or the NEC, whichever is greater, but in no case shall it be less than # 16 AWG for under 50 volts and no less than # 14 for 50 volts or above.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes.
   1. The section includes requirements for grounding electrodes, equipment grounding and electrical bonding.

1.02 SUBMITTALS

A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
   1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
   2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260526.G01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
   3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data
   1. Pursuant to Section 013300 Submittal Procedures.
   2. Manufacturer's data including materials of construction, methods of installation and related information for each item specified in PART 2 PRODUCTS.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ground Rods (260526.G01).
   1. Ground rods shall be provided as shown on the drawings.
   2. Ground rods shall be copper clad.
   3. Ground rods shall be a minimum of 5/8 inch diameter.
   4. Ground rods shall be a minimum of 10 feet long.

B. Compression Connectors (260526.C20).
   1. Compression connections shall be provided as shown on the drawings and as required for bonding end-use equipment.
   2. Compression connections shall be compress-deforming type, extruded copper material.
   3. Compression connections shall be tin electroplated for corrosion resistance.
   4. Compression connections shall be ring-type connectors. Forked connectors shall not be used on grounding conductors.
   5. Provide Burndy products, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General.
   1. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.
   2. Bond separately derived systems, including generators, to the grounding electrode system.
   3. Maintain equipment ground continuity throughout the facility by means of a grounding conductor routed in all raceways.
   4. Provide grounding conductors pursuant to Section 260519. Conductors shall be copper and shall be sized per the Drawings or the NEC, whichever is greater.

   5. Provide ground bushings for all conduits that do not terminate in a hub type fitting and install at the source of power with a bonding conductor fastened to the ground bushing.
   6. Provide ground bar kits as shown on the Drawings and where two (2) or more grounding conductors are terminated in a box or enclosure.
   7. Install ground rods at the locations and in the number shown on the Drawings or per the NEC, whichever is greater.
   8. Bond the grounding electrode system to all metallic water and wastewater piping.

B. Grounding Conductors.
   1. Brush grounding conductors clean of debris before connections are made.
   2. Strip insulated conductor insulation in a neat, workman like manner where insulated conductors are used.
   3. Fasten all conductors securely.

C. Connections.
   1. Install connectors according to the manufacturer's directions, using the proper dies, tools, molds, shots, loads, etc. designed specifically for this purpose.
   2. Provide irreversible welded type connections to ground rods, re-bar, lightning protection box, building steel etc.
   3. Provide compression connector type connections to end use equipment and bolt to the equipment using washers and split lock washers for secure fastening. Bolts shall be grade 5 for grounding connections and shall be tightened to the manufacturer's recommend torque.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. This section includes requirements pertaining to electrical equipment anchoring and electrical equipment hanging and support.

1.02 SUBMITTALS

A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
   1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
   2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260529.H01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
   3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.
   1. Pursuant to Section 013300 Submittal Procedures.
   2. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS.
   3. Seismic calculations and drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Hot Dipped Galvanized Hardware (260529.H11).
   1. Bolts shall be hot dipped galvanized steel and sized for the load served and have a hex head unless specifically specified otherwise elsewhere.
   2. Nuts shall be hot dipped galvanized steel hex nut.
   3. Washers shall be hot dipped galvanized steel, USS pattern flat washers.
   4. Split lock washers shall be hot dipped galvanized steel.
   5. Threaded rods and couplings shall be hot dipped galvanized steel.
   6. Eye-bolts, u-bolts, bent-bolts and similar connecting hardware shall be hot dipped galvanized steel.

B. Galvanized Hardware (260529.H12)
   1. Shall be similar to 260529.H11, except finish shall be regular galvanized in lieu of hot dipped galvanized.

C. Hot Dipped Galvanized Anchors (260529.A11).
   1. Wedge or stud anchors installed in concrete or masonry shall be hot dipped galvanized steel and sized for the load served.
   2. Toggle type fasteners shall only be used in hollow sheetrock wall. The wing part of the fastener may be mild steel, but the bolt shall be hot dipped galvanized steel.

D. Galvanized Anchors (260529.A12)
   1. Shall be similar to 260529.A11, except finish shall be regular galvanized in lieu of hot dipped galvanized.

E. Hot Dipped Galvanized Beam Clamps (260529.B11).
   1. Beam clamps shall be hot dipped galvanized steel and sized for the load served.

F. Galvanized Beam Clamps (260529.B12).
   1. Beam clamps shall be regular galvanized and sized for the load served.

G. Hot Dipped Galvanized Strut Channel (260529.S11).
   1. Strut channel shall be hot dipped galvanized after fabrication and shall be a minimum of 12 gauge.
   2. Strut channel shall have factory pre-drilled holes.

H. Galvanized Strut Channel (260529.S12).
   1. Shall be similar to 260529.S11, except finish shall be regular galvanized in lieu of hot dipped galvanized.

2.02 SEISMIC BRACING

A. Seismic Anchoring and Bracing Products (260529.S90).
   1. Provide seismic bracing for the vertical and lateral restraint of all conduits, conduit racks, raceways, cable trays, required by the International Building Code and Oregon Structural Specialty Code.

PART 3 EXECUTION

3.01 INSTALLATION

A. General.
   1. Hardware shall be set to a torque as recommended by the manufacturer.
   2. Washers and split lock washers shall be installed on all bolts, threaded rods and anchors.
   3. Lead or plastic type anchors are prohibited from use on the project.
   4. When threaded rods are installed in drop-in type anchors, a washer, split lock washer and a jamb nut shall be installed at the anchor to ensure stability.
   5. When channel (strut) is installed as a hanger or support from threaded rod, washers, split lock washers and jamb nuts shall be installed on both sides of the strut to lock it in place.
   6. Cut ends of channel, strut, threaded rods or other cut fittings shall be filed smooth before installation.
   7. Cut ends of hot dipped galvanized channel and strut shall be coated with three coats of cold galvanizing compound after the channel has been filed to prohibit rust.
   8. Concrete anchors shall be installed as per the manufacturer's directions and set using the manufacturer's supplied tool.
   9. Threaded rod shall not extend more than one (1) inch beyond the channel, strut or other material it is supporting.
   10. Hangers and supports shall be installed level and plumb.
   11. Hangers and supports shall be installed per the National Electrical Code, Building Code and Structural Code and shall be designed to safely support the load. The ENGINEER may request the CONTRACTOR provide a copy of their design calculations for the seismic requirements and the load served.

B. Indoor and Outdoor Installation
   1. Hot dipped galvanized products shall be used in all outdoor locations.
   2. Regular galvanized products shall be used in all indoor locations.

C. Seismic Anchoring and Bracing
   1. The design of the seismic anchoring and bracing system shall be by a licensed Structural Engineer in the State of Oregon. The CONTRACTOR shall arrange and pay for the services of the licensed Engineer.
   2. Wet stamped and signed calculations and drawing of the seismic anchoring and bracing system shall be submitted to the Architect and Engineer for review and approval.

END OF SECTION

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SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY
- A. Section Includes
  1. The Section includes the requirements pertaining to conduits and fittings used to contain electrical conductors and cables.
  2. All conductors and cables shall be installed in conduit or approved raceways regardless of which Division the conductors or cables are specified.

1.02 REFERENCES
- A. The following is a list of standards which may be referenced in this Section.
  1. American National Standards Institute (ANSI).
     a. C80.1, Rigid Steel Conduit-Zinc Coated.
  2. American Society for Testing Materials (ASTM).
     a. A123 E1, Standard Specification for Zinc-Coated (Galvanized) Coatings on Iron and Steel Products.
  3. National Electrical Contractors Association (NECA).
     a. National Electrical Installation Standards (NEIS).
  4. National Electrical Manufacturers Association (NEMA).
     a. TC 3, PVC Fittings for use with Rigid PVC Conduit and Tubing.
     b. TC 6, PVC and ABS plastic Utilities Duct for Underground Installation.
  5. Nation Fire Protection Association (NFPA).
     a. 70, National Electrical Code (NEC).
  6. Underwriters Laboratories, Inc. (UL).
     a. 6, Standard for Safety Rigid Metal Conduit.
     b. 514B, Standards for Safety Fittings for Conduit and Outlet Boxes.
     c. 651, Standard for Safety Schedule 40 and 80 PVC Conduit.
     d. 651A, Standard for Safety Type EB and Rigid PVC Conduit and HDPE Conduit.
     e. 1660, Standard for Safety Liquid-Tight Flexible Nonmetallic Conduit.
     f. 360, Standard for Safety Liquid-Tight Flexible Metallic Conduit.
     g. 797, Standard for Safety Electrical Metallic Conduit.

1.03 SUBMITTALS
- A. Product data
  1. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
  2. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
  3. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260501.S01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  4. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
  5. Pursuant to Section 01 33 00 Submittal Procedures.
  6. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS.

PART 2 PRODUCTS

2.01 MATERIALS
- A. **EMT Conduit (260533.C50).**
  1. EMT conduit may be used in all indoor and outdoor locations. In damp and outdoor locations the fittings shall be watertight compression fittings. Set screw fittings shall be acceptable in indoor locations.
  2. Conduit connectors shall have insulated throats, plastic bushings or ground bushing installed.
- B. **Rigid Non-metallic Conduit (PVC) (260533.C30).**
  1. Shall be schedule 40 PVC unless specifically called out otherwise on the Drawings.
  2. Shall be sunlight resistant.
  3. Shall be manufactured in accordance with UL-651 Standard.
  4. Conduit and fittings shall be securely glued.
  5. Provide conduit bell ends at vaults unless specifically called out otherwise on the Drawings.
  6. Provide PW Pipe, Carlon, or approved equal.
- C. **Galvanized Rigid Steel Conduit (GRC) (260533.C70).**
  1. Shall be mild steel, hot dipped galvanized inside and out.
  2. Shall be manufactured in accordance with ANSI C80.1 – Rigid Steel Conduit, Zinc Coated, and UL-6.
  3. Conduit fittings shall be hot dipped galvanized malleable iron.
  4. Condulets shall be form 7 type.
  5. The use of three-piece couplings shall be incorporated only when unavoidable and not simply due to poor planning and layout.
  6. The use of compression, setscrew and split conduit fittings is unacceptable.
  7. Gaskets shall be installed on all condulet covers regardless of the environment they are installed in.
  8. Conduit straps shall be hot dipped galvanized malleable iron and incorporate matching conduit spacers when attached directly to walls, ceilings and floors.
  9. LTV steel, Triangle PWC, or approved equal.
- D. **Galvanized Sheet Metal Boxes (260533.B15).**
  1. Shall comply with NEMA specifications for sheet metal boxes.
  2. All boxes shall be deep, no shallow boxes shall be permitted.
  3. Provide mud rings or industrial covers for the devices installed and a depth to match the sheetrock where applicable.
- E. **Medium In-Ground Pedestrian HDPE Box (260533.M01)**
  1. Shall be HDPE in ground box with flush HDPE cover.
  2. Dimensions shall be 13" x 24" x 12" deep.
  3. Lid shall be ASTM Pedestrian rated.
  4. Bolts shall be provided with penta-head bolts for cover.
  5. Cover shall have verbiage molded into the top identifying the type of service served such as electric, fiber optic, communications, etc.
  6. Shall be Old Castle Carson 1324, or approved equal.

2.02 ACCESSORIES
- A. **10 mil PVC Corrosion Protection Tape (260533.T50).**
  1. Provide 10 mil PVC corrosion tape. Provide 3M Scotchrap all Weather corrosion protection tape 50, or approved equal.
- B. **Glue (260533.G01).**
  1. Glue shall be the wet/dry rated cement commonly referred to as "Blue Glue".

2.03 FIRESTOPPING
- A. Firestopping products shall be provided in all fire and smoke rated partition penetrations per Specification Section 078400 Firestopping.

PART 3 EXECUTION

3.01 INSTALLATION
- A. General Requirements
  1. Install conduit runs in accordance with the schematic representation shown on the Drawings.
  2. Minimum conduit size shall be .75 inch unless specifically called out otherwise on the drawings.
  3. Where raceways are indicated, but the routing is not identified, the routing shall be the CONTRACTOR'S choice and in accordance with the rest of the Contract Documents and the National Electrical Code (NEC).
  4. All conduit connections electrical panelboards and switchboards shall be made using GRC only.
  5. Raceways shall be electrically and mechanically complete before the conductors are installed.
  6. Routing of conduits may be adjusted to avoid obstructions. Coordinate with other trades prior to installation of raceways. Lack of such coordination shall not be justification for extra compensation and removal and reinstallation to resolve conflicts shall be at the CONTRACTOR's expense.
  7. Conduits shall be reamed.
  8. Exposed conduits and surface raceways shall be installed parallel or perpendicular to the structural members and surfaces and shall be level and or plumb.
  9. When two or more conduits are routed in the same general direction their routing shall be parallel with symmetrical bends.
  10. Conduits shall be bent with equipment specifically designed for this purpose and for the specific size and type of conduit.
  11. Conduits that are creased or crushed shall be replaced.
  12. Install conduits such that they do not interfere with the proper and safe operation of equipment and do not block or otherwise interfere with the ingress and egress and installation of removable hatches and covers.
  13. Install expansion joints as needed across expansion joints in the structure and at other locations where necessary to compensate for thermal or mechanical expansion or contraction.
  14. Conduits shall be routed at least six (6) inches from high temperature piping, ducts and flues.
  15. Final connections to dry type transformers, motors, instruments and other equipment requiring a flexible connection shall be made with LFMC conduit. Lengths shall not exceed three (3) feet.
  16. All conduits shall be capped throughout construction to prevent entrance of dirt, trash, water, etc.
  17. Metallic threads shall all be coated with conduit thread lubricant before assembly. Failure to install the lubricant will result in removal of all conduit and reassembly with the conduit lubricant.
- B. Electrical Metallic Raceway (EMT) Installation
  1. Electrical Metallic raceways (EMT) shall be used throughout this project as follows:
     a. Indoor installations only.
- C. Underground Conduit Installation.
  1. Underground conduits shall be PVC except as specifically noted differently elsewhere.
  2. GRC type conduit shall be installed between finished grade up to 72" AFG for all exterior exposed applications.
  3. Conduits routed under a concrete slab shall be routed under the vapor barrier. The conduits shall be routed deep enough so the radius of the conduit stubbed up through the slab is completely below grade. The vapor barrier shall be sealed at every point a conduit penetrates the barrier as per the requirements specified for the vapor barrier.
  4. Underground conduits shall be routed as shown on the Drawings.
  5. Power conduits shall be separated from all other conduits by a minimum of 12 inches and when required to cross other conduits it shall be done at a 90 degree angles.
  6. Conduits routed in structural concrete shall be routed in such a manner as to not interfere with the structural integrity of the concrete. The ENGINEER shall approve CONTRACTOR's proposed conduit routing before installation. It is the CONTRACTOR's responsibility to coordinate conduit routing with the ENGINEER well before it is scheduled to be installed. Conduits shall be stubbed up directly under the enclosure or device their will serve. The CONTRACTOR is responsible to coordinate with the other trades prior to installation of raceways. Lack of coordination shall not be justification for extra

compensation and removal and re-installation of conduits to resolve conflicts shall be done at the CONTRACTOR's expense.
  7. Rigid metallic conduit installed in or extended through concrete shall be wrapped with 10 mil PVC corrosion protection tape with a minimum 50 % overlap. The conduit shall be wrapped beginning a minimum of six inches before entering concrete and be wrapped continuously to a point six inches beyond exiting the concrete.
  8. Underground conduit shall have a minimum of 24 inches of cover unless specifically called out differently on the Drawings.
  9. Identification tape shall be centered and laid neatly above all underground conduits that extend beyond the envelope of a building or structure. The tape shall be 12 inches below finished grade.
- D. Boxes
  1. Install boxes and enclosures in accordance with the schematic representation as indicated on the Drawings.
  2. Boxes and enclosures shall be mounted level and plumb.
  3. Boxes and enclosures shall not be altered, holes drilled, etc. in any way that may compromise the NEMA rating of the enclosure or box.
  4. Boxes and enclosures shall be bonded the equipment grounding conductor.
  5. Provide a divider whenever a box contains conductors of different potentials that the code requires separation.
  6. Surface mounted enclosures and boxes shall be spaced off the surface at least 1/4 inch in damp or wet locations.
  7. Enclosures shall be provided whenever a junction or pull box larger than 4 inches square is required.
  8. Sheet metal boxes are permitted only in locations where EMT conduit is approved.
  9. Enclosures shall be labeled with a nameplate as specified in Section 26 05 53 – Identification for Electrical Systems. The nameplate shall match the callout on the Drawings. If no callout exists, the CONTRACTOR is responsible to meet with the ENGINEER and develop a list of pull box, junction box and termination box nomenclature and their as-built Drawings shall reflect these callouts.
- E. In-Ground Box Installation
  1. Provide a crushed gravel base (3/4 minus) for all in-ground boxes. Depth shall be six inches minimum.
- F. Miscellaneous
  1. Provide cord grip for any unsupported cord.

END OF SECTION

SECTION 26 05 48 - SEISMIC RESTRAINTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY
- A. Section Includes:
  1. This section includes requirements pertaining to seismic restraints for electrical equipment.

1.02 REFERENCED STANDARDS
- A. The following is a list of standards which may be referenced in this Section:
  1. American Society of Civil Engineers (ASCE)
     a. ASCE 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures

1.03 SUBMITTALS
- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
  1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
  2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260529.H01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data.
  1. Pursuant to Section 013000 Submittal Procedures.
  2. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS.
  3. Seismic calculations and drawings.

1.04 REQUIREMENTS
- A. This project shall comply with the current edition of the Oregon Structural Specialty Code, Oregon Electrical Specialty Code, and ASCE 7-16.
- B. The seismic restraints for the project shall be designed to the following standards:
  1. Seismic Design Category D.
  2. All electrical systems shall have an Importance Factor of 1.25.
- C. The following electrical systems shall be provided with engineered seismic restraints:
  1. Suspended and supported conduit systems.
  2. Electrical equipment stands for panelboards and CT enclosures.
  3. Transformers, wall mounted.
  4. Transformers, floor mounted.
  5. All electrical enclosures weighing more than 20 lbs. This shall include, but not be limited to, panelboards, control panels, general enclosures, and luminaires.
  6. All other Electrical Systems required by ASCE 7-16 and the Oregon Structural Specialty Code.
- D. The CONTRACTOR shall pay for and obtain the services of a licensed Structural ENGINEER in the State of Oregon. The ENGINEER shall provide the following:
  1. Restraint, bracing, and anchorage calculations and details. These details shall be project specific. Typical bracing details for commonly used restraint systems shall be acceptable.
     a. The details and calculations shall be suitable for a deferred submittal to the AHJ for the purposes of obtaining an electrical permit.

     b. Number, size, capacity, and location of seismic restraints.
     c. Backing material to be used in stud wall applications.
     d. The details and calculations shall be suitable for installation by the CONTRACTOR.
  2. The Structural ENGINEER shall provide shop drawings for review and approval by the ENGINEER and ARCHITECT. The shop drawings shall include:
     a. Project-specific restraint details.
     b. Project-specific calculations
     c. Wet stamped/signed documents.
  3. The Structural ENGINEER shall perform an on-site inspection of the seismic restraint installation performed by the CONTRACTOR. The Structural ENGINEER shall provide a written report of the inspection, including identifying any deficiencies. The report shall be submitted to the ENGINEER for review and approval. The inspection shall be performed by the ENGINEER prior to the bracing being covered. The CONTRACTOR shall bear the responsibility of scheduling this inspection.
     a. The CONTRACTOR shall be responsible for installing all seismic restraints per the Structural ENGINEER's requirements. Make all corrections required by the Structural ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS
- A. **Seismic Restraints (260545.R01).**
  1. Restraints shall be provided as directed by the Structural ENGINEER.
  2. Material type shall confirm with the requirements of 26 05 29 Hangers & Supports for Electrical Systems.
  3. Bracing shall be permitted to utilize cable-style bracing systems, where permitted by Code and the Structural ENGINEER.

PART 3 EXECUTION

3.01 INSTALLATION
- A. General.
  1. Install all restraints as directed by the Structural ENGINEER and as required by Code.

END OF SECTION

SECTION 26 05 53 - ELECTRICAL AND CONTROL IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY
- A. Section Includes
  1. Requirements for identification of electrical, safety, measurement, data, fire alarm, security, monitoring, control and related components and equipment.

1.02 SUBMITTALS
- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
  1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
  2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260553.S21) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data
  1. Pursuant to Section 013300 – Submittal Procedures.
  2. The initial submittal shall contain all the products, samples and data base specified. An initial submittal that does not contain all the specified data shall be returned as incomplete.
- C. Samples
  1. Provide a sample of each type and size of nameplate, label, tag and means of attachment specified for approval by the OWNER.
- D. Quality Assurance / Quality Control Submittals
  1. The CONTRACTOR shall be responsible for submitting a data base of all identification nameplates, labels, panel schedules and tags required for the Work. The data base shall be developed in the most current edition of Microsoft Excel for the OWNER's future use.
- E. Closeout Submittals
  1. Pursuant to Section 017800 – Closeout Submittals.

PART 2 PRODUCTS

2.01 MATERIALS
- A. **Circuit Breaker Panel Schedules (260553.S21).**
  1. Shall be created in Microsoft Excel software. One copy of each schedule shall be included in the closeout submittals.
  2. Shall be printed on 60 - 70 lb white card stock.
- B. **Heat Sealing Lamination Products (260553.L11).**
  1. Provide documents in laminate when specified. Laminate shall be clear, non- yellowing and sized for various sized documents.
  2. Shall be 5 mil in thickness.
- C. **Plastic Nameplates (260553.P05).**
  1. Shall have a black background with white engraved letters. Nameplates for emergency functions shall be red background with white engraved letters. The nameplates shall have self adhesive rated for the environment which they are installed. The font type shall be consistent on all nameplates.
  2. Provide products supplied by E.R. Perry Signs & Engraving, or approved equal.

- D. **Epoxy Gel (260553.E05).**
  1. Shall be a two component, 100 % solids, moisture tolerant, high modulus, high strength, structural epoxy paste adhesive.
  2. Provide Sika type Sikadur 31, Hi-Mod Gel, or approved equal.
- E. **Conduit Trench Marker Tape (260553.T21).**
  1. Shall be a minimum of six (6) inches wide, polyethylene tape manufactured for this purpose.
  2. Color code for tape shall be as listed below and the verbiage on the tape shall identify the type of system i.e. "Caution Buried Electric Line Below".
     a. Electric Power – RED
     b. Fiber Optic – ORANGE
     c. Data/Phone – ORANGE
     d. Control – ORANGE
  3. Provide products manufactured by Seaton Identification Products, Harris Industries, or approved equal.
- F. **Conductor and Cable Identification Sleeves (260553.T31).**
  1. The identification sleeves shall be properly sized for the cable or conductor.
  2. Shall be adhesive style.
  3. Sleeves shall be white with black machine generated characters.
  4. Provide Brady wire and cable sleeves, or approved equal.
- G. **Conductor Color Coding (260553.C89).**
  1. Conductors shall be colored as specified in the table below. The technical specification requirements for the conductors are specified elsewhere.

Conductor Color Coding

System	Conductor	Color
All Systems	Equipment Grounding	Green
IT / Data	Data Cable Sheath (outer cover)	Blue
24 Volt DC	Positive	Blue
	Negative	White w/Blue Stripe
	Discrete Input Line (hot leg) Side	Blue
	Discrete Input Switch Leg	Blue w/White Stripe
	Discrete Output Line (hot leg) Side	Blue
	Discrete Output Switch Leg	Blue w/Orange Stripe
24 Volt AC	Hot Leg	Red
	Neutral	White
	Discrete Input Line (hot leg) Side	Red
	Discrete Input Switch Leg	Red w/Blue Stripe
120 Volt AC Control	Hot Leg	Red
	Neutral	White
	Discrete Input Line (hot leg) Side	Red
	Discrete Input Switch Leg	Red w/White Stripe
	Discrete Output Line (hot leg) Side	Red
	Discrete Output Switch Leg	Red w/Orange Stripe
120/240 Volt Single Phase	Hot Leg # 1	Black
	Hot Leg # 2	Red
	Neutral	White
120/208 Volt Three Phase	Phase A	Black
	Phase B	Red
	Phase C	Blue
	Neutral	White

System	Conductor	Color
120, 208, 277 Volt	Switch Legs	Pink
480 Volt Three Phase	Phase A	Brown
Wye or Delta Corner Tap	Phase B	Orange
	Phase C	Yellow
	Neutral	Gray
120/240 Delta Three Phase	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow
	Neutral	Gray

PART 3 EXECUTION

3.01 INSTALLATION
- A. Circuit Breaker Panel Schedules
  1. CONTRACTOR shall request panel schedules in Microsoft Excel software and printing instructions from ENGINEER. CONTRACTOR shall update the panel schedules to reflect as-built conditions. Print schedules on 60 - 70 lb white card stock with black ink.
  2. Schedules shall be neatly trimmed with 1/8" white space borders.
  3. The finished schedules shall be laminated and neatly trimmed with 1/8" of laminate border.
  4. A sample layout shall be submitted to OWNER for approval prior to installation.
- B. Plastic Nameplates
  1. Provide plastic nameplates for panelboards, motor control centers, motor starters, disconnects, variable frequency drives, control panels and similar equipment. The verbiage on the nameplate shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available on the Contract Drawings.
  2. In addition to the nameplate identifying the equipment, a second nameplate shall be provided that identifies the source of power for the equipment i.e. "Fed From PNL208-1".
  3. Typically the nameplates shall be centered and installed near the top of the equipment.
  4. Nameplates shall be black with white characters unless specified otherwise.
  5. Nameplates on emergency panels shall be red with white characters.
- C. Conduit Trench Marker Tape
  1. Provide conduit trench marker tape for single or multiple buried conduits. The color and verbiage shall match the type of system installed. If the trench contains several systems, one of which is electric power, the tape shall be for electric power.
  2. The tape shall be installed 12 inches below finished grade and shall be laid flat and parallel to the conduits.
  3. Provide # 14 AWG, red, THWN-2 tracer wire fastened to one of the conduits. Tracer wire shall be fastened to the conduit with nylon cable ties at five (5) foot spacing or less. The tracer wire shall be brought up with the conduit to points where it terminates or enters in-ground boxes and vaults. The tracer wire shall be fastened above ground with stainless steel cable ties. Label the wire "tracer wire" and seal the end so water cannot penetrate with a heat shrink tubing type cap.
- D. Conductor and Cable Identification Sleeves
  1. Provide adhesive, machine generated, white labels with black characters for all cables and conductors. Explanation is provided below on how various systems shall be identified. In many cases the information necessary to develop the unique identification labels will be provided on the Contract Drawings. The verbiage required for the identification shall be as identified on the Contract Drawings. The CONTRACTOR shall request the required verbiage from the ENGINEER should it not be available or clear based on the information provided on the Contract Drawings.
  2. The labels shall be installed between 6 to 8 inches from the end. Conductors shall be labeled at all splices and points of termination.
  3. Power conductors and cables, including the neutral and the ground conductors shall all be identified individually. The identification label will be developed as follows: The first set of characters will be the

equipment code identifying the source of power "PNL208" followed by the circuit number "CKT 12". For example, the label would read "PNL208-CKT 12".

END OF SECTION

SECTION 26 05 73 - OVERCURRENT PROTECTIVE DEVICE STUDY

PART 1 GENERAL

1.01 SUMMARY
- A. Section Includes:
  1. The section includes the requirements for a Short-Circuit Study, Protective Device Coordination Study, Arc Flash Study, and Arc Flash Warning Labels.

1.02 REFERENCES
- A. Referenced Standards:
  1. American National Standards Institute (ANSI).
  2. Institute of Electrical and Electronics Engineers (IEEE):
     a. 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
     b. 399, Recommended Practice for Industrial and Commercial Power System Analysis.
     c. 1584, Guide for Performing Arc Flash Hazard Calculations.
  3. National Electrical Manufacturers Association (NEMA): Z535.4, Product Safety Signs and Labels.
  4. National Fire Protection Association (NFPA):
     a. 70, National Electrical Code (NEC).
     b. 70E, Standard for Electrical Safety in the Workplace.
     c. 99, Health Care Facilities Code
  5. Occupational Safety and Health Standards (OSHA): 29 CFR, Part 1910, Subpart S, Electrical.
  6. Oregon Electrical Specialty Code.

1.03 SUBMITTALS
- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
  1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
  2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260573.S21) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data:
  1. Pursuant to 013300 Submittal Procedures.
  2. Arc Flash Warning Label templates.

1.04 QUALITY ASSURANCE
- A. Short circuit, protective device coordination, and arc flash studies shall be provided by a corporately and financially independent, unbiased, testing authority. The testing authority shall be independent of manufacturers, suppliers, and installers of equipment being tested. The testing authority shall have a minimum of five (5) years experience testing similar projects.

1.05 SEQUENCING AND SCHEDULING
- A. Initial complete protective device coordination and arc flash studies shall be submitted at the same time as the submittal for all of the electrical distribution equipment. Approval of the study and the electrical distribution equipment shall be co-dependent, and will only be reviewed and approved simultaneously.
- B. Revised short circuit, protective device studies, arc flash studies, and arc flash labels shall be submitted 10 days before energizing electrical equipment.

- C. Final short circuit, protective device studies, and arc flash studies shall be completed prior to project completion. Final version of study shall include as-built equipment, materials, and parameter data or settings entered into equipment based on study.
- D. Submit final arc flash labels described herein and in compliance with NFPA 70E and NEMA Z535.4 prior to project completion.

1.06 GENERAL STUDY REQUIREMENTS
- A. The Study shall be provided for the following:
  1. New electrical service.
- B. The Study shall be signed and stamped by a licensed Professional Electrical Engineer in the State of Oregon.
- C. Equipment and component titles used in the studies shall be identical to equipment and component titles shown on the Drawings.
- D. Perform studies using one of the following electrical engineering software packages:
  1. SKM Power Tools for Windows
  2. ETAP
  3. EDSA
  4. Easy Power
- E. Perform complete fault calculations for all new and future loads indicated on the Drawings.
- F. Provide individual protective device time-current characteristics for the low voltage distribution system.
- G. Time current curves for all three branches of the Essential Electrical System (Life Safety, Critical, and Equipment) in both Normal and Emergency mode shall be provided.
- H. The ENGINEER shall review the settings of all electronic trip circuit breakers and arc flash hazard levels. The settings shall not be set nor the labels installed prior to approval by the ENGINEER.

PART 2 STUDIES AND PRODUCTS

2.01 SHORT CIRCUIT STUDY
- A. General
  1. Prepare a Short Circuit Study in accordance with IEEE 39.
  2. Cable impedances shall be based on copper conductors.
  3. Bus impedances shall be based on copper buses.
  4. Cable and bus resistances shall be calculated at 25 degrees Celsius.
  5. Medium voltage cable reactance shall be based on typical dimensions for standard cables with 133% insulation levels.
  6. 600-volt cable reactance shall be based on the typical dimensions of THWN-2 conductors.
  7. Transformer impedances shall be 92.5% of nominal impedance based on tolerances specified in IEEE C57.12.00.
- B. The Short Circuit Study final report shall include the following:
  1. Basic description, purpose, and scope of the study.
  2. Descriptions of the scenarios evaluated and identification of the scenario used to evaluate short circuit ratings.
  3. Explanation of bus and branch numbering system.
  4. Prevailing conditions.
  5. Selected base per unit quantities.
  6. Source impedance data, including electric utility system, generator, and motor fault contribution characteristics.
  7. Impedance diagrams.
  8. Zero-sequence impedance diagrams.
  9. One line diagrams and associated tabulations of data used to model the system components.
  10. Calculation methods and assumptions.
  11. Typical calculations.

  12. Tabulation of calculation quantities.
  13. Results, conclusions, and recommendations.
- C. The short circuit interrupting and momentary (when applicable) duties for an assumed three-phase bolted fault shall be calculated at each:
  1. Utility Service point.
  2. Medium Voltage Switchgear.
  3. Low Voltage Switchgear.
  4. Switchboard.
  5. Motor Control Center.
  6. Automatic Transfer Switch.
  7. Distribution Panel.
  8. Branch Circuit Panelboard.
  9. Future load contributions as shown on the One-Line Diagram.
  10. Any additional point within the power distribution system as specified by the Engineer.
- D. The Short Circuit Study shall be used to verify the following:
  1. Equipment and protective devices are applied within their ratings.
  2. Adequacy of distribution equipment bus bars to withstand short circuit stresses.
  3. Cable and bus way sizes for ability to withstand short circuit heating, in addition to normal current loads.
- E. Provide a tabulation of equipment short circuit versus available fault duties. The tabulation shall identify percentage of rated short circuit current and clearly identify equipment with insufficient ratings.
  1. General Data
     a. Short circuit reactance of rotating machines.
     b. Cable and conduit material data.
     c. Bus data.
     d. Transformer data.
     e. Circuit resistance and reactance values.
  2. Short Circuit Data
     a. Fault impedances.
     b. X/R ratios.
     c. Asymmetry factors.
     d. Motor contributions.
     e. Short circuit kVA.
     f. Symmetrical and asymmetrical fault currents.
  3. Equipment Evaluation
     a. Equipment bus bracing, equipment short circuit rating, transformer, cable, busway.
     b. Maximum fault current available.
- F. Provide a written summary at the end of the Short Circuit Study, which shall include the following:
- G. Selected equipment deficiencies.
- H. Results of short circuit study.
- I. Conclusions and recommendations.
- J. The Contractor shall be notified in writing of existing circuit protective devices improperly rated for new fault conditions.
- K. The Short Circuit Study data shall be revised for as-built conditions.

2.02 ARC FLASH STUDY
- A. Perform an Arc Flash Hazard Study after short circuit and protective device setting recommendations have been completed, reviewed, and accepted by the Engineer. Perform the analysis under worst-case arc flash conditions for all modes of operation. Provide an analysis of all operating scenarios which will be or have been influenced by the proposed or completed additions to the subject system.

- B. The Arc Flash Hazard Study shall be performed in accordance with NFPA 70E, OSHA 29 CFR, Part 1910 Subpart S, and IEEE 1584.
- C. The Arc Flash Hazard Study shall include the following:
  1. Basic description, purpose, and scope of the study.
  2. One Line Diagram.
  3. Short Circuit Study.
  4. Protective Device Settings Study.
  5. Calculation methods and assumptions.
  6. Typical calculation.
  7. Evaluation summary spreadsheet.
  8. Conclusions and recommendations.
- D. Base Calculation: For each major part of the power distribution system, the following shall be determined:
  1. Flash hazard protection boundary.
  2. Limited approach boundary.
  3. Restricted approach boundary.
  4. Prohibited approach boundary.
  5. Incident energy level.
  6. Personal protection equipment (PPE) hazard/risk category.
  7. Type of PPE required.
- E. Produce arc flash warning labels that list items in Part C above and provide the following additional items:
  1. Bus name.
  2. Bus voltage.
- F. Produce detail sheets that list items in Part C above and the following items:
  1. Bus name.
  2. Upstream protective device name, type, and settings.
  3. Bus-to-line voltage.
- G. Produce arc flash evaluation summary sheet listing the following additional items:
  1. Bus name.
  2. Upstream protective device name, type, and settings.
  3. Bus-to-line voltage.
  4. Protective device bolted fault current.
  5. Arcing fault current.
  6. Protective device trip/delay setting.
  7. Breaker opening time.
  8. Solidly grounded column.
  9. Equipment type.
  10. Gap.
  11. Arc flash boundary.
  12. Working distance.
  13. Incident energy.
  14. Required protective fire rated clothing type and class.
- H. Analyze short circuit, protective device coordination, and arc flash calculations and highlight equipment that is determined to be underrated or causes incident energy values greater than 40 cal/cm2. Provide proposals to reduce energy levels.
- I. Provide a written summary at the end of the Arc Flash Hazard Study, which shall include the following.
  1. Equipment manufacturer's information used to prepare study.
  2. Assumptions made during study.
  3. Copy of one line diagram.
  4. Arc flash evaluations summary spreadsheet.
  5. Bus detail sheets.

  6. Arc flash warning labels printed in color on adhesive backed labels.

2.03 ARC FLASH WARNING LABELS
- A. Provide arc flash warning labels per NEC 110.16 and NFPA 70E.
- B. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.

PART 3 EXECUTION

3.01 GENERAL
- A. Adjust relay and protective device settings according to reduce arc flash while maintaining coordination between downstream circuit breakers and the upstream main circuit breaker.
- B. Perform minor modifications to equipment as required to accomplish conformance with short circuit study.
- C. Notify Contractor in writing of required major equipment modifications.
- D. Provide laminated one-line diagrams (minimum size 11" x 17") to post on interior of electrical room doors.
- E. Provide arc flash warning labels on equipment as specified on this Section.

END OF SECTION

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Revisions

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86683
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OREGON
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BENJAMIN E. PERRY
EXPIRES: 12-31-2022

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PROJECT TECHNICAL SPECIFICATIONS

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SECTION 26 05 83 - WIRING CONNECTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes.
1. This Section includes requirements for conductor termination methods.

1.02 SUBMITTALS

A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260583.C01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.
1. Pursuant to Section 013300 - Submittal Procedures.
2. Manufacturer's data including materials of construction, applications and related information for each item specified in PART 2 PRODUCTS.

PART 2 PRODUCTS

2.01 MATERIALS

A. Small Compression Connectors (260583.C01).
1. Insulated fork, ring or splicing (butt) connectors shall be provided for # 10 AWG or smaller conductors that splice together or terminate with a screw other than in a terminal block.
2. Connectors shall be properly sized for the conductor and for the stud used.
3. Burndy, Panduit, Thomas and Betts, or approved equal.

B. Electrical Spring Connectors (Wire Nuts) (260583.W01).
1. Provide properly sized spring connectors for the size and number of conductors spliced.
2. Ideal, 3M, Thomas and Betts, or approved equal.

C. Insulated Mechanical Multi-Tap Connectors (260583.M01).
1. Provide properly sized, insulated, mechanical, multi-tapped connectors for splices.
2. Burndy, Panduit, Thomas and Betts, or approved equal.

2.02 ACCESSORIES

A. Thin Wall Heat Shrink Tubing (260583.T01).
1. Thin walled heat shrink tubing shall be flame retardant and made of cross-linked polyolefin.
2. The tubing shall have a minimum operating temperature of – 55 to + 135 degrees Celsius.
3. Burndy, Panduit, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General
1. Care shall be taken when terminating conductors to avoid kinking, cutting or puncturing the jacket or allowing contamination by grease, oil or water.
2. Care shall be taken when terminating conductors to properly support the conductors and to avoid undue pressure on the connector or utilization equipment.

3. Conductors shall be terminated by use of lugs, pressure type connectors wire nuts or terminal blocks. Wrapping conductors around a screw type terminal is not acceptable.
4. Compression connectors shall be installed using the tool and die provided by the same manufacturer as the connectors and as per their directions.
5. Compressions on connectors used for # 8 AWG conductors and larger shall have a minimum of two (2) circumferential crimps.
6. Indenter type crimps on compression connectors shall not be used on conductors larger than # 10 AWG.
7. Connectors shall be installed as per the manufacturer's directions.
8. Insulated wire ferrules shall be provided for conductors terminated on terminal blocks utilizing a crimping tool provided by the ferrule manufacture specifically for this purpose.
9. Where wire ducts in enclosures exist, conductors shall be grouped together and routed in the wire ducts and shall be fanned out to the terminals.
10. Wire nuts shall be used on conductors # 10 AWG or less and only for splicing conductors at light fixtures, at receptacles and motors. No other splicing of conductors with wire nuts are permitted unless specifically identified on the Drawings.
11. All spare conductors shall be identified individually, neatly coiled and fastened with cable ties. The coil shall be labeled to describe its origin. Spare conductors shall be left long enough to be neatly routed and terminate anywhere within the enclosure.
12. Conductors installed outdoors which are not terminated the same day, shall have heavy wall heat shrinkable end caps installed the same day they are pulled in. The end caps shall remain in place until the day they are terminated.
13. Heavy wall heat shrink tubing shall be installed over splices or over the barrel of connectors installed outdoors.
14. Thin wall heat shrink tubing shall be installed over splices or over the barrel of connectors installed indoors.
15. As connections are set with a torque wrench, a black felt marker shall be used to mark across the bolt, nut or screw indicating the torque has been set.

B. Terminations For Motors.
1. Conductors sized # 10 AWG or less for phase conductors shall be connected with wire nuts set tight. The wire nuts shall be wrapped with premium grade electrical tape with a 50 percent overlap, installed in a clockwise rotation to hold the connector in place and to keep debris out of the connector.
2. The equipment grounding conductor shall be terminated on a lug identified for this use. If the motor is not supplied with a lug, a ring or compression type lug shall be used.
3. Conductors sized larger than # 10 AWG shall be terminated with compression connectors properly sized. The connectors shall be bolted together in a pigtail type fashion using stainless steel bolts, flat washers, lock washers and nuts. They shall have a torque as recommended by the bolt manufacturer for the bolt size used.
4. The bolt shall not be longer than the minimum necessary for the connection. The connectors shall be wrapped with varnished cambric tape with a 50 percent overlap covering the end of the connectors and extending one inch beyond the connector barrel. The varnished cambric tape shall be held in place by two layers of premium quality electrical tape, each layer with a 50 percent overlap.
5. Insulated Mechanical Multi-Tap Connectors may be used for motor terminations in lieu of the compression connectors and varnished cambric tape method.
6. Conductors shall be left as long as practical for termination in the motor terminal box.

END OF SECTION

SECTION 26 21 16 - ELECTRICAL UTILITY SERVICES

PART 1 GENERAL

1.01 SUMMARY

A. The Section includes electrical utility requirements and contact information.

1.02 SYSTEM DESCRIPTION

A. Electrical Service
1. The CONTRACTOR shall coordinate all work and inspections with the ENGINEER, the local jurisdiction having authority, AND Pacific Power (PP&L) (electric utility).
2. The OWNER is responsible for all costs for this work including fees for permits, and fees for the electric utility.
3. The CONTRACTOR shall provide all necessary installation services that are not provided by the electric utility.
4. The CONTRACTOR shall provide all necessary components that are not provided by the electric utility. All components shall be as specified by the electric utility. Components include conduits, pull rope, vaults, pull boxes, transformer pads, current transformer cabinets, meter socket enclosures, bollards, and ancillary items.
5. Provide all trenching and backfilling per electric utility's requirements.
6. The CONTRACTOR shall comply with the electric utility's electric service requirements.

B. Contact info:
1. Kristi Wheeler, PacificCorp. Kristi.Wheeler@pacificorp.com

PART 2 PRODUCTS

2.01 MATERIALS

A. **Transformer Vault (262116.V01)**
1. Coordinate exact part number with representative identified in this Section.

B. **Transformer Vault Lid (262116.L01)**
1. Coordinate exact part number with representative identified in this Section.

C. Sectionalizing Vault (262116.V02).
1. Coordinate exact part number with representative identified in this Section.

D. Sectionalizing Vault Lid (262116.L02).
1. Coordinate exact part number with representative identified in this Section.

E. CT Enclosure (262116.C01).
1. Provide per utility company requirements.

F. Meter Base (262116.B01).
1. Provide per utility company requirements.

PART 3 INSTALLATION

3.01 QUALITY CONTROL

A. All work shall comply with the electric utility's electrical service requirements, electric utility's specifications, and the Contract Documents.
B. CONTRACTOR shall coordinate work with other trades to avoid conflicts, delays and unnecessary interference with operation of the facility during construction.
C. CONTRACTOR shall provide all materials and incidentals required for a complete and operable system, even if not indicated explicitly by the Contract Documents.
D. The routing of the conduit is critical and shall be coordinated with the utility, ENGINEER and OWNER.
E. The utility meter socket and CT can shall be installed per the utilities specifications.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes.
1. This Section includes the requirements for panelboards, mini-power centers, utility meter sockets and current transformer (CT) can.

1.02 REFERENCES

A. The following is a list of Standards which may be referenced in this Section.
1. National Fire Protection Association (NFPA).
a. 70 – National Electrical Code (NEC).
2. National Electrical Contractors Association (NECA).
a. 5055 - National Electrical Installation Standards (NEIS).
3. National Electrical Manufacturers Association (NEMA).
a. AB 1 – Molded Case Circuit Breakers.
b. KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 volts maximum).
c. PB 1 – Panelboards
d. PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
4. International Electrical Testing Association (NETA).
a. Acceptance Testing Specifications.
5. Underwriters Laboratory, Inc. (UL).
a. 50 – Enclosures for Electrical Equipment.
b. 67 – Panelboards.
c. 489 – Molded Case Circuit Breakers and Circuit Breaker Enclosures.

1.03 SUBMITTALS

A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
1. The product data shall be bound in a three-ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 262416.P01) typewritten in the upper right-hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.
1. Pursuant to Section 013300 Submittal Procedures.
2. Manufacturer's data including materials of construction, equipment dimensions, weight and related information for each item specified in PART 2 PRODUCTS.

1.04 SUBSTITUTION REQUESTS

A. All substitution requests shall meet the following:
1. Shall be received by the ENGINEER no later than ten (10) business days prior to date of final addendum during the bid period. Submittals that do not meet this requirement shall be returned as LATE and shall not be considered for a substitution request.
2. Shall have clearly labeled and marked-up product data, indicating the features and part numbers. Submittals shall be individually labeled with the reference key note number or luminaire identification tag for which the substitution request is being made. Generic product catalog data or unmarked and or unlabeled substitution requests shall not be considered and shall be returned as INCOMPLETE to the CONTRACTOR.
3. All product data identified as OWNER Standard shall not be eligible for a substitution request

1.05 QUALITY ASSURANCE

A. Panelboards shall be manufactured in accordance with the Standards listed under 1.2 REFERENCES.

1.06 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be stored and installed in clean, dry and heated environment.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Distribution Panelboard (262416.P01).
1. Shall be rated service entrance rated.
2. Shall have a NEMA 3R enclosure, painted gray and surface mount unless shown otherwise on the Drawings. Enclosure shall not have pre-punched conduit knockouts.
3. Front cover shall be provided with a door within a door configuration with continuous hinged doors that are lockable for both the inner access and the front door providing access to the circuit breakers. The dead front shall be attached to the access door such then when opened the dead front swings open with the door.
4. Main breaker shall have an available in-rush current (AIC) rating as shown on the Drawings. Branch circuit breakers shall have the same rating unless specifically shown otherwise on the Drawings.
5. Main breaker shall have an ampere rating as shown on the Drawings.
6. Branch circuit breaker capacity shall be as shown on the Drawings. Provide branch circuit breakers as shown on the Drawings.
7. Bus material shall be tin plated aluminum rated for the voltage and ampere rating shown on the Drawings as a minimum.
8. Grounded conductor connection means shall be isolated, aluminum.
9. Grounding conductor connection means shall be aluminum.
10. Breakers shall be bolt-on type. No half-sized breakers shall be permitted.
11. Provide two (2) 2-pole and two (2) single-pole locks for the branch circuit breakers.
12. See the panel schedule in the Drawings for additional data.
13. Provide arc flash labels compliant with the NEC, OESC and OSHA.
14. Where shown on the Drawings, provide integral, factory installed TVSS, IEEE C62.41 certified, 50kA per phase surge rating or higher. Coordinate voltage to match panel.
15. Provide Siemens P2 Series, or approved equal.

B. Load Center (262416.P02).
1. Shall have a NEMA 1 enclosure, painted gray and surface mount unless shown otherwise on the Drawings. Enclosure shall not have pre-punched conduit knockouts.
2. Branch circuit breaker capacity shall be as shown on the Drawings. Provide branch circuit breakers as shown on the Drawings.
3. Bus material shall be tin plated aluminum rated for the voltage and ampere rating shown on the Drawings as a minimum.
4. Grounded conductor connection means shall be isolated, aluminum.
5. Grounding conductor connection means shall be aluminum.
6. Provide two (2) 2-pole and two (2) single-pole locks for the branch circuit breakers.
7. See the panel schedule in the Drawings for additional data.
8. Provide arc flash labels compliant with the NEC, OESC and OSHA.
9. Provide Eaton BR series, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General.

1. All identification labeling shall be in compliance with Section 260553 - Electrical and Control Identification.
2. Panels shall be grounded and bonded as shown on the Drawings and per the NEC whichever is more stringent.
3. Conductors shall be neatly grouped and routed within the enclosures.
4. Used and spare conductors shall be clearly identified as specified in Section 260519 – Low Voltage Electrical Power Conductors and Cables.
5. Due to the number of conduits entering the panelboards it will be imperative that the CONTRACTOR plan the layout carefully, so all the conduits fit in the bottom of the panelboards. Should a gutter be necessary, it shall be no deeper than the panelboards and only as wide as necessary to accommodate the conduits.
6. Provide typed circuit directory for each panelboard.
7. Install nameplates as shown on the Drawings and specified in Section 260553 - Electrical and Control Identification.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes.
1. This Section includes the requirements for wiring devices such as receptacles, toggle switches and devices plates.

1.02 REFERENCES

A. The following is a list of Standards which may be references in the Section.
1. National Electrical Contractors Association (NECA): National Electrical Installation Standards (NEIS).
2. National Electrical Manufacturers Association (NEMA).
a. WD1 – General Requirements for Wiring Devices.
b. WD6 – Wiring Device Dimensional Requirements.
3. National Fire Protection Association (NFPA): 70.
4. Underwriters Laboratories, Inc. (UL): 1070.

1.03 SUBMITTALS

A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
1. The product data shall be bound in a three ring binder with tabs for each Section. The tabs shall be numbered to match the specification Section numbers. Submittals not bound and labeled as specified will be rejected as incomplete.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 262726.R01) typewritten in the upper right hand corner of the submittal. The submittals within each Section tab shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.
1. Pursuant to Section 013300 Submittal Procedures.
2. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 PRODUCTS.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ground Fault Circuit Interrupter Receptacle (262726.R10).
1. Shall be heavy duty hospital grade, tamper-resistant, weather-resistant two-pole, three wire grounding type with screw type terminals suitable for number 10 American Wire Gauge (AWG).
2. Shall be NEMA 5-20R, rated for 20 amperes, 125 volt configuration.
3. Provide duplex or single receptacles as shown on the Drawings.
4. Shall be white in color unless fed from an emergency circuit and in that case the receptacle shall be red in color.
5. Provide Hubbell GFR8300S or approved equal. Red receptacles shall be sample model number except for color designation.

B. Weatherproof Receptacle Device Plates (262726.P11).
1. Weatherproof receptacle device plates shall be provided as shown on the drawings and in all locations that may be subjected to damp or wet conditions.
2. Weatherproof receptacle device plates shall be in-use type weatherproof receptacle device plates that allow for weatherproof protection even when a cord is plugged into the device.
3. Weatherproof receptacle device plates shall be metallic.
4. Weatherproof receptacle device plates shall be gasketed.
5. Weatherproof receptacle device plates shall be lockable.
6. Weatherproof receptacle device plates shall be UL Listed.
7. The device plate shall be PVC-coated and of a similar design when installed on PVC-coated boxes.
8. Provide Red Dot model CKMUV, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. **General**.
1. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.
2. Devices shall be bonded to their enclosure and the equipment grounding conductor with a separate grounding conductor attached to the device which will allow the device to be detached from the enclosure without disconnecting the equipment grounding conductor from the enclosure.
3. The use of the mounting yoke as the only method for bonding is unacceptable.
4. Devices that are not installed at the end of the line (circuit) shall be pig-tailed out and the pig-tails shall be connected to the line and load conductors.
5. After the pigtailed conductors are terminated on the device and before it is installed in the enclosure the exposed energized parts shall be wrapped with electrical insulating tape with a minimum of three wraps.
6. As the device is installed in the enclosure, care shall be taken to neatly fold the conductors inside the enclosure so as to not kink, bind or otherwise damage the sheath of the conductors.
7. Terminations on all devices shall be via pressure or compression type connectors. Wrapping conductors around a termination screw and tightening is unacceptable.
8. Mounting heights for receptacles shall be 18 inches to center from finished floor unless called out otherwise on the Drawings or specified at different height to meet minimum code requirements. Where countertops are present, receptacles shall be mounted horizontally and mounted 4 inches to center above the back-splash. The CONTRACTOR is responsible to coordinate with the approved casework submittals. Failure to do so will require the CONTRACTOR to relocate devices at their expense.
9. Mounting height for switches shall be 42 inches to center above finished grade unless called out otherwise on the Drawings or specified at different height to meet minimum code requirements. Where countertops are present, switches shall be mounted 5 inches to center above the back-splash. The CONTRACTOR is responsible to coordinate with the approved casework submittals. Failure to do so will require the CONTRACTOR to relocate devices at their expense.
10. Coordination is the responsibility of the CONTRACTOR. If a conflict exists for the mounting location of devices, the CONTRACTOR shall bring it to the ENGINEER's attention during the rough-in phase and the ENGINEER shall provide direction. Failure to coordinate conflicts during the rough-in phase will result in relocation of devices at the CONTRACTOR's expense.
11. All receptacles fed from emergency panels shall be red in color.
12. Devices shall be installed level and plumb. Devices shall be brought out plumb with the wall surface via UL listed spacers approved for this purpose if necessary.
13. Devices shall be tested for voltage, polarity, ground integrity and in the case of GFCI receptacles, that they operate as intended.
14. The position of devices, as shown on the Drawings, are general locations only unless dimensioned. The CONTRACTOR is responsible to coordinate with various trades to ensure no conflict exists.

END OF SECTION

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Revisions

No.	Description	Date

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REGISTERED PROFESSIONAL ENGINEER
86683
Digital Signature
OREGON
BENJAMIN E. KEY
08.20.12
EXPIRES: 12-31-2022

Issuance
100% CD

Date
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PROJECT TECHNICAL SPECIFICATIONS

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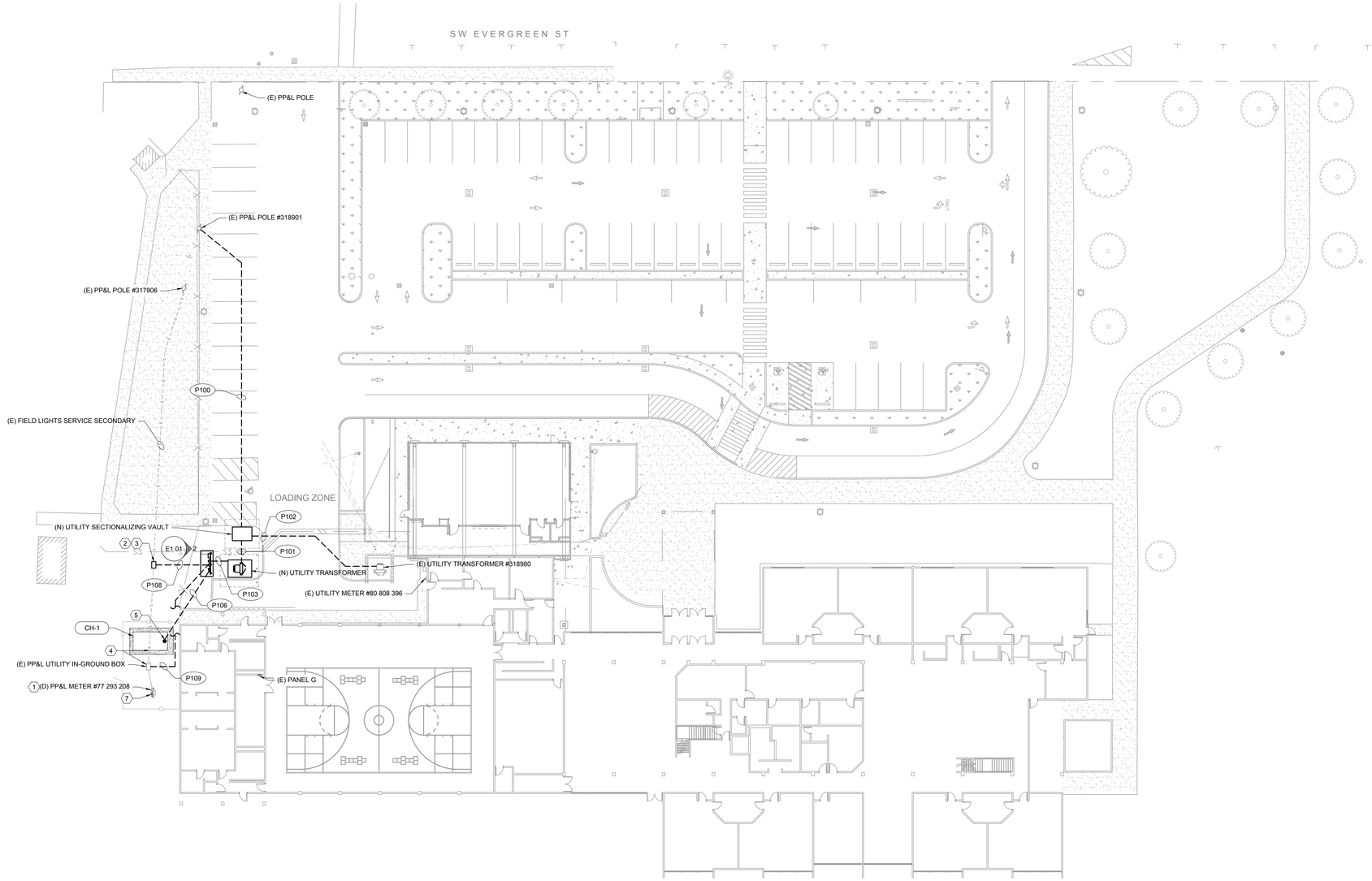
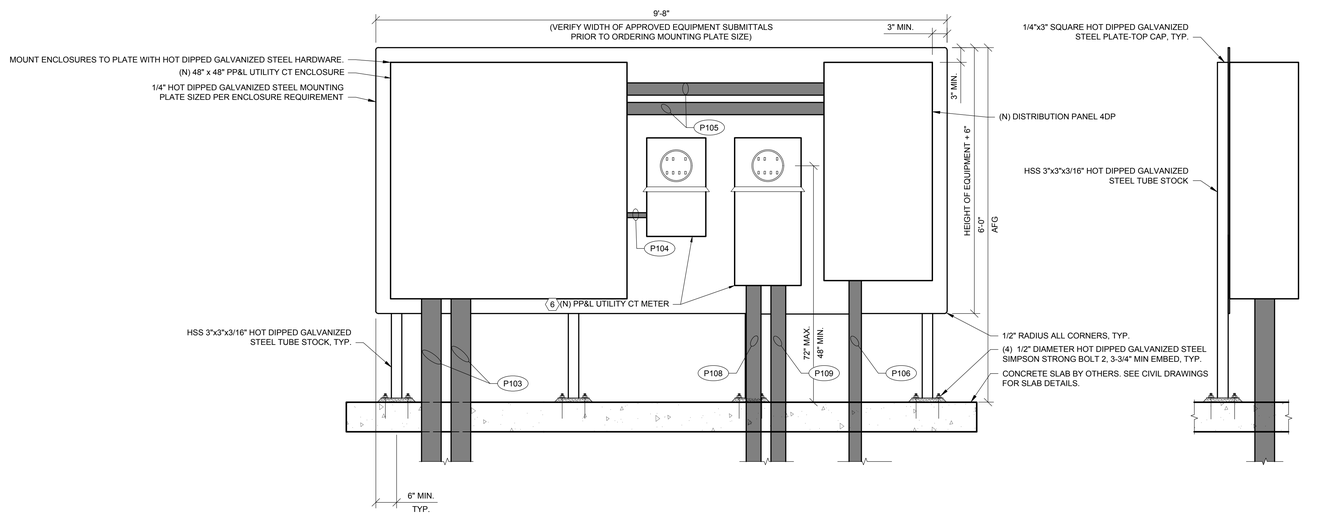


1 ELECTRICAL SITE PLAN
SCALE: 1" = 20'
0' 5' 10' 20'



ELEVATION VIEW

PROFILE VIEW

2 ENCLOSURE STAND DETAIL
SCALE: NTS

SHEET KEY NOTES

1. EXISTING PP&L METER SHALL BE REMOVED. EXISTING METER BASE ENCLOSURE SHALL REMAIN TO BE UTILIZED AS PULL BOX. CONTRACTOR SHALL REMOVE METER FROM BASE AND REMOVE ALL INTERIOR LUGS AND COMPONETRY.
2. NEW MEDIUM HDPE IN-GROUND BOX (260533.M01).
3. CONTRACTOR SHALL INTERCEPT EXISTING PP&L UTILITY SERVICE LINE IN LOCATION AS SHOWN. EXISTING SERVICE CONDUCTORS SHALL BE PULLED BACK COMPLETELY. NEW CONDUIT SHALL BE ROUTED TO NEW METERBASE LOCATION AS SHOWN. CONTRACTOR SHALL COORDINATE NEW UTILITY CONDUCTORS WITH PP&L.
4. SECTION OF EXISTING PP&L UTILITY SERVICE LINE CONDUIT SHALL BE ABANDONED UNDERGROUND. CONTRACTOR SHALL LABEL CONDUIT AS ABANDONED IN EXISTING POWER JBOX.
5. COORDINATE EXACT LOCATION FOR CHILLER CONNECTION WITH APPROVED CHILLER SUBMITTALS.
6. CONTRACTOR SHALL LABEL EACH METER WITH PERMANENT ENGRAVED LABELING THAT INDICATES WHICH SERVICE EACH METER SERVES. CONTRACTOR SHALL VERIFY EXACT REQUIREMENTS WITH PP&L UTILITY. LABELING SHALL BE APPROVED BY PP&L PRIOR TO INSTALLATION.
7. EXISTING 480/277V FIELD LIGHTS SERVICE FEED SHALL BE INTERCEPTED AND ROUTED AROUND THE EXISTING CHILLER. THE EXISTING CT METER SHALL BE REPLACED IN NEW LOCATION AS SHOWN. CONTRACTOR SHALL INSTALL SERVICE CONDUITS AS SHOWN AND PER PP&L REQUIREMENTS. COORDINATE THE INSTALLATION OF NEW SERVICE CONDUCTORS WITH PP&L.

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86683
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OREGON
BENJAMIN E. PERRY
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Drawing Title
ELECTRICAL SITE PLAN

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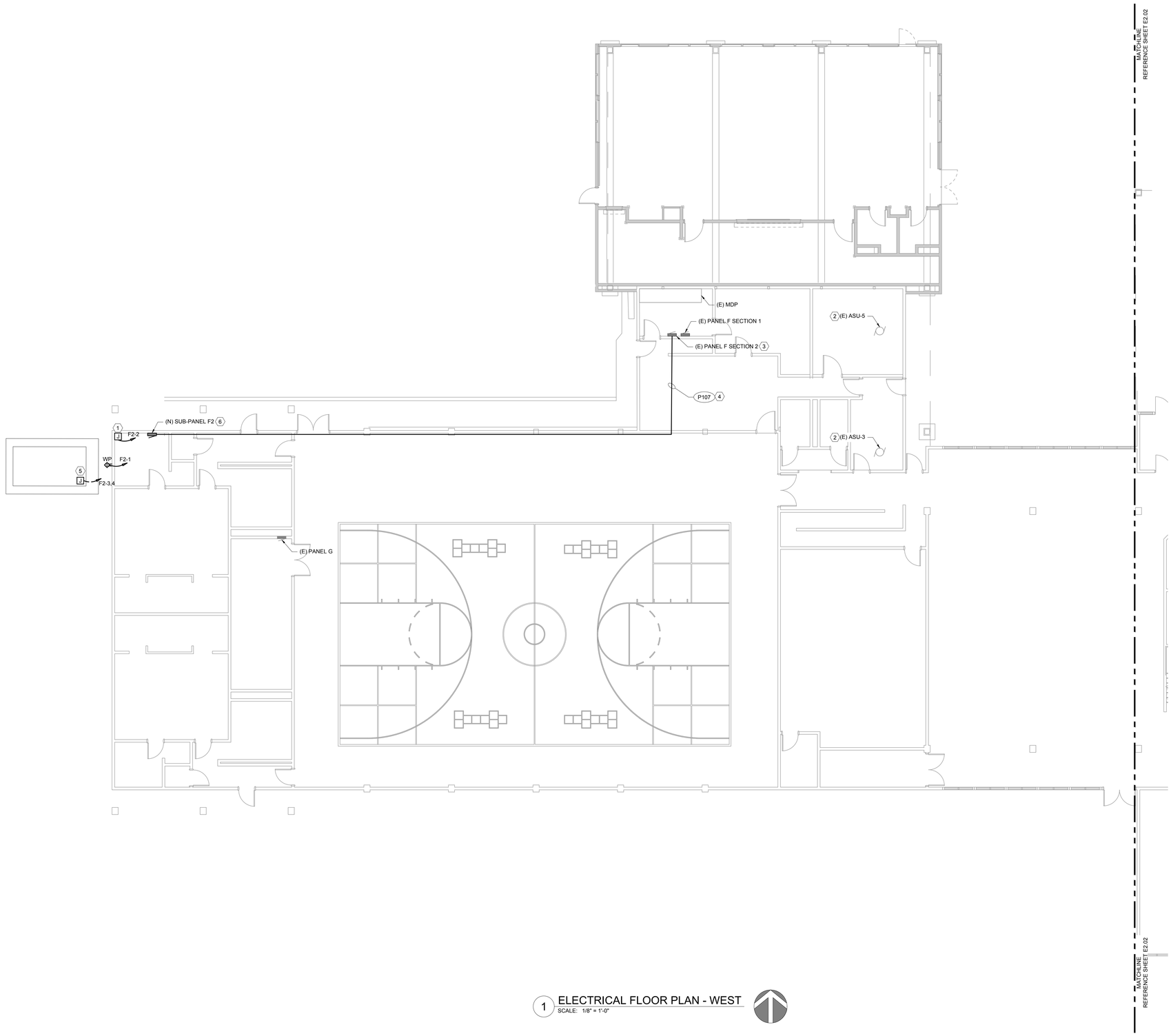
E1.01



1 ELECTRICAL FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

SHEET KEY NOTES

1. 120V CIRCUIT FOR HEAT TRACE CONNECTION. COORDINATE EXACT LOCATION WITH MECHANICAL CONTRACTOR.
2. EXISTING AIR HANDLING UNIT MOTOR SHALL BE REPLACED WITH NEW. EXISTING STARTER SHALL BE REMOVED AND REPLACED WITH NEW VFD. CONTRACTOR SHALL DISCONNECT ELECTRICAL CONNECTION FROM EXISTING UNIT AND RE-INSTALL TO NEW MOTOR THROUGH NEW VFD. INTERCEPT AND EXTEND EXISTING CONDUIT AND WIRING. COORDINATE ALL WORK AND EXACT LOCATIONS OF NEW VFD'S WITH MECHANICAL CONTRACTOR.
3. PROVIDE NEW 40A 2-POLE BREAKER TO EXISTING SPACE ON PANEL F SECTION 2 FOR NEW SUB-PANEL FEEDER.
4. FEEDER SHALL BE ROUTED UP HIGH IN ACCESSIBLE ATTIC SPACE AND HIGH ACROSS GYMNASIUM WALL.
5. PROVIDE TWO (2) 20-AMP, 120V CIRCUITS FOR CHILLER CONTROL & HEATER POWER. WIRE PER MANUFACTURERS INSTRUCTIONS.
6. PROVIDE LOAD CENTER TYPE PANEL (262416.P02). PANEL SHALL BE NEMA 1 CONSTRUCTION, 120/208 SINGLE-PHASE, 40 AMP BUSS WITH MAIN LUGS ONLY AND 12 CIRCUIT SPACES. CONTRACTOR SHALL COORDINATE EXACT CHILLER PIPING INSTALLATION LOCATION AND ADJUST PANEL INSTALLATION LOCATION ACCORDINGLY TO COMPLY WITH ALL NEC REQUIREMENTS.

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Revisions

No.	Description	Date

Stamp

REGISTERED PROFESSIONAL ENGINEER
86683
Digital Signature
OREGON
MAY 08, 2012
BENJAMIN E. PERRY
EXPIRES: 12-31-2022

Issuance
100% CD

Date
12/22/2021

Project Number
19056.007

Drawing Title
ELECTRICAL FLOOR PLAN - WEST

Sheet No
E2.01

DATE
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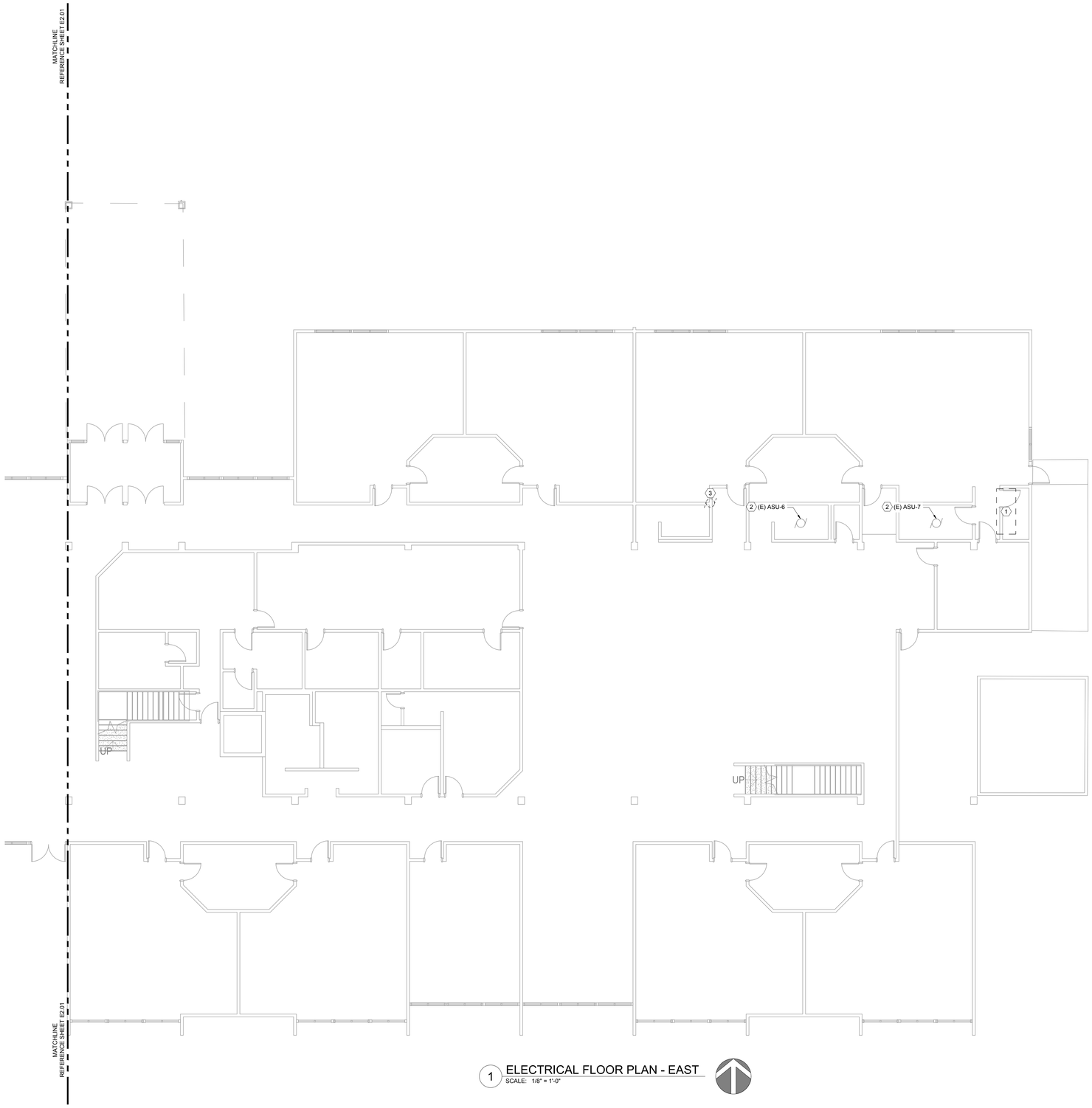
SHEET KEY NOTES

1. EXISTING CHILLER UNIT TO BE REMOVED. CONTRACTOR SHALL REMOVE ELECTRICAL CONNECTION COMPLETELY BACK TO SOURCE.
2. EXISTING AIR HANDLING UNIT MOTOR SHALL BE REPLACED WITH NEW. EXISTING STARTER SHALL BE REMOVED AND REPLACED WITH NEW VFD. CONTRACTOR SHALL DISCONNECT ELECTRICAL CONNECTION FROM EXISTING UNIT AND RE-INSTALL TO NEW MOTOR THROUGH NEW VFD. INTERCEPT AND EXTEND EXISTING CONDUIT AND WIRING. COORDINATE ALL WORK AND EXACT LOCATIONS OF NEW VFD'S WITH MECHANICAL CONTRACTOR.
3. EXISTING PUMP SHALL BE REMOVED. REMOVE ELECTRICAL CONNECTION COMPLETELY BACK TO SOURCE. COORDINATE WORK WITH MECHANICAL CONTRACTOR.



1 ELECTRICAL FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

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Drawing Title
ELECTRICAL FLOOR PLAN - EAST

Sheet No
E2.02

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