EVERGREEN ENGINEERING, INC.
Engineering and Construction Services

UNIVERSITY OF OREGON
DESCHUTES HALL
MACHINE ROOM UPGRADES
PHASE 1

PROJECT MANUAL

Engineer:
Evergreen Engineering
1740 Willow Creek Circle
Eugene, Oregon 97402
541-484-4771

Contact: Patrick Sandow
psandow@eeeug.com

Owner:
University of Oregon
1295 Franklin Boulevard
Eugene, Oregon 97403
541- 346-2147

Contact: David Ward
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January 2013 Job #2471.1

UNIVERSITY OF OREGON

Deschutes Hall
Machine Room Upgrades

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Drawings

OREGON UNIVERSITY SYSTEM

NOTICE OF RETAINER CONTRACT OPPORTUNITY

THIS OPPORTUNITY IS ONLY AVAILABLE TO CONTRACTORS WITH A CURRENT OREGON UNIVERSITY SYSTEM (OUS) RETAINER CONTRACT FOR CONSTRUCTION RELATED SERVICES.

The State of Oregon, acting by and through the State Board of Higher Education on behalf of the University of Oregon ("Owner") is accepting sealed bids for a public improvement project at the Capital Construction Main Office until 3:00 PM, Pacific Time, January 29, 2013 ("Closing Date and Time") for the University of Oregon, Deschutes Hall Machine Room Upgrades Phase 1 project located on the campus of the University of Oregon, in Eugene, Oregon ("Project"). The Project includes remodeling rooms 321, 321A, and 325 for the Computer and Information Science Department on the third floor of Deschutes Hall. Work includes demolition, reconfiguring rooms 321A and 325 into one room, replacing the HVAC and electrical systems serving room 321, adding electrical equipment to the first floor Electrical Room 133, and reinforcing the floor joists under rooms 321, 321A, and 325.

A mandatory pre-bid conference will be conducted at 11:00 AM on January 15, 2013. Bidders shall meet with Owner's Representative at Deschutes Hall, Room 321 for that purpose. Attendance will be documented through a sign-in sheet prepared by the Owner's Representative. Prime bidders who arrive more than 5 minutes after start of time of the meeting (as stated in the solicitation and by the Owner's Representative's watch) or after the discussion portion of the meeting (whichever comes first) shall not be permitted to sign in and will not be permitted to submit a bid on the Project.

Bids will be received on a lump-sum basis for all of the work. **Bid packets may be obtained on the OUS Bid and Business Opportunities website (http://secure.ous.edu/bid/).**

All bidders must comply with requirements of the prevailing wage law in ORS 279C.800 through ORS 279C.870. All bidders must be registered with the Construction Contractor's Board at the time of bid submission. No bid will be considered unless fully completed in the manner provided in the "Instructions to Bidders" upon the Bid Form provided and accompanied by Bid Security. OUS encourages bids from Minority, Women, and Emerging Small Businesses.

OREGON STATE BOARD OF HIGHER EDUCATION

By: Jamie Moffitt, Vice President for Finance and Administration

OREGON UNIVERSITY SYSTEM

STANDARD RETAINER CONTRACT

INSTRUCTIONS TO BIDDERS

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INSTRUCTIONS TO BIDDERS

Oregon Administrative Rules ("OAR") Chapter 580, Divisions 61 and 63 govern this OUS procurement process.

Article 1. Definitions

1.1. Capitalized words used herein but not defined shall have the meaning set forth in the OUS Retainer General Conditions and OAR 580-061-0010. The following terms used herein shall have the meaning set forth below:

"Bid Form"- refers to OUS Contract Form B-5 provided by Owner to be completed by Bidder.

"Project Manual"- The Project Manual includes, but is not necessarily limited to the following: the Advertisement for Bids or Notice of Contracting Opportunity, these Instructions to Bidders, Supplemental Instructions to Bidders, Bid Form, OUS Retainer Contract General Conditions, Supplemental General Conditions (if any), Sample Retainer Contract Supplement, Performance Bond, Payment Bond, and the Plans and Specifications.

Article 2. Scope of Work

2.1 The Work contemplated in this document shall be for the Owner in connection with the Project described in the Project Manual.

Article 3. Examination of Site and Conditions

3.1 Before making a Bid, the Bidder shall examine the Work site to ascertain its physical condition. The Bidder shall be responsible for being fully informed as to the quality, quantity and sources of supply of the materials listed on the Project Manual. Failure to comply with this Section will not release Contractor from entering into the Contract nor excuse Contractor from performing the Work in strict accordance with the terms of the Contract Documents.

3.2 The Owner will not be responsible for any loss or unanticipated costs which may arise as a result of Contractor's failure to be fully informed in advance with regard to all conditions pertaining to the Work and the character of the Work required.

3.3. No statement made by any officer, agent, or employee of the Owner in relation to the physical conditions pertaining to the Work site or quality, quantity, and supply of materials will be binding on the Owner, unless included in writing in the Project Manual or an Addendum.

Article 4. Substitute Materials Approval Process

4.1 Prior to submitting a Bid including a Substitution, the Bidder must first seek approval of the Substitution from the Architect (or Engineer, as appropriate hereafter) by submitting a written request for approval at least three calendar days prior to the Closing Date and Time. The Bidder submitting the request shall be responsible for its timely delivery.

4.2 Substitution approval requests shall be accompanied by samples, records of performance, certified copies of tests by impartial and recognized laboratories, and such other information as the Architect may request.

4.3 Within a reasonable time after receiving such a request the Owner (or Architect if so designated) will consider

whether the Substitution sought by Bidder is of equal value, utility, as the designated product in the Project Manual. If the requested Substitution is approved an Addendum to the Project Manual shall be issued. A copy of each Addendum will be posted on the OUS Bid and Business Opportunities website (http://secure.ous.edu/bid) and shall become a part of the Project Manual.

4.4 When the Architect approves a Substitution by Addendum, it is with the understanding that the Contractor guarantees the substituted article or material to be equal or better than the one specified.

Article 5. Interpretation of Project Manual

5.1 A Bidder in doubt as to the meaning of any part of the Project Manual may submit a written request for an interpretation to the Architect at any time prior to three calendar days prior to the Closing Date and Time.

5.2 Any interpretation of the Project Manual will be made only by a duly issued Addendum. The Owner will not be responsible for any other explanation or interpretation of the Project Manual nor for any other approval of a particular manufacturer's process or item.

5.3 To establish a basis of quality, certain processes, types of machinery and equipment or kinds of materials may be specified in the Project Manual either by description of process or by designating a manufacturer by name and referring to a brand or product designation or by specifying a kind of material. Whenever a process is designated or a manufacturer named, brand or item designation given, or whenever a process or material covered by patent is designated or described, it shall be understood that the words "or approved equal" follow such name, designation or description, whether they do so or not.

Article 6. Execution of the Bid Form

6.1 The Bid Form relates to Bids on a specific Project Manual. Only the amounts and information asked for on the Bid Form furnished by the Owner will be considered as the Bid. Each Bidder shall Bid upon the Work exactly as set forth in the Bid Form. The Bidder shall include in the Bid a sum to cover the cost of all items contemplated by the Project Manual. Bids that fail to address alternates set forth on the Bid Form may be considered non-responsive.

6.2 Each Bid Form must: 1) Be completed in accordance with these instructions; 2) Include the appropriate signatures as noted on the Bid Form; 3) Include numbers pertaining to base Bids stated both in writing and in figures; and 4) Include the Bidder's typed or clearly printed address.

6.3 When Bidding on an alternate for which there is no charge, the Bidder shall write the words "No Charge" in the space provided on the Bid Form. If one or more alternates is shown on the Bid Form, the Bidder shall indicate whether each is "add" or "deduct."

Article 7. Prohibition of Alterations to Bid

7.1 Bids which are incomplete, or contain ambiguities or conditions not provided for in the Bid Form, may be rejected.

Article 8. Submission of Bid

8.1 Each Bid shall be sealed in an envelope, properly addressed to the appropriate project representative of the Owner, showing on the outside of the envelope the name of the Bidder and the name of the project. Bids will be received at the time and place stated in the Advertisement for Bids.

Article 9. Bid Closing and Opening of Bids

9.1 All Bids must be received by the Owner before the Closing Date and Time. Any Bids received after the Closing Date and Time will be rejected and returned to the Bidder unopened.

Article 10. Acceptance or Rejection of Bids by Owner

10.1 Unless all Bids are rejected, the Owner will award the Contract based on the lowest responsive Bid from a responsible Bidder. If that Bidder does not execute the Contract, the Contract will be awarded to the next lowest responsible Bidder or Bidders in succession.

10.2 The procedures for Contract awards shall be in compliance with the provisions of OARs adopted by the Owner.

10.3 The Owner reserves the right to reject all Bids and to waive minor informalities.

10.4 In determining the lowest Bidder, the Owner reserves the right to take into consideration any or all authorized base Bids as well as alternates or combinations indicated in the Bid Form.

10.5 If Owner has not accepted a Bid within 30 calendar days after the opening of the Bids, each of the three lowest Bidders may withdraw the Bid submitted.

Article 11. Withdrawal of Bid

11.1 At any time prior to the Closing Date and Time a Bidder may withdraw its Bid. This will not preclude the submission of another Bid by such Bidder prior to the Closing Date and Time.

11.2 After the Closing Date and Time, no Bidder will be permitted to withdraw its Bid within the time period specified in Article 10 for award and execution, except as provided for in that Article.

Article 12. Execution of Contract, Agreement, Performance Bond and Payment Bond

12.1 The Owner will provide the successful Bidder with Contract Documents within 10 calendar days after the award of the Contract. The Bidder shall be required to execute the Contract as provided, including a Performance Bond and a Payment Bond from a surety company licensed to do surety business in the State of Oregon, within 20 calendar days after the award of the Contract. The Contract Documents shall be delivered to the Owner in the manner stated in the Notice of Award.

Article 13. Recyclable Products

13.1 Contractors must use recyclable products to the maximum extent economically feasible in the performance of the Contract.

OREGON UNIVERSITY SYSTEM

STANDARD RETAINER CONTRACT

BID FORM

OUS CAMPUS: UNIVERSITY OF OREGON

PROJECT: University of Oregon, Deschutes Hall Machine Room Upgrades – Phase 1

BID CLOSING DATE: __Tuesday, January 29, 2013, 3:00 pm_____

FROM: _____
Name of Contractor

TO: The State of Oregon, acting by and through the Oregon State Board of Higher Education, on behalf of the University of Oregon ("Owner")
(campus or office name and address)

Capital Construction
1295 Franklin Boulevard
1276 University of Oregon
Eugene, OR 97403-1276

1. The Undersigned (*check one of the following and insert information as requested*):

____a. An individual doing business under an assumed name registered under the laws of the State of _____; or

____b. A partnership registered under the laws of the State of _____; or

____c. A corporation organized under the laws of the State of _____; or

____d. A limited liability corporation/company organized under the laws of the State of _____;

hereby proposes to furnish all material and labor and perform all Work hereinafter indicated for the above project in strict accordance with the Contract Documents for the Basic Bid as follows:

_____ Dollars ($_____)

and the Undersigned agrees to be bound by each of the following documents:

• Notice of Retainer Contract Opportunity

• Instructions to Bidders
• Supplemental Instructions to Bidders, if any
• OUS Retainer Contract General Conditions
• UO Supplemental Retainer Contract General Conditions
• Sample Retainer Contract Supplement
• Performance Bond and Payment Bond
• Plans and Specifications
• Prevailing Wage Rates
• Payroll and Certified Statement Form
(found at http://egov.oregon.gov/BOLI/WHD/PWR/W_PWR_Forms.shtml)

• Any ADDENDA numbered ____ through____, inclusive *(fill in blanks).*

2. The Undersigned proposes to add to the Base Bid indicated above the items of work relating to the following Alternate:

ALTERNATE #1: *Convert existing wet sprinkler system serving Room 321, 321A and 325 to a pre-action sprinkler system.*
ADD: $_____

ALTERNATE #2: *Replace existing chilled water pump located in the ground floor Mechanical Room 113. Existing pump is a Taco #2508-S77-7.20, serial #41382, 208/3ph, 200gpm @ 55ft, 3" suction connection, 2-1/2" discharge connection. Replace with Taco #FI2508. Reuse existing VFD and valves.*
ADD: $_____

3. The work shall be completed within the time stipulated and specified in division 1, Section 01 10 00 of the Specifications.

4. The Undersigned certifies that: (1) This Bid has been arrived at independently and is being submitted without collusion with and without any agreement, understanding, or planned common course of action with any other vendor of materials, supplies, equipment or services described in the invitation to bid designed to limit independent bidding or competition; and (2) The contents of the Bid have not been communicated by the Undersigned or its employees or agents to any person not an employee or agent of the Undersigned and will not be communicated to such person prior to the official opening of the Bid.

5. The undersigned **HAS, HAS NOT** (*circle applicable status*) paid unemployment or income taxes in Oregon within the past 12 months and **HAS, HAS NOT** (*circle applicable status*) a business address in Oregon.

6. The Undersigned agrees, if awarded a contract, to comply with the provisions of ORS 279C.800 through 279C.870 pertaining to the payment of the prevailing rates of wage.

7. Contractor's CCB registration number is _____. As a condition to submitting a bid, a Contractor must be registered with the Oregon Construction Contractors Board in accordance with ORS 701.035 to 701.055, and disclose the registration

number. Failure to register and disclose the number will render the bid unresponsive and it will be rejected, unless contrary to federal law.

8. The successful Bidder hereby certifies that all subcontractors who will perform construction work as described in ORS 701.005(2) were registered with the Construction Contractors Board in accordance with ORS 701.035 to 701.055 at the time the subcontractor(s) made a bid to work under the Contract.

9. The successful Bidder hereby certifies that, in compliance with the Worker's Compensation Law of the State of Oregon, its Worker's Compensation Insurance provider is _____, Policy No. _____, and that Contractor shall submit Certificates of Insurance as required.

10. Contractor's Project Manager for this project is: _____, Office Phone: _____ Cell Phone: _____.

11. The Undersigned certifies that it has not discriminated against minority, women, or emerging small businesses in obtaining any subcontracts for this project.

12. The Undersigned agrees, if awarded the Contract, to execute and deliver to Owner, within twenty (20) calendar days after receiving the Contract Documents, an Agreement Form and a satisfactory Performance Bond and Payment Bond, each in an amount equal to one hundred (100) percent of the Contract sum, using forms provided by the Owner. The surety requested to issue the Performance Bond and Payment Bond will be:

_____.

(name of surety company - not insurance agency)

The Undersigned hereby authorizes said surety company to disclose any information to the Owner concerning the Undersigned's ability to supply a Performance Bond and Payment Bond each in the amount of the Contract.

13. In determining the lowest Bidder, the Owner reserves the right to take into consideration any or all authorized base Bids as well as alternates or combinations indicated in the Bid Form.

By signature below, Contractor agrees to be bound by this Bid.

NAME OF FIRM _____

ADDRESS _____

_____

FEDERAL TAX ID _____

TELEPHONE NO _____

FAX NO _____

SIGNATURE 1) _____
Sole Individual

or 2) _____
Partner

or 3) _____
Authorized Officer of Corporation

(SEAL)

_____
Attested: Secretary of Corporation

Payment information will be reported to the IRS under the name and taxpayer ID # provided above. Information not matching IRS records could subject Contractor to 31 percent backup withholding.

***** ***END OF BID*** *****

OREGON UNIVERSITY SYSTEM

RETAINER SUPPLEMENTAL GENERAL CONDITIONS

To The

GENERAL CONDITIONS
FOR RETAINER CONTRACTS

Supplement No. _____
Project Name:
University of Oregon, Deschutes Hall Machine Room Upgrades – Phase 1

The following modify the July 1, 2012 Oregon University System "General Conditions for Retainer Contracts ("OUS Retainer General Conditions") for the above referenced Retainer Contract Supplement. Where a portion of the OUS Retainer General Conditions is modified by these Supplemental General Conditions, the unaltered portions shall remain in effect.

Section B.4 is hereby deleted and replaced with the following:

Contractor shall obtain and pay for all necessary permits, licenses and fees, except for those specifically excluded in the Retainer Supplemental General Conditions, for the construction of the Work, for temporary obstructions, enclosures, opening of streets for pipes, walls, utilities, environmental Work, etc., as required for the project. Contractor shall be responsible for all violations of the law, in connection with the construction or caused by obstructing streets, sidewalks or otherwise. Contractor shall give all requisite notices to public authorities. Notwithstanding the first sentence of this paragraph, Owner shall pay for the following: Plan check fees and permit fees required for the general building permit, systems development charges, and building department inspection fees. Notwithstanding the foregoing, however, Contractor shall obtain all permits, licenses and fees required for the construction of the Work.

Section K.2 is hereby deleted and replaced with the following:

As part of the Work, Contractor shall submit two completed operation and maintenance manuals ("O & M Manuals") for review by the Owner prior to submission of any pay request for more than 75% of the Work. Owner's receipt of the O & M Manuals shall be a condition precedent to any payment thereafter due. The O & M Manuals shall contain a complete set of all submittals, all product data as required by the specifications, training information, telephone list and contact information for all consultants, manufacturers, installer and suppliers, manufacturer's printed data, record and shop drawings, schematic diagrams of systems, appropriate equipment indices, warranties and bonds. The Owner

shall review and return one O & M Manual for any modifications or adjustments required. Prior to submission of its final pay request, Contractor shall deliver two complete and approved sets of O & M Manuals in paper form and one complete and approved set in electronic form to the Owner and Owner's receipt of the O & M Manuals shall be a condition precedent to Owner's obligation to make final payment.

Section K.4 is hereby deleted and replaced with the following:

As part of the Work, and prior to submission of the final application for payment, the Contractor shall schedule with the Owner and provide training sessions for all equipment and systems as required by the Contract Documents. Contractor shall schedule training sessions at least two weeks in advance of the date of training to allow Owner to provide its personnel with adequate notice. The O & M Manual shall be used as a basis for training. In addition to any off-site training required by the Contract Documents, training shall include a formal session conducted at the Work site after the equipment and/or system is completely installed and operational in its normal operating environment.

OREGON UNIVERSITY SYSTEM

GENERAL CONDITIONS FOR RETAINER CONTRACTS

July 1, 2012

INSTRUCTIONS: The attached **Oregon University System General Conditions for Retainer Contracts ("OUS Retainer General Conditions")** apply to all designated retainer contracts. Changes to the OUS Retainer General Conditions (including any additions, deletions or substitutions) should only be made by attaching Retainer Supplemental General Conditions. The text of these OUS Retainer General Conditions should not otherwise be altered.

TABLE OF SECTIONS

OREGON UNIVERSITY SYSTEM
GENERAL CONDITIONS FOR RETAINER CONTRACTS
("OUS Retainer General Conditions")

SECTION A
GENERAL PROVISIONS

A.1 DEFINITION OF TERMS

In the Contract Documents the following terms shall be as defined below:

AMENDMENT, means a writing which, when fully executed by the Parties to this Contract, constitutes a change to a Contract Document. Amendments to Supplements (hereinafter a "Supplement Amendment") shall be issued in accordance with the changes provisions of Section D and, if applicable, establish a Contract Price or Contract Time adjustment.

APPLICABLE LAWS, means federal, state and local laws, codes, rules, regulations and ordinances applicable to the Work and to the Contract.

ARCHITECT/ENGINEER, means the Person appointed by the Owner to make drawings and specifications and, to provide contract administration of the Work contemplated by the Contract to the extent provided herein or by supplemental instruction of Owner (under which Owner may delegate responsibilities to the Architect/Engineer), in accordance with ORS Chapter 671 (Architects) or ORS Chapter 672 (Engineers) and administrative rules adopted thereunder.

CHANGE ORDER, means a written order issued by the Owner to be later included as an Amendment. A Change Order shall not be effective until executed as an Amendment.

CLAIM, means a demand by Contractor pursuant to Section D.3 for review of the denial of Contractor's initial request for an adjustment of Contract terms, payment of money, extension of Contract Time or other relief, submitted in accordance with the requirements and within the time limits established for review of Claims in these OUS Retainer General Conditions.

CONSTRUCTION CHANGE DIRECTIVE, means a written order by the Owner to the Contractor requiring a change in the Work within the general scope of the Contract Documents, issued under the changes provisions of Section D.

CONTRACT, means the written agreement between the Owner and the Contractor comprised of the Contract Documents which describe the Work to be done and the obligations between the parties.

CONTRACT DOCUMENTS, means the Solicitation Document and addenda thereto, Instructions to Offerors, Supplemental Instructions to Offerors, the OUS Retainer Contract, OUS Retainer General Conditions, Retainer Supplemental General Conditions, if any, the accepted Offer, Plans, Specifications, Supplements, Amendments, and Construction Change Directives .

CONTRACT PERIOD, as set forth in the Contract Documents, means the total period of time beginning with the full execution of a Supplement and, if applicable, the issuance of a Notice to Proceed and concluding upon Final Completion.

CONTRACT PRICE, means the total of the awarded Offer amount, as increased or decreased by the price of approved alternates, as indicated in the Contract Documents.

CONTRACT TIME, means any incremental period of time allowed under the Contract to complete any portion of the Work as reflected in the project schedule.

CONTRACTOR, means the Person awarded the Contract for the Work contemplated.

DAYS, are calendar days, including weekdays, weekends and holidays, unless otherwise specified.

DIRECT COSTS, means, unless otherwise provided in the Contract Documents, the cost of materials, including sales tax, cost of delivery; cost of labor, including social security, Medicare and unemployment insurance, and fringe benefits required by agreement or custom; worker's compensation insurance; project specific insurance (including, without limitation, Builder's Risk Insurance and Builder's Risk Installation Floater); bond premiums, rental cost of equipment, and machinery required for execution of the Work; and the additional costs of field personnel directly attributable to the Work.

FINAL COMPLETION, means the final completion of all requirements under the Contract, including Contract Closeout as described in Section K but excluding Warranty Work as described in Section I.2, and the final payment and release of all retainage, if any, released.

FORCE MAJEURE, means an act, event or occurrence caused by fire, riot, war, acts of God, nature, sovereign, or public enemy, strikes, freight embargoes or any other act, event or occurrence that is beyond the control of the party to this Contract who is asserting Force Majeure.

MWESB REPORT, means an accurate report by the Contractor to the Owner identifying all Minority, Women and Emerging Small Business (MWESB) enterprises, as those terms are defined in ORS 200.005, receiving contracts throughout the course of the Work. An initial MWESB report is required (see Section E.2.9) and MWESB Reports are required annually (see Section E.2.9) and as a condition of final payment (see Section K.1). The initial report shall be in the form required by OUS and as posted from time to time on the OUS website and shall include the total number of contracts and subcontracts awarded to MWESB enterprises and the dollar value of their respective contracts and subcontracts. The annual reports shall include the total number of contracts and subcontracts awarded to MWESB enterprises, the dollar value of each, and the expenditure toward each contract and subcontract during the previous twelve (12) months. The final report shall include the total number of contracts and subcontracts awarded to MWESB enterprises and the dollar value of their respective contracts and subcontracts including all Supplements and Amendments incorporated during the course of the project. The reports shall only include enterprises certified with the State of Oregon as MWESB enterprises and shall include individual identification of each enterprise as a Minority business enterprise, a Women business enterprise, and/or an Emerging Small Business Enterprise, as applicable.

NOTICE TO PROCEED, means the official written notice from the Owner stating that the Contractor is to proceed with the Work defined in the Contract Documents. Notwithstanding the Notice to Proceed, Contractor shall not be authorized to proceed with the Work until all initial Contract requirements, including the Contract, performance bond and payment bond, and certificates of insurance, have been fully executed and submitted to Owner in a suitable form.

OFFER, means a bid in connection with Instructions to Bidders or a proposal in connection with a Request for Proposals.

OFFEROR, means a bidder in connection with Instructions to Bidders or a proposer in connection with a Request for Proposals.

OVERHEAD, means those items which may be included in the Contractor's markup (general and administrative expense and profit) and that shall not be charged as Direct Cost of the Work, including without limitation such Overhead expenses as wages or salary of personnel above the level of foreman (i.e., superintendents and project managers), expenses of Contractor's offices and supplies at the job site (e.g. job trailer) and at Contractor's principal place of business and including expenses of personnel staffing the job site office and Contractor's principal place of business, and Commercial General Liability Insurance and Automobile Liability Insurance.

OWNER, means the State of Oregon acting by and through the Oregon State Board of Higher Education, in its own right or on behalf of one of its institutions as identified in the Solicitation Document, also known as the Oregon University System (OUS). Owner may elect, by written notice to Contractor, to delegate certain duties to more than one party, including without limitation, to an Architect/Engineer. However, nothing in these OUS Retainer General Conditions is intended to abrogate the separate design professional responsibilities of Architects under ORS Chapter 671 or of Engineers under ORS Chapter 672.

PERSON, means a natural person or entity doing business as a sole proprietorship, a partnership, a joint venture, a corporation, a limited liability company or partnership, or any other entity possessing the legal capacity to contract.

PLANS, means the drawings which show the location, type, dimensions, and details of the Work to be done under the Contract.

PUNCH LIST, means the list of Work yet to be completed or deficiencies which need to be corrected in order to achieve Final Completion of the Contract.

RECORD DOCUMENT, means the as-built Plans, Specifications, testing and inspection records, product data, samples, manufacturer and distributor/supplier warranties evidencing transfer of ownership to Owner, operational and maintenance manuals, shop drawings, Construction Change Directives, MWESB Reports, correspondence, certificate(s) of occupancy, and other documents listed in Subsection B.9.1 of these OUS Retainer General Conditions, recording all Services performed.

SOLICITATION DOCUMENT, means Instructions to Bidders or Offerors or a Request for Proposal or a Request for Quotes.

SPECIFICATION, means any description of the physical or functional characteristics of the Work, or of the nature of a supply, service or construction item. Specifications may include a description of any requirement for inspecting, testing or preparing a supply, service or construction item for delivery and the quantities or qualities of materials to be furnished under the Contract. Specifications generally will state the results or products to be obtained and may, on occasion, describe the method and manner of doing the Work to be performed. Specifications may be incorporated by reference and/or may be attached to the Contract.

SUBCONTRACTOR, means a Person having a direct contract with the Contractor, or another Subcontractor, to perform one or more items of the Work.

SUBSTANTIAL COMPLETION, means the date when the Owner accepts in writing the construction, alteration or repair of the improvement to real property constituting the Work or any designated portion thereof as having reached that state of completion when it may be used or occupied for its intended purpose. Substantial Completion of facilities with operating systems occurs only after thirty (30) continuous Days of successful, trouble-free operation of the operating systems as provided in Section K.4.2.

SUBSTITUTIONS, means items that in function, performance, reliability, quality, and general configuration are the same or better than the product(s) specified. Approval of any substitute item shall be solely determined by the Owner. The decision of the Owner is final.

SUPPLEMENT, means a writing which, when fully executed by the Parties thereto, constitutes written agreement between the Owner and the Contractor comprised of the Contract Documents which describe the Work to be done and the obligations between the parties.

RETAINER SUPPLEMENTAL GENERAL CONDITIONS, means those conditions that remove from, add to, or modify these OUS Retainer General Conditions. Retainer Supplemental General Conditions may be included in the Solicitation Document or may be a separate attachment to the Contract.

WORK, means the furnishing of all materials, equipment, labor, transportation, services and incidentals necessary to successfully complete any individual item or the entire Contract and the carrying out of duties and obligations imposed by the Contract Documents.

A.2 SCOPE OF WORK

The Work contemplated under this Contract includes all labor, materials, transportation, equipment and services for, and incidental to, the completion of all construction work in connection with the project described in the Contract Documents. The Contractor shall perform all Work necessary so that the project can be legally occupied and fully used for the intended use as set forth in the Contract Documents.

A.3 INTERPRETATION OF CONTRACT DOCUMENTS

A.3.1 Unless otherwise specifically defined in the Contract Documents, words which have well-known technical meanings or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings. Contract Documents are intended to be complementary. Whatever is called for in one, is interpreted to be called for in all. However, in the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following descending order of precedence:

(a) Contract Supplements, Amendments and Construction Change Directives, with those of later date having precedence over those of an earlier date;

(b) The Retainer Supplemental General Conditions;

(c) The OUS Retainer Contract;

(d) The OUS Retainer General Conditions;

(e) Division One (General Requirements) of the Specifications;

(f) Detailed Schedules of finishes, equipment and other items included in the Specifications;

(g) Plans and Specifications (other than Division One and the Detailed Schedules to the Specifications);

(h) Large-scale drawings on Plans;

(i) Small-scale drawings on Plans;

(j) Dimension numbers written on Plans which shall prevail and take precedence over dimensions scaled from Plans;

(k) The Solicitation Document, and any addenda thereto;

(l) The accepted Offer.

A.3.2 In the case of an inconsistency between Plans and Specifications or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Owner's interpretation in writing.

A.3.3 If the Contractor finds discrepancies in, or omissions from the Contract Documents, or if the Contractor is in doubt as to their meaning, the Contractor shall at once notify the Owner. Matters concerning and interpretation of requirements of the Contract Documents will be decided by the Owner, who may delegate that duty in some instances to the Architect/Engineer. Responses to Contractor's requests for interpretation of Contract Documents will be made in writing by Owner (or the Architect/Engineer) within any time limits agreed upon or otherwise with reasonable promptness. Interpretations and decisions of the Owner (or Architect/Engineer) will be consistent with the intent of and reasonably inferable from the Contract Documents. Contractor shall not proceed without direction in writing from the Owner (or Architect/Engineer).

A.3.4 References to standard specifications, manuals, codes of any technical society, organization or association, to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, laws or regulations in effect in the jurisdiction where the project is occurring on the first published date of the Solicitation Document, except as may be otherwise specifically stated.

A.4 EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE

A.4.1 It is understood that the Contractor, before submitting an Offer, has made a careful examination of the Contract Documents; has become fully informed as to the quality and quantity of materials and the character of the Work required; and has made a careful examination of the location and conditions of the Work and the sources of supply for materials. The Owner will in no case be responsible for any loss or for any unanticipated costs that may be suffered by the Contractor as a result of the Contractor's failure to acquire full information in advance in regard to all conditions pertaining to the Work. No oral agreement or conversation with any officer, agent, or personnel of the Owner, or with the Architect/Engineer either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained.

A.4.2 Should the Plans or Specifications fail to particularly describe the materials, kind of goods, or details of construction of any aspect of the Work, Contractor shall have the duty to make inquiry of the Owner and Architect/Engineer as to what is required prior to performance of the Work. Absent Specifications to the contrary, the materials or processes that would normally be used to produce first quality finished Work shall be considered a part of the Contract requirements.

A.4.3 Any design errors or omissions noted by the Contractor shall be reported promptly to the Owner, including without limitation, any nonconformity with Applicable Laws.

A.4.4 If the Contractor believes that adjustments to cost or Contract Time is involved because of clarifications or instructions issued by the Owner (or Architect/Engineer) in response to the Contractor's notices or requests for information, the Contractor must submit a written request to the Owner, setting forth the nature and specific extent of the request, including all time and cost impacts against the Contract as soon as possible, but no later than thirty (30) Days after receipt by Contractor of the clarifications or instructions issued. If the Owner denies Contractor's request for additional compensation, additional Contract Time, or other relief that Contractor believes results from the clarifications or instructions, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process. If the Contractor fails to perform the obligations of Sections A.4.1 to A.4.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations.

A.5 INDEPENDENT CONTRACTOR STATUS

The service or services to be performed under this Contract are those of an independent contractor as defined in ORS 670.600. Contractor represents and warrants that it is not an officer, employee or agent of the Owner as those terms are used in ORS 30.265.

A.6 RETIREMENT SYSTEM STATUS AND TAXES

Contractor represents and warrants that it is not a contributing member of the Public Employees' Retirement System and will be responsible for any federal or state taxes applicable to payment received under this Contract. 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, except as a self-employed individual. Unless the Contractor is subject to backup withholding, Owner will not withhold from such payments any amount(s) to cover Contractor's federal or state tax obligations.

A.7 GOVERNMENT EMPLOYMENT STATUS

A.7.1 If this payment is to be charged against federal funds, Contractor represents and warrants that it is not currently employed by the Federal Government. This does not preclude the Contractor from holding another contract with the Federal Government.

A.7.2 Contractor represents and warrants that Contractor is not an employee of the State of Oregon for purposes of performing Work under this Contract.

SECTION B
ADMINISTRATION OF THE CONTRACT

B.1 OWNER'S ADMINISTRATION OF THE CONTRACT

B.1.1 The Owner shall administer the Contract as described in the Contract Documents (1) during construction (2) until final payment is due and (3) during the one-year period for correction of Work. The Owner will act as provided in the Contract Documents, unless modified in writing in accordance with other provisions of the Contract. In performing these tasks, the Owner may rely on the Architect/Engineer or other consultants to perform some or all of these tasks.

B.1.2 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 Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. The Owner will not make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Owner 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.

B.1.3 Except as otherwise provided in the Contract Documents or when direct communications have been specifically authorized, the Owner and Contractor shall communicate with each other about matters arising out of or relating to the Contract. Communications by and with the Architect/Engineer's consultants shall be through the Architect/Engineer. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

B.1.4 Based upon the Architect/Engineer's evaluations of the Contractor's Application for Payment, or unless otherwise stipulated by the Owner, the Architect/Engineer will review and

certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

B.2 CONTRACTOR'S MEANS AND METHODS; MITIGATION OF IMPACTS

B.2.1 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, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures.

B.2.2 The Contractor is responsible to protect and maintain the Work during the course of construction and to mitigate any adverse impacts to the project, including those caused by authorized changes, which may affect cost, schedule, or quality.

B.2.3 The Contractor is responsible for the actions of all its personnel, laborers, suppliers, and Subcontractors on the project. The Contractor shall enforce strict discipline and good order among Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of persons who are unfit or unskilled for the tasks assigned to them.

B.3 MATERIALS AND WORKMANSHIP

B.3.1 The intent of the Contract Documents is to provide for the construction and completion in every detail of the Work described. All Work shall be performed in a professional manner and unless the means or methods of performing a task are specified elsewhere in the Contract Documents, Contractor shall employ methods that are generally accepted and used by the industry, in accordance with industry standards.

B.3.2 The Contractor is responsible to perform the Work as required by the Contract Documents. Defective Work shall be corrected at the Contractor's expense.

B.3.3 Work done and materials furnished shall be subject to inspection and/or observation and testing by the Owner to determine if they conform to the Contract Documents. Inspection of the Work by the Owner does not relieve the Contractor of responsibility for the Work in accordance with the Contract Documents.

B.3.4 Contractor shall furnish adequate facilities, as required, for the Owner to have safe access to the Work including without limitation walkways, railings, ladders, tunnels, and platforms. Producers, suppliers, and fabricators shall also provide proper facilities and access to their facilities.

B.3.5 The Contractor shall furnish Samples of materials for testing by the Owner and include the cost of the Samples in the Contract Price.

B.4 PERMITS

Contractor shall obtain and pay for all necessary permits, licenses and fees, except for those specifically excluded in the Retainer Supplemental General Conditions, for the construction of the Work, for temporary obstructions, enclosures, opening of streets for pipes, walls, utilities, environmental Work, etc., as required for the project. Contractor shall be responsible for all violations of the law, in connection with the construction or caused by obstructing streets, sidewalks or otherwise. Contractor shall give all requisite notices to public authorities.

B.5 COMPLIANCE WITH GOVERNMENT REGULATIONS

B.5.1 Contractor shall comply with Applicable Laws pertaining to the Work and the Contract. Failure to comply with such requirements shall constitute a breach of Contract and shall be grounds for Contract termination. Without limiting the generality of the foregoing, Contractor expressly agrees to comply with the following, as applicable:
(i) Title VI and VII of Civil Rights Act of 1964, as amended; (ii) Section 503 and 504 of the Rehabilitation Act of 1973, as amended; (iii) the Health Insurance Portability and Accountability Act of 1996; (iv) the Americans with Disabilities Act of 1990, as amended; (v) ORS Chapter 659A; as amended; (vi) all regulations and administrative rules established pursuant to the foregoing laws; and (vii) all other applicable requirements of federal and state civil rights and rehabilitation statutes, rules and regulations.

B.5.2 Contractor shall comply with all applicable requirements of federal and state civil rights and rehabilitation statutes, rules and regulations, and

(a) Contractor shall not discriminate against Disadvantaged, Minority, Women or Emerging Small Business enterprises, as those terms are defined in ORS 200.005, or a business enterprise that is owned or controlled by or that employs a disabled veteran, as that term is defined in ORS 408.225, in the awarding of subcontracts.

(b) Contractor shall maintain, in current and valid form, all licenses and certificates required by Applicable Laws or this Contract when performing the Work.

B.5.3 Unless contrary to federal law, Contractor shall certify that it shall not accept a bid from Subcontractors to perform Work as described in ORS 701.005 under this Contract unless such Subcontractors are registered with the Construction Contractors Board in accordance with ORS 701.035 to 701.055 at the time they submit their bids to the Contractor.

B.5.4 Unless contrary to federal law, Contractor shall certify that each landscape contractor, as defined in ORS 671.520(2), performing Work under this Contract holds a valid landscape contractor's license issued pursuant to ORS 671.560.

B.5.5 The following notice is applicable to Contractors who perform excavation Work. ATTENTION: Oregon law requires you 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. You may obtain copies of the rules by calling the center at (503)232-1987.

B.5.6 Failure to comply with any or all of the requirements of B.5.1 through B.5.5 shall be a breach of Contract and constitute grounds for Contract termination. Damages or costs resulting from such noncompliance shall be the responsibility of Contractor.

B.6 SUPERINTENDENCE

Contractor shall keep on the site, during the progress of the Work, a competent superintendent and any necessary assistants who shall be satisfactory to the Owner and who shall represent the Contractor on the site. Directions given to the superintendent by the Owner shall be confirmed in writing to the Contractor.

B.7 INSPECTION

B.7.1 Owner shall have access to the Work at all times.

B.7.2 Inspection of the Work will be made by the Owner at its discretion. The Owner will have authority to reject Work that

does not conform to the Contract Documents. Any Work found to be not in conformance with the Contract Documents, in the discretion of the Owner, shall be removed and replaced at the Contractor's expense.

B.7.3 Contractor shall make or obtain at the appropriate time all tests, inspections and approvals of portions of the Work required by the Contract Documents or by Applicable Laws or orders of public authorities having jurisdiction. Unless otherwise provided, the Contractor shall make 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. Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work. The Contractor shall give the Owner timely notice of when and where tests and inspections are to be made so that the Owner may be present for such procedures. 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 Owner.

B.7.4 As required by the Contract Documents, Work done or material used without required inspection or testing and/or without providing timely notice to the Owner may be ordered removed at the Contractor's expense.

B.7.5 If directed to do so any time before the Work is accepted, the Contractor shall uncover portions of the completed Work for inspection. After inspection, the Contractor shall restore such portions of Work to the standard required by the Contract. If the Work uncovered is unacceptable or was done without required testing or inspection or sufficient notice to the Owner, the uncovering and restoration shall be done at the Contractor's expense. If the Work uncovered is acceptable and was done with sufficient notice to the Owner, the uncovering and restoration will be paid for pursuant to a Supplement Amendment.

B.7.6 If any testing or inspection reveals failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Owner's and Architect/Engineer's services and expenses, shall be at the Contractor's expense.

B.7.7 When the United States government participates in the cost of the Work, or the Owner has an agreement with other public or private organizations, or if any portion of the Work is being performed for a third party or in close proximity to third party facilities, representatives of these organizations shall have the right to inspect the Work affecting their interests or property. Their right to inspect shall not make them a party to the Contract and shall not interfere with the rights of the parties of the Contract. Instructions or orders of such parties shall be transmitted to the Contractor, through the Owner.

B.8 SEVERABILITY

If any provision of this Contract is declared by a court to be illegal or in conflict with any law, the validity of the remaining terms and provisions shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular provision held to be invalid.

B.9 ACCESS TO RECORDS

B.9.1 Contractor shall keep, at all times on the Work site, one record copy of the complete Contract Documents, including the Plans, Specifications, Construction Change Directives and addenda, in good order and marked currently to record field changes and selections made during construction, and one record copy of Shop Drawings, Product Data, Samples and similar submittals, and shall at all times give the Owner access thereto.

B.9.2 Contractor shall retain and the Owner and its duly authorized representatives shall have access, for a period not less than ten (10) years, to all Record Documents, financial and accounting records, and other books, documents, papers and records of Contractor which are pertinent to the Contract, including records pertaining to Overhead and indirect costs, for the purpose of making audit, examination, excerpts and transcripts. If for any reason, any part of the Work or this Contract shall be subject to litigation, Contractor shall retain all such records until all litigation is resolved and Contractor shall continue to provide Owner and/or its agents with full access to such records until such time as all litigation is complete and all periods for appeal have expired and full and final satisfaction of any judgment, order or decree is recorded and Owner receives a record copy of documentation from Contractor.

B.10 WAIVER

Failure of the Owner to enforce any provision of this Contract shall not constitute a waiver or relinquishment by the Owner of the right to such performance in the future nor of the right to enforce any other provision of this Contract.

B.11 SUBCONTRACTS AND ASSIGNMENT

B.11.1 Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound by the terms and conditions of these OUS Retainer General Conditions, and to assume toward the Contractor all of the obligations and responsibilities which the Contractor assumes toward the Owner thereunder, unless (1) the same are clearly inapplicable to the subcontract at issue because of legal requirements or industry practices, or (2) specific exceptions are requested by Contractor and approved in writing by Owner. Where appropriate, Contractor shall require each Subcontractor to enter into similar agreements with sub-subcontractors at any level.

B.11.2 At Owner's request, Contractor shall submit to Owner prior to their execution either Contractor's form of subcontract, or the subcontract to be executed with any particular Subcontractor. If Owner disapproves such form, Contractor shall not execute the form until the matters disapproved are resolved to Owner's satisfaction. Owner's review, comment upon or approval of any such form shall not relieve Contractor of its obligations under this Agreement or be deemed a waiver of such obligations of Contractor.

B.11.3 Contractor shall not assign, sell, or transfer its rights, or delegate its responsibilities under this Contract, in whole or in part, without the prior written approval of the Owner. No such written approval shall relieve Contractor of any obligations of this Contract, and any transferee shall be considered the agent of the Contractor and bound to perform in accordance with the Contract Documents. Contractor shall remain liable as between the original parties to the Contract as if no assignment had occurred.

B.12 SUCCESSORS IN INTEREST

The provisions of this Contract shall be binding upon and shall accrue to the benefit of the parties to the Contract and their respective permitted successors and assigns.

B.13 OWNER'S RIGHT TO DO WORK

Owner reserves the right to perform other or additional work at or near the project site with other forces than those of the Contractor. If such work takes place within or next to the project site, Contractor shall coordinate work with the other contractors or forces, cooperate with all

other contractors or forces, carry out the Work in a way that will minimize interference and delay for all forces involved, place and dispose of materials being used so as not to interfere with the operations of another, and join the Work with the work of the others in an acceptable manner and perform it in proper sequence to that of the others. The Owner will resolve any disagreements that may arise between or among Contractor and the other contractors over the method or order of doing all work (including the Work). In case of unavoidable interference, the Owner will establish work priority (including the Work) which generally will be in the sequence that the contracts were awarded.

B.14 OTHER CONTRACTS

In all cases and at any time, the Owner has the right to execute other contracts related to or unrelated to the Work of this Contract. The Contractor of this Contract shall fully cooperate with any and all other contractors without additional cost to the Owner in the manner described in section B.13.

B.15 GOVERNING LAW

This Contract shall be governed by and construed in accordance with the laws of the State of Oregon without regard to principles of conflict of laws.

B.16 LITIGATION

Any Claim between Owner and Contractor that arises from or relates to this Contract and that is not resolved through the Claims Review Process in Section D.3 shall be brought and conducted solely and exclusively within the Circuit Court of Marion County for the State of Oregon; provided, however, if a Claim must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this section be construed as a waiver by the State of Oregon of any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. CONTRACTOR, BY EXECUTION OF THIS CONTRACT, HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION B.16.

B.17 ALLOWANCES

B.17.1 The Contractor shall include in the Contract Price 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.

B.17.2 Unless otherwise provided in the Contract Documents:

(a) when finally reconciled, allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

(b) 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 Price but not in the allowances;

(c) whenever costs are more than or less than allowances, the Contract Price shall be adjusted accordingly by Amendment. The amount of the Amendment shall reflect (i) the difference between actual costs and the allowances under Section B.17.2(a) and (2) changes in Contractor's costs under Section B.17.2(b).

(d) Unless Owner requests otherwise, Contractor shall provide to Owner a proposed fixed price for any allowance work prior to its performance.

B.18 SUBMITTALS, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

B.18.1 The Contractor shall prepare and keep current, for the Architect's/Engineer's approval (or for the approval of Owner if approval authority has not been delegated to the Architect/Engineer), a schedule and list of submittals which is coordinated with the Contractor's construction schedule and allows the Architect/Engineer reasonable time to review submittals. Owner reserves the right to finally approve the schedule and list of submittals. Submittals include, without limitation, Shop Drawings, Product Data, and Samples which are described below:

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

(b) 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.

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

B.18.2 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 of submittals by the Architect/Engineer 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, or for approval of safety precautions or, unless otherwise specifically stated by the Architect/Engineer, of any construction means, methods, techniques, sequences or procedures, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect/Engineer's review of the Contractor's submittals shall not relieve the Contractor of its obligations under the Contract Documents. The Architect/Engineer's approval of a specific item shall not indicate approval of an assembly of which the item is a component. Informational submittals upon which the Architect/Engineer 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 Architect/Engineer without action.

B.18.3 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect/Engineer 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 Architect/Engineer without action.

B.18.4 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.

B.18.5 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 Architect/Engineer.

B.18.6 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 the Architect/Engineer's review or approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect/Engineer in writing of such deviation at the time of submittal and (i) the Architect/Engineer has given written approval to the specific deviation as a minor change in the Work, or (ii) a Supplement Amendment or Construction Change Directive has been executed by Owner 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 Architect/Engineer's review or approval thereof.

B.18.7 In the event that Owner elects not to have the obligations and duties described under this Section B.18 performed by the Architect/Engineer, or in the event no Architect/Engineer is employed by Owner on the project, all obligations and duties assigned to the Architect/Engineer hereunder shall be performed by the Owner.

B.19 SUBSTITUTIONS

The Contractor may make Substitutions only with the consent of the Owner, after evaluation by the Owner and only in accordance with a Supplement Amendment or Construction Change Directive. Substitutions shall be subject to the requirements of the bid documents. By making requests for Substitutions, the Contractor: represents that the Contractor has personally investigated the proposed substitute product; represents that the Contractor will provide the same warranty for the Substitution that the Contractor would for the product originally specified unless approved otherwise; certifies that the cost data presented is complete and includes all related costs under this Contract including redesign costs, and waives all claims for additional costs related to the Substitution which subsequently become apparent; and will coordinate the installation of the accepted Substitution, making such changes as may be required for the Work to be completed in all respects.

B.20 USE OF PLANS AND SPECIFICATIONS

Plans, Specifications and related Contract Documents furnished to Contractor by Owner or Owner's Architect/Engineer shall be used solely for the performance of the Work under this Contract. Contractor and its Subcontractors and suppliers are authorized to use and reproduce applicable portions of such documents appropriate to the execution of the Work, but shall not claim any ownership or other interest in them beyond the scope of this Contract, and no such interest shall attach. Unless otherwise indicated, all common law, statutory and other reserved rights, in addition to copyrights, are retained by Owner.

B.21 FUNDS AVAILABLE AND AUTHORIZED

Owner reasonably believes at the time of entering into this Contract that sufficient funds are available and authorized for expenditure to finance the cost of this Contract within the Owner's appropriation or limitation. Contractor understands and agrees that, to the extent that sufficient funds are not available and authorized for expenditure to finance the cost of this Contract, Owner's payment of amounts under this Contract attributable to Services performed after the last day of the current biennium is contingent on Owner receiving from the Oregon Legislative Assembly appropriations, limitations or other expenditure authority sufficient to allow Owner, in the exercise of its reasonable administrative discretion, to continue to make payments under this Contract.

B.22 NO THIRD PARTY BENEFICIARIES

Owner and Contractor are the only parties to this Contract and are the only parties entitled to enforce its terms. Nothing in this Contract gives, is intended to give, or shall be construed to give or provide any benefit or right, whether directly, indirectly, or otherwise, to third persons unless such third persons are individually identified by name herein and expressly described as intended beneficiaries of the terms of this Contract.

SECTION C
WAGES AND LABOR

C.1 MINIMUM WAGE RATES ON PUBLIC WORKS

Contractor shall comply fully with the provisions of ORS 279C.800 through 279C.870. Documents establishing those conditions, as determined by the Commissioner of the Bureau of Labor and Industries (BOLI), are included as attachments to or are incorporated by reference in the Contract Documents. Pursuant to ORS 279C.830(1)(d), Contractor shall pay workers at not less than the specified minimum hourly rate of wage, and shall include that requirement in all subcontracts. If the Work is subject to both the state prevailing wage rate law and the federal Davis-Bacon Act, Contractor shall pay the higher of the applicable state or federal prevailing rate of wage. Contractor shall provide written notice to all workers of the number of hours per day and days per week such workers may be required to work.

C.2 PAYROLL CERTIFICATION AND FEE REQUIREMENTS

C.2.1 In accordance with ORS 279C.845, the Contractor and every Subcontractor shall submit written certified statements to the Owner, on the form prescribed by the Commissioner of the Bureau of Labor and Industries, certifying the hourly rate of wage paid each worker which the Contractor or the Subcontractor has employed on the project and further certifying that no worker employed on the project 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 the Contractor or the Subcontractor that the Contractor or Subcontractor has read the certified statement, that the Contractor or Subcontractor knows the contents of the certified statement, and, that to the Contractor's or Subcontractor's best knowledge and belief, the certified statement is true. 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. Certified statements for each week during which the Contractor or Subcontractor has employed a worker on the project shall be submitted once a month, by the fifth business day of the following month. The Contractor and Subcontractors shall preserve the certified statements for a period of ten (10) years from the date of completion of the Contract.

C.2.2 Pursuant to ORS 279C.845(7),the Owner shall retain 25 percent of any amount earned by the Contractor on this public works project until the Contractor has filed the certified statements required by section C.2.1. The Owner shall pay to the Contractor the amount retained under this subsection within 14 days after the Contractor files the required certified statements, regardless of whether a Subcontractor has failed to file certified statements.

C.2.3 Pursuant to ORS 279C.845(8), the Contractor shall retain 25 percent of any amount earned by a first-tier Subcontractor on this public works project until the first-tier Subcontractor has

filed with the Owner the certified statements required by C.2.1. Before paying any amount retained under this subsection, the Contractor shall verify that the first-tier Subcontractor has filed the certified statement. Within 14 days after the first-tier Subcontractor files the required certified statement the Contractor shall pay the first-tier Subcontractor any amount retained under this subsection.

C.2.4 In accordance with statutory requirements and administrative rules promulgated by the Commissioner of the Bureau of Labor and Industries, the fee required by ORS 279C.825(1) will be paid by Owner to the Commissioner.

C.3 PROMPT PAYMENT AND CONTRACT CONDITIONS

C.3.1 As a condition to Owner's performance hereunder, the Contractor shall:

C.3.1.1 Make payment promptly, as due, to all persons supplying to Contractor labor or materials for the prosecution of the Work provided for in this Contract.

C.3.1.2 Pay all contributions or amounts due the State Industrial Accident Fund from such Contractor or Subcontractor incurred in the performance of the Contract.

C.3.1.3 Not permit any lien or claim to be filed or prosecuted against the Owner on account of any labor or material furnished. Contractor will not assign any claims that Contractor has against Owner, or assign any sums due by Owner, to Subcontractors, suppliers, or manufacturers, and will not make any agreement or act in any way to give Subcontractors a claim or standing to make a claim against the Owner.

C.3.1.4 Pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167.

C.3.2 As a condition to Owner's performance hereunder, if Contractor fails, neglects or refuses to make prompt payment of any claim for labor or services furnished to the Contractor of a Subcontractor by any person in connection with the project as such claim becomes due, the proper officer(s) representing the Owner may pay the claim and charge the amount of the payment against funds due or to become due Contractor under this Contract. Payment of claims in this manner shall not relieve the Contractor or the Contractor's surety from obligation with respect to any unpaid claims.

C.3.3 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, 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 public contracting agency under such contract.

C.3.4 All employers, including Contractor, that employ subject workers who work under this contract in the State of Oregon shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. Contractor shall ensure that each of its Subcontractors complies with these requirements.

C.4 PAYMENT FOR MEDICAL CARE

As a condition to Owner's performance hereunder, Contractor shall promptly, as due, make payment to any person, 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, all sums of which the Contractor agrees to pay for such services and all moneys and sums which the Contractor has collected or deducted from the wages of personnel pursuant to any law, contract or agreement for the purpose of providing or paying for such services.

C.5 HOURS OF LABOR

As a condition to Owner's performance hereunder, no person shall be employed to perform Work under this Contract for more than ten (10) hours in any one day or forty (40) hours in any one week, except in cases of necessity, emergency or where public policy absolutely requires it. In such instances, Contractor shall pay the employee at least time and a half pay:

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

(b) For all overtime in excess of ten (10) hours a day or forty (40) hours in any one week when the work week is four consecutive Days, Monday through Friday; and

(c) For all Work performed on Saturday and on any legal holiday specified in ORS 279C.540.

This section C.5 will not apply to Contractor's Work under this Contract to the extent Contractor is currently a party to a collective bargaining agreement with any labor organization.

This Section C.5 shall not excuse Contractor from completion of the Work within the time required under this Contract.

SECTION D
CHANGES IN THE WORK

D.1 CHANGES IN WORK

D.1.1 The terms of this Contract shall not be waived, altered, modified, supplemented or amended in any manner whatsoever, without prior written agreement and then only after any necessary approvals have been obtained. A Supplement or Amendment is required, which shall not be effective until its execution by the parties to this Contract and all approvals required by public contracting laws have been obtained.

D.1.2 It is mutually agreed that changes in Plans, quantities, or details of construction are inherent in the nature of construction and may be necessary or desirable during the course of construction. Within the general scope of this Contract, the Owner may at any time, without notice to the sureties and without impairing the Contract, require changes consistent with this Section D.1. All changes to the Work shall be documented and Amendments shall be executed under the conditions of the Contract Documents. Such changes may include, but are not limited to:

(a) Modification of specifications and design.
(b) Increases or decreases in quantities.
(c) Increases or decreases to the amount of Work.
(d) Addition or elimination of any Work item.
(e) Change in the duration of the project.
(f) Acceleration or delay in performance of Work.
(g) Deductive changes.

Deductive changes are those that reduce the scope of the Work, and shall be made by mutual agreement whenever feasible. In cases of suspension or partial termination under Section J, Owner reserves the right to unilaterally impose a deductive change and to self perform such Work, for which the provisions of B.13 (Owner's Right to Do Work) shall then apply. Adjustments in compensation shall be made under the provisions of D.1.3, in which costs for deductive changes shall be based upon a Direct Costs adjustment together with the related

percentage markup specified for profit, Overhead and other indirect costs, unless otherwise agreed to by Owner.

D.1.3 The Owner and Contractor agree that adjustments to or deletions from the Work shall be administered and compensated according to the following:

(a) Unit pricing may be utilized at the Owner's option when unit prices or solicitation alternates were provided that established the cost for adjustments to Work, and a binding obligation exists under the Contract on the parties covering the terms and conditions of the adjustment to Work.

(b) If the Owner elects not to utilize unit pricing, or in the event that unit pricing is not available or appropriate, fixed pricing may be used for adjustments to or deletions from the Work. In fixed pricing the basis of payments or total price shall be agreed upon in writing between the parties to the Contract, and shall be established before the Work is done whenever feasible. Notwithstanding the foregoing, the mark-ups set forth in D.1.3(c) shall be utilized in establishing fixed pricing, and such mark-ups shall not be exceeded. Cost and price data relating to adjustments to or deletions from the Work shall be supplied by Contractor to Owner upon request, but Owner shall be under no obligation to make such requests.

(c) In the event that unit pricing and fixed pricing are not utilized, then adjustments to or deletions from the Work shall be performed on a cost reimbursement basis for Direct Costs. Such Work shall be compensated on the basis of the actual, reasonable and allowable cost of labor, equipment, and material furnished on the Work performed. In addition, the following markups shall be added to the Contractor's or Subcontractor's Direct Costs as full compensation for profit, Overhead and other indirect costs for Work directly performed with the Contractor's or Subcontractor's own forces:

On Labor.....	15%
On Equipment.....	10%
On Materials.....	10%

(d) When adjustments to or deletions from the Work under D.1.3(c) are invoiced by an authorized Subcontractor at any level, each ascending tier Subcontractor or Contractor will be allowed a supplemental mark-up on each piece of subcontract Work covered by a an Amendment as follows:

$0.00 - $5,000.00	10%, and then
Over $5,000.00	5%

Payments made to the Contractor shall be complete compensation for Overhead, profit, and all costs that were incurred by the Contractor or by other forces furnished by the Contractor, including Subcontractors, for adjustments to or deletions from the Work pursuant to a Supplement Amendment. Owner may establish a maximum cost for additional Work under this Section D.1.3, which shall not be exceeded for reimbursement without additional written authorization from Owner in the form of a Supplement Amendment. Contractor shall not be required to complete such additional Work without additional authorization.

D.1.4 Any necessary adjustment of Contract Time that may be required as a result of adjustments to or deletions from the Work must be agreed upon by the parties before the start of the revised Work unless Owner authorizes Contractor to start the revised Work before agreement on Contract Time adjustment. Contractor shall submit any request for additional compensation (and additional Contract Time if Contractor was authorized to start Work before an adjustment of Contract Time was approved) as soon as possible but no later than thirty (30) Days after receipt of Owner's request for additional Work . If Contractor's request for additional compensation or adjustment of Contract Time is not made within the thirty (30) Day time limit, Contractor's requests pertaining to that additional Work shall be barred. The thirty (30) Day time limit for making requests shall not be extended for any reason, including without limitation Contractor's claimed inability to determine the amount of additional compensation or adjustment of Contract Time, unless an extension is granted in writing by Owner. If the Owner denies Contractor's request for additional compensation or adjustment of Contract Time, Contractor may proceed to file a Claim under Section D.3, Claims Review Process. No other reimbursement, compensation, or payment will be made, except as provided in Section D.1.5 for impact claims.

D.1.5 If any adjustment to Work under Section D.1.3 causes an increase or decrease in the Contractor's cost of, or the Contract Time required for the performance of any other part of the Work under this Contract, Contractor shall submit a written request to the Owner, setting forth the nature and specific extent of the request, including all time and cost impacts against the Contract as soon as possible, but no later than thirty (30) Days after receipt of Owner's request for adjustments to or deletions from the Work by Contractor.

The thirty (30) Day time limit applies to claims of Subcontractors, suppliers, or manufacturers who may be affected by Owner's request for adjustments to or deletions from the Work and who request additional compensation or an extension of Contract Time to perform; Contractor has responsibility for contacting its Subcontractors, suppliers, or manufacturers within the thirty (30) Day time limit, and including their requests with Contractor's requests. If the request involves Work to be completed by Subcontractors, or materials to be furnished by suppliers or manufacturers, such requests shall be submitted to the Contractor in writing with full analysis and justification for the adjustments to compensation and Contract Time requested. The Contractor shall analyze and evaluate the merits of the requests submitted by Subcontractors, suppliers, and manufacturers to Contractor prior to including those requests and Contractor's analysis and evaluation of those requests with Contractor's requests for adjustments to compensation or Contract Time that Contractor submits to the Owner. Failure of Subcontractors, suppliers, manufacturers or others to submit their requests to Contractor for inclusion with Contractor's requests submitted to Owner within the time period and by the means described in this section shall constitute a waiver of these Subcontractor claims. The Owner will not consider direct requests or claims from Subcontractors, suppliers, manufacturers or others not a party to this Contract. The consideration of such requests and claims under this section does not give any Person, not a party to the Contract the right to bring a claim against Owner, whether in this claims process, in litigation, or in any dispute resolution process.

If the Owner denies the Contractor's request for adjustment to compensation or Contract Time, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process.

D.1.6 No request or Claim by the Contractor for additional costs or an adjustment of Contract Time shall be allowed if made after receipt of final payment application under this Contract. Final payment application must be made by Contractor within the time required under Section E.6.4.

D.1.7 It is understood that changes in the Work are inherent in construction of this type. The number of changes, the scope of those changes, and the effect they have on the progress of the original Work cannot be defined at this time. The Contractor is notified that numerous changes may be required and that there will be no compensation made, unless and only to the extent otherwise provided in the Contract Documents, to the Contractor

directly related to the number of changes. Each change will be evaluated for extension of Contract Time and increase or decrease in compensation based on its own merit.

D.2 DELAYS

D.2.1 Delays in construction include "Avoidable Delays", which are defined in Section D.2.1.1, and "Unavoidable Delays", which are defined in Section D.2.1.2. The effect of Avoidable Delays is described in Section D.2.2 and the effect of Unavoidable Delays is described in Section D.2.3.

D.2.1.1 Avoidable Delays include any delays other than Unavoidable Delays, and include delays that otherwise would be considered Unavoidable Delays but that:

(a) Could have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor or its Subcontractors.

(b) Affect only a portion of the Work and do not necessarily prevent or delay the prosecution of neither other parts of the Work nor the completion of the whole Work within the Contract Time.

(c) Do not impact activities on the accepted critical path schedule.

(d) Are associated with the reasonable interference of other contractors employed by the Owner that do not necessarily prevent the completion of the whole Work within the Contract Time.

D.2.1.2 Unavoidable Delays include delays other than Avoidable Delays that are:

(a) To the extent caused by any actions of the Owner, or any other employee or agent of the Owner, or by separate contractor employed by the Owner.

(b) To the extent caused by any site conditions which differ materially from what was represented in the Contract Documents or from conditions that would normally be expected to exist and be inherent to the construction activities defined in the Contract Documents. The Contractor shall notify the Owner immediately of differing site conditions before the area has been disturbed. The Owner will investigate the area and make a determination as to whether or not the conditions differ materially from either the conditions stated in the Contract Documents or those which could reasonably be expected in execution of this particular Contract. If Contractor and the Owner agree that a differing site condition exists, any adjustment to compensation or Contract Time will be determined based on the process set forth in Section D.1.5 for adjustments to or deletions from Work. If the Owner disagrees that a differing site condition exists and denies Contractor's request for additional compensation or Contract Time, Contractor may proceed to file a Claim under Section D.3, Claims Review Process.

(c) To the extent caused by Force Majeure acts, events or occurrences that could not have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor or its Subcontractors.

(d) To the extent caused by adverse weather conditions. Any adverse weather conditions must be substantiated by documentary evidence that weather conditions were abnormal for the specific time period claimed, could not have been anticipated by the Contractor, and adversely impacted the project in a manner that could not be avoided by rescheduling the Work or by implementing measures to protect against the weather so that the Work could proceed. A rain, windstorm, high water, or other natural phenomenon for the specific locality of the Work, which might reasonably have been anticipated from the previous 10-year historical records of the general locality of the Work, shall not be construed as abnormal. The parties agree that rainfall greater than the following levels cannot be reasonably anticipated:

(i) Daily rainfall equal to, or greater than, 0.50 inch during a month when the monthly rainfall exceeds the normal monthly average by twenty-five percent (25 %) or more.

(ii) daily rainfall equal to, or greater than, 0.75 inch at any time.

The Office of the Environmental Data Service of the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce nearest the project site shall be considered the official agency of record for weather information.

D.2.2 Contractor shall not be entitled to additional compensation or additional Contract Time for Avoidable Delays.

D.2.3 In the event of Unavoidable Delays, based on principles of equitable adjustment, Contractor may be entitled to the following:

(a) Contractor may be entitled to additional compensation or additional Contract Time, or both, for Unavoidable Delays described in Section D.2.1.2 (a) and (b).

(b) Contractor may be entitled to additional Contract Time for Unavoidable Delays described in Section D.2.1.2(c) and (d).

In the event of any requests for additional compensation or additional Contract Time, or both, as applicable, arising under this Section D.2.3 for Unavoidable Delays, other than requests for additional compensation or additional Contract Time for differing site conditions for which a review process is established under Section D.2.1.2 (b), Contractor shall submit a written notification of the delay to the Owner within two (2) Days of the occurrence of the cause of the delay. This written notification shall state the cause of the potential delay, the project components impacted by the delay, and the anticipated additional Contract Time extension or the additional compensation, or both, as applicable, resulting from the delay. Within seven (7) Days after the cause of the delay has been mitigated, or in no case more than thirty (30) Days after the initial written notification, the Contractor shall submit to the Owner, a complete and detailed request for additional compensation or additional Contract Time, or both, as applicable, resulting from the delay. If the Owner denies Contractor's request for additional compensation or adjustment of Contract Time, the Contractor may proceed to file a Claim under Section D.3, Claims Review Process.

If Contractor does not timely submit the notices required under this Section D.2, then unless otherwise prohibited by law, Contractor's Claim shall be barred.

D.3 CLAIMS REVIEW PROCESS

D.3.1 All Contractor Claims shall be referred to the Owner for review. Contractor's Claims, including Claims for adjustments to compensation or Contract Time, shall be submitted in writing by Contractor to the Owner within five (5) Days after a denial of Contractor's initial request for an adjustment of Contract terms, payment of money, extension of Contract Time or other relief, provided that such initial request has been submitted in accordance with the requirements and within the time limits

established in these OUS Retainer General Conditions. Within thirty (30) Days after the initial Claim, Contractor shall submit to the Owner a complete and detailed description of the Claim (the "Detailed Notice") that includes all information required by Section D.3.2. Unless the Claim is made in accordance with these time requirements, it shall be waived by Contractor.

D.3.2 The Detailed Notice of the Claim shall be submitted in writing by Contractor and shall include a detailed, factual statement of the basis of the Claim, pertinent dates, Contract provisions which support or allow the Claim, reference to or copies of any documents which support the Claim, the dollar value of the Claim, and the Contract Time adjustment requested for the Claim. If the Claim involves Work to be completed by Subcontractors, the Contractor will analyze and evaluate the merits of the Subcontractor claim prior to forwarding it and that analysis and evaluation to the Owner. The Owner will not consider direct claims from Subcontractors, suppliers, manufacturers, or others not a party to this Contract. Contractor agrees that it will make no agreement, covenant, or assignment, nor will it commit any other act that will permit or assist any Subcontractor, supplier, manufacturer, or other to directly or indirectly make a claim against Owner.

D.3.3 The Owner will review all Claims and take one or more of the following preliminary actions within ten (10) Days of receipt of the Detailed Notice of a Claim: (1) request additional supporting information from the Contractor; (2) inform the Contractor and Owner in writing of the time required for adequate review and response; (3) reject the Claim in whole or in part and identify the reasons for rejection; (4) based on principles of equitable adjustment, recommend approval of all or part of the Claim; or (5) propose an alternate resolution.

D.3.4 The Owner's decision shall be final and binding on the Contractor unless appealed by written notice to the Owner within fifteen (15) Days of receipt of the decision. The Contractor must present written documentation supporting the Claim within fifteen (15) Days of the notice of appeal. After receiving the appeal documentation, the Owner shall review the materials and render a decision within thirty (30) Days after receiving the appeal documents.

D.3.5 The decision of the Owner shall be final and binding unless the Contractor delivers to the Owner its request for mediation, which shall be a non-binding process, within fifteen (15) Days of the date of the Owner's decision. The mediation process will be considered to have commenced as of the date the Contractor delivers the request. Both parties acknowledge and agree that participation in mediation is a prerequisite to commencement of litigation of any disputes relating to the Contract. Both parties further agree to exercise their best efforts in good faith to resolve all disputes within sixty (60) Days of the commencement of the mediation through the mediation process set forth herein.

In the event that a lawsuit must be filed within this sixty (60) Day period in order to preserve a cause of action, the parties agree that, notwithstanding the filing, they shall proceed diligently with the mediation to its conclusion prior to actively prosecuting the lawsuit, and shall seek from the Court in which the lawsuit is pending such stays or extensions, including the filing of an answer, as may be necessary to facilitate the mediation process. Further, in the event settlements are reached on any issues through mediation, the plaintiff shall promptly cause to be entered by the Court a stipulated general judgment of dismissal with prejudice, or other appropriate order limiting the scope of litigation as provided in the settlement.

D.3.6 Should the parties arrive at an impasse regarding any Claims or disputed Claims, it is agreed that the parties shall participate in mediation as specified in Section D.3.5. The mediation process will be considered to have been commenced as of the date one party delivers to the other its request in writing to mediate. The mediator shall be an individual mutually acceptable to both parties, but in the absence of agreement each party shall select a temporary mediator and the temporary mediators shall jointly select the permanent mediator. Each party shall pay its own costs for the time and effort involved in mediation. The cost of the mediator shall be split equally between the two parties. Both parties agree to exercise their best effort in good faith to resolve all disputes in mediation. Participation in mediation is a mandatory requirement of both the Owner and the Contractor. The schedule, time and place for mediation will be mutually acceptable, or, failing mutual agreement, shall be as established by the mediator. The parties agree to comply with Owner's administrative rules governing the confidentiality of mediation, if any, and shall execute all necessary documents to give effect to such confidentiality rules. In any event, the parties shall not subpoena the mediator or otherwise require the mediator to produce records, notes or work product, or to testify in any future proceedings as to information disclosed or representations made in the course of mediation, except to the extent disclosure is required by law.

D.3.7 Unless otherwise directed by Owner, Contractor shall proceed with the Work while any Claim, or mediation or litigation arising from a Claim, is pending. Regardless of the review period or the final decision of the Owner, the Contractor shall continue to diligently pursue the Work as identified in the Contract Documents. In no case is the Contractor justified or allowed to cease or Delay Work, in whole or in part, without a written stop work order from the Owner.

SECTION E
PAYMENTS

E.1 SCHEDULE OF VALUES

The Contractor shall submit, at least ten (10) Days prior to submission of its first application for progress payment, a schedule of values ("Schedule of Values") for the contracted Work. This schedule shall provide a breakdown of values for the contracted Work and will be the basis for progress payments. The breakdown shall demonstrate reasonable, identifiable, and measurable components of the Work. Unless objected to by the Owner, this schedule shall be used as the basis for reviewing Contractor's applications for payment. If objected to by Owner, Contractor shall revise the schedule of values and resubmit the same for approval of Owner.

E.2 APPLICATIONS FOR PAYMENT

E.2.1 Owner shall make progress payments on the Contract monthly as Work progresses, in accordance with the requirements of this Section E.2. Applications for payment shall be based upon estimates of Work completed and the Schedule of Values. As a condition precedent to Owner's obligation to pay, all applications for payment shall be approved by the Owner. A progress payment shall not be considered acceptance or approval of any Work or waiver of any defects therein. Owner shall pay to Contractor interest for overdue invoices at the rate of two-thirds of one percent per month on the progress payment, not including retainage, due the Contractor. Overdue invoices will be those that have not been paid within forty five (45) days from the latest of:

(a) The date of the receipt of the accurate invoice;

(b) The date Owner receives the correct application for payment if no invoice is received;

(c) The date all goods and services have been received; or

(d) The date a Claim is made certain by agreement of the parties or by operation of law.

Notwithstanding the foregoing, in instances when an application for payment is filled out incorrectly, or when there is any defect or impropriety in any submitted application or when there is a good faith dispute, Owner shall so notify the Contractor within fifteen (15) Days stating the reason or reasons the application for payment is defective or improper or the reasons for the dispute. A defective or improper application for payment, if corrected by the Contractor within seven (7) Days of being notified by the Owner, shall not cause a payment to be made later than specified in this section unless interest is also paid. Payment of interest will be postponed when payment on the principal is delayed because of disagreement between the Owner and the Contractor.

Owner reserves the right, instead of requiring the Contractor to correct or resubmit a defective or improper application for payment, to reject the defective or improper portion of the application for payment and pay the remainder of the application for such amounts which are correct and proper.

Owner, upon written notice to the Contractor, may elect to make payments to the Contractor only by means of Electronic Funds Transfers (EFT) through Automated Clearing House (ACH) payments. If Owner makes this election, the Contractor shall arrange for receipt of the EFT/ACH payments.

E.2.2 Contractor shall submit to the Owner an application for each payment and, if required, receipts or other vouchers showing payments for materials and labor including payments to Subcontractors. Contractor shall include in its application for payment a schedule of the percentages of the various parts of the Work completed, based on the Schedule of Values which shall aggregate to the payment application total, and shall include, on the face of each copy thereof, a certificate in substantially the following form:

"I, the undersigned, hereby certify that the above bill is true and correct, and the payment therefore, has not been received.

Signed: _____
Dated: _____"

E.2.3 Generally, applications for payment will be accepted only for materials that have been installed. Under special conditions, applications for payment for stored materials will be accepted at Owner's sole discretion. Such a payment, if made, will be subject to the following conditions:

(a) The request for stored material shall be submitted at least thirty (30) Days in advance of the application for payment on which it appears. Applications for payment shall be entertained for major equipment, components or expenditures only.

(b) The Contractor shall submit applications for payment showing the quantity and cost of the material stored.

(c) The material shall be stored in a bonded warehouse and Owner shall be granted the right to access the material for the purpose of removal or inspection at any time during the Contract Period.

(d) The Contractor shall name the Owner as co-insured on the insurance policy covering the full value of the property while in the care and custody of the Contractor until it is installed. A certificate noting this coverage shall be issued to the Owner.

(e) Payments shall be made for materials and equipment only. The submitted amount in the application for payment shall be reduced by the cost of transportation from the storage site to the project site and for the cost of an inspector to verify delivery and condition of the goods at the storage site. The cost of storage and inspection shall be borne solely by the Contractor.

(f) Within sixty (60) Days of the application for payment, the Contractor shall submit evidence of payment covering the material and/or equipment stored and of payment for the storage site.

(g) Payment for stored materials and/or equipment shall in no way indicate acceptance of the materials and/or equipment or waive any rights under this Contract for the rejection of the Work or materials and/or equipment not in conformance with the Contract Documents.

(h) All required documentation shall be submitted with the respective application for payment.

E.2.4 The Owner reserves the right to withhold all or part of a payment, or may nullify in whole or part any payment previously made, to such extent as may be necessary in the Owner's opinion to protect the Owner from loss because of:

(a) Work that is defective and not remedied, or that has been demonstrated or identified as failing to conform with Applicable Laws or the Contract Documents,

(b) third party claims filed or evidence reasonably indicating that such claims will likely be filed unless security acceptable to the Owner is provided by the Contractor;

(c) failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment (in which case Owner may issue checks made payable jointly to Contractor and such unpaid Persons under this provision, or directly to Subcontractors and suppliers at any level under Section C.3.2.1);

(d) reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Price;

(e) damage to the Work, Owner or another contractor;

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

(g) failure to carry out the Work in accordance with the Contract Documents; or

(h) assessment of liquidated damages, when withholding is made for offset purposes.

E.2.5 Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

(a) Take that portion of the Contract Price properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Price allocated to that portion of the Work in the Schedule of Values, less retainage as provided in Section E.5. Pending final determination of cost to the Owner of changes in the Work, no amounts for changes in the Work can be included in applications for payment until the Contract Price has been adjusted by a Supplement Amendment;

(b) Add that portion of the Contract Price 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 pursuant to Section E.2.3, suitably stored off the site at a location agreed upon in writing), less retainage as provided in Section E.5;

(c) Subtract the aggregate of previous payments made by the Owner; and

(d) Subtract any amounts for which the Owner has withheld or nullified payment as provided in the Contract Documents.

E.2.6 Contractor's applications for payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier.

E.2.7 The Contractor warrants to Owner 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 payments are received from the Owner shall be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided financing, labor, materials and equipment relating to the Work.

E.2.8 If Contractor disputes any determination by Owner with regard to any application for payment, Contractor nevertheless shall continue to expeditiously perform the Work. No payment made hereunder shall be or be construed to be final acceptance or approval of that portion of the Work to which such partial payment relates or shall relieve Contractor of any of its obligations hereunder.

E.2.9 Contractor shall submit its initial MWESB Report within ten (10) Days of Contractor's execution of the Contract.. Contractor shall submit annual MWESB Reports on June 30 of each year the Contract is active. Contracts - first executed by Contractor within ninety (90) Days before June 30 of the year of execution by Contractor may at the discretion of Owner be exempt from submitting the annual MWESB Report otherwise due on that June 30. The final MWESB Report shall be filed with the application for final payment. Timely receipt of MWESB Reports by Owner shall be a condition precedent to Owner's obligation to pay any progress payments or final payment otherwise due.

E.3 PAYROLL CERTIFICATION REQUIREMENT

Owner's receipt of payroll certification pursuant to Section C.2 of this Contract shall be a condition precedent to Owner's obligation to pay any progress payments or final payment otherwise due.

E.4 DUAL PAYMENT SOURCES

Contractor shall not be compensated for Work performed under this Contract from any state agency other than the agency that is a party to this Contract.

E.5 RETAINAGE

E.5.1 Retainage shall be withheld and released in accordance with the requirements set forth in OAR 580-063-0045.

E.5.1.1 Owner may reserve as retainage from any progress payment an amount not to exceed five percent of the payment. As Work progresses, Owner may reduce the amount of retainage on or may eliminate retainage on any remaining monthly Contract payments after 50 percent of the Work under the Contract is completed if, in the Owner's discretion, 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 Contractor's surety; except that when the 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 written application by the Contractor, Owner shall respond in writing within a reasonable time.

E.5.1.2 Contractor may request in writing:

(a) to be paid amounts which would otherwise have been retained from progress payments where Contractor has deposited acceptable bonds and securities of equal value with Owner or in a custodial account or other mutually-agreed account satisfactory to Owner, with an approved bank or trust company to be held in lieu of the cash retainage for the benefit of Owner;

(b) for construction projects over $1,000,000, that retainage be deposited in an interest bearing account, established through the State Treasurer for state agencies, in a bank, savings bank, trust company or savings association for the benefit of Owner, with earnings from such account accruing to the Contractor; or

(c) that the Owner allow Contractor to deposit a surety bond for the benefit of Owner, in a form acceptable to Owner, in lieu of all or a portion of funds retained, or to be retained. Such bond and any proceeds therefrom shall be made subject to all claims in the manner and priority as set forth for retainage.

When the Owner has accepted the Contractor's election of option (a) or (b), Owner may recover from Contractor any additional costs incurred through such election by reducing Contractor's final payment. Where the Owner has agreed to Contractor's request for option (c), Contractor shall accept like bonds from Subcontractors and suppliers on the project from which Contractor has required retainages.

E. 5.1.3 The retainage held by Owner shall be included in and paid to the Contractor as part of the final payment of the Contract Price. The Owner shall pay to Contractor interest at the rate of two-thirds of one percent per month on the final payment due Contractor, interest to commence forty five (45) Days after the date which Owner receives Contractor's final approved application for payment and Work under the Contract has been completed and accepted and to run until the date when final payment is tendered to Contractor. The Contractor shall notify Owner in writing when the Contractor considers the Work complete and deliver to Owner its final application for payment and Owner shall, within fifteen (15) Days after receiving the written notice and the application for payment, either accept the Work or notify the Contractor of Work yet to be performed on the Contract. If Owner does not within the time allowed notify the Contractor of Work yet to be performed to fulfill contractual obligations, the interest provided by this subsection shall commence to run forty five (45) Days after the end of the 15-Day period.

E.5.1.4 Owner will reduce the amount of the retainage if the Contractor notifies the Owner that the Contractor has deposited in an escrow account with a bank or trust company, in a manner authorized by the Owner, bonds and securities of equal value of a kind approved by the Owner and such bonds and securities have in fact been deposited.

E.5.1.5 Contractor agrees that if Contractor elects to reserve a retainage from any progress payment due to any Subcontractor or supplier, such retainage shall not exceed five percent of the payment, and such retainage withheld from Subcontractors and suppliers shall be subject to the same terms and conditions stated in Subsection E.5 as apply to Owner's retainage from any progress payment due to Contractor.

E.6 FINAL PAYMENT

E.6.1 Upon completion of all the Work under this Contract, the Contractor shall notify the Owner, in writing, that Contractor has completed Contractor's obligations under the Contract and shall prepare its application requesting final payment. Upon receipt of such notice and application for payment, the Owner will inspect the Work, and, if acceptable, submit to Contractor a recommendation as to acceptance of the completed Work and the final estimate of the amount due the Contractor. If the Work is not acceptable, Owner will notify Contractor within fifteen (15) Days of Contractor's request for final payment. Upon approval of this final application for payment by the Owner and compliance by the Contractor with provisions in Section K, and Contractor's satisfaction of other provisions of the Contract Documents as may be applicable, the Owner shall pay to the Contractor all monies due under the provisions of these Contract Documents.

E.6.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Owner (1) 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 thirty (30) Days' prior written notice has been given to the Owner, (2) 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, (3) consent of surety, if any, to final payment and (4), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. 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.

E.6.3 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final application for payment.

E.6.4 Contractor agrees to submit its final payment application within ninety (90) Days after Substantial Completion, unless written extension is granted by Owner. Contractor shall not delay final payment application for any reason, including without limitation nonpayment of Subcontractors, suppliers, manufacturers or others not a party to this Contract, or lack of resolution of a dispute with Owner or any other person of matters arising out of or relating to the Contract. If Contractor fails to submit its final payment application within ninety (90) Days after Substantial Completion, and Contractor has not obtained written extension by Owner, all requests or Claims for additional costs or an extension of Contract Time shall be waived.

SECTION F
JOB SITE CONDITIONS

F.1 USE OF PREMISES

Contractor shall confine equipment, storage of materials and operation of Work to the limits indicated by Contract Documents, Applicable Laws, permits or directions of the Owner. Contractor shall follow the Owner's instructions regarding use of premises, if any.

F.2 PROTECTION OF WORKERS, PROPERTY AND THE PUBLIC

F.2.1 Contractor shall maintain continuous and adequate protection of all of the Work from damage and shall protect the Owner, workers and property from injury or loss arising in connection with this Contract. Contractor shall remedy acceptably to the Owner any damage, injury, or loss, except such as may be directly due to errors in the Contract Documents or caused by authorized representatives or personnel of the Owner. Contractor shall adequately protect adjacent property as provided by law and the Contract Documents.

F.2.2 Contractor shall take all necessary precautions for the safety of all personnel on the job site or otherwise engaged in the undertaking of the Work and shall comply with the Contract Documents, best practices and all applicable provisions of federal, state and municipal safety laws and building and fire codes to prevent accidents or injury to persons on, about or adjacent to the premises where the Work is being performed. Contractor shall erect and properly maintain at all times, as required by the conditions and progress of the Work, all necessary safeguards for protection of workers and the public against any hazards created by construction. Contractor shall designate a responsible employee or associate on the Work site, whose duty shall be the prevention of accidents. The name and position of the person designated shall be reported to the Owner. The Owner has no responsibility for Work site safety. Work site safety shall be the responsibility of the Contractor.

F.2.3 Contractor shall not enter upon private property without first obtaining permission from the property owner or its duly authorized representative. Contractor shall be responsible for the preservation of all public and private property along and adjacent to the Work contemplated under the Contract and shall use every precaution necessary to prevent damage thereto. In the event the Contractor damages any property, the Contractor shall at once notify the property owner and make, or arrange to make, full restitution. Contractor shall, immediately and in writing, report to the Owner, all pertinent facts relating to such property damage and the ultimate disposition of the claim for damage.

F.2.4 Contractor shall be responsible for protection of adjacent work areas including impacts brought about by activities, equipment, labor, utilities, vehicles and materials on the site.

F.2.5 Contractor shall at all times direct its activities in such a manner as to minimize adverse effects on the environment. Handling of all materials shall be conducted so no release will occur that may pollute or become hazardous.

F.2.6 In an emergency affecting the safety of life or limb or of the Work or of adjoining property, the Contractor, without special instruction or authorization from the Owner, shall act reasonably to prevent threatened loss or injury, and shall so act, without appeal, if instructed by the Owner. Any compensation claimed by the Contractor on account of emergency work shall be determined in accordance with section D.

F.3 CUTTING AND PATCHING

F.3.1 Contractor shall be responsible for coordinating all cutting, fitting, or patching of the Work to make its several parts come together properly and fit to receive or be received by work of other contractors or Subcontractors shown upon, or reasonably implied by, the Contract Documents.

F.3.2 Contractor shall be responsible for restoring all cut, fitted, or patched surfaces to an original condition; provided, however, that if a different condition is specified in the Contract Documents, then Contractor shall be responsible for restoring such surfaces to the condition specified in the Contract Documents.

F.4 CLEANING UP

From time to time as may be prudent or ordered by the Owner and, in any event, immediately after completion of the Work, the Contractor shall, at its own expense, clean up and remove all refuse and unused materials of any kind resulting from the Work. If Contractor fails to do so within twenty-four hours after notification by the Owner the work may be done by others and the cost charged to the Contractor and deducted from payment due the Contractor.

F.5 ENVIRONMENTAL CONTAMINATION

F.5.1. Contractor shall be held responsible for and shall indemnify, defend (with counsel of Owner's choice),and hold harmless Owner from and against any costs, expenses, damages, claims, and causes of action, (including attorney fees), or any of them, resulting from all spills, releases, discharges, leaks and disposal of environmental pollution, including storage, transportation, and handling during the performance of the Work or Contractor's obligations under the Contract which occur as a result of, or are contributed by, the negligence or actions of Contractor or its personnel, agents, or Subcontractors or any failure to perform in accordance with the Contract Documents (except to the extent otherwise void under ORS 30.140). Nothing in this section F.5.1 shall limit Contractor's responsibility for obtaining insurance coverages required under Section G.3 of this Contract, and Contractor shall take no action that would void or impair such coverages.

F.5.1.1 Contractor agrees to promptly dispose of such spills, releases, discharge or leaks to the satisfaction of Owner and regulatory agencies having jurisdiction in a manner that complies with Applicable Laws. Cleanup shall be at no cost to the Owner and shall be performed by properly qualified and, if applicable, licensed personnel.

F.5.1.2 Contractor shall obtain the Owner's written consent prior to bringing onto the Work site any (i) environmental pollutants or (ii) hazardous substances or materials, as the same or reasonably similar terms are used in any Applicable Laws. Notwithstanding such written consent from the Owner, the Contractor, at all times, shall:

(a) properly handle, use and dispose of all environmental pollutants and hazardous substances or materials brought onto the Work site, in accordance with all Applicable Laws;

(b) be responsible for any and all spills, releases, discharges, or leaks of (or from) environmental pollutants or hazardous substances or materials which Contractor has brought onto the Work site; and

(c) promptly clean up and remediate, without cost to the Owner, such spills, releases, discharges, or leaks to the Owner's satisfaction and in compliance with all Applicable Laws.

F.5.2 Contractor shall report all reportable quantity releases, as such releases are defined in Applicable Laws, including but not limited to 40 CFR Part 302, Table 302.4 and in OAR 340-142-0050 , to applicable federal, state, and local regulatory and emergency response agencies. Upon discovery, regardless of quantity, Contractor must telephonically report all releases to the Owner. A written follow-up report shall be submitted to Owner within 48 hours of the telephonic report. Such written report shall contain, as a minimum:

(a) Description of items released (identity, quantity, manifest numbers, and any and all other documentation required by law.)

(b) Whether amount of items released is EPA/DEQ reportable, and, if so, when reported.

(c) Exact time and location of release, including a description of the area involved.

(d) Containment procedures initiated.

(e) Summary of communications about the release between Contractor and members of the press or State , local or federal officials other than Owner.

(f) Description of cleanup procedures employed or to be employed at the site, including disposal location of spill residue.

(g) Personal injuries, if any, resulting from, or aggravated by, the release.

F.6 ENVIRONMENTAL CLEAN-UP

F.6.1 Unless disposition of environmental pollution is specifically a part of this Contract, or was caused by the Contractor (reference F.5 Environmental Contamination), Contractor shall immediately notify Owner of any hazardous substance(s) which Contractor discovers or encounters during performance of the Work required by this Contract. "Hazardous substance(s)" means any hazardous, toxic and radioactive materials and those substances defined as "hazardous substances," "hazardous materials," "hazardous wastes," "toxic substances," or other similar designations in any federal, state, or local law, regulation, or ordinance, including without limitation asbestos, polychlorinated biphenyl (PCB), or petroleum, and any substances, materials or wastes regulated by 40 CFR, Part 261 and defined as hazardous in 40 CFR S 261.3. In addition to notifying Owner of any hazardous substance(s) discovered or encountered, Contractor shall immediately cease working in any particular area of the project where a hazardous substance(s) has been discovered or encountered if continued work in such area would present a risk or danger to the health or well being of Contractor's or any Subcontractor's work force, property or the environment.

F.6.2 Upon being notified by Contractor of the presence of hazardous substance(s) on the project site, Owner shall arrange for the proper disposition of such hazardous substance(s).

F.7 FORCE MAJEURE

A party to this Contract shall not be held responsible for delay or default due to Force Majeure acts, events or occurrences unless they could have been avoided by the exercise of reasonable care, prudence, foresight, and diligence by that party. The Owner may terminate this Contract upon written notice after determining that delay or default caused by Force Majeure acts, events or occurrences will reasonably prevent successful performance of the Contract.

SECTION G
INDEMNITY, BONDING, AND INSURANCE

G.1 RESPONSIBILITY FOR DAMAGES / INDEMNITY

G.1.1 Contractor shall be responsible for all damage to property, injury to persons, and loss, expense, inconvenience, and delay that may be caused by, or result from, the carrying out of the Work to be done under this Contract, or from any act, omission or neglect of the Contractor, its Subcontractors, employees, guests, visitors, invitees and agents.

G.1.2 To the fullest extent permitted by law, Contractor shall indemnify, defend (with counsel approved by Owner) and hold harmless the Owner, Architect/Engineer, Architect/Engineer's

consultants, and their respective officers, directors, agents, employees, partners, members, stockholders and affiliated companies (collectively "Indemnitees") from and against all liabilities, damages, losses, claims, expenses (including reasonable attorney fees), demands and actions of any nature whatsoever which arise out of, result from or are related to, (a) any damage, injury, loss, expense, inconvenience or delay described in this Section G.1., (b) any accident or occurrence which happens or is alleged to have happened in or about the project site or any place where the Work is being performed, or in the vicinity of either, at any time prior to the time the Work is fully completed in all respects, (c) any failure of the Contractor to observe or perform any duty or obligation under the Contract Documents which is to be observed or performed by the Contractor, or any breach of any agreement, representation or warranty of the Contractor contained in the Contract Documents or in any subcontract, (d) the negligent acts or omissions of the Contractor, a Subcontractor or anyone directly or indirectly employed by them or any one of 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 (except to the extent otherwise void under ORS 30.140), and (e) any lien filed upon the project or bond claim in connection with the Work. 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 Section G.1.2.

G.1.3 In claims against any person or entity indemnified under Section G.1.2 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section G.1.2 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.

G.2 PERFORMANCE AND PAYMENT SECURITY; PUBLIC WORKS BOND

G.2.1 When the Contract Price is $100,000 or more (or $50,000 or more in the case of Contracts for highways, bridges and other transportation projects), the Contractor shall furnish and maintain in effect at all times during the Contract Period a performance bond in a sum equal to the Contract Price and a separate payment bond also in a sum equal to the Contract Price. Contractor shall furnish such bonds even if the Contract Price is less than the above thresholds if otherwise required by the Contract Documents.

G.2.2 Bond forms furnished by the Owner and notarized by awarded Contractor's surety company authorized to do business in Oregon are the only acceptable forms of performance and payment security, unless otherwise specified in the Contract Documents.

G.2.3 Before execution of the Contract the Contractor shall file with the Construction Contractors Board, and maintain in full force and effect, the separate public works bond required by Oregon Laws 2005, Chapter 360, and OAR 839-025-0015, unless otherwise exempt under those provisions. The Contractor shall also include in every subcontract a provision requiring the Subcontractor to have a public works bond filed with the Construction Contractors Board before starting Work, unless otherwise exempt, and shall verify that the Subcontractor has filed a public works bond before permitting any Subcontractor to start Work.

G.3 INSURANCE

G.3.1 Primary Coverage: Insurance carried by Contractor under this Contract shall be the primary coverage. The coverages indicated are minimums unless otherwise specified in the Contract Documents.

G.3.2 Workers' Compensation: All employers, including Contractor, that employ subject workers who work under this Contract in the State of Oregon shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. This shall include Employer's Liability Insurance with coverage limits of not less than the minimum amount required by statute for each accident. Contractors who perform the Work without the assistance or labor of any employee need not obtain such coverage if the Contractor certifies so in writing. Contractor shall ensure that each of its Subcontractors complies with these requirements. The Contractor shall require proof of such Workers' Compensation coverage by receiving and keeping on file a certificate of insurance from each Subcontractor or anyone else directly employed by either the Contractor or its Subcontractors.

G.3.3 Builder's Risk Insurance:

G.3.3.1 Builder's Risk: During the term of this Contract, for new construction the Contractor shall obtain and keep in effect Builder's Risk insurance on an all risk forms, including earthquake and flood, for an amount equal to the full amount of the Contract, plus any changes in values due to modifications, Change Orders and loss of materials added. Such Builder's Risk shall include, in addition to earthquake and flood, theft, vandalism, mischief, collapse, transit, debris removal, and architect's fees ("soft costs") associated with delay of project due to insured peril. Any deductible shall not exceed $50,000 for each loss, except the earthquake and flood deductible which shall not exceed 2 percent of each loss or $50,000, whichever is greater. The deductible shall be paid by Contractor if Contractor is negligent. The policy will include as loss payees Owner, the Contractor and its Subcontractors as their interests may appear.

G.3.3.2 Builder's Risk Installation Floater: For Work other than new construction, Contractor shall obtain and keep in effect during the term of this Contract, a Builder's Risk Installation Floater for coverage of the Contractor's labor, materials and equipment to be used for completion of the Work performed under this Contract. The minimum amount of coverage to be carried shall be equal to the full amount of the Contract. The policy will include as loss payees Owner, the Contractor and its Subcontractors as their interests may appear. Owner may waive this requirement at its sole and absolute discretion.

G.3.3.3 Such insurance shall be maintained until Owner has occupied the facility.

G.3.3.4 A loss insured under the Builder's Risk insurance shall be adjusted by the Owner and made payable to the Owner as loss payee. 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. The Owner shall have power to adjust and settle a loss with insurers.

G.3.4 General Liability Insurance:

G.3.4.1 Commercial General Liability: Upon issuance of a Supplement, Contractor shall obtain, and keep in effect at Contractor's expense for the term of the Supplement, Commercial General Liability Insurance covering bodily injury and property damage in the amount of $1,000,000 per claim and $2,000,000 per occurrence in a form satisfactory to Owner. This insurance shall include personal injury liability, products and completed operations, and contractual liability coverage for the

indemnities provided under this Contract (to the extent contractual liability coverage for the indemnity is available in the marketplace), and shall be issued on an occurrence basis.

G.3.4.2 Automobile Liability: Contractor shall obtain, at Contractor's expense, and keep in effect during the term of this Contract, Automobile Liability Insurance covering owned, and/or hired vehicles, as applicable. The coverage may be written in combination with the Commercial General Liability Insurance. Contractor shall provide proof of insurance of not less than $1,000,000 per claim and $2,000,000 per occurrence. Contractor and its Subcontractors shall be responsible for ensuring that all non-owned vehicles maintain adequate Automobile Liability insurance while on site.

G.3.4.3 Owner may adjust the insurance amounts required in Section G.3.4.1 and G.3.4.2 based upon institution specific risk assessments through the issuance of Supplemental General Conditions and a Supplement.

G.3.4.4 "Tail" Coverage: If any of the required liability insurance is arranged on a "claims made" basis, "tail" coverage will be required at the completion of this Contract for a duration of 36 months or the maximum time period available in the marketplace if less than 36 months. Contractor shall furnish certification of "tail" coverage as described or continuous "claims made" liability coverage for 36 months following Final Completion. Continuous "claims made" coverage will be acceptable in lieu of "tail" coverage, provided its retroactive date is on or before the effective date of this Contract. Owner's receipt of the policy endorsement evidencing such coverage shall be a condition precedent to Owner's obligation to make final payment and to Owner's final acceptance of Work or services and related warranty (if any).

G.3.4.5: Umbrella Liability (if required by Owner through issuance of Supplemental General Conditions): Contractor shall obtain, at Contractor's expense, and keep in effect during the term of this Contract, Umbrella liability Insurance over and above the general liability, automobile liability and workers' compensation coverage if required by Owner in specified limits at time of requirement.

G.3.4.6 Pollution Liability (if required by Owner through issuance of Supplemental General Conditions): Contractor shall obtain, at Contractor's expense, and keep in effect during the term of this Contract, Pollution liability Insurance in minimum amounts of $3,000,000 naming Owner as "additional insured," as noted in the "additional insured section below.

G.3.5 Additional Insured: The general liability insurance coverage, professional liability, umbrella, and pollution liability if required, shall include the Owner as additional insureds but only with respect to the Contractor's activities to be performed under this Contract.

If Contractor cannot obtain an insurer to name the Owner as additional insureds, Contractor shall obtain at Contractor's expense, and keep in effect during the term of this Contract, Owners and Contractors Protective Liability Insurance, naming the Owner as additional insureds with not less than a $2,000,000 limit per occurrence. This policy must be kept in effect for 36 months following Final Completion. As evidence of coverage, Contractor shall furnish the actual policy to Owner prior to execution of the Contract.

G.3.6 Notice of Cancellation or Change: If the Contractor receives a non-renewal or cancellation notice from an insurance carrier affording coverage required herein, or receives notice that coverage no longer complies with the insurance requirements herein, Contractor agrees to notify Owner by fax within five (5) business days with a copy of the non-renewal or cancellation notice, or written specifics as to which coverage is no longer in compliance. When notified by Owner, the Contractor agrees to stop Work pursuant to this Contract, unless all required insurance remains in effect. Any failure to comply with the reporting provisions of this insurance, except for the potential exhaustion of aggregate limits, shall not affect the coverages provided to the Owner and its institutions, divisions, officers, and employees.

Owner shall have the right, but not the obligation, of prohibiting Contractor from entering the Work site until a new certificate(s) of insurance is provided to Owner evidencing the replacement coverage. The Contractor acknowledges and agrees that Owner reserves the right to withhold payment to Contractor until evidence of reinstated or replacement coverage is provided to Owner.

G.3.7 Certificate(s) of Insurance: As evidence of the insurance coverage required by this Contract, the Contractor shall furnish certificate(s) of insurance to the Owner prior to execution of the Contract. The certificate(s) will specify all of the parties who are additional insureds or loss payees for this contract. Insurance coverage required under this Contract shall be obtained from insurance companies or entities acceptable to the Owner and that are eligible to provide such insurance under Oregon law. Eligible insurers include admitted insurers that have been issued a certificate of authority from the Oregon Department of Consumer and Business Services authorizing them to conduct an insurance business and issue policies of insurance in the state of Oregon, and certain non-admitted surplus lines insurers that satisfy the requirements of applicable Oregon law and which are subject to approval by the Owner. The Contractor shall be financially responsible for all deductibles, self-insured retentions and/or self-insurance included hereunder. Any deductible, self-insured retention and/or self-insurance in excess of $50,000 shall be subject to approval by the Owner in writing and shall be a condition precedent to the effectiveness of any Supplement.

G.3.8 Retainer Contract Program: For the OUS Retainer Contract Program the term "Contract" as used in this Section G in the phrases "keep in effect during the term of this Contract" and "prior to execution of the Contract" shall mean each Retainer Contract Supplement issued under the Retainer Contract.

SECTION H
SCHEDULE OF WORK

H.1 CONTRACT PERIOD

H.1.1 Time is of the essence. The Contractor shall at all times carry on the Work diligently, without delay and punctually fulfill all requirements herein. If required by the Contract Documents, Contractor shall commence Work on the site within fifteen (15) Days of Notice to Proceed, unless directed otherwise.

H.1.2 Unless specifically extended by Supplement Amendment , all Work shall be complete by the date contained in the Contract Documents. The Owner shall have the right to accelerate the completion date of the Work, which may require the use of overtime. Such accelerated Work schedule shall be an acceleration in performance of Work under Section D.1.2 (f) and shall be subject to the provisions of Section D.1.

H.1.3 The Owner shall not waive any rights under the Contract by permitting the Contractor to continue or complete in whole or in part the Work after the date described in Section H.1.2 above.

H.2 SCHEDULE

H.2.1 Contractor shall provide, by or before the pre-construction conference, the initial as-planned schedule for review and acceptance by the Owner. The submitted schedule must illustrate Work by project components, with labor trades, and long lead items broken down by

building and/or floor where applicable. If Owner shall so elect, Contractor shall provide the schedule in CPM format showing the graphical network of planned activities, including i) a reasonably detailed list of all activities required to complete the Work; ii) the time and duration that each activity will take to completion; and iii) the dependencies between the activities. Schedules lacking adequate detail, or unreasonably detailed, will be rejected. The schedule shall include the following: Notice to Proceed or the date the Work commences, if no Notice to Proceed is issued by Owner, Substantial Completion, and Final Completion. Schedules shall be updated monthly, unless otherwise required by the Contract Documents, and submitted with the monthly application for payment. Acceptance of the Schedule by the Owner does not constitute agreement by the Owner as to the Contractor's sequencing, means, methods, or durations. Any positive difference between the Contractor's scheduled completion and the Contract completion date is float owned by the Owner. Owner reserves the right to negotiate the float if it is deemed to be in Owner's best interest to do so. In no case shall the Contractor make a claim for delays if the Work is completed within the Contract Time but after Contractor's scheduled completion. **H.3 PARTIAL OCCUPANCY OR USE**

H.3.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage, provided such occupancy or use is consented to 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 reasonably accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, insurance or self-insurance, maintenance, heat, utilities, and damage to the Work, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents with respect to such portion of the Work. Approval by the Contractor to partial occupancy or use shall not be unreasonably withheld. Immediately prior to such partial occupancy or use, the Owner and Contractor shall 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. 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.

SECTION I
CORRECTION OF WORK

I.1 CORRECTION OF WORK BEFORE FINAL PAYMENT

The Contractor warrants to the Owner that 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, and that the Work will conform to the requirements of the Contract Documents. Work failing to conform to these requirements shall be deemed defective. Contractor shall promptly remove from the premises and replace all defective materials and equipment as determined by the Owner, whether incorporated in the Work or not. Removal and replacement shall be without loss or expense to the Owner, and Contractor shall bear the cost of repairing all Work destroyed or damaged by such removal or replacement. Contractor shall be allowed a period of no longer than thirty (30) Days after Substantial Completion for completion of defective (Punch List) work. At the end of the thirty-day period, or earlier if requested by the Contractor, Owner shall arrange for inspection of the Work by the Architect/Engineer. Should the work not be complete, and all corrections made, the costs for all subsequent reinspections shall be borne by the Contractor. If Contractor fails to complete the Punch List work within the thirty (30) Day period, Owner may perform such work and Contractor shall reimburse Owner all costs of the same within ten (10) Days after demand without affecting Contractor's obligations.

I.2 WARRANTY WORK

I.2.1 Neither the final certificate of payment nor any provision of the Contract Documents shall relieve the Contractor from responsibility for defective Work and, unless a longer period is specified, Contractor shall correct all defects that appear in the Work within a period of one year from the date of issuance of the written notice of Substantial Completion by the Owner except for latent defects which will be remedied by the Contractor at any time they become apparent. The Owner shall give Contractor notice of defects with reasonable promptness. Contractor shall perform such warranty work within a reasonable time after Owner's demand. If Contractor fails to complete the warranty work within such period as Owner determines reasonable, or at any time in the event of warranty work consisting of emergency repairs, Owner may perform such work and Contractor shall reimburse Owner all costs of the same within ten (10) Days after demand, without affecting Contractor's obligations. The Contractor shall perform the warranty Work by correcting defects within twenty-four (24) hours of notification by Owner, unless otherwise specified in the Contract Documents. Should the Contractor fail to respond within the specified response time, the Owner may, at its option, complete the necessary repairs using another contractor or its own forces. If Owner completes the repairs using Owner's own forces, Contractor shall pay Owner at the rate of one and one-half (1½) times the standard hourly rate of Owner's forces, plus related overhead and any direct non-salary costs. If Owner completes the repairs using another contractor, Contractor shall pay Owner the amount of Owner's direct costs billed by the other contractor for the work, plus the direct salary costs and related overhead and direct non-salary expenses of Owner's forces who are required to monitor that contractor's work. Work performed by Owner using Owner's own forces or those of another contractor shall not affect the Contractor's contractual duties under these provisions, including warranty provisions.

I.2.2 Nothing in this Section I.2 shall negate guarantees or warranties for periods longer than one year including, without limitation, such guarantees or warranties required by other sections of the Contract Documents for specific installations, materials, processes, equipment or fixtures.

I.2.3 In addition to Contractor's warranty, manufacturer's warranties shall pass to the Owner and shall not take effect until such portion of the Work covered by the applicable warranty has been accepted in writing by the Owner.

I.2.4 The one-year period for correction of Work shall be extended with respect to portions of Work performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work, and shall be extended by corrective Work performed by the Contractor pursuant to this Section, as to the Work corrected. 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.

I.2.5 Nothing contained in this Section I.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 period for correction of Work as described in this Section I.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.

I.2.6 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 Price will be reduced as appropriate and

equitable. Such adjustment shall be effected whether or not final payment has been made.

SECTION J
SUSPENSION AND/OR TERMINATION OF THE WORK

J.1 OWNER'S RIGHT TO SUSPEND THE WORK

J.1.1 The Owner has the authority to suspend portions or all of the Work due to the following causes:

(a) Failure of the Contractor to correct unsafe conditions;

(b) Failure of the Contractor to carry out any provision of the Contract;

(c) Failure of the Contractor to carry out orders;

(d) Conditions, in the opinion of the Owner, which are unsuitable for performing the Work;

(e) Time required to investigate differing site conditions;

(f) Any reason considered to be in the public interest.

J.1.2 The Owner shall notify Contractor and the Contractor's Surety in writing of the effective date and time of the suspension, and Owner shall notify Contractor and Contractor's surety in writing to resume Work.

J.2 CONTRACTOR'S RESPONSIBILITIES

J.2.1 During the period of the suspension, Contractor is responsible to continue maintenance at the project just as if the Work were in progress. This includes, but is not limited to, protection of completed Work, maintenance of access, protection of stored materials, temporary facilities, and clean-up.

J.2.2 When the Work is recommenced after the suspension, the Contractor shall replace or renew any Work damaged during the suspension, remove any materials or facilities used as part of temporary maintenance, and complete the Work in every respect as though its prosecution had been continuous and without suspension.

J.3 COMPENSATION FOR SUSPENSION

J.3.1 Depending on the reason for suspension of the Work, the Contractor or the Owner may be due compensation by the other party. If the suspension was required due to acts or omissions of Contractor, the Owner may assess the Contractor actual costs of the suspension in terms of administration, remedial work by the Owner's forces or another contractor to correct the problem associated with the suspension, rent of temporary facilities, and other actual costs related to the suspension. If the suspension was caused by acts or omissions of the Owner, the Contractor may be due compensation which shall be defined using Section D, Changes in Work. If the suspension was required through no fault of the Contractor or the Owner, neither party shall owe the other for the impact.

J.4 OWNER'S RIGHT TO TERMINATE CONTRACT

J.4.1 The Owner may, without prejudice to any other right or remedy, and after giving Contractor seven (7) Days' written notice and an opportunity to cure, terminate the Contract in whole or in part under the following conditions:

(a) If Contractor should, voluntarily or involuntarily, seek protection under the United States Bankruptcy Code and Contractor as debtor-in-possession or the Trustee for the estate fails to assume the Contract within a reasonable time;

(b) If Contractor should make a general assignment for the benefit of Contractor's creditors;

(c) If a receiver should be appointed on account of Contractor's insolvency;

(d) If Contractor should repeatedly refuse or fail to supply an adequate number of skilled workers or proper materials to carry on the Work as required by the Contract Documents, or otherwise fail to perform the Work in a timely manner;

(e) If Contractor should repeatedly fail to make prompt payment to Subcontractors or for material or labor, or should disregard laws, ordinances or the instructions of the Owner; or

(f) If Contractor is otherwise in breach of any part of the Contract.

(g) If Contractor is in violation of Applicable Laws, either in the conduct of its business or in its performance of the Work.

J.4.2 At any time that any of the above occurs, Owner may exercise all rights and remedies available to Owner at law or in equity, and, in addition, Owner may take possession of the premises and of all materials and appliances and finish the Work by whatever method it may deem expedient. In such case, the Contractor shall not be entitled to receive further payment until the Work is completed. If the Owner's cost of finishing the Work exceeds the unpaid balance of the Contract Price, Contractor shall pay the difference to the Owner.

J.5 TERMINATION FOR CONVENIENCE

J.5.1 Owner may terminate the Contract in whole or in part whenever Owner determines that termination of the Contract is in the best interest of Owner or the public.

J.5.2 The Owner shall provide the Contractor with seven (7) Days prior written notice of a termination for Owner's or for public convenience. After such notice, the Contractor shall provide the Owner with immediate and peaceful possession of the premises and materials located on and off the premises for which the Contractor received progress payment under Section E. Compensation for Work terminated by the Owner under this provision will be according to Section E. In no circumstance shall Contractor be entitled to lost profits for Work not performed due to termination.

J.6 ACTION UPON TERMINATION

J.6.1 Upon receiving a notice of termination, and except as directed otherwise by the Owner, Contractor shall immediately cease placing further subcontracts or orders for materials, services, or facilities. In addition, Contractor shall terminate all subcontracts or orders to the extent they relate to the Work terminated and, with the prior written approval of the Owner, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts and orders.

J.6.2 As directed by the Owner, Contractor shall, upon termination, transfer title and deliver to the Owner all Record Documents, information, and other property that, if the Contract had been completed, would have been required to be furnished to the Owner.

I.6.3 Upon Owner's notice of termination pursuant to either Section J.4 or J.5, if Owner shall so elect, Contractor shall assign to the Owner such subcontracts and orders as Owner shall specify. In

the event Owner elects to take assignment of any such subcontract or order, Contractor shall take such action and shall execute such documents as Owner shall reasonably require for the effectiveness of such assignment and Contractor shall ensure that no contractual arrangement between it and its subcontractors or suppliers of any tier or sub-tier shall prevent such assignment.

SECTION K
CONTRACT CLOSE OUT

K.1 RECORD DOCUMENTS

As a condition of final payment (and subject to the provisions of section E.6), Contractor shall comply with the following: Contractor shall provide Record Documents for the entire project to Owner. Record Documents shall depict the project as constructed and shall reflect each and every change, modification, and deletion made during the construction. Record Documents are part of the Work and shall be provided prior to the Owner's issuance of final payment. Record Documents include all modifications to the Contract Documents, unless otherwise directed, and accurate MWESB Reports.

K.2 OPERATION AND MAINTENANCE MANUALS

As part of the Work, Contractor shall submit two completed operation and maintenance manuals ("O & M Manuals") for review by the Owner prior to submission of any pay request for more than 75% of the Work. Owner's receipt of the O & M Manuals shall be a condition precedent to any payment thereafter due. The O & M Manuals shall contain a complete set of all submittals, all product data as required by the specifications, training information, telephone list and contact information for all consultants, manufacturers, installer and suppliers, manufacturer's printed data, record and shop drawings, schematic diagrams of systems, appropriate equipment indices, warranties and bonds. The Owner shall review and return one O & M Manual for any modifications or adjustments required. Prior to submission of its final pay request, Contractor shall deliver three (3) complete and approved sets of O & M Manuals to the Owner and Owner's receipt of the O & M Manuals shall be a condition precedent to Owner's obligation to make final payment.

K.3 COMPLETION NOTICES

K.3.1 Contractor shall provide Owner written notice of both Substantial and Final Completion. The certificate of Substantial Completion shall state the date of Substantial Completion, the responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and the time within which the Contractor shall finish all items on the Punch List accompanying the Certificate. Both completion notices must be signed by the Contractor and the Owner to be valid. The Owner shall provide the final signature on the approved notices. The notices shall take effect on the date they are signed by the Owner.

K.3.2 Substantial Completion of a facility with operating systems (e.g., mechanical, electrical, HVAC) shall be that degree of completion that has provided a minimum of thirty (30) continuous Days of successful, trouble-free operation, which period shall begin after all performance and acceptance testing has been successfully demonstrated to the Owner. All equipment contained in the Work, plus all other components necessary to enable the Owner to operate the facility in the manner that was intended, shall be complete on the Substantial Completion date. The Contractor may request that a Punch List be prepared by the Owner with submission of the request for the Substantial Completion notice.

K.4 TRAINING

As part of the Work, and prior to submission of the final application for payment, the Contractor shall schedule with the Owner training sessions for all equipment and systems as required by the Contract Documents. Contractor shall schedule training sessions at least two weeks in advance of the date of training to allow Owner to provide its personnel with adequate notice. The O & M Manual shall be used as a basis for training. Training shall be a formal session conducted at the Work site after the equipment and/or system is completely installed and operational in its normal operating environment.

K.5 EXTRA MATERIALS

As part of the Work, Contractor shall provide spare parts, extra maintenance materials, and other materials or products in the quantities specified in the Contract Documents prior to final payment. Delivery point for extra materials shall be designated by the Owner.

K.6 ENVIRONMENTAL CLEAN-UP

As part of the Final Completion notice, or as a separate written notice submitted with or before the notice of Final Completion, the Contractor shall notify the Owner that all environmental and pollution clean-up, remediation and closure have been completed in accordance with all Applicable Laws and pursuant to the authority of all agencies having jurisdiction, and Contractor shall provide Owner with any and all documentation related to the same, including but not limited to directives, orders, letters, certificates and permits related to or arising from such environmental pollution. The notice shall reaffirm the indemnification given under Section F.5.1 above. Contractor's completion of its obligations under this Section K.6 and Owner's receipt of documents evidencing such completion shall be a condition precedent to Owner's obligation to make final payment.

K.7 CERTIFICATE OF OCCUPANCY

Owner's receipt of an unconditioned certificate of occupancy from the appropriate state and/or local building officials shall be a condition precedent to Owner's obligation to make final payment, except to the extent failure to obtain an unconditional certificate of occupancy is due to the fault or neglect of Owner.

K.8 OTHER CONTRACTOR RESPONSIBILITIES

The Contractor shall be responsible for returning to the Owner all property of Owner issued to Contractor during construction such as keys, security passes, site admittance badges, and all other pertinent items. Upon notice from Owner, Contractor shall be responsible for notifying the appropriate utility companies to transfer utility charges from the Contractor to the Owner. The utility transfer date shall not be before Substantial Completion and may not be until Final Completion, if the Owner does not take beneficial use of the facility and the Contractor's forces continue with the Work.

K.9 SURVIVAL

All warranty and indemnification provisions of this Contract, and all of Contractor's other obligations under this Contract that are not fully performed by the time of Final Completion or termination, shall survive Final Completion or any termination of the Contract.

OREGON UNIVERSITY SYSTEM

STANDARD PUBLIC IMPROVEMENT CONTRACT

PERFORMANCE BOND

Bond No._____
Solicitation _____
Project Name _____

_____(Surety #1)	Bond Amount No. 1:	$_____
_____(Surety #2)*	Bond Amount No. 2:*	$_____
* *If using multiple sureties*	Total Penal Sum of Bond:	$_____

We, _____as Principal, and the above identified Surety(ies), authorized to transact surety business in Oregon, as Surety, hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns firmly by these presents to pay unto the State of Oregon, acting by and through the State Board of Higher Education, on behalf of the OUS (OUS), the sum of (Total Penal Sum of Bond)

_____

(Provided, that we the Sureties bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety), and

WHEREAS, the Principal has entered into a contract with the OUS, the plans, specifications, terms and conditions of which are contained in the above-referenced Solicitation;

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Performance Bond by reference, whether or not attached to the contract (all hereafter called "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and all authorized modifications of the Contract which increase the amount of the work, the amount of the Contract, or constitute an authorized extension of the time for performance, notice of any such modifications hereby being waived by the Surety:

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH that if the Principal herein shall faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, and shall well and truly and fully do and perform all matters and things undertaken by Contractor to be performed under the Contract, upon the terms set forth therein,

and within the time prescribed therein, or as extended as provided in the Contract, with or without notice to the Sureties, and shall indemnify and save harmless the OUS, and _____(name of institution and any other Owner agency), and members thereof, its officers, employees and agents, against any direct or indirect damages or claim of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by the Principal or its subcontractors, and shall in all respects perform said contract according to law, then this obligation is to be void; otherwise, it shall remain in full force and effect.

Nonpayment of the bond premium will not invalidate this bond, nor shall the State of Oregon or the OUS, be obligated for the payment of any premiums.

This bond is given and received under authority of ORS Chapters 279C and 351, the provisions of which hereby are incorporated into this bond and made a part hereof.

IN WITNESS WHEREOF, WE HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES.

Dated this _____ day of _____, 20__.

PRINCIPAL: _____

By_____
Signature

_____
Official Capacity

Attest: _____
Corporation Secretary

SURETY: _____
[Add signatures for each surety if using multiple bonds]

BY ATTORNEY-IN-FACT:
[Power-of-Attorney must accompany each surety bond]

_____
Name

_____
Signature

_____
Address

_____
City State Zip

_____ _____
Phone Fax

OREGON UNIVERSITY SYSTEM

STANDARD PUBLIC IMPROVEMENT CONTRACT

PAYMENT BOND

Bond No. _____
Solicitation _____
Project Name _____

_____(Surety #1)	Bond Amount No. 1:	$ _____
_____(Surety #2)*	Bond Amount No. 2:*	$ _____
** If using multiple sureties*	Total Penal Sum of Bond:	$ _____

We, _____, as Principal, and the above identified Surety(ies), authorized to transact surety business in Oregon, as Surety, hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns firmly by these presents to pay unto the State of Oregon, acting by and through the State Board of Higher education, on behalf of the Oregon University System (OUS), the sum of (Total Penal Sum of Bond) _____ _____
(Provided, that we the Sureties bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety), and

WHEREAS, the Principal has entered into a contract with the OUS, the plans, specifications, terms and conditions of which are contained in above-referenced Solicitation;

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Payment Bond by reference, whether or not attached to the contract (all hereafter called "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and schedule of contract prices which are set forth in the Contract and any attachments, and all authorized modifications of the Contract which increase the amount of the work, or the cost of the Contract, or constitute authorized extensions of time for performance of the Contract, notice of any such modifications hereby being waived by the Surety:

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH that if the Principal shall faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, and shall well and truly and fully do and perform all matters and things by it undertaken to be performed under said Contract and any duly authorized modifications that are made, upon the terms set forth therein, and within the time prescribed therein, or as extended therein as provided in the Contract, with or without notice to the Sureties, and shall indemnify and save harmless the OUS and _____ (name of institution and any other Owner agency), and members thereof, its officers, employees and agents, against any claim for direct or indirect damages of every kind and description that shall be suffered or

claimed to be suffered in connection with or arising out of the performance of the Contract by the Contractor or its subcontractors, and shall promptly pay all persons supplying labor, materials or both to the Principal or its subcontractors for prosecution of the work provided in the Contract; and shall promptly pay all contributions due the State Industrial Accident Fund and the State Unemployment Compensation Fund from the Principal or its subcontractors in connection with the performance of the Contract; and shall pay over to the Oregon Department of Revenue all sums required to be deducted and retained from the wages of employees of the Principal and its subcontractors pursuant to ORS 316.167, and shall permit no lien nor claim to be filed or prosecuted against the State on account of any labor or materials furnished; and shall do all things required of the Principal by the laws of this State, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Nonpayment of the bond premium will not invalidate this bond, nor shall the State of Oregon, or the OUS be obligated for the payment of any premiums.

This bond is given and received under authority of ORS Chapters 279C and 351, the provisions of which hereby are incorporated into this bond and made a part hereof.

IN WITNESS WHEREOF, WE HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES:

Dated this _____day of _____, 20__.

PRINCIPAL: _____

By _____
Signature

_____
Official Capacity

Attest: _____
Corporation Secretary

SURETY: _____
[Add signatures for each if using multiple bonds]

BY ATTORNEY-IN-FACT:
[Power-of-Attorney must accompany each bond]

_____
Name

_____
Signature

_____
Address

_____
City State Zip

_____
Phone Fax

PREVAILING WAGE RATES

for

Public Works Contracts in Oregon

OREGON BUREAU OF LABOR AND INDUSTRIES

Brad Avakian
Commissioner
Bureau of Labor and Industries

Effective: January 1, 2013

http://www.oregon.gov/boli/WHD/PWR/Pages/January_2013_Index.aspx

RETAINER CONTRACT SUPPLEMENT
OUS RETAINER CONTRACT FOR CONSTRUCTION RELATED SERVICES

Supplement No.
Project Name
Owner's Project Manager

This Retainer Contract Supplement dated (the "Supplement") is entered into between:

"Contractor":

Federal Tax ID No.

and "Owner": The State of Oregon, acting by and through the State Board of Higher Education, on behalf of:

(collectively, the "Parties") pursuant to the Retainer Contract for Construction Related Services between the Parties terminating June 30, 2014 (the "Retainer Contract"). Capitalized terms have the meaning defined in the OUS Retainer General Conditions unless otherwise defined in the Retainer Contract or herein.

1. DESCRIPTION OF THE PROJECT. The project to which this Supplement pertains is described as follows: (the "Project").

2. WORK TO BE PERFORMED. Contractor shall perform the following work on the Project : (the "Work"). Contractor will perform the Work according to the terms and conditions of this Supplement and the Contract Documents, which are incorporated herein by this reference.

3. SCHEDULE. Contractor shall perform the Work according to the following schedule: (the "Schedule").

4. COMPENSATION. Owner shall compensate Contractor for Work ☐ (a) in the firm, fixed-price amount of $; or ☐ (b) on a time and materials basis subject to a maximum not-to-exceed price of $ _____; in accordance with the requirements of the OUS Retainer General Conditions. If the Work is performed on a time and materials basis, Contractor's listing of wage rates, material unit costs and overhead charges for the Work is attached to this Supplement.

The cost of the Work under this Supplement, even if this Supplement is later amended to include additional work, must not exceed the greater of $1,000,000 or the maximum allowable under

OAR 580-063-0030.

5. TERM. This Supplement is effective on the date it has been signed by every Party hereto and all approvals required by Applicable Law have been obtained (the "Effective Date"). No Work shall be performed or payment made prior to the Effective Date. Contractor shall perform its obligations in accordance with the Contract Documents, unless this Supplement is earlier terminated or suspended.

6. PERFORMANCE AND PAYMENT BONDS. The performance and payment bond requirements for this Project are as follows (check one of the following):

☐ As a condition precedent to the effectiveness of this Supplement and to Owner's obligation to make payment for the Work, Contractor shall provide the Owner with a performance bond and a separate payment bond in a sum equal to the Contract Price stated in Section 4 of this Supplement.

☐ This Project has a Contract price of $100,000 or less, and Owner has determined that performance and payment bonds will not be required for this Project.

7. MINIMUM WAGE RATES.

☐ Prevailing Wage Rates requirements do not apply to this Project because the maximum compensation for all Owner-contracted Work does not exceed $50,000.

☐ Prevailing Wage Rates requirements apply to this Project because the maximum compensation for all Owner-contracted Work is more than $50,000. Contractor and all subcontractors shall comply with the provisions of ORS 279C.800 through 279C.870, relative to Prevailing Wage Rates and the required public works bond, as outlined in Sections C.1, C.2 and G.2.3 of the OUS Retainer General Conditions. The Bureau of Labor and Industries (BOLI) wage rates and requirements set forth in the following BOLI booklet (and any listed amendments to that booklet), which are incorporated herein by reference, apply to the Work authorized under this Supplement:

PREVAILING WAGE RATES for Public Works Contracts in Oregon, ____, 20__, as amended _____, 20__ **[delete "as amended _____, 20__" if there have been no amendments since last rate change]**, which can be downloaded at the following web address:

[http://www.boli.state.or.us/BOLI/WHD/PWR/pwr_book.shtml]

The Work will take place in _____ County, Oregon.

8. TAX COMPLIANCE CERTIFICATION. Contractor hereby certifies and affirms, under penalty of perjury as provided in ORS 305.385(6), that, to the best of Contractor's knowledge, Contractor is not in violation of any of the tax laws described in ORS 305.380(4). For purposes of this certification, "tax laws" means a state tax imposed by ORS 320.005 to 320.150 and 403.200 to 403.250, ORS Chapters 118, 314, 316, 317, 318, 321 and 323; the elderly rental assistance program under ORS 310.630 to 310.706; and local taxes administered by the Oregon Department of Revenue under ORS 305.620.

9. INSURANCE REQUIREMENTS.

☐ Contractor shall comply with and obtain the insurance coverage amounts stated in the OUS Retainer General Conditions.

☐ The Owner has determined that the Contractor shall obtain insurance in the amount described in the Retainer Supplemental General Conditions, attached hereto.

10. KEY PERSONS. ☐ If checked here, the following provision is incorporated into this Supplement:

The Parties agree that certain Contractor personnel are specifically valuable to the Project ("Key Persons"). Key Persons shall not be replaced during the Project without the written consent of Owner, which shall not be unreasonably withheld. If Contractor intends to substitute personnel, Owner shall receive the request at least 15 days prior to the effective date of substitution. When replacements have been approved by Owner, Contractor shall provide a transition period of at least 10 working days during which the original and replacement personnel shall be working on the Project concurrently. Upon authorization for the replacement of a Key Person, all subsequent substitutions of that Key Person shall require Owner's written consent in accordance with this Section. The Key Persons for this Project are the following:

Project Executive: _____ shall be Contractor's Project Executive, and will provide oversight and guidance throughout the Project term.

Project Manager: _____ shall be Contractor's Project Manager and will participate in all meetings throughout the Project term.

Job Superintendent: _____ shall be Contractor's on-site Job Superintendent throughout the Project term.

Project Engineer: _____ shall be Contractor's Project Engineer, providing assistance to the Project Manager, and subcontractor and supplier coordination throughout the Project term.

11. OTHER TERMS. Except as specifically modified by this Supplement, all terms of the Retainer Contract remain unchanged.

12. EXECUTION AND COUNTERPARTS. This Supplement may be executed in several counterparts, each of which shall be an original, all of which shall constitute but one and the same instrument.

Contractor hereby confirms and certifies that the representations, warranties, and certifications contained in the Retainer Contract remain true and correct as of the Effective Date of this Supplement.

IN WITNESS HEREOF, the Parties have duly executed this Supplement as of the dates indicated below.

, Contractor

The State of Oregon, acting by and through

	the State Board of Higher Education, on behalf of , Owner
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____

RETAINER CONTRACT SUPPLEMENT AMENDMENT
OUS RETAINER CONTRACT FOR CONSTRUCTION RELATED SERVICES

Supplement No.:
Amendment No.:
Project Name:

This Amendment dated to the Retainer Contract Supplement is entered into between:

"Contractor":

Federal Tax ID No.

and "Owner": The State of Oregon, acting by and through the State Board of Higher Education, on behalf of:

(collectively the "Parties") pursuant to the Retainer Contract for Construction Related Services between the Parties expiring June 30, 2014 (the "Retainer Contract"). Capitalized terms have the meaning defined in the OUS Retainer General Conditions unless otherwise defined in the Contract Documents.

1. SERVICES: The Work described in the Retainer Contract Supplement is being amended as follows**:** .

2. SCHEDULE. The schedule contained in Section 3 of the Retainer Contract Supplement is hereby replaced in its entirety with the following schedule: .

3. COMPENSATION. Section 4 of the Retainer Contract Supplement, is hereby replaced in its entirety with the following:

"Owner will compensate Contractor for Work ☐ (a) in the firm, fixed-price amount of $; or ☐ (b) on a time and materials basis subject to a maximum not-to-exceed price of $_____; in accordance with the requirements of the OUS Retainer General Conditions. If the Project is done on a time and materials basis, Contractor's listing of wage rates, material unit costs and overhead charges for the Work is attached to this Supplement.

The total cost of Work including the original amount contemplated in the Supplement and the additional amount contemplated in this Amendment, must not exceed the greater of $1,000,000 or the maximum allowable under OAR 580-063-0030."

4. TERM. This Amendment is effective on the date it has been executed by the Parties and all required approvals have been obtained (the "Effective Date"). No Work will be performed or payment made prior to the Effective Date.

5. TAX COMPLIANCE CERTIFICATION. Contractor hereby certifies and affirms, under penalty of perjury as provided in ORS 305.385(6), that, to the best of Contractor's knowledge, Contractor is not in violation of any of the tax laws described in ORS 305.380(4). For purposes of this certification, "tax laws" means a state tax imposed by ORS 320.005 to 320.150 and 403.200 to 403.250, ORS Chapters 118, 314, 316, 317, 318, 321 and 323; the elderly rental assistance program under ORS 310.630 to 310.706; and local taxes administered by the Oregon Department of Revenue under ORS 305.620.

6. EXECUTION AND COUNTERPARTS. This Amendment may be executed in several counterparts, each of which shall be an original, all of which shall constitute but one and the same instrument.

Contractor hereby confirms and certifies that the representations, warranties and certifications contained in the Retainer Contract and the Retainer Contract Supplement remain true and correct as of the Effective Date of this Amendment.

IN WITNESS HEREOF, the Parties have duly executed this Amendment as of the dates indicated below.

, Contractor	The State of Oregon, acting by and through the State Board of Higher Education, on behalf of , Owner
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____

Oregon University System

CapCon MWESB Subcontractor Report

REPORT BEING SUBMITTED	

OVERALL PROJECT DATA

Reporting Period	2011
Campus	
General Contractor's Name	
Contract Number	
Project Name	
Contract Execution Date (Date Contract was Signed by the Owner)	
Date of Final Payment Application	
Initial Total Contract Value	
Total Contract Value billed within the fiscal year (July 1 - June 30)	
Final Total Contract Value	
Total Number of Subcontractors Used on Project	
Total Number of First-Tier Subcontractors Used on Project	
Number of First-Tier MWESB Subcontractors	

CALCULATED REPORTING DATA (Self Calculating - No Data Entry)

Number of MWESB Subcontractors	0
% MWESB Subcontractors	
% First-Tier MWESB Subcontractors	

CERTIFIED MWESB TOTALS

Value Awarded to MWESB Contractors	$0.00
% Value Awarded to MWESB Contractors	
Value - **minority-owned** MWESB subcontractors	$0.00
% - **minority-owned** MWESB subcontractors	
Value - **women-owned** MWESB subcontractors	$0.00
% - **women-owned** MWESB subcontractors	
Value - **emerging small business** MWESB subcontractors	$0.00
% - **emerging small business** MWESB subcontractors	

SELF-IDENTIFIED or OTHER CERTIFIED MWESB TOTALS

Value - **self-identified or other certified** subcontractors	$0.00
% - **self-identified or other certified** subcontractors	

OVERALL PROJECT CONTRACT HISTORY

% Value Awarded to MWESB Contractors at Initial Contract	#DIV/0!
% Value Awarded to MWESB Contractors at Final Contract	#DIV/0!

FOR OFFICIAL USE ONLY:

Date Received by the Campus	
Initials of Campus staff who checked the document	

Oregon University System

CapCon MWESB Subcontractor Report

Name of MWESB General/ Subcontractor/ Supplier	State of Oregon MWESB Certification Number	Self-Identified or Other Certified	Initial Sub-Contract Value	Sub-Contract value billed within the fiscal year (July 1-June 30)	Final Sub-Contract Value	Minority-Owned	Women-Owned	Emerging Small Business

CapCon MWESB Project Contract Report

File Version 4.10.13

Created: September 15, 2011/Updated 4/3/12

Purpose of File:

Each Fiscal year, the OUS campuses are required to report data to the State Legislature on Minority, Women and Emerging Small Business Contractors and Sub-Contractors who provide goods and services. Various statistics are calculated, based on the data input being provided by the contractors. This file is for the collection of the data for each project by contract. Each University will compile statistics associated with all of their contracts during each fiscal year. Once consolidated at the University level, the information is sent to OUS who in turn consolidates all of the information from the seven institutions and reports it to the Legislature.

General Information on how to use the file:

You will fill this form out at least twice for your project. Small projects that do NOT span over the end of a fiscal year (June 30 – July 1) will require two submittals (An Initial and a Final). Any project spanning over the end of a fiscal year will require three submittals (Initial, Year-End and Final). For larger projects that span over multiple fiscal years, the Year-End report will need to be submitted multiple times.

The first Submittal will always be the "Initial" report which is due within 10 days of the execution of the contract or in the case of a CM/GC contract, the establishment of an Early Work Amendment or Guaranteed Maximum Price Amendment.

At the end of every fiscal year, you are required to submit a "Year-End" report.

At the completion of the project you are required to submit a "Final" report.

2) The areas shaded in gray in the OVERALL PROJECT DATA section are for input by the Contractor. The gray portion of the "Individual Contractor/Sub-Contractor Data Entry Matrix" is also an area intended for Contractor input.

3) For some items, a drop-down box is provided. This is to maintain the consistency of data used to sort information.

4) For other items, simply type in the information. If the type of information typed in is incorrect, you will get an error message or your results may look incorrect. For example, when you enter a date, simply type it: 8/17/11. You do not need to spell out the month.

Saving your file:

1) FILE NAMING CONVENTION – All files submitted to the campus shall be named as defined by the following naming convention: (filename = FYXX_ContractNumber_SubmissionStatus)

FYXX = XX refers to the two digit extension of the year. Example "FY12" for Fiscal Year 2012.

Include an underscore between the FYXX and the Contract Number. There should be no blanks in the filename.

ContractNumber = Insert the number that is established on the front of your contract with the campus.

Include an underscore between the Contract Number and the Submission Status. There should be no blanks in the filename.2) SubmissionStatus = "I" for Initial; "Y" for Year end; "F" for Final. This should correspond with what you select at the top of the report as explained in item 1 of "Filling Out the Form" below.

Filling Out the Form:

1) Use the drop-down box adjacent to the REPORT BEING SUBMITTED heading to pick the corresponding report you are submitting for your project. This will establish highlighted headings (in light green) in the "Individual C/S-C Data Entry Matrix" & OPERALL PROJECT DATA sections that define for you which columns or rows should be completely filled out prior to submission.

2) Next, fill in the information in the OVERALL PROJECT DATA section. Again, rows highlighted in green will tell you which cells to fill in based upon the type of report being submitted. Only fill in the cells that are highlighted. The top 5 cells should remain the same for the duration of the reporting on the project. Cell B-11 should also remain unchanged after the initial submittal. Cells B-14 thru B-16 may change over the life of the project if you add additional sub-contractors as the project progresses.

3) Once you have completed the OVERALL PROJECT DATA section, begin entering each sub-contractor in the "Individual C/S-C Data Entry Matrix table. Columns F, J, K & L are drop-down selections in the table area. Just pick the appropriate response for these columns. There are "notes" that pop up as you select cells in the columns that helps explain what information is needed for each column.

4) **IMPORTANT:** Use the tab key to move across the columns. This is necessary in order to avoid generating false information in the cells so that calculations occur appropriately.

5) The first two rows of the Matrix are formatted to receive information. They will be identified in bright red when you make the selection of the type of form you are submitting (Cell B-1). To add another row that is properly formatted (like the rows above it), simply press the tab key when you get to the last column in the row you just filled in.

6) To change information in a cell, simply type over it or press the Delete key on your keyboard. Using other methods to change data can cause unwanted results. For example, copy and paste can add unwanted data. Using the spacebar to delete information actually leaves behind a space—which is a character—which will cause math errors.

7) You must have a State of Oregon Certification Number OR indicate that a contractor is self-identifying as a MWESB. If you have not filled in one of these, then the Name of the Contractor will remain bright red (which is an error symbol).

8) All cells in the CALCULATED REPORTING DATA section are automatically generated formulas and cannot be changed.

9) Columns to be completed are as follows:

Name of MWESB General/ Subcontractor: List each MWESB used on the project (all tiers). If you as the General, are an MWESB contractor, submit your information in the first row.

State of Oregon MWESB Certification Number: This is the number provided when a contractor or subcontractor applies for and receives this certification. Enter this number.

Self-Identified or Other Certified: If a sub-contractor indicates that they are a women, minority or emerging small business, but doesn't have certification, indicate here by identifying with a "Yes" by picking it from the drop-down box.

Initial Sub-Contract Value: This is the value of the subcontract-with the specific contractor listed, not to be confused with the value of the overall construction contract between the Contractor and the Owner. Once this number is entered, it should not change on subsequent submittals of the form.

Sub-Contract value billed within the fiscal year (July 1-June 30): This is the value for work performed during the year being reported. If your reporting requirements span multiple years due to the size of your project, this information may be replaced by new information for subsequent years.

Final Sub-Contract Value: This is the final value of the sub-contract, including any additions or deductions that occur over the course of the project.

MORE THAN ONE OF THE FOLLOWING CATEGORIES CAN BE SELECTED:

Minority-Owned: Certified by the State of Oregon or self-identifying; select Yes from the drop-down if it applies or leave blank if it does not.

Women-Owned: Certified by the State of Oregon or self-identifying; select Yes from the drop-down if it applies or leave blank if it does not.

Emerging Small Business: Certified by the State of Oregon or self-identifying; select Yes from the drop-down if it applies or leave blank if it does not apply.

10) Check your work prior to submitting the document to make sure that all cells in (light green) highlighted rows or columns are completed. If you do not have light green highlights showing up on your document, please return to #1 in this section and follow the directions given. REMEMBER TO SAVE YOUR FILE AGAIN NOW.

Submitting your Form:

Follow the directions as provided by the campus you are contracted with to submit this document. Typically you should be given an E-mail address within your contract transmittal or cover letter for which to submit the file.

SECTION 01 10 00

GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Specifications and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 OWNER OCCUPANCY

A. The Owner will occupy the premises during the entire period of construction for the conduct of normal operations.

B. A cleaning schedule is required to be submitted to the Project Manager prior to the commencement of work. This schedule will include at a minimum the:
   1. Frequency of cleaning.
   2. Procedures used for prevention of dust during demolition.
   3. Procedures used for prevention of dust when making a wall penetration or drilling into concrete.
   4. Method of "sealing" the construction area from the existing electronic equipment.

1.03 WORK SCHEDULE

A. Work in this contract shall be completed according to the following schedule:
   1. Contractor selected on or about January 31, 2013.
   2. Onsite work may not commence until Agreement is executed, and an acceptable certificate of insurance is received by the Owner.
   3. The work shall be substantially complete, inspected, and available for Punchlist review with Design Team and Owner on or before September 9, 2013.
   4. Final completion (ready for User occupancy) shall be on or before September 23, 2013.

B. Work in this contract shall be scheduled and completed with the following understood:
   1. The Owner or his representative shall specifically authorize any shutdown time that may be required to complete the work.
   2. Owner intends to occupy project during construction. Schedule work to minimize outages of power and air handling in room 321. Stage work so that the amount of dust and other particulate matter in room 321 is minimized. All work should be coordinated with the owner to minimize conflicts and to facilitate continuous Owner operations throughout the building, but with particular focus on room 321.
   3. Daily work hours are predominately 7 am to 5 pm, Monday through Friday. The Contractor may work whatever hours are necessary to complete the project by September 9, 2013.
   4. The work shall be coordinated with the Owner and other on-site contractors for the best interest of the overall project. The UO Project Manager must be notified and approve of all off-hour work, prior to the commencement of the work.
   5. Contractor shall develop a detailed schedule with the UO Project Manager.
   6. No cutting or removal work shall begin until authorized by the Owner.

1.04 WORK RESTRICTIONS

A. The contract price shall include all costs to provide a complete system. Costs will include all fees and time associated with access and limitations to traffic routes, delivery, storage and loading areas; and include costs for traffic planning and control, after-hours and premium time and off-site storage necessary or resulting from Contract requirements and restrictions.

1.05 USE OF THE PREMISES

A. All personnel who will enter upon the Owner's property shall be required to certify their awareness of and familiarity with the requirements of this Section.

B. Contractor shall limit use of the premises for work and storage to allow for:
   1. Owner occupancy, day and night.
   2. Public use, day and night.
   3. Security.
   4. Safe entry and exit for vehicles and pedestrians.
   5. Overhead protection shall be provided for all entries.

C. Access through the interior of the building shall be coordinated with the UO Project Manager during the construction period.

D. The Contractor will be responsible for purchasing parking permits valid for the duration of the project.

E. Space for a construction dumpster will be coordinated with the UO Project Manager.

F. Staging and access for the work will be from the driveway off of Agate Street on the northeast corner of Deschutes Hall and 13th Avenue. Contractor to coordinate timing of deliveries and material handling methods with the UO Project Manager.

G. The Contractor's employees shall comply with all the Owner's regulations as well as those required by state and local regulating agencies having jurisdiction at the site, especially OSHA.

H. Any costs, directly or indirectly incurred by the Contractor and related to the availability of parking permits are the responsibility of the Contractor. Any disputes or claims related to parking are subject to the appeals process of the Department of Public Safety.

I. Contractor shall coordinate and phase construction activities with the Owner and User to ensure the existing servers remain in operation during the project. There are several critical pieces of computer server equipment that will need to remain fully operational during the project. Contractor to coordinate with UO Project Manager and Department Users and include temporary electrical and mechanical provisions as required to ensure full operation during the Work.

1.06 PROTECTIONS

A. All sidewalks, asphalt paving, concrete, trees, shrubs, lawn areas, irrigation systems, and underground utility tunnels shall be protected from construction damage at all times. The Contractor is responsible for the work to repair any damage caused by the Contractor.

B. Clean, repair, resurface, or restore existing surfaces to their original, or better condition, or completely replace such surfaces to match existing, where damaged by construction operations.

C. The Owner will not be responsible for protection of material or equipment from vandalism or theft. Security is the responsibility of the Contractor.

D. Debris shall not be allowed to remain in or around the building during construction, but shall be disposed of as rapidly as it accumulates. The work area is limited and must be maintained clean.

E. Do not store materials where they will interfere with operation of the Owner. Storage areas must be coordinated and approved by the Owner’s Representative prior to the start of work.

F. Contractor is responsible for releases of hazardous materials from equipment, power tools, and vehicles brought on site. Contractor agrees to have resources and capability to monitor, contain, and clean up such releases, including, but not limited to, gasoline, diesel, hydraulic fluid, and oil. Contractor agrees to notify Owner if these or other materials are released at the

site.

G. Dust Control: Execute work by methods to minimize raising dust from construction operations. Methods may include, but are not limited to the following:

1. Provide ventilation fans and HEPA filtration fan box units to maintain a slight negative pressure in the construction areas and to prevent air-borne dust from dispersing into sensitive computer equipment.

2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner. See also specification section 01 50 00-1.06 for additional details. Occupied areas include, but are not limited to the existing server room and its equipment.

1.07 LOCATION AND COSTS FOR TEMPORARY UTILITIES

A. Electrical service for the project limited to 20 amp 120 v circuits will be paid for by the Owner. Connection to the service shall be the responsibility of the Contractor, with the Owner's approval.

B. Water service for the project will be paid for by the Owner. Connection to the service shall be the responsibility of the Contractor, with the Owner's approval.

C. The workers may use the Owner's restroom facilities.

D. Existing utility service is not to be interrupted. Ten (10) days written notice and approval is required prior to any utility shutdown required by the Work.

1.08 STORAGE

A. Material shall be stored off-site to insure the preservation of their quality and delivered to the job as need.

B. Temporary construction storage areas shall be limited to the areas designated by the Owner's Representative and is intended to allow for daily access of material and equipment only. Security is the responsibility of the Contractor.

C. Public safety at temporary storage and access areas shall be the responsibility of the Contractor. Provide temporary means to limit access and ensure safety as required.

D. Provide substantial covering to protect both stored equipment and installed equipment from damage from traffic and subsequent construction operations. Remove coverings from premises when no longer needed.

1.09 SALVAGE

A. All demolition material shall become the property of the Contractor and shall be removed from the premises. Items specifically defined as "Salvage to Owner" shall be delivered to a campus location as directed by the UO Project Manager.

1.10 PRE-CONSTRUCTION CONFERENCE

A. A pre-construction conference shall include in the agenda: Contract management, work schedule, work practices pertaining to maintaining a clean work area, daily reports, recycling, emergency phone number, traffic control, parking, hazardous material, storage areas, and other subjects of interest desired by the Contractor, the Owner's Representative, the UO Project Manager and other participants.

1.11 PERMITS

A. The Owner shall pay for plan check and permit fees.

B. The Contractor shall pick up all necessary permits, schedule inspection, finalize acceptance, and close-out the permit.

C. The Contractor shall procure and pay for all other required permits, licenses, and inspections for the construction of the work, including but not limited to temporary obstructions and enclosures.

D. The Contractor shall be responsible for all violations of the law for any cause in connection with the construction of the work or caused by obstruction of streets, or sidewalks or otherwise and shall give all requisite notices to public authorities.

E. Permit drawings and specifications are to be returned to the UO Project Manager at the completion of the Project.

1.12 RESIDENT PROJECT OBSERVER

A. The UO Project Manager will provide on-site observation during construction.

1.13 GUARANTEE

A. Materials and workmanship shall be guaranteed for a minimum of a one-year period after Final Acceptance by the Owner. Contractor shall repair any failures due to inferior workmanship and/or material, without additional expense to the Owner.

B. Materials, products or systems provided with guarantees longer than one year shall remain valid, and not reduced by the Requirements of this section.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

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

E. Number of copies of submittals.

F. Submittal procedures.

1.02 RELATED SECTIONS

A. Reference all specification sections. Refer to the Table of Contents for the project to ensure that you have been provided all of the specifications. It is the responsibility of the contractor and subcontractor to use all of the specifications for bidding and constructing work.

1.03 PROJECT COORDINATION

A. Project Coordinator: Project Manager.

B. During construction, coordinate use of site and facilities through the Project Manager.

C. Comply with Project Manager's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

D. Comply with instructions of the Project Manager for use of temporary utilities and construction facilities.

E. Coordinate field engineering and layout work under instructions of the Project Manager.

F. Make the following types of submittals to Engineer through the Project Manager:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Manufacturer's instructions and field reports.
   6. Applications for payment and change order requests.
   7. Weekly Progress schedules.
   8. Coordination drawings.
   9. Closeout submittals.

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. Architect.
3. Contractor.
4. Engineer.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
5. Designation of personnel representing the parties to Contract, Owner and Engineer.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, and Engineer, as appropriate to agenda topics for each meeting.

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. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Maintenance of quality and work standards.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to Work.

E. Record minutes and distribute electronically via email within two days after meeting to participants, Engineer, Owner and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 5 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 5 days.

C. Within 5 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 2 days after joint review, submit complete schedule.

E. Provide a 3 week look ahead schedule at each weekly OAC meeting.

3.04 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.

B. Submit to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Submit each required Division in complete sections.

D. Samples will be reviewed only for aesthetic, color, finish selection, and quality of material.

E. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

F. Owner and departmental User contacts will review the submittals concurrently with the Design Team.

3.05 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 types indicated.

B. Submit for Engineer’s knowledge as contract administrator or for Owner. No action will be taken.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

A. 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 as required.
   5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

3.07 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
   1. Small Size Sheets, Not Larger than 8-1/2 x 11 inches: Submit 6 copies.

B. Documents for Information: Submit two copies.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Engineer.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.08 SUBMITTAL PROCEDURES

A. Transmit each submittal with approved form.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. 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.

E. Schedule submittals to expedite the Project, and coordinate submission of related items.

F. For each submittal for review, allow 10 days excluding delivery time to and from the Contractor.

G. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

H. Provide space for Contractor and Engineer’s review stamps.

I. When revised for resubmission, identify all changes made since previous submission.

J. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

K. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

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.

1.02 TEMPORARY UTILITIES

A. Contractor to provide temporary electrical power during electrical service shutdowns.

B. Owner will provide the following:
   1. Electrical power and metering, consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.

C. Contractor to include provisions for supplemental, temporary air cooling, as required during the work to maintain a temperature range of 50-82 ˚F with a relative humidity range of 20%-80%, non-condensing.

1.03 TEMPORARY SANITARY FACILITIES

A. Use of existing facilities located at Deschutes Hall is permitted.

B. Maintain daily in clean and sanitary condition.

1.04 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.05 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.06 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. Provide “Zipwall” system, or similar as approved by UO Project Manager.

1.07 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.

1.08 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

1.09 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. 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.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.010 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition.

PART 2PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

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. Spare parts and maintenance materials.

1.02 RELATED SECTIONS

A. Section 01 10 00- General Requirements

1.03 SUBMITTALS

A. Proposed Products List:
1. Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
2. Submit within 15 days after date of Agreement.
3. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals:
1. Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data.
2. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals:
1. Prepared specifically for this Project.
2. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals:
1. Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
2. 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.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Do not use products having any of the following characteristics:
   1. Made using or containing CFC's or HCFC's.

C. Adhesives and Joint Sealants:
   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.
      a. Provide only products having industry standard low volatile organic compound (VOC) content.
      b. Require each installer to certify compliance and submit product data showing product content.

D. Aerosol Adhesives:
   1. Provide only products having lower volatile organic compound (VOC) content than required by Green Seal GS-36.

E. Provide interchangeable components of the same manufacture for components being replaced.

F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

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 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products of types and in quantities specified in individual specification sections.

B. Deliver with a transmittal to the UO Project Manager; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Engineer/Owner will consider requests for substitutions only during the pre-bid period.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. 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. Will provide the same warranty for the substitution as for the specified product.
3. Will 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.
5. Will reimburse Owner and A/E for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:
1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The Engineer/Owner will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

A. 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 manufacturer's warranties, inspections, and service.

B. 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 projects.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 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. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Prevent contact with material that may cause corrosion, discoloration, or staining.

H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I. 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

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

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. Pre-installation meetings.

D. Cutting and patching.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Owner personnel.

H. Closeout procedures, except payment procedures.

1.02 RELATED SECTIONS

A. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.
   2. Limitations on cutting structural members.

1.03 SUBMITTALS

A. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

B. 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. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.
      g. Written permission of affected separate Contractor.
      h. Date and time work will be executed.

C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. See sections 01 10 00 and 01 50 00 for additional details.

1. Provide ventilation fans and HEPA filtration fan box units to maintain a slight negative pressure in the construction areas and to prevent air-borne dust from dispersing into sensitive computer equipment.

2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner. Occupied areas include, but are not limited to the existing server room and its equipment.

C. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

1.05 COORDINATION

A. See Section 01 10 00 for occupancy-related 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. Coordinate scheduling and phase of work to minimize disruption of existing servers that will remain in operation during the project

D. Notify affected utility companies and comply with their requirements.

E. 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.

F. 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.

G. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

H. Coordinate completion and clean-up of work of separate sections.

I. 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.

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 60 00.

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 incorrect fabrication.

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 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.

3.04 ALTERATIONS

A. 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 the Engineer before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. 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.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. 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.
   2. 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.
   3. 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.
   4. Verify that abandoned services serve only abandoned facilities.
   5. 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.

D. 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.

E. 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 Engineer.

F. 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.

G. 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.

H. Clean existing systems and equipment.

I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site.

J. Do not begin new construction in alterations areas before demolition is complete.

3.05 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 CMU, cementitious, or concrete 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 local code, to full thickness of the penetrated element.

J. 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.

K. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

L. 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.

M. 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.

3.06 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.

3.07 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.

3.08 SYSTEMS STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer, Commissioning Agent, 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.

3.09 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. Provide the owner with a list of any specialized equipment required for maintenance of installed equipment. Include local vendors, current cost, and date.

3.010 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.011 FINAL CLEANING

A. Owner will provide comprehensive cleaning after final acceptance. Contractor to provide final cleaning.

B. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

C. Use cleaning materials that are nonhazardous.

D. 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.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned. Follow manufacturer’s specifications for cleaning of equipment

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site.

H. Clean Owner-occupied areas of work.

3.012 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Engineer and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.

C. Notify Engineer when work is considered ready for Substantial Completion.

D. 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 Engineer’s review.

E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

F. Accompany Project Coordinator on preliminary final inspection.

G. Notify Engineer when work is considered finally complete.

H. Complete items of work determined by Engineer's final inspection.

I. Refer to UO Campus Construction Standards Division 01 for more information on closeout procedures.

3.013 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections for one year from date of Substantial Completion.

B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section describes work associated with commissioning of selected systems including commissioning meetings, construction checks, equipment start-up, functional testing, operations and maintenance manuals, and operator training.

B. Work Provided Under Separate Contract: Owner's Commissioning Authority (CA) will supervise commissioning activities and provide the following commissioning services:
1. Develop commissioning plan.
2. Assist Contractor to incorporate commissioning activities into Project Construction Schedule.
3. Conduct commissioning meetings.
4. Review project submittals.
5. Develop Construction Checklists and Functional Test Plans.
6. Observe Construction checks and start-up of selected equipment.
7. Supervise and document functional testing.
8. Review O&M manuals and as-built documents.
9. Coordinate operator training.
10. Prepare final commissioning report.

C. Contractor shall provide the following services:
1. Assign individuals representing Contractor and mechanical, electrical, controls, and low voltage subcontractors as members of Commissioning Team.
2. Incorporate commissioning activities in Contractor’s construction schedule.
3. Assist CA in development of Construction Checklists.
4. Execute Construction Checklists.
5. Perform Equipment Start-up.
6. Perform contractor directed verification of automatic controls, communications, and fire and life safety systems and provide required verification documentation.
7. Assist CA in development of Functional Test Plans.
8. Assist CA with Functional Testing.
9. Provide operations & maintenance documentation.
10. Perform operator training and supervise training performed by manufacturer’s representative.
11. Provide submittals, product data, and shop drawings, design documents as specified.

D. Contractor shall provide related services as directed, including, but not limited to:
1. Access to the Work
2. Incidental labor, facilities, and equipment to assist CA in conducting commissioning activities.
3. Completion of required submittals.
4. Coordination of Work with activities of CA.

1.02 RELATED SECTIONS

A. 22 08 00 – COMMISSIONING OF PLUMBING

B. 23 08 00 - COMMISSIONING OF HVAC

C. 26 08 00 – COMMISSIONING OF ELECTRICAL

1.03 DEFINITIONS

A. CA: Individual responsible for supervising commissioning work.

B. Construction Phase Commissioning Plan: Document prepared by the CA that guides commissioning work through construction, verification, and warranty periods. The plan will include a listing of commissioning team members, systems to be commissioned, narrative description of the commissioning tasks and responsibilities, and a draft copy of the commissioning forms to be executed by the Contractor.

C. Construction Phase: Phase of the project during which the facility is constructed and equipment is installed and started. During the Construction Phase, the Contractor completes construction checklists, performs equipment start-up, performs TAB work, submits O&M manuals, and performs control system verification. The Construction Phase generally ends at Substantial Completion.

D. Verification Phase: Phase of the project during which functional testing and operator training is performed. The Verification Phase generally begins at Substantial Completion and ends at Final Completion.

E. On-Line Commissioning System: The CA will maintain an online commissioning system, which serves as a central location for accessing commissioning documents such as the Owner's Project Requirements, Commissioning Plan, status reports, design reviews, submittal reviews, schedules, and Issues Log. The online system provides current project information to authorized project team members through general Internet access. The site URL is https://www.swecx.com. The Issues Log portion of the site allows for the Owner's Construction Manager, Architect, and General Contractor to provide comments, document actions, and indicate resolutions.

1.04 SUBMITTALS

A. Designated Commissioning Team Representatives: Submit list of names and contact information for individuals representing Contractor and Subcontractor as members of Commissioning Team.

B. Construction Schedule: Submit updated project construction schedule to CA monthly. Incorporate time and duration of Commissioning activities, as provided by CA, into the construction schedule

C. Construction Submittals and Shop Drawings: Provide as required to perform commissioning work.
1. Contractor to provide CA a copy of submittal log. CA will review log and identify submittals that are associated with equipment and systems being commissioned and required to be submitted to the CA.
2. Contractor to provide one/two copies of each submittal or shop drawing to the Owner's Representative, including all resubmissions, required by the CA at the same time submittals are provided to the Design Team. CA will review submittals concurrently with the Design Team and provide review comments to the Design Team. The Design Team will consolidate review comments into a single submittal review response to be provided to the Contractor.
3. Contractor to provide a copy of Design Team submittal review comments to the CA.

D. Engineering Data: Provide shop drawings, product data, performance data, engineering data, installation and start-up data, operation and maintenance information, schematics, wiring diagrams, programming manuals, and similar information as necessary for completion of the Work of the Section in accordance with Commissioning Schedule.

E. Construction Checklists: Complete and submit to CA for certification. Attach copies of all manufacturers' field or factory performance and start-up test documentation provided for associated equipment or systems.

F. Control Verification Reports: Complete and submit to CA for certification.

G. Operator Training Schedule: Contractor shall submit training schedule listing all required training sessions as specified and in accordance with Training Plans. Training schedule shall include date and time of training, location, and name and qualification of trainer, and facilities needed for training. Training Schedule to be submitted to Owner's Authorized Representative four weeks prior to substantial completion.

H. Operations and Maintenance Manuals: Furnish one copy of draft and final Operations and Maintenance Manuals for review by CA. Deliver two manuals to CA or provide access to manuals at project site. CA will return manuals to Contractor upon completion of CA review.

I. 23 08 00 - COMMISSIONING OF HVAC

J. 26 08 00 – COMMISSIONING OF ELECTRICAL

1.05 QUALITY ASSURANCE

A. Provide qualified mechanics and technicians to provide required commissioning services. Technicians shall have knowledge of the Work and experience with installation and operation of the general systems and components involved to assist in commissioning activities. Individuals shall be adequately equipped to effectively assist the CA as necessary. Upon request submit names and qualifications of technicians to CA for approval.

B. Provide qualified instructors to perform operator training. Instructor shall be knowledgeable in the specific equipment and systems involved. Upon request submit names and qualifications of technicians to CA for approval.

1.06 SEQUENCING

A. Schedule adequate time as determined by CA for execution of Commissioning Plan.

B. CA will conduct a Commissioning Process Meeting approximately 30 days after Contractor received Notice-to-Proceed and after all subcontractors are identified.

C. CA will prepare a Construction Phase Commissioning Plan approximately 30 days after Commissioning Process Meeting.

D. Provide construction submittals and shop drawings to CA as described above in SUBMITTALS.

E. Provide engineering data as required by CA to prepare Construction Checklists within four weeks after date of approved submittal.

F. CA will conduct an initial commissioning coordination meeting approximately 30 days before equipment begins to arrive at the project site to coordinate commissioning activities and execution of construction checklists. Additional commissioning coordination meetings will be

scheduled as necessary throughout the process to discuss commissioning schedule and coordination among trades.

G. Perform Construction Checks as equipment is received, installed, and placed in operation. Construction checks shall be performed as work is complete. For example, equipment inspection shall be performed upon receipt of equipment on site, installation inspection shall be performed when equipment in set in place and anchored, and so on.

H. Submit schedule for operator training to Owner's Authorized Representative and CA eight weeks prior to Substantial Completion. Schedule shall include time and duration of each required training session.

I. Submit fire alarm system control verification report two weeks prior to Fire Marshall's acceptance test.

J. Submit control verification reports three weeks after Substantial Completion.

K. Functional testing will be scheduled after construction checklists; testing, adjusting, and balancing report; and control verification reports have been submitted and accepted. Contractor shall provide written notice that systems are completely operational, and ready for functional testing. Functional testing may proceed prior to acceptance if the CA and Owner's Authorized Representative determines that deficiencies will not significantly affect system performance and timing is critical. The CA will provide notification to Contractor, Architect, and Owner's Authorized Representative a minimum of one week prior to performing functional testing.

L. Submit draft operations and maintenance manuals to Owner's Authorized Representative 30 days prior to substantial completion.

M. Operator training shall be performed within a 30-day period following Substantial Completion.

N. Troubleshooting, corrections, and retesting shall be completed within 3 months of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide specialized test equipment including manufacturer's proprietary test equipment, as necessary for commissioning of mechanical, plumbing and electrical systems and components. Comply with requirements of individual technical Sections of Division 22, 23, and 26. Common test equipment such as temperature, pressure, speed, and electrical power measuring devices shall be provided by CA.

PART 3 - EXECUTION

3.01 APPLICATION

A. Commissioning Meetings: Commissioning Team shall attend meetings as required by CA including Commissioning Process Meeting, submittal review meetings, and coordination meetings prior to construction checks; adjusting and balancing; and functional testing. Commissioning team shall attend troubleshooting meetings as required to resolve issues identified in submittal reviews and commissioning reports.

B. Construction Checklists:
1. Provide equipment installation, start-up, and operating information requested by the CA as required to develop Construction checklists.
2. Perform Construction Checks for all equipment being commissioned as described in Construction Checklists prior to equipment start-up. The Contractor shall designate responsibility for completing construction checks among subcontractors. The designated subcontractor shall initial and date each item on checkout sheets as completed and submit executed forms to CA for certification. All items listed in the Construction Checklists shall be complete prior to certification unless the incomplete item does not affect safe and reliable equipment operation. If such an item is identified, a description of the incomplete work must be attached to the Construction Checklists. Equipment requiring construction checkout shall not be started until the Construction Checklists are fully executed by the Contractor.
3. Contractor shall maintain “Cx Submittal Status Report”. CA will furnish Excel status report spreadsheet that will be used to monitor completion of construction checklists.
4. Contractor shall start-up equipment as described in Construction Checklists. Where required, provide manufacturer's agent to perform start-up as specified in Divisions 22, 23, and 26.
5. Fully executed Construction Checklists shall be submitted to the CA for certification.
6. CA will document unresolved issues in a project Issues Log. The Issues Log documents status, responsibility, and required action for each unresolved issue.
7. CA shall perform a recheck of selected equipment. If minor discrepancies are identified, Contractor shall recheck all similar systems and resubmit Construction Check forms for certification. If major discrepancies are identified, CA shall perform Construction Checks, and Contractor shall compensate Owner for additional commissioning costs by Contract modification.

C. Control Verification Reports:
1. Perform control system verification and prepare verification reports as specified in Divisions 22, 23, 25, and 26. Verification shall be performed by manufacturer’s authorized installation contractor. Verification report shall include a description of the incomplete work.
2. Submit completed Control Verification Reports to the CA for acceptance.
3. CA will document unresolved issues in a project Issues Log. The Issues Log documents status, responsibility, and required action for each unresolved issue.

D. Functional Tests:
1. Assist CA in performing Functional Tests, which shall generally include operating equipment and systems as necessary for testing. The CA will record test measurements and documentation of results.
2. CA will document all unresolved issues in a project Issues Log. The Issues Log documents status, responsibility, and required action for each unresolved issue.
3. CA shall retest selected systems once to verify that corrective work is complete. Retests will be performed after notification from the Contractor that work is complete. If corrective work is not complete and additional retesting is required, Contractor shall compensate Owner for costs of additional CA testing sessions by Contract modification.

E. Operations & Maintenance Manuals: Contractor shall provide complete operation and maintenance information for all equipment and systems being commissioned. Information shall be suitably bound, organized, and comprehensive. CA will review and provide written review comments to the Owner’s Authorized Representative.

F. Operator Training: Instruct Owner's operating personnel in operation and maintenance of mechanical and electrical equipment and all systems being commissioned.
1. Instruct Owner in proper operation and maintenance of equipment and systems. Instruction shall generally include topics listed in manufacturer’s operations and

maintenance manual. Operator instructions shall cover all aspects of manual, automatic, and safety controls. Contractor shall also instruct the Owner in the general configuration of systems and location of equipment and components. Equipment shall be fully operational prior to instruction.

2. Contractor shall furnish training by equipment manufacturers where specifically required. Manufacturer's field start-up and adjustment will not fulfill manufacturer's training requirement.
3. Contractor shall coordinate operator training with the Owner's Authorized Representative and CA as follows:
   a. Training Plan: The CA shall develop an Operator Training Plan, which provides details regarding the type and amount of training required. The plan will include a Training Record and an Evaluation Form to be executed at the completion of each training session.
   b. Training Schedule: Contractor shall develop a training schedule for approval by the Owner's Authorized Representative.
   c. Training Record and Evaluation Forms: The training record, included on the training plan, provides documentation of the duration and general topics covered during each training session. The Contractor shall complete training records after each training session and return the completed forms to the CA. Contractor shall furnish Owner's staff with an Evaluation Form. The Owner's Authorized Representative will complete the evaluation form and return the completed form to the CA. Training will not be accepted until the Training Record and Evaluation Forms are returned fully executed to the CA.

G. Issues Resolution: Unresolved issues will be listed in the project on-line Issues Log. Refer to On-line Commissioning System in Article 1.03, Definitions above. Each issue will be identified with an identification number. The Issues Log will include a description of the unresolved condition, identify the responsible individual(s), and describe suggested corrective action. The Contractor will periodically access the On-line Commissioning System to monitor the status of commissioning issues, and shall diligently complete all tasks that are identified as the responsibility of the Contractor. The Contractor shall modify on-line issue status when each item is completed and provide a description of corrective action performed. Contractor and related subcontractors shall attend commissioning meetings to review the Issues Log and coordinate resolution of issues as required by the CA.

3.02 QUALITY CONTROL

A. Provide mechanics that are experienced with the Work and installed components of each system to assist in completion of the commissioning activities.
   1. Work necessary to provide systems complying with performance requirements of the contracts is the Contractor's responsibility.

B. Manufacturer's Field Services: Provide manufacturer's representatives with expertise in components and systems. Where required, manufacturer's representative shall perform start-up, testing, and maintenance training of Owner's facilities staff including classroom and onsite instruction.

3.03 ACCESS TO WORK

A. Contractor shall provide facilities and access for CA to perform work including but not limited to:
1. Keys, security passes, passwords, codes, etc.
2. Ladders.
3. Lifts where work is more than 12 feet above floor level.
4. Removal of ceiling tiles, partitions, panels, or other fixed construction necessary for completion of work.
5. Proprietary programming and metering equipment.

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Specifications and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 SECTION INCLUDES

A. Selective demolition of building elements for alterations purposes.

B. Abandonment and removal of existing utilities and utility structures.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

B. Obtain required permits

C. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.

D. Provide, erect, and maintain temporary barriers and security devices.

E. Conduct operations to minimize effects on and interference with adjacent structures and occupants.

F. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

G. Do not begin removal until receipt of notification to proceed from Owner.

H. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

3.02 EXISTING UTILITIES

A. Coordinate work with Owner's Authorized Representative; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 10 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 10 days prior written notice to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. 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 Engineer before disturbing existing installation.
      a. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions.
   2. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. 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.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. 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.

F. 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. Patch as specified for patching new work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

D. Contractor may not use Owner's dumpsters.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Design and installation of modifications to the existing wet and dry sprinkler systems serving Deschutes Hall.

1.02 REFERENCE STANDARDS

A. ASTM A 135/A 135M - Standard Specification for Electric-Resistance Welded Steel Pipe; current edition.

B. ASTM A 795/A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; current edition.

C. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.

D. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; National Fire Protection Association; 2010.

E. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

F. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; current edition.

G. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

A. See Section 01 60 00 - Product Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13.

2.02 ABOVE GROUND PIPING

A. Black Steel Pipe: ASTM A-135 Schedule 10 or ASTM A-53 Schedule 40, Type E, Grade A or B. All steel piping must be domestic; no foreign steel piping.
   1. Steel Pipe 2” and smaller is to be Schedule 40, or UL listed proprietary pipe

similar to Allied Dyna-Thread for UL listed Threaded Corrosion Resistance Ratio (CCR) greater than or equal to 1.0.

2. Steel Pipe 2-1/2" and larger is to be Schedule 10 or 40 and shall be verified to have a CRR of 1.0 or greater.
3. Schedule 40, Black Steel Pipe Requires:
   a. Screwed joints ANSI B2.1 or welded joints ANSI B31.10, B31.10a, B31.20b
   b. Mechanical Grooved couplings joined by an UL and FM approved combination of bolted couplings, gaskets and grooves. Grooves may be rolled or cut and be dimensionally compatible with the coupling.
4. Schedule 10, Black Steel Pipe Requires:
   a. Welded joints, ANSI B31.10, B31.10b
   b. UL and FM approved mechanical couplings. Couplings may be of the bolted rolled grooved type or the mechanical locking type. Grooves for the rolled grooved type shall be rolled only.
5. Cast Iron Fittings:
   a. Flanges and fittings: ASME B16.1 or AWWA C207
   b. Screwed: ASME B16.4
6. Mechanical Grooved Couplings: Malleable iron housing conforming to ASTM A 47, Grade 32510 or ductile iron conforming to ASTM A 536, Grade 65-45-12. Coupling nuts and bolts shall be of steel and conform to ASTM A 183.
7. Flange Gaskets: Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain arimid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR).
8. Square head bolts and heave hexagon nuts: ASME B18.2.1 and ASME B18.2.2 and ASTM A 307, ASTM A 575, or ASTM A 576.

2.03 PIPE HANGERS AND SUPPORTS

A. Hangers shall be in accordance with NFPA 13 as adopted by the Oregon Structural Specialty Code and Oregon Fire Code.

B. Manufacturers known to be acceptable: Michigan, Tolco.

C. Hangers, brackets, supports, anchors, and related appurtenances are to be UL listed for pipe size(s) being suspended.

D. Pipe may be anchored to corridor walls using unistrut and pipe clamps.

E. Hanging of pipes from ductwork is prohibited

PART 3 EXECUTION

3.01 DESIGN AND INSTALLATION

A. Provide design of wet sprinkler system modifications in rooms 321, 321A, 325, and dry sprinkler system modifications in the attic space to include:

1. Verify existing sprinkler system coverage.
2. Modify or add sprinkler heads as necessary.
3. Ensure required devices are installed and connected as required to fire alarm system.
4. Provide calculations and fire protection drawings as required for permit application and UO review.

B. The existing attic space dry fire sprinkler system riser is located on the third floor stair

landing. Extreme care must be taken when working on this system to ensure it does not accidentally trip.

C. Fire protection must be maintained during construction and while work is being done on the wet and dry sprinkler systems.

D. Install piping, hangers, and supports in accordance with NFPA 13.

E. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

F. Sleeve pipes passing through partitions, walls, and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Pipe Hangers and Supports:
1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Do not penetrate building structural members unless indicated.

K. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

L. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

M. Provide gate valves for shut-off or isolating service.

N. Drains and Drips:
1. Piping shall drain back to the express drain located beside the riser. Where this is not possible, auxiliary drains must be provided and discharge location to be reviewed and approved by FS EH&S.
2. Install auxiliary drains at low points in system.
3. Five or fewer trapped heads will not require a drain valve, but may be drained through a plugged tee.
4. Drains are to have a 3/4 inch hose line connection.

3.03 1-YEAR WARRANTY INSPECTION

A. Contractor to conduct a 1 year inspection with FS EH&S of system equipment and system operational functions prior to expiration of 1 year warranty and correct any found items at the cost of the Contractor. Provide report to FS PM and EH&S.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe Markers.

1.02 SUBMITTALS

A. Product Data: Provide manufacturers catalog literature for each product required.

B. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation; www.bradycorp.com.

B. Champion America, Inc; www.Champion-America.com.

C. Seton Identification Products; www.seton.com/aec.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PIPE MARKERS

A. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.03 VALVE TAGS

A. Brass valve tags shall include:

1. Valve number
2. Area of the building it serves (floor, area, room, etc.)
3. Valve status: Normally open or normally closed
4. Piping system

PART 3EXECUTION

3.01 INSTALLATION

A. Install tags with corrosion resistant chain.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

C. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 22 08 00

COMMISSIONING OF PLUMBING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes Commissioning activities required for work of Division 22 Sections including but not limited to construction checks, equipment start-up, functional testing, and operator training.
   1. Comply with Section 01 91 13 – General Commissioning Requirements for Commissioning activities for Division 22 work.

1.02 SEQUENCING

A. Provide written notification to Commissioning Authority CA in advance of significant project dates as directed and as listed below.
   1. Four weeks prior to installation of lay-in ceiling tiles or other partial concealment of equipment to be commissioned.
   2. Four weeks prior to any system being ready for balancing.

1.03 SUBMITTALS

A. Provide submittals of systems being commissioned to Owner's Authorized Representative as required by Section 01 91 13.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 CONSTRUCTION CHECKLISTS

A. Contractor shall execute as required by Section 01 91 13. Construction Checklists for each system being commissioned will be prepared by CA during construction.

3.02 FUNCTIONAL TESTING

A. Contractor shall assist CA with functional testing as required by Section 01 91 13. Functional Test Plans for each system being commissioned will be prepared by CA during construction, and will generally include a rigorous verification of instrument calibration, equipment performance, package equipment control system operations, automatic control sequence of operations, fire and life safety sequences, and operator interface functions. CA will supervise and document functional testing. Contractor shall provide qualified technicians to assist CA during on-site testing and perform the following functions.
   1. Operate equipment and systems as necessary to conduct testing.
   2. Manipulate control parameters to simulate test conditions as detailed in Functional Test Plans.
   3. Provide proprietary hardware and software as needed to interface with manufacturers packaged control systems.

B. Labor required for retesting due to failure of equipment, or systems not performing in accordance with Contract Documents shall be provided at no additional cost to Owner.

3.03 OPERATIONS AND MAINTENANCE TRAINING

A. Provide operation and maintenance instruction to Owner's personnel as required by Division 01 and 22.

3.04 SCHEDULE OF SYSTEM BEING COMMISSIONED

A. Commission systems and equipment listed below including associated equipment, piping, and control systems.

B. Plumbing Systems:
1. Plumbing piping

END OF SECTION

SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Condensate drain.
   2. Domestic Cold Water.

1.02 REFERENCE STANDARDS

A. University of Oregon Campus Construction Standards; third edition, May 2011

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

C. ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2002.

D. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.

1.03 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with University of Oregon standards.

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

1.05 REGULATORY REQUIREMENTS

A. Perform Work in accordance with Oregon plumbing codes.

1.01 DELIVERY, STORAGE, AND HANDLING

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

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 CONDENSATE DRAINS, DOMESTIC COLD WATER, ABOVE GRADE

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L, Hard Drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: Solder, lead free, ASTM B 32, 95-5 tin-antimony.

2.02 PIPE HANGERS AND SUPPORTS

A. Condensate Drains and Domestic Cold Water:
   1. Copper Pipe Support:
      a. Suspended supports: Copper plated adjustable clevis or J pipe hanger.
      b. Floor mounted supports: Strut channel and pipe clamp with isolation pad or insert.

2.03 BALL VALVES

A. Manufacturers:
   1. Conbraco Industries; www.conbraco.com.
   2. Nibco, Inc; www.nibco.com.
   3. Milwaukee Valve Company; www.milwaukeevalve.com.
   4. Also acceptable: Crane, Jenkins, Stockham, Hammond.
   5. Substitutions: See Section 01 60 00 (01600) - Product Requirements.

B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, stainless steel balls, full port, reinforced teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.04 GATE VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, screwed bonnet, non-rising stem, lockshield stem, inside screw with backseating stem, solid wedge disc, alloy seat rings, solder ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide brass connections where jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for access to valves.

G. Provide access where valves and fittings are not exposed.

H. Install valves with stems upright or horizontal, not inverted.

I. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.

2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide copper plated hangers and supports for copper piping.

3.03 APPLICATION

A. Install unions downstream of valves and at equipment.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.04 SCHEDULES

A. Pipe Hanger Spacing:
   1. Copper Piping:
      a. Pipe size: 1/2 inches to 1-1/2 inches:
         1) Maximum hanger spacing: 6 ft.
         2) Minimum hanger rod diameter: 3/8 inches.

END OF SECTION

SECTION 23 05 00

MECHANICAL SCOPE OF WORK

PART 1 GENERAL

1.01 OVERVIEW

A. The Owner is renovating Research Server Rooms 321, 321A & 325 of the Deschutes Hall building at the University of Oregon in Eugene, Oregon.
   1. Existing HVAC and electrical systems will be replaced. Work will be coordinated to ensure the computer servers remain in operation during construction.
   2. Work is divided into two phases. Only phase 1 work is being performed at this time.
   3. The work consists of replacing the HVAC system serving these rooms, removing the wall between 321A and 325, reinforcing the floor joists, replacing the UPS system and installing new switchgear to serve the research server room that includes all materials, labor, and services to complete the installation as outlined in this summary of work and on the drawings.

B. The following list of work to be performed by the Contractor is presented for the purpose of complementing or clarifying the Drawings, Specifications, and other Contract Documents; but shall not limit the definition of Work as described herein nor shall it constitute a complete list of the Work of the Contract.

C. Clarifications to the technical aspects of this specification and the Drawings are available from the Owner's Engineer, Evergreen Engineering, Eugene, Oregon, (541) 484-4771, Mr. Patrick Sandow, Project Manager.

D. Cutting and Welding
   1. In the event that hot work is required, the Owner shall be contacted prior to performing the hot work. All Owner hot work requirements must be adhered to during the project.

1.02 The Contractor shall:

A. Accept the site in its existing condition at the time of commencement of the Work. A site visit by the Contractor is required to ensure a first-hand understanding of this Scope of Work.

B. Submit to the Owner for approval a list of temporary buildings, if any, that the Contractor intends to bring onto the site.

C. Before commencing any work, submit for review and approval of the Owner a detailed schedule (simple bar graph) showing the commencement, the order, and the completion dates for the various parts of this Work. The Work shall be performed in accordance with the approved detailed schedule.

D. Transport to the site Contractor's construction materials and equipment required for the performance of the Work; storing and locating such materials in areas designated by the Owner.

E. Provide, install and maintain barricades, guardrails, warning lights, and similar devices in conformance with the safety regulations governing the Work.

1.03 Before starting any work that will have an effect on existing utilities (electrical, sewer, water, etc.) and that will temporarily discontinue or disrupt service to the existing building or equipment, Contractor will notify the Owner in writing 10 days in advance and obtain the Owner's approval before proceeding with this phase of the Work. Owner will shut down and/or lock out all installed equipment or systems when work is being performed in or near energized equipment.

1.04 Maintain a clean work area. Containment of dust and fumes is required per the general specification Section 01 10 00, paragraph 1.02.

1.05 Final clean-up will require wiping down all walls and vertical surfaces and vacuuming the floor.

1.06 Refer to Section 01 10 00 - General Requirements for additional working conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. All material furnished under this specification shall be new and of first quality

B. Fabrication methods shall follow the best accepted practice within the industry.

C. Fabrication shall be performed in a workmanlike manner. Poor workmanship, even though structurally sound, shall be cause for rejection where appearance is a justifiable consideration.

D. All nuts, bolts, and caulking will be supplied by the successful bidder.

E. At the time of final clean up, all finish surfaces shall be free of scratches and other surface blemishes, and all repaired surfaces shall be equal to the original finish and shall not be visible.

PART 3 EXECUTION

3.01 GENERAL

A. Remove the door to room 321A and the wall between 321A and 325.
   1. The doorway will be framed to match existing construction.
   2. Rigid insulation will be used to cover the existing windows as shown on 1000A01.

B. Strip curtains will be added to separate the hot and cold aisles in room 321 as shown on 1000A01 and 1000A02.

C. Remove and dispose of the existing HVAC system to include the down flow Liebert AC unit, hydronic piping and three wall mounted Mitsubishi ductless split systems as shown on 1000M02.

D. Relocate toilet room exhaust fan EF-3 and reroute ductwork as shown on 1000M03 and 1000M04.

E. Furnish and install new redundant computer room ac units, ductwork, air outlets, controls, and hydronic piping as shown on drawing 1000M04.

F. Testing and balancing scope will be performed by Air Inc. of Eugene, Oregon and will be paid for by Owner. Mechanical Contractor to coordinate scheduling TAB work with UO Project Manager and will assist in the balancing of the ductwork system.

END OF SECTION

SECTION 23 05 10

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes the basic mechanical Requirements for all mechanical work. It applies to all Specification sections included in Division 23 and their relationship specifically to Specification sections in Divisions 11, 13 and 26.

B. Requirements for the following are included:
1. Related Sections.
2. Regulatory Requirements
3. Submittals.
4. Quality Assurance.
5. Delivery, Storage, and Handling.
6. Safety Considerations.
7. Cleaning, Startup, and Adjustments.
8. Products.
9. Installation.
10. Mechanical Procedures.
11. Warranties.

C. Provide all labor, equipment and materials that are required to provide a complete installation of the mechanical systems as indicated on the Drawings and in the Specifications including the required Scope of Work for proper execution of Division 23.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of the Contract, including General Conditions, Supplementary General Conditions, and Division 1, apply to the work specified in this section.

B. The work in this section applies to the Division 23 Subcontractors design and installation. Where a conflict occurs between this section and the technical sections of the Specifications, the technical sections of the Specifications shall take precedence over this section.

C. The contract documents include Drawings, Specifications and data sheets. The Drawings may include plans, elevations, details, process flow and instrumentation diagrams. The Subcontractor is responsible for reviewing all of the documentation. Where a conflict occurs between documents the Subcontractor shall request additional information (RFI). The Subcontractor is responsible for all systems under their jurisdiction, where a conflict occurs between the Drawings the Subcontractor is responsible for most extensive scope of work.

D. Reference all Division 1 Documents. Coordination is a requirement of this project.

E. It is the responsibility of this Subcontractor to coordinate exact Requirements governed by actual job conditions. Check all information and report any discrepancies before submitting a bid or fabricating work.

F. All dimensions shown on the Drawings are in feet and inches unless indicated otherwise. If in doubt, obtain clarifications from the engineer prior to submitting bid. Dimensions marked on the Drawings shall take preference to scale measurements and large-scale Drawings shall govern over small-scale Drawings. When measurements are affected by the conditions already established, take field measurements. Do not scale the Drawings.

G. Any supplementary Drawings required to complete any auxiliary small bore piping shall

be provided by this Subcontractor. Provide all taps, vents, ports, etc. required in piping and ductwork for instruments.

1.03 REGULATORY REQUIREMENTS

A. When references are made to standards, Specifications, or codes refer to the latest edition including addenda, bulletins, or other revisions existing on the date of the signing of the Contract of subsequent updates.

B. Codes and Ordinances:
1. Install work in conformance with applicable local, state, federal ordinances and statutes. Nothing in the Specifications or Drawings shall be construed to permit deviation from the governing codes. In case of conflict with local ordinances and statutes, the more stringent shall take precedent.
2. Where material specified exceeds the quality of that permitted by code the Specifications shall govern.
3. Conflicts between the contract documents and applicable codes or ordinances shall be brought to the attention of the Design Team for clarification.
4. The contractor shall obtain all permits and arrange all inspections required by codes applicable to this Division and shall submit written evidence to the UO Project Manager that required permits, inspections, and code Requirements have been secured.

C. Compliance with the University of Oregon Construction Standards, Third Edition (May 2011), Division 23 Mechanical and all referenced Divisions, Sections, Appendices and other individual Requirements therein is mandatory. University of Oregon Construction Standards will have precedence when conflict with the Drawings and/or Specifications.

1.04 SUBMITTALS

A. Product Data: Provide wiring diagrams (where applicable) with electrical characteristics and connection Requirements.

B. Test Reports: Provide all test reports to the UO Project Manager.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instruction for safe operating procedures.

E. Maintenance Data: Include assembly Drawings, data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Work shall be executed by skilled mechanics under the direction of a qualified supervisor knowledgeable and experienced in the basic principles required for the installation of the mechanical systems.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Shipment:
1. In accordance with manufacturer's instructions, each product shall be correctly prepared for shipment as specified and for storage in a manner requiring no disassembly prior to operation. Products shall be shipped FOB jobsite unless otherwise noted.
2. The Subcontractor shall be solely responsible for the preparation for shipment provisions employed with respect to materials and application.
3. To prevent damage during shipment, all flange facings shall be protected by securely fastened metal, metal-faced wood or heavy gauge plastic covers.
4. Equipment shall be completely free of water prior to any shipment preparation.

5. Bearings, bearing housings, and oil systems, including reservoirs, coolers, filters, and piping, shall be thoroughly cleaned internally of metal particles, dirt and debris, and coated with a suitable rust inhibitor prior to shipment.
6. To eliminate damage during shipment, storage, operation, maintenance instruments and valves, including auxiliary systems, must be securely mounted and/or supported.
7. Threaded connections shall be provided with a pipe plug of the same material as the connections (except cast iron connections shall have steel plugs). Plugs shall have a square or hex head. Teflon tape shall be used as a thread sealant.
8. Open ends of tubes and pipe shall be capped for protection.
9. Separate, loose, or spare parts shall be boxed and each part individually protected as required. Each individual container shall be marked both inside and outside with the equipment or part number for which the parts are intended.
10. One complete set of Installation, Operating and Maintenance Instructions shall be packed and shipped with the equipment or components. This set is in addition to the sets which are to be sent directly to the UO Project Manager.
11. Each container shall also include a complete Bill of Materials identifying each part. In some instances, such as instruments, specific tagging shall be required.

1.07 SAFETY CONSIDERATIONS

A. Install all equipment with suitable access clearances that satisfy OSHA and code Requirements for maintenance or removal of replaceable parts. Provide unions or flanges to allow maintenance or removal when rebuilding the system.

B. Subcontractor shall notify the UO Project Manager immediately of any equipment requiring maintenance that cannot be reached by normal walkways due to interference with ductwork, piping, or other obstructions and propose an alternate means of access. Including overhead platforms, ladders and safety railings or handholds, or as required to meet OSHA standards.

1.08 CLEANING, STARTUP, AND ADJUSTING

A. The Contractor shall be responsible for proper operation of systems, minor subsystems, and services provided under this Section. It shall coordinate startup procedures, calibration, and system checkout with Subcontractors involved. System operational problems shall be diagnosed; correctional procedures shall be initiated with the various Subcontractors as required to bring the system into compliance with the design, and the problem then shall be rechecked to verify that the system operates normally. Issues shall be brought to the attention of the UO Project Manager.

B. All parts of the installation must be thoroughly cleaned upon completion of the work. Clean up and remove from the premises refuse material, crates, and rubbish arising from work.

PART 2 PRODUCTS

2.01 GENERAL

A. Equipment and components shall be the manufacturer's most recent standard design. Equipment and component designs which have not been previously used successfully in an industrial or similar application are not acceptable unless approved in writing by the Engineer.

B. The Subcontractor shall provide seismic restraint of equipment, pipe, ductwork, and other related items in Division 23.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with the Requirements of the equipment or component manufacturer, including special Requirements for seismic restraints.

B. Work necessitated by the discovery of existing interference's that must remain shall be brought to the attention of the UO Project Manager. Existing conditions are the responsibility of the Subcontractor. Field routing may require additional elbows, it is a requirement that these be provided by the Subcontractor to provide a complete installation.

C. Equipment Manufacturer's Responsibility and Services:
   1. The manufacturer's representative shall provide the initial startup of equipment in the presence of the Contractor and UO Project Manager.
      a. Provide a prestart check of all piping, valves, ductwork, control devices, control panels, and equipment.
      b. Calibrate and adjust equipment and controls for operation at the specified design conditions.
      c. Provide a record of all startup events noting problems and their resolution.
      d. Provide a record of all setpoints for operational controls and devices.
   2. Upon the completion of equipment startup, provide adequate instructional time with Owner's personnel to review the operations and maintenance manuals and perform each step necessary for startup, shutdown, troubleshooting, and routine maintenance. The instructional time shall be scheduled through the UO Project Manager.

3.02 MECHANICAL PROCEDURES

A. Testing Requirements:
   a. Furnish copies of test reports, signed by the inspector, to the UO Project Manager before making claims for final payment.

3.03 WARRANTIES

A. The Contractor shall provide to the Owner all Warranties and Guaranties including those from the manufacturers per the Requirements of Section 01 70 00 Execution and Closeout Requirements.

B. Provide manufacturer's written warranties covering defects in material and workmanship of products and equipment utilized for the project.

C. Warranties shall be for a period of 1 year from the date of substantial completion unless more stringently specified within individual Sections of this Division.

D. See OUS Retainer General Conditions, Section K.3.2 for substantial completion requirements as follows:
Substantial Completion of a facility with operating systems (e.g., mechanical, electrical, or HVAC) shall be that degree of completion that has provided a minimum of thirty (30) continuous days of successful, trouble-free operation, which period shall begin after all performance and acceptance testing has been successfully demonstrated to the Owner. All equipment contained in the Work plus all other components necessary to enable the Owner to operate the facility in the manner that was intended, shall be complete on the Substantial Completion date. The Contractor may request that a Punch List be prepared by the Owner with submission of the request for the Substantial Completion notice.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.02 REFERENCE STANDARDS

A. University of Oregon, Campus Construction Standards, May 2011

1.03 SUBMITTALS

A. Product Data: Provide manufacturers catalog literature for each product required.

B. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation; www.bradycorp.com.

B. Champion America, Inc; www.Champion-America.com.

C. Seton Identification Products; www.seton.com/aec.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/2 inch (6 mm).
   3. Background Color: Black.

2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.04 PIPE MARKERS

A. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Identify control panels and major control components outside panels with plastic nameplates.

E. Identify valves in main and branch piping with tags.

F. Tag automatic controls devices. Key to control schematic.

G. Identify piping, concealed or exposed, with plastic pipe markers. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, and at each side of penetration of structure or enclosure.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC (FOR REFERENCE ONLY)

PART 1 GENERAL

1.01 SUMMARY

A. TAB will be paid for and performed by Owner. This section included for reference only. Mechanical Contractor to assist with coordination, access and scheduling TAB activities with UO Project Manager.

1.02 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

1.03 REFERENCES

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.04 SUBMITTALS

A. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
   2. 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.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   3. SMACNA HVAC Systems Testing, Adjusting, and Balancing.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Temperature control systems are installed complete and operable.
   2. Access doors are closed and duct end caps are in place.
   3. Air outlets are installed and connected.
   4. Hydronic systems are flushed, filled, and vented.
   5. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

3.03 INSTALLATION TOLERANCES

A. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus or minus 10 percent of design.

B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

A. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

3.05 AIR SYSTEM PROCEDURE

A. Adjust distribution systems to provide required or design supply, return, and exhaust air quantities.

3.06 SCOPE

A. Test, adjust, and balance the following:
   1. Air Inlets and Outlets
   2. Air handling units

3.07 MINIMUM DATA TO BE REPORTED

A. Supply Air/Return Air/Outside Air:
   1. Identification/location
   2. Design air flow
   3. Actual air flow

B. Chilled Water:
   1. Identification/location
   2. Design water flow
   3. Actual water flow

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

1.02 REFERENCE STANDARDS

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 FIBER GLASS DUCT WRAP INSULATION

A. Manufacturers:
   1. Knauf Insulation; www.knaufusa.com.
   2. Johns Manville Corporation; www.jm.com.
   3. Owens Corning Corp; www.owenscorning.com.
   4. CertainTeed Corporation; www.certainteed.com.
   5. Substitutions: See Section 01 60 00 (01600) - Product Requirements.

B. Insulation: ASTM C 553; flexible, noncombustible blanket.
   1. 'K' ('Ksi') value: 0.27 at 75 degrees F when tested in accordance with ASTM C 518.
   2. Maximum Service Temperature: 350˚F unfaced / 250˚F faced.
   3. Maximum Water Vapor Sorption: 5.0% by weight.

PART 3EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 SCHEDULES

A. External Insulation on Supply and Return Air Ducts: R-8

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2007.

B. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation; 2007.

C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.
5. Substitutions: See Section 01 60 00 (01600) - Product Requirements.

B. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches (0.029 ng/Pa s m).

PART 3EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.03 SCHEDULE

A. Chilled Water Systems:
   1. Chilled Water Supply and Return: all sizes – 1-1/2" thickness

END OF SECTION

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes Commissioning activities required for work of Division 23 Sections including but not limited to construction checks, equipment start-up, functional testing, and operator training.
   1. Comply with Section 01 91 13 – General Commissioning Requirements for Commissioning activities for Division 23 work.

1.02 SEQUENCING

A. Provide written notification to Commissioning Authority (CA) in advance of significant project dates as directed and as listed below.
   1. Two weeks prior to start-up of air handling units, air-conditioning units, chillers, in row coolers, in rack cooler, and pumps.
   2. Four weeks prior to installation of lay-in ceiling tiles or other partial concealment of equipment to be commissioned.
   3. Four weeks prior to any system ready for balancing.

1.03 SUBMITTALS

A. Provide control system custom software, hardware, and technical manuals as necessary for development of Commissioning activities. Control system submittals include but are not limited to operating sequences, point data base, workstation remote access, on-site custom programming/editing software, and programming and operations manual as necessary for development of Commissioning activities. Submit a minimum of 12 weeks prior to equipment start-up.

B. Provide sample control verification report to Commissioning Authority 12 weeks prior to substantial completion. Submittal shall show format and content of final verification report.

C. Provide submittals of systems being commissioned to Owner's Authorized Representative as required by Section 01 91 13.

D. Provide electronic copies (or hard copies where appropriate) of control system final configuration parameters, programs, databases, files, and electrical data as necessary to reconfigure and/or replace control components upon device failure

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide all necessary control hardware, software, and temporary licenses to enable Commissioning Authority to conduct activities and to fully access any electronic control systems furnished for this project. Commissioning Authorities' laptop computer may be used for access if software and hardware systems provided are compatible with existing computer configuration, otherwise furnish laptop computer where required for duration of project.

B. Provide minimum of two HVAC control operator interface sites for both on-site and remote access as described below.

1. Commissioning Authority Access Functions: Review and modification of control programming, monitoring of control system operations, review and modification of software database, setup and monitoring trend data in tabular and graphical formats.
2. Remote Access: Remote access using Internet and shall include all functions described above.
3. Provide credentials for Commissioning Authority. Security access level shall be suitable to perform necessary commissioning functions.
4. Provide labor required to install hardware and software on personal computers at Commissioning Authority's office. Software will be manufacturer's most recent version and will be compatible with the CA's personal computers. Provide Commissioning Authority with two hours training after fully functional remote access is established.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's Representative to execute Construction Checklists and perform operational training as specified in Division 23 including the following systems:
   1. Computer room air handlers
   2. Variable frequency drives
   3. Building automation system

3.02 CONSTRUCTION CHECKLISTS

A. Contractor shall execute as required by Section 01 91 13 Construction Checklists for each system commissioned will be prepared by Commissioning Authority during construction.

3.03 CONTROL VERIFICATION REPORTS

A. Building Automation System: BAS control contractor shall perform verification of the function and performance of control hardware and software. Provide verification report demonstrating proper system installation and operation. Verification report shall include the following:
   1. Network Communication: Verify that all network devices properly communicate on network. Verify communication speed and reliability is acceptable.
   2. Input and Output Verification:
      a. Verify that all input and output points are indicating properly. Verification tests shall be "end-to-end" meaning field measurement to workstation graphic display value.
      b. Calibrate all analog inputs. Acceptance accuracy shall be as specified for product accuracy. Repair or replace all devices that do not conform to specified accuracy.
      c. Operate all analog outputs from 0% to 100% of operating range. Verify that controlled device operates over the entire output range and that maximum and minimum operating conditions are achieved.
      d. Valves and dampers shall close fully and provide tight shutoff. Leakage rates shall not exceed specified values.
      e. Verify that all digital outputs operate controlled devices.
   3. Sequence of Operation Verification: Systematically verify automatic control sequence of operation functions in field after installation is complete. Verification stall include:
      a. Time scheduling
      b. Operating modes
      c. Tune and adjust control loops and control sequences to optimize efficiency and performance. Control loops shall be stable and maintain desired setpoints.
   4. Trending: Confirm trending utilities to storage operating data as required to verify operation and performance of control modes, sequence, and loops. Meet with Owner and CA to review configuration, parameter interval, and duration prior to trend setup.

5. Operator Interface: Review function of operator interface. Confirm that graphic operator interface accurately depicts as constructed system configuration and that all required content is displayed and functions as intended.
6. Alarms: Confirm alarm utilities are configured as required, alarm conditions are displaying in alarm logs, on graphic displays, and provide annunciation and reporting as required. Meet with Owner and CA to review configuration parameters prior to alarm utility setup.
7. Coordination: Assist balancing contractor with development of control setpoints and parameters as specifically indicated or otherwise required to provide Sequence of Operation. Setpoints would include but would not be limited to actuator positions required to provide minimum ventilation rates, supply air pressure setpoints for variable air volume air distribution systems, and terminal unit calibration parameters.
8. Controls Verification Report: After system operation is completely verified, provide written certification to Owner that systems have been fully tested, are operating according to specifications and ready for functional testing. Include documentation to the Commissioning Authority detailing verification results. Report shall include:
    a. Updated control construction drawings and equipment data that incorporates all changes made during construction.
    b. Printed as-built control code.
    c. Printed point data base.
    d. Input/Output Verification Log: Submit point verification log including point identification, control system readout value, verification measurement, and required calibration offset where applied.
    e. Sequence of Operation Verification: Submit verification test report listing complete text of control sequence and test results. Verify all specified control sequences.
    f. Trend Logs: Submit printed trend reports for the following:
        i. Time schedules. Seven day log demonstrating that equipment operates according to programmed time schedules.
        ii. Automatic control sequences. Trends shall be set-up as follows:
            (i) Analog Control: Points that modulate over time shall be sampled at appropriate intervals and durations to demonstrate proper operating sequences. For example, a discharge temperature control loop would require trending during the morning warm-up mode and normal daytime operation mode. Each trend shall include all measured variables, control output signal, actual output signal, and controlled variable.
            (ii) Digital Control: Dual-state control or monitoring points shall be recorded as COV (+) or change of value meaning that the changed parameter only needs to be recorded after the value changes from its previous state. A minimum of one week of samples shall be provided to properly demonstrate equipment cycles, modes, and schedules.
    g. Include trend graphs as described below:
        i. Lines shall be labeled and shall be distinguishable from each other by using either different line types, or different line colors.
        ii. Indicate engineering units of the y-axis values; e.g., degrees F., inches w.g., Btu/lb, percent wide open, etc.
        iii. The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.
        iv. All points trended for one HVAC subsystem; e.g., air handling unit, chilled water system, etc. shall be trended during the same trend period.
        v. Each graph shall be clearly labeled with HVAC subsystem title, date, and times.
    h. List of incomplete work.
6. Demonstration: Demonstrate operation of control system to Engineer, Commissioning Authority, and Owner including:
    a. Menu functions.
    b. Point overrides.
    c. Control loop response after point modification.

d. Alarm response time.

3.04 FUNCTIONAL TESTING

A. Contractor shall assist Commissioning Authority with functional testing as required by Section 01 91 13. Functional Test Plans for each system being commissioned will be prepared by Commissioning Authority during construction, and will generally include a rigorous verification of instrument calibration, equipment performance, packaged equipment control system operations, automatic control sequence of operations, fire and life safety sequences, and operator interface functions. Commissioning Authority will supervise and document functional testing. Contractor shall provide qualified technicians to assist Commissioning Authority during on-site testing and perform the following functions.
1. Operate equipment and systems as necessary to conduct testing.
2. Manipulate control parameters to simulate test conditions as detailed in Functional Test Plans.
3. Access control programming and database as required to verify control configuration or to correct observed deficiencies.
4. Create graphic displays and/or trend report as required to document test results.
5. Provide proprietary hardware and software as needed to interface with manufacturer's packaged control systems.

B. Labor required for retesting due to failure of equipment, or systems not performing in accordance with Contract Documents shall be provided at no additional cost to Owner.

3.05 OPERATIONS AND MAINTENANCE TRAINING

A. Provide operation and maintenance instruction to Owner's personnel as required by Division 01 and 23.

3.06 SCHEDULE OF SYSTEMS BEING COMMISSIONED

A. Commission systems and equipment listed below including associated equipment, piping, ductwork, and control systems.

B. HVAC Systems: All HVAC systems, equipment, and controls.

END OF SECTION

SECTION 23 09 00

BUILDING AUTOMATION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes control equipment and installation for HVAC systems and components.

B. The BAS control system shall be an extension of the existing Siemens Apogee BAS and all controllers and software shall match existing or be latest version of existing.

C. New panels installed that require Ethernet connections to communicate with the existing Siemens system, the Ethernet cabling shall be installed by the owner. Coordination of all Ethernet cabling installation shall be coordinated with Jeff Hite, 541-346-1732 jeffh@uoregon.edu.

1.02 RELATED DOCUMENTS

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

1. Section 01 00 00 – General Requirements
2. Section 01 60 00 – Product Requirements
3. Section 23 05 00 – Mechanical Scope of Work
4. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC
5. Section 26 00 10 – Basic Electrical Requirements
6. Section 26 05 00 – Electrical Scope of Work
7. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
8. Section 26 05 29 – Hangers and Supports for Electrical Systems
9. Section 26 05 34 – Conduit
10. Section 26 05 53 – Identification for Electrical Systems
11. Section 26 27 26 – Wiring Devices

1.03 DEFINITIONS

A. DDC: Direct Digital Controls

B. IP: Internet Protocol

C. I/O: Input/Output

D. LAN: Local Area Network.

E. TCP: Transfer Control Protocol

F. Scope Terminology

1. Provide = Furnish equipment, engineer, program, and install
2. Furnish = Furnish equipment, engineer, and program
3. Mount = securely fasten or pipe
4. Install = mount and wire
5. Wire = wire only

1.04 SYSTEM DESCRIPTION

A. The Building Automation System (BAS) contractor shall furnish and install a networked system of HVAC controls. The contractor shall incorporate direct digital controls (DDC) for the computer room air conditioning units and relief fan.

B. The BAS contractor shall provide networking to new DDC equipment using communication standards. The system shall not be limited to only standard protocols, but shall

also be able to integrate to a wide variety of third-party devices and applications via drivers and gateways.

C. The BAS contractor shall provide stand-alone controls where called for on the drawings or sequences.

1.05 WORK INCLUDED

A. The installation of the control system shall be performed under the direct supervision of the controls manufacturer, with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.

B. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:

1. Provide a submittal that meets the requirements below for approval.
2. Coordinate installation schedule with the mechanical contractor and general contractor.
3. Provide installation of all panels and devices unless otherwise stated.
4. Provide all low voltage control wiring and conduit for the DDC system.
5. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
6. Participate in commissioning for all equipment that is integrated into the BAS.
7. Provide testing, demonstration and training as specified below.

1.06 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 5 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 5 seconds.
3. Object Command: Reaction time of less than 5 seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within 5 seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 2 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Programmable controllers shall execute DDC PI control loops, and scan and update process values and outputs at least once per second.
7. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
   a. Water Temperature: Plus or minus 1 deg F.
   b. Water Flow: Plus or minus 5 percent of full scale.
   c. Water Pressure: Plus or minus 2 percent of full scale.
   d. Space Temperature: Plus or minus 1 deg F.
   e. Ducted Air Temperature: Plus or minus 1 deg F.
   f. Outside Air Temperature: Plus or minus 2 deg F.
   g. Dew Point Temperature: Plus or minus 3 deg F.
   h. Temperature Differential: Plus or minus 0.25 deg F.
   i. Relative Humidity: Plus or minus 2 percent.
   j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
   k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
   l. Air Pressure (Space): Plus or minus 0.01-inch wg.
   m. Air Pressure (Ducts): Plus or minus 0.1-inch wg.

n. Electrical: Plus or minus 5 percent of reading.

1.07 SUBMITTALS

A. Provide submittals for fast track items that need to be approved and released to meet the schedule of the project. Provide submissions for the following items separately:
1. Valve schedule and cut sheets.
2. Factory mounting and wiring diagrams and cut sheets.

B. Provide a complete submittal with all controls system information for approval before construction starts. Include the following:
1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Details of control panel faces, including sizes, controls, instruments, and labeling.
4. If dampers are furnished by others, submit a damper actuator schedule coordinating actuator sizes with the damper schedule.
5. Schedule of valves including leakage and flow characteristics.
6. Written description of the Sequence of Operations.
7. Network riser diagram showing wiring types, network protocols, locations of floor penetrations and number of control panels. Label control panels with network addresses. Show all routers, switches, hubs and repeaters.
8. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
9. Starter and variable frequency drive wiring details of all automatically controlled motors.

C. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

D. Submit a description of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.

E. Wiring Diagrams: Detail the wiring of the control devices and the panels. Show point-to-point wiring from field devices to the control panel. Show point-to-point wiring of hardwired interlocks. Show a ladder diagram or schematic of wiring internal to the panels, including numbered terminals. Clearly designate wiring that is done at a factory, at a panel shop or in the field.

F. Submit sample graphics for approval before starting system commissioning.

G. After the BAS system is approved for construction, submit sample operator workstation graphics for typical systems for approval. Print and submit the graphics that the operator will use to view the systems, change setpoints, modify parameters and issue manual commands. Programming shall not commence until typical graphics are approved.

1.08 QUALITY ASSURANCE

A. Codes
1. Perform all wiring in accordance with Division 26, NEC, local codes and Owner’s requirements.
2. Uniform Building Code (UBC).
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
4. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

5. All equipment shall be UL listed and approved and shall meet with all applicable NFPA standards, including UL 916 - PAZX Energy Management Systems.
6. Provide UL 864 – UUKL Smoke Control, where controllers and networks are used for that purpose.
7. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
8. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory-mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.10 COORDINATION

A. Coordinate location of thermostats, humidistats, panels, and other exposed control components with plans and room details before installation.

B. Coordinate equipment with the existing fire alarm system to achieve compatibility with equipment that interfaces with that system.

C. Coordinate power for control units and operator workstation with electrical contractor.

D. Coordinate equipment with provider of starters and drives to achieve compatibility with motor starter control coils and VFD control wiring.

E. Coordinate scheduling with the mechanical contractor and general contractor. Submit a schedule for approval based upon the installation schedule of the mechanical equipment.

F. Products Furnished but Not Installed Under This Section.
   1. Hydronic Piping:
      a. Temperature Sensor Wells and Sockets
      b. Flow Switches
      c. Flow Meters
   2. Sheet Metal Accessories
      a. Airflow Stations
      b. Duct Mounted Air Temperature Sensors

G. Integrate to equipment as called for in the sequence of operations

1.11 WARRANTY

A. Conform to the warranty requirement of the Contract Documents, General Requirements and this section or a minimum of 12 months.

B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system demonstration.

C. 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.

D. During normal building occupied hours, failure of items that are critical for system operation shall be provided within 4 hours of notification from the Owner's Representative.

E. This warranty shall apply equally to both hardware and software.

PART 2 PRODUCTS

2.01 ACCEPTABLE SYSTEMS

A. Provide an extension to an existing Siemens APOGEE System as installed by the Siemens Industry branch office.

2.02 ELECTRONIC DOCUMENTATION

A. Provide software applications and files to view documentation through the GUI.

B. Provide all controls cut sheets in PDF format. Make them available to any user accessing the system over the Internet.

C. Provide a text version of the sequence of operation. Make the written sequence available from the graphic that represents each system. The sequence shall pop up in a printable format such as HTML or PDF.

2.03 CONTROLLER SOFTWARE (i.e. Building Controller software, , DDC software, Field Panel software)

A. Reuse existing software. If new controllers need updated versions of the controller software, then provide updated versions, such that at the completion of this project, the Owner has controller software licenses for all of the existing and new generations of controllers.

2.04 BUILDING CONTROLLERS (B-BC)

A. Provide all necessary hardware for a complete operating system as required. The Building Controller shall be able to operate as a stand-alone panel and shall not be dependent upon any higher-level computer or another controller for operation.

B. Basis of design is Siemens PX Modular and Compact Controllers (PXC).

C. Computing Power and Memory Minimum:
1. A 32-bit, stand-alone, multi-tasking, multi-user, real-time 100MHz digital control microprocessor module.
2. Inputs shall be 16-bit minimum analog-to-digital resolution.
3. Outputs shall be 10-bit minimum digital-to-analog resolution.
4. Memory module (24 megabyte, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating system and databases (see Controllers Software section), including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, dial-up communications.
5. Real-time clock and battery
6. Data collection/Data Trend module sized for 10,000 data samples.
7. Flash Memory Firmware: Each building level Control Panel shall support firmware upgrades without the need to replace hardware.

D. Onboard or Modular Hardware and Connections:
1. Primary Network communication module, if needed for primary network communications.
2. Secondary Network communication module, if needed for secondary network communications.
3. RJ45 port 10/100Mbaud.
4. RS485 ports for subnetworks and point expansion.
5. Man to Machine Interface port (MMI).
6. USB Port.

E. Input and Output Points Hardware
1. Input/output point modules as required, including spare capacity.
2. Monitoring of the status of all hand/off/auto (HOA) switches.
3. Monitoring of all industry-standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
4. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
5. Graduated intensity LEDs or analog indication of value for each analog output.

F. Code compliance
1. Approvals and standards: UL916; CE; FCC.
2. Provide UL864-UUKL where called for in the sequences of operations.

G. Accessories:
1. Appropriate NEMA-rated metal enclosure.
2. Power supplies as required for all associated modules, sensors, actuators, etc.

H. The operator shall have the ability to manually override automatic or centrally executed commands at the primary control panels via local, point discrete, on-board hand/off/auto (HOA) operator override switches. If on-board switches are not available, provide separate control panels with HOA switches. Mount panel adjacent to primary control panel. Provide HOA switch for each digital output, including spares.

I. Each Building Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.

J. Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.

K. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile 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 30 days.

L. Building level control panels shall provide at least two serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. Primary control panels shall allow temporary use of portable devices without interrupting the normal communications, operation of permanently connected modems, printers or terminals.

M. Building level controllers shall have the capability to serve as a gateway between MODBus sub-networks and the BAS. Provide software, drives and programming.

N. Isolation shall be provided at all primary control panel terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

O. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be “future” on drawings and provisions for 10% more of each point type.

P. Environment.
1. Controller hardware shall be suitable for the anticipated ambient conditions.

2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).

Q. Immunity to power and noise.
1. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
3. Isolation shall be provided at all primary network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
   a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3V.
   b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.
   c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500V signal, 1 kV power.
   d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max).
4. Isolation shall be provided at all Building Controllers' AC input terminals to suppress induced voltage transients consistent with:
   a. IEEE Standard 587 1980
   b. UL 864 Supply Line Transients
   c. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

2.05 ADVANCED APPLICATION CONTROLLERS

A. Provide all necessary hardware for a complete operating system as required. The Advanced Application level control panel shall be able to operate as a stand-alone panel and shall not be dependent upon any higher-level computer or another controller for operation.

B. Basis of design is Unitary Equipment Controller (PXC-UCM).

C. This level of controller shall be used for the following types of systems:
1. Secondary pumping systems
2. VAV air handlers
3. Air handlers up to 15,000 cfm
4. Systems with over 12 controlled points
5. Systems with custom sequences

D. Each System Level Control Panel shall, at a minimum, be provided with:
1. Appropriate NEMA-rated metal enclosure.
2. A 32-bit, stand-alone, multi-tasking, multi-user, real-time digital control microprocessor module.
3. Inputs shall be 16-bit minimum digital resolution.
4. Outputs shall be 10-bit minimum digital resolution.
5. Primary Network communication module, if needed for primary network communications.
6. Secondary Network communication module, if needed for secondary network communications.
7. Memory module (4 megabyte, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating system and databases, including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, dial-up communications.
8. Real-time clock and battery.
9. Data collection/data trend module sized for 10,000 data samples.

10. Power supplies as required for all associated modules, sensors, actuators, etc.
11. Input/output point modules as required including spare capacity.
12. Software modules as required for all sequences of operation, logic sequences and energy management routines. Relay logic is not acceptable.
13. Monitoring of the status of all hand-off-auto switches. The status of the HOA switch shall be available as a BAS data point.
14. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
15. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
16. Graduated intensity LEDs or analog indication of value for each analog output.
17. Approvals and standards: UL916; CE; FCC
18. Provide UL864-UUKL where called for in the sequences of operations.

E. Each System Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.

F. Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.

G. Each Advanced Application Control Panel shall provide battery backup to support the real-time clock and RAM memory, such as trend logs, for a minimum of 100 hours.

H. Each System Level Control Panel shall support firmware upgrades without the need to replace hardware.

I. System Level control panels shall provide at least two RS-232C serial data communication ports for operation of operator I/O devices such as operator terminals, and additional memory. Primary control panels shall allow temporary use of portable devices without interrupting the normal communications.

J. Isolation shall be provided at all primary control panel terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

K. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be “future” on drawings and provision for 10% more of each point type.

2.06 CONTROL PANELS

A. Controllers in mechanical rooms shall be mounted in NEMA 1 enclosures.

B. Mount on walls at an approved location or provide a free-standing rack.

C. Panels shall be constructed of 16 gauge, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with ANSI 61 gray polyester-powder painted finish, UL listed. Provide common keying for all panels.

D. Provide power supplies for control voltage power.

E. Dedicate 1 power supply to the DDC controller. Other devices shall be on a separate power supply, unless the power for the control device is derived from the controller terminations.

F. Power supplies for controllers shall be a transformer with a fuse or circuit breaker. Power supplies for other devices can be plain transformers.

G. All power supplies for 24V low voltage wiring shall be Class 2 rated and less than 100VA. If low voltage devices require more amps, then provide multiple power supplies. If a single device requires more amps, then provide a dedicated power supply in a separate enclosure and run separate, non-class 2 conduits to the device.

H. Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers and operator workstations.

I. All devices in a panel shall be permanently mounted, including network switches, modems, media converters, etc.

J. Provide a pocket to hold documentation.

2.07 GENERAL SPECIFICATIONS FOR DEVICES

A. Provide mounting hardware for all devices, including actuator linkages, wells, installation kits for insertion devices, wall boxes and fudge plates, brackets, etc.

B. If a special tool is required to mount a device, provide that tool.

2.08 SENSORS

A. Temperature Sensors
   1. All temperature sensors shall meet the following specifications:
      a. Accuracy: Plus or minus 0.2 percent at calibration point.
      b. Wire: Twisted, shielded-pair cable.
      c. Vibration and corrosion resistant.
   2. Space temperature sensors shall meet the following specifications:
      a. 10k ohm type 2 thermisters.
   3. Insertion elements in ducts shall meet the following specifications:
      a. Single point 10k ohm thermister.
      b. Use where not affected by temperature stratification.
      c. The sensor shall reach more that 1/3 the distance from the duct wall.
      d. Junction box for wire splices.
   4. Averaging elements in ducts shall meet the following specifications:
      a. 72 inches (183 cm) long.
      b. Flexible.
      c. Use where prone to temperature stratification, in front of coils, or where ducts are larger than 9 sq. ft.
      d. Junction box for wire splices.
   5. Insertion elements for liquids shall meet the following specifications:
      a. Platinum RTD with 4-20mA transmitter.
      b. Threaded mounting with matching well.
      c. Brass well with minimum insertion length of 2-1/2 inches for pipes up to 4” diameter.
      d. Brass well with insertion length of 6 inches for pipes up to 10” diameter
      e. Junction box for wire splices.
   6. Outside-Air Sensors Platinum RTD with 4-20mA transmitter:
      a. Watertight enclosure, shielded from direct sunlight.
      b. Circulation fan.
      c. Watertight conduit fitting.
   7. Low Temperature Detection Thermostat for coil freeze protection
      a. Remote bulb element
      b. Manual reset
      c. Temperature adjusting screw
      d. Main and separate reverse-acting auxiliary contacts

B. Humidity Sensors shall meet the following specifications:
   1. Bulk polymer sensor element.

2. Accuracy: 2 percent full range with linear output.
3. Room Sensors: With locking cover matching room thermostats, span of 0 to 100 percent relative humidity.
4. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

C. Air Static Pressure Transmitter shall meet the following specifications:
1. Non-directional sensor with suitable range for expected input, and temperature compensated.
2. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
3. Output: 4 to 20 mA.
4. Building Static-Pressure Range: 0 to 0.25 inches wg.
5. Duct Static-Pressure Range: 0 to 5 inches wg.

D. Pressure Transmitters: Direct-acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

E. Equipment operation sensors as follows:
1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.
2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
3. Status Inputs for direct-drive electric motors: Current-sensing relay with current transformers, adjustable and sized for 175 percent of rated motor current.
4. Status inputs for belt-drive electric motors: Current sensing transmitter with linear 4-20mA output

F. Electronic Valve/Damper Position indication: Visual scale indicating percent of travel and 0 to 10 V dc, feedback signal.

G. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless steel or bronze paddle. For chilled water applications, provide vapor-proof type.

H. Air Differential Pressure Switches: Diaphragm-type air differential pressure switches with die cast aluminum housing, adjustable setpoint, minimum 5 amp switch rating at 120VAC, SPDT switches, and the switch pressure range shall be suited for the application. Provide Dwyer or approved equal. These switches shall be utilized for filter status.

I. Leak detectors: Provide spot leak detectors that can be secured to the floor or secured to a drain pan. The detection shall use microchip-controlled energized probes. The detector shall operate on 24Vor less. Provide a way to adjust the height of the leak probes. The SPDT contacts shall be inside a watertight enclosure.

2.09 ELECTRONIC ACTUATOR SPECIFICATION

A. ELECTRONIC DAMPER ACTUATORS
1. Actuator shall be direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall use a "V" bolt and "V" shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single-bolt or set-screw type fasteners are not acceptable.
2. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.
3. For power-failure/safety applications, a mechanical, spring-return mechanism shall be used.

4. Actuators with spring-return mechanisms shall be capable of either clockwise or counterclockwise spring-return operation by simply changing the mounting orientation.
5. Proportional actuators shall accept a 2-10VDC, 4-20mA signal, or be of the two-point floating type and provide a 2-10VDC actuator position feedback signal.
6. All actuators shall have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.
7. All actuators shall have an external direction of rotation switch to aid in installation and to allow proper control response.
8. Actuators shall be provided with a factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook up to an electrical junction box.
9. Actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association. They must be manufactured under ISO 9001.

PART 3 EXECUTION

3.01 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.

B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

3.02 INSTALLATION

A. Controls contract to be sole sourced to Siemens. Contact person is Dave Yarbrough phone: (503) 880-6750.

B. Provide all relays, switches, sources of emergency and UPS battery back-up electricity and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified. All field wiring shall be done by this contractor.

C. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.

D. Mount surface-mounted control devices on brackets to clear the final finished surface on insulation.

E. Install equipment level and plumb.

F. Unless otherwise noted, install wall-mounted thermostats and humidistat 60" above the floor measured to the center line of the instrument, or as otherwise directed by the Engineer.

G. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.

H. Install outdoor sensors in perforated tube and sunshield.

I. Install damper motors on outside of duct in protected areas, not in locations exposed to outdoor temperatures.

J. Install labels and nameplates on each control panel listing the name of the panel referenced in the graphics and a list of equipment numbers served by that panel.

K. Furnish hydronic instrument wells, valves, and other accessories to the mechanical contractor for installation.

L. Create the monitoring and alarm point database in PHASE 1 to be reviewed, coordinated, and configured among the BAS contractor, Owner and the equipment manufacturer. A determination will be made as to which alarms will be classified as “critical alarms” and the method of alarm notification needs to be established.

M. The following alarms are integral to the factory supplied Liebert ACU controller:
1. Room low temperature alarm
2. Room high temperature alarm
3. Room low humidity alarm
4. Room high humidity alarm
5. Humidifier problem
6. Fan overload
7. Change filter
8. Loss of airflow
9. Loss of power
10. Leak under floor
11. Smoke detected
12. Loss of water flow
13. Standby unit on

N. In addition to the Liebert alarms, the BAS will also monitor and alarm the following points:
1. Chilled water coil freeze protection
2. Communications failure
3. UPS power failure
4. UPS battery status
5. Building power failure via dry contacts
6. Switchboard power consumption monitoring

3.03 ELECTRICAL WIRING SCOPE

A. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor. If power circuits are shown on the electrical drawings, this contractor shall continue the power run to the control device. If power circuits are not shown, this contractor shall coordinate with the electrical contractor to provide breakers at distribution panels for power to controls. This contractor is then responsible for power from the distribution panel.

B. This contractor shall not be responsible for power to control panels and control devices that are furnished by others, unless it is part of the control interlock wiring.

C. Refer to Coordination section for devices this contractor is responsible to mount and which are turned over to others to mount.

D. This contractor shall be responsible for wiring of any control device that is furnished as part of this section of specification.

E. Wiring for controls furnished by others:
1. Provide control wiring for HVAC controls furnished by others. Wiring may include, but is not limited to, interlocks, stand-alone thermostats, safeties and remote control devices such as valves, sensors, etc.

F. Interlock wiring shall be run in separate conduits from BAS associated wiring.

3.04 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. All low voltage control wiring shall be Class 2. Control wiring that is not Class 2 shall be run in separate conduits from Class 2 wiring.

B. Floor-level network wiring between terminal units can be combined with thermostat and other low voltage wiring in the same conduit. All other network wiring shall be in dedicated conduits.

C. Install raceways, boxes, and cabinets according to Division 26 Sections “Conduit” and “Boxes”.

D. Install building wire and cable according to Division 26 Section "Conductors and Cables."

E. Installation shall meet the following requirements:
1. Conceal cable and conduit, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway or conduit.
3. Install concealed cable using plenum rated cable.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. All wiring in lab areas shall be in conduit.
8. All unsupported risers shall be rigid steel conduit. Supported risers shall be EMT.

F. Rigid conduit shall be steel, hot dip galvanized, threaded with couplings, ¾ inch minimum size, manufactured in accordance with ANSI C-80-1. Electrical metallic tubing (EMT) with compression fittings or intermediate metallic conduit (IMC) may be used as conduit or raceway where permitted by the NEC.

G. Concealed control conduit and wiring shall be provided in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90-degree angles.

H. Install conduit adjacent to machine to allow service and maintenance.

I. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

J. Connect hand/off/auto (HOA) selector switches to override automatic interlock controls when switch is in hand position.

K. Ground equipment.

3.05 COMMUNICATION WIRING

A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer’s installation recommendations for all communication cabling.

B. Do not install communication wiring in raceway and enclosures containing Class 1 wiring.

C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

D. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

E. Cable bundling:

1. RS485 cabling run open air in accessible areas can be bundled with other Class 2 low voltage cabling.
2. RS485 cabling run between terminal units in conduits above ceilings or under floors or in inaccessible areas can be bundled with other Class 2 low voltage cabling.
3. RS485 cabling run between floors shall be in a communication only conduit.
4. RS485 conduit run long distances between utility rooms or between buildings shall be in a communication-only conduit.
5. Fiber optics can be run with Ethernet and RS485 cabling as long as the conduit is bent to fiber optic standards and junction boxes are sized for fiber optic use.

F. FLN Cabling
1. FLN cabling shall be low capacitance, 20-24 gauge, twisted shielded pair.
2. The shields shall be tied together at each device.
3. The shield shall be grounded at one end only and capped at the other end.

G. Ethernet Cabling
1. All Ethernet cabling shall be provided by the owner.
2. Coordinate installation of Ethernet cabling with Jeff Hite 541-346-1732 jeffh@uoregon.edu.
3. Contractor shall prepare Ethernet cabling locations by installing a 4" square box with single gang mud ring and ¾" conduit to accessible ceiling space or cable tray.

H. All runs of communication wiring shall be unspliced length when that length is commercially available.

I. All communication wiring shall be labeled to indicate origination and destination data.

J. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.06 IDENTIFICATION

A. Match UO Campus Standards for wiring and conduit identification.

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
3. Calibration test controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

B. Engage a factory-authorized service representative to perform start-up service.

C. Replace damaged or malfunctioning controls and equipment.
1. Start, test, and adjust control systems.
2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.08 SYSTEM CHECKOUT AND STARTUP

A. Inspect each termination in the MER control panels and devices to make sure all wires are connected according to the wiring diagrams and all termination are tight.

B. After the controls devices and panels are installed and power is available to the controls, perform a static checkout of all the points, including the following:

1. Inspect the set-up and reading on each temperature sensor against a thermometer to verify its accuracy.
2. Inspect the setup and reading on each humidity sensor against a hygrometer to verify its accuracy.
3. Inspect the reading on each CO2 sensor using a calibration kit to verify the sensor range accuracy matches the DDC setup.
4. Inspect the reading of each status switch to verify the DDC reads the open and close correctly.
5. Command each relay to open and close to verify its operation.
6. Command each 2-position damper actuator to open and close to verify operation.
7. Command each 2-position valve to open and close to verify operation.
8. Ramp each modulating actuator to 0%, 25%, 50%, 75% and 100% to verify its operation.
9. Ramp each modulating output signal, such as a VFD speed, to verify its operation.
10. Test each safety device with a real-life simulation, for instance check freezestats with ice water, water detectors with water, etc.

C. Document that each point was verified and operating correctly. Correct each failed point before proceeding to the dynamic start-up.

D. Verify that each DDC controller communicates on its respective network correctly.

E. After all of the points are verified, and power is available to the mechanical system, coordinate a start-up of each system with the mechanical contractor. Include the following tests:

1. Start systems from DDC.
2. Verify that each setpoint can be met by the system.
3. Change setpoints and verify system response.
4. Change sensor readings to verify system response.
5. Test safety shutdowns.
6. Verify time delays.
7. Verify mode changes.
8. Adjust filter switches and current switches for proper reactions.
9. Adjust proportional bands and integration times to stabilize control loops.

F. Perform all program changes and debugging of the system for a fully operational system.

G. Verify that all graphics at the operator workstations correspond to the systems as installed. Verify that the points on the screens appear and react properly. Verify that all adjustable setpoints and manual commands operate from the operator workstations.

H. After the sequence of operation is verified, setup the trends that are listed in the sequence of operations for logging and archiving for the commissioning procedure.

3.09 SYSTEM COMMISSIONING, DEMONSTRATION AND TURNOVER

A. The BAS Contractor shall prepare and submit for approval a complete acceptance test procedure, including submittal data relevant to point index, functions, sequence, inter-locks, and associated parameters, and other pertinent information for the operating system. Prior to acceptance of the BAS by the Owner and Engineer, the BAS contractor shall completely test the BAS using the approved test procedure.

B. After the BAS contractor has completed the tests and certified the BAS is 100% complete, the Engineer shall be requested, in writing, to approve the satisfactory operation of the system, sub-systems, and accessories. The BAS contractor shall submit Maintenance and Operating manuals at this time for approval. An acceptance test in the presence of the Engineer and Owner's Representative shall be performed.

C. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.

3.10 PROJECT RECORD DOCUMENTS

A. Project Record Documents: Submit three (3) copies of record (as-built) documents upon completion of installation. Submittal shall consist of:

1. Project Record Drawings. As-built versions of the submittal shop drawings provided as AutoCAD-compatible files in electronic format and as 11 x 17 inch prints.
2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements in the Control System Demonstration and Acceptance section of this specification.
3. Operation and Maintenance (O & M) Manual.
    a. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
    b. Documentation of all programs created using custom programming language, including setpoints, tuning parameters, and object database.
    c. Graphic files, programs, and database on electronic media.
    d. List of recommended spare parts with part numbers and suppliers.
    e. Licenses, guarantees, and warranty documents for equipment and systems.

B. Provide updated versions of Operating manuals.

3.11 TRAINING

A. At a time mutually agreed upon, during system commissioning as stated above, the BAS Contractor shall give 16 hours of on-site training on the operation of all BAS equipment. Describe its intended use with respect to the programmed functions specified. Operator orientation of the automation system shall include, but not be limited to:

1. Explanation of drawings and operator's maintenance manuals.
2. Walk-through of the job to locate all control components.
3. Operator workstation and peripherals.
4. DDC Controller and ASC operation/sequence.
5. Operator control functions including scheduling, alarming, and trending.
6. Explanation of adjustment, calibration and replacement procedures.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Chilled Water Supply and Return

1.02 REFERENCE STANDARDS

A. University of Oregon Campus Construction Standards; third edition, May 2011

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

C. ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2002.

D. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.

1.03 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with University of Oregon standards.

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

1.05 REGULATORY REQUIREMENTS

A. Perform Work in accordance with Oregon plumbing codes.

1.01 DELIVERY, STORAGE, AND HANDLING

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

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 CHILLED WATER SUPPLY AND RETURN

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L, Hard Drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: Solder, lead free, ASTM B 32, 95-5 tin-antimony.

2.02 PIPE HANGERS AND SUPPORTS

A. Chilled Water Supply and Return:
   1. Copper Pipe Support:
      a. Suspended supports: Copper plated adjustable clevis or J pipe hanger.
      b. Floor mounted supports: Strut channel and pipe clamp with isolation pad or insert.

2.03 BALL VALVES

A. Manufacturers:
   1. Conbraco Industries; www.conbraco.com.
   2. Nibco, Inc; www.nibco.com.
   3. Milwaukee Valve Company; www.milwaukeevalve.com.
   4. Also acceptable: Crane, Jenkins, Stockham, Hammond.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze, two piece body, stainless steel balls, full port, reinforced teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.04 GATE VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, screwed bonnet, non-rising stem, lockshield stem, inside screw with backseating stem, solid wedge disc, alloy seat rings, solder ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide brass connections where jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for access to valves.

G. Provide access where valves and fittings are not exposed.

H. Install valves with stems upright or horizontal, not inverted.

I. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide copper plated hangers and supports for copper piping.

3.03 APPLICATION

A. Install unions downstream of valves and at equipment.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.04 SCHEDULES

A. Pipe Hanger Spacing:
1. Copper Piping:
a. Pipe size: 1/2 inches to 1-1/2 inches:
1) Maximum hanger spacing: 6 ft.
2) Minimum hanger rod diameter: 3/8 inches.

END OF SECTION

SECTION 23 21 14

HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Strainers.

B. Balancing valves.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

1.03 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

B. Project Record Documents: Record actual locations of flow controls.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. Nibco, Inc: www.nibco.com
3. Mueller Industries: www.muellerindustries.com

B. Size 2 inch and Under:
1. Cast bronze for 125 psi working pressure, Y pattern with 20 mesh stainless steel perforated screen. Tapped cap with blow-off plug.

2.02 BALANCING VALVES

A. Manufacturers:
1. ITT Bell & Gossett: www.bellgossett.com.
2. Griswold Controls: www.griswoldcontrols.com.
3. Taco, Inc: www.taco-hvac.com.

B. Size 2 inch and Under:

1. Construction: Class 125, Brass or bronze body with temperature and pressure test ports on inlet and outlet. Furnish with calibrated nameplate, memory stop, and capped drain port.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Provide manual air vents at system high points.

C. Provide valved drain and hose connection on strainer blow down connection.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

1.02 REFERENCE STANDARDS

A. University of Oregon Campus Construction Standards; third edition, May 2011

B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2002.

D. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.03 PERFORMANCE REQUIREMENTS

A. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.04 SUBMITTALS

A. Product Data: Provide data for duct materials.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G60/Z180 coating.

B. Flexible Ducts/Hose:
   1. Manufacturers:
      a. Thermaflex; www.thermaflex.net
         1) Product: G-KM Flexible duct
      b. Hi-Tech Duravent; www.hitechduravent.com
      c. Hose Craft USA; www.hosecraftusa.com
   2. Materials of construction:
      a. Coated substrate or polymer supported by outward cast helically wound spring steel wire.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts and formaldehyde resistivity.
2. VOC Content: Not more than 250 g/L, excluding water.
3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
4. For Use With Flexible Ducts: UL labeled.
5. Acceptable Products:
   a. www.tremcosealants.com; Product: Trempro 656.
   b. Substitutions: See Section 01 60 00 (01600) - Product Requirements.

D. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.03 DUCT MANUFACTURERS

A. Metal-Fab, Inc; www.mtlfab.com.

B. SEMCO Incorporated; www.semcoinc.com.

C. United McGill Corporation; www.unitedmcgill.com.

D. Or approved equal.

2.04 MANUFACTURED METAL DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Duct sizes indicated are nominal outside dimensions and include liner thickness if applicable.

C. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

E. Use double nuts and lock washers on threaded rod supports.

F. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.02 SCHEDULES

A. Ductwork Material:
   1. Supply: Galvanized Steel.
   2. Return & Exhaust: Galvanized Steel.
   3. Outside Air: Galvanized Steel.

B. Ductwork Pressure Class:
   1. Supply: 2 inch
   2. Return & Exhaust: 2 inch.
   3. Outside Air: 2 inch.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct access doors.

B. Volume dampers.

C. Control dampers.

D. Flexible duct connections

1.02 REFERENCE STANDARDS

A. University of Oregon Campus Construction Standards; third edition, May 2011

B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.03 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume dampers.

B. Project Record Drawings: Record actual locations of access doors.

PART 2 PRODUCTS

2.01 DUCT ACCESS DOORS

A. Manufacturers:
   1. Nailor Industries Inc; www.nailor.com.
   2. Ruskin Company; www.ruskin.com.
   3. SEMCO Incorporated; www.semcoinc.com.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1-inch-thick (25 mm) insulation with sheet metal cover.
   1. Less Than 12 inches (300 mm) Square: Secure with sash locks.
   2. Up to 18 inches (450 mm) Square: Provide two hinges and two sash locks.
   3. Up to 24 x 48 inches (600 x 1200 mm): Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Provide an additional hinge.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.02 VOLUME DAMPERS

A. Manufacturers:
   1. Ruskin Company: www.ruskin.com.
   2. Tamco
   3. Greenheck

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and

Flexible, and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

2.03 CONTROL DAMPERS

A. Manufacturers:
   1. Ruskin Company: www.ruskin.com.
   2. Tamco
   3. Greenheck

B. Performance: Test in accordance with AMCA 500-D.

C. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage (2.7 mm).

D. Blades: Galvanized steel, maximum blade size 8 inches (200 mm) wide, 48 inches (1200 mm) long, minimum 22 gage (0.85 mm), attached to minimum 1/2 inch (13 mm) shafts with set screws.

E. Blade Seals: Synthetic elastomeric inflatable mechanically attached, field replaceable.

F. Jamb Seals: Spring stainless steel.

G. Shaft Bearings: Oil impregnated sintered bronze.

H. Linkage Bearings: Oil impregnated sintered bronze.

I. Leakage: Less than one percent based on approach velocity of 2000 ft/min (10 m/sec) and 4 inches wg (1.0 kPa).

J. Maximum Pressure Differential: 6 inches wg (1.5 kPa).

K. Temperature Limits: -40 to 200 degrees F (-40 to 93 degrees C)

L. Damper actuators provided by Controls Contractor.

2.04 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
      a) Net Fabric Width: Approximately 2 inches wide.
   2. Metal: 3 inches wide, 24 gage thick galvanized steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters and coils. Provide minimum 8 x 8 inch size for hand access. 18x18 inch size for shoulder access, and as indicated. Review locations prior to fabrication.

C. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing.

D. Provide flexible duct connections at ACU-1 and ACU-2 connections.

END OF SECTION

SECTION 23 81 24
COMPUTER ROOM AIR CONDITIONERS - FLOOR MOUNTED

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air conditioning units.

B. Unit controls.

1.02 RELATED REQUIREMENTS

A. Section 23 21 14 - Hydronic Specialties.

1.03 PERFORMANCE REQUIREMENTS

A. Cooling:
1. Total Capacity: 37.2 kW; 126,964 Btu/hr
2. Sensible Capacity: 37.2 kW; 126,964 Btu/hr
3. Air flow: 5500 cfm.
4. Air entering coil: 80˚ F DB and 62.8˚ F WB.
5. Air leaving coil: 58.2˚ F DB and 54.6˚ F WB.
6. Number of fans: one.
7. Fan motor: 3.6 hp.

B. Chilled Water Coil:
1. Coil water flow: 18 gpm.
2. Coil entering water: 48˚ F.

C. Reheat:
1. Capacity: 51,200 Btu/hr; 15 kW.

D. Humidifier:
1. Total capacity: 11 lb/hr
2. Input: 4.8 kW.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data & Shop Drawings: Submittals shall include Single-Line Diagrams; Dimensional, Electrical, and Capacity Data; Piping and Electrical Connection Drawings.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 WARRANTY

A. See Section 01 70 00 - Closeout Submittals, for additional warranty requirements.

1.06 EXTRA MATERIALS

A. Provide one set of filters for each unit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Liebert Corporation; Model CW041UCSA2S086: www.liebert.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 AIR CONDITIONING UNITS

A. Description: Packaged, water cooled, factory assembled, pre-wired and pre-piped unit, consisting of cabinet, fan, filters, humidifier, and controls.

B. Assembly: Up-flow air delivery, in draw-through configuration.

2.03 CABINET AND FRAME

A. The frame shall be constructed of heliarc welded tubular steel.

B. It shall be painted using the autophoretic coating process for maximum corrosion protection.

C. The exterior panels shall be insulated with a minimum 1 in, 1.5 lb density fiber insulation.

D. The main front panel shall have captive 1/4 turn fasteners.

E. The exterior panels shall be powder coated.

2.04 ELECTRONICALLY COMMUTATED (EC) FAN AND MOTOR

A. The fans are plug/plenum type, single inlet and shall be dynamically balanced. The drive package shall be direct drive, electronically commutated and variable speed. The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance.

B. The fan motor(s) shall be 4.15 hp with a maximum operating speed of 1510 RPM.

2.05 CHILLED WATER COIL

A. The cooling coil shall be of A-frame design with a minimum 11.7 ft² face area.

B. The coil shall be controlled by a factory installed 2-way modulating control valve. It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of 471 ft. per minute at 5500 CFM.

C. The water circuit shall be designed to distribute water into the entire coil face area. The coil shall be supplied with 48° F entering water temperature, with a 15° F temperature rise. The coil shall require 18 GPM of chilled water and the pressure drop shall not exceed 5.6 ft H2O.

D. The entire coil assembly shall be mounted in a stainless steel condensate drain pan.

2.06 FILTERS

A. The filter chambers shall be an integral part of the system, located within the cabinet serviceable from either end of the unit.

B. The filters shall be rated not less than Minimum Efficiency Reporting Value (MERV) 8, when tested in accordance with ASHRAE 52.2. 4 inch nominal thickness.

2.07 REHEAT COILS

A. Electric low watt density reheat elements of rugged stainless steel finned tubular construction with three stages of nonionizing reheat with maximum sheath temperatures below 420 degrees F.

B. Capacity: 51.2 kBTU/hr (15 kW)

2.08 HUMIDIFIER

A. Infrared Type: High intensity quartz lamps mounted above stainless steel evaporator pan. An automatic water supply system continuously maintains water level and an automated flush system greatly reduces mineral precipitation. A flow control valve permits operation at water pressure between 15 and 150 psig.

2.09 MICROPROCESSOR CONTROL SYSTEM

A. The Liebert iCOM unit control with large graphic display shall be factory-set for Intelligent Control which uses “fuzzy logic” and “expert systems” methods. Proportional and Tunable PID shall also be user selectable options. iCOM control shall be compatible with remote monitoring and control devices and provide BMS interface via MODbus, and SNMP. Internal unit component control shall include the following:

1. System Auto Restart – The auto restart feature will automatically restart the system after a power failure. Time delay is programmable.
2. Sequential Load Activation – On initial startup or restart after power failure, each operational load is sequenced with a minimum of one second delay to minimize total inrush current.
3. Predictive Humidity Control – Calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature.

B. The User Menus Shall be Defined as follows:

1. Active Alarms: Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm.
2. Event Log: Unit memory shall hold the 400 most recent events with ID number, time and date stamp for each event.
3. Graphic Data View: Eight graphic records shall be available: return air temperature, return air humidity, supply air temperature, outdoor temperature and four custom graphs. Unit View: Status Overview summary displays shall include temperature and humidity values, active functions and percent of operation and any alarms of the host unit.
4. Total Run Hours: Menu shall display accumulative component operating hours for major components including fan motor, humidifier and reheat.
5. Various Sensors: Menu shall allow setup and display of optional custom sensors. The control shall include four customer accessible analog inputs for sensors provided by others.
6. Display Setup: Customer shall pre-select the desired grouping of display languages at the time of the order.
7. System View – Status Overview: Menu shall display a summary of operation for the total number of operating units within a Unit-to-Unit configuration.
8. Spare Parts List: Menu shall include a list of critical spare parts, their quantity and part numbers.
9. Unit Diary: Menu shall include a free field area within the unit memory where unit history may be stored for reference.

C. Setpoints Menu shall be defined as follows:

1. Temperature Setpoint 65-85˚F.
2. Temperature Sensitivity ±1˚ to 9.9˚ in 0.1˚F increments.

3. Humidity Setpoint 20-80% RH
4. Humidity Sensitivity 1-30% RH
5. High Temperature Alarm 35-90˚F
6. Low Temperature Alarm 35-90˚F
7. High Humidity Alarm 15-85% RH
8. Low Humidity Alarm 15-85% RH

D. Standby Settings/Lead-Lag: Menu shall allow planned rotation or emergency rotation of operating and standby units.

E. Timers/Sleep Mode: Menu shall allow various customer settings for turning on/off unit.

F. Alarm Setup: Menu shall allow customer settings for alarm notification (audible/local/remote). The following alarms shall be available as a minimum:

1. High Temperature
2. Low Temperature
3. High Humidity
4. Low Humidity
5. Main Fan Overload
6. Humidifier Problem
7. Change Filter
8. Loss of Air Flow
9. Loss of Power
10. Leak Under Floor
11. Smoke Detected
12. Loss of Water Flow
13. Standby Unit On

G. Remote Monitoring:

1. All alarms shall be communicated to the Liebert monitoring system with the following information: Date and time of occurrence, unit number and present temperature and humidity.
2. Provide termination for remote signaling of system status, alarms, and remote shutdown.

H. SmartAisle Controls

1. SmartAisle Control algorithms shall employ a supply air temperature sensor and a rack based network of (4) 2T sensors per unit connected by a daisy chain CANbus communication wire to the iCOM unit controller in order to control the unit fan speed and chilled water valve position independent of one another.

2.10 OPTIONAL COMPONENTS

A. Non-locking Disconnect, factory mounted, a non-automatic molded case switch operational form the outside of the unit. Access to the high voltage electric panel compartment can be obtained with the switch in either the “on” or “off” position. The

molded case switch disconnect models contain separate main fuses.

B. Seismic Anchor Clips and instructions

C. Leak Detection: Liqui-tect Sensor is a hermetically sealed solid state device with no moving parts. Alarm is activated when sensor detects the presence of moisture.

D. Smoke Sensor: The smoke sensor samples the return air and shuts down the unit if smoke is detected. It also provides a visual and audible alarm. Dry contacts are available for a remote customer alarm.

E. Remote Temperature and humidity sensors**:** These devices are provided in a vented case for mounting in the room to be conditioned.

F. Economizer Controls: Controls shall be provided for modulating field supplied and installed air economizer dampers, including software modifications, outside air sensor, discharge air sensor, and additional airflow sensor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide adequate drainage connections for water cooled units and humidifier flushing system.

C. Provide valves in chilled water inlet and outlet piping as indicated on the drawings.

D. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer’s recommended clearances.

E. Install and connect devices furnished by manufacturer but not specified to be factory mounted.

3.02 FIELD QUALITY CONTROL

A. Provide the services of the manufacturer's field representative to start and adjust systems and equipment and instruct operating personnel.

3.03 SYSTEM STARTUP

A. Prepare and start systems. Set initial temperature and humidity set points.

END OF SECTION

SECTION 26 00 10

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes the basic electrical Requirements for all electrical Work. It applies to all Specification sections included in Division 26 and their relationship specifically to Specification sections in Section 23.

B. Requirements for the following are included:
1. Related Sections.
2. Regulatory Requirements
3. Submittals.
4. Quality Assurance.
5. Delivery, Storage, and Handling.
6. Safety Considerations.
7. Cleaning, Startup, and Adjustments.
8. Products.
9. Installation.
10. Electrical Procedures.
11. Warranties.

C. Provide all labor, equipment and materials that are required to provide a complete and code compliant installation of the electrical systems as indicated on the Drawings and in the Specifications.

D. Coordinate details of facility equipment and construction for all Specification Divisions, which affect the Work covered under this Division.

E. Furnish and install all incidental items not actually shown or specified, but which are required by good practice to provide complete and code compliant functional systems.

F. Intent of Drawings:

1. Electrical plan Drawings show only general locations of equipment, devices, and raceways, unless specifically dimensioned.

2. The Contractor shall be responsible for the proper routing of raceways.

3. Coordinating with other trades and checking field obstructions is the responsibility of the Contractor.

4. Contractor to review all other applicable Drawings in preparation of the Bid. Check all information and report any apparent discrepancies before submitting the Bid.

G. In the event of a conflict between the Specifications and/or the Drawings and the National Electrical Code® (NEC®) the Requirements of the more stringent shall prevail. Contractor shall notify Engineer of the conflict and what action they are going to take prior to taking it.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of the Contract, including Division 1, General Requirements and Product Requirements, apply to the Work specified in this section.

B. The Work in this section applies to the Division 23 Subcontractors design and installation. Where a conflict occurs between this section and the technical sections of the Specifications, the technical sections of the Specifications shall take precedence over this

section.

C. The contract documents include Drawings and Specifications. The Drawings may include plans, elevations, details, one-line diagrams, panel schedules, raceway schedules, fixture schedules, and process instrumentation diagrams. The Subcontractor is responsible for reviewing all of the documentation. Where a conflict occurs between documents the Subcontractor shall request additional information (RFI). The Subcontractor is responsible for all systems under their jurisdiction, where a conflict occurs between the Drawings the Subcontractor is responsible for most extensive scope of Work. Estimates shall not be based on the lesser of the systems described within the documents.

D. Reference all Division 1 Documents. Coordination is a Requirement of this project.

E. It is the responsibility of the Subcontractor to coordinate exact Requirements governed by actual job conditions. Check all information and report any discrepancies before submitting a bid or fabricating Work.

F. All dimensions shown on the Drawings are in feet and inches unless indicated otherwise. If in doubt, obtain clarifications from the engineer prior to submitting bid. Dimensions marked on the Drawings shall take preference to scale measurements and large-scale Drawings shall govern over small-scale Drawings. When measurements are affected by the conditions already established, take field measurements. Do not scale the Drawings.

1.03 REGULATORY REQUIREMENTS

A. When references are made to standards, Specifications, or codes refer to the latest edition including addenda, bulletins, or other revisions existing on the date of the signing of the Contract of subsequent updates.

B. Codes and Ordinances:
   1. All Work and materials shall comply with the latest rules, codes and regulations, including, but not limited to the following:
      a. Occupational Safety and Health Act Standards (OSHA).
      b. NFPA #70 - National Electric Code (NEC)
      c. NFPA #101 - Life Safety Code.
      d. City Electrical Code.
      e. All other applicable Federal, State and local laws and regulations.

C. Compliance with all Codes and regulations is mandatory. Nothing in these Drawings and Specifications should permit Work that does not conform to any code or regulation. Conflicts between the contract documents and applicable codes or ordinances shall be brought to the attention of the Construction Manager or Engineer for clarification. Where Work is shown to exceed minimum Requirements, the Subcontractor shall comply with the Drawings and Specifications.

D. Compliance with the University of Oregon Construction Standards, Third Edition (May 2011), Division 26 Electrical and all referenced Divisions, Sections, Appendices and other individual Requirements therein is mandatory. University of Oregon Construction Standards will have precedence when conflict with the Drawings and/or Specifications.

E. Install Work in conformance with applicable local, state, federal ordinances and statutes. In case of conflict with local ordinances and statutes, the more stringent shall take precedent. Where material specified exceeds the quality of that permitted by code the Subcontractor shall comply with the Drawings and Specifications.

F. The Owner shall pay for plan check and permit fees.

G. The Subcontractor shall pick up all necessary permits, arrange all inspections, finalize acceptance, and close-out the permit as required by codes applicable to this Division and shall submit written evidence to the Construction Manager that required permits, inspections, and code requirements have been secured.

H. No Work shall be concealed until inspection has been completed and approved by proper agencies, and if requested the Owner, and the stamping Engineer. If Work is concealed without inspection and approval, the Subcontractor shall be responsible for all Work required by opening and restoring the concealed areas, in addition to all required modifications at no additional cost to the client. Subcontractor to provide access for the future inspection as required.

1.04 SUBMITTALS

A. Product Data: Provide wiring diagrams with electrical characteristics and connection Requirements.

B. Test Reports: Provide all test reports to the Construction Manager.

C. Manufacturer's Installation Instructions: Indicate settings, electrical connections, and wiring instructions.

D. Operation Data: Include instruction for safe operating procedures.

E. Maintenance Data: Include assembly Drawings, data including replacement sizes, and lubrication instructions.

F. Inspection and permit certificates, certificates of final inspection and acceptance from the authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Work shall be executed by skilled Workers under the direction of a qualified supervisor knowledgeable and experienced in the basic principles required for the installation of the electrical systems.

B. Electrical materials and equipment shall be furnished with a UL listing label.

C. Conformance to the latest codes and other legal Requirements are the responsibility of the Contractor. Discuss conflicts between Specifications and the codes immediately with the Engineer's project electrical engineer for resolution.

D. Contractor shall obtain all permits and arrange all inspections required by codes applicable to this Division and shall submit written evidence to the Construction Manager that the required permits, inspections and code Requirements have been secured.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Shipment
   1. In accordance with manufacturer's instructions, each product shall be correctly prepared for shipment as specified and for storage in a manner requiring no disassembly prior to operation. Products shall be shipped FOB jobsite unless otherwise noted.
   2. The Subcontractor shall be solely responsible for the preparation for shipment provisions employed with respect to materials and application.
   3. Equipment shall be completely free of water prior to any shipment preparation.
   4. To eliminate damage during shipment, storage, operation, maintenance instruments and auxiliary systems, must be securely mounted and/or supported.
   5. Open ends of conduit and pipe shall be capped for protection.
   6. Separate, loose, or spare parts shall be boxed and each part individually protected as required. Each individual container shall be marked both inside and outside with the equipment or part number for which the parts are intended.

B. One complete set of Installation, Operating and Maintenance Instructions shall be packed and shipped with the equipment or components. This set is in addition to the sets which

are to be sent directly to the Construction Manager.

C. Each container shall also include a complete Bill of Materials identifying each part. In some instances, such as instruments, specific tagging shall be required.

1.07 SAFETY CONSIDERATIONS

A. Install all equipment with suitable access clearances that satisfy OSHA and code Requirements for maintenance or removal of replaceable parts. Provide fittings or J. Boxes to allow maintenance or removal when rebuilding the system.

B. Subcontractor shall notify the Construction Manager immediately of any equipment requiring maintenance that cannot be reached by normal walkways due to interference with duct work, piping, or other obstructions and propose an alternate means of access. Including overhead platforms, ladders and safety railings or handholds, or as required to meet OSHA standards.

1.08 CLEANING, STARTUP, AND ADJUSTING

A. The Construction Manager shall be responsible for proper operation of systems, minor subsystems, and services provided under this Section. System operational problems shall be diagnosed; correctional procedures shall be initiated with the various Subcontractors as required to bring the system into compliance with the design, and the problem then shall be rechecked to verify that the system operates normally. Issues shall be brought to the attention of Construction Manager.

B. All parts of the installation must be thoroughly cleaned upon completion of the Work. Clean up and remove from the premises all refuse material, crates, and rubbish arising from Work.

PART 2 PRODUCTS

2.01 GENERAL

A. Equipment and components shall be the manufacturer's most recent standard design. Equipment and component designs which have not been previously used successfully in an industrial or similar application are not acceptable unless approved in writing by the Construction Manager.

B. Provide one quart of each standard paint used from each equipment and/or materials supplier for touch up. All paint cans are to be sufficiently labeled to identify where they are to be used.

C. All equipment over 150 pounds in weight shall be provided with lifting lugs.

D. The Subcontractor shall provide seismic restraint of equipment, large conduit, and other related items in Division 26 in accordance with Section 26_05_29 Hangers and Supports for Electrical Systems.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with the Requirements of the equipment or component manufacturer, the NEC and local code Requirements, and NECA recommended practices.

B. Work necessitated by the discovery of existing interference's that must remain shall be brought to the attention of the Construction Manager. Existing conditions are the responsibility of the Subcontractor. Field routing may require additional bends, it is a

Requirement that these be provided by the Subcontractor to provide a complete installation.

C. Equipment Manufacturer's Responsibility and Services
   1. A manufacturer's representative for major equipment and operating systems shall be available as necessary to assist the Subcontractor during installation, and to provide written certification that the equipment has been installed as specified and in accordance with the manufacturer's Requirements.
   2. The manufacturer's representative shall provide the initial startup of equipment in the presence of Construction Manager and Client.
      a. Provide a prestart check of all wiring, control devices, panels, and equipment.
      b. Calibrate and adjust equipment and controls for operation at the specified design conditions.
      c. Provide a record of all startup events noting problems and their resolution.
      d. Provide a record of all set points for operational controls and devices.
   3. Upon the completion of equipment startup, provide adequate instructional time with Client's personnel to review the operations and maintenance manuals and perform each step necessary for startup, shutdown, troubleshooting, and routine maintenance. The instructional time shall be scheduled through Construction Manager.
   4. Upon completion of the inspections, startup, testing, and checkout procedures, the equipment manufacturer shall submit written notice to Client that the units are ready for use. A certificate of calibration shall be provided for all equipment.

3.02 ELECTRICAL PROCEDURES

A. Testing Requirements
   1. Arrange for testing of installed systems in accordance with Requirements of authorities having jurisdiction and the Requirements of Division 1 and Division 26. Testing procedures shall include provisions of labor, materials, instruments, and power necessary for successful completion. Test duration shall be per Specifications except when the authority having jurisdiction requires a longer test period.
   2. Specific Requirements
      a. Perform tests on individual equipment, systems, and their controls. Whenever equipment or systems under test are interrelated with other equipment or systems, they shall be operated simultaneously with equipment or systems being tested.
      b. Repair or replace defective Work and repeat tests until particular system and component parts receive approval of the regulating authority. Repair any damage resulting from tests and replace damaged materials at no cost to Owner.
      c. Make final tests in presence of appropriate inspector and Construction Manager's representative.
      d. Furnish copies of test reports and certificates of acceptance, signed by the inspector, to Construction Manager before making claims for final payment; such claims will not be processed until these submittals have been made.

3.03 WARRANTIES

A. The Construction Manager shall provide to the Owner all Warranties and Guaranties including those from the manufacturers per the Requirements of Section 01 70 00 Execution and Closeout Submittals.

B. Provide manufacturer's written warranties covering defects in material and Workmanship of products and equipment utilized for the project.

C. Warranties shall be for a period of 1 year from the date of substantial completion unless

more stringently specified within individual Sections of Division 26.

D. See OUS Retainer General Conditions, Section K.3.2 for substantial completion requirements as follows:
Substantial Completion of a facility with operating systems (e.g., mechanical, electrical, or HVAC) shall be that degree of completion that has provided a minimum of thirty (30) continuous days of successful, trouble-free operation, which period shall begin after all performance and acceptance testing has been successfully demonstrated to the Owner. All equipment contained in the Work plus all other components necessary to enable the Owner to operate the facility in the manner that was intended, shall be complete on the Substantial Completion date. The Contractor may request that a Punch List be prepared by the Owner with submission of the request for the Substantial Completion notice.

END OF SECTION

SECTION 26 05 00

ELECTRICAL SCOPE OF WORK

PART 1 GENERAL

1.01 OVERVIEW

A. The Owner is renovating Research Server Rooms 321, 321A & 325 of the Deschutes Hall building at the University of Oregon in Eugene, Oregon. Existing HVAC and electrical systems will be replaced. Work will be coordinated to ensure the computer servers will stay operational during construction. Work is divided into two phases. Only phase 1 Work is being performed at this time. The Work consists of replacing the HVAC system serving these rooms, removing the wall between 321A and 325, reinforcing the floor joists, replacing the UPS system and installing new switchgear to serve the research server room that includes all materials, labor, and services to complete the installation as outlined in this Summary of Work and on the Drawings.

B. The following list of Work to be performed by the Contractor is presented for the purpose of complementing or clarifying the Drawings, Specifications, and other Contract Documents; but shall not limit the definition of Work as described herein nor shall it constitute a complete list of the Work of the Contract.

C. Clarifications to the technical aspects of this Specification and the Drawings are available from the Owner's Engineer, Evergreen Engineering, Eugene, Oregon, (541) 484-4771, Mr. Patrick Sandow, Project Manager.

D. The Contractor shall:

1. Accept the site in its existing condition at the time of commencement of the Work. A site visit by the Contractor is required to ensure a first-hand understanding of this Scope of Work.
2. Submit to the Owner for approval a list of temporary buildings, if any, that the Contractor intends to bring onto the site.
3. Before commencing any Work, submit for review and approval of the Owner a detailed schedule (simple bar graph) showing the commencement, the order, and the completion dates for the various parts of this Work. The Work shall be performed in accordance with the approved detailed schedule.
4. Transport to the site Contractor's construction materials and equipment required for the performance of the Work; storing and locating such materials in areas designated by the Owner.
5. Provide, install and maintain barricades, guardrails, warning lights, and similar devices in conformance with the safety regulations governing the Work.

1.02 Before starting any Work that will have an effect on existing utilities (electrical, sewer, water, etc.) and that will temporarily discontinue or disrupt service to the existing building or equipment, Contractor will notify the Owner in writing ten (10) days in advance and obtain the Owner's approval before proceeding with this phase of the Work. Owner will shut down and/or lock out all installed equipment or systems when Work is being performed in or near energized equipment.

1.03 Maintain a clean Work area. Containment of dust and fumes is required per the general Specification Section 01 10 00, paragraph 1.06.

1.04 Final clean-up will require wiping down all walls and vertical surfaces and vacuuming the floor.

1.05 Refer to Section 01 10 00 General Requirements for additional Working conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. All material furnished under this Specification shall be new and of first quality.

B. Fabrication methods shall follow the best accepted practice within the industry.

C. Fabrication shall be performed in a Workmanlike manner. Poor Workmanship, even though structurally sound, shall be cause for rejection where appearance is a justifiable consideration.

D. All nuts, bolts, and caulking will be supplied by the successful bidder.

E. At the time of final clean up, all finish surfaces shall be free of scratches and other surface blemishes, and all repaired surfaces shall be equal to the original finish and shall not be visible.

PART 3 EXECUTION

3.01 PHASE 1

A. First Floor.
1. Install new breakers in existing switchboard L.
2. Install new switchboard L1 in Electrical Room 133.

B. Third Floor
1. Disconnect and remove existing power conditioning equipment and data multi outlet raceway including associated conduit and wire in room 321.
2. Disconnect and remove duplex and data outlet and associated wiring in east wall of room 325.
3. Disconnect and relocate server racks and UPS equipment in room 321 by the user group.
4. Replace (4) duplex receptacles with 4-plex receptacles in room 321.
5. Reconfigure receptacle wiring in rooms 321, 321A and 325 as shown on Drawings
6. Install new UPS module, Battery Cabinet and Maintenance Bypass Cabinet in room 321A.
7. Install UPS distribution power panels in room 321
8. Provide wiring to server racks under the raised floor as indicated on Drawings.

END OF SECTION

SECTION 26 05 01

MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED SECTIONS

A. Reference all Specification Sections and related Contract Documents to establish the total general requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the Contractor and Subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:
   1. Execution Requirements: Additional requirements for alterations work.
   2. Basic Electrical Requirements.

B. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Owner before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company and Owner.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least ten (10) days before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is

accepted. Disable system only to make switchovers and connections. Minimize outage duration.

1. Notify owner before partially or completely disabling system.
2. Notify local fire service.
3. Make notifications at least ten (10) days in advance.
4. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Notify Owner at least ten (10) days before partially or completely disabling system.
2. Notify telephone utility company at least ten (10) days before partially or completely disabling system.
3. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut embedded or concealed conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and/or switches and remove devices. Remove abandoned outlets and/or switches if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlet and/or switch boxes that are not removed.

E. Disconnect and remove abandoned panel boards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panel Boards

1. Clean exposed surfaces and check tightness of electrical connections.
2. Replace damaged circuit breakers and provide closure plates for vacant positions.
3. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires

1. Remove existing luminaires in work area in scope for cleaning.
2. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry.
3. Replace lamps, ballasts and broken electrical parts.

END OF SECTION

SECTION 26 05 13

MEDIUM-VOLTAGE CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Medium voltage cable.

B. Cable Systems: Splicing, terminating, pulling, racking, and other accessories for medium voltage

C. Approved tools for working with cables.

1.02 RELATED SECTIONS

A. Reference all Specification Sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the Contractor and Subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following sections:
   1. Section 26 00 10 - Basic electrical requirements.
   2. Section 26 05 53 - Identification for electrical systems.
   3. Section 26 05 26 - Grounding and bonding for electrical systems

B. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

C. CAUTION: Use of this Section without including all Sections and related Contract Documents may result in the omission of basic Requirements.

1.03 REFERENCES

A. IEEE C2 - National Electrical Safety Code; Institute of Electrical and Electronic Engineers; 2007or latest adopted edition.

B. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R 2003) or latest adopted edition.

C. NEMA WC 74 - S5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy; National Electrical Manufacturers Association; 2006 or latest adopted edition.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007 or latest adopted edition.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted edition.

1.04 SUBMITTALS

A. See Section 26 00 10 Basic Electrical Requirements for submittal procedures.

B. Manufacturer's Data, Fabrication/Erection/Installation Drawings: Provide for cable, terminations, and accessories.

   1. Insulating Tape.

   2. Medium Voltage Cables

a. Cable manufacturer's compound number and/or compound supplier's compound number for conductor shield, insulation shield, and jacket materials.

b. Date and report number for AEIC qualification test report covering the materials in 1.04(a) above.

c. Minimum and maximum diameter over insulation and over extruded insulation shielding.

d. Location of Manufacturer's plant.

e. Description and performance characteristics of insulation pellet inspection.

3. Medium voltage terminating kits.

4. Terminators.

C. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.

D. Installation Procedures
1. Manufacturer's directions for ground megger use w/ proposed method indicated. Include manufacturer's certificate stating the factory test voltage and approval for field acceptance per NETA-ATS standards.
2. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of product.
3. Terminator manufacturer's installation instructions.
4. Typical installation instructions for terminating kits.

E. Project Record Documents: Record actual sizes and locations of cables.

F. Certificate of Compliance
1. Material and Equipment: Provide manufacturer's statement certifying that the product supplied meets or exceeds contract requirements. Submit the following for approval:
   a. Medium voltage cable.
   b. Medium voltage terminators
   c. Medium voltage elbows, splices and taps (if specified or shown on the Drawings).
2. Indicate approval of installation by Authority Having Jurisdiction (AHJ).
3. Workmens competency: Submit medium voltage cable installer/splicer/terminator certification of competency and experience 30 days before making splices or terminations in medium voltage cables.

G. Maintenance Data: Include instructions for testing and cleaning cable and accessories.

H. Minimum insulation K factor.

I. Cable materials and manufacture
1. Meet or exceed all applicable requirements of the ICEA, AEIC and NEMA standards.
2. Perform tests and sampling frequency in accordance with AEIC except as modified herein.

3. Perform tests required by this section, AEIC and ICEA.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Electrical components and/or systems shall be listed and labeled by a nationally recognized testing laboratory (NRTL) such as: UL,ETL,CSA, or FM; shall be labeled and/or listed as part of a UL labeled assembly; or shall be evaluated by a third party acceptable to the Authority Having Jurisdication (AHJ) as suitable for the use intended. All labels shall be applied at the manufacturer's factory or facility prior to shipment.

C. Equipment must meet all applicable codes and Requirements. Where conflicting Requirements occur between other required Codes or standards, the more stringent Requirements shall apply.

D. Conform to the following standards:

1. AEIC – Association of Edison Illuminating Companies.
2. AEIC CS6-1996 – Specifications for Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 through 69 kV (6th Edition).
3. ANSI/IEEE Standard 383™-2003 – IEEE Standard for Type Test of Class IE Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations.
4. ANSI/IEEE Standard 400™-2001 – IEEE Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field.
5. ANSI/IEEE Standard C2-2007 – National Electrical Safety Code (NESC) Part 3: Safety Rules for the Installation and Maintenance of Underground Electric Supply and Communication Lines.
6. ASTM B496-2004 – Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors.
7. CAN/CSA C68.3-97 (R2006) – Shielded and Concentric Neutral Power Cables Rated 5-46kV.
8. ICEA – Insulated Cable Engineers Association.
9. ICEA S-96-639 / NEMA WC74-2000 – Shielded Power Cables for Use in the Transmission and Distribution of Electric Energy 5,000 – 46,000 V.
10. ICEA S-96-659 / NEMA WC71-2000 – Non-Shielded Power Cables Rated 2001-5000V.
11. IEEE Standard 48™-1996 (R2003) – IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminators 2.5 kV through 756 kV.
12. IEEE Standard 386™-1995 (R2001) – IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems above 600 V.
13. IEEE Standard 400™-2001 – IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems.
14. IEEE Standard 404™-2000 - -IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2,500V to 500,000V.
15. IEEE Standard 510™-1983 (R1992) – Recommended Practices for Safety in High-Voltage and High Power Testing.
16. IEEE Standard 525™-1992 – IEEE Guide for the Design and Installation of Cable Systems in Substations.
17. IEEE Standard 576™-2000 – Recommended Practice for Installation, Termination and Testing of Insulated Power Cables as Used in Industrial and Commercial Applications.

18. NECA/MACSCB 600-2003 – Recommended Practice for Installing and Maintaining Medium Voltage Cable (ANSI).
19. NETA – InterNational Electrical Testing Association Inc.
20. NETA-ATS-2005 – Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.
21. UL 1072-2006 – Medium Voltage Power Cables.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide cable tag containing name of manufacturer, NEC® designation, and year and month of manufacture.

B. Furnish Cable in continuous lengths, free of kinks and defects at time of delivery to project jobsite.

C. Provide new cable delivered to the project site less than two years since manufacture. Provide cable from manufacturer's stock, not suppliers' warehouse stock.

D. Ensure compatibility among cable components.

E. When applicable, the cable passes the "Vertical Tray Flame Test" requirements of UL 1072 and ANSI/IEEE Standard 383™.

F. Voltage Rating: 15, kV as indicated.

G. Cable Rating: Continuous duty at 105 degrees C, wet or dry locations, suitable for underground duct installations, UL labeled as MV-105 as applicable.

H. Sizes: as indicated on the Drawings.

2.02 THREE CONDUCTOR GROUNDING CONDUCTOR 15KV CABLE - SHIELDED

A. Acceptable Manufacturer's
   1. General Cable (formerly BICC and Cablec).
   2. Okonite.
   3. Southwire.
   4. Substitutions: Substitutions are subject to owner and stamping engineers approval.

B. Cable: Manufactured using the triple tandem extrusion process in which all layers, from the conductor, to and including, the insulation tape shield, are installed at essentially the same time without intervening storage period on reels or other storage devices.

C. Conductor: annealed uncoated copper Class B stranding per ASTM B-496 and Part 2 of ICEA. Free from moisture, corrosion, and excessive drawing lubricant before conductor shielding is applied.

D. Strand Screen: Extruded EPR that meets or exceeds electrical and physical requirements of ICEA S-93-639/NEMA WC74 and UL 1072

E. Insulation: homogeneous wall of ethylene propylene rubber (EPR) insulation (133 percent level) applied directly over conductor shielding. Provide insulation having physical and electrical properties in accordance with ICEA S-93 639 / NEMA WC74, AEIC CS6 and UL 1072. Insulation compound with 100 percent inspection using continuous pellet inspection and rejection system.

F. Insulation Screen: extruded conducting thermosetting insulation shield applied over insulation in intimate contact with outer surface of insulation, free stripping, leaving no conducting particles or other residue on insulation surface. Legibly identified as being conducting. The thickness of this layer shall be in accordance with Table D-3 of AEIC CS6. The insulation shield shall meet the resistivity requirements of paragraph D.4 of AEIC CS6.

G. Shield: Helically apply [10] mil uncoated copper shielding tape with a minimum overlap of 12.5 percent. The copper tape shall meet all of the requirements of Part 4 of ICEA.

H. Jacket: Apply overall black chlorosulfonated polyethylene (CSPE), polyvinyl chloride (PVC), or chlorinated polyethylene (CPE) jacket. Use cable jacket meeting the electrical, physical and sunlight resistant requirements of ICEA S-93 639 / NEMA WC74 and of UL Standard 1072. The average thickness of the jacket shall be as specified in Part 4 of ICEA. Provide a minimum thickness at any point of not less than 80 percent of that specified. CSA listed to C68.3.

I. Grounding Conductor: Uncoated copper in accordance with UL 1072.

J. Cable Identification: Identify cable with surface printing indicating manufacturer, size, insulation type, insulation thickness, voltage rating, insulation level, year of manufacture, NRTL designations, and footage. Date of purchase must be less than 12 months from manufacture date.

K. Phase identification: Color coded (black, red, blue) polyester ribbon under the copper shield tape.

L. Shipping: Seal ends of cables before shipment to prevent entrance of moisture.

2.03 FACTORY TESTS

A. Standard Tests: Provide certified test reports of applicable tests on cable furnished per AEIC CS6, ICEA S-93 639 / NEMA WC74 or ICEA S-96-659 / NEMA WC71 and UL Standard 1072 to Contractor at the time of delivery of the cable to the project site. When in conflict, apply more stringent test. Provide 24-inch samples for Owner's sample tests. Identify each sample as follows:
   1. Factory master reel number.
   2. Sequential footage number.
   3. Shipping reel number.
   4. Shipping reel length.
   5. Test number.
   6. Manufacturer's order number.
   7. Contractor's or Owner's order number.

B. Record the beginning sequential footage indicator on each test report.

C. Test each shipping reel of cable in accordance with AEIC requirements.
rubber insulation. Provide hot or cold shrink type terminator with internal stress relief tube to distribute the electric field over the entire length of the skirted insulator. Do not use cable joints / splices / taps.

D. Acceptable Manufacturer's:
   1. Cooper Power Systems
   2. Elastimold
   3. 3M
   4. Substitutions are subject to owner and stamping engineers approval.

E. Modular Molded Rubber Separable Connectors (Loadbreak Elbows)

1. Shielded 200-amp insulated connector system rated for continuous operation at 15 kV and 105 degrees C, with emergency overload temperature rating of 140 degrees C and short circuit temperature rating of 250 degrees C.
2. Design and test system components in accordance with the specifications listed in IEEE Standard 386™ for 15, kV 200-amp dead-break connectors.
3. Provide system consisting of components as shown on Drawings.
4. Accommodate the 15kV shielded cable sizes shown on Drawings.

F. Splicing Sleeves
1. Long barrel type, rated for applied voltage.
2. Provide completed splice approved for underground direct burial and water immersion service.

G. Where required and approved the joints or splices must conform to IEEE Standard 404™.

2.04 CONDUCTOR AND CABLE STRIPPING TOOLS

A. Acceptable Manufacturer's
1. Greenlee
2. Hi-Line Company
3. Ideal
4. Ripley Company (Utility Tool), BP A, BP 1A, BP 2A, Icon, PIT 1T, TSW-4550, WS 6, WS 7, WS 7A, WS 8, WS 8A, WS 15, WS 64-U, WS 5A, or WS 66.
5. Speed Systems, Inc., 1542-2CL and 1700 Series.
6. Or approved equivalent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that trench, or manholes are ready to receive cable.

B. Verify that field measurements are as indicated.

C. Verify routing and termination locations of cable bank prior to rough-in.

D. Cable routing is shown in approximate locations unless dimensioned. Route as required to complete wiring system.

E. Beginning of installation means Contractor accepts existing conditions.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Deliver product to and receive products at the site under provisions of Division 1, General Requirements, and Section 26 00 10.

B. On receipt, inspect cable protective covering for evidence of damage during shipment. Report immediately to carrier if evidence of damage is found.

C. Accomplish unloading without contacting cable surface or protective wrap. If unloading by crane, use cradle supporting reel flanges or a shaft through arbor hole. If using a forklift, lift the reel at 90 degrees to flanges. Use forms long enough to make complete lifting contact with both reel flanges.

D. If using inclined ramp for unloading, use ramp wide enough to contact both reel flanges completely. Accomplish stopping of reels at bottom by using reel flanges and not the surface of the cable.

E. Do not drop reels from delivering vehicle to ground.

F. Store reels on hard surface to prevent flanges from sinking into the earth and allow the weight of the reel and cable to rest on the cable surface.

G. Do not store reels in an area where construction equipment, falling or flying objects or other materials will contact the cable.

H. Store cable where chemicals or petroleum products will not be spilled or sprayed on the cable.

I. Store cable away from open fires or sources of heat.

J. When a reel of cable is rolled from one point to another, check for and remove objects on surface that could contact or damage the cable surface or protective wrap. Roll reel in direction to prevent loosening of the cable on the reel.

K. Store cable according to manufacturer's recommendations, as a minimum. In addition, store cable in location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provisions for ventilation to prevent condensation and for protection from weather. If air temperature at the cable storage location will be below 5 degrees C, move cable to a heated (10 degrees C minimum) location. If necessary, properly store cable off site at Contractor's expense.

3.03 INSTALLATION / CABLE PULLING

A. Usage

1. 3 -Conductor and Grounding Medium Voltage Cable
   a. Shielded: Use for above and underground applications (except for Jumper Cable applications – see Jumper Cable below) and install on cable tray in utility tunnel. Cable shielding may not be used as the primary grounding conductor.

B. Install cable and terminations in accordance with manufacturer's instructions, installation guidelines and IEEE Standard 576.

C. Install cable using mechanical means with cable pulling equipment, pulleys, sheaves, wheel, and rollers. Use hydraulic or electric pulling equipment with smooth, variable speed control is required. Do not manually pull in cables.

D. Ground cable shield at each termination and splice.

E. Use listed pulling compounds compatible with the cable's outer jacket, the raceway involved, and acceptable to the cable manufacturer. If compatible, use Polywater® Type J or F lubricant.

F. Include approval of cable pull setup by Contractor and Owner prior to each pull.

G. Furnish cable-pulling calculations. Submit to A/E, prior to cable installation, calculations that indicate the maximum pulling tension of the cable will not be exceeded.
1. Do not exceed tension of 0.008 pounds per circular mil of conductor cross sectional area.
2. Do not exceed cable pulling tensions and bending radius recommended by the manufacturer.

H. Where required, use pulling eyes and bolts with long barrel ferrules that compress onto the exposed conductors. Follow cable manufacturer's instructions for application of pulling eyes. Provide temporary seal over remaining exposed conductors using tape and heat shrink sleeving.

I. Where pulling equipment is attached to columns, structure, or strut framework, ensure maximum stress limitations of support and structure systems are not exceeded.

J. Do not pull cable into conduit embedded in concrete until after concrete is poured and

has set up.

K. Use correctly sized cable pulley (sheave) for each cable-pull. Size sheave diameter per cable calculations. Use sheave wide enough for cables to properly ride over the sheave. Do not use narrow sheaves. Set up sheaves for direct reading from dynamometer.

L. Where cable is pulled under tension over sheaves, conduit bends or other curved surfaces, select radium that will not result in excessive sidewall pressure and included sheaves, conduit bends or other curved surfaces in above calculations.

M. During the pulling operation, use dynamometer to record pulling tension. Give notice to Owner before cable is pulled so his Representative can observe pull. Record dynamometer readings and submit five (5) copies to Owner.

N. Include witnessing of cable pulls by cable manufacturer and certification by manufacturer that cable was not damaged during installation. Include witnessing of dynamometer readings and certification that the manufacturer's allowable pulling tension for each pull was not exceeded. (Determine requirement for the manufacturer's witnessing of cable installation in Electrical Work Group).

O. Support cables in utility tunnel manholes with cable racks and secure to rack insulators with self-locking nylon cable ties. Place each cable on a separate insulator.

P. Avoid abrasion and other damage to cables during installation.

Q. Do not use splices unless specifically preapproved in writing by A/E or Owner's project lead electrical engineer.

R. Provide terminals and connectors acceptable for the type of conductor used.

S. Accurately record exact sizes, lengths, locations, and quantities of cables. Also show where all splices and terminations are located for each cable. Submit this information to the A/E and Owner.

T. Provide all material for sample splices.

3.04 FIELD QUALITY CONTROL

A. Inspect exposed cable sections for physical damage before and after installation. Replace damage cable at Contractor's expense.

B. Inspect cable for proper connections as indicated.

C. Inspect shield grounding, cable supports, and terminations for proper installation.

D. Perform inspections and tests listed in NETA STD ATS, Section 7.3.3.

3.05 PROTECTION

A. Protect installed cables from entrance of moisture.

3.06 SPLICES, TAPS AND TERMINATION OF CABLES

A. Use tools specified in Article 2.04 of this Section, for the required task, instead of a standard utility knife, when cutting the outer jacket, tape-shields, semi-conductor insulation or stripping insulation from medium voltage cables.

B. Follow the manufacturer's installation instructions for all approved splices, taps and terminations.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wire and cable for 600 volts and less.

B. Wiring connectors and connections.

1.02 RELATED SECTIONS

A. Reference all specification sections and related Contract Documents to establish the total general requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the Contractor and Subcontractor to use all of the Specifications for bidding and construction work. Related specifications include but are not limited to the following:
   1. Basic Electrical Requirements.
   2. Excavation.
   3. Fill and Backfill: Bedding and backfilling.
   4. Trenching for Site Utilities: Excavating, bedding, and backfilling.
   5. Identification of Electrical Systems.

B. CAUTION: Use of this Section without including all Sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006, or latest adopted edition.

B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007, or latest adopted edition,.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008, or latest adopted edition.

1.04 SUBMITTALS

A. Product Data: Provide for each cable assembly type.

   1. Product data sheets on each cable size and type used including outer diameter, impedance, weight, and materials.

B. Test Reports: Indicate procedures and values obtained.

C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors, substitutions are subject to Owner and stamping engineers approval.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.

E. Project Record Documents: Record actual locations of components and circuits.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Products: Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WIRING REQUIREMENTS

A. Concealed Dry Interior Locations: Use only building wire in raceway, building wire with Type THHN insulation in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.

B. Exposed Dry Interior Locations: Use only building wire in raceway, building wire with Type THHN insulation in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.

C. Above Accessible Ceilings: Use only building wire in raceway, building wire with Type THHN insulation in raceway, nonmetallic-sheathed cable, armored cable, or metal clad cable.

D. Wet or Damp Interior Locations: Use only building wire with Type THWN insulation in raceway, direct burial cable, armored cable with jacket, or metal clad cable.

E. Exterior Locations: Use only building wire with Type THWN insulation in raceway, direct burial cable, service-entrance cable, armored cable with jacket, or metal clad cable.

F. Underground Installations: Use only building wire with Type THWN insulation in raceway, direct burial cable, service-entrance cable, armored cable, or metal clad cable.

G. Unless otherwise noted in the plans, use only building wire in raceway.

H. Use solid conductor for feeders and branch circuits 12 AWG and smaller.

I. Use stranded conductors for control circuits.

J. Use conductor not smaller than 12 AWG for power and lighting circuits.

K. Use conductor not smaller than 18 AWG for control circuits.

L. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

M. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

N. Conductor sizes are based on copper unless indicated as aluminum or "AL".

O. If aluminum conductor is substituted for copper conductor, size to match circuit requirements for conductor ampacity and voltage drop, substitutions are subject to Owner and stamping engineers approval.

2.02 WIRE MANUFACTURERS

A. Cerro Wire Inc: www.cerrowire.com.

B. Industrial Wire & Cable: www.iewc.com.

C. Southwire Company: www.southwire.com.

D. American Insulated Wire Company.

E. Encore.

F. General Cable.

G. Okonite.

H. Substitutions: Substitutions are subject to Owner and stamping engineers approval.

2.03 BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor: Copper.
   1. For Sizes Smaller Than 4 AWG: Copper.
   2. For Sizes 4 AWG and Larger: Copper unless otherwise specified on drawings.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: NFPA 70, Type THHN.
   1. For Feeders and Branch Circuits Smaller Than 4 AWG: Type THHN.
   2. For Feeders and Branch Circuits Larger Than 4 AWG: Type XHHW or THHN/THWN.
   3. Insulation: Thermoplastic material rated 90 degrees C.

2.04 INSTRUMENTATION CABLE

A. Non-plenum Applications:
   1. For Class 1 power-supplied applications (100 VA $\geq$ Class 1 $\leq$ 1,000 VA), or for 480 VAC applications, use 600-volt rated cable (per NEC® Article 725 Class 1 guidelines).
   2. For Class 2 power-supplied applications (less than 100 VA) use 300-volt rated cable (per NEC® Article 725 Class 2 and 3 guidelines).
   3. Type CMR.
   4. Individual Conductors: 18 AWG, stranded, tinned- or bare-copper conductor with polyethylene or PVC insulation. Maximum overall nominal diameter not to exceed 0.278-inches.
   5. Assembly: twisted-single-pair, continuous 100 percent coverage, aluminum-polyester shield, 20 AWG drain-wire, and overall PVC jacket.

B. Plenum Applications:
   1. For Class 1 power-supplied applications (100 VA $\geq$ Class 1 $\leq$ 1,000 VA), applications, use 600-volt rated cable (per NEC® Article 725 Class 1 guidelines.
   2. For Class 2 power-supplied applications (less than 100 VA) use 300-volt rated cable (per NEC® Article 725 Class 2 and 3 guidelines).
   3. Type CMP.
   4. Individual Conductors: 18 AWG, stranded, tinned- or bare-copper conductor with Teflon® insulation. Maximum overall nominal diameter not to exceed 0.278-inches.
   5. Assembly: twisted single pair, continuous 100 percent coverage aluminum-polyester shield, 20 AWG drain wire, and overall Teflon® jacket.

2.05 METAL CLAD CABLE

A. Description: NFPA 70, Type MC.

B. Conductor: Copper.
   1. For Sizes Smaller Than 4 AWG: Copper.

2. For Sizes 4 AWG and Larger: Copper unless otherwise specified on drawings.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90 degrees C.

E. Insulation Material: Thermoplastic.

F. Armor Material: Steel or Aluminum.

G. Armor Design: Interlocked metal or corrugated sheath.

H. Jacket: PVC; use in locations indicated.

I. Fittings:
1. Acceptable Manufacturers:
   a. Crouse-Hinds TMCX Series.
   b. O-Z/Gedney Tek-Mate Type JMC.
   c. T&B StarTek series.
2. NRTL listed cable-to-box fittings for the application.
3. Fully rated to match or exceed sheath fault current rating.
4. Maintain ground continuity.

2.06 TRAY CABLE

A. Description: NFPA 70, Type TC.
1. Individual Conductors: Conductor size per schedule on Drawings, 7- or 19-strand copper, PVC insulation, nylon jacket, rated 90 degrees C dry, 75 degrees C wet, color-coded per NEMA WC 57/ICEA. Provide a minimum of one green or bare grounding conductor in each bundle or per each set of phase conductors comprising parallel feeders.
2. Assembly: Bundle wrapped with cable tape and covered with PVC jacket.
3. Parallel feeder runs: Each bundle shall have an oversized ground conductor rated per the upstream breaker.

B. Description: NFPA 70, Type TCER.
1. Assembly: Bundled with ground conductor in overall jacket.
2. Parallel feeder runs: Each cable shall have an oversized ground conductor rated per the upstream breaker.

2.07 WIRING CONNECTORS

A. Split Bolt Connectors:
1. Manufacturer: T&B, Burndy
2. Substitutions: Substitutions are subject to Owner and stamping engineers approval.

B. Solderless Pressure Connectors:
1. Manufacturer: T&B, Burndy
2. Substitutions: Substitutions are subject to Owner and stamping engineers approval.

C. Spring Wire Connectors:
1. Manufacturer: T&B, Burndy
2. Substitutions: Substitutions are subject to Owner and stamping engineers approval.

D. Compression Connectors:
1. Manufacturer: T&B, Burndy
2. Substitutions: Substitutions are subject to Owner and stamping engineers approval.

2.08 PULLING COMPOUNDS

A. Acceptable Manufacturers:
   1. Ideal, Aqua Gel II .
   2. American Polywater® Corporation, Polywater G or J. Use Polywater on underground raceways or where there is no chance for it to leak from the overhead raceway on to surfaces below.
   3. 3M, WL Wire Pulling Lubricant.
   4. Use pulling compounds that do not dry out over time and are environmentally safe.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

C. Verify that raceway installation is complete and supported.

D. Verify that field measurements are as indicated.

3.02 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.03 INSTALLATION

A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA

B. Route wire and cable as required to meet project conditions.
   1. Wire and cable routing indicated is approximate unless dimensioned.
   2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
   3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.

C. Use wiring methods indicated.

D. Pull all conductors into raceway at same time.

E. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

F. Protect exposed cable from damage.

G. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.

H. Use suitable cable fittings and connectors.

I. Neatly train and lace wiring inside boxes, equipment, and panel boards.

J. Clean conductor surfaces before installing lugs and connectors.

K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

L. Terminate aluminum conductors with tin-plated aluminum-bodied compression connectors only. Fill with anti- oxidant compound before installing conductor.

M. Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

N. Use split bolt connectors for copper conductor splices and taps, six (6) AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

O. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

P. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

Q. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

3.04 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding components.

1. Provide all components necessary to complete the grounding system(s) consisting of:
   a. Existing metal underground water pipe.
   b. Metal underground water pipe.
   c. Metal frame of the building.
   d. Concrete-encased electrode.
   e. Existing metal underground gas piping system.
   f. Metal underground gas piping system.
   g. Rod electrodes.
   h. Plate electrodes.
   i. Active electrodes.

1.02 RELATED SECTIONS

A. Reference all specification sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the contractor and subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:
   1. Basic Electrical Requirements.
   2. Electrical Identification.
   3. Site Grounding.

B. CAUTION: Use of this Section without including all sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007or latest adopted edition.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted edition.

C. NFPA 99 - Standard for Health Care Facilities; National Fire Protection Association; 2005 or latest adopted edition.

1.04 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms or less measured using three point fall-of-potential method.

B. SUBMITTALS
   1. See –Basic Electrical Requirements for submittals procedures.

C. Product Data: Provide for grounding electrodes and connections.

D. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual locations of components and grounding electrodes.

G. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2PRODUCTS

2.01 MANUFACTURERS

A. Cooper Power Systems

B. Framatome Connectors International

C. Substitutions: Substitutions are subject to Owner and stamping engineers approval.

2.02 ELECTRODES

A. Rod Electrodes: Copper clad steel.
1. Diameter: 3/4 inch.
2. Length: 10 feet.

B. Active Electrodes: Metallic-salt-filled copper-tube electrode.
1. Shape: Straight.
2. Length: 8 feet.
3. Connector: U-bolt pressure plate.

C. Foundation Electrodes: 4/0 AWG unless otherwise specified on Drawings.

2.03 CONNECTORS AND ACCESSORIES

A. Wire: Exterior 7 Stranded hard drawn copper or otherwise specified on Drawings. Interior standard copper building wire or otherwise specified on Drawings. Interior and exterior wire sized per Drawings.

B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements or otherwise specified on Drawings.

C. Below Grade, Outdoors, and Indoor Wet Locations: Exothermic-welded type connectors by Cadweld, or Thermoweld.

D. Indoor Dry Areas or in Manholes/Handholes/Inspection Ports: Compression type connectors by T&B, Burndy, or Anderson. Exothermic connections may be allowed for connections if so specified on Drawings.

E. Connections with bolted or mechanical fasteners are not allowed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

A. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.

B. Provide grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

C. Install 4/0 AWG bare copper wire in foundation footing where indicated.

D. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.

E. Provide bonding to meet requirements described in Quality Assurance.

F. Bond together metal siding not attached to grounded structure; bond to ground.

G. Install transient suppression plate where indicated.

H. Install ground grid under access floors where indicated. Construct grid of 2 AWG bare copper wire installed on 24 inch centers both ways. Bond each access floor pedestal to grid.

I. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to under floor ground grid. Use 2 AWG bare copper conductors.

J. Provide grounding and bonding in patient care areas to meet Requirements of NFPA 99 and NFPA 70.

K. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
   1. Terminate each end of this conductor on a grounding lug, bus, or bushing and to all accessible intermediate metallic enclosures.

L. Connect equipment grounding electrode conductors to metal water pipe using a listed grounding clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meters and insulated portion of piping.

M. Separately Derived Source:
   1. Bond Transformers, UPS systems, power conditioners, inverters, generators or other power supplies to the grounding electrode system.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SECTION INCLUDES THE REQUIREMENTS NECESSARY TO FURNISH AND INSTALL:

A. Conduit and equipment supports.

B. Anchors and fasteners.

C. Coordination of location and dimensions of concrete equipment pads.

D. Requirements for the following are included:
   1. References
   2. Submittals.
   3. Quality Assurance

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the contractor and subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:

   1. Basic Electrical Requirements.

   2. Electrical Identification.

   3. Slotted Channel Framing

   4. Seismic Restraints Criteria

B. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association-2006 or latest adopted edition.

B. NFPA 70 - National Electrical Code; National Fire Protection Association-2008 or latest adopted edition.

1.04 SUBMITTALS

A. See Section 26 00 10 BASIC ELECTRICAL REQUIREMENTS for submittal procedures.

B. Product Data: Provide manufacturer’s catalog data for fastening systems.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. The contractor shall submit details of all equipment supports and conduit and/or cable tray support racks for approval prior to installation and rack fabrications. Details shall be stamped by professional engineer, registered in the state where the project is located and

shall include cable tray and/or conduit arrangements and seismic bracing of equipment or support racks.

1.05 QUALITY ASSURANCE

A. Conform to Requirements of NFPA 70 – National Electrical Code–2008 or latest edition for the jurisdiction.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thomas & Betts

B. B-line

C. Hilti

D. Threaded Rod Company

E. Substitutions: Substitutions are subject to Owner and stamping engineer"s approval.

2.02 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
1. Do not use powder-actuated anchors, spring clips, or beam clamps (See 2. below).
2. Obtain permission from Architect and Structural Engineer before using powder-actuated anchors.
3. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
4. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
5. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
6. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
7. Solid Masonry Walls: Use expansion anchors or preset inserts.
8. Sheet Metal: Use sheet metal screws.
9. Wood Elements: Use wood screws.

D. Formed Steel Channel:
1. Product: Specified by stamping engineer,
2. Substitutions - Substitutions are subject to owner and stamping engineer's approval.

E. Powder-Actuated Anchors:
1. Product: Specified by stamping engineer,
2. Substitutions - Substitutions are subject to owner and stamping engineer's approval.

F. Steel Spring Clips:
1. Product: Specified by stamping engineer,
2. Substitutions - Substitutions are subject to owner and stamping engineer's approval.

PART 3 EXECUTION

3.01 INSTALLATION

A. Anchors, fasteners, conduit, raceway, equipment supports and assemblies shall meet the seismic zone of the project location. Provide required bracing as required to meet the applicable code

B. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
   2. Do not drill or cut structural members.
   3. Provide caddy clips for ¾-inch conduit (maximum) in offices with drop ceilings only.
   4. Obtain permission from Architect and Structural Engineer before drilling or cutting structural members.

C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs.

D. Supports shall not be fastened to piping, ductwork, mechanical equipment, or conduit.

E. Permission is required to use powder-actuated anchors. Written permission can be obtained from the owner and stamping structural engineer.

F. Drilling or welding to the structural steel members is permitted with written permission from the owner and stamping structural engineer.

G. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Prior to installing supports verify that they will not interfere with the installation and/or maintenance of other equipment. A minimum of 12-inches of clearance from any heat source shall be required.

I. Install free standing electrical distribution equipment, transformers, switchgear, and vfd's in non-cleanroom areas on 3 ½-inch concrete pads. Embed steel channels in house keeping pads for switchgear and substations. House keeping pad shall extend 3-inches minimum beyond equipment footprint. Refer to Drawings for additional Requirements.

J. Provide 15 kV switchgear, 480V unit substations including switchgear, transformers, and 480V motor control centers, with 3 ½-inch concrete pad with embedded support channel installed to level to within 1/8-inch for a five (5) foot run as measured with a level that is a minimum six (6) feet in length.

K. Supports shall not interfere with the installation or maintenance of other equipment. Allow a minimum if 12-inches of clearance from any heat source.

3.02 CORROSION PROTECTION

A. Conduit clamps made from steel or malleable iron with rust-resistant zinc- or cadmium-plated finish shall be used in corrosion areas.

B. Fiberglass or coated metallic supports shall be used in areas subject to corrosives.

C. Cut ends of mounting channel shall have a field applied galvanized or other approved coating.

3.03 CABINETS AND PANELBOARDS

A. Install surface-mounted cabinets and panel boards with a minimum of four anchors. The number of anchors shall be up to the vendor Requirements of the equipment.

B. Bridge studs top & bottom of cabinets and panel boards with channels to support recessed mounted cabinets and panel boards in stud walls.

C. Provide fiberglass supports inside of the electrical equipment where wire management is required.

3.04 EXPOSED RACEWAY SUPPORT

A. Support individual raceways by wall brackets, strap hangers, or ceiling trapeze, fastened by wood screws on wood, toggle bolts on hollow masonry units, expansion shields on concrete or brick, and machine screws or welded thread studs on steel work.

B. Support exposed conduit with 1-5/8 inch channel anchored to building construction with anchoring device. Threaded studs driven in by power charge and provided with lock washers and nuts may be used in lieu of expansion shields. Obtain approval from A/E prior to using anchoring devices.

C. Support raceways from structural members only. Do not support from pipe hangers or rods, ductwork, mechanical equipment, cable tray, other conduit, or other slotted channel framing supporting systems from other trades.

D. Do not install single all-threads with conduit hangers or straps for any conduit supports.

E. Support multiple raceways adjacent to each other by ceiling trapeze. Where space permits, trapeze shall have 25 percent spare capacity for future raceways.

F. Do not use nails anywhere or wooden plugs inserted in concrete or masonry as a base for raceway or box fastenings. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.

G. Protect ends of support channels and all-thread rods with caps designed for this use.

Ensure positive locking on all threaded-rod-supports. This applies to all systems hung by threaded rods from the truss or roof and includes any turnbuckles, couplings or splices on threaded rods. This can be achieved by one of the following methods:

1. Install double-nuts, as shown on the Drawings.
2. A welded nut.
3. A lock washer.
4. Double-nut all rod couplings

H. Do not share supports with ceiling or lighting systems. No conduits, fittings or boxes may be supported from ceiling or fixture support wires.

3.05 SUPPORT OF EXPOSED BOXES

A. Install boxes in a secure, substantial manner supported independently of conduit by attachment to the building structure or a structural member. Use bar hangers in frame construction or fasten boxes directly with wood screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded, threaded studs on steelwork. Threaded studs driven in by a powder charge and provided with lock washer and nuts are acceptable in lieu of expansion shields; use galvanized mounting hardware in utility areas.

3.06 HANGER INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
   2. Do not drill or cut structural members.
   3. Obtain permission from Architect and structural engineer before drilling or cutting structural members.

B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

C. Install surface-mounted cabinets and panel boards with minimum of four anchors.

D. In wet and damp locations use steel channel supports to stand cabinets and panel boards one (1) inch off wall.

E. Use sheet metal channel to bridge studs above and below cabinets and panel boards recessed in hollow partitions.

END OF SECTION

SECTION 26 05 34

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit, fittings and conduit bodies.

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the contractor and subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:
   1. Basic Electrical Requirements.
   2. Grounding and Bonding.
   3. Hangers and Supports.
   4. Electrical Identification.
   5. Boxes.

B. CAUTION: Use of this Section without including all sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding Requirements between this Section and any other section, the provisions of this Section shall govern.

1.03 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005 or latest adopted edition.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005 or latest adopted edition.

C. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006 or latest adopted edition.

D. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; 2006 or latest adopted edition.

E. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007 or latest adopted edition.

F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005 or latest adopted edition.

G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association; 2003 or latest adopted edition.

H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004 or latest adopted edition.

I. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted edition.

1.04 SUBMITTALS

A. See Section 26 00 10 - Administrative Requirements for submittals procedures.

B. Product Data: Provide for metallic conduit, flexible metal conduit, liquid tight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.

C. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.05 QUALITY ASSURANCE

A. Equipment must meet all applicable codes and Requirements. Where conflicting Requirements occur between other required codes or standards, the more stringent Requirements shall apply.

B. Conform to Requirements of NFPA 70.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Conduit Size: Comply with NFPA 70.
   1. Minimum Size: 3/4 inch unless otherwise specified.

B. Underground Installations:
   1. More than 5 Feet from Foundation Wall: Sch. 40 PVC conduit.
   2. Within 5 Feet from Foundation Wall: Use galvanized rigid steel conduit, plastic coated galvanized rigid steel conduit, or Sch. 40 PVC conduit.
   3. In or Under Slab on Grade: Use galvanized rigid steel conduit, plastic coated galvanized rigid steel conduit or Sch. 40 PVC conduit.
   4. Minimum Size: 3/4 inch.
   5. Underground Outside of Building
      a. Shall be slurry encased PVC Schedule 40 conduit, unless indicated otherwise.
      b. For conduit runs longer than 100 feet, use slurry-encased galvanized rigid steel or fiberglass conduit for all bends, otherwise, all 22.5-degree bends and greater shall be slurry-encased rigid steel conduit.
      c. Slurry shall extend 6-inches beyond bend.
      d. For circuits 600V and below, conduits 2” and smaller shall be sand encased; i.e., lighting conduit.
   6. Underslab Above 600V
      a. PVC Schedule 40 conduit, 18-inch minimum depth below finished floor.
      b. For conduit runs longer than 100 feet, use slurry-encased galvanized rigid steel or fiberglass conduit for all bends, otherwise, all 22.5-degree bends and greater shall be slurry-encased rigid steel conduit with slurry extending 6-inches

beyond bend.

7. Underslab 600V and below
   a. Greater than or equal to 3-Inch diameter
      1) PVC Schedule 40 conduit, 18-inch minimum depth below finished floor.
      2) For conduit runs longer than 100 feet, use slurry-encased galvanized rigid steel or fiberglass conduit for all bends; otherwise, all 22.5 degree bends and greater shall be slurry-encased rigid steel conduit Slurry shall extend 6-inches beyond bend.
   b. Less than 3-Inch diameter
      1) PVC Schedule 40 conduit, 18-inch minimum depth below finished floor.
      2) For conduit runs longer than 100 feet, use slurry-encased galvanized rigid steel or fiberglass conduit for all bends.
      3) Slurry shall extend 6-inches beyond bend.

C. Outdoor locations above grade below 600 Volts
   1. Use galvanized rigid steel conduit, rigid aluminum conduit, and intermediate metal conduit.

D. In Slab Above Grade
   1. Use galvanized rigid steel conduit, or Sch. 40 PVC conduit.
   2. Maximum Size Conduit in Slab: 3/4 inch; 1/2 inch for conduits crossing each other.

E. Wet and damp locations above grade below 600 Volts
   1. Use galvanized rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, fiberglass conduit, electrical metallic tubing, Sch. 80 PVC conduit, or nonmetallic tubing.

F. Dry locations above grade:
   1. Concealed: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, electrical metallic tubing, Sch. 40 PVC conduit, or nonmetallic tubing.
   2. Exposed below 600 Volts: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, electrical metallic tubing, or Sch. 80 PVC conduit.
   3. Exposed above 600 Volts: rigid galvanized steel conduit or Sch. 80 PVC conduit.

G. Final connection to, valves, local instrumentation, and lighting
   1. Flexible Metal Conduit or Liquid Tight Flexible Metal Conduit.

2.02 METAL CONDUIT

A. Manufacturers:
   1. Allied Tube & Conduit
   2. Beck Manufacturing, Inc.
   3. Picoma.
   4. Wheatland Tube Company.
   5. Substitutions: Substitutions are subject to owner and stamping engineer's approval.

B. Rigid Steel Conduit: ANSI C80.1.

C. Rigid Aluminum Conduit: ANSI C80.5.

D. Intermediate Metal Conduit (IMC): Rigid steel.

E. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.03 PVC COATED METAL CONDUIT

A. Manufacturers:

1. Allied Tube & Conduit.
2. Thomas & Betts Corporation.
3. Robroy Industries.
4. Substitutions: Substitutions are subject to owner and stamping engineer's approval.

B. Description: NEMA RN 1; rigid steel conduit with external PVC coating.

C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.04 FLEXIBLE METAL CONDUIT

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. Electri-Flex Company.
3. International Metal Hose.
4. Substitutions: Substitutions are subject to owner and stamping engineer's approval.

B. Description: Interlocked steel construction.

C. Fittings: NEMA FB 1.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. Electri-Flex Company.
3. International Metal Hose.
4. Substitutions: Substitutions are subject to owner and stamping engineer's approval.

B. Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit.
2. Beck Manufacturing, Inc.
3. Picoma.
4. Wheatland Tube Company.
5. Substitutions: Substitutions are subject to owner and stamping engineer's approval.

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.07 NONMETALLIC CONDUIT

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. Electri-Flex Company.
3. International Metal Hose.
4. Substitutions: Substitutions are subject to owner and stamping engineer's approval.

B. Description: NEMA TC 2; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.08 NONMETALLIC TUBING

A. Manufacturers:
1. Beck Manufacturing, Inc.
2. Cantex Inc.
3. Picoma.
4. Lamson & Sessions (Carlon).
5. Substitutions: Substitutions are subject to owner and stamping engineer's approval.

B. Description: NEMA TC 2.

C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

D. Prior to installation, store products specified in this Section in a dry location. Following installation, protect products from the effects of moisture, corrosion, and physical damage during construction. Keep openings in conduit and tubing capped with manufactured seals during construction.

3.02 INSTALLATION

A. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install steel conduit as specified in NECA 101.

C. Install nonmetallic conduit in accordance with manufacturer's instructions.

D. Arrange supports to prevent misalignment during wiring installation.

E. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

F. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

G. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.

H. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

I. Do not attach conduit to ceiling support wires.

J. Arrange conduit to maintain headroom and present neat appearance.

K. Route exposed conduit parallel and perpendicular to walls.

L. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

M. Route conduit in and under slab from point-to-point.

N. Do not cross conduits in slab.

O. Maintain adequate clearance between conduit and piping.

P. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

Q. Cut conduit square using saw or pipe cutter; de-burr cut ends.

R. Bring conduit to shoulder of fittings; fasten securely.

S. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

T. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.

U. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.

V. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

W. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic joints.

X. Provide suitable pull string in each empty conduit except sleeves and nipples.

Y. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

Z. Coordinate installation of underground raceways with other outside and building construction work. Maintain existing outside utilities in operation unless otherwise authorized. All excavation and backfill required because of this work shall be included. Excavation of trenches shall be sequenced to minimize “open time’ and inconvenience.

AA. Install low point drains in all conduit runs comprised of more that 20 feet outside prior to entry into field devices.

BB. Ground and bond conduit under provisions of Section 26 05 26.

CC. Identify conduit under provisions of Section 26 05 53.

DD. Conduit fill not to exceed 40%.

END OF SECTION

SECTION 26 05 35

SURFACE RACEWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface metal raceways.

B. Surface nonmetal raceways.

C. Multi-outlet assemblies.

D. Wireways.

E. Wall duct.

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the Contractor and Subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:

1. Basic Electrical Requirements.
2. Electrical Identification.
3. Underfloor Ducts: Trench duct.
4. Wiring Devices: Receptacles.

B. CAUTION: Use of this Section without including all sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006 or latest adopted edition.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to Requirements of NFPA 70.

B. Conform to UL 870-1995 (R2003) – Wireways, Auxiliary Gutters, and Associated Fittings.

C. Maintain one copy of document on site.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

E. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wireways:

1. B-line
2. Circle AW.
3. Hoffman.
4. Panduit.
5. Square D.
6. Weigman.
7. Wiremold
8. Substitutions: Substitutions are subject to Owner and stamping engineer's approval.

B. Multi-outlet Assembly:

1. Hubbell.
2. Walker Duct.
3. Wiremold.
4. Substitutions: Substitutions are subject to Owner and stamping engineer's approval.

2.02 SURFACE RACEWAYS

A. Surface Metal Raceway: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
   1. Size: As shown on Drawings.
   2. Finish: Gray enamel.
   3. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories.

B. Surface Nonmetal Raceway: Plastic channel with fitted cover, suitable for use as surface raceway.
   1. Size: As shown on Drawings.
   2. Finish: Gray.

C. Multi-outlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles suitable for use as multi-outlet assembly.
   1. Size: As indicated on Drawings.
   2. Receptacles: Provide covers and accessories to accept convenience receptacles specified in Section 26 27 26(16140).
   3. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard

accessories.

4. Receptacle Color: Brown.

5. Channel Finish: Gray enamel.
6. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes and connectors.

D. Wireway: General purpose type wireway.
1. Manufacturer's standard knockouts.
2. Size: As shown on Drawings.
3. Connector: Slip-in.
4. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
5. Finish: Rust inhibiting primer coating with gray enamel finish.

E. Wall Duct: Sheet metal wall duct suitable for installation of X-ray cables; with surface covers and accessories as indicated.
1. Hinged cover with full gasketing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install raceways securely, in a neat and workmanlike manner, as specified in NECA 1.

C. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.

D. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

E. Wireway Supports: Provide steel channel as specified in Section 26 05 29.

F. Close ends of wireway and unused conduit openings.

G. Ground and bond raceway and wireway under provisions of Section 26 05 26.
1. Maintain grounding continuity between raceway components to provide continuous grounding path.

H. Install metal cover plates on outlets.

END OF SECTION

SECTION 26 05 37

BOXES

PART 1 PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the Contractor and Subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:

1. Basic Electrical Requirements.
2. Electrical Identification.
3. Wiring Devices: Wall plates in finished areas.

B. CAUTION: Use of this Section without including all sections and related Contract Documents may result in the omission of basic requirements.

C. In the event of conflict regarding requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006 or latest adopted edition.

B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007 or latest adopted edition.

C. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2003 or latest adopted edition.

D. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2003 or latest adopted edition.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2003 or latest adopted edition.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted edition.

1.04 SUBMITTALS

A. See Section 260010 – Basic Electrical Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Appleton Electric.

B. Arc-Co./Division of Arcade Technology.

C. Unity Manufacturing.

D. Crouse Hinds

E. Substitutions: Substitutions are subject to Owner and stamping engineers approval.

2.02 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Wall Plates for Finished Areas: As specified in Section 26_27_26(16140).

2.03 FLOOR BOXES

A. Material: Cast metal.

B. Shape: Round.

C. Service Fittings: As specified in Section 26_27_26(16140).

2.04 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26_27_16(16139).

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
   1. Material: Galvanized cast iron.
   2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
   3. Cover Legend: "ELECTRIC".

E. Fiberglass Handholes: Die molded glass fiber hand holes:
   1. Cable Entrance: Pre-cut 6 x 6 inch cable entrance at center bottom of each side.
   2. Cover: Glass fiber weatherproof cover with nonskid finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION

A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

C. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

E. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

F. Maintain headroom and present neat mechanical appearance.

G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

I. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

J. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

K. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

L. Use flush mounting outlet box in finished areas.

M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

N. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

P. Use stamped steel bridges to fasten flush mounting outlet box between studs.

Q. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

R. Use adjustable steel channel fasteners for hung ceiling outlet box.

S. Do not fasten boxes to ceiling support wires.

T. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

U. Use gang box where more than one device is mounted together. Do not use sectional box.

V. Use gang box with plaster ring for single device outlets.

W. Use cast outlet box in exterior locations exposed to the weather and wet locations.

X. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

Y. Set floor boxes level.

Z. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.02 RELATED SECTIONS

A. Reference all specification sections and related Contract Documents to establish the total general requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the specifications. It is the responsibility of the contractor and subcontractor to use all of the specifications for bidding and construction work. Related specifications include but are not limited to the following:

1. Basic Electrical Requirements.

B. CAUTION: Use of this Section without including all sections and related Contract Documents may result in the omission of basic requirements.

C. In the event of conflict regarding requirements between this Section and any other section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted edition.

1.04 SUBMITTALS

A. See Section 26 00 10 – Basic Electrical Requirements for submittals procedures.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements for additional Requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation.

B. Seton Identification Products.

C. Hellermann Tyton.

D. Substitutions: Substitutions are subject to Owner and stamping engineer's approval.

2.02 NAMEPLATES AND LABELS

A. Provide nameplates, nametags and service legends to identify all electrical distribution, monitoring and control equipment.

B. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

C. Locations:
1. Each electrical distribution and control equipment enclosure.
2. Each MCC bucket, label to include description of load.
3. Each electrical load and disconnecting means, nameplate to include source of power.
4. Communication cabinet's nameplate to include source of power.

D. Letter Size:
1. Use 1/8 inch (3 mm) letters for identifying individual equipment and loads.
2. Use 1/4 inch (6 mm) letters for identifying grouped equipment and loads.

E. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background. Use only for identification of individual wall switches and receptacles and control device. Label to contain source of power and circuit identification.

2.03 WIRE MARKERS

A. Manufacturers:
1. Brady.
2. Critchley.
3. Impact Inc.
4. Substitutions: Substitutions are subject to owner and stamping engineers approval.

B. Description: Heat-shrink cover or heat-shrink tubing type.

C. Locations: Each conductor at panel board gutters, pull boxes, outlet boxes, and junction boxes each load connection.

D. Conductor-Color Tape: Colored vinyl electrical tape.

E. Legend:
1. Power and Lighting Circuits: Branch circuit as indicated on drawings.
2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

F. Conductors over 600 volts: Identification Markers / Tags:

1. Acceptable Manufacturers:
   a. EVERLAST™ or FASTTAGS™ by TECH Products.
   b. EZ Tag.

2.04 RACEWAY, JUNCTION AND PULL BOX MARKERS

A. Manufacturers:
   1. Brady.
   2. Critchley.
   3. Substitutions: Substitutions are subject to owner and stamping engineers approval.
      a. Match the rating of the label to the environment where the label will be installed. All material shall be compatible for the environment in which it is to be installed.
      b. Match the rating of the label to the type of surface that the label will be applied on.
      c. Location: Furnish markers for each conduit.
      d. Conduit and Cable Tray Color Coding Schedule: Band with appropriately colored tape all exposed conduits, including conduits above lay-in or accessible ceilings, together with associated pull and junction boxes at intervals of not over 10 feet (3 meters) and at all intersection and direction changes.
      e. Color:
   4. 208 Volt System: Blue.
   5. Fire Alarm System: Red.
   6. Telecom: yellow

2.05 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. 3M.
   2. Substitutions: Substitutions are subject to owner and stamping engineers approval.

B. Description: 4 inch (100 mm) wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment front using screws.

C. Secure nameplates to inside surface of door on panel board that is recessed in finished locations.

D. Identify conduit using with appropriately colored tape.

E. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches (75 mm) below finished grade.

END OF SECTION

SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION, SHORT CIRCUIT, ARC FLASH STUDY AND WARNING LABELS PRINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance requirements for over-current protective devices.

B. Short circuit study.

C. Coordination study and analysis.

1.02 RELATED SECTIONS

A. Section 26 24 13 - Switchboards: Over-current protective devices in switchboards.

B. Section 26 24 16 - Panel boards: Over-current protective devices in panel boards.

1.03 REFERENCES

A. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001 or latest adopted edition.

B. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997 or latest version.

C. NFPA 70 - National Electrical Code; 2008 or latest adopted edition.

D. NFPA 70E - Standard for Electrical Safety in the Workplace, 2009 or latest adopted edition.

1.04 SUBMITTALS

A. See Section 26 00 10 – Basic Electrical Requirements for submittal procedures.

B. Study Preparer's Qualifications.

C. Study Report: Submit protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.
   1. Evaluation of product data submittals by Electrical engineer will not commence until acceptable studies have been submitted.
   2. Evaluation of product data submittals by Electrical engineer will not commence until acceptable preliminary studies in sufficient detail to ensure that device selection will be adequate have been submitted.
   3. Include stamp or seal and signature of preparing engineer.

D. Product Data: In addition to submittals specified elsewhere, submit manufacturer's time-current curves for all protective devices.

E. Field Engineer Qualifications.

F. Field Inspection Report: Show final adjusted settings of protective devices.

G. Certificates: Prior to final inspection, certify that field adjustable protective devices have been set in accordance with requirements of protective device analysis.

H. Project Record Documents: Revise protective device study as required to show as-built conditions.
   1. Submit not less than 30 days prior to final inspection of electrical system.
   2. Include hard copies in operation and maintenance data submittals.
   3. Include all files prepared using Easy Power software package, on CD-ROM, with

file name cross-references to specific pieces of equipment and systems.

I. Overcurrent Protective Device Coordination, Short Circuit, Arc Flash Study and printing of Equipment Warning Labels shall be provided by Square D.

1.05 PROTECTIVE DEVICE STUDY

A. Analyze the specific electrical and utilization equipment (according to NEC definition), the actual protective devices to be used, and the actual feeder lengths to be installed.
   1. Scope of Studies: All new and existing distribution wiring and equipment, from primary source to buses and branch circuit panel boards.
   2. Scope of Studies: From and including 12kV disconnect and fuse in substation IVA to Switchboard L1 in main electrical room 133 to all downstream switchboards and panels.
   3. Primary Source, for Purposes of Studies: 12kV Substation IVA
   4. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
   5. Report: State the methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with all electrical equipment and wiring to be protected by the protective devices; identify nodes on the diagrams for reference on report that includes:
   1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the main switchboard bus and all downstream devices containing protective devices.
   2. Breaker and fuse ratings.
   3. Generator kW and voltage ratings, percent impedance, X/R ratios, and wiring connections.
   4. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
   5. Identification of each bus, with voltage.
   6. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

C. Short Circuit Study: Calculate the fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
   1. Show fault currents available at key points in the system down to a fault current of 7,000 A at 480 V and 208 V.
   2. Include motor contributions in determining the momentary and interrupting ratings of the protective devices.
   3. Primary Fault Level Assumptions: Obtain data from utility company.
   4. Primary Fault Level Assumptions at: New Switchboard L1
      a. Fault Current at 13,800 V.
      b. 3-Phase Fault: 32.4 kA, X/R of 11; 1/2 cycle symmetrical, including motor contribution and operation of all on-site generators; for calculations for devices with 1/2 cycle response; use this value as a steady-state quantity.
      c. L-G Fault: 2 kA resistance limited.
   5. Report: Include all pertinent data used in calculations and for each device include:
      a. Device identification.
      b. Operating voltage.
      c. Protective device.
      d. Device rating.
      e. Calculated short circuit current, asymmetrical and symmetrical, and ground fault current.

D. Arc flash study including printing of warning labels.

E. Coordination Study: Perform an organized time-current analysis of each protective device in series from the individual device back to the primary source, under normal conditions (0.1 sec), alternate operations, and emergency power conditions (0.02 sec).
   1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
   2. Plot the specific time-current characteristics of each protective device on log-log paper.
   3. Organize plots so that all upstream devices are clearly depicted on one sheet.
   4. Also show the following on curve plot sheets:
      a. Device identification.
      b. Voltage and current transformer ratios for curves.
      c. 3-phase and 1-phase ANSI damage curves for each transformer.
      d. No-damage, melting, and clearing curves for fuses.
      e. Cable damage curves.
      f. Transformer inrush points.
      g. Maximum short circuit cutoff point.
      h. Simple one-line diagram for the portion of the system that each curve plot illustrates.
      i. Software report for each curve plot, labeled for identification.

F. Analysis: Determine ratings and settings of protective devices to minimize damage caused by a fault and so that the protective device closest to the fault will open first.
   1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
   2. Motors with Solid-State Protective Modules: Select settings for best possible motor protection, taking into consideration actual installed motor torque and current and thermal characteristics.
   3. Identify any equipment that is underrated as specified.
   4. Identify existing protective devices that will not achieve required coordination and cannot be field adjusted to do so.
   5. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in the same frame, time curve characteristics of induction relays, CT ranges, etc.
   6. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve a change to the contract sum.
   7. In all cases where adequate protection or coordination cannot be achieved at any extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
   8. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Architect.

G. Protective Device Rating and Setting Chart: Summarize in tabular format the required characteristics for each protective device based on the analysis; include:
   1. Device identification.
   2. Relay CT ratios, tap, time dial, and instantaneous pickup.
   3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
   4. Fuse rating and type.
   5. Ground fault pickup and time delay.
   6. Input level and expected response time at two test points that are compatible with commonly available test equipment and the ratings of the protective device.

7. Highlight all devices that as furnished by Contractor will not achieve required protection.

1.06 QUALITY ASSURANCE

A. Study Preparer Qualifications: Qualified engineer of switchgear manufacturer or approved professional engineer.

B. Study Preparer Qualifications: Professional electrical engineer licensed in Oregon State in which the project is located
   1. Experienced in preparation of studies of similar type and magnitude.
   2. Familiar with the software analysis products specified.

C. Study Preparer Qualifications: Electrical company regularly engaged in short circuit and coordination studies, with at least 5 years experience in work of this type, and employing professional electrical engineer licensed in Oregon to perform the studies.
   1. Acceptable company:
      a. Schneider Electric–Square D

   2. Substitutions are subject to owner and stamping engineers approval.

D. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
   1. Acceptable Software Products:
      a. EDSA Micro Corporation: www.edsa.com.
      b. Operation Technology, Inc; ETAP: www.etap.com.
      c. SKM Systems Analysis, Inc; Power Tools for Windows: www.skm.com.
      d. ESA, Inc. Easy Power for Windows: www.easypower.com.
   2. Substitutions are subject to owner and stamping engineers approval.

E. Contractor Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.

F. Owner's Responsibility: Provide data on relevant Owner power distribution equipment.

PART 2 PRODUCTS

2.01 PROTECTIVE DEVICES

A. Provide protective devices of ratings and settings as required so that the protective device closest to the fault will open first.

B. Replace existing protective devices to achieve specified performance.

C. The specified equipment has been designed and selected to achieve the specified performance; ensure that equipment actually installed provides that performance.

D. In addition to requirements specified elsewhere, provide over-current protective devices having ratings and settings in accordance with results of this analysis.

PART 3EXECUTION

3.01 FIELD QUALITY CONTROL

A. Provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the installed protective devices to conform to Requirements determined by the coordination analysis.

B. Adjust installed protective devices having adjustable settings to conform to requirements

determined by the coordination analysis.

C. Adjust solid-state protective modules for motors prior to applying load to motor.

D. Submit report showing final adjusted settings of all protective devices.

E. Submit report showing the arc flash energy levels, rating of personal protective equipment and print warning labels.

END OF SECTION

SECTION 26 05 83 10

OEM ELECTRIC MOTORS

PART 1 GENERAL

1.01 WORK INCLUDED

A. This Section specifies the requirements for electric motors, which are provided as drivers for equipment that is normally assembled for off-the-shelf availability.

B. Related Work
   1. Section 23 05 10 - Basic Mechanical Requirements
   2. Section 26 00 10 - Basic Electrical Requirements

1.02 DESIGN CRITERIA

A. It is the intent of this Specification that the driven equipment supplier, provide his standard electric motors. When options are available from the group of standard OEM motors, the following design criteria shall apply:
   1. Motors shall be of NEMA Premium™ efficiency per NEMA MG 1.
   2. Antifriction, grease-lubricated ball bearings for horizontal motors and grease-lubricated thrust bearings for vertical motors with a L-10 life and recognize the motor is direct-coupled for 100,000 hour life.
   3. Minimum insulation class of F or better. Motor temperature rise class B at service factor load.
   4. Motor speed shall be the lowest possible.
   5. Locked rotor code shall not exceed Code L under 3 hp, Code K for 3 and 5 hp, Code H for 7 1/2 and 10 hp, and Code G for 15 hp and above.
   6. Service factor of 1.15 based on ambient temperature of 40 degrees C.
   7. Motor type B speed torque current curve per NEMA MG 1.
   8. Motors shall be able to overcome starting load inertia as well as accelerating the load to rated speed under both rated and at 10 percent reduced voltage conditions during starting without excessive heating. Motors must be able to start when driving a squared law (variable torque) load per table 12-7 of NEMA MG 1.

B. Motor enclosures and junction boxes shall be suitable for the area electrical classification listed for the driven equipment.

1.03 SUBMITTALS

A. Provide the following in addition to the standard requirements with the Bid.
   1. Horsepower rating and speed of each motor.
   2. Motor manufacturer and model.
   3. Motor efficiency and power factor.
   4. Life of bearings provided.
   5. Make and model of bearings.
   6. Enclosure type.
   7. Service factor.
   8. Insulation type and temperature rise.

1.04 QUALITY ASSURANCE, REFERENCES AND REGULATORY REQUIREMENTS

A. Electrical components and/or systems shall be listed and labeled by a nationally recognized testing laboratory (NRTL) such as: UL, ETL, CSA, or FM; shall be labeled and/or listed as part of a UL-labeled assembly, or shall be evaluated by a third party acceptable to the authority having jurisdiction (AHJ) as suitable for the use intended. All labels shall be applied at the manufacturer's factory or facility prior to shipment.

B. Equipment must meet all applicable codes and requirements. Where conflicting

Requirements occur between other required codes or Standards, the more stringent Requirements shall apply.

C. Conform to the following Standards:
1. ANSI/IEEE Standard 43™-- IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery. 2000 or latest adopted edition.
2. ANSI/IEEE 112™- Test Procedures for Polyphase Induction Motors and Generators.-2004 or latest adopted edition.
3. IEEE Standard 841™- IEEE Standard for Petroleum and Chemical Industry - Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors - Up to and Including 370 kW (500 hp).-2001 or latest adopted edition.
4. NEMA MG 1- Motors and Generators.-2004 or latest adopted edition.
5. NEMA MG 2- Safety Standards and Guide for Selection, Installation, and Use of Electric Motors and Generators.-2001 or latest adopted edition.
6. NEMA MG 3-- Sound Level Prediction for Installed Rotating Electrical Machines.- latest adopted edition.
7. NEMA MG 10 - Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors.-2001 or latest adopted edition.
8. NEMA MG 11 - Energy Management Guide for Selection and Use of Single-Phase Motors; latest adopted edition.
9. UL 674-2003 (R2006) - Motors, Generators, Electric, for Use in Hazardous Locations: Class I, Groups C and D; Class II, Groups E, F, and G.- latest adopted edition.
10. UL 1004- Motors, Electric.- latest adopted edition.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. OEM manufacturer's standard supplier.

B. When alternates are available, the following are preferred manufacturers.
1. A.O. Smith (Century®, Gould, MagneTek and Universal Electric™).
2. Baldor.
3. General Electric.
4. Marathon Electric.
5. Rockwell Automation (Reliance Electric).
6. Siemens.
7. Toshiba Houston.
8. US Motors.
9. Substitutions: Substitutions are subject to owner and stamping engineers approval.

2.02 GENERAL

A. Nameplates
1. Stainless steel with permanent legible marking, containing NEMA data and guaranteed minimum efficiency at full and ¾ load.
2. Stamped with raised letters.
3. Include motor weight and variable speed drive capability.
4. Attach nameplate and wiring diagram connection plates to the motor frame with rivets or screws.

B. Screws and bolts are to be plated for added corrosion resistance. Use minimum bolt strength of grade 5 with flanged hex heads.

1. Motors Driven By PWM-Type Variable Frequency Drives

C. Motors driven by variable frequency drives shall be rated for inverter duty according to the requirements of NEMA MG 1 or the motor shall not be loaded to greater than 87 percent of the motor nameplate full load amps to allow for heat generated by the non-sinusoidal waveform of the drive.

D. Provide motor insulation system rated for 1,600 volts and 0.1 microsecond rise time.

E. Provide from factory externally mounted shaft grounding.

2.03 MOTORS DRIVEN BY NON-PWM-TYPE VARIABLE FREQUENCY DRIVES

A. Motors driven by variable frequency drives shall be rated for inverter duty according to the requirements of NEMA MG 1 or the motor shall not be loaded to greater than 87 percent of the motor nameplate full load amps to allow for heat generated by the non-sinusoidal waveform of the drive.

B. Provide motor insulation system rated for 1,600 volts and 0.1 microsecond rise time.

C. Provide from factory externally mounted shaft grounding.

2.04 MOTOR EFFICIENCY AND POWER FACTOR

A. Follow the requirements of Motor Efficiency and Power Factor Table at the end of this Section.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with the manufacturer's recommendations and NEMA MG 2.

B. Provide from factory externally mounted shaft grounding.

3.02 FIELD TESTS

A. Perform the following tests on all motors and submit "installed motor test" results prior to putting motors into service and acceptance by Owner. Provide all test equipment with certified calibration label to perform the tests.
   1. Measurement of no-load and full-load current (each phase).
   2. Motor circuit analyzer test.
   3. Inspection of bearings and lubrication.
   4. Verify proper rotational direction.
   5. All other tests specified in the equipment manufacturer's O&M manual for field test prior to startup.

Motor Efficiency and Power Factor

HP	Nominal Speed (rpm)	Minimum Rated Load Efficiency[1]	Minimum Rated Power Factor
10	3,600	90.2	90.8
	1,800	91.0	86.1
	1,200	90.2	83.0
	900	91.0	71.0
15	3,600	91.0	91.4
	1,800	92.0	85.4
	1,200	91.0	82.8
	900	91.0	72.0
20	3,600	91.7	90.6
	1,800	93.0	86.8
	1,200	91.7	84.0
	900	91.3	72.0
25	3,600	92.0	91.8
	1,800	93.5	82.7
	1,200	92.4	85.4
	900	90.1	71.0
30	3,600	92.4	88.3
	1,800	93.6	83.3
	1,200	93.0	86.0
	900	92.0	71.0
40	3,600	93.0	89.6
	1,800	94.1	82.1
	1,200	93.6	87.4
	900	92.0	71.0
50	3,600	93.0	86.3
	1,800	94.1	83.3
	1,200	93.6	87.2
	900	93.0	78.6
60	3,600	93.6	88.8
	1,800	94.5	85.6
	1,200	93.9	86.2
	900	93.0	78.4
75	3,600	94.1	90.1
	1,800	95.0	85.9

[1] Note: Efficiency numbers listed are nominal NEMA values and are not to be used as guaranteed numbers.

HP	Nominal Speed (rpm)	Minimum Rated Load Efficiency[1]	Minimum Rated Power Factor
	1,200	94.5	86.8
	900	94.0	79.5
100	3,600	94.5	90.3
	1,800	95.0	95.2
	1,200	94.5	86.1
	900	94.0	81.0
125	3,600	94.5	89.6
	1,800	95.4	86.9
	1,200	94.5	86.7
	900	95.2	82.0
150	3,600	94.5	89.5
	1,800	95.4	86.4
	1,200	95.0	85.4
	900	95.0	80.0
200	3,600	95.0	90.4
	1,800	95.0	88.2
	1200	95.0	84.6
	900	95.2	82.2

END OF SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Commissioning activities required for work of Division 26 Sections including but not limited to construction checks, equipment start-up, functional testing, and operator training.
   1. Comply with Section 01 91 13 – General Commissioning Requirements for Commissioning activities for Division 26 work.

1.02 SEQUENCING

A. Provide written notification to Commissioning Authority (CA) in advance of significant project dates including but not limited to the following:
   1. Two weeks prior to Manufacturer's start-up of uninterruptible power supply.
   2. Two weeks prior to Manufacturer's start-up of power distribution units.
   3. Two weeks prior to Manufacturer's start-up of power monitoring system.
   4. Two weeks prior to Manufacturer's start-up of emergency power off (EPO) system.

1.03 SUBMITTALS

A. Provide submittals of systems being commissioned to Owner's Authorized Representative as required by Section 01 91 13 COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's representative to perform construction checks and operational training as specified in Division 26 including the following systems:
   1. Uninterruptible power supply
   2. Power distribution units
   3. Power monitoring system
   4. Emergency power off system

3.02 CONSTRUCTION CHECKLISTS

A. Contractor shall perform as required by Section 01 91 13. Construction checklists for each system being commissioned will be prepared by Commissioning Authority during construction.
   1. Perform voltage and amperage measurements for mechanical equipment as required in Section 22 08 00 and 23 08 00.

3.03 FUNCTIONAL TESTING

A. Contractor shall perform testing as directed by Commissioning Authority and as required by Section 01 91 13. Functional Test Plans for each system being commissioned will be prepared by Commissioning Authority during construction. Provide an allowance of on-site labor hours per trade for assisting Commissioning Authority with Functional Testing as listed below. Labor required for retesting due to failure of equipment or systems to perform in accordance with Contract Documents shall be provided at no additional cost to Owner.

B. Perform standby and emergency power system pre-test prior to functional testing. Coordinate pre-test with Division 23. Provide pre-test documentation to Commissioning Authority prior to functional testing.

C. Assist Commissioning Agent with data center cooling system capacity tests functional testing.
   1. Contractor shall provide temporary electric load banks to simulate data processing equipment heat production to facilitate testing. Load banks shall be rack mounted type and compatible with racks.

3.04 OPERATIONS AND MAINTENANCE TRAINING

A. Provide operation and maintenance instruction to Owner's personnel as required by Division 01 and 26.

3.05 SCHEDULE OF SYSTEMS BEING COMMISSIONED

A. Commission systems and equipment listed below including associated equipment and control systems.
   1. Secondary Power Distribution
   2. Uninterruptible power supply system
   3. Power distribution units
   4. Power monitoring system
   5. Emergency power off system

END OF SECTION

SECTION 26 09 14

ELECTRICAL POWER MONITORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Instrument transformers.

B. Meters and meter switches and relays.

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the contractor and subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:

1. Basic Electrical Requirements
2. Switchboards: Switchboard metering.
3. Electricity Metering: Electrical metering equipment.

B. CAUTION: Use of this Section without including all sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding Requirements between this Section and any other section, the provisions of this Section shall govern.

1.03 REFERENCES

A. ANSI C12.1 - American National Standard Code for Electricity Metering; 2001 or latest adopted edition.

B. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988 or latest adopted edition.

C. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Institute of Electrical and Electronic Engineers; 1993 (R 2003) or latest adopted edition.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted edition.

1.04 SUBMITTALS

A. Product Data: Provide electrical ratings, adjustment ranges, enclosure type, outline dimensions, mounting dimensions, and terminal connection information for each type of product indicated.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
1. Attach copies of approved Product Data submittals for products (such as switchboards and switchgear) that describe power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.

1.05 QUALITY ASSURANCE

A. Conform to Requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 METERING TRANSFER SWITCHES

A. Manufacturers:
   1. Square D
   2. ASCO
   3. GE Industrial
   4. Allen-Bradley/Rockwell Automation
   5. Substitutions: Substitutions are subject to Owner and engineer's approval.

B. Ammeter Transfer Switch: Rotary multistage snap-action type with 600 volt AC-DC silver plated contacts, engraved escutcheon plate, pistol grip handle, and four positions including OFF.

C. Voltmeter Transfer Switch: Rotary multistage snap action type with 600 volt AC-DC silver plated contacts, engraved escutcheon plate, pistol grip handle, and four positions including OFF.

2.02 POWER METERS

A. Manufacturers:
   1. Square D
   2. Substitutions: No substitutions are acceptable as the new equipment must be compatible and work with existing Square D equipment.
   3. Power meter shall be Square D, PM-870 RD

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with NECA 1.

C. Grounding: Comply with IEEE 1100, 'Power and Grounding Sensitive Electronic Equipment'.

D. All CT's for metering and power monitoring to have shorting blocks to allow for the removal of meter or power monitor for replacement.

E. All PT's for metering and power monitoring to have switch blocks to allow for the removal of meter or power monitor for replacement.

END OF SECTION

SECTION 26 09 16

ELECTRIC CONTROLS AND RELAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pushbutton and selector switches.

B. Control stations and panels.

C. Relays and time-delay relays.

D. Control power transformers.

1.02 RELATED REQUIREMENTS

A. Section 26 27 16 - Electrical Cabinets and Enclosures: Cabinets and Terminal Blocks.

B. Section 26 33 53 - Static Uninterruptible Power Supply

1.03 REFERENCE STANDARDS

A. NEMA ICS 1 - Industrial Control and Systems: General Requirements; National Electrical Manufacturers Association; 2005 or latest approved edition.

B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005) or latest approved edition.

C. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006) or latest approved edition.

D. NEMA ST 1 - Specialty Transformers (Except General Purpose Type); National Electrical Manufacturers Association; 1988 (R1997) or latest approved edition.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest approved edition.

1.04 SUBMITTALS

A. Shop Drawings: Submit to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.

B. Product Data: Provide for each component showing electrical characteristics and connection Requirements.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience, and with service facilities within 100 miles of Project.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

PART 2PRODUCTS

2.01 MANUFACTURERS

A. Siemens

B. Square D

C. Eaton

D. General Electric

E. Substitutions: Substitutions are subject to Owner and stamping engineer's approval.

2.02 COMPONENTS

A. Control Switches and Stations:
   1. Contacts: NEMA ICS 2, Form Z.
   2. Contact Ratings: NEMA ICS 2, A150.
   3. Selector Switch Operators: Two position rotary selector switch.
   4. Pushbutton Operator: Unguarded type.
   5. Control Stations: Standard duty oiltight type pushbutton station.

B. Magnetic Control Relays: NEMA ICS 2, Class A300.
   1. Contacts: NEMA ICS 2, Form Z.
   2. Contact Ratings: NEMA ICS 2, Class A150.
   3. Coil Voltage: 120 volts, 60 Hz, AC.

C. Solid-State Relays: NEMA ICS 2.
   1. Contacts: NEMA ICS 2, Form Z.
   2. Contact Ratings: NEMA ICS 2, Class A150.
   3. Coil Voltage: 120 volts, 60 Hz, AC.

D. Time-Delay Relays: NEMA ICS 2, Class A600, pneumatic time-delay relay with (TBD) second time delay after energization.
   1. Contacts: NEMA ICS 2, Form Z.
   2. Contact Ratings: NEMA ICS 2, Class A150.
   3. Coil Voltage: 120 volts, 60 Hz, AC.

E. Interval Timing Relays: NEMA ICS 2, Class A300, repeat cycle timer.
   1. Contacts: NEMA ICS 2, Form Z.
   2. Contact Ratings: NEMA ICS 2, Class A150.
   3. Coil Voltage: 120 volts, 60 Hz, AC.

F. Clock Timers: NEMA ICS 2, Class A300, 24 hour timer.
   1. Astronomical dial.
   2. Contacts: NEMA ICS 2, Form Z.
   3. Contact Ratings: NEMA ICS 2, Class A150.
   4. Coil Voltage: 120 volts, 60 Hz, AC.

G. Control Power Transformers: NEMA ST 1, machine tool transformer with isolated secondary winding.
   1. Power Rating: 100 VA or 150 VA.
   2. Voltage Rating: 208 volts primary; 120 volts secondary.

2.03 ENCLOSURES

A. Control Station Enclosures: NEMA ICS 6; Type 1.

B. Relay Enclosures: NEMA ICS 6; Type 1.

C. Fabrication: Shop fabricate control panels to NEMA ICS 1, using cabinets and terminal blocks furnished under the provisions of Section 26 27 16 (16139).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install individual relays and time-delay relays in enclosures.

C. Install cabinets under the provisions of Section 26 27 16.

D. Make electrical wiring interconnections as indicated.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Switchboards.

B. Switchboard accessories.

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the contractor and subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:
   1. Basic Electrical Requirements.
   2. Grounding and Bonding.

B. CAUTION: Use of this Section without including all sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 REFERENCES

A. UL-891

B. ANSI C12.1 - American National Standard Code for Electricity Metering; 2001or latest adopted version.

C. ANSI C39.1 - American National Standard Requirements for Electrical Analog Indicating Instruments; 1981 (R1992) or latest adopted version.

D. IEC 60051-1 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 1: Definitions and General Requirements Common To All Parts; International Electrotechnical Commission; 1997 or latest adopted version.

E. IEC 60051-2 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 2: Special Requirements for Ammeters and Voltmeters International Electrotechnical Commission; 1984 or latest adopted version.

F. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988 or latest adopted version.

G. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Institute of Electrical and Electronic Engineers; 1993 (R 2003) or latest adopted version.

H. NECA 400 - Standard for Installing and Maintaining Switchboards (ANSI); National Electrical Contractors Association; 2007 latest adopted version.

I. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006) or latest adopted version.

J. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2006 or latest adopted version.

K. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007 or latest adopted version.

L. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007 or latest adopted version.

M. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted version.

1.04 SUBMITTALS

A. See Section 26 00 10 Basic Electrical Requirements for submittal procedures.

B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of over-current protection components.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and Requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.

D. Test Reports: Indicate results of factory production tests.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual locations of switchboards.

G. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Conform to Requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum thirty years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver in 48 inch (219 mm) maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.07 MAINTENANCE MATERIALS

A. Furnish two of each key.

PART 2PRODUCTS

2.01 MANUFACTURERS

A. Square D.

B. No substitutions.

2.02 SWITCHBOARDS

A. Description
   1. NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified. Suitable for use as service entrance, 2 incoming circuit breakers with 3 CT's power meter PM-870RD in Auto Throw-over system configuration: Standard Main-Generator, Modbus TCP-Ethernet UL 1008 listed, 100 Base T copper Hub System with the following delays and features:Transition-2 sec
   2. Source loss-3 sec
   3. Utility stabilization-10 sec
   4. Generator stabilization-10 sec
   5. Generator cool down-15 sec
   6. Generator exercise duration: 30 min
   7. Generator exercise with load switch
   8. Transition type: Open
   9. Touch screen HMI
   10. Surge protection with surge rating 120kA, includes surge counter
   11. Ethernet communication card
   12. Padlock attachment
   13. Shunt trip without communication-120VAC
   14. Spring charging motor: 120VAC
   15. Shunt close without communication

B. Ratings:
   1. As indicated on Drawings.

C. Main Section Devices: 100% rated, Fixed mounted circuit breaker, Ammeter trip unit, LSIG, Modbus communication wired, auxiliary switches mounted.

D. Distribution Section Devices: Group mounted, 80% rated, thermal magnetic breakers, electronic trip LSI functions.100kAIC

E. Bus Material: Silver or tin-plated copper

F. Bus Connections: Bolted, accessible from front only. Provide complete bus, device supports, mounting, and connection for all distribution devices shown as provision for future devices. All distribution device line and load connection straps shall be rated to carry the full continuous current rating of the device frame (not trip rating). Full height busing shall be provided unless indicated otherwise on plans.

G. Fully insulate load side bus bars in rear accessible compartments. Do not reduce spacing of insulated bus.

H. Ground Bus: Extend length of switchboard.

I. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.

J. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

K. Pull Box: Removable top and sides, same construction as switchboard.
   1. Set front back sufficient distance to accommodate circuit breaker lifting devices.
   2. Provide insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.

L. Enclosure: Type 1 - General Purpose (unless noted otherwise on plans)
   1. Align sections at front and rear.
   2. Switchboard Height: 92 inches (2.37 meters), excluding floor sills, lifting members and pull boxes.
   3. Switchboard weight: approx. 3404 lbs
   4. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
   5. Mimic Bus: Show bussing, connections and devices in single line form on the front panels of the switchboard.
      a. Use blue factory painting.
      b. Use plastic strips.
      c. Fasten strips flat against the panel face with screws or rivets.

M. Provide thermostatically controlled electric heaters in each section, sized to prevent condensation under expected weather conditions at project site.
   1. Provide terminals for separate connection of heater power circuit.
   2. Voltage Rating: 120 volts.

2.03 POWER METERS

A. Watt-Hour Meters and Wattmeters: ANSI C12.1, three phase induction type with two stators, each with current and potential coil, rated 5 amperes and 120 volts at 60 Hertz.
   1. Meter suitable for connection to 3- and 4-wire circuits.
   2. Potential indicating lamps.
   3. Adjustments for light and full load, phase balance, and power factor.
   4. Four dial clock register.
   5. Integral demand indicator.
   6. Ratchets to prevent reverse rotation.
   7. Removable meter with draw-out test plug.
   8. Semi-flush mounted case with matching cover.

B. Impulse-Totalizing Demand Meter: ANSI C12.1, suitable for use with switchboard watt-hour meter.
   1. Two circuit totalizing relay.
   2. Cyclometer.
   3. Four dial.
   4. Positive chart drive mechanism.
   5. Capillary pen holding minimum one-month ink supply.
   6. Roll chart with minimum 31 day capacity.
   7. Indicate and record five minute integrated demand of the totalized system.

C. Provide meters with appropriate multiplier tags.

2.04 METERING TRANSFORMERS

A. Current Transformers: IEEE C57.13, 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

2.05 SOURCE QUALITY CONTROL

A. Shop inspect and test switchboard according to NEMA PB 2.

B. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify

Owner at least 7 days before inspections and tests are scheduled so that arrangements can be made if desired.

PART 3 EXECUTION

3.01 PREPARATION

A. Provide concrete housekeeping pad under the provisions of Section 03 30 00.

B. Verify that field measurements are as indicated on shop Drawings.

3.02 INSTALLATION

A. Install switchboard in locations shown on Drawings, according to NEMA PB 2.1.

B. Install in a neat and workmanlike manner, as specified in NECA 400.

C. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

3.04 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections in accordance with manufacturer's instructions. Tighten accessible bus connections and mechanical fasteners after installing switchboard.

C. Adjust circuit breaker trip and time delay settings to values as instructed by Engineer.

3.05 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 24 16

PANEL BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panel boards.

B. Lighting and appliance panel boards (Branch circuit panel boards).

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the contractor and subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:
   1. Basic Electrical Requirements.
   2. Grounding and Bonding.
   3. Electrical Identification.

B. CAUTION: Use of this Section without including all Sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006, or latest adopted edition.

B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005) , or latest adopted edition.

C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006) , or latest adopted edition.

D. NEMA PB 1 - Panel boards; National Electrical Manufacturers Association; 2006, or latest adopted edition.

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panel boards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007, or latest adopted edition.

F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007, or latest adopted edition.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008, or latest adopted edition.

1.04 SUBMITTALS

A. See Section 26 00 20 Basic Electrical Requirements (01300) - for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating. Indicate circuit breaker and fusible switch characteristics, including voltage, frame size, trip rating, short-circuit rating in RMS symmetrical amperes, and standard time-current curves.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations of panel boards and record actual circuiting arrangements.

E. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Conform to Requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 MAINTENANCE MATERIALS

A. Furnish two of each panel board key.

PART 2 PRODUCTS

2.01 LIGHTING AND BRANCH PANEL BOARDS

A. Manufacturers
   1. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com..
   2. GE
   3. Square D:
   4. Siemens.
   5. Substitutions are subject to Owner and stamping engineers approval.

B. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panel board.

C. Panel board Bus: Copper, ratings as indicated. Provide copper ground bus in each panel board; provide insulated ground bus if indicated.

D. Minimum Integrated Short Circuit Rating: As indicated on Drawings.

E. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
   1. Type SWD for lighting circuits.
   2. Class A ground fault interrupter circuit breakers where scheduled.
   3. Do not use tandem circuit breakers.

F. Cabinet Box: 6 inches deep, 20 inches wide.

G. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panel boards in accordance with NEMA PB 1.1 and NECA 1.

B. Install panel boards plumb. Install recessed panel boards flush with wall finishes.

C. Height: 6 feet to top of panel board; install panel boards taller than 6 feet with bottom no more than 4 inches above floor.

D. Provide filler plates for unused spaces in panel boards.

E. Provide typed circuit directory for each branch circuit panel board. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

G. Provide spare conduits out of each recessed panel board to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 5 empty 1 inch.

H. Ground and bond panel board enclosure according to Section 26 05 26.

3.02 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, and Section 7.6 for circuit breakers.

3.03 ADJUSTING

A. Measure steady state load currents at each panel board feeder; rearrange circuits in the panel board to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 26 26 00

POWER DISTRIBUTION UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution units (PDUs).

1.02 REFERENCES

A. NEMA PB 1 – Panel boards; National Electrical Manufacturers Association; 2006 or latest adopted edition.

B. NEMA ST 20 - Dry Type Transformers for General Applications; National Electrical Manufacturers Association; 1992 (R1997) or latest adopted edition.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate cable lengths and construction, circuit arrangements and directory, control system wiring diagram, connection diagram for external wiring, and details of conduit and wiring connections and terminations.

C. Product Data: Provide electrical characteristics and connection Requirements for unit and accessories.

D. Test Reports: Indicate procedures and results.

E. Manufacturer's Installation Instructions.

F. Manufacturer's Certificate: Certify that power distribution units meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

H. Project Record Documents: Record actual locations of components and cables.

I. Operation Data: Start-up and resetting unit.

J. Maintenance Data: Instructions for cleaning methods, recommended cleaning materials, addition and modification of branch circuit arrangements, repair and parts replacement.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.05 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect products from moisture and dust by storing them in a clean, dry location remote from areas involved in construction operations. Provide additional protection in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install until building finishes are complete.

B. Maintain temperature between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C) during and after installation of units.

C. Maintain relative humidity between 0 percent and 95 percent (non-condensing) during and after installation of units.

1.08 MAINTENANCE SERVICE

A. Furnish service and maintenance of power distribution units for one year from Date of Substantial Completion.

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Furnish 1 extra control circuit fuse.

C. Furnish 1 extra cable and connector of each size and type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Myers Power Products, Inc.

B. Liebert Corporation.

C. Powervar, Inc.

D. Substitutions: Substitutions are subject to owner and stamping engineers approval.

2.02 POWER DISTRIBUTION UNITS

A. Power Distribution Unit: For data processing equipment, suitable for under floor cable connection, providing surge protection, harmonic filters, isolation transformer, voltage regulation, and branch circuit over-current protective devices.

B. Service Conditions:
   1. Temperature: 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
   2. Humidity: Less than 95 percent humidity (non-condensing).
   3. Altitude: Less than 3,300 feet (1,000 meters) above sea level.

C. Ratings:
   1. System Continuous Rating: As indicated on Drawings.
   2. Input Voltage Rating: 120/208 volts, 1 phase.
   3. Output Voltage Rating: 120/208 volts, 1 phase.
   4. Impedance: 3 percent, maximum.
   5. Input Voltage Limits: plus 10, minus 20 percent.
   6. Frequency: 60 plus or minus 3 Hz.
   7. Load Power Factor: Capable of operating between 60 percent lagging and 60 percent leading power factor.

8. Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.
9. Output Voltage Regulation: plus 6, minus 8 percent.
10. Output Harmonic Distortion: Maximum 2 percent rms total harmonic distortion.
11. Three-phase Overload Ratings:
    a. 500 percent for 1 cycle.
    b. 100 percent for 10 seconds.
12. Response Time: 100 percent correction in 1 cycles.
13. Audible Noise: Less than 52 dBA at distance of 3 feet (1 m) in non-reverberating environment.
14. Efficiency: 90 percent minimum over operating range.
15. Normal Mode Attenuation: 32 dB, 10 Hz. to 1 MHz.
16. Common Mode Attenuation: 126 dB.

D. Isolation Transformer: NEMA ST 20, factory-assembled, air cooled dry type shielded isolation transformer, ratings to match unit ratings specified.
1. Insulation System: Class 220C, with 150 degree C average winding temperature rise.
2. Winding Taps: NEMA ST 20.
3. Sound Levels: NEMA ST 20.
4. Basic Impulse Level: 10 kilo volts.
5. Ground core and coil assembly to enclosure using a visible flexible copper grounding strap.
6. Provide electrostatic winding shield with separate insulated grounding connection.
7. Coil Conductors: Continuous windings with terminations brazed or welded.
8. Isolate core and coil from enclosure using vibration-absorbing mounts.

E. Branch Circuit Panel board: NEMA PB 1, circuit breaker type, with bus ratings to match unit capacity specified. Provide copper ground bus and double capacity neutral bus.

F. Molded Case Circuit Breakers: Plug-in type thermal magnetic trip circuit breakers, with common trip handle for all poles; UL listed.

G. Enclosure: Allow access from front for servicing adjustments and connections, with access through hinged door equipped with tumbler lock and latch handle.
1. Cooling: Forced convection.
2. Equip air inlet with permanent filters and pressurize cabinet to prevent entry of dirt.
3. Equip cabinet for fork truck lifting.
4. Provide cabinet grounding lug.
5. Identify internal wiring at each end of conductor.
6. Electroplate brackets and securing hardware with corrosion resistant material. Secure bolts, studs and nuts with lock washers.
7. Cabinet Finish: Manufacturer's standard finish.
8. Cabinet Finish: Primed and painted inside and outside with gray semi-gloss enamel.

2.03 CONTROLS AND INDICATORS

A. Controls: AC input circuit breaker; INDICATOR TEST switch.

B. Indicators: Provide audible and visual alarm indication of abnormal conditions.
1. Output Overvoltage: Higher than 6 percent above rated.
2. Output Under-voltage: Less than 13 percent below rated.
3. Transformer Over-temperature: Temperature higher than 180 degrees C.

C. Meters: Use 1 percent accuracy meters.
1. Voltage: Input and output, phase-phase and phase-neutral.
2. Current: Input and output, each phase; output neutral current; ground current.
3. Apparent Power: Output kVA.

2.04 ACCESSORIES

A. Power Supply Junction Box: Watertight box, with terminal blocks for connection of incoming power feeder circuit, and connector for input cable.

B. Input Cable: 12 feet (4 m) length, cable made up of building wire in liquid-tight flexible metal conduit.

C. Control Circuit Junction Box: Watertight box, with terminal blocks for connection of control and interlock circuits, and connector for cable to unit.

D. Control Cable: 12 feet (4 m) length, cable made up of building wire in liquid-tight flexible metal conduit.

E. Output Cables: Fabricate output cables using copper building wire and liquid-tight flexible metal conduit.

F. Remote Emergency Power Off Switches: Switch assembly with normally open contact mounted in painted wall box. Provide three conductor cables for connection to unit.

G. Transient Suppression Plate: Copper, 3 feet (1 m) square.

2.05 SOURCE QUALITY CONTROL

A. Provide inspection and testing for completed power distribution units.

B. Make completed power distribution units available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 FIELD QUALITY CONTROL

A. Measure output voltage of branch circuit panel board.

B. Inspect installation to assure units are properly grounded.

3.04 ADJUSTING

A. Adjust settings in accordance with manufacturer's instructions.

3.05 DEMONSTRATION

A. Demonstrate operation of unit.

END OF SECTION

SECTION 26 27 16

CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hinged cover enclosures.

B. Cabinets.

C. Terminal blocks.

D. Accessories.

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the Contractor and Subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:
   1. Section 26 00 10 - Basic Electrical Requirements.
   2. Section 26 05 53 - Electrical Identification.
   3. Section 26 05 29 - Hangers and Supports.

B. CAUTION: Use of this Section without including all sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006 or latest adopted version.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2003 or latest adopted version.

C. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks; National Electrical Manufacturers Association; 2005 or latest adopted version.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted version.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard data for enclosures and cabinets.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to Requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 MAINTENANCE MATERIALS

A. Furnish two of each key.

PART 2 PRODUCTS

2.01 ENCLOSURE MANUFACTURERS

A. Cooper B-Line

B. Qube Corporation

C. Robroy Industries

D. Circle AW.

E. Hoffman.

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 HINGED COVER ENCLOSURES

A. Construction: NEMA 250, Type 1 steel enclosure.

B. Covers: Continuous hinge, held closed by flush latch operable by screwdriver.

C. Provide interior back panel for mounting terminal blocks and electrical components; finish with white enamel.

D. Enclosure Finish: Manufacturer's standard enamel.

2.03 CABINETS

A. Boxes: Galvanized steel.

B. Box Size: As Indicated in plans.

C. Backboard: Provide back panel for mounting terminal blocks.

D. Fronts: As Indicated in Plans.

E. Knockouts: As Indicated in plans

F. Provide metal barriers to form separate compartments wiring of different systems and voltages.

G. Provide accessory feet for free-standing equipment.

2.04 TERMINAL BLOCKS

A. Manufacturers: Shall be the same as the enclosure manufacturer.

B. Terminal Blocks: NEMA ICS 4.

C. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

D. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

E. Provide ground bus terminal block, with each connector bonded to enclosure.

2.05 ACCESSORIES

A. Plastic Raceway: Plastic channel with hinged or snap-on cover.
   1. Product: Panduit

B. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 26 05 29.

C. Install cabinet fronts plumb.

D. Penetrate cabinets from sides of bottom; do not enter from top unless indicated on prints.

3.02 CLEANING

A. Clean electrical parts to remove conductive and harmful materials.

B. Remove dirt and debris from enclosure.

C. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Receptacles.

B. Device plates

1.02 RELATED SECTIONS

A. Reference all Specification sections and related Contract Documents to establish the total general requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the Contractor and Subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:
   1. Basic Electrical Requirements.
   2. Electrical Identification.
   3. Boxes.

B. CAUTION: Use of this Section without including all Sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding requirements between this Section and any other section, the provisions of this Section shall govern.

1.03 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006 or latest adopted version.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005) or latest adopted version.

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 or latest adopted version.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008 or latest adopted version.

1.04 SUBMITTALS

A. See Section 26 00 10 -Basic Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Furnish two of each style, size, and finish wall plate.

C. Provide two protective rings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Leviton Manufacturing, Inc

B. Hubbell.

C. Bryant.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WALL SWITCHES

A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: Ivory plastic with toggle handle.
   2. Indicator Light: Lighted handle type switch; red handle.
   3. Locator Light: Lighted handle type switch; red color handle.
   4. Ratings:
   5. Match branch circuit and load characteristics
      a. 120 volts, AC, 20 amps.
      b. 277 volts, AC. 20 amps.

B. Weatherproof: switches as specified mounted in a cast metal box with gasketed, weatherproof device plate as specified.

2.03 WALL DIMMERS

A. Wall Dimmers: Semiconductor dimmer for incandescent lamps, Type as indicated on drawings, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: Ivory plastic with rotary knob.
   2. Voltage: 120 volts.
   3. Power Rating: Match load shown on drawings; 600 watts minimum.
   4. Power Rating: As indicated in plans.

B. Accessory Wall Switches: Match dimmer appearance.

2.04 RECEPTACLES

A. Receptacles: Heavy duty, complying with NEMA WD 6 and WD 1.
   1. Device Body: Ivory plastic.
   2. Receptacles on stand-by power shall be red.
   3. Configuration: NEMA WD 6, type as specified and indicated.

B. All 4-plex receptacles installed shall be by the same manufacturer and have identical appearance characteristics, unless noted otherwise.

C. General Purpose Receptacle
   1. Industrial specification grade, nylon base, back and side wire, 20A, 125V or as otherwise shown on Drawings.
   2. Straight or locking blade receptacles as shown on the Drawings, industrial specification grade.
   3. Convenience Receptacle Configuration: NEMA WD 1; Type 5-20R.

D. Single Receptacles: Type, voltage amps and colors as indicated on the Drawings.

2.05 TELEPHONE JACKS

A. Product: Empty outlet boxes and cover plates conforming to the Requirements of the telephone system vendor.

B. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that outlet boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that floor boxes are adjusted properly.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

E. Verify that openings in access floor are in proper locations.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.

E. Do not share neutral conductor.

F. Install receptacles with grounding pole on top.

G. Connect wiring device grounding terminal to outlet box with bonding jumper.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping conductor around screw terminal.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install protective rings on active flush cover service fittings.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 37(16138) to obtain mounting heights specified.

B. Install wall switch 48 inches (1.2 m) above finished floor.

C. Install convenience receptacle 18 inches (450 mm) above finished floor.

D. Install convenience receptacle 6 inches (150 mm) above counter.

E. Install dimmer 48 inches (1.2 m) above finished floor.

F. Install telephone jack 18 inches (450 mm) above finished floor.

G. Install telephone jack for side-reach wall telephone to position top of telephone at 54 inches (1.4 m) above finished floor.

H. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches (1.2 m) above finished floor.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Basic Electrical Requirements

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify that each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

1. Test all ground fault interrupter (GFI) devices individually per the manufacturer's recommendations and Requirements.

G. Verify that each telephone jack is properly connected and circuit is operational.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 33 53

STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 GENERAL

1.01 SUMMARY

A. This Specification describes a three-phase continuous duty, on-line, double conversion, solid-state uninterruptible power system, hereafter referred to as the UPS. The UPS shall operate in conjunction with the building electrical system to provide power conditioning, back-up and distribution for critical electrical loads. The UPS shall consist of: the UPS module, battery cabinet(s), maintenance bypass cabinet and critical power distribution panels. Other features shall be as described in this Specification.

1.02 RELATED SECTIONS

A. Reference all Specification Sections and related Contract Documents to establish the total general Requirements for electrical materials and methods. Refer to the Table of Contents for the project to ensure that you have been provided all of the Specifications. It is the responsibility of the Contractor and Subcontractor to use all of the Specifications for bidding and construction work. Related Specifications include but are not limited to the following:
   1. Basic Electrical Requirements.
   2. Electrical Identification.

B. CAUTION: Use of this Section without including all Sections and related Contract Documents may result in the omission of basic Requirements.

C. In the event of conflict regarding Requirements between this Section and any other Section, the provisions of this Section shall govern.

1.03 UPS SYSTEM DESCRIPTION

A. The UPS system shall consist of the following main components:
   1. UPS module containing a Rectifier, Inverter, Battery Charger, Static Bypass, and associated Control and Monitor Panel.
   2. Battery string(s) in Line-and-Match Battery Cabinets.
   3. Non-matching wall mounted maintenance bypass cabinet, and distribution panels.

B. The UPS Module shall operate as an on-line, fully automatic system in the following modes:
   1. Normal
      a. Utilizing commercial AC power input, the critical load shall be continuously supplied by the Inverter.
      b. The Inverter shall power the load while regulating both voltage and frequency.
      c. The Rectifier shall derive power from the commercial AC source and shall supply DC power to the Inverter.
      d. Simultaneously, the Battery Charger shall charge the battery.
   2. Battery Power
      e. Upon failure of the commercial AC power, the critical load shall continue to be supplied by the Inverter, which shall obtain power from the batteries without any operator intervention.

f. There shall be no interruption to the critical load upon failure or restoration of the commercial AC source.

3. Recharge
   a. Upon restoration of the AC source, the Charger shall resume recharging the batteries and simultaneously the Rectifier shall provide power to the Inverter. This shall be an automatic function and shall cause no interruption to the critical load.
4. Bypass
   a. If the UPS module must be taken out of the Normal mode due to overload, load fault, or internal failures, the static bypass switch shall automatically transfer the critical load to the commercial AC power.
   b. Return from Bypass mode to Normal mode of operation shall be automatic.
   c. No-break transfer to and from Bypass mode shall be capable of being initiated manually from the front panel.
5. Energy Saver
   a. The UPS shall continuously monitor the voltage and frequency of the bypass source.
   b. When the source parameters are within acceptable limits, the UPS will utilize a minimal/optimal combination of its internal subsystems to ensure acceptable power is always delivered to the critical load, at a system efficiency of 99% or greater, over the range of 10% to 100% load.
   c. The Energy Saver System shall be enabled by the user, and shall be adjustable. It shall incorporate a “High Alert Mode” to automatically (without user intervention) provide maximum power conditioning any time bypass source variation levels exceed preset, adjustable limits.
   d. When Energy Saver System is utilized, the UPS must attenuate ANSI C62.41-type line transients to within IEC and ITIC limits.
   e. The Energy Saver System shall be able to distinguish between upstream (utility) faults and downstream (load) faults, and react appropriately to protect and support the critical load, without interruption.

1.04 REFERENCES

A. UL 1778 (Underwriters Laboratories) – Standard for Uninterruptible Power Supply Equipment. Product safety Requirements for the United States.

B. CSA C22.2 No 107.1(Canadian Standards Association) – Commercial and Industrial Power Supplies. Product safety Requirements for Canada.

C. NEMA PE-1 – (National Electrical Manufacturers Association) – Uninterruptible Power Systems standard.

D. IEC 62040-1-1 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 1-1: General and safety Requirements for UPS used in operator access areas.

E. IEC 62040-1-2 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 1-2: General and safety Requirements for UPS used in restricted access locations.

F. IEC 62040-3 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test Requirements.

G. IEEE 587 (ANSI C62.41) Category A & B (International Electrical and Electronics Engineers) – Recommended practices on surge voltages in low voltage power circuits.

H. CISPR 22: FCC Rules and Regulations 47, Part 15, Class A (Federal Communications Commission) – Radio Frequency Devices (prior to Feb 16, 2006).

I. MIL-HDBK-217E (Military Handbook) – Reliability prediction of electronics equipment

1.05 SUBMITTALS

A. The UPS shall be supplied with sufficient documentation. One copy of the installation and operation manual shall be furnished. It shall possess sufficient detail and clarity to enable the owner's technicians or representatives to install and operate the UPS equipment and accessories. The manual shall include the following major items:
   1. UPS description
   2. UPS site planning and unpacking
   3. UPS installation
   4. Optional accessory installation
   5. UPS theory of operation
   6. Operating procedures
   7. System events
   8. UPS maintenance
   9. Performance and technical Specifications
   10. Wiring Requirements and recommendations
   11. Physical features and Requirements
   12. Cabinet dimensions

1.06 QUALIFICATIONS

A. The UPS manufacturer shall have a minimum of forty years experience in the design, manufacture and testing of solid-state UPS systems. A list of installed UPS systems of the same type as the manufacturer proposes to furnish for this application shall be supplied upon request.

B. The UPS manufacturer shall have ISO 9001 certification for engineering/R&D, manufacturing facilities and service organization.

C. The UPS manufacturer shall maintain a staffed 7x24x365 call center for technical and emergency support.

D. Field Engineering Support
   1. The UPS manufacturer shall directly employ a nationwide field service department staffed by factory-trained field service engineers dedicated to startup, maintenance, and repair of UPS equipment.
   2. The organization shall consist of local offices managed from a central location.
   3. Field engineers shall be deployed in key population areas to provide on-site emergency response within 24 hours.
   4. A map of the United States showing the location of all field service offices must be submitted with the proposal.
   5. Third-party maintenance will not be accepted.

E. Spare Parts Support
   1. Parts supplies shall be located in the field to provide 80% of all emergency needs.
   2. The factory shall serve as the central stocking facility where a dedicated supply of all parts shall be available within 24 hours.

F. Product Enhancement Program
   1. The UPS manufacturer shall make available feature upgrade service offerings to all users as they are developed.
   2. These upgrades shall be available as optional field-installable kits.

G. Maintenance Contracts
   1. A complete range of preventative and corrective maintenance contracts shall be provided and offered with the proposal.
   2. Under these contracts, the manufacturer shall maintain the user's equipment to the latest factory revisions.

1.07 ENVIRONMENTAL REQUIREMENTS

A. The UPS shall withstand any combination of the following external environmental conditions without operational degradation.
   1. Operating Temperature:
      a. 0 degrees C to + 40 degrees C (32 degrees F to 104 degrees F) without de-rating (excluding batteries).
   2. Storage Temperature:
      a. - 25 degrees C to + 60 degrees C (-13 degrees F to 140 degrees F). Prolonged storage above + 40 degrees C (104 degrees F) will cause rapid battery self-discharge.
   3. Relative Humidity (operating and storage):
      a. 95% maximum non-condensing.
   4. Elevation:
      a. Operational: 5000 ft (1500 m) maximum without de-rating.
      b. Transportation: Capable of air transport.

1.08 SAFETY

A. The UPS shall be certified by Underwriters Laboratories in accordance with UL 1778.

B. The UPS shall be certified by the Canadian Standards Association in accordance with CSA C22.2 NO.107.1-M91.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers
   1. Eaton Corporation, Powerware 9390 UPS System.
   2. Schneider Electric-APC

2.02 UPS MODULE STANDARD FEATURES

A. The UPS module shall consist of the following standard components:
   1. Rectifier/Charger
      a. Shall convert incoming AC power to regulated DC output for supplying the inverter and for charging the battery.
      b. Shall be a high-frequency PWM design, using Insulated Gate Bi-polar Transistors (IGBTs).
      c. The modular design of the UPS shall permit safe and fast removal and replacement of the rectifier/charger module.
      d. Shall be capable of drawing power from the utility with a power factor of 0.99 under nominal conditions.
      e. Shall feature protection circuitry that prevents the IGBTs from sourcing current in excess of their published ratings.

f. An option shall be provided to allow the rectifier to be capable of operating from a delta transformer output or high impedance grounded transformer (400 or 480V systems only).

B. Inverter: The inverter shall feature an IGBT pulse-width-modulation (PWM) design with high speed switching. The inverter shall also have the following features:

1. The inverter shall be capable of providing the specified quality output power while operating from any DC source voltage (rectifier or battery) within the specified DC operating range.
2. The modular design of the UPS shall permit safe and fast removal and replacement of the inverter module. Mean time to repair (MTTR) for the module shall be no more than 30 minutes in order to return UPS to normal mode.
3. The inverter shall feature protection circuitry that prevents the IGBTs from sourcing current in excess of their published ratings.

C. Static Bypass: The bypass shall serve as an alternative source of power for the critical load when an abnormal condition prevents operation in normal mode. The bypass shall consist of a fully rated, continuous duty, naturally commutated static switch for high-speed transfers. The bypass shall feature the following transfer and operational characteristics.
1. Transfers to bypass shall be automatically initiated for the following conditions:
   a. Output overload period expired.
   b. Critical bus voltage out of limits.
   c. Internal over temperature period expired.
   d. Total battery discharge.
   e. UPS failure.
2. Uninterrupted automatic re-transfer shall take place whenever the inverter is capable of assuming the critical load.
3. Uninterrupted automatic re-transfers shall be inhibited for the following conditions:
   a. When transfer to bypass is activated manually or remotely.
   b. In the event of multiple transfers/re-transfer operations the control circuitry shall limit “cycling” to three (3) operations in any ten-minute period. The fourth transfer shall lock the critical load on the bypass source.
   c. UPS failure.
4. Uninterrupted manual transfers shall be initiated from the control panel. Uninterrupted manual transfers to bypass and from bypass shall be possible with the inverter logic. During manual transfers to bypass mode, the inverter must verify proper bypass operations before transferring the critical load to the bypass.
5. All transfers to bypass shall be inhibited for the following conditions:
   a. Bypass voltage out of limits (+/- 10% of nominal)
   b. Bypass frequency out of limits (+/- 3 Hz, adjustable, factory set)
   c. Bypass out of synchronization
   d. Bypass phase rotation / installation error
6. Static transfer time: No break, complete in less than 4ms.
7. The bypass shall be manually energized using the control panel or remotely through a building alarm input.

D. Monitoring and control components: The following components shall provide monitor and control capability:
1. Control panel with status indicators.
2. Alarm and metering display.
3. Building alarm monitoring.
4. Communication ports.

E. Battery management system: The UPS shall contain a battery management system which has the following features:
   1. Battery time remaining while operating in normal mode and battery mode.
      a. Battery time available information shall be displayed real-time, even under changing load conditions.
      b. Upon commissioning, battery runtime information shall be available.

   2. Automatically test the battery string(s) to ensure that the battery is capable of providing greater that 80% of its rated capacity.
      a. Testing the batteries shall not jeopardize the operation of the critical load.
      b. Upon detection of the battery string(s) not capable of providing 80%, the UPS system will alarm that the battery needs attention/replacement.
      c. The battery test shall be able to detect open battery string, shorted battery string and battery capacity (runtime) less than 80% of "new" battery capacity
   3. The UPS shall communicate battery test and monitoring data to the UPS manufacturer's remote monitoring site. Battery life remaining, capacity, and number of on-battery events shall be provided in a monthly report.
   4. An optional temperature sensor shall be available to monitor the ambient temperature internal to the battery cabinet.
      a. If the ambient temperature increases, the UPS system charger shall automatically reduce the charging voltage to a level recommended by the battery manufacturer.
      b. If the ambient temperature is decreased the UPS shall automatically increase the battery charge voltage to that recommended by the battery manufacturer.

F. Wiring Terminals. Voltage and configurations: 208Vac 4-wire output configurations, the neutral output compression terminal shall be sized for 200% of UPS module rated current to accommodate higher neutral currents associated with non-linear loads. The UPS module shall contain mechanical compression terminals (adequately sized to accommodate 90°C wiring) for securing user wiring to the following locations:
   1. Rectifier/charger input connections (3-wire plus ground)
   2. Bypass input connections (3-wire plus ground for 3-wire plus ground output configuration (480Vac), or 4-wire plus ground for 4-wire plus ground output configuration, 208 or 400V service)
   3. DC link connections for battery cabinets (positive and negative).
   4. AC output connections (3 or 4 wires plus ground).

2.03 UPS MODULE OPTIONS AND ACCESSORIES

A. Separate Manual Maintenance Bypass Cabinet.
   1. The Manual maintenance bypass switch is used to isolate UPS module from commercial AC input and critical load.
   2. Switch shall provide complete isolation of UPS for servicing and, if necessary, complete removal and replacement of UPS while still providing bypass power to critical load.
   3. Switch shall be make-before-break, interlocked between UPS and bypass to prohibit improper operation.
   4. Provide kirk-key interlocks to insure proper sequence of operations is followed when transferring the critical loads to the manual bypass and back to the UPS.

B. Simple Network Management Protocol (SNMP) Network Adapter and UPS Power Monitoring Software: SNMP adapters shall provide a communications interface between the UPS module and SNMP-compatible network management systems. This capability shall allow the unit to be monitored remotely over an Ethernet network using a standard web browser.

C. UPS Power Monitoring Software: This system shall continuously monitor critical power elements associated with the UPS, using the communications port on each module and a

customer furnished PC. The system shall automatically alarm if any problems arise and notify local or remote personnel of the alarm condition via email, page, or text message.

D. Battery Cabinet: The battery cabinet shall feature valve regulated, high-rate discharge, lead-acid batteries which provide energy to support the critical load during a momentary loss of input power to the rectifier. The batteries shall be flame retardant in accordance with UL 94V2 Requirements. The battery cabinet shall have the following features:
   1. The battery cabinet shall be the same depth and height as the UPS module.
   2. The battery cabinet shall feature a mechanical enclosure of like appearance to the UPS module and shall feature casters. Each battery cabinet shall require front access only for installation, service and maintenance. The battery cabinet shall provide top and bottom cable entry.
   3. Power wiring internal to each battery cabinet shall be factory provided. Each battery cabinet shall feature up to 10 battery trays which can be individually disconnected from the battery cabinet power wiring with quick disconnect devices. Each battery tray shall be firmly secured to the battery cabinet frame with fasteners. Each battery tray shall be removable from the front of the battery cabinet.
   4. Each battery cabinet shall feature a DC rated circuit breaker. The circuit breaker within the battery cabinet shall only provide protection to the battery string within that battery cabinet. For battery configurations involving multiple battery cabinets, a battery string in one battery cabinet may be isolated from the DC link via its circuit breaker without removing other battery strings from the DC link and the UPS module.
   5. The circuit breaker in each battery cabinet shall feature an A/B auxiliary switch. The UPS module shall be capable of monitoring and alarming an open battery cabinet circuit breaker condition.
   6. The circuit breaker in each battery cabinet shall feature a 48VDC under voltage release device. The UV device shall operate to trip the battery breaker(s) for an emergency power off command or battery disable command.
   7. Power and Control wiring between the battery cabinet and the UPS shall be factory provided with compression type connectors between cabinets.
   8. The batteries shall be configured with a ¼" spade type connector for attaching sense leads to each jar to facilitate the future addition of a battery monitoring system.
   9. Expected battery life: 200 complete full load discharge cycles when operated and maintained within Specifications.

2.04 UNINTERRUPTIBLE POWER SUPPLY RATINGS AND OPERATING CHARACTERISTICS

A. The UPS shall have a maximum rating of 40kVA/36kW upgradable to 80kVA/72kW via system software.
   1. UPS Rating (max) is the maximum output possible from the UPS (for a load power factor range of 0.9 lagging to 0.9 leading).
   2. The UPS shall not require de-rating when supporting a leading power factor load of 0.9 or greater.
   3. The UPS may be ordered with any of the three (3) optional ratings (where available) and later upgraded to its corresponding full UPS Rating (max).

B. Rectifier/charger input
   1. Nominal three phase input voltage: 208 Vac:
      3-wire plus ground for 3-wire plus ground output configuration
   2. Operating input voltage range: +10%, -15% of average nominal input voltage without battery discharge.
   3. For 60Hz systems, operating input frequency range shall be 55 to 65Hz.
   4. Input power factor 0.99 lagging.
   5. Normal input current limit: The UPS shall have the following programmable input current

limit settings while operating in normal mode:
   a. Rectifier/charger input current limit shall be adjustable from 100 to 115% of full-load input current.
   b. Battery input current limit shall be adjustable from 10% to 15% of the UPS full load input current regardless of the actual load on the UPS.
6. On generator input current limit: The UPS shall have the following programmable input current limit settings while operating in normal mode on generator:
   a. Rectifier/charger input current limit shall be adjustable from 100% to 115% of full-load input current.
   b. Battery recharge input current limit shall be adjustable from 10% to 15% of the UPS full load input current regardless of the actual load on the UPS.
7. Input current total harmonic distortion (THD) shall be less than 4.5%.
8. Power walk-in: Ramp-up to full utility load adjustable from 3 seconds to 60 seconds.

C. Bypass input
1. Synchronizing bypass voltage range shall be +/- 10% of average nominal input voltage.
2. Synchronizing bypass frequency range is centered on the nominal frequency.
3. Bypass and rectifier inputs can be supplied from out of phase sources if required.
4. Input surge withstand capability: The UPS shall be in compliance with IEEE 587 (ANSI C62.41), category A & B (6kV).

D. Rectifier/charger output
1. Nominal DC voltage shall be variable between 384VDC to 480VDC for 208V input, and between 432VDC to 480VDC for a 400 or 480V input.
2. Steady state voltage regulation shall be +/- 0.5%.
3. Voltage ripple shall be less that 0.5% (peak-to-peak).
4. Capacity: The rectifier/charger shall support a fully loaded inverter and recharge the battery to 90% of its full capacity within 10 times the discharge when input current limit is set at maximum.
5. Low line voltage operation: The rectifier/charger shall be capable of sharing the DC load with the battery when the input voltage falls below the specified operation input voltage range, the on battery indicator shall enunciate operation in this mode.
6. DC sensing: Redundant DC voltage sensing methods shall be incorporated for providing battery over-voltage protection.
7. Battery charger characteristics: The UPS battery charging system shall have the following characteristics:
   a. The charger shall be capable of being configured for several charge modes including:
      1) A charging mode that increases battery life by allowing the battery to rest, reducing positive plate corrosion
      2) A charging mode floating the battery at a set level, which can be adjusted via software, used for flooded cell applications
         a) Nominal Float Voltage: 2.25 V per cell.
         b) Equalizing Voltage: 2.38 V maximum per cell (adjustable).
         c) Automatic (time based) or manual (user initiated) equalization available
   b. UPS module will automatically adjust battery shutdown based upon loading and battery capacity.
      1) The UPS module shall automatically adjust the final discharge voltage between 1.67 and 1.75 Volts per cell based on the existing load and the rate and length of discharge.
      2) The absolute minimum operational voltage is 1.67 V per cell (adjustable).
8. The UPS module will automatically disconnect the battery system in case of full battery discharge followed by prolonged utility AC voltage failure. The time window before battery disconnection occurs shall be programmable for both time and voltage.

E. UPS output in normal mode
   1. Nominal output voltage: 208 VAC, 3-phase, 3 wire plus ground at the output of the Bypass cabinet. Output wiring configuration is based upon input wiring configuration for systems without internal transformers.
   2. Steady-state voltage regulation (in inverter) shall be within +/- 1% average from nominal output voltage.
   3. Transient voltage response shall be < +/- 5% from nominal voltage for 100% load step, full load re-transfers and full load drop on battery.
   4. Transient voltage recovery shall be 25ms to within +/- 1% of steady state.
   5. Linear load harmonic distortion capability: Output voltage THD of less than 2% for 100% linear load.
   6. Non-linear load harmonic distortion capability: Output voltage THD of less than 5% for 100% non-linear load when tested using the non-linear load described in IEC 62040-3 connected line to neutral.
   7. Manual output voltage adjustment shall be +/- 3% from nominal.
   8. Line synchronization range shall be +/- 3Hz, adjustable to+/-0.5 Hz.
   9. Frequency regulation shall be +/- 0.01Hz free running.
   10. Frequency slew rate shall be 1 Hz/second maximum (adjustable).
   11. Phase angle control:
       a. Balanced linear load shall be +/- 1 degree from nominal 120 degrees
       b. Unbalanced linear loads shall less than +/- 5 degrees from average phase voltage for 100% load unbalance.
   12. Phase voltage control:
       a. Balanced linear loads shall be +/- 1% from average phase voltage
       b. Unbalanced linear loads shall be less than +/- 5% for 100% load unbalanced
   13. Overload current capability (with nominal line and fully charged battery): The unit shall maintain voltage regulation for up to 110% of resistive/inductive load for 10 minutes, up to 125% for 30 seconds, and up to 150% for 10 seconds.
   14. Fault clearing current capability: 150% phase-to-phase for 10 cycles; 300% phase-to-neutral for up to 10 cycles
   15. Static transfer time: No break, completed in less than 4ms.
   16. Common mode noise attenuation:
       a. -65dB up to 20kHz, -40db up to 100kHz
       b. > 100dB with isolation transformer
   17. Acoustical noise: Noise generated by the UPS under normal operation shall not exceed 65dbA at one meter from any operator surface, measured at 25 degrees C (77 degrees F) and full load.
   18. EMI Suppression: The UPS shall meet FCC rules and regulation 47, part 15, for Class A devices prior to Feb 16, 2006, CISPR .
   19. Electrostatic discharge (ESD): The UPS shall meet IEC 801-2 Specifications. The UPS shall withstand a 25 kV pulse without damage and with no disturbance or adverse effect to the critical load.
   20. Efficiency: The UPS efficiency shall be up to 94%.

F. UPS Output with Energy Saver System option
   1. The Energy Saver System acts to optimize the internal components of the UPS power train to maximize system efficiency when the bypass source is within the following (adjustable) limits: Voltage: +/-10%, and Frequency: +/-3Hz.
   2. Nominal output voltage 208 VAC, 3-phase, 3 wire plus ground at the output of the Integrated Distribution and Bypass cabinet. Output wiring configuration is based upon input wiring configuration for systems without internal transformers.
   3. Steady-state voltage regulation shall be within +/- 10% from nominal output voltage.
   4. Line synchronization range shall be +/- 3Hz, adjustable to +/- 5Hz.
   5. Frequency regulation shall be +/-3Hz when bypass source is within the limits in (1) above, and +/- 0.01Hz free running,

6. Overload current capability (with bypass source within the limits of (1) above) 1000% for 20msec, 600% for 50 ms
7. Static transfer time: No break, completed in less than 2ms, including detection time.
8. Acoustical noise: Noise generated by the UPS under normal operation shall not exceed 65dbA at one meter from any operator surface, measured at 25 degrees C (77 degrees F) and full load.
9. EMI Suppression: The UPS shall meet FCC rules and regulation 47, part 15, for Class A devices prior to Feb 16, 2006.
10. Electrostatic discharge (ESD): The UPS shall meet IEC 801-2 Specifications. The UPS shall withstand a 25 kV pulse without damage and with no disturbance or adverse effect to the critical load.
11. Efficiency: The UPS efficiency shall be greater than 99%, over the range of 10 to 100% load. (98.5% for 208V units)

2.05 UPS MECHANICAL DESIGN

A. Enclosures: The UPS shall be housed in free-standing double front enclosures (safety shields behind doors) equipped with casters and leveling feet. The enclosures shall be designed for computer room applications. Front doors shall have locks to prevent unauthorized entry.

B. Ventilation: The UPS shall be designed for forced-air cooling. Air inlets shall be on the front of the unit. Air outlets shall be on the top. Eighteen inches of clearance over the UPS outlets shall be required for proper air circulation. Air filters shall be commonly available sizes.

C. No back or side clearance or access shall be required for the system. The back and side enclosure covers shall be capable of being located directly adjacent to a wall.

D. Cable entry: Standard cable entry for the UPS cabinet shall be through either the enclosure bottom or top. A dedicated wireway shall be provided within the UPS cabinet for routing user input and output wiring.

E. Front access: All serviceable subassemblies shall be modular and capable of being replaced from the front of the UPS (front access only required). Side or rear access for installation, service, repair or maintenance of the UPS system shall not be required.

F. Service area Requirements: The 208Vac system shall require no more than thirty-six (36) inches of front service access room and shall not require side or rear access for service or installation. The 400 or Vac system shall require no more than forty-two (42) inches of front service access room and shall not require side or rear access for service or installation.

2.06 UPS CONTROLS AND INDICATORS

A. Microprocessor controlled circuitry: The UPS controls shall have the following design and operating characteristics:
   1. Fully automatic operation of the UPS shall be provided through the use of microprocessor controlled Digital Signal Processing. DSP shall eliminate variances from component tolerance or drift, and provide consistent operational responses.
   2. All operating and protection parameters shall be firmware controlled, thus eliminating a need for manual adjustments. The logic shall include system test capability to facilitate maintenance and troubleshooting. Printed circuit board replacement shall be possible without requiring calibration.
   3. Start-up and transfers shall be automatic functions.

B. Digital Front Panel Display: The UPS control panel shall be a digital front panel display that features an 8x40 (8 lines, each with 40 characters) backlit LCD display. The LCD shall display UPS status, metering, battery status, alarm/event queue, active alarms and UPS

configurations. The front panel display shall show a system mimic diagram with an outlined power path, current operating mode and event logs.

C. Control Panel Indicators: The UPS control panel shall provide the following monitoring functions with indicator LED's:
   1. NORMAL: This shall indicate that the commercial AC utility or generator source is supplying power to the rectifier and the inverter is supporting the critical load. A text message shall indicate if the bypass line is not within tolerance.
   2. BYPASS: This shall indicate that the UPS has transferred the load to the bypass circuit.
   3. BATTERY: This shall indicate that the commercial AC utility or generator source has failed and the battery is supplying power to the inverter, which is supporting the load. A text message shall indicate if the battery charge is low or if the battery is installed but disconnected.
   4. ALARM: This shall indicate that the UPS detects an alarm condition, outlined in detail in the operator's manual.

D. Control Panel Controls: The UPS control panel shall provide the following functions from front panel push buttons:
   1. EVENTS: Displays the list of Active System Events and a historical log of system events. Historical logs shall include a detailed time stamped list of the latest 128 events.
   2. METERS: Displays performance meters for the system or critical load. When selected, the front display shall show individual screens of input parameters, output parameters or bypass parameters including; voltage, current and frequency. In addition, the battery display shall show runtime remaining.
   3. CONTROLS: Displays a System Controls screen. Allows selection of operating mode, normal, bypass, charger on/off and Power Module on/off.
   4. SETUP: Allows display contrast, date and time information serial communication port configuration and display of firmware revision numbers.
   5. RETURN: Confirms selection or returns to previous screen.

E. Interface panel: The UPS shall be equipped with an interface panel, located behind a protective cover, which provides the following signals and communication features in a Class 2 environment:
   1. Alarm contact: A dry contact for annunciating a summary alarm shall be provided for customer use. This contact shall be Form "C" capable of supplying both N/O and N/C contacts. Contact ratings shall be 5A max at a voltage not to exceed 28VDC or 277VAC.
   2. RS232 (EIA / TIA-232) communications interface: Circuitry shall be provided for one RS232 (EIA / TIA-232) communication port for connection to automated service department diagnostic tools. This port may be used with simple ("dumb") terminals to gain remote access to all unit operation information.
   3. Building alarms: Two inputs shall be provided for monitoring the status of external dry contacts. Building alarms shall be set up through the UPS configuration mode function on the RS232 (EIA / TIA-232) port.
   4. External EPO contacts: Shall be provided to connect an external remote emergency power off switch to shutdown the UPS and de-energize the critical load.
   5. Battery control contacts: Contacts shall be provided to connect the battery UVR and auxiliary signals from a battery breaker or battery disconnect switch.
   6. External bypass indicator connection: A connection point shall be provided to acknowledge that an external maintenance bypass has been closed around the UPS, placing the critical load on utility power.
   7. The system shall have options to add four (4) additional building alarms, 384 logged events, 4 additional languages, Mandarin or Russian as a primary language.

3.07 COMMUNICATIONS

A. Communications Bay: The UPS shall be equipped with field configurable communications bays that will accommodate four (4) communication devices

B. Remote Monitoring:
   1. Optional WEB/SNMP communication capabilities will be available for all systems.
   2. The UPS shall be able to be monitored remotely via communications devices. UPS manufacturer shall provide optional communications devices capable of communicating via various industry standard protocols such as RS232 and ModBus. Monitoring of UPS status may also be performed through isolated dry contact Form C relays.
   3. Remote monitoring of the UPS shall also be possible through status indicators elsewhere in the same facility through a device that replicates these indicators.

C. The UPS communication capability should be able to integrate into any industry standard Building Management System (BMS) and/or Network Management System (NMS). The UPS must also be able to be monitored via any standard Internet browser (i.e. Internet Explorer and Netscape).

D. All optional hardware interfaces shall be “Hot-swappable” (UPS maintains power to critical applications while changing interfaces).

E. Shutdown:
   1. There shall be a mechanism that provides graceful, orderly, unattended, sequential shutdown of one or multiple computers powered by one UPS. This shutdown shall be performed via in-network or out-of-network means. The order of shutdown shall be user-defined, allowing the maximization of runtime on battery for more critical systems.
   2. Shutdown of AS/400 computers shall be possible through open-collector relay contacts or isolated, dry contact, Form-C relays.
   3. The UPS shall also be capable of interfacing with an operating system’s built-in shutdown routine, e.g. Windows NT. This shall be done through a cable connection to the optional serial port on the UPS.

F. Notification:
   1. There shall be a mechanism to send alerts to key personnel via email or SNMP traps. An alarm notification may also be sent by a network message.
   2. Dial-out to a computer for alarm notification may be performed. The user may respond by dialing-in to retrieve alarm history and a summary of current meter status.
   3. Management: A remote battery test may be performed via an Ethernet network. The UPS shall be tested through invoking a single command.

3.08 UPS MODULE PROTECTION

A. Rectifier/Charger and Bypass protection shall be provided through individual fusing of each phase.

B. Battery protection shall be provided by thermal-magnetic molded-case circuit breakers in each battery cabinet (if standard battery pack is provided) or external protective device for an external battery.

C. Electronic current limiting circuitry and fuses in the Inverter circuit shall provide output protection.

D. To comply with agency safety Requirements, the UPS module shall not rely upon any disconnect devices outside of the UPS module to isolate the battery cabinet from the UPS module.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate installation of network cabling for UPS monitoring with Jeff Hite 541-346-1732 jeffh@uoregon.edu .

3.02 COMMISSIONING

A. Factory start-up shall be provided on a 5x8 basis (7 x 24 optional). Start-up service shall be provided at no extra charge and shall include one visit to perform all procedures and tests specified within UPS Installation and Operation manual. UPS manufacturer shall also offer the following optional services:
   1. Pre-energize visit to inspect installation and provide guidance to installers as required.
   2. Post-start-up visit for alarm notification configuration, operator training, generator testing, etc.

B. The following procedures and tests shall be performed by Field Service personnel during the UPS startup:
   1. Visual Inspection:
      a. Visually inspect all equipment for signs of damage or foreign materials.
      b. Observe the type of ventilation, the cleanliness of the room, the use of proper signs, and any other safety related factors.
   2. Mechanical Inspection:
      a. Check all the power connections for tightness.
      b. Check all the control wiring terminations and plugs for tightness or proper seating.
   3. Electrical Pre-check:
      a. Check the DC bus for a possible short circuit.
      b. Check input and Bypass power for proper voltages and phase rotation.
      c. Check all lamp test functions.
   4. Initial UPS Startup:
      a. Verify that all the alarms are in a "go" condition.
      b. Energize the UPS module and verify the proper DC, walkup, and AC phase on.
      c. Check the DC link holding voltage, AC output voltages, and output waveforms.
      d. Check the final DC link voltage and Inverter AC output. Adjust if required.
      e. Check for the proper synchronization.
      f. Check for the voltage difference between the Inverter output and the Bypass source.
      g. Optional on site full-load, step-load, and battery discharge tests using supplier furnished load bank, shall also be offered.
   5. Operational Training: Before leaving the site, the field service engineer shall familiarize responsible personnel with the operation of the UPS. The UPS equipment shall be available for demonstration of the modes of operation.

3.03 WARRANTY

A. All components of the UPS system shall be covered by a standard one-year limited factory warranty and service protection package.

B. One-year limited factory warranty shall include replacement coverage for the UPS parts for a period of 18 months from shipment or 12 months from start-up, whichever occurs sooner.

C. One-year service protection package shall include 7x24 on-site repair/replacement labor for UPS parts and batteries; 7x24 technical support coverage; and 7x24 remote monitoring service (with monthly reports for UPS and battery performance). Standard response time shall be 8 hours from receipt of call. Manufacturer shall also offer, as an option, 7x24 on-site service support with guaranteed response times of 4, or 2 hours in certain major metropolitan areas. Additional preventive maintenance visits shall be available as an option for both UPS and battery components.

D. Manufacturer shall also include Start-up services consisting of: 5x8 Start-up service of UPS and batteries, with option for 7x24 Start-up. On-site user training, Site Audit, installation and commissioning of monitoring service, and validation of one-year limited factory warranty will be performed during the start-up.

E. Manufacturer shall also offer an optional service plan to provide 7x24 on-site coverage (preventive and corrective) for UPS and batteries, guaranteed response time, remote monitoring, Web access to service site history, annual Site Audit, UPS and battery preventive maintenance visit, and discounts on upgrade and modification kits. Manufacturer shall also provide an optional battery service plan to provide parts-and-labor coverage for partial and full battery strings, either with preventive maintenance or replacement coverage.

END OF SECTION