UNIVERSITY OF OREGON

WILLAMETTE 74 – ALEMAN LASER LAB

EUGENE, OREGON

PROJECT MANUAL

Designer:
Campus Planning Design and Construction
1295 Franklin Blvd.
University of Oregon
Eugene, Oregon 97403
Ph: (541) 346-8238 Fx: (541) 346-6927

Contact: Kevin Spahn
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May 29, 2014

Job #: CP14-043

UNIVERSITY OF OREGON

Willamette 74 – Aleman Laser Lab
University of Oregon

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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 Campus Planning Design and Construction until 2:00 PM, Pacific Time, Tuesday June 24th, 2014 ("Closing Date and Time") for the Willamette 74 – Aleman Laser Lab Renovation project located on the campus of the University of Oregon, in Eugene, Oregon ("Project"). The Project includes new interior partitions, casework and flooring, as well as mechanical, plumbing and electrical renovation to the interior laboratory space.

A mandatory **pre-bid conference** will be conducted at 2:00 PM, Pacific Time, Thursday June 12th, 2014. Bidders shall meet with Owner's Representative at the Willamette Atrium 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

Table of Contents

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

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

Project Name: Willamette 74 – Aleman Laser Lab

The following modify the Oregon University System "Instructions to Bidders, Form B-2" for this procurement. Where a portion of the Instructions to Bidders has been modified by these Supplemental Instructions to Bidders, the unaltered portions shall remain in effect.

OREGON UNIVERSITY SYSTEM

STANDARD RETAINER CONTRACT

BID FORM

OUS CAMPUS: UNIVERSITY OF OREGON

PROJECT: Willamette 74 – Aleman Laser Lab Renovation

BID CLOSING DATE: 2:00 PM, Pacific Time, Tuesday June 24th, 2014

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 work shall be completed within the time stipulated and specified in Division 1, Section 01 10 00 - Suppary, of the Specifications.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

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

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

11. 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.

12. 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 _____

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 A.1, Definition for "Overhead" is deleted and replaced with the following:

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 or General Conditions, including without limitation such Overhead expenses as wages or salary of personnel primarily at the Contractor's principle place of business, Contractor's office costs and supplies at Contractor's principal place of business, and Commercial General Liability Insurance and Automobile Liability Insurance.

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 codified 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 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 s 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 on 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 agrees 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 cope 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, or if there will be a Guaranteed Maximum Price (GMP) Amendment, then within ten (10) Days of Contractor's execution of the GMP Amendment. Contractor shall submit annual MWESB Reports on June 30 of each year the Contract is active. Contracts (or GMP Amendments) 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 controller of 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 the Owner 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 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 Stat, 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 their 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 remain 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 agrees Owner reserves the right to withhold payment to Contract 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, t 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 provision 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 project 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 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 (refer also to 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 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 held 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

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: _____

PREVAILING WAGE RATES

for

Public Works Contracts in Oregon

BOLI

OREGON BUREAU OF LABOR AND INDUSTRIES

Brad Avakian
Commissioner
Bureau of Labor and Industries

Effective: January 1, 2014
http://www.oregon.gov/boli/WHD/PWR/Pages/January_2014_Index.aspx
As Amended: April 1, 2014
http://www.oregon.gov/boli/WHD/PWR/docs/April_1_2014_Amendment.pdf

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

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Willamette 74 - Aleman Laser Lab.

B. Owner's Name: University of Oregon.

C. The project includes new interior partitions, casework and flooring, as well as mechanical, plumbing and electrical renovation to the interior laboratory space.

D. Substantial Completion for entire project be by 5:00 pm, Tuesday, September 30th, 2014.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price.

1.03 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.

B. Owner intends to occupy the Project upon Substantial Completion.

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

D. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Existing building spaces may not be used for storage.

D. Time Restrictions:
   1. Limit conduct of especially noisy interior work between the hours of 8:00 a.m. to 5:00 p.m.
   2. At contractor's discretion, work may occur off-hours, including evenings, nights and weekends.

E. The Owner will provide 2 parking hangtags. Additional parking will be the responsibility of teh Contractor.

F. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 10 days written notice to Owner.
   3. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

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

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

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

1.02 RELATED REQUIREMENTS

A. Form B-1 - NOPI Contract Opportunity (Invitation to Bid)

B. Form B-2 - Instructions to Bidders

C. Form B-5 - Bid Form

D. Form B-8 - General Conditions

E. Form B-9 - Performance Bond

1.03 SCHEDULE OF VALUES

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

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

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

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

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

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

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

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

E. Execute certification by signature of authorized officer.

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

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

H. Submit three copies of each Application for Payment.

I. Include the following with the application:

1. Transmittal letter as specified for Submittals in Section 01 30 00.
2. Construction progress schedule, revised and current as specified in Section 01 30 00.

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

K. Payroll Certificates certified by Project Manager

1.05 MODIFICATION PROCEDURES

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

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

C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
2. Promptly execute the change.

D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.

E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.
1. On request, provide following data:
   a. Quantities of products, labor, and equipment.
   b. Taxes, insurance, and bonds.
   c. Overhead and profit.
   d. Justification for any change in Contract Time.
   e. Credit for deletions from Contract, similarly documented.
2. Support each claim for additional costs with additional information:
   a. Origin and date of claim.
   b. Dates and times work was performed, and by whom.
   c. Time records and wage rates paid.
   d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

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

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

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

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

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

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

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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 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 Architect 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 Architect.
   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 Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

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

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

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, 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 copies within two days after meeting to participants, with two copies to Architect, Owner, participants, 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. Submit updated schedule with each Application for Payment.

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 Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

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

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

E. Electronic submittals are acceptable and encouraged. Provide physical samples for selection and verification where indicated in the specifications.

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. Electronic submittals are acceptable and encouraged. Provide physical samples for selection and verification where indicated in the specifications.

C. Submit for Architect'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.
   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 the number of copies that Contractor requires, plus two copies that will be retained by Architect.

B. Documents for Information: Submit two copies.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   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 a copy of approved submittal form.

B. Transmit each submittal with approved form.

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

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

E. 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.

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

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

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

I. Provide space for Contractor and Architect review stamps.

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

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

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

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Quality assurance submittals.

C. Mock-ups.

D. Control of installation.

E. Tolerances.

F. Testing and inspection services.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

E. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with building personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Security requirements.

C. Vehicular access and parking.

D. Waste removal facilities and services.

1.02 TEMPORARY UTILITIES

A. 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.

B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TEMPORARY SANITARY FACILITIES

A. Use of existing facilities located at Willamette 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 prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

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 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.06 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.

1.07 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.

1.08 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.

PART 2 PRODUCTS - 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. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 5 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

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

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

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

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

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use product meeting those standards or description after approval by the project Designer.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; 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. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. 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 Architect for review or redesign services associated with re-approval by authorities.

D. 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.

E. 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 Architect 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 manufacturers' 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 products.
   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. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

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

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

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

I. All storage shall occur within the work site. No storage is permitted at building exterior or in corridors.

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.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Closeout procedures, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures.

C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal 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.

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. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

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 from 6pm to 8am.

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. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and

conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

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

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

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

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 misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 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 Architect 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, and 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 ; 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 Architect.

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; do not burn or bury.

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

K. Comply with all other applicable requirements of this section.

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 rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. 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.

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; do not burn or bury.

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. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.08 ADJUSTING

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

3.09 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

D. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.10 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Notify Architect when work is considered ready for Substantial Completion.

C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

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

E. Notify Architect when work is considered finally complete.

F. Return keys

G. Deliver permit set, O&M manuals, as-built drawings and specifications to Owner

H. Verify receipt and documentation of certificate of occupancy

I. Complete items of work determined by Architect's final inspection.

END OF SECTION

SECTION 20 10 00

GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.01 CONTRACT CONDITIONS

A. Work of this Division is bound by the Provisions of Division 1 bound herewith, in addition to these Specifications and accompanying Drawings.

B. Work of this Division shall conform to published installation and materials standards of the University of Oregon specifically applicable to Divisions 20, 21, 22 and 23, available online at http://campusops.uoregon.edu/cc/cc-standards, which are incorporated herein by reference.

1.02 SECTION INCLUDES

A. General requirements specifically applicable to Division 20, 21, 22 and 23 sections, which apply in addition to Division 1 - General Requirements.

1.03 DRAWINGS AND SPECIFICATIONS

A. The Drawings and Specifications are complimentary, and what is called for by one shall be as binding as if called for by both.

B. Use of the word "Provide" shall be equivalent to "Furnish and Install."

C. Use of singular or plural in article, paragraph, and subparagraph headings does not indicate numbers of products required. Example: The heading "Chiller" does not necessarily mean there is only one chiller required.

D. Abbreviations:
1. ADA: Americans with Disabilities Act
2. AASHTO: American Association of State Highway and Transportation Officials
3. ASTM: American Society for Testing and Materials
4. AWWA: American Water Works Association
5. ANSI: American National Standards Institute
6. NEMA: National Electrical Manufacturers' Association
7. ASME: American Society of Mechanical Engineers
8. UL: Underwriters' Laboratories
9. IAPMO: International Association of Plumbing and Mechanical Officials
10. Fed. Spec.: Federal Specifications
11. MSS: Manufacturers' Standardization Society of the Valve and Fitting Industry
12. WOG: Non-shock Water-Oil-Gas maximum working pressure rating
13. NFPA: National Fire Prevention Association
14. FM: Factory Mutual
15. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association
16. ARI: Air Conditioning and Refrigeration Institute
17. AMCA: Air Movement and Control Association
18. TIMA: Thermal Insulation Manufacturers' Association
19. ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers
20. AABC: Associated Air Balance Council
21. NEBB: National Environmental Balancing Bureau

E. For products specified by listing one or more manufacturers, followed by a model number for each manufacturer, the following requirements apply:
1. Provide one of the listed model numbers or an approved substitution.
2. Electrical requirements, duct connections, pipe connections, and space requirements indicated on Drawings are based on one of the listed models, and may not be suitable for all models listed. Provide revisions required to accommodate the model actually furnished.

SECTION 20 10 00
GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

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E. For products specified by listing one or more manufacturers, followed by a model number for each manufacturer, the following requirements apply:
   1. Provide one of the listed model numbers or an approved substitution.
   2. Electrical requirements, duct connections, pipe connections, and space requirements indicated on Drawings are based on one of the listed models, and may not be suitable for all models listed. Provide revisions required to accommodate the model actually furnished.

1.04 PERMITS, FEES, AND GOVERNING AGENCIES

A. Obtain permits and pay fees required by governing agencies.

B. Minimum requirements not otherwise stated herein shall meet governing codes and standards.

C. Arrange and pay for inspections and tests required by applicable codes and ordinances.

1.05 SITE VISITATION AND FIELD MEASUREMENTS

A. Examine site of proposed Work to verify conditions. Beginning of Work means acceptance of conditions.

B. If conditions differ substantially from conditions indicated on Drawings, notify Architect before commencing Work.

1.06 SUBSTITUTIONS

A. Substitution requests will not be considered unless they are submitted in writing, in accordance with Division 0 and Division 1.

B. Substitution requests will not be considered unless they include the following:
   1. Model numbers of proposed substitutions.
   2. Options that are required to make the proposed substitution comply with Specifications.
   3. Summary of modifications of the Work that are required to accommodate the proposed substitution.

1.07 OWNER FURNISHED ITEMS

A. Refer to Division 1.

1.08 ALTERNATES

A. Refer to Division 1.

B. Laboratory Vacuum System.

1.09 PROJECT MANAGEMENT AND COORDINATION

A. General: Provide Work to coordinate mechanical, electric and plumbing effort with the work of other Divisions.

B. Project Management and Coordination:
   1. Provide coordination for the Work of Divisions 20, 21, 22 and 23 in accordance with Division 1.
   2. Locations shown on Drawings are approximate and are not intended to fully coordinate the Work of all Sections. Plan exact locations based on field measurements of field conditions and the Work of other Sections.
   3. Drawings do not show all required duct and pipe offsets and fittings. Provide offsets and fittings as required to coordinate with the Work of other Sections and with field conditions.
   4. Locate equipment, piping, valves, dampers, etc. to provide adequate space for normal operating and maintenance activities.

1.10 CUTTING AND PATCHING

A. Provide cutting and patching for the Work of Divisions 20, 21, 22 and 23 in accordance with Division 1 unless this is identified be provided in the Division 1 documents.

1.11 SHOP DRAWINGS AND PRODUCT DATA

A. Provide shop drawings and product data for the Work of Divisions 20, 21, 22 and 23 in accordance with Division 1. Refer to each Section for required shop drawings and product data submittals.

B. Acceptable Submittal Formats: Hard-Copy, or Electronic. If Electronic format is selected, at least one Hard-Copy of the information must be submitted with the Electronic copies to the Engineer (the Hard-Copy will not be returned).

C. Submittal formats shall conform with the following requirements:
   1. Each hard-copy Submittal package shall be formatted as follows:
      a. Use three-ring loose leaf binders.
      b. Provide index referencing specification section and page.
      c. Tab individual sections.
   2. Each Electronic Submittal package shall be formatted as follows:
      a. The full extent of the submitted data shall be presented in a single electronic file on a CD-ROM.
      b. File Format Type: Adobe PDF, or universally readable equivalent.
      c. Scanned information: Minimum 400 dpi.
      d. Provide index referencing specification section and page.
      e. Bookmark individual sections.
      f. One file per CD-ROM.
         1) Format CD-ROM for use in PC compatible hardware.
         2) Format CD-ROM so that additional files may be written to it (read-write).

D. Contractor may provide one (1) early submittal for items with long lead times as determined by the Contractor. The submittal shall be clearly identified as “Long Lead Time Item Submittal”.

E. The remainder of the shop drawings and product data shall be submitted as a single Project Submittal, except:
   1. Control system shop drawings and product data may be provided as a single, separate submittal package prior to beginning of control work on site.
   2. Fire Sprinkler Shop Drawings and Product Data may be provided as a single, separate submittal package before or after the project submittal.
   3. Seismic Restraint Shop Drawings, and Product Data may be provided as a single, separate submittal package before or after the Project Submittal.

F. The Project Submittal must be submitted no more than three (3) weeks after the Long Lead Time Item Submittal. If the Project Submittal is found to be incomplete, it will be rejected and returned. The Project Submittal shall then be completed by the Contractor and resubmitted in its entirety.

G. Definitions of comments used in submittal review:
   1. "No Exception Taken" The meaning and intent of this statement is that the Engineer finds no objection (except those noted thereon or in correspondence) to inclusion of items or Work indicated in construction provided that it:
      a. Complies with Contract Drawings and Specifications as to quantities, space requirements, and dimensions.
      b. Does not interfere with other trades.
      c. Is not the cause of union tradesmen disputes.
      d. Does not infringe on patent rights.
      e. Is not the cause of injury or damage to persons or property.
      f. Complies with OSHA regulations.
   2. "Rejected" The meaning and intent of this statement is that the submitted material does not conform to plans and specifications. Resubmittal of a different product or shop drawing is required.
   3. "Revise and Resubmit" This statement is used when the general product line is acceptable, but the submitted material varies in dimension, accessories, etc. from what is required. Resubmittal is required.
   4. "Make Corrections Noted" This statement is used as an alternative to "Revise and Resubmit" when resubmittal is not required.
   5. Said review does not relieve Contractor of any Contractual responsibilities.

1.12 TEMPORARY FACILITIES AND CONTROLS

A. Refer to Division 1.

B. Use of Project equipment for temporary service during construction is acceptable in accordance with requirements and limitations listed herein, and in accordance with requirements referenced in Division 1.
   1. General Requirements:
      a. Contractor shall notify Owner's Representative and the Engineer of intention to utilize Project equipment for temporary service. Indicate in writing what equipment will be utilized and indicate the start of use date for each.
      b. Equipment start up shall comply with manufacturer's requirements. Where Factory startup is required, it shall be completed before equipment is used for temporary service.
      c. Provide temporary control of equipment as necessary. Safety limits (non-freeze, low limit, etc.), and safety operating interlocks must be functional prior to use of the equipment.
      d. Use of equipment for temporary service during construction shall not shorten or otherwise modify the warranty the Owner receives. Starting date for warranties shall remain in accordance with Division 1 and Divisions 20, 21, 22 and 23 stipulations.

1.13 SCHEDULING

A. Schedule the Work of Divisions 20, 21, 22 and 23 in accordance with Division 1.

B. Schedule Work at such a time, and in such a manner, to minimize interference and inconvenience to the Owner.

C. Work in existing operating laboratories and offices that causes disruptions of existing services shall be coordinated with the Owner. Provide a minimum of 10 day notice prior to any shutdown of existing services.

1.14 OPERATION AND MAINTENANCE MANUALS

A. Provide operation and maintenance manuals for the Work of this Division in accordance with Division 1 and Section 20 2000.

1.15 MATERIAL AND EQUIPMENT

A. Comply with Division 1.

B. Similar products shall be of the same manufacturer.

C. Comply with manufacturer's printed instructions, in addition to requirements of the Contract Documents, regarding storage, handling, installation, operation, and adjustment of materials and equipment.

D. Protect ductwork, piping, outlets/inlets, equipment, and mechanical appurtenances from damage. Provide temporary covers as necessary to prevent accumulation of dust and debris.

E. Notify the Architect (or authorized representative) immediately of conflicts between manufacturer's instructions and Contract Documents. Resolve such conflicts before proceeding with the work.

1.16 CONTRACT CLOSEOUT

A. Comply with Division 1.

1.17 FINAL CLEANING

A. Provide cleaning for the Work of Divisions 20, 21, 22 and 23 in accordance with Division 1.

1.18 RECORD DOCUMENTS

A. Provide Record Documents for the Work of this Division in accordance with Division 1.

B. Record Drawings shall include:

1. Contract Drawings
2. Fire Suppression System Shop Drawings
3. Seismic Restraint Shop Drawings

1.19 INSTRUCTION OF OPERATING PERSONNEL

A. Provide instruction of Owner's operating personnel associated with the Work of Divisions 20, 21, 22 and 23 in accordance with Division 1.

B. Instruct Owner's designated operating personnel in the operation and maintenance of all systems.

C. Submit written certificate from Owner that Instruction of Operating Personnel has been performed.

1.20 WARRANTIES

A. Provide and document warranties applicable to the Work of Divisions 20, 21, 22 and 23 in accordance with Division 1 and Section 20 2000.

1.21 DEMOLITION

A. Provide demolition for the Work of this Division in accordance with Division 2.

B. Where items are to be salvaged for relocation or retained by the Owner, removal shall cause no damage to these items. Move in accordance with manufacturer's instructions.

1.22 PAINTING

A. Provide painting for the Work of Divisions 20, 21, 22 and 23 in accordance with Division 9.

B. Provide cleaning and surface preparation for products specified in Divisions 20, 21, 22 and 23 that have finishes specified in Division 9.

C. Paint the following items with one coat of primer and two coats of oil-based enamel:
1. Uninsulated black steel pipe which is not concealed within walls or above ceilings.
2. Steel supports, stands, and brackets which are not galvanized or factory painted.
3. Pipe rollers, hangers, and hanger rods which are not galvanized.
4. Additional items noted on Drawings or in Divisions 20, 21, 22 and 23.

D. Colors shall be approved by Architect.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 20 20 00

MECHANICAL OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General and specific requirements for Operation and Maintenance Manuals applicable to Division 20, 21, 22 and 23 sections. Requirements apply in addition to Division 1 requirements. Contractor shall provide Operation and Maintenance Manual for the Work of this Division.

1.02 SHOP DRAWINGS AND PRODUCT DATA

A. Submittals required for the following, in accordance with Section 20 1000:
   1. Table of Contents (TOC) for the Operation and Maintenance Manual. Provide one complete TOC with Project Submittal.

1.03 CONTRACT CLOSEOUT

A. Submittals required for the following, in accordance with Section 20 1000:
   1. Operation and Maintenance Manual. Provide 3 complete sets.
   2. Valve diagrams and directories. Provide laminated copies in addition to those included in O&M Manuals.

PART 2 PRODUCTS

2.01 GENERAL

A. The requirements listed herein apply to one full set of the Operation and Maintenance Manual. Provide multiple copies of the set in accordance with requirements listed under Part 1 of this Section.

B. Information provided in the Operation and Maintenance Manuals shall be customized for the specific equipment provided for, and as applied to, this Project.

2.02 PRESENTATION

A. Format:
   1. Manufacturer's literature shall be pre-printed.
   2. Documents generated specifically for this project shall be machine printed on white paper, or typed.
   3. Hand written material is not acceptable unless specifically noted herein.
   4. Internally subdivide binder contents with permanent page dividers in accordance with the organizational format described herein. Tab titles shall, as a minimum, be legibly printed and inserted into reinforced laminated plastic tabs.
   5. Separate copies of valve directories and diagrams shall be laminated and mounted with chains in Mechanical Room. Specific location to be verified with Owner or Architect.

B. Binding:
   1. In three-ring (D-side ring style) loose leaf plastic or cloth side binders. Paper report binders, or bend-tab thesis covers are not acceptable.
   2. 8-1/2 inch x 11 inch format.
   3. Ring size as necessary to contain the information for this project. Minimum ring size: 1 inch. Maximum ring size: 4 inch.
   4. Provide sheet lifters, front and back, in each notebook.
   5. Provide multiple binders where required to accommodate the data. Each binder maximum 80% full.

6. Label each binder with typed, permanently adhered, labels on the front cover and the spine. Minimum Label information:
    a. Project Name
    b. Project Location
    c. Project Owner
    d. Project Engineer
    e. Volume (notebook no.) of (number of notebooks in one set of O&M Manuals)

C. Provide a plastic page cover for each occurrence of the following pages:
    1. Cover Sheet
    2. Table of Contents
    3. Nameplate Directory
    4. Valve Directory
    5. Service and Dealer Directory

2.03 ORGANIZATION AND CONTENT OF MANUAL

A. Include in the front of EACH Notebook of the Operation and Maintenance Manual:
    1. Cover Sheet
    2. Table of Contents:
        a. List the contents of the full manual.
        b. List full extent of major and minor divisions (tabs).

B. Include the following information in the Project Operation and Maintenance Manual:
    1. Directories, including:
        a. Equipment and Nameplate Directory
        b. Itemized Service and Maintenance Directory
        c. Service and Dealer Directory
        d. Warranties Directory
        e. Valve Directory
    2. Material and Equipment Information (with Individual Tabs by Divisions 20, 21, 22 and 23 Section Number and Name), including:
        a. Shop Drawings and Product Data
        b. Manufacturer's Printed Operation and Maintenance Manuals
        c. Service Contracts and Field Start-up Reports
    3. Cleaning, Certification, and Test Reports:
        a. Domestic water system disinfections report and test results
        b. Combination Fire/Smoke Damper Operational Certification
        c. Copy of Testing, Adjusting, and Balancing (TAB) Report from Owner’s TAB Contract.
        d. Copy of Commissioning Report from Owner’s Commissioning Contract.
    4. System Information (with Individual Tabs by Divisions 20, 21, 22 and 23 Section Number and Name), including:
        a. Operation instructions
        b. Record drawings (reduced size set)
        c. Controls operation and maintenance Information

2.04 DESCRIPTION OF MANUAL CONTENT

A. Cover Sheet, listing:
    1. Project name and location
    2. Architect
    3. Engineer
    4. General Contractor
    5. Mechanical Contractor
    6. Electrical Contractor

B. Table of Contents, listing:
   1. Volume number.
   2. Section title
   3. Items included under each section (e.g., equipment name and number, parts list, service instructions, etc.)

C. Directories (with Individual Directory Specific Tab):
   1. “Equipment Nameplate Directory”. This is a summary of the equipment included in the Project with a nameplate designation (code), such as “AHU-1", including:
      a. Mechanical equipment type
      b. Nameplate designation
      c. Manufacturer's nameplate data
         1) Data as read from the nameplate for the actual equipment provided
      d. Installed location
         1) List room name and number
      e. Area served
      f. Control switch normal position
   2. “Itemized Service and Maintenance Directory”. Obtain information from the manufacturer. This is an itemized summary listing of service and inspection requirements. Itemize by Nameplate Designation (i.e.; AHU-1, CH-1, etc.). include:
      a. Service and lubrication schedule:
         1) Filter, size, number of, performance, clean pressure drop, and recommended change-out.
         2) Bearing type, recommended lubricant, and frequency.
      b. Inspection Requirements:
         1) Inspection type (e.g., belt wear, refrigerant charge, etc.), frequency, recommended actions.
   3. “Service and Dealer Directory”. This is a summary of the equipment and material suppliers for the Project, including:
      a. Company name for authorized service and parts
      b. Physical address
      c. Phone number, fax number, e-mail, and web site address (if available)
      d. Summary listing of applicable equipment and materials
   4. “Warranties”. In addition to the warranty statement, include:
      a. Project name as shown on the Project Manual
      b. The equipment (nameplate designation and description) and/or system to which the warranty applies
      c. Effective date of the warranty
      d. Expiration date of the warranty
      e. Extent of the warranty
      f. Company name, address, telephone number, and contact person for the issuer of the warranty
   5. “Valve Directory”. This is a sequential, ascending, summary of the numbered valves in the Project, separated by system, including:
      a. Valve number
      b. Valve Type
      c. Valve Size
      d. Installed location
      e. Valve function
      f. Valve normal position
   6. “Valve Diagram.” This is a graphic, diagrammatic (not to scale) chart showing valves with rooms and sections of piping served by each valve, separated by system, including:
      a. Valve number
      b. Piping type
      c. Valve function (shutoff, throttling, sectionalizing, etc.)

D. Material and Equipment Information (under individual material or equipment specification specific tabs):
    1. Shop Drawings and Product Data for items reviewed, approved, and provided for this Project.
    2. Manufacturer's Printed Operation and Maintenance Manuals, including:
        a. Manufacturer's parts list.
        b. Information for starting, adjusting, and maintaining each item in continuous operation for long periods of time.
        c. Dismantling and reassembling of the complete units and sub-assembly components with illustrations including “exploded” views showing and identifying each separate item.
        d. Identification of special tools and instrument requirements.
        e. Detailed explanation of function and control of each piece of equipment, component, or accessory.
        f. Precautions for operation of equipment and reason for each precaution.
        g. Troubleshooting guide.
    3. Service Contracts and Field Start-up Reports:
        a. Provide for fans, boilers, chillers, etc.
        b. Include list of inspection requirements to be completed prior to end of warranty.

E. Cleaning, Certification, and Test Reports:
    1. Backflow Prevention Devices Inspection and Testing. Coordinate with requirements listed in Section 22 4100.
    2. Piping Systems Cleaning, Disinfection, and Chemical Treatment Report. Coordinate with requirements listed in Section 22 5400.
    3. Written certification of combination fire/smoke damper testing. Coordinate with requirements listed in Section 20 9100.
    4. Air and Water Balance Report. Coordinate with requirements listed in Section 20 9100.
        a. When an Air and Water Balance Report is provided in a separate notebook (three-ring binder), reference the notebook as a volume of the Project Operation and Maintenance Manual set. Label the notebook accordingly.
    5. Seismic restraint system installation report certifying that seismic restraints are installed in conformance with approved shop drawings and no additional restraints are necessary based on field conditions. Include the written authorization, from seismic restraint system Engineer, of the designated representative.
    6. Commissioning Report. Coordinate with Owner’s separate Commissioning Contract.
        a. Where Commissioning Report is provided in a separate notebook (three-ring binder), reference the notebook as a volume of the Project Operation and Maintenance Manual set. Label the notebook accordingly.

F. System Information:
    1. Operation Instructions. Under individual system specific tab. Provide complete, detailed guidance for the operation and maintenance of each system (e.g., Hydronic System, etc.)
        a. Information shall include:
            1) Start-up
            2) Routine and normal operation
            3) Adjustment and regulation
            4) Chemical treatment
            5) Testing
            6) Detection of malfunction
            7) Shut-down
            8) Cleaning
            9) Summer and winter operations
            10) Emergency operation
    2. Product or System Drawings: Provide an 11 inch by 17 inch set (print-to-fit) bound in a separate pressboard report cover with reinforced top hinges. Label front of report cover in accordance with previously listed notebook labeling requirements.

3. Controls Operation and Maintenance Information. Coordinate with controls requirements listed in Division 23.
    a. Where controls information is provided in separate notebook(s) (three-ring binder), reference the notebook(s) as volume(s) of the Project Operation and Maintenance Manual set. Label the notebook(s) accordingly.

PART 3 EXECUTION

3.01 GENERAL

A. Information provided in the Operation and Maintenance Manuals shall be specific to actual equipment, materials, and systems provided under the Work of this project.

B. Pre-printed Parts lists, service instructions, equipment data manuals, etc., shall be marked to indicate the model number of the corresponding item provided under the Work of this project.
    1. Use an arrow stamp to designate the pre-printed model numbers for Products applicable to this Project. Arrow shall be of a reproducible color (i.e.; red or black).
    2. Where the corresponding model number is not shown on a pre-printed sheet, hand write the model number, and associated data, in ink using legible block style lettering.

END OF SECTION

SECTION 20 30 00

MECHANICAL SYSTEMS FIRE STOPPING

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 10 00 - General Mechanical Provisions

B. Section 20 20 00 - Mechanical Operation and Maintenance Manuals

1.02 SUMMARY

A. Section includes requirements for through-penetration fire stopping for items including piping, ductwork, wiring, conduit, and equipment provided under divisions 20, 21, 22 and 23, and requirements for recessing equipment, cabinets, devices and/or appurtenances in fire rated walls, ceilings, or floors.

B. Products shall be of a single manufacturer for each type of fire stopping required, and where several types are integrated into a single assembly. Provide putty, sealants, wraps, boards, and accessories as necessary and required for the work of this project.

1.03 REFERENCES

A. Underwriters Laboratories:
   1. UL Fire Resistance Directory
   2. UL Component Listing Test Criteria
   3. Warnock Hersey

B. American Society For Testing And Materials Standards:
   1. ASTM E 814 - 88: Standard Test Method For Fire Tests of Through-Penetration Firestops

C. International Building Code, 2003, with Oregon Amendments (Oregon Structural Specialty Code, OSSC, 2004) – Chapter 7 Fire Resistance Rated Construction

1.04 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to a given type of construction.

B. Barriers: Time rated fire walls, ceiling/floor assemblies, and structural floors.

C. Fire Stopping: Assembly of materials applied at penetrations to limit spread of heat, fire, gases and smoke.

D. Penetration: Opening through or into a barrier such that full thickness of rated materials is not obtained.

E. System: Specific products and applications, classified and numbered by Underwriters Laboratories (UL), Inc. to close specific barrier penetrations.

F. F Rating: Time period that fire stop assembly can withstand fire and hose stream test as determined in accordance with ASTM E 814.

G. T Rating: As required for F Rating and to limit temperature rise above the initial temperature to 325 degrees F on protected side as determined in accordance with ASTM E 814.

1.05 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 10 00. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 20 00.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 20 00 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Manufacturer's installation drawings and instructions for each proposed assembly. Identify intended product and applicable UL System number or UL classified devices.	X	X				X		X
Manufacturer recommendations and drawings relating to non-standard applications where necessary.	X	X						X
Modifications, component connections, anchorage methods, and required hardware.	X	X						X

1.06 QUALITY ASSURANCE

A. Installer Qualification: Acceptable to, or certified by, Fire Stopping system manufacturer.

B. Regulatory Requirement: Contractor shall verify acceptance from Authority Having Jurisdiction for proposed assemblies conforming to, or not conforming to, specific UL Fire Stop System Numbers, or UL classified devices.

C. Products shall comply with the requirements of Oregon Revised Statute (ORS) 453.005 (7) (e), effective January 1, 2011. The referenced statute limits the use of three types of brominated fire retardant chemicals, which are defined as hazardous substances.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original, unopened packaging with legible manufacturer's identification. Store materials in accordance with manufacturer's instructions. Store in clean, dry, ventilated location, protected from freezing.

1.08 WARRANTY

A. Submit copies of written warranty for Fire Stopping assemblies. Warranty period shall be one year minimum.

PART 2 - PRODUCTS

2.01 GENERAL

A. Fire Stop products and accessories shall be asbestos-free, intumesce when exposed to temperatures of 250 degrees F, and maintain an effective barrier against flame, smoke and gases. Mortar systems must be Warnock Hersey approved.

B. Fire Stop Fire Rating: Not less than rating of barrier penetrated in which fire stopping will be installed.

2.02 FIRE STOPPING ASSEMBLIES

A. Assemblies of materials used to seal spaces around penetrations shall have a UL Fire Stop System Number appropriate for the construction type, penetration type, annular space requirements, and fire rating at each penetration.

B. Systems and devices must withstand the passage of cold smoke either as an inherent property of the system or by the use of a separate product included as a part of the UL system or device and designed to perform this function. Systems complying with the requirements for through-penetration firestopping in fire-rated construction are acceptable provided the system will provide a smoke seal.

C. Performance Requirements: Fire Stop assembly shall be able to withstand standard fire and hose stream test (F Rating) and limit temperature rise (T Rating) of penetrations on protected side as required by Authorities Having Jurisdiction. Conform to ASTM E 814.

D. Manufacturers: 3M, Dow, Chase Technology Corp., Bio Fireshield Inc., ProSet, Johns Manville, Specified Technologies Inc, Metacaulk, GS Hevi-Duti/Nelson, Hilti, NUCO Inc., or approved.

2.03 ACCESSORIES

A. Fill, void, or cavity materials: As classified under category XHHW in the UL Fire Resistance Directory.

B. Forming materials: As classified under category XHKU in the UL Fire Resistance Directory.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide Fire Stopping seal at pipe, duct, wiring, or conduit penetration, installed under divisions 20, 21, 22 and 23, through fire rated construction.

B. Provide fire rated assembly around equipment, cabinets, devices and/or appurtenances, installed under divisions 20, 21, 22 and 23, in fire rated walls, ceilings, or floors.

C. Verify barrier penetrations are properly sized and in suitable condition for application of materials.

D. Provide masking and drop cloths to prevent contamination of adjacent surfaces by Fire Stopping materials. Clean spills of liquid components. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

E. Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance. Cut and trim materials as required to neatly match edges of penetration.

F. Comply with manufacturer’s recommendations for temperature and humidity conditions before, during, and after installation of Fire Stopping.

END OF SECTION

SECTION 20 42 00

SEISMIC RESTRAINTS

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SCOPE OF WORK

A. Project specific items include but not limited to the following:
   1. Seismic support and bracing of fan coil units.
   2. Seismic support and bracing of piping; including multiple HVAC and laboratory piping supported on single/double trapeze.

B. Provide seismic restraints in accordance with ASCE Standard 7-05 requirements for piping, ductwork, and mechanical equipment.

C. Provide engineering for seismic restraint system, assemblies, and components.

D. Provide shop drawings and installation instructions for seismic restraint system.

E. Provide final inspection and report for installed restraint system acceptance.

F. Seismic bracing of coils installed in-line in ducts and with piping connections.

G. DEFINITIONS AND STANDARDS

H. Referenced Standards:
   1. ASCE Standard 7-05: American Society of Civil Engineers / Structural Engineering Institute, Standard 7-05, Minimum Design Loads for Buildings and Other Structures

I. Design Criteria:
   1. Occupancy Category: ASCE 7-05 Occupancy Category designation, Table 1-1.
   2. Site Classification: ASCE 7-05 Site Classification designation, Table 20.3-1.
   3. Peak Spectral Response Acceleration (SS): ASCE 7-05 Figure 22-1 - Maximum Considered Earthquake Ground Motion of 0.2s spectral response acceleration, Site Class B.
   4. Design Spectral Response Acceleration (SDS): ASCE 7-05, Eqs. 11.4-1 and 11.4-3.
   5. Seismic Design Category: ASCE 7-05 Seismic Design Category designation, Tables 11.6-1 and 11.6-2.
   6. Component Importance Factor (IP): ASCE 7-05, Section 13.1.3.

J. Custom Engineered Assembly: Anchorage and seismic restraint assembly, comprised of standard or proprietary components, designed and applied to system by the Seismic Engineer.

K. Pre-Engineered Assembly: Previously designed anchorage and seismic restraint assembly selected and applied to system by the Seismic Restraint System Engineer.

L. Seismic Restraint System Engineer: Registered Professional Engineer currently licensed in Oregon as a structural, civil, or mechanical engineer. Responsible for designing, applying, and inspecting pre-engineered seismic restraint assemblies and components in accordance with applicable codes and component manufacturer's published recommendations.

M. Seismic Engineer: Professional engineer currently licensed in Oregon as a structural, civil, or mechanical engineer. Responsible for designing, applying, and inspecting custom seismic restraint components in accordance with applicable codes.

N. Equipment Definition:
   1. Equipment referred to by type is typical. Equipment not specifically listed here is still subject to the requirements listed herein.
   2. Weight: Installed operating weight of equipment as reported by equipment manufacturer on the shop drawings.

O. Ductwork and Piping Definition:
   1. Duct Run: A length of duct without change in direction.
   2. Piping Run: A length of pipe without change in direction.
   3. Component Weight: Calculated installed (operating) weight of component.
   4. Longitudinal Bracing: Restraints applied to limit motion parallel to the centerline of the pipe or duct.
   5. Transverse Bracing: Restraints applied to limit motion perpendicular to the centerline of the pipe or duct.

1.03 PROJECT DESIGN CRITERIA

A. Restraint system, assemblies, and components shall be designed and installed to resist lateral loads in accordance with the current adopted State of Oregon Structural Specialty Code.

B. Seismic Design Criteria:
   1. Occupancy Category: II
   2. Site Classification: B
   3. Peak Spectral Response Acceleration (Ss) = 0.81
   4. Design Spectral Response Acceleration (SDs) = 0.540.54
   5. Seismic Design Category: D
   6. Maximum Allowable Lateral Loads and Anchorage Requirements: See Structural Drawings.
   7. Component Importance Factors (IP): 1.0.

1.04 SYSTEM ENGINEERING AND QUALITY ASSURANCE

A. Seismic restraint system shall be engineered to comply with criteria stated and referenced herein.

B. Seismic restraints and related engineering for HVAC, plumbing, and piping systems to be provided by a single vendor.

C. Application of Pre-engineered Assemblies by Seismic Restraint System Engineer:
   1. Application of Custom Engineered and/or Pre-Engineered Assemblies, as applicable to this project, and as follows:
      a. Application of restraints for floor or roof-mounted equipment.
      b. Application of restraints for curb mounted equipment including unit-to-curb and curb-to-structure attachments.
      c. Application of seismic restraint assemblies for vibration isolated and suspended equipment.
      d. Application of seismic restraint assemblies for piping and ductwork.
   2. Submittal packages shall bear the stamp of only the responsible Seismic Restraint System Engineer.
   3. Approved Pre-engineered Assembly and Application Services: Mason Industries, Kinetics, or an independent professional engineer meeting qualifications listed herein as Seismic Restraint System Engineer.

D. Custom Engineered Assemblies:
   1. System engineering shall include design and Application of Custom Engineered Assemblies, as applicable to this project, and as follows:
      a. Design and Application of seismic restraint assemblies for piping and ductwork.

2. Engineering shall be performed by, or under the direct supervision of, a Seismic Engineer meeting the qualifications listed herein. Submittal packages shall bear the signed seal of only the Seismic Engineer.

E. For anchorage requirements and allowable lateral loads at attachment to building structural system, provide structural analysis and report from an independent Registered Structural Engineer currently licensed in the State of Oregon.

1.05 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Pre-submittal:
1. Included within project Mechanical Submittals, submit attached letter outlining how the seismic requirements for this project will be met (i.e., Pre-engineered Assemblies, Custom Assemblies). In the letter state what companies will be providing the services and the qualifications of the responsible individuals.

B. Shop drawings shall be submitted as one complete package inclusive of all mechanical systems and equipment.

C. Submit the following in accordance with Section 20 10 00 (Reference isolated equipment as numbered in Contract Documents):
1. Seismic Restraint Location Plan: Full or half size copies of ductwork and piping plans from the Contract Documents, showing locations and type of seismic restraint assemblies to be used.
   a. Drawings shall consist of mechanically reproduced copies of the Contract Documents, or custom drafted specifically for the Work of this Project and bear only the seal of the Seismic Restraint System Engineer or Seismic Engineer. All other seals shall be eradicated from drawings prior to submittal.
   b. Provide separate drawings for ductwork and piping systems.
   c. Each drawing shall be printed on a single sheet. Drawings pieced together from multiple copies are not acceptable.
2. Seismic Restraint Assembly Installation Details: Pre-Engineered or Custom Engineered assembly details showing required components, dimensions, and method of connection to supporting structure.
3. Calculations For System Application: Calculations shall indicate maximum forces anticipated at each restraint assembly, method of determining forces, and selection of restraint assemblies.
   a. For Pre-Engineered Assemblies, include documentation of design conditions, maximum load capacity of assembly, and maximum forces at anchorage points.
   b. For Custom Engineered Assemblies, submit calculations identifying maximum load capacity of assembly, maximum forces on each component, sizing/selection of each component, and maximum forces at anchorage points.

D. The entire submittal package comprised of drawings, details, and calculations for mechanical ductwork, piping, and equipment shall be stamped and signed in accordance with the requirements listed under 1.05 SYSTEM ENGINEERING AND QUALITY ASSURANCE in this specification section.

E. At seismic restraint system installation completion, submit three (3) copies of report from seismic restraint system Engineer, or the Engineer's representative, certifying that seismic restraints are installed in conformance with approved shop drawings and no additional restraints are necessary based on field conditions. Include written authorization, from Seismic Restraint System Engineer, of the designated representative.

F. Prior to Contract Closeout submit Operation and Maintenance information required as indicated in Section 20 2000.

PART 2 PRODUCTS

2.01 PRE-ENGINEERED ASSEMBLIES

A. Anchorage and seismic restraint assemblies, comprised of standard or proprietary components, capable of application to restraint system and supporting structure.

B. Acceptable Proprietary Manufacturers: Mason Industries or Kinetics. No substitutions.

PART 3 EXECUTION

3.01 GENERAL

A. Seismic restraint system shall be installed in strict accordance with the manufacturer's written instructions and certified submittal data.

B. Conflicts with other trades that result in rigid contact with the equipment or piping due to inadequate space or other conditions shall be coordinated with the Seismic Restraint Engineer and corrected.

C. Attach restraints and anchors to a common structural element plane and within a common structural system.

D. For non-isolated suspended equipment, piping and ducts, install solid braces or taut flexible cable restraints.

E. Provide supplementary support steel for equipment, piping, and ductwork required for the work of this Section.

3.02 FAN COIL UNITS AND REHEAT COILS INSTALLED IN-LINE WITH DUCTWORK, WITH PIPING CONNECTIONS

A. Depending on the weight of the equipment, method of attachment to overhead structure, Ip factor and ceiling space available, seismically brace equipment based on weight and other ruling factors required by the seismic standard.

B. Provide flexible hose V-Loops at the connection of the piping to the coil. Flexible hose V-loops with a high pressure rating are specified in Section 22 11 00 Piping. The seismic engineer shall select the appropriate length of flexible hose required.

C. Seismic bracing and hoses shall not block access to the equipment valve train.

3.03 DUCTWORK AND PIPING SEISMIC RESTRAINT

A. Provide minimum of two transverse supports and one longitudinal support on each pipe or duct run. Transverse bracing shall be installed at each turn and at each end of a run with a minimum of one brace at each end. Where a pipe or duct run is shorter than the minimum interval between braces, provide braces at each end.

B. Where restraints are attached to clevis style pipe hangers, the cross bolt must be reinforced.

END OF SECTION

SECTION 20 4200 - SEISMIC RESTRAINT SYSTEM ENGINEERING PRE-SUBMITTAL

PROJECT:_____
(Project Title)

The Undersigned states the following:

- Seismic restraints for the work of Divisions 22 and 23 for this project will be provided as required in Section 20 4200.
- Application of Pre-Engineered Restraint Assemblies will be provided by Seismic Restraint System Engineer meeting qualifications of Section 20 4200.

  Seismic Restraint System Engineer: _____

  Firm Name: _____

  Authorized Representative: _____

  (Name of representative authorized to act on Engineer's behalf)

- Design for Custom Engineered Restraint Assemblies will be provided by Seismic Engineer meeting qualifications of Section 20 4200.

  Seismic Engineer: _____

  Firm Name: _____

  Authorized Representative: _____

  (Name of representative authorized to act on Engineer's behalf)

- Upon completion of seismic restraint system installation the Engineers listed above, or the designated representative listed, will inspect and certify that seismic restraints are installed in conformance with approved shop drawings and, based on actual field conditions, no additional restraints are necessary to comply with applicable codes.

Submitted by: _____ Signature: _____

Firm: _____

Address: _____

Telephone: _____ E-mail:_____

Date: _____

SECTION 20 60 00

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 10 00 - General Mechanical Provisions

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 10 00. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 20 00.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 20 00 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Pipe Labels		X						
Control and Equipment Nameplates		X						
Regulatory Signage	X	X						
Pipe Union Labels	X	X						

1.03 REFERENCES

A. ANSI A13.1 (American National Standards Institute) - Scheme for the Identification of Piping Systems, latest edition.

B. NFPA 99 (National Fire Protection Association) - Standard for Health Care Facilities, latest edition.

PART 2 PRODUCTS

2.01 PIPE LABELS

A. Pipe Labels:
   1. Type: Preformed plastic or adhesive-backed vinyl, with factory printed legend on colored background.
   2. Letter Size: Conform to ANSI A13.1 1981.
   3. Background Color: Conform to ANSI A13.1 1981.
   4. Flow Direction Arrow: At each pipe label.
   5. Legend Wording:
      a. Match the pipe description shown in Symbols List on Drawings.
      b. Steam piping: Include nominal pressure (e.g. 60psi or 20psi).
   6. Manufacturer: Seton, Brady, MSI, or approved.

2.02 CONTROL AND EQUIPMENT NAMEPLATES

A. Nameplates:
   1. Type: Laminated plastic, with engraved white letters on black background.
   2. Letter Size: 1/2 inch tall.

B. Provide nameplates for mechanical equipment -- including air handling units, fans, pumps, terminal units, heat exchangers, expansion tanks etc. Wording to match equipment designations on Drawings.

C. Nameplate of each mechanical equipment shall include "area served" or "system served". See Drawing Schedules for description of area or system served.

D. Provide nameplates for control panels and major control components.

E. Attach nameplates with rivets or screws; adhesive only fastening not permitted. Provide weather-proof sealant for outdoor applications where screws penetrate casing.

F. At room thermostats and temperature sensors, write the name of the unit served on the inside of cover in permanent ink.

2.03 REGULATORY SIGNAGE

A. Non-Potable Water Signs:
   1. Type: 60 mil thickness, press-polished vinyl plastic rectangular sign with rounded corners. Sign shall be factory configured with one mounting hole in each corner.
   2. Size: 10 inches wide by 7 inches tall.
   3. OSHA Header: “Caution”.
   4. Warning Language: NONPOTABLE WATER. DO NOT DRINK.
   5. Colors:
      a. Background - Yellow
      b. Lettering - Black
   6. Manufacturer: Seton or approved.

2.04 MISCELLANEOUS LABELS

A. Pipe Union Labels:
   1. Material: White vinyl, self-adhesive, permanent.
   2. Red lettering, minimum 1/2 inch tall.
   3. Labels at unions and die-electric unions read “UNION”.
   4. Manufacturer: Seton, Brady, MSI, or approved.

PART 3 EXECUTION

3.01 PIPE LABELS

A. Provide labels for piping.

B. Labels shall be oriented to be visible from the normal access side of the pipe.

C. Locate pipe labels as follows:
   1. Within 3 feet of each valve.
   2. Within 3 feet of each equipment connection.
   3. Within 3 feet of each wall, floor, or ceiling penetration.
   4. Within 3 feet of each branch.
   5. At intervals along the pipe, not to exceed 20 feet on center.
   6. In Tunnels, or Utilidors as indicated previously except:
      a. Maximum 100 feet on center.
      b. On each side of an accessway, within 5 feet of the opening.

D. Prior to label installation; clean pipe or insulation surfaces according to label manufacturer's recommendations.

E. Review pipe labeling with Owner during construction, prior to application. Labeling shall be as approved by Owner (University Construction Project Manager) and per Owner's published construction standards. Refer to http://campusops.uoregon.edu/cc/cc-standards.

3.02 REGULATORY SIGNAGE

A. Sign location and mounting shall be in accordance with OSHA Requirements.

B. Wall mount one Non-potable water sign immediately adjacent to each fixture with water service from a Non-potable lab water distribution system.

C. Signs shall be secured to the wall with screws. Provide suitable accessories for the wall type where each sign is mounted.

D. Sign location shall be adjusted such that a clear and unobstructed view is provided. Final placement of each sign shall be approved by the Owner's Representative.

3.03 PIPE UNION LABELS

A. Provide label for each union and die-electric union concealed inside pipe insulation. Orient label parallel with pipe run and position to be visible from the normal access side of the pipe.

B. Prior to label installation, clean surfaces in accordance with label manufacturer's instructions.

END OF SECTION

SECTION 20 91 00

TESTING, ADJUSTING AND BALANCING (PROVIDED BY OWNER)

PART 1 GENERAL

1.01 GENERAL NOTE

A. This Section provided as a reference for other Sections in the project. The Testing and Balancing Contractor will be provided by the owner.

1.02 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 23 0900 - Controls

D. Section 23 0910 - Controls - Sequence Of Operation

1.03 SECTION INCLUDES

A. Testing, adjusting, and balancing (TAB) of air systems.

B. Testing, adjusting, and balancing (TAB) of water systems.

C. Measurement of final operating conditions of HVAC equipment.

1.04 QUALIFICATIONS

A. Work of this Section shall be performed by a firm currently certified by the National Environmental Balancing Bureau (NEBB) in the following categories:
   1. Certification for Performance of both Air and Hydronic TAB
   2. Certification for Sound and Vibration Testing

B. Work of this section shall be accomplished under the on-site supervision of a NEBB Certified supervisor assigned full time to an office in the State of Oregon. The NEBB certified person designated in writing to NEBB (for the purpose of NEBB Certification of the firm) shall be the supervisor who will represent the firm. The NEBB certified supervisor shall be responsible for the supervision of on-site TAB work and the setup/review of the balancing report.

1.05 APPROVED FIRMS

A. Approved Firm: Northwest Engineering Service, Inc./Air Introduction and Regulation, Inc.

1.06 QUALITY ASSURANCE

A. Work of this Section shall be done in accordance with the current edition of the NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

B. Maintain and calibrate measuring instruments in accordance with NEBB standards.

1.07 SUBMITTALS

A. Submittals required for the following, in accordance with Division 1 requirements, Section 20 1000 and Section 20 2000:
   1. Final Balancing Report:
      a. Copies: Provide 4 copies of report with one copy directly to Mechanical Engineer. Insert remaining copies into Mechanical Operation and Maintenance Manuals submitted per Section 20 1000.
      b. Binding: Bind report in 3-ring binder with indexed tabs.
      c. Content:
         1) Cover sheet: Provide cover sheet with each report containing:

a) Project name and location
b) Architect
c) Engineer
d) Mechanical Contractor
e) Testing, Adjusting and Balancing Firm

2) Table of Contents: Indexed to tabs.
3) Content:
a) Data required by this Section
b) Reduced copies of Drawings relating reference points to outlet logs, including room numbers.
c) Note discrepancies between design and actual data.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Check the following and report to Contractor for necessary corrections:
1. Drafts, noise and vibration.

3.02 SCOPE OF WORK

A. Fan Coil Units:
1. Record Maximum and Minimum fan CFM, operating speed and initial filter pressure drop.

B. Balance supply and exhaust outlets and inlets noted on the drawings.

C. Hydronic Systems:
1. Test, adjust and record water flow at cooling coils and reheat coils.
2. List inlet and outlet water temperatures at full water flow through each coil.
3. List air temperature measurements simultaneous with water measurements.

D. Room Pressurization:
1. Lab 74C Laser Bay Area: Adjust room general exhaust CFM to ensure a positive differential pressure of at least +0.03" w.g. between the laboratory and adjacent Lab 74A and 74B.
2. Lab 74A and 74B (with chemical odor work): Adjust room general exhaust CFM to ensure a negative differential pressure of at least -0.02" w.g. between 74A and 74B, and adjacent corridor.

END OF SECTION

SECTION 21 10 00
FIRE PROTECTION

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 20 4200 - Seismic Restraints

1.02 GENERAL REQUIREMENTS

A. Provide complete design and engineering, shop drawings, and installation of a complete fire protection system for full coverage of the remodel area.

B. The fire protection system shall fully comply with the latest adopted edition of NFPA 13 - Installation of Sprinkler Systems.

C. Provide seismic restraints in accordance with NFPA 13, the 2007 Oregon Structural Specialty Code, and The Project Design Criteria in Section 20 4200.

1.03 SCOPE OF WORK

A. Modify and/or add to existing wet pipe sprinkler system to accommodate new floor plan layout.

B. Provide sprinkler coverage in new closet created under stair.

1.04 SYSTEM ENGINEERING AND QUALITY ASSURANCE

A. Fire Protection engineering and design shall be performed by, or under the direct supervision of, a currently licensed Oregon Professional Engineer. Submittal packages (drawings, calculations) shall bear the signed seal of the supervising engineer.

B. The Fire Protection System engineer/designer:
   1. Shall be familiar with and comply with documented standards and ordinances required by the local authority having jurisdiction.
   2. Shall be responsible for verifying design and field conditions prior to submitting shop drawings for preliminary approval. Field conditions include, but are not limited to, available ceiling space, and obstructions such as ducts and structural elements.

1.05 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer’s Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

PRODUCT TABLE	Operation & Maintenance Information							
	1	2	3	4	5	6	7	8
Pipe, fittings, hangers, and joining systems.		X						
Sprinkler Heads. Indicate head response type and listed coverage area.		X						
Specialties		X						
Prepare a complete set of system drawings showing: (1) System Type(s) and sizing method(s) used. (2) Pipe runs, pipe sizes, valves, flow switches, and drains. (3) Schedule of proposed products for each pipe size, fire protection system type, and area served. (4) Hydraulic reference points and remote design areas, referenced to calculations. (5) List of symbols and abbreviations used. (6) Head locations and types in relationship to structure, lights, diffusers, speakers, and other architectural elements. Include head types lights, diffusers, speakers and other architectural elements in Symbols List. (7) Supply riser location and detail. (8) Location and height of fire department connections. (9) Flexible assemblies and seismic loops at pipes crossing building expansion and seismic joints. (10) Manufacturer's model number and location of equipment.	X							
Hydraulic Calculations for Pipe Sizing: (1) For calculated pipe sizes, submit hydraulic calculation worksheets. (2) Worksheets shall include a list of all abbreviations used. (3) Worksheets shall include hydrant flow and test data with location, date, and testing agency. (4) Worksheets shall include information listed in NFPA 13.	X							

C. Submit Shop Drawings as follows:
   1. Submit system drawings to Architect for preliminary review and comments.
   2. If comments are received, make noted changes and resubmit to Architect for review.
   3. Following Architect final review, submit final drawings to the local/state Fire Marshal for approval.
   4. After receiving approval from the local/state Fire Marshal, submit the drawings with Fire Marshal’s approval stamp to the Architect.

PART 2 PRODUCTS

2.01 GENERAL

A. Products shall be UL listed and FM approved for the purpose and system specified.

2.02 PIPE AND FITTINGS

A. Sprinkler Systems:
   1. Pipe and fittings shall conform to NFPA 13.
   2. Proprietary pipe, listed and installed in accordance with NFPA 13, shall be limited to the following products:
      a. Allied Dyna-Flo / Super Flo
      b. Allied Dyna-Thread / Super-40.

2.03 SPRINKLER HEADS

A. General:
   1. Sprinkler heads shall be quick-response type to comply with owner's standards.
   2. Provide proper temperature rating in accordance with NFPA 13.

B. Manufacturer: Tyco Fire Products, Viking, Standard, Reliable, or approved.

C. Upright:
   1. Finish:
      a. Concealed: Standard brass.
      b. Exposed: Standard brass.
   2. Application: Exposed piping and concealed spaces.

D. Wet Pendant:
   1. Finish:
      a. Concealed: Standard brass.
      b. Exposed: Standard brass.
   2. Application: Exposed piping and concealed spaces.

E. Recessed Wet Pendant:
   1. Finish: Polished chrome head and cup.

F. Semi-Recessed Wet Pendant:
   1. Finish: White enamel head and escutcheon.
   2. Application: Acoustical tile ceiling areas.

G. Upright:
   1. Application: Concealed spaces and areas with no ceilings.
   2. Fusing Element: Solder link.
   3. Finish: Standard brass.
   4. Manufacturer: Viking, Tyco, Standard, Reliable, or approved.

2.04 PIPE SUPPORTS

A. Ring Hangers for Pipe Sizes 3 inch and smaller:
   1. Type: Carbon steel band, adjustable, with knurled swivel nut.
   2. Finish:
      a. Indoors: Zinc plated.
      b. Outdoors or Wet Areas: Hot dip galvanized.
   3. Approvals: UL and FM.
   4. For uninsulated copper piping: Equivalent to model specified, with addition of copper plating, neoprene coating, or PVC coating.
   5. Manufacturer:
      a. Anvil Fig. 69.
      b. B-Line Fig. B 3170.
      c. Super Strut C-727.
      d. PHD Model 151.
      e. Erico/Michigan Model 100.
      f. Tolco Fig. 2, Fig. 200 for sizes 2” and smaller.

B. Clevis Hangers for Pipe Sizes 4 inch and larger:
   1. Type: Adjustable clevis.
   2. Material: Carbon Steel.
   3. Finish:
      a. Indoors: Zinc plated.
      b. Outdoors or Wet Areas: Hot dip galvanized.
   4. Approvals: UL and FM.
   5. Manufacturers:
      a. Anvil Fig. 260.
      b. B-Line Fig. B 3100.
      c. Super Strut C-710.
      d. PHD Model 450.
      e. Erico/Michigan Model 400.
      f. Tolco Fig. 1.

C. Hanger Rods:
   1. Materials: Carbon Steel.
   2. Finish:
      a. Indoors: Zinc plated.
      b. Outdoors or Wet Areas: Hot dip galvanized.
      c. Diameter: Meet or exceed NFPA requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install pipe plumb, parallel, and true to building structural system. Where possible, use full 20 ft. lengths.

B. Install hangers at branch line connections to cross mains and as required by NFPA 13.

C. Coordinate piping and head locations with structure, ductwork, plumbing, lighting, and other electrical work.

D. Coordinate sprinkler head locations with architectural reflected ceiling plans, where these are installed.

3.02 INSPECTION AND TESTS

A. Arrange and pay for inspection and tests required by the authorities and agencies to obtain complete and final acceptance of system.

B. Provide certificate in duplicate of Fire Marshal's acceptance, when required.

END OF SECTION

SECTION 22 11 00

PIPING

PART 1 GENERAL

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 21 1000 - Fire Protection: Fire sprinkler piping above grade

1.02 TRENCHING, BACKFILLING, AND COMPACTION

A. Provide trenching, backfilling, and compaction for the Work of this Section.

B. Trenching, backfilling, and compaction shall comply with requirements referenced in Section 20 1000, in addition to requirements specified in this Section.

1.03 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer’s Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Piping Specialties		X						
Flexible Pipe Connections		X						
Pipe Supports		X						

1.04 QUALITY ASSURANCE

A. Qualification of Welders:
   1. Welders performing the Work of this Section shall have been certified within the last five years. Upon request, the Contractor shall provide the Owner with the names of welders employed in the Work, together with certification that each of these welders has passed qualification tests as prescribed by the National Certified Pipe Welding Bureau, or by other approved agency.
   2. Welders installing piping connected to a boiler shall be qualified based on the Contractor's welding procedures and shall be boiler maker or steam fitter certified. In addition, at least one of the following is required:
      a. National Board "R" stamp certificate.
      b. "O" stamp certificate.
      c. ASME Code shop with appropriate stamp.

PART 2 PRODUCTS

2.01 PLUMBING PIPING

A. Domestic Water (CW):
   1. Pipe: Type L copper, hard drawn, ASTM B-88.
   2. Fittings: Wrought copper, ANSI B-16.22.
   3. Joints:
      a. 2-1/2 inch diameter & smaller: Lead-free 95-5 tin-antimony solder or silver/copper-alloy brazed.
      b. 3 inch diameter & larger: Silver/copper-alloy brazed.

B. Laboratory Waste and Vent (LW, LV):
   1. Pipe: Schedule 40, flame-retardant polypropylene.
   2. Fittings: Flame-retardant polypropylene, standard DWV patterns.
   3. Joints:
      a. Above Grade: Mechanical .
      b. Below Grade: Electrofusion.
   4. Transition Couplings: Approved for use with systems to be joined.
   5. Pipe, Fitting, and Coupling Manufacturer: IPEX Labline Mechanical joint system (above grade) and IPEX Enfield Electrofusion system (below grade), to match owner's standards.

C. Cooling Coil Condensate Drain (CD) within building:
   1. Pipe: Type L copper, hard drawn, ASTM B-88.
   2. Fittings: Wrought copper, ANSI B-16.22.
   3. Joints: Lead-free 95-5 tin-antimony solder, or approved.

2.02 HYDRONIC PIPING

A. Chilled Water (CHS, CHR), 2-1/2 inch diameter and smaller:
   1. Option #1:
      a. Pipe: Type L copper, hard drawn, ASTM B-88.
      b. Fittings: Wrought copper, ANSI B-16.22.
      c. Joints: Lead free 95-5 tin-antimony solder or approved.
   2. Option #2:
      a. Pipe: Schedule 40 black steel, ASTM A-53, Grade B.
      b. Fittings: Malleable iron, class 150, ANSI B-16.3.
      c. Joints: Screwed.

B. Heating Water (HS, HR), 2-1/2 inch diameter and smaller:
   1. Option #1:
      a. Pipe: Type L copper, hard drawn, ASTM B-88.
      b. Fittings: Wrought copper, ANSI B-16.22.
      c. Joints: Lead free 95-5 tin-antimony solder or approved.
   2. Option #2:
      a. Pipe: Schedule 40 black steel, ASTM A-53, Grade B.
      b. Fittings: Malleable iron, class 150, ANSI B-16.3.
      c. Joints: Screwed.

2.03 PROCESS COOLING WATER

A. Chilled Water (PCWS, PCWR), 2-1/2 inch diameter and smaller:
   1. Pipe: Type L copper, hard drawn, ASTM B-88.
   2. Fittings: Wrought copper, ANSI B-16.22.
   3. Joints: Lead free 95-5 tin-antimony solder or approved.

2.04 LABORATORY GASES AND VACUUM PIPING

A. Compressed Air (A):
   1. Pipe: Type L copper tubing, hard drawn, ASTM B819, factory cleaned and sealed, marked for oxygen service.
   2. Pipe Seals: Factory-installed rubber plugs.
   3. Fittings: Wrought copper, factory cleaned and bagged for oxygen service.
   4. Joints: Brazed, using copper-phosphorus brazing filler alloy, without flux.
   5. Manufacturer: Mueller or approved.

B. Nitrogen (N):
   1. Pipe: Type L copper tubing, hard drawn, ASTM B819, factory cleaned and sealed, marked for oxygen service.
   2. Pipe Seals: Factory-installed rubber plugs.
   3. Fittings: Wrought copper, factory cleaned and bagged for oxygen service.
   4. Joints: Brazed, using copper-phosphorus brazing filler alloy, without flux.
   5. ABS/Copper Connections: Composite Union – Socket x Male BSPT fitting.
   6. Manufacturer: Mueller or approved.

C. Vacuum (VAC):
   1. Pipe: Type L copper, hard drawn, ASTM B-88.
   2. Fittings: Wrought copper, ANSI B-16.22.
   3. Joints: Lead-free 95-5 tin-antimony solder or silver/copper-alloy brazed.

2.05 PURIFIED WATER PIPING

A. Reverse Osmosis Water and Deionized Water (RO and DI):
   1. Pipe: Schedule 80 PVC, ASTM D-1785, Grade 1.
   2. Fittings: Schedule 80 PVC, ASTM D-2464.
   3. Joints: Threaded.
   4. Joint tape: Teflon.

2.06 FLEXIBLE PIPE CONNECTIONS

A. Reheat and Cooling Coil Flexible Hose Connections - Vee Loop:
   1. Application: Pipe connections to coils installed In-line with ducts.
   2. Description: Factory assembled unit consisting of two flexible sections of hose and braid, connected with elbows and/or return bend in a "V" configuration.
   3. Flexible Hose: Corrugated 304 stainless steel hose, 304 stainless steel braid and 304 stainless steel braid band.
   4. Nipples and Elbows: Schedule 40 carbon steel welded to hose with NPT connection.
   5. Return Bend: With air release/drain connection and support bracket.
   6. Relative Movement: Minimum 4 inches in all directions.
   7. Maximum Rated Pressure: 700 psig at 70 deg F for a size 3/4" x 24" end to end hose, with 15" in live length and 94 corrugations.
   8. Minimum Burst Pressure: Four times the Rated Pressure.
   9. Dielectric Unions: Brass or Bronze unions required at connection to copper piping.
   10. Manufacturer: Mason VMN, or approved.

2.07 PIPING SPECIALTIES

A. Escutcheons:
   1. General Purpose:
      a. Construction:
         1) 2” diameter opening and smaller: Cast brass, nickel-plated with set screw.
         2) Over 2” diameter opening: Chrome plated stamped steel.
      b. Size: Sufficient to cover sleeves and openings.

B. Strainers:
   1. Body:
      a. At steel pipe, iron or steel.
      b. At copper pipe, bronze or brass.
   2. Rated Working Pressure:
      a. High pressure steam: 250 psig minimum.
      b. All others: 125 psig minimum.
   3. Pattern: Self-cleaning Y with blow-off connection.
   4. Basket:
      a. 2-1/2 inch and larger: 0.045 inch perforated, type 304 stainless steel.
      b. 2 inch and smaller: 20 mesh monel.
   5. Manufacturer: Fabrotech, Sarco, Hoffman, Keckley, Meuller, Armstrong, Hayward, Wheatley, Streamflow, Victaulic, or approved.

C. Unions for steel pipe:
   1. Body: Iron
   2. Seat: Brass.
   3. Rated Working Pressure:
      a. Domestic Water: 125 psi minimum.
      b. Hydronic: 250 psi minimum at 210 degrees F.
      c. Steam: 300 psi in MPS and MPCS, 150 psig in LPS, MPC, LPC and PC.
   4. Connection: Screwed or flanged to match pipe.

D. Unions for copper pipe:
   1. Body: Bronze.
   2. Seat: Brass.
   3. Rated Working Pressure:
      a. Domestic Water: 125 psi minimum.
      b. Hydronic: 250 psi minimum at 210 degrees F.
   4. Connection: Screwed, brazed, or flanged to match pipe.

E. Unions for connecting copper pipe to steel pipe, 2-1/2 inch and smaller:
   1. Description: Red brass body and seat. Gasketed dielectric unions will not be permitted by owner's standards. See Detail on drawings.
   2. Rated Working Pressure: 250 psig minimum at 210 degrees F.
   3. Connection: Screwed or brazed, to match pipe.

2.08 PIPE SUPPORTS

A. General: Notwithstanding other finish requirements herein, provide Pre-Galvanized, Hot-Dip Galvanized, or Stainless Steel support components, with fasteners as follows:
   1. Hot-dip galvanized supports: Provide stainless steel fasteners and fittings.
   2. Pre-galvanized supports: Provide zinc-plated fasteners and fittings.

B. Ring Hangers for Pipe Sizes 3 inch and smaller:
   1. Type: Carbon steel band, adjustable, with knurled swivel nut.
   2. Finish:
      a. Indoors: Zinc plated.
      b. Outdoors or Wet Areas: Hot dip galvanized.
   3. Approvals: UL and FM.
   4. For uninsulated copper piping: Equivalent to model specified, with addition of copper plating, neoprene coating, or PVC coating.
   5. Manufacturer:
      a. Anvil Fig. 70
      b. B-Line Fig. B 3170
      c. Super Strut C-727
      d. PHD Model 151
      e. Erico/Michigan Model 100

C. Hanger Rods:
   1. Material: Carbon steel.
   2. Finish:
      a. Indoors: Zinc plated.
      b. Outdoors or Wet Areas: Hot dip galvanized.

D. Insulated Pipe Shields for Use at Pipe Supports:
   1. Type: Preformed pipe insulation with an insulation shield.
   2. Insulation (Pipe sizes 1-1/4 inch through 3 inch), except steam and steam condensate piping:
      a. Type: Rigid, polyisocyanurate foam, preformed to fit pipe size.
      b. Conductivity ("k"): Not to exceed 0.19 at 75 degrees F mean temperature.
      c. Thickness: To match adjacent pipe insulation. See Section 22 1410.
      d. Length: To match insulation shield.
      e. Manufacturer: Dow “Trymer 2000".
   3. Insulation (Pipe sizes 4 inch and larger and steam and steam condensate piping):
      a. Type: Rigid, hydrous calcium silicate, premolded to fit pipe size.
      b. Density: 14 pounds per cubic foot.
      c. Conductivity ("k"): Not to exceed 0.36 at 75 degrees F mean temperature.
      d. Temperature Rating: 1200 degrees F.
      e. Manufacturer:
         1) Manville "Thermo-12"
         2) Owens Corning "Kaylo 10"
   4. Insulation Jacket:
      a. Type: .016 inch thick aluminum, preformed to fit pipe.
      b. Finish: Stucco embossed pattern.
      c. Moisture Barrier: Kraft or polyethylene.
   5. Insulation Shield:
      a. Type: Galvanized steel, 2 overlapping pieces, full 360 degree.
      b. Minimum Thickness:
         1) Pipe Sizes 1-1/4 to 2 inch: 24 gauge
         2) Pipe Sizes 2-1/2 to 3 inch: 20 gauge
      c. Minimum Length: 12 inch.
   6. Manufacturer: E.J. Bartells, ISSI Product Inc., Pipe Shields Inc., Erico/Michigan, or field fabricated with components specified herein.

E. Wall Supports & Trapeze Assemblies:
   1. Description: Field fabricate of manufactured channel components.
   2. Channels: Pre-Galvanized, Hot-Dip Galvanized, or Stainless Steel channel strut components.
   3. Pipe Supports: U-bolt, U-strap, or roller type components in accordance with those specified herein and compatible with manufactured channel system.
   4. Trapeze Size: Trapeze size, type and load rating selected by this Section for span and total weight supported. Provide sizing criteria with product data submittal.

2.09 SLEEVES AND SEALS

A. Sleeves:
   1. Material: Galvanized steel.
   2. Minimum Gauge: 20 gauge minimum.
   3. Minimum Size: 1/2 Inch larger than diameter of pipe, including insulation.

PART 3 EXECUTION

3.01 GENERAL

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

B. Install piping plumb and parallel true to building structural system.

C. Where possible, use full 20 foot lengths.

D. Install branch piping to allow for expansion with offsets and swing joints as necessary to prevent undue strain.

E. Do not use bushings and close nipples.

F. Do not penetrate structural members.

G. Screwed joints shall have less than two percent of threads showing.

H. Ream pipes to full inside diameter prior to making up joints.

I. Comply with applicable IAPMO Installation Standard for each particular piping material.

J. Make branches and elbows with fittings specified herein. "Pulled tees", saddle taps, and field fabricated fittings are not acceptable.

K. Testing of Piping Systems:
   1. Advise Architect or authorized representative when testing will be performed.
   2. Test before concealing pipe joints and welds.
   3. Before testing, isolate all equipment or components which are not rated for test pressures.
   4. Record temperature at start and finish of test. Pressure readings at finish of test shall be adjusted to account for temperature change of medium during the test.
   5. Test pressures shall be as specified herein for each type of piping system.
   6. Comply with testing requirements of authorities having jurisdiction, in addition to requirements specified herein.
   7. Piping systems shall hold test pressure for a minimum of one hour with no leakage.

3.02 HYDRONIC PIPING

A. Conform to applicable portions of ANSI/ASME B31.9 Building Services Piping.

B. Make connections between steel and copper pipe in accessible locations, using red brass unions or isolation flanged connections, as determined by pipe size.

C. Install piping level, using eccentric reducers as required to have and even plane on top for venting air.

D. Provide manual air vents at system high points and where shown on Drawings.

E. At low points of systems, provide ball valves with caps for drainage.

F. Test Pressure: Fill system with water and pressurize to 150 psig.

3.03 PIPING SPECIALTIES

A. Escutcheons:
   1. Install on exposed pipe through walls, floors, or ceilings.
   2. Secure escutcheon to pipe and wall.
   3. Escutcheons not required in mechanical rooms.

B. Strainers:
   1. Install upstream of each control valve, automatic valve, steam trap, solenoid valve, and where shown on Drawings.
   2. Strainer shall be same size as pipe.
   3. For water and condensate piping, install strainer with "Y" pointing down.
   4. For steam piping, install strainer with "Y" horizontal, to allow condensate to drain.
   5. Provide clearance for basket removal.

C. Unions for steel pipe:
   1. Provide unions as follows:
      a. Where indicated on Drawings.

b. At each automatic control valve.
c. As required for removal of pumps, steam traps, and equipment with piping connections.

D. Unions for copper pipe:
1. Provide unions as follows:
a. Where indicated on Drawings.
b. At each automatic control valve.
c. As required for removal of pumps, steam traps, and equipment with piping connections.

E. Unions for connecting copper pipe to steel pipe, 2-1/2 inch and smaller:
1. Provide specified brass unions as follows:
a. Where indicated on Drawings.
b. At connection points between copper and steel pipe.
c. Install in accessible locations.

3.04 PIPE SUPPORTS

A. General:
1. Refer to Section 22 1410 to determine pipe insulation requirements.
2. Supports for the following shall bear directly on the pipe:
a. Uninsulated pipe.
b. 1 inch and smaller domestic hot water and heating water pipe.
3. Size hangers to fit outside of pipe insulation, except where hangers shall bear directly on the pipe.
4. Provide pipe support shoe welded to pipe at each roller hanger.
5. Comply with applicable IAPMO Installation Standard for particular piping material.

B. Insulated Pipe Shields:
1. Provide insulated pipe shield at each support, except as follows:
a. Pipe sizes 1 inch and smaller.
b. Where supports are permitted to bear directly on the pipe.
c. Where support shoes are required.
2. Secure insulation with 16 gauge stainless steel wire, stainless steel bands, or nylon tape as recommended by insulation manufacturer.
3. Cover pipe insulation with aluminum jacket and preformed fitting covers.
4. For cold pipe installations, seal seams and joints in jacket with vapor barrier mastic or tape, to provide a continuous positive vapor barrier.

C. Steel Pipe, Horizontal:
1. Support within 2 feet of each direction change.
2. Maximum spacing of supports:

Pipe Size	Rod Diameter	Maximum Spacing
1 inch and smaller	3/8 inch	7 feet 0 inches
1-1/4 inch - 2 inch	3/8 inch	10 feet 0 inches
2-1/2 inch - 3-1/2 inch	1/2 inch	10 feet 0 inches

D. Copper Pipe, Horizontal:
1. Support within 2 feet of each direction change.
2. Maximum spacing of supports:

Pipe Size	Rod Diameter	Maximum Spacing
1-1/2 inch and smaller	3/8 inch	6 feet 0 inches
2 inch and larger	3/8 inch	10 feet 0 inches

E. Cast Iron Pipe, Horizontal:
1. For joints less than 4 feet o.c.: Support at every other joint.

2. For joints 4 feet or greater o.c.: Support at every joint.
3. Support at every horizontal branch.
4. Maximum spacing of supports: 10 feet o.c.

F. Plastic Pipe, Horizontal:
1. Support 4 foot maximum on center or provide a continuous channel cradle support under pipe per pipe manufacturer's recommendations.
2. Support to permit axial movement.

3.05 SLEEVES AND SEALS

A. Install sleeves and seals at pipe penetrations through walls and floors. Insulation shall be continuous through penetrations. Coordinate with pipe insulation requirements in Section 22 1410.

B. Caulk between pipe and sleeve at penetrations of walls and floors which are not fire-rated.

END OF SECTION

SECTION 22 13 00

VALVES

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Ball Valves		X						
Check Valves		X						
Pressure Regulating Valves		X						

PART 2 PRODUCTS

2.01 BALL VALVES

A. Potable Water Services (CW):
   1. Type: Full port, 2-piece body with stainless steel trim, approved for use in potable water systems.
   2. Body: Bronze.
   3. Rated Working Pressure: Minimum of 150 psig steam; 600 psig WOG.
   4. Handle:
      a. Uninsulated Pipe: Standard lever handle.
      b. Insulated Pipe: Extended lever handle.
   5. Ends: Soldered or threaded.
   6. Stem and Ball: 316 stainless steel.
   7. Seat and Seals: MPTFE, RPTFE, PTFE, TFE, or Buna-N.
   8. Standards:
      a. Domestic Potable Water System: Comply with ANSI/NSF 372, ANSI/NSF 61-9 Annex G.
      b. MSS SP-110.
   9. Manufacturer: Apollo 77CLF-140 (threaded) or Apollo 77CLF-240 (soldered)

B. Non-Potable or Industrial Water Services (ICW, IHW, IHWR):

1. Type: Full port, 2-piece body with stainless steel trim.
2. Body: Bronze.
3. Rated Working Pressure: Minimum of 150 psig steam; 600 psig WOG.
4. Handle:
    a. Uninsulated Pipe: Standard lever handle.
    b. Insulated Pipe: Extended lever handle.
5. Ends: Threaded or soldered.
6. Stem and Ball: 316 stainless steel.
7. Seat and Seals: MPTFE, RPTFE, PTFE, TFE, or Buna-N.
8. Standards: Comply with MSS SP-110.
9. Manufacturer: Crane, Worcester, Apollo, Watts, Hammond, Grinnell, Milwaukee, WKM, Jomar, or approved. Similar to Apollo 77C-140 (threaded) or Apollo 77C-240 (soldered).

C. Ball Valves In Hydronic Systems (HS, HR, CHS, CHR) and Process Cooling Water Systems (PCWS, PCWR):
1. Type: Full port, 2-piece body with stainless steel trim.
2. Body: Bronze.
3. Rated Working Pressure: Minimum of 150 psig steam; 600 psig WOG.
4. Handle:
    a. Uninsulated Pipe: Standard lever handle.
    b. Insulated Pipe: Extended lever handle.
5. Ends: Threaded, to allow removal of valve in piping.
6. Stem and Ball: 316 stainless steel.
7. Seat and Seals: MPTFE, RPTFE, PTFE, TFE, or Buna-N.
8. Standards: Comply with MSS SP-110.
9. Manufacturer: Crane, Worcester, Apollo, Watts, Hammond, Grinnell, Milwaukee, WKM, Jomar, or approved. Similar to Apollo 77C-140 (threaded).

D. Ball Valves In Nitrogen (N) and Compressed Air (A) Services:
1. Type: Full port, three piece, double seal, cleaned and bagged for oxygen service.
2. Body: Bronze or brass.
3. Ball: Chrome plated brass.
4. Seats, Seals, Lubricants, and Materials: Suitable for oxygen service.
5. Maximum Allowable Pressure: 600 psig at 100 deg F.
6. Tube Extensions: Type K copper with gauge port with brass plug.
7. Manufacturer: Beacon Medaes, Allied Healthcare, Hill-Rom or approved.

E. Ball Valves In Vacuum (VAC) Services:
1. Type: Full port, 2-piece body with stainless steel trim.
2. Body: Bronze.
3. Rated Working Pressure: Vacuum service to 29 inches Hg.
4. Handle: Standard lever handle.
5. Ends: Threaded or soldered.
6. Stem and Ball: 316 stainless steel.
7. Seat and Seals: MPTFE, RPTFE, PTFE, TFE, or Buna-N.
8. Standards: Comply with MSS SP-110.
9. Manufacturer: Crane, Worcester, Apollo, Watts, Hammond, Grinnell, Milwaukee, WKM, Jomar, or approved. Similar to Apollo 77C-140 (threaded) or Apollo77C-240 (soldered).

F. Ball Valves in Pure Water Services (RO, DI):
1. Body: Schedule 80 PVC.
2. Seats: EPDM O-rings.
3. Rated for 150 PSI water service at 73°F water non-shock.
4. Connection: NPT Threaded.
5. Manufacturer: Nibco/Chemtrol Model T45CE-E, or approved

2.02 CHECK VALVES

A. Nitrogen Check Valve:
   1. Description: Brass and bronze construction, 400 psig WOG, EPR-seated, spring-loaded, 0.5 psig opening pressure, cleaned and bagged for oxygen service.
   2. Manufacturer: Beacon Medaes Pipeline Check Valve, or approved.

2.03 PRESSURE REGULATING VALVES

A. Pressure Reducing Valve, Water (Process Cooling Water):
   1. Body: Bronze.
   2. Seat: Renewable steel.
   3. Strainer: Integral stainless steel.
   4. Diaphragm: High temperature.
   5. Range: Adjustable.
   6. Relief: Built in by-pass not allowing reduced pressure to exceed main pressure.
   7. Manufacturer: Watts, Cash-Acme, McDonnell-Miller, Wilkins or approved. Similar to Watts Model U5B (U5BLP for reduced pressures below 25 psig).

PART 3 EXECUTION

3.01 GENERAL

A. Valves shall be full line size, except where noted otherwise.

B. Install valves in locations which are accessible without damage to finished walls and ceilings.

C. Where possible, position valve operator towards access opening.

END OF SECTION

SECTION 22 14 10

PIPING INSULATION

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 22 1100 - Piping: Pipe Supports, Insulated Pipe Shields

1.02 QUALITY ASSURANCE

A. Products shall have flame spread and smoke developed ratings based on test procedures in accordance with NFPA-255 and UL-723. Ratings shall be indicated on the product or on the shipping cartons.

B. Unless otherwise specified herein, products shall have flame spread ratings not to exceed 25 and smoke developed ratings not to exceed 50.

C. Products shall comply with the requirements of Oregon Revised Statute (ORS) 453.005 (7) (e), effective January 1, 2011. The referenced statute limits the use of three types of brominated fire retardant chemicals, which are defined as hazardous substances.

1.03 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information required for the products listed in the Product Table, indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
   3. Manufacturer's Operation Manuals
   4. Manufacturer’s Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Pipe Insulation		X						
Jackets and Fitting Covers		X						
Accessories		X						

PART 2 PRODUCTS

2.01 PIPE INSULATION

A. Preformed Fiberglass (FG):
   1. General: Preformed to fit pipe size, with factory applied vapor barrier facing.
   2. Conductivity ("k"): Not to exceed 0.24 at 75 degrees F mean temperature.
   3. Vapor Barrier Facing:

a. General: Factory applied glass fiber reinforced aluminum foil laminate.
b. Permeability: Not to exceed 0.02 perms.
c. Closure System: Self-sealing pressure sensitive lap.

4. Manufacturer and Model: Owens Corning "Evolution Paper-free ASJ", or approved.

B. Polymer Foam (PF):
1. Type: Flexible, flexible engineered polymer foam, pre-slit tubing.
2. Joining System: Pre-slit, pre-glued, with peel-off release liner.
3. Conductivity ("k"): Not to exceed 0.24 at 75 degrees F mean temperature.
4. Manufacturer: Nomaco K-Flex "Imcolock", Thermacell or approved.

2.02 JACKETS AND FITTING COVERS

A. Polyvinyl Chloride Jackets and Fitting Covers (PVC):
1. Type: White PVC, preformed to fit pipe and fittings, UV-resistant.
2. Shapes: Elbows, tees, valves, reducers, flanges, and end caps; in various sizes including Zest-on Flanged Gate Valve Fitting Covers or similar style cover sized to provide complete coverage of balancing valves and flow control valves.
3. Thickness:
a. Indoors: Minimum 20 mils (.020 inches, 0.75 mm).
b. Outdoors: Minimum 30 mils (.030 inches, 0.75 mm).
4. Manufacturer:
a. Johns Manville "Zeston 2000"
b. Certain-Teed "Snap Form"
c. Ceel-Co "Ceel-Tite 300"
d. Knauf "PVC Fitting Covers

2.03 ACCESSORIES

A. Insulating Cement: Comply with ANSI/ASTM C195.

B. Finishing Cement: Comply with ASTM C449.

C. Mastic, Coatings, Tapes, and Adhesives: Comply with Manufacturer's installation instructions for each type of insulation.

PART 3 EXECUTION

3.01 DEFINITIONS

A. Above Ground:
1. Includes:
a. Items inside buildings, except direct-buried below slab-on-grade floors.
b. Items inside tunnels and buried pipe chases.

B. Exposed in Finished Spaces:
1. Includes:
a. Items inside buildings.
2. Does not include:
a. Items concealed by permanent ceilings, floors, or walls.
b. Items in tunnels.
c. Items in mechanical rooms

C. Hot Pipe: Piping, fittings, equipment, or accessories handling media at design temperatures above 105 degrees F.

D. Cold Pipe: Piping, fittings, equipment, or accessories handling rain water, potable cold water, and media at design temperature of 60 degrees F or below.

3.02 GENERAL

A. Install products in accordance with Manufacturer's instructions.

B. Install products in accordance with MICA (Midwest Insulation Contractors Association) - National Commercial & Industrial Insulation Standards.

C. Insulate new pipe, fittings, valves, and specialties for each piping system included under APPLICATION TO PIPING SYSTEMS.

D. Insulate pipe, fittings, valves, and specialties where existing insulation is removed to facilitate the remodel work.

E. Insulate pipe, fittings, valves, and specialties where insulation was previously removed under separate abatement contracts.

F. Where insulated piping is to be removed, report any portions which appear to be existing friable insulation to Architect. Repair and removal of asbestos are not part of this work.

G. Verify piping has been tested and approved before installing insulation.

H. Clean and dry piping before installing insulation.

I. Piping with electric heating cable:
   1. General: Verify that electric heating cable, if required, has been installed and tested, prior to installation of insulation.
   2. Thickness:
      a. For nominal pipe sizes 1/2 inch - 1 inch provide 1 inch thick insulation.
      b. For nominal pipe sizes 1-1/4 inch - 2 inch provide 1-1/2 inch thick insulation.
      c. For nominal pipe sizes 2-1/2 inch and larger provide 2 inch thick insulation.
   3. Sizing: For pipe sizes 1-1/4 inch and smaller, use 1/4 inch larger diameter insulation to allow room for installation over cable.

J. On exposed piping, locate insulation seams in least visible location.

K. Insulation shall be continuous through walls, floors, ceilings, sleeves, and other penetrations. Where penetrations through non-structural framing members would require openings larger than allowed by the Oregon Structural Specialty Code or Oregon Mechanical Specialty Code (Section 302), fill maximum allowable size annulus with polyurethane expanding foam sealer. Trim foam sealer flush with framing member, butt insulation tight to foam, and seal vapor barrier to framing member.

L. Label insulation that covers unions. Refer to Section 20 6000 for labeling requirements.

M. Fill joints, cracks, seams, and depressions with canvas and finishing cement to form smooth surfaces.

3.03 TEMPERATURE-SPECIFIC REQUIREMENTS

A. Cold Pipe Installation Requirements:
   1. Seal seams and joints in vapor barrier facings, fitting covers, and insulation jackets with vapor barrier mastic or tape, to provide a continuous positive vapor barrier.
   2. At interruptions in insulation, seal ends of insulation to provide a continuous vapor barrier. For insulation with vapor barrier, seal with canvas or fiberglass cloth sealed with vapor barrier mastic. For insulation with PVC or aluminum jacket, seal ends with reducer endcaps, same material as jacket, tight to pipe surface and seal to pipe surface with vapor barrier mastic.
   3. For Cold Pipe do not insulate the following:
      a. Exposed supplies at plumbing fixtures
      b. Pressure reducing valves
      c. Reduced pressure backflow preventers located in mechanical rooms

d. Water hammer arresters
e. Trap primer valves
f. Vacuum breakers
g. Pressure relief valves
h. Strainer access covers
i. Control valve actuators
j. Test plugs
k. Air vents

B. Hot Pipe Installation Requirements:
1. In addition to tape system, staple insulation vapor barrier laps with outward clinch monel staples, 4 inches on center.
2. In addition to tape, secure fitting covers with serrated stainless steel tacks.
3. At interruptions in insulation, seal ends of insulation to cover exposed insulation. For insulation with vapor barrier, seal with canvas or fiberglass cloth sealed with mastic. For insulation with PVC or aluminum jacket, seal ends with reducer endcaps, same material as jacket, tight to pipe surface and seal to pipe surface with mastic.
4. For Hot Pipe, do not insulate the following:
a. Water hammer arresters
b. Vacuum breakers
c. Pressure relief valves
d. Strainer access covers
e. Steam traps 1 inch or smaller
f. Control valves 1 inch or smaller
g. Control valve actuators
h. Test plugs
i. Air vents
j. Flow control valves 1 inch or smaller
k. Balancing valves 1 inch or smaller

3.04 INSULATION AT PIPE SUPPORTS

A. Refer to Section 22 1100 for insulated pipe shields at pipe supports. At insulated pipe shields, lap insulation vapor barrier over cover of pipe shield and seal with factory approved vapor barrier tape. Seal longitudinal seams of pipe shield cover with vapor barrier tape or mastic. For piping where PVC or aluminum jacket is required, jacket shall be continuous over insulated pipe shields.

B. Refer to Section 22 1100 for pipe support shoes at pipe supports. At pipe support shoes, fully insulate pipe around support shoe. Fill support shoe cavity with unfaced fiberglass insulation. For piping where PVC or aluminum jacket is required, jacket shall be continuous over support shoes.

C. For heating water, condenser water, and domestic hot water pipes on ring hangers and clevis hangers where supports bear directly on the pipe per Section 22 1100, insulation shall cover the hanger, with cutout at the top of hanger. Fill hanger cutout with unfaced fiberglass insulation and seal vapor barrier with pressure sensitive tape to match vapor barrier facing.

D. For heating water and domestic hot water pipes on channel strut where supports bear directly on the pipe per Section 22 1100, insulation shall be butted or trimmed tight to the side of the channel strut.

3.05 FIBERGLASS PIPE INSULATION (FG)

A. General:
1. Secure longitudinal laps in insulation vapor barrier with factory applied pressure sensitive tape system and outward clenching staples.
2. Secure butt joints in insulation vapor barrier with pressure sensitive tape to match vapor barrier.

3. Insulate fittings and valves (unless noted otherwise) with fiberglass fitting inserts and PVC Fitting Covers.

3.06 ENGINEERED POLYMER FOAM PIPE INSULATION (PF)

A. Seal pre-glued longitudinal seams with factory approved seam roller.

B. Seal butt joints with manufacturer approved contact adhesive or fuse seal system.

C. Insulate fittings with oversize pipe insulation or miter-cut pieces of pipe insulation, joined with manufacturer approved contact adhesive or fuse seal system, to provide a continuous positive vapor barrier.

D. For piping through studs with plastic or nylon stud inserts cut insulation 1/4" longer than stud space for tight fit.

3.07 JACKETS AND FITTING COVERS

A. General:
   1. Provide Fitting covers as follows:
      a. On piping where type FG insulation is required provide fitting covers at pipe fittings, valves, and piping accessories.
      b. On steam and steam condensate piping provide fitting covers at pipe fittings, valves, and piping accessories.
      c. Insulated piping in areas "Subject to Damage."
      d. Insulated piping located outside building above ground.
      e. Valves where adjacent piping has jackets.
      f. Balancing Valves and Flow Control Valves, where adjacent piping has jackets.
   2. Provide Jackets as follows:
      a. Insulated piping Exposed in Finished Spaces.
      b. Insulated piping in areas "Subject to Damage."
      c. Insulated piping located outside building above ground.
      d. On steam and steam condensate piping.
      e. On piping where type CG insulation is required.
   3. Where jackets and fitting covers are required, use the following types:
      a. For Type FG insulation indoors: PVC (except where noted otherwise).
      b. CW piping 4" and over: AL.
      c. On steam and steam condensate piping: AL.
      d. Outdoors above ground: AL.
      e. On piping where type CG insulation is required: Type BL.
      f. Fitting covers shall be same material as jackets, except at Contractor's option Type EF insulation may be used as fitting covers on type FG insulation at flanged connections and grooved couplings.

B. Installation:
   1. General:
      a. Overlap seams 2 inches minimum and as indicated herein.
      b. Seal per manufacturer's recommendations.
   2. Polyvinyl Chloride Jackets and Fitting Covers (PVC):
      a. Fitting Covers:
         1) Lap PVC fitting covers over adjacent vapor barrier facing with end of overlap pointed downward.
         2) On indoor installations secure PVC fitting covers with fitting cover manufacturer's pressure sensitive tape and secure ends of tapes using outward-clenching staples.
         3) On outdoor installations seal fitting covers with cover manufacturer's solvent welding adhesive.
      b. Piping Jackets:

1) Lap PVC jackets over fitting covers with longitudinal seams of jackets on lower third of piping, and end of overlap pointed downward.
2) On indoor installations secure PVC fitting covers with fitting cover manufacturer's pressure sensitive tape and secure ends of tapes using outward-clenching staples.
3) On outdoor installations seal fitting jacket seams and seal jackets to fitting covers using cover manufacturer's solvent welding adhesive.

3.08 APPLICATION TO PIPING SYSTEMS

A. Domestic Cold Water (CW):
   1. Type: FG with PVC jacket for exposed piping. Or, at Contractor's option provide type PF.
   2. Thickness: 1". At Contractor's option, 1/2 inch thickness for branch lines up to 12 feet long for concealed piping serving individual fixtures.

B. Chilled Water (CHS, CHR) and Cooling Coil Condensate P-Trap:
   1. Type: FG with PVC jacket for exposed piping.
   2. Thickness: 1".

C. Heating Water (HS, HR):
   1. Type: FG with PVC jacket for exposed piping.
   2. Thickness: 1"

D. Process Cooling Water (PCWS, PCWR):
   1. Type: FG with PVC jacket for exposed piping.
   2. Thickness: 1"

END OF SECTION

SECTION 22 20 00

METERS AND GAUGES

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 10 00 - General Mechanical Provisions

B. Section 20 20 00 - Mechanical Operation and Maintenance Manuals

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 10 00. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 20 00.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 20 00 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Nitrogen Meter		X	X	X	X			

PART 2 - PRODUCTS

2.01 METERS

A. Nitrogen Meters:
   1. Description: Diaphragm type, diecast aluminum case, suitable for metering industrial nitrogen gas at 15 psi inlet pressure, direct reading in cubic feet.
   2. Maximum Allowable Operating Pressure: 25 psi with 1.5 safety factor. MAOP shall be stamped on meter nameplate.
   3. Manufacturer: Sensus 415 with 25 psi case. (formerly Equimeter 415) to match owner's meter standards.

PART 3 - EXECUTION

3.01 GENERAL

A. Install in accordance with manufacturer's recommendations.

B. Install the meter at an elevation that allows a user to read the meter at a readable height. Verify acceptable height with owner's representative before installation.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Emergency Eye Wash		X		X				X
Condensate Receptor		X						

PART 2 PRODUCTS

2.01 EMERGENCY FIXTURES

A. Emergency Eye Wash Station (EW-1) At New Sink:
   1. Usage and Accessibility: Emergency Spray eye/face and body wash and ADA Compliant.
   2. Fixture:
      a. Description: Deck-mounted, 3.6 gpm flow control, inline strainer, dust covers, instant stay-open lever valve, 8 foot flexible stainless steel hose, internal flow control and filter, in-line dual check backflow preventer, universal emergency sign.
      b. Backflow Preventer: ASSE 1024 approved in-line dual check installed on inlet of hose.
      c. Dimensions: 8 inch high.
      d. Material: ABS plastic shower head and dust cover, stainless steel lever valve.
      e. Supply: 3/8 inch IPS supply.
      f. Manufacturer: Watersaver or approved. Similar to Watersaver EW1022BP.

2.02 PLUMBING FIXTURES

A. CR-1 (Condensate Receptor)
   1. Acid resistant oval black resin polypropylene cup sink.
   2. Approximate Size: 5.7"L x 2.7"W x 3.7"D x 8.3"H.
   3. Manufacturer: Durcon Laboratory Tops, IPEX Labline, or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Install in accordance with manufacturer's instructions.

B. Install fixture traps easily removable for servicing and cleaning.

END OF SECTION

SECTION 22 51 00

HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Testing and Balancing Devices		X	X	X	X			
Manual Balancing Valves: Provide a schedule showing equipment tag, manufacturer's selected valve size and design GPM for each coil or equipment item.		X						

PART 2 PRODUCTS

2.01 AIR CONTROL DEVICES

A. Manual Air Vents:
   1. Description: Full line size tee with 6 inch high nipple, up to a 1/4 inch standard port ball valve, with 1/4 inch soft copper tube down to accessible location, terminating with 1/4 inch threaded bronze plug.

2.02 TESTING AND BALANCING DEVICES

A. Pressure / Temperature Test Plugs:
   1. Type: Automatic-sealing port to receive a 1/8 inch o.d. pressure or temperature probe.
   2. Body and Cap: Brass.
   3. Size: 1/2 inch N.P.T.
   4. Core: Dual seal, elastomeric, rated for 275 deg. F maximum operating temperatures.
   5. Extension: For up to 2 inch insulation thickness.
   6. Manufacturer: Sisco, Peterson Equipment Co., Hydro Temp, Flow Design Inc., or approved. Similar to Sisco P/T Plug Model BNO-500.

B. Manual Balancing Valves:
   1. Type: Multi-turn, equal percentage, 'Y' pattern, venturi, globe style valve with two threaded metering ports fitted with check valves for attaching a differential pressure meter.
   2. Valve Material:
      a. Sizes 1/2" - 2": Brass valve body with brass steam and plug or nonporous copper alloy.
      b. Sizes 2 1/2" - 12": Cast Iron with integral flanges or ductile iron with grooved ends with bronze stem and plug disc.
   3. Operator: Multi-turn handwheel with micrometer type indicator providing a minimum of four full 360 degree handwheel turns of adjustment. Concealed memory feature with locking tamper-proof setting.
   4. Accuracy Of Differential Pressure Measurement: +/- 5% minimum.
   5. Rated Working Pressure: 250 psig minimum.
   6. Rated Temperature: 225 deg. F minimum.
   7. Connections:
      a. Pipe sizes up to 2 inch: Threaded.
      b. Pipe sizes 2 1/2" and greater: Flanged.
   8. Valve Sizing: See "Part 3 Execution" hereafter.
   9. Manufacturer: Armstrong, Tour & Andersson, Wheatley, or approved. Similar to Armstrong CBV Series or Tour & Andersson TA series.

PART 3 EXECUTION

3.01 GENERAL

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

B. Manual Air Vents:
   1. Provide at system high points and where shown on Drawings.

3.02 TESTING AND BALANCING DEVICES

A. Manual Balancing Valves:
   1. The valve manufacturer, or authorized representative, shall be responsible for selecting the appropriate sized balancing valve for the equipment or piping flow rates shown on the contract drawings. Valve size will not necessarily be the same as the pipe size in which the valve is installed. Provide a schedule showing the selected valve size and flow rate for each equipment tag in the project.
   2. The valve shall be installed with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings.

END OF SECTION

SECTION 22 62 00

LABORATORY VACUUM EQUIPMENT

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 10 00 – General Mechanical Provisions

B. Section 2020 00 – Mechanical Operation and Maintenance Manuals

C. Section 22 11 00 - Piping

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 10 00. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 20 00.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 20 00 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Laboratory Vacuum Pump		X	X	X	X			

PART 2 PRODUCTS

2.01 VACUUM PUMPS

A. Laboratory Vacuum Pump (VP-1):
   1. Description: Portable vacuum pump used for aspirating acidic or basic solutions and organic solvents.
   2. Construction: PTFE, dry diaphram
   3. Oil-Free
   4. Rating:
      a. Free Air Displacement: 2.5 cfm @ 60 Hz
      b. Ultimate Pressure: 35 torr
      c. Maximum Vacuum: 28.5 ins. Hg
      d. Motor Horsepower: 1/5 h.p.
      e. Voltage: 115V, 60 Hz
   5. Adjustable Vac./Gas Ballast
   6. Tubing, I.D. Ins: 1/4
   7. Intake (Exhaust) Threaded NPT: M14 (1/8)
   8. Weight: 21.25 lbs
   9. Overall Dimensions: 13.8" L x 6.8"W x 8.8"H

10. Accessories: Red vacuum hose and clamps for vacuum pump discharge, thick walled for vacuum applications.
11. Manufacturer: Welch Dryfast Model 2047B-01, or approved.

PART 3 EXECUTION

3.01 GENERAL

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

3.02 VACUUM PUMPS

A. Provide start-up by manufacturer's authorized representative.

B. Submit start-up report.

END OF SECTION

SECTION 23 07 00

DUCTWORK INSULATION

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 QUALITY ASSURANCE

A. Products shall have flame spread and smoke developed ratings based on test procedures in accordance with NFPA-255 and UL-723. Ratings shall be indicated on the product or on the shipping cartons.

B. Unless otherwise specified herein, products shall have flame spread ratings not to exceed 25 and smoke developed ratings not to exceed 50.

C. Products shall comply with the requirements of Oregon Revised Statute (ORS) 453.005 (7) (e), effective January 1, 2011. The referenced statute limits the use of three types of brominated fire retardant chemicals, which are defined as hazardous substances.

1.03 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
   3. Manufacturer's Operation Manuals
   4. Manufacturer’s Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Duct Insulation		X				X		
Accessories		X						

PART 2 PRODUCTS

2.01 DUCT INSULATION

A. Flexible Duct Liner:
   1. Type: Flexible fiberglass liner in roll form with black mat coating exposed to airstream.
   2. Noise Reduction Coefficient: Not less than 0.7, in accordance with ASTM C-423-81a.
   3. Conductivity ("k"): Not to exceed 0.24 at 75 degrees F mean temperature.
   4. Maximum Service Velocity: Not less than 4,000 feet per minute.
   5. Manufacturer: CertainTeed, Knauf, Owens Corning, Johns Manville, or approved. Similar to Johns Manville “Duct Liner PM.”

B. Fiber Free Duct Liner (Elastomeric Foam):
   1. Type: Fiber Free, mold resistant, noise reducing, flexible, closed cell, elastomeric sheet.
   2. Conductivity ("k"): Not to exceed 0.27 at 75 degrees F mean temperature.
   3. Flame Spread Index: Not to exceed 25.
   4. Smoke Developed Index: Not to exceed 50.
   5. Mold Growth: UL 181.
   6. Fungi Resistance: ASTM G21/C1338.
   7. Bacterial Resistance: ASTM G22.
   8. Sound Transmission Class: 25 for 1” nominal thickness.
   9. Approved Manufacturer: Armaflex CoilFlex Duct liner, K-FLEX USA Duct Liner, or approved.

2.02 ACCESSORIES

A. Mastic, Coatings, Tapes, and Adhesives: Comply with manufacturer's installation instructions for each type of insulation.

PART 3 EXECUTION

3.01 GENERAL

A. Prior to installation of insulation, verify that:
   1. Ductwork has been tested and approved.
   2. Duct seams have been sealed.
   3. Duct surfaces are clean and dry.

B. Do not insulate the following:
   1. Pre-insulated underground ducts.
   2. Ducts constructed of fiberglass duct board, unless otherwise noted.
   3. Duct access doors. Tape insulation to duct around duct access door

C. Install products in accordance with manufacturer’s recommendations.

D. Install products in accordance with MICA (Midwest Insulation Contractors Association) - National Commercial & Industrial Insulation Standards.

E. Definitions:
   1. Outside Air Ducts: Ducts conveying untempered outside air.
   2. Tempered Air Ducts: Ducts conveying air within 15 degrees F of conditioned space setpoint temperature.
   3. Vented Spaces: Includes unconditioned spaces (attics, crawl spaces, vented mechanical rooms) outside the building envelope.
   4. Unconditioned spaces & plenums: Includes unconditioned, unvented spaces such as unvented mechanical rooms, shafts, or plenums (with or without return air) within the building envelope.

3.02 FIBERGLASS BLANKET INSULATION WITH VAPOR BARRIER

A. Fully wrap duct, with facing to the outside.

B. Overlap vapor barrier facing 2 inches minimum at seams and joints.

C. Seal all seams, joints, and penetrations with foil-faced pressure sensitive tape of same material as insulation facing, to provide a continuous vapor barrier.

D. On ducts 24 inches or more in width, secure insulation on underside of ducts with stick pins 18 inches maximum on center, 6 inches minimum from edges of duct. Cut pins off flush with washer and seal with vapor barrier tape.

3.03 APPLICATION TO DUCT SYSTEMS

A. Supply Ducts From Fan Coil Units Shown With Internal Liner:
   1. Insulation Type: Fiber Free Elastomeric Foam Duct Liner.
   2. Insulation Thickness: 1 inch.

B. Return and Exhaust Air Ducts Shown With Internal Liner For Acoustic Attenuation:
   1. Insulation Type: Fiberglass duct Liner.
   2. Insulation Thickness: 1 inch.

END OF SECTION

SECTION 23 09 00

CONTROLS - BUILDING AUTOMATION SYSTEM

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 20 6000 - Mechanical Identification

D. Section 20 9100 - Testing, Adjusting, and Balancing

E. Section 23 1000 - Controls Sequences of Operations

F. Section 23 8220 - Terminal Heat Transfer Units

1.02 WORK INCLUDED

A. Building Automation System (BAS) Contractor shall provide new BAS components networked into existing building BAS panels, incorporating direct digital control (DDC) for temperature control and monitoring.

B. Provide engineering, installation, calibration, software, software programming, and checkout for complete and fully operational BAS. The following shall be included:
   1. Workstation operator graphics and user interface access to BAS equipment in project shall be added to existing campus workstation/s as directed by University Facilities. Include building floor plan with new equipment shown overlayed.
   2. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.
   3. Provide equipment cabinets, panels, data communication network cables and associated hardware, including controls for items indicated on Drawings and described hereinafter including sensors, switches, relays, transformers, thermostats, temperature sensors, control panels and central processing hardware and software.
   4. Install interconnecting cables between supplied cabinets, application controllers and input/output devices.
   5. Provide system installation, startup, commissioning, adjustment and validation of the control system.
   6. Owner training.
   7. Provide as-built documentation in Operation and Maintenance manuals.
   8. Provide network cable and conduit run from the laboratory BAS controller/s to the existing PXCM panel installed in the adjacent mechanical room serving the Process Cooling Water System.
   9. Provide UPS for new control panel/s required by this Section.

1.03 WORK BY OTHERS

A. Installation of sensor wells and temperature control valves furnished by BAS manufacturer.

1.04 SYSTEM DESCRIPTION

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. The installing manufacturer shall certify in writing, that the shop drawings have been prepared by the equipment manufacturer and that the equipment manufacturer has supervised their installation. In addition, the equipment manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.

B. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specifically for this project.

C. The system shall be scalable in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, and operator devices.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O, and data collection. The failure of any single component or network connection shall not interrupt the execution of any control strategy, reporting, alarming and trending function, or any function at any operator interface device.

E. DDC Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC Controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central or intermediate processing device.

F. DDC Controllers shall be able to assign password access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust or control only the points that the operator is authorized for. All other points shall not be displayed at the PC workstation or portable terminal. (e.g. all base building and all tenant points shall be accessible to any base building operators, but only certain base building and tenant points shall be accessible to tenant building operators). Passwords and priority levels for every point shall be fully programmable and adjustable.

1.05 APPROVED CONTROL SYSTEMS AND VENDORS

A. Direct Digital Control system components and shall be as manufactured, designed, and installed by local or regional branch office of Siemens Building Technologies Division, and shall utilize the APOGEE Product line.

B. Inclusion herein does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.
   1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.
   2. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.06 QUALITY ASSURANCE

A. The BAS system shall be designed and installed, commissioned and serviced by manufacturer factory trained personnel employed manufacturer or manufacturer representative. Manufacturer shall have an in-place support facility within 2 hours response time of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. Distributors or licensed installing contractors are not acceptable.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.

D. BAS shall comply with UL 864 UUKL and 864 UDTZ, and other subsystem listings as applicable, and herein specified, where required for operation of fire& life safety systems.

E. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

1.07 REFERENCE STANDARDS

A. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof , shall govern design and selection of equipment and material supplied:
   1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
   2. ANSI/ASHRAE Standard 135-2004, BACnet.
   3. Uniform Building Code (UBC), including local amendments.
   4. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
   5. National Electrical Code (NEC).
   6. FCC Part 15, Subpart J, Class A
   7. EMC Directive 89/336/EEC (European CE Mark)
   8. UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences
   9. Owner's Standards: University of Oregon Campus Construction Standards in effect at the time of bid. Refer to http://facilities.uoregon.edu/?q=node/608.

B. City, county, state, and federal regulations and codes in effect as of contract date.

C. Except as otherwise indicated the system supplier shall secure and pay for permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

1.08 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Drawings:
   1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval, as indicated in Product Table included herein.
   2. Drawings shall be submitted in the following standard sizes: 8.5"x11" and 11" x 17".
   3. Drawings shall be made available on DVD or CD-ROM.

C. Project Management:
   1. The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases. Schedule shall show all the target dates for transmission of project information and documents and shall indicate timing and dates for system installation, debugging, and commissioning.

D. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Index sheet, listing contents in alphabetical order							X	
Valve schedules		X	X					

PRODUCT TABLE	Operation & Maintenance Information							
	1	2	3	4	5	6	7	8
Index sheet, listing contents in alphabetical order							X	
Damper Schedules		X	X					
Equipment data cut sheets for equipment to be furnished as part of this project		X	X	X				
Point List	X							
System Schematics, including: Sequence of operations, point names and addresses, Wiring diagrams, Panel layouts, and System riser diagrams	X						X	
Logic flow diagrams for digital control sequences	X							
Acceptance test procedure list					X		X	
Manufacturer's equipment parts list of functional components of system, and data sheets for equipment furnished.							X	
AutoCAD disk and hard copy of system schematics, including wiring diagrams.							X	
Description of sequence of operations							X	
Auto-CAD compatible as-installed drawings.							X	
As-installed logic flow diagrams for digital control sequences.							X	
As-installed interconnection wiring diagrams							X	
Operator's Manual							X	
Trunk cable schematic showing remote electronic panel locations, and trunk data.							X	
List of connected data points, including panels to which they are connected and input device (detector, thermostat, etc.)							X	
Software programming literature.							X	
Conduit routing diagrams							X	

1.09 TRAINING

A. Contractor shall provide training in operation, maintenance, and programming of DDC system for Owner Designated Personnel. Training shall be presented by factory trained instructor, provided through installing control system manufacturer, to give full instruction to designated personnel in operation of system installed. Instructors shall be thoroughly familiar with subject matter they are to teach. Training shall conform to, and include, the following:
   1. Provide 2 hours of training for Owner's designated operating personnel.
   2. Students shall be provided with binder containing product and system specific training modules for system installed. Minimum of one copy per student plus one extra copy.
   3. Training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays, on dates and times as selected by Owner.
   4. Explanation of drawings, operations and maintenance manuals.
   5. Walk-through of job to locate control components.
   6. Operator workstation and peripherals.
   7. DDC controller and ASC operation/function.
   8. Operator control functions including graphic generation and field panel programming.
   9. Explanation of adjustment, calibration and replacement procedures.

1.10 WARRANTY

A. Warranty shall cover costs for parts, labor, associated travel, and expenses for a period of one year from completion of system acceptance.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday through Friday, 48 hours on Saturday and Sunday. Factory authorized warranty service shall be available on site within 30 minutes of a call for service.

C. This warranty shall apply equally to both hardware and software.

D. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Failures on control systems that include all computer equipment, transmission equipment and all sensors and control devices during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.

E. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

F. Provide updates to operator workstation software, project-specific software, graphic software, database software, and firmware that resolve Contractor identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with the above-mentioned items. Do not install updates or upgrades without Owner's authorization.

PART 2 PRODUCTS

2.01 GENERAL

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.02 UPS FOR DDC

A. Provide UPS (Uninterruptible Power Supply) for new BAS controllers.

B. Control transformers serving BAS control equipment shall be grouped at BAS panel and powered by UPS.

2.03 NETWORKING COMMUNICATIONS

A. The design of the BAS shall support networking of operator workstations and Building Controllers. The network architecture shall consist of two levels, an Ethernet based primary network for all operator workstations, servers, and primary DDC controllers along with secondary Floor Level Networks (FLN) for terminal equipment application specific controllers.

B. Access to system data shall not be restricted by the hardware configuration of the building management system. The hardware configuration of the BAS network shall be totally transparent to the user when accessing data or developing control programs.

C. Operator Workstation Communication:
   1. All color graphic operator workstations shall reside on the Ethernet network and the consoles shall be set up in a client/server configuration.
   2. The servers will act as the central database for system graphics and databases to provide consistency throughout all system workstations.
   3. The network shall allow concurrent use of multiple BAS software site licenses.

D. Workstation Graphics:
   1. BAS Contractor shall create color graphic floor plan display and system schematics for each piece of mechanical and control equipment including fan coil units and auto-dampers.

2.04 OPERATOR'S INTERFACE

A. Reuse existing workstation/s on campus approved by the owner's representative.

2.05 APPLICATION SPECIFIC CONTROLLERS (ASC)

A. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

2.06 INPUT/OUTPUT INTERFACE

A. Hardwired inputs and outputs may tie into the system through building or application specific controllers.

2.07 PRIMARY CONTROL DEVICES

A. General:

1. Major components shall conform to following requirements.

B. Control Damper Actuators:
   1. Damper actuators shall be low voltage 24 volt type.
   2. Operator linkage arrangement to permit normally open or normally closed positions of damper as indicated.
   3. Exhaust air damper actuators shall be mechanical spring return.
   4. Normal (Failed) Position:
      a. Exhaust Air: Normally open.

C. Control Valves and Actuators
   1. General:
      a. The BAS contractor shall furnish motorized control valves and actuators, including control wiring.
      b. Automatic control valves shall be fully proportioning for equal percentage flow characteristics.
      c. Valves shall be sized by Control Manufacturer.
      d. Valve body and actuator selection shall be sufficient to handle system pressure and ambient temperature and shall close against differential pressures encountered.
      e. Valve Selection Criteria:
         1) Sizing:
            a) Modulating Chilled water and Heating Water: Six psig drop maximum.
         2) Normal (Failed) Position:
            a) Heating at Reheat Coil: Last position
            b) Fan Coil Units Chilled Water: Open
         3) Flow Capacity: As shown on Drawings

D. Quality Assurance for Actuators and Valves:
   1. UL Listed Standard 873 and C.S.A. Class 4813 02 certified.
   2. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.
   3. Five-year manufacturer’s warranty. Two-year unconditional and three-year product defect from date of installation.

E. Valve Actuators:
   1. Control Valve Actuators (3 inch and smaller):
      a. Actuators shall have a gear release button on non-spring return models to allow manual setting. The actuator shall have either an insulating air gap between it and the linkage or a non-conducting thermoplastic linkage. Care shall be taken to maintain the actuator's operating temperatures and humidity within its specifications. Pipes shall be fully insulated and heat shields shall be installed if necessary. Condensation may not

form on actuators and shall be prevented by a combination of insulation, air gap, or other thermal break.
   b. The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within 1/21 of control signal.
   c. Valve body and actuators shall be shipped fully assembled and tested at the valve factory prior to shipment.

F. Acceptable Manufacturers: Belimo, Siemens, or approved.

2.08 SENSORS

A. Room Temperature Sensors:
   1. 10k Ohm Thermister.
   2. Setpoint Range 50 to 95 deg F +/- 0.5 degrees F.
   3. External set point adjustment
   4. LCD display: Temperature and critical point
   5. Occupant Override Button
   6. Input jack.
   7. Cover color: White.
   8. Model: Siemens 540-680 Series 1000 room sensor.

B. Room Humidity Sensors:
   1. Relative humidity sensor with capacitive sensing element.
   2. Humidity Accuracy: ± 2%.
   3. Output: 0 to 10 Vdc Linear, Proportional.
   4. Input jack.
   5. Cover color: White
   6. Manufacturer: Siemens QFA3000.WU

C. Duct and Liquid Temperature Sensors:
   1. 100 ohm Platinum RTD.
   2. Duct - Averaging: 20-1200 deg F, ± 0.7 degrees F over range.
   3. Liquid Immersion: 30-250 deg F, ± 0.7 degrees F over range.
   4. Immersion sensors shall be provided with separable stainless steel well.
   5. Averaging elements with sufficient length to span duct.
   6. Model: Siemens 533-380, 535-49X series and 536-767.

D. Current Transformers:
   1. Current transformer switches shall be furnished for equipment run status purposes in air and water applications.
   2. The current transformers shall be designed to be installed or removed without dismantling the primary bus or cables. The transformer shall be of a split core design. The core and windings shall be completely encased in a UL approved thermoplastic rated 94VA. No metal parts shall be exposed other than the terminals. The current transformers shall meet the following specifications:
      a. Accuracy: 1% at 5.0 to 25.0 VA accuracy class with U.P.F. burden.
      b. Provide a disconnect switch for each current transformer.

2.09 MISCELLANEOUS

A. Laboratory On/Off Switch For Fan Coil Units serving Laser Bays:
   1. Switch shall be a maintained switch position style.
   2. Manufacturer Model: IDEC TW series

PART 3 EXECUTION

3.01 CONTROL SYSTEM INSTALLATION (GENERAL)

A. Installation shall be by Control System Manufacturer. Installation by Wholesalers, Franchised Dealers, or any firm whose principal business is not that of manufacturing and installing automatic temperature control systems shall not be acceptable.

B. Install products in accordance with manufacturer's instructions.

C. Provide miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

D. Contractor shall collaborate with Owner directly to determine Owner’s preference for naming conventions, etc. before entering data in system.

E. Prepare and start logic control system under provisions of this section.

F. Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.02 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. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

D. 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.

E. Do not begin work until unsatisfactory conditions are resolved.

3.03 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from owner’s representative prior to installation.

B. Instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.

C. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections — sized to suit pipe diameter without restricting flow.

3.04 ELECTRICAL AND WIRING

A. Provide interlock and control wiring. Wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and national, state and local electrical codes.

B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for communications trunks.

C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of control equipment with the owner's representative prior to rough-in.

D. NEC Class 1 (line voltage) wiring shall be UL Listed in approved conduit according to NEC and Division 26 requirements.

E. Low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub fused when required to meet Class 2 current limit.)

F. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in conduit may be used provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenums shall be UL Listed specifically for that purpose.

G. Provide power and transformers for control components from electrical service provided by Division 26 at the system control panel where indicated on the electrical drawings or from local electrical panel. Coordinate with electrical contractor.

H. Control wiring exposed in Lab spaces, mechanical, electrical and telephone rooms to be installed in raceways. Other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit).

3.05 IDENTIFICATION

A. Provide nameplates for switches, starters, and control devices in accordance with Section 20 6000.

B. Nameplate wording shall be consistent with device names used on shop drawings and in Contract Documents.

C. Point name and address shall be indicated at each end of control wire connections to DDC equipment.

D. Identifiers shall match record documents.

3.06 PROTECTION

A. The contractor shall protect work and material from damage by its employees and/or subcontractors and shall be liable for damage thus caused.

B. The contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted.

3.07 COORDINATION

A. Coordination with controls specified in other sections or divisions:
   1. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
      a. All communication media and equipment shall be provided as specified in Part 2, “Communication” of this specification.
      b. Each supplier of controls product is responsible for the configuration, programming, startup, and testing of that product to meet the sequences of operation described in this section.
      c. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

3.08 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.09 EXISTING EQUIPMENT

A. Unless otherwise directed, the contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators. Should the contractor find existing equipment that requires maintenance, the architect is to be notified immediately.

3.10 INSTALLATION OF SENSORS

A. General:
   1. Install sensors in accordance with the manufacturer's recommendations.
   2. Mount sensors rigidly and adequately for the environment within which the sensor operates.
   3. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
   4. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

3.11 ACTUATORS

A. Mount and link control damper actuators according to manufacturer's instructions.
   1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
   2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
   3. Provide all mounting hardware and linkages for actuator installation.
   4. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.
   5. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

B. Actuator Mounting for Damper and Valve arrangements shall comply to the following:
      a. Damper Actuators: Shall not be installed in the air stream
      b. A weather shield shall be used if actuators are located outside. For Damper Actuators use clear plastic enclosure.
      c. Damper or valve actuator ambient temperature shall not exceed 122 degrees F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary

d. Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.

3.12 DDC OBJECT TYPE SUMMARY

A. Provide database generation.

B. Displays:
   1. System displays shall show analog and binary object types within the system. They shall be logically laid out for easy use by the owner.

C. Trendlog:
   1. Binary and analog object types (including zones) shall have the capability to be automatically trended.
   2. Trend Logs to be provided in Microsoft Excel format complete with descriptive headings of data columns and graphs appropriately scaled to demonstrate their operation. Trend logs to include the following data points:
      a. Room control temperature and setpoint.
      b. Room monitored temperature.
      c. Terminal Unit discharge air temperature and setpoint.
      d. Room and duct static pressures.
      e. Building T.U. supply air CFM and setpoint.
      f. Control valves % output.
   3. Additional trend log submittals may be necessary following any changes or modifications made to verify control system performance.

D. Alarm:
   1. Analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.

E. Database Save:
   1. Provide back-up database for stand-alone application controllers on disk.

3.13 START-UP AND COMMISSIONING

A. Perform commissioning in accordance with Division 1 requirements.

B. Pre-functional Checks, System Start-up, and Verification: When system installation and pre-functional checks are complete, calibrate equipment and verify transmission media operation before system is placed on-line. Testing, calibrating, adjusting and final field tests shall be completed by system installer. Verify that systems are operable from local controls in specified failure mode upon panel failure or loss of power. Upon completion of calibration, Contractor shall startup system, perform necessary testing and run diagnostic tests to ensure proper operation. Contractor shall be responsible for generating software and entering database information necessary to perform sequence of control and specified software routines.

C. Qualified technician, Factory trained by control system Manufacturer, shall perform functional testing under normal operating conditions.

D. After completion of functional testing, allow technician’s time to monitor, trend and adjust control system during warranty period to fine tune programmed items and ensure system is operating properly. Time normally required to address warranty issues is excluded. Submit trend logs of controlled equipment, as requested by Engineer periodically, to verify control system performance.

END OF SECTION

SECTION 23 10 00

CONTROLS SEQUENCE OF OPERATIONS

PART 1 GENERAL

1.01 GENERAL

A. Provide a complete building automation system based on the following points and sequence of operation. The point list is the minimum amount of points to be provided. Provide additional points to meet the sequence of operation.

B. Point Definitions and Abbreviations:
   1. The following points as defined for each piece of equipment are designated as follows:
      a. Digital Input (DI) – Sensor provides two-state input to controller, such as an open/closed position, alarm, or on/off status.
      b. Digital Output (DO) – Controller provides two-state output to controlled equipment, such as open/close, start/stop, or enable/disable.
      c. Analog Input (AI) – Sensor provides variable input to controller, such as temperature, pressure, or position (for example, percent open).
      d. Analog Output (AO) – Controller provides variable output. 0–20mA, 4–20mA and 0-10VDC are the only acceptable analog outputs. The driver for analog outputs must come from both hardware and software resident in the controllers. Transducers will not be acceptable under any circumstance.
      e. Floating Point Control Output (FO): Controller provides on/reverse output to slow-acting operator at controlled item when the input signal is above or below the setpoint. Use of floating point control may utilize two (2) DO outputs or single AO.
      f. N.O. - Normally Open.
      g. N.C. - Normally Closed.

C. Control setpoints noted herein are estimated setpoints for initial start-up. During testing and monitoring, Control Contractor shall be responsible for setpoint adjustment to obtain optimum system performance.

D. System setpoints:
   1. Setpoints (i.e., temperatures, static pressure etc.) shall be adjustable.
   2. Setpoints shall be directly adjustable through system graphics at the workstation without requiring any modification of BAS computer code. This may require assigning virtual points to adjustable setpoints.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 LASER LAB TEMPERATURE CONTROLS

A. Refer to "HVAC OPERATION MATRIX" schedule shown on drawing M302 for additional operational information.

B. Fan Coil Unit (FCU-74-1 and FCU-74-2) and Duct Mounted Reheat Coils (RHC-1 and RHC-2):
   1. Operation: Continuous except during a shutdown of the building supply air fans S-8 & S-9 providing 100% outside air to the fan coil units, and via On/Off wall mounted switch.
   2. Normal Humidity Level (49% and lower relative humidity)
      a. BAS modulates chilled water temperature control valve to maintain 56 deg F (adjustable) supply air temperature from the unit.
   3. High Humidity Levels (50% and higher relative humidity)
      a. BAS modulates chilled water temperature control valve open to provide the lowest coil supply temperature (approximately 49 deg F) to maintain a maximum relative humidity of 50% (adjustable) at wall mounted humidity sensors located in either one of the two laser bays.

4. Reheat Coil:
    a. Room temperature control: Wall mounted room temperature sensor resets supply air temperature downstream of the reheat coil to maintain 72 deg F (adjustable) in the space.

5. Fan Coil Unit Variable Volume Airflow:
    a. If cooling output to the chilled water valve reaches 100%, and room temperature or relative humidity continues rising above setpoint: BAS incrementally increases fan airflow from 50% minimum to 100% maximum design CFM via a 4-20 ma signal sent to the fan coil unit EC motor controller to maintain the room temperature or humidity setpoint.
    b. Automatic damper SAD-2 (N.O.) in FCU-74-1 supply air duct to cryo-pump closet set at "minimum" design CFM shown on the HVAC plan. Supply air to closet varies based on fan coil unit fan speed.

6. On/Off Switch For Fan Coil Units and Building Supply Damper Control:
    a. A wall mounted switch mounted in Lab 74C, where shown on the floor plan, allows the user to stop the two fan coil units via the BAS, and close building supply air damper SD-1 (N.O.) serving the laser bays. Operation will not return to normal mode until switch is reactivated. Closure of damper prevents air being drawn through the building supply duct by the room exhaust.
    b. Face of switch shall include red LED illumination when set in “OFF Mode”. Provide label under switch to read: “FAN COIL UNITS AND BUILDING SUPPLY DAMPER CLOSED" – LIGHT ON”.
    c. Automatic damper SAD-2 (N.O.) in FCU-74-1 supply air duct to cryo-pump closes when FCU-74-1 is off.

7. Cryo-Pump Closet Temperature:
    a. BAS monitors temperature in the exhaust duct serving the cryo-pump closet, alarms network if the temperature rises above 83 deg F (adjustable) and initiates the following sequence:
        1) Fan Coil Unit FCU-74-1 provides maximum cooling for the cryo-pump closet. BAS increases fan speed to maximum design CFM. Cooling coil control valve opens to maximum position.
        2) Automatic damper SAD-2 (N.O.) in FCU-74-1 supply air duct to cryo-pump closet modulates open from minimum CFM to maximum design CFM shown on the HVAC plan to maintain a 85 deg F maximum temperature in the closet exhaust duct.

8. Building Supply Fan Shutdown:
    a. BAS monitors operation of existing building supply fans S-8 and S-9 via existing status monitoring points. Building supply air damper SD-1 closes when the building supply fans are off due to fan failure or maintenance shutdown. Closure of damper prevents air being drawn through the building supply duct by the room exhaust.
    b. BAS initiates the following sequence:
        1) Fan Coil Unit FCU-74-2 stops operation.
        2) Fan Coil Unit FCU-74-1 continues operation to provide cooling for the cryo-pump closet. BAS increases fan speed to maximum design CFM. Cooling coil control valve opens to maximum position.
        3) Automatic damper SAD-2 (N.O.) in FCU-74-1 supply air duct to cryo-pump closet opens to "maximum" design CFM shown on the plans to match building exhaust air CFM from closet.

9. Filter Load Monitoring:
    a. BAS monitors filter pressure drop on one (1) fan coil unit at a magnehelic gauge specified in Section 23 40 00 and alarms network when filters require replacement on both units.

10. Point Summary (Per item or space):
    a. Inputs:
        1) Fan coil unit fan run status via current transformer (2) (CT).
        2) Fan coil unit cooling coil supply air temperature (2) (AI).
        3) Reheat coil supply air temperature (2) (AI).
        4) Room temperature (2) (AI).
        5) Room relative humidity (2) (AI).
        6) Cryo-pump closet temperature in exhaust duct (1) (AI)
        7) Existing S-8 and S-9 fan operation (Existing points).
        8) Filter load monitoring on one fan coil unit (1) (AI).
    b. Outputs:
        1) Fan coil unit start/stop via building supply fan shutdown mode (2) (DO).
        2) Fan speed control (2) (AO).
        3) Fan coil cooling coil valve (2) (AO).
        4) Reheat coil heating valve (2) (AO).
        5) Building supply air duct damper SAD-1 (DO).
        6) Cryo-pump closet FCU-74-1 supply air damper SAD-2 (AO).
    c. Alarms:
        1) Control panel communication failure.
        2) Cryo pump closet temperature alarm (critical alarm).
        3) Fan coil unit fan failure.
        4) Room temperature +/- 1.5 deg F more than setpoint
        5) Humidity +10% higher than setpoint

C. Existing Duct Reheat Coil (RHC-3):
    1. Reheat Coil:
        a. Room temperature control provided by existing pneumatic thermostat relocated by this Section.

D. Control Network:
    a. Provide network cable from the BAS controller provided in the lab to existing Siemens system panel installed in the adjacent basement mechanical room. Wiring and conduit provided by this Section.

END OF SECTION

SECTION 23 31 00

DUCTWORK

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 23 0700 - Ductwork Insulation

D. Section 23 3300 - Ductwork Accessories

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer’s Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Duct Sealants		X						

PART 2 PRODUCTS

2.01 DUCTWORK

A. Fabrication and Site Delivery:
   1. Factory / Shop sealed by blanking or capping duct ends, bagging of small fittings, surface wrapping or shrink wrapping.

B. Rectangular, Single Wall Ducts (Low Pressure):
   1. Ducts Included:
      a. Supply ducts.
      b. General exhaust ducts.
   2. Material: Galvanized steel.
   3. Fabricate and support in accordance with:
      a. Oregon Mechanical Specialty Code (IMC), current edition.
      b. SMACNA HVAC Duct Construction Standards, 1995 edition.
   4. SMACNA Pressure Classification:
      a. Supply Ducts: +2 inches w.g.
      b. Exhaust Ducts: -2 inches w.g.
   5. Transverse Joints, Indoors: In accordance with details in SMACNA HVAC Duct Construction Standards or one of the following proprietary joint systems:
      a. Ductmate "25" with butyl gasket tape.

b. Ductmate "35" with butyl gasket tape.
c. Lockformer "TDC" with butyl gasket tape.
d. Ward Duct Connectors Inc. "WDCI Lite" with butyl gasket tape.
e. Ward Duct Connectors Inc. "WDCI Heavy" with butyl gasket tape.

6. Crossbreaking:
   a. Duct panels 16 inches wide and larger shall be beaded or crossbroken, regardless of whether or not duct is lined or insulated.
   b. Beads shall be 1/8 inch deep, shall be parallel to transverse joints, and shall be spaced 12 inches on center.
7. Material Thickness:
   a. Where duct gauges are not identified on the drawings: Determined gauge using tables in SMACNA HVAC Duct Construction Standards, based on duct size, material, pressure class, joint type, and reinforcement spacing.
      1) "Addendums to SMACNA" and other publications by proprietary joint manufacturers shall not be used for determining material thickness.
      2) For determining duct gauges using SMACNA tables, proprietary joint systems shall be considered equivalent to the following SMACNA rigidity classes:
      3) Lockformer "TDC," 24 gauge: Class "D."
      4) Lockformer "TDC," 22 gauge: Class "E."
      5) Lockformer "TDC," 20 gauge: Class "F."
      6) Lockformer "TDC," 18 gauge, with tie rod(s) on each side of joint: Class "K."
      7) Ductmate "25": Class "F."
      8) Ductmate "35": Class "J."
      9) Ward "WDCI Lite": Class "F."
      10) Ward "WDCI Heavy": Class "J."
   b. Ducts with proprietary joints shall be 24 gauge minimum.
8. Sealing Requirements: Seal transverse joints and longitudinal seams with tape-and-adhesive or liquid duct sealer, specified herein. Not required for gasketed, flanged joints.
9. Fittings: See duct construction detail shown on drawings.

C. Round Single Wall (Medium Pressure):
1. Ducts Included:
   a. Supply and general exhaust ducts and associated fittings, shown without internal insulation.
2. Material: Galvanized steel.
3. Fabricate and support in accordance with latest editions of:
   a. Uniform Mechanical Code
   b. SMACNA HVAC Duct Construction Standards
4. SMACNA Pressure Classification: 10 inch w.g. minimum.
5. Seam Type: Spiral lockseam.
6. Material Thickness: In accordance with tables in SMACNA HVAC Duct Construction Standards, based on duct diameter, duct material, and pressure class.
7. Sealing Requirements:
   a. Medium Pressure: Seal transverse joints with tape-and-adhesive or liquid duct sealer, specified herein.
8. Fittings:
   a. Factory-fabricated by duct manufacturer.
   b. Elbows shall be of die-stamped, pleated, standing seam, or gored (segmented) construction.
   c. 90° gored elbows shall be 5 piece.
   d. 45° gored elbows shall be 3 piece.
   e. Gored elbows shall have continuously welded seams.
   f. Joints of standing seam fittings shall be fully sealed with liquid sealant.
   g. See duct construction detail shown on drawings.
9. Manufacturer: Metco, Dee's Sheet Metal, Semco, Arrow, Arjae Sheet Metal, or approved.

D. Liquid Duct Sealer, Indoors:
   1. Sealer for environmental air ducts:
      a. UL Classification: Flame spread rating not to exceed 25; smoke developed rating not to exceed 50; when applied in a 2 inch wide strip at a thickness of 0.0032 inch.
      b. Low-Emitting Material: Volatile organic compound (VOC) content less than 30 grams per liter for metal-to-metal bonding per SCAQMD Rule #1168.
      c. Application Temperature Limits: 40 to 110 deg. F.
      d. Manufacturer: United McGill Corp., Accumetric, Vulkem, Carlisle Hardcast, Alcoa, Design Polymerics, Miracle Adhesives, Ductmate, or approved. Similar to Accumetric Boss 350.

E. Rolled Tape Sealant, Indoors:
   1. Application: Apply to duct joints and seams visible within the space, or concealed.
      a. Description: Aluminum pressure sensitive, water resistant, rolled duct joint sealant.
      b. Appearance and sealant: Mill finish aluminum, butyl adhesive/sealant substrate.
      c. Thickness: 17 mils
      d. UL Classification: UL 181B-FX. Flame spread rating not to exceed 25; smoke developed rating not to exceed 50.
      e. Application Temperature Limits: -20 to 200 deg. F.
      f. Seal Classes: SMACNA 1/2 through 6 in. w.g.
      g. Seal Classes: SMACNA A, B, C.
      h. VOC: 0 g/l.
      i. Compliance: LEED compliant SCAQMD Rule 1168.
      j. Manufacturer: Hardcast Inc. Foil-Grip 1403-181BFX Indoor/Outdoor Duct Rolled Sealant or approved.

PART 3 EXECUTION

3.01 GENERAL

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

B. Provide duct fittings and offsets not shown on Drawings, if required for coordination with the work of other sections.

C. Install products in accordance with Manufacturer's recommendations and standards referenced herein.

D. Duct sizes on Drawings are net inside dimensions, measured to inside face of internal duct face for double-wall ducts.

E. Fabricate and install ductwork to minimize gaps. Gaps in sheet metal shall be no larger than allowed for sealant per sealant manufacturer’s installation instructions.

3.02 DUCT SUPPORTS

A. Provide Pre-Galvanized, Hot-Dip Galvanized, or Stainless Steel support components for support of the work.

3.03 DUCT AND FITTING HANDLING

A. Delivery to Site:
   1. At site, sealed ends shall be visually examined and resealed as required.

B. Storage:
   1. Store away from high dust generating processes.
   2. Provide pallets or blocking to keep above floor.
   3. Provide temporary cover to protect stored material.

C. Installation:
   1. Protective coverings shall be removed immediately before installation and inspected to determine if wipe down is necessary.
   2. During construction, provide temporary sealing of openings into duct systems, to prevent accumulation of dust in ducts.
   3. Open ends of completed duct and overnight work-in-progress shall be sealed.

3.04 DUCT SEALING

A. Joints, Seams and at all wall penetrations.

B. Clean duct surfaces prior to applying sealant.

C. Prior to application, verify that ducts are dry and within specified temperature limits.

D. Inspect after first application of sealant to identify areas where shrinkage has occurred. Fill voids with a second application.

END OF SECTION

SECTION 23 33 00
DUCTWORK ACCESSORIES

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 23 3100 - Ductwork

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Volume Dampers		X						
Turn Vanes		X						
Automatic Dampers		X						

PART 2 PRODUCTS

2.01 VOLUME DAMPERS

A. Volume Dampers, up to 10 inch width:
   1. Blade: Minimum 22 ga. galvanized steel.
   2. Regulator: Quadrant type, 1/4 inch diameter shaft, wingnut, indicator dial marked "open" and "shut".
   3. Bearings: 1/4 inch diameter shaft, spring-lock on tail bearing.
   4. Regulator/Bearing Set Manufacturer: Duro-dyne KS-145; Duro-dyne SRST for externally insulated ducts, or approved.

B. Volume Dampers, 11 inch to 20 inch width:
   1. Blade: Minimum 18 ga. galvanized steel. Use multiple blades for height over 12 inches.
   2. Regulator: Quadrant type, 3/8 inch diameter shaft, wingnut, indicator dial marked "open" and "shut".
   3. Bearings: 3/8 inch diameter shafts, spring-lock on tail bearing.
   4. Regulator/Bearing Set Manufacturer: Duro-dyne KSR-195; Duro-dyne SRST for externally insulated ducts, or approved.

C. Volume Dampers, 21 inch to 30 inch width:
   1. Blade: Minimum 16 ga. galvanized steel. Use multiple blades for height over 12 inches.
   2. Regulator: Quadrant type, 1/2 inch diameter shaft, wingnut, indicator dial marked "open" and "shut".
   3. Bearings: 1/2 inch diameter shafts.
   4. Regulator/Bearing Set Manufacturer: Duro-dyne KS-12; Duro-dyne SRST for externally insulated ducts, or approved.

D. Volume Dampers, over 30 inch width:
   1. Blade: Minimum 16 ga. galvanized steel with stiffeners as required. Use multiple blades for height over 12 inches.
   2. Regulator:
      a. Description: Quadrant type, 1/2 inch diameter shaft size, wingnut, indicator dial marked "open" and "shut".
      b. Manufacturer: Duro-dyne K-5; or approved.
   3. Shaft: 1/2 inch diameter, continuous across damper width.
   4. End Bearing:
      a. Description: Cast alloy, inside duct type, 1/2 inch diameter shaft size.
      b. Manufacturer: Duro-dyne SB-112 or approved.
   5. Regulator/Bearing Set Manufacturer: Duro-dyne KS-12; Duro-dyne SRST for externally insulated ducts, or approved.

E. Opposed Blade (OB) Volume Dampers:
   1. Damper Assembly:
      a. Type: V-crimped galvanized steel.
      b. Blade Action: Opposed blade as noted on Drawings.
      c. Blades: 6 inches wide, v-crimped, 16 ga. galvanized steel.
      d. Frames: 16 ga. galvanized steel or extruded aluminum.
      e. Blade-to-blade Linkage: Concealed within frame.
      f. Blade Axles: 1/2 inch diameter hexagonal or square zinc-plated steel; or 7/8 inch diameter hexagonal extruded aluminum.
      g. Bearings: Oil-impregnated sintered bronze or molded synthetic.
      h. Control Shaft: 1/2 inch diameter, extends 6 inches beyond frame.
      i. Performance Ratings: Certified in accordance with AMCA Standard 500.
      j. Manufacturer: Ruskin, Greenheck, Cesco, or approved. Similar to Ruskin CD35.
   2. Regulator:
      a. Quadrant type, 1/2 inch diameter shaft size, wingnut, indicator dial marked "open" and "shut". Duro-dyne K-5 or approved.

2.02 AUTOMATIC DAMPERS

A. Supply Air Isolation and Control Dampers (SAD-1 and SAD-2):
   1. Description: Extruded aluminum, airfoil blade, low leakage, single or multiple blade type as required.
   2. Blade Action: Parallel blade for two-position isolation dampers opposed blade for modulating control or as noted on Drawings.
   3. Blades: Extruded aluminum, airfoil shape. Damper blades shall not exceed 6 inches in width, and 48 inches in length. Provide multiple sections for dampers over 48”.
   4. Frames: 13 ga. galvanized steel or extruded aluminum, flanges for mounting.
   5. Blade-to-blade Linkage: Damper drive shaft to be directly bolted to damper blade, with no slip-on or keyed connection and no jackshaft. Drive shaft to extend through damper frame, into damper blade.
   6. Blade Axles: 1/2” diameter hexagonal or square zinc plated steel; or 7/8” diameter hexagonal extruded aluminum.
   7. Bearings: Oil-impregnated sintered bronze or bearing grade molded synthetic.
   8. Control Shaft: 1/2” diameter, extends 6” beyond frame.
   9. Blade Edge Seals: Extruded vinyl or rubber.

10. Jamb Seals: Flexible stainless steel.
11. Leakage Rate: Maximum of 4 cfm per sq ft at 1 inch w.g.
12. Performance Ratings: Certified in accordance with AMCA Standard 500.
13. Actuator: Provided by Section 23 0900.
14. Manufacturer and Model: T.A. Morrison Company (TAMCO) Series 1500, Ruskin model CD50, or approved.

2.03 TURN VANES

A. Turn Vanes, 20 inch and less duct width:
   1. Arrangement: Stationary vanes fixed to side rails installed in 90 degree square elbows.
   2. Vane and Rail Material: Galvanized steel.
   3. Vanes: Double wall, minimum 26 gauge, 90 degree, 2-inch throat radius.
   4. Rails: Minimum 24 gauge, 1-1/2 inch on center vane spacing.
   5. Manufacturer: Durodyne, Ductmate, Hardcast, Ward Industries, Cain, or approved. Similar to Durodyne Junior Vane Rail JVR2.

B. Turn Vanes, greater than 20 inch duct width:
   1. Arrangement: Stationary vanes fixed to side rails installed in 90 degree square elbows.
   2. Vane and Rail Material: Galvanized steel.
   3. Vanes: Double wall, minimum 24 gauge, 90 degree, 4-1/2 inch throat radius.
   4. Rails: Minimum 24 gauge, 3-1/4 inch on center vane spacing.
   5. Manufacturer: Durodyne, Ductmate, Hardcast, Ward Industries, Cain, or approved. Similar to Durodyne Vane Rail VR2.

PART 3 EXECUTION

3.01 GENERAL

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

3.02 AUTOMATIC DAMPERS

A. Install per manufacturer’s recommendations. Coordinate with controls work in Sections 23 0900 and 23 1000 for damper actuator installation.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 20 9100 - Testing, Adjusting, and Balancing

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Registers	X	X						

PART 2 PRODUCTS

2.01 GRILLES AND REGISTERS

A. General:
   1. Refer to Drawings for types, neck sizes, and blow patterns.

B. Supply Register Wall (SRW-1):
   1. Type: Double deflection, individually adjustable blades.
   2. Material: Steel or aluminum.
   3. Border: 1-1/4 inch wide, countersunk screw holes, gasket.
   4. Front Blades: Maximum 3/4 inch on center, parallel to long dimension.
   5. Rear Blades: Maximum 3/4 inch on center, parallel to short dimension.
   6. Finish: White.
   7. Opposed Blade Damper adjustable through the grille.
   8. Manufacturer: Titus, Price, Krueger, Carnes, or approved. Similar to Titus 300RL or Price 520DFLAB12.

C. Return Register (RR-1)
   1. Type: Single deflection, fixed blades.
   2. Material: Steel or aluminum.
   3. Border: 1-1/4 inch wide, countersunk screw holes, gasket.

4. Blades: Spaced 3/4 inch on center maximum, parallel to long dimension.
5. Blade Angle: Fixed, between 35 and 45 degrees.
6. Finish: White.
7. Opposed Blade Damper: Adjustable through grille.
8. Manufacturer: Titus, Kreuger, Carnes, Tuttle & Bailey, Anemostat, E.H. Price, or approved. Similar to Titus 350RL or Price 530DFLAB12.

D. Exhaust Register Wall (ERW-1):
1. Type: Single deflection, fixed blades.
2. Material: Steel or aluminum.
3. Border: 1-1/4 inch wide, countersunk screw holes, gasket.
4. Blades: Spaced 3/4 inch on center maximum, parallel to long dimension.
5. Blade Angle: Fixed, between 35 and 45 degrees.
6. Finish: White.
7. Opposed Blade Damper: Adjustable through grille.
8. Manufacturer: Titus, Krueger, Carnes, Tuttle & Bailey, E.H. Price, or approved. Similar to Titus 350RL or Price 530DFLAB12.

PART 3 EXECUTION

3.01 GENERAL

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

B. Secure grilles and registers with flat head, countersunk screws, flush with borders, painted to match borders. Hex head and/or bright finish screws are not acceptable.

C. Install outlets and inlets tight to mounting surfaces.

D. Center outlets and inlets between lights and in ceiling tiles, as shown on Architectural reflected ceiling plans.

E. Install outlets and inlets plumb and square with walls and ceilings.

END OF SECTION

SECTION 23 40 00

AIR CLEANING DEVICES

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Filter Media	X	X						
Filter Gauge	X	X						
HEPA Fan Units	X	X	X	X			X	X

PART 2 PRODUCTS

2.01 FILTER MEDIA

A. Medium Efficiency Filters (30%, MERV 8):
   1. Location: Fan Coil Units.
   2. Type: Pleated media, disposable.
   3. Material: Reinforced non-woven cotton and synthetic fabric.
   4. Listing: UL 900 Class 1.
   5. Minimum Efficiency: 30% average efficiency based on ASHRAE 52.1-1992 and MERV 8 minimum when tested in accordance with ASHRAE 52.2-1999.
   6. Media Depth:
      a. Fan Coil Units: 2 inches.
      b. Filter Modules: 4 inches.
   7. Maximum Pressure Drop:
      a. 2 inch Thickness: 0.07 inch w.g. at 250 fpm face velocity when clean.
   8. Quantity: Provide three (3) sets of filters as follows; one set furnished with unit, one set to be installed before final air balance, and one set delivered to the owner.
   9. Manufacturer: Farr, Cambridge, Fram, Flanders, Filtration Group, or approved. Similar to Farr Type 30/30.

2.02 FILTER GAUGE

A. Filter Gauge:
   1. Location: Fan coil units FCU-74-1 and FCU-74-2.
   2. Filter gauge shall be field mounted on the filter access side piped with copper tubing around filter bank.
   3. Type: Filter differential pressure gauge with manually adjustable signal flag and indicating output signal for BAS monitoring.
   4. Range: 0 to 1 inches, w.g. Control signal output 4-20 mA.
   5. Manufacturer: Dwyer, Cleveland Draft Gauge, Farr, or approved. Similar to Dwyer series 605 Magnehelic Differential Pressure Indicating Transmitter.

2.03 HEPA FAN UNITS (HFU-1 THROUGH HFU-3)

A. General Features:
   1. EC brushless DC motor with internal microprocessor. Dynamically adjusts motor speed to maintain set airflow to compensate for changes in static pressure in duct system and filter loading.
   2. Housing Style: Standard. Removal of HEPA filter and motor requires removal of housing.
   3. Electrical enclosure with on/off switch, fan speed adjustment and LED speed indicator.
   4. Constant airflow over a wide range of external static pressures.
   5. Low power consumption at 235 watts.
   6. Low sound level at 48 dBA.
   7. High Efficiency Particulate Air (HEPA) UL 900 Filter: 99.99% @ 0.3 micron.
   8. Forward-curved centrifugal-type fan.
   9. Walk-able plenum (excluding pre-filter), rated to 250 lbs.
   10. Pre-filter: Snap-in.
   11. Tested to IEST recommended RPC standards.
   12. UL listing: UL 507ed with standard UL 900 filter.
   13. Size: 48" x 24" to be installed in standard ceiling T-bar or similar framing on laser platform.
   14. Finish:
      a. Housing: Standard aluminum mil finish.
      b. Screen: Standard anodized aluminum.

B. Controls: None

C. Options: None.

D. Warranty: 18 months.

E. Performance Requirements: See Schedule on Drawings.

F. Manufacturer: Envirco MAC10 IQ, or approved.

PART 3 EXECUTION

3.01 GENERAL

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

B. Install filter gauge piped around Fan Coil Unit filter rack.

C. Do not operate systems without filters in place.

END OF SECTION

SECTION 23 82 20

TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 20 10 00 - General Mechanical Provisions

B. Section 20 20 00 - Mechanical Operation and Maintenance Manuals

C. Section 23 09 00 - Controls - Building Automation System (BAS)

D. Section 23 40 00 - Air Cleaning Devices

1.1 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 10 00. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 20 00.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 20 00 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Fan Coil Units	X	X	X	X				X

PART 2 PRODUCTS

2.1 FAN-COIL UNITS (FCU-74-1 AND FCU-74-2)

A. General
   1. Institutional grade, high performance, horizontal style, exposed style direct drive units.
   2. Units shall be completely factory assembled, tested and shipped as one piece. All units shall be capable of meeting or exceeding the scheduled capacities for cooling, heating and air delivery.
   3. Unit dimensions for each model and size shown on the plans and fan coil unit detail shall be considered maximum values to fit within the space constraints and allow access to fan coil unit components.
   4. Unit performance for each model and size shown on the drawing schedule shall be considered minimum values.
   5. Units shall be ETL listed in compliance with UL/ANSI Standard 1995 and be certified as complying with the latest edition of ARI Standard 440.

B. Construction
   1. Unit chassis shall be fabricated of heavy gauge G90 galvanized steel panels able to meet 125 hour salt spray test per ASTM B-117.
   2. Exterior panels including plenum shall be insulated with Elastomeric closed cell Foam Insulation in lieu of standard fiberglass insulation. Insulation shall conform to UL 181 for erosion and NFPA 90A for fire, smoke and melting, and comply with a 25/50 Flame Spread and Smoke Developed Index per ASTM E-84 or UL 723. Additionally, insulation shall comply with Antimicrobial Performance Rating of 0, no observed growth, per ASTM G-21. Polyethylene insulation is not acceptable.
   3. Units shall have 1" duct collar connections both on the supply and the return side to allow horizontal supply and return duct connections in the field.
   4. Exposed units shall have exterior panels fabricated of galvannealed steel with power coated finish. The side and bottom access panels shall be attached with quick open fasteners to allow for easy removal and access for service.
   5. A filter housing shall be provided at the return inlet and filter accessible from either the bottom or side of the unit.
   6. Unit mountings shall be provided at a minimum of four locations at the top of the unit.

C. Sound
   1. Submit published sound power level data tested in accordance with ARI Standard 350-2000.
   2. Sound power shall not exceed the noise level shown in the drawing schedule.

D. Fan and Motor Assembly
   1. Unit fan shall be a dynamically balanced, forwardly curved; DWDI centrifugal type constructed of 18 gauge zinc coated galvanized steel for corrosion resistance.
   2. Provide Electronically Commutated (EC) Motor and factory installed electrical noise suppression (line reactors) to minimize harmonic noise on the electrical service.
   3. The fan assembly shall be easily removable for servicing the motor and blower at, or away from the unit. The entire fan assembly shall be able to come out of the unit by removing four nuts per fan and unplugging the motor(s).
   4. Provide a factory installed fan speed controller inside the unit control panel to allow automatic adjustment of fan speed via a 0-10 vdc or 4-20 ma control signal from the Building Automation System (BAS). In addition, provide a manual adjustment of the EC motor speed and fan airflow at the controller.

E. Chilled Water Coil
   1. Coils shall be ARI 410 certified and tagged with an ARI 410 label.
   2. Cooling coil shall meet the specified capacity shown on the drawings.
   3. Coils shall have seamless copper tubes and shall be mechanically expanded to provide an efficient, permanent bond between the tube and fin. Fins shall have high efficiency aluminum surface optimized for heat transfer, air pressure drop and carryover.
   4. Coils shall be hydrostatically tested at 450 PSIG air pressure under water, and rated for a maximum of 300 PSIG working pressure at 200°F.
   5. Coils shall be provided with a manual air vent fitting to allow for coil venting.
   6. Cooling coils shall be in a common tube sheet.
   7. Coils shall be field reversible for right or left hand connections.

F. Drain Pans
   1. Primary condensate drain pans shall be single wall; heavy gauge stainless steel for corrosion resistance, and extend under the entire cooling coil. Drain pans shall be of one-piece construction and be positively sloped for condensate removal.
   2. Drain pans shall be field reversible for right or left hand connections.
   3. The drain pan shall be externally insulated with fire retardant, closed cell foam insulation. The insulation shall carry no more than a 25/50 Flame Spread and Smoke Developed Rating per ASTM E-84 and UL 723 and an Antimicrobial Performance Rating of 0, no observed growth, per ASTM G-21.
   4. Provide a secondary drain connection on the primary drain pan for condensate overflow.

G. Filters and Filter Gauges
   1. Provide 2" thick Merv 8 filters and filter gauges. Refer to Section 23 40 00 for filter and filter gauge requirements.

H. Capacity and Performance: Refer to Fan Coil Unit schedule shown on the drawings.

I. Manufacturers: Johnson Controls Inc, Enviro-Tech Model FNX exposed unit, or approved.

PART 3 EXECUTION

3.1 GENERAL

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

B. Fan Coil Units:
   1. Refer to fan coil unit detail shown on the mechanical drawings.
   2. Chilled water piping inside the fan coil unit cabinet shall be provided by the Division 23 contractor.
   3. Coordinate accessible side of fan coil unit for access to fan, coil piping components, filters and electrical control panel with fan coil representative.
   4. Provide seismic restraint requirements specified in Section 20 42 00.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section includes general electrical requirements for all Division 26 work and is supplemental and in addition to the requirements of Division 1.

B. It is the intention of this Division of the Specifications and the Contract Drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and fully operational condition all equipment, materials, devices and necessary appurtenances to provide a complete electrical system. Provide all materials, appliances and apparatus not specifically mentioned herein or shown on the drawings, but which are necessary to make a complete, fully operational installation of all electrical systems shown on the contract drawings or described herein. Connect equipment and devices furnished and installed under other Divisions of this specification (or the Owner) under this Division.

C. Workmanship shall be of the best quality and competent and experienced electricians shall be employed and shall be under the supervision of a competent and experienced foreman.

D. The drawings and specifications are complimentary and what is called for (or shown) in either is required to be provided as if called for in both. Where conflicting information occurs within the drawings and specifications or between the drawings and specifications, the more expensive alternative shall be used as a basis for bidding and construction.

E. See Division 01 for sequence of work.

1.03 WORK IN OTHER DIVISIONS

A. See all other specifications for other work which includes but is not limited to:

Communications

Conveying Systems

Cutting and Patching

Door Hardware

Electronic Safety and Security

Equipment Wiring

Fire Protection

Mechanical Control Wiring

Mechanical Equipment

Painting, Refinishing and Finishes

Temporary Power

1.04 CODES, PERMITS, INSPECTION FEES

A. The following codes and standards are referenced in the Division 26 specifications. Perform all work and provide materials and equipment in accordance with the latest referenced codes and standards of the following organizations:

1. American National Standards Institute (ANSI)
2. National Electrical Manufacturer's Association (NEMA)
3. National Fire Protection Association (NFPA)
4. Underwriter's Laboratories (UL)

B. Install the electrical systems based on the following:

NFPA 70 National Electrical Code as adopted and amended by the Local Jurisdiction.

IBC International Building Code as adopted and amended by the Local Jurisdiction.

C. The referenced codes establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the governing codes and rules and not contrary to same.

D. Obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work by the inspectors and give the inspectors all necessary assistance in their work of inspection.

1.05 COORDINATION

A. Coordinate work with that of the other Contractors and/or other trades doing work on the project. Examine all drawings and specifications of other trades for construction details and coordination. Make every reasonable effort to provide timely notice of work affecting other trades to prevent conflicts or interference as to space requirements, dimensions, openings, block-outs, sleeving or other matters which will cause delays or necessitate work-around methods.

B. Obtain submittals and shop drawings of all equipment with electrical connections furnished under other divisions of the specification and by the Owner. Provide all wiring in accordance with specific equipment requirements. Immediately advise the Architect of any changes which may affect the contract price.

C. Special attention is called to the following items. Coordinate all conflicts prior to installation:

1. Door swings such that switches will be located on the "strike" side of the door.
2. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all electrical outlets, lighting fixtures and other electrical outlets and equipment are clear from and in proper relation to these items.
3. Location of cabinets, counters and doors so that electrical outlets, lighting fixtures and equipment are clear from and in proper relation to these items.
4. Recessing and concealing electrical materials in CMU walls, concrete construction and precast construction.
5. At each switchboard, panelboard and motor control center location the Contractor shall monitor the work of all trades to assure that the space and clearance requirements of code are met.
6. Review specifications for other Divisions of the work to determine where other Divisions are requiring electrical connections. Verify electrical provisions shown on contract drawings by examining shop drawing submittals of other Divisions prior to submission to the owner. Do not proceed with ordering of supporting electrical equipment, such as circuit breakers, until electrical characteristics are verified. Proceed with rough only after verification of shop drawings.

D. Digital format copies of bid drawings will be furnished to the successful bidder. Augment bid documents with additional information to ensure coordination between trades. Provide digital format electrical systems drawings showing all ceiling devices, fixtures, raceways and cable tray locations and routing to mechanical contractor to be used for coordination drawings provided by mechanical contractor. Include dimensions and elevations of devices, fixtures, raceway and cable tray.

E. Furnish, install and place in satisfactory condition all raceways, boxes, conductors and connections and all other materials required for the electrical systems shown or noted in the contract documents to be complete, fully operational and fully tested upon completion of the project. Raceways, boxes and ground connections are shown diagrammatically only and

indicate the general character and approximate location. The layout does not necessarily show the total number of raceways or boxes for the circuits required, nor are the locations of indicated runs intended to show the actual routing of the raceways.

F. Where routings of major raceways and telecommunication pathways are indicated on plan sheets, the routing information supplements the information on diagrams. If no routing information is shown, route the systems in a manner that will coordinate with new and existing infrastructure and the work of other trades.

G. The horsepower of motors and apparatus wattage's shown on the drawings are estimated requirements of equipment furnished under other Divisions of this contract. Provide overload elements to suit actual equipment nameplate current. Advise Architect of any equipment changes or substitutions affecting electrical systems.

H. Consult the architectural drawings for the exact height and location of all electrical equipment not specified herein or shown on the drawings. Make any minor changes (less than 6'-6" horizontal) in the location of the raceways, outlets, boxes, devices, wiring, etc., from those shown on the drawings without extra charge, where coordination requires or if so directed by the Architect before rough-in.

I. Provide inserts or sleeves for outlet boxes, conductors, cables and/or raceways as required. Coordinate the installation thereof with other trades.

J. The Contractor will not be paid for relocation of work, cuttings, patching and finishing required for work requiring reinstallation due to lack of coordination prior to installation.

1.06 WARRANTY

A. Refer to General Conditions of the Contract.

1.07 CORRECTION OF WORK

A. Within one year after the date of Substantial Completion of the work, the Contractor shall correct any work found to be not in conformance with the Contract Documents promptly after written notice from the owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive acceptance of the work under this Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

1.08 CHANGE ORDERS

A. Comply with the requirements of Division 1.

B. Material pricing shall be based on competive market conditions and include contractor net discounting. "List" or "book" pricing of material will not be accepted. Upon request, demonstrate that pricing is competitive by furnishing quotes from competing vendors or distributors.

C. Labor units shall be based on standard publications such as NECA or RS Means, using standard (not "change order") construction production. Where the change order requires additional work that is not normally part of the construction process, separately itemize the work and identify specific inefficiencies.

D. Labor pricing shall include an average of the journeyman and apprentice labor classification rates used to perform the work.

1.09 SUBMITTALS AND SHOP DRAWINGS

A. Submittals and Shop Drawings: Schedule so as not to delay construction schedule and no later than 60 days after award of contract, submit common brochure(s) with index and divider tabs by specification section, containing all required catalog cuts. Allow two weeks for review for each submittal and resubmittal. Incomplete submittals and shop drawings which do not comply with these requirements will be returned for correction, revision and resubmittal. See General Conditions for format, quantity, etc.

B. Submit in a three ring binder with hardboard covers. Submittals shall show:

1. Indicate listing by UL or other approved testing agency.
2. Highlight with yellow or blue marker adequate information to demonstrate materials being submitted fully comply with contract documents.
3. Review and check all material prior to submittal and stamp "Reviewed and Approved".

C. Shop drawings shall show:

1. Ratings of items and systems.
2. How the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.
3. System layout floor plans with complete device layout, point-to-point wiring connection between all components of the system, wire sizes and color coding.
4. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
5. Electrical rooms: Submit 1/2" = 1'0" detail plans and wall elevations of each room showing actual size of equipment in place. Identify coordinating elements such as structural beams or mechanical systems. Submittals shall show coordination among all suppliers of equipment, including power components, fire alarm, racks, nurse call, public address, security, etc. Submit room layouts at same time as material submittals, and prior to installation of any equipment.
6. List of all Division 23 equipment noting actual rating of equipment that will be installed. For discrepancies between the requirements of the proposed equipment and the equipment provisions indicated on the drawings, indicate the contractor's proposed no cost change to the electrical system to accommodate the submitted equipment.

D. The Contractor agrees:

1. Submittals and shop drawings processed by the Architect are not change orders.
2. The purpose of submittals and shop drawings by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept.
3. Submittals demonstrate equipment and material Contractor intends to furnish and install and indicate detailing fabrication and installation methods Contractor intends to use.
4. To accept all responsibility for assuring that all materials furnished under this Division of the specifications meet, in full, all requirements of the contract documents.
5. To pay for Engineers review cost of submittal review beyond one resubmittal.

E. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Corrections or comments made during this review do not relieve contractor from compliance with the requirements of the drawings and specifications. Contractor is responsible for: Dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; performing his work in a safe and satisfactory manner.

F. Submittals and shop drawings are required per the submittals schedule at the end of this Section.

1.10 PROJECT CLOSE-OUT

A. Coordinate with close-out provisions in Division 01 - General Requirements.

B. Request For Final Punchlist

1. To request a final electrical punch list, forward a letter to Sparling, Inc. stating; "The electrical work on this project is complete, all punch list items to date are complete, items a. - m. in the Punchlist Procure paragraph in Section 260500 - Common Work Results For Electrical are complete and the project is ready for final punch list observation."
2. Project Punchlist Procedure: Perform the following procedures for project closeout of electrical portions of work.
    a. Provide engraved nameplates on electrical equipment.
    b. Refinish electrical equipment finishes which are damaged.
    c. Clean light fixtures per Section 260500 - Common Work Results For Electrical.

d. Color code junction boxes per Section 260533 - Raceways and Boxes For Electrical Systems.
e. Insert word processed (typed) Panel Schedules in all new and existing panelboards with actual "as-built" circuit descriptions.
f. Number all circuit breakers.
g. Obtain final electrical permit inspection. Include copies in O & M manual.
h. Provide written warranty in O & M per the General Conditions of the Contract.
i. Furnish Record Drawings per this section. Obtain signature on Job Completion Form.
j. Furnish O & M Manuals per this section. Obtain signature on Job Completion Form.
k. Give instruction periods to owner's personnel per this section. Obtain signature on Job Completion Form.
l. To request final acceptance of project, fill out Job Completion Form in this section and forward to Sparling. Note: If inspectors have not signed form, a copy of signed-off permits will suffice.
m. Include with Job Completion Form, a copy of the final punch list with the word "DONE", and the date and Contractor's initials after each item on the list.

1.11 ELECTRICAL EQUIPMENT OPERATION AND MAINTENANCE (O&M) MANUALS

A. Provide O&M manuals required in Division 01 - General Requirements plus one manual for Sparling for all equipment furnished under Division 26 - Electrical of the specifications. Submit a preliminary copy, complete except for the bound cover, 60 days prior to completion of the project for checking and review. Deliver final bound corrected copies as noted in Division 1 - General Requirements plus a copy to Sparling 20 days prior to scheduled instruction periods. Obtain a receipt for the manuals and forward a copy of the receipt to the Engineer with the Job Completion Form.

B. The information included must be the exact equipment installed. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

C. These O&M manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. Present and arrange information in a logical manner for efficient use by the Owner's operating personnel. The information provided shall include but not be limited to the following:

1. Equipment manufacturer, make, model number, size, nameplate data, etc.
2. Description of system configuration and operation including component identification and interrelations. A master control schematic drawing(s) may be required for this purpose.
3. Dimensional and performance data for specific unit provided as appropriate.
4. Manufacturer's recommended operation instructions.
5. Manufacturer's recommended lubrication and servicing data including frequency.
6. Complete parts list including reordering information, recommended spares and anticipated useful life (if appropriate). Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable. Include the parts list and part diagram that was included with the product's packaging, note that a "catalog cut" will not meet this criterium.
7. Shop drawings.
8. Wiring diagrams.
9. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation.
10. A complete list of local (nearest) manufacturer representative and distributor contacts for each type of equipment and manufacturer. Include name, company, address, phone, fax, e-mail address, and web site.

11. A complete list of local (nearest) manufacturer representative and distributor contacts for each type of equipment and manufacturer. Include name, company, address, phone, fax, e-mail address, and web site.

D. Furnish complete wiring diagrams for each system for the specific system installed under the contract. "Typical" line diagrams will not be acceptable unless revised to indicate the exact field installation.

E. Group the information contained in the manuals in an orderly arrangement by specification index. Provide a typewritten index and divider sheets between categories with identifying tabs. Bind the completed manuals with hard board covers not exceeding 5" thick. (Provide two or more volumes if required.) Signal and communication systems shall be in separate volumes. Imprint the covers with the name of the job, Owner, Architect, Electrical Engineer, Contractor and year of completion. Imprint the back edge with the name of the job, Owner and year of completion. Hard board covers and literature contained may be held together with screw post binding.

1.12 INSTRUCTION PERIODS

A. After substantial completion of the work and 20 days after the O&M manuals have been delivered to the Owner and after all tests and final inspection of the work by the Authority(s) Having Jurisdiction, demonstrate the electrical systems and instruct the Owner's designated operating and maintenance personnel in the operation and maintenance of the various electrical systems.

1.13 RECORD DRAWINGS

A. Continually record the actual electrical system(s) installation on a set of prints kept readily available at the project during construction. These prints shall be used for this purpose alone.

1. Mark record prints with red erasable pencil. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown.
2. Accurately locate the exact dimensions all underground and underslab raceways and stub-outs.
3. Note changes of directions and locations, by dimensions and elevations, as utilities are actually installed.
4. Include addenda items and revisions made during construction.
5. Erase conditions not constructed or "X-out" and annotate "not constructed" to clearly convey the actual "as constructed" condition.
6. Organize record drawings sheets in manageable sets, bind and print suitable titles, dates and other identification on the cover of each set.

B. Transmit the record drawing set to the Architect at the completion of the work. Final payment to the contractor will not be authorized until these prints have been submitted to and accepted by the Architect.

C. Transfer the changes marked up on the record prints into AutoCAD 2008 (or higher) at the completion of the work. Provide two (2) sets of prints, one set of fixed line reproducible drawings and one set of AutoCAD drawing files on CD Rom. Transmit drawings, CAD files and the record drawing mark-ups to the Architect. Final payment to the contractor will not be authorized until these documents have been submitted to and accepted by the Architect.

1.14 FINAL ACCEPTANCE REQUEST

A. Submit to the Architect, with a copy to the Sparling Engineer, a Sparling Job Completion Form (form attached in this section) properly filled out prior to the time final acceptance of the electrical work is requested.

1.15 ABBREVIATIONS AND DEFINITIONS

A. When the following abbreviations and definitions are used in relation to the work for Division 26 they shall have the following meanings:

Item	Meaning

AHJ	Authority Having Jurisdiction.
Boxes	Outlet, Junction or Pull Boxes.
Code	All applicable codes currently enforced at project location.
Compression	Compressed using a leveraged powered (hydraulic or equivalent) crimping tool.
Connection	All materials and labor required for equipment to be fully operational.
Exterior Location	Outside of or penetrating the outer surfaces of the building weather protective membrane.
Fully Operational	Tested, approved, and operating to the satisfaction of the AHJ, manufacturer and contract documents.
Furnish	Deliver to the jobsite
Install	To enter permanently into the project and make fully operational.
Kcml	Thousand circular mils (formerly MCM).
Mfr.	Manufacturer.
NEC	National Electrical Code, National Fire Protection Association, Publication #70.
NIC	Not in Contract.
Noted	Shown or specified in the contract documents.
Provide	Furnish and install.
Required	As required by code, AHJ, contract documents, or manufacturer for the particular installation to be fully operational.
Shown	As indicated on the drawings or details.
Wiring	Raceway, conductors and connections.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials and equipment installed shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled unless otherwise permitted by the Authority Having Jurisdiction (Inspector).

B. All materials to be new, free from defects and not less than quality herein specified. Materials shall be designated to insure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

C. Each type of materials furnished shall be of the same make, be standard products of manufacturers regularly engaged in production of such materials and be the manufacturer's latest standard design.

D. All materials, equipment and systems furnished that include provisions for storing, displaying, reporting, interfacing, inputting, or functioning using date specific information shall perform properly in all respects regardless of the century. Any interface to other new or existing materials, equipment or systems shall function properly and shall be century compliant, both in regards to information sent and received.

2.02 SUBSTITUTION OF MATERIALS

A. No Substitute:

Where a specified product is indicated "no substitute", it is the intent of this specification to require new materials to be compatible with the existing installation or as specifically requested by the owner. To this end certain materials and systems no substitution will be allowed.

B. Prior to Bid Opening:

Acceptance of products other than those specified will be issued by addendum to the bid documents only after the following requirements are met and the proposed listed material is determined to meet or exceed the requirements:

1. Requests for listing to be original material, clearly indicating the product fully complies with contract documents and be neatly marked with yellow felt tip marker to clearly define and describe the product for which listing is requested.
2. Include certified laboratory test report for lighting fixtures.
3. Samples shall be submitted if requested.
4. Requests shall be received 10 days prior to bid opening.
5. Requests containing insufficient information to confirm compliance with contract documents will not be considered.

C. After Award of Contract:

Substitution of products will be considered after award of contract only under the following conditions:

1. The Contractor shall have placed orders for specified materials promptly after contract is awarded and the specified products can not be delivered to the project to meet the Owner's construction schedule.
2. The reason for the unavailability is beyond the Contractor's control, i.e., due to strikes, bankruptcy, discontinuance of manufacturer, acts of God.
3. The specified product is no longer manufactured.
4. There is compelling economic advantage to the Owner.

D. In all cases, should a substituted material result in requiring electrical system or building modifications; the Contractor alone shall pay all costs to provide these modifications including all costs to the Engineer and Architect for redesign, and updating of record drawings required to accommodate the required modifications.

2.03 NAMEPLATES

A. Provide nameplates per Section 260553 - Identification for Electrical Systems.

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft. Handle all equipment carefully to prevent damage, breakage, denting, and scoring of finishes. Do not install damaged equipment.

B. Store products subject to damage by the elements above ground, undercover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instruction.

3.02 CUTTING BUILDING CONSTRUCTION

A. Obtain permission from the Architect and coordinate with other trades prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.

B. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.03 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire rated floor and wall assemblies to maintain fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 section "Firestopping".

3.04 PAINTING

A. Items furnished under this Division that are scratched or marred in shipment or installation shall be refinished with touchup paint selected to match installed equipment finish.

3.05 EQUIPMENT CONNECTION

A. For equipment furnished under this or other Divisions of the specifications, or by owner, provide complete all electrical connections necessary to serve such equipment and provide required control connections to all equipment so that the equipment is fully operational upon completion of the project. Provide disconnect switch as required by code whenever an equipment connection is shown on the drawings.

B. Investigate existing equipment to be relocated and provide new connections as required.

C. Obtain rough-in requirements for equipment furnished under other divisions of this specification prior to roughing-in. Review shop drawings and submittals of other Divisions to determine requirements.

3.06 CLEAN UP

A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.

1. Wipe surfaces of electrical equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
2. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent, high pressure sodium, metal halide, and mercury vapor fixtures to comply with requirements for new fixtures.

3.07 TESTING AND DEMONSTRATION

A. Demonstrate that all electrical equipment operates as specified and in accordance with manufacturer's instructions. Perform tests in the presence of the Architect, Owner or Engineer. Provide all instruments, manufacturer's operating instructions and personnel required to conduct the tests. Repair or replace any electrical equipment that fails to operate as specified and or in accordance with manufacturer's requirements.

SPARLING ELECTRICAL JOB COMPLETION FORM

PROJECT NAME: _____
PROJECT LOCATION: _____
DATE: _____

A. Electrical Inspectors Final Acceptance (Copy of certificate attached.)

_____
Name Agency Date

B. Fire Marshal's Final Acceptance of Fire Alarm System (Copy of certificate attached.)

_____
Name Agency Date

C. The following systems have been demonstrated to Owner's representative.

1. Power Distribution System _____
Owner's Rep. Date

2. Lighting Control & Dimming System _____
Owner's Rep Date

3. _____

4. _____

5. _____

6. _____

D. Record Drawings
Attached Transmitted previously to _____
Date

E. O & M Manuals
Attached Transmitted previously to _____

F. Test Reports
Attached Transmitted previously to _____
Date

G. The work is complete in accordance with contract documents and authorized changes except for

_____
and the architect/engineer's representative is requested to meet with
_____ at _____ on _____
Supervisor of Electrical Work Time Date

_____ _____
Contractors Rep. Signature Date

END OF SECTION

SECTION 26 05 10

EXISTING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 and Division 02 Specification Sections, apply to this Section.

1.02 RELATED WORK

A. Same as in Section 260500 - Common Work Results For Electrical.

1.03 INDICATED EXISTING SYSTEMS

A. The electrical drawings show portions of the existing electrical systems which are to remain, be removed or be modified as a part of the Contractor's work. The indicated information is derived from record drawings and other data obtained from or with the permission of the owner. Where indicated, concealed systems are also derived from record drawings and the Engineer's best judgment of the configuration.

B. The Contractor shall inspect the existing installation prior to bidding and shall judge the work required. Inspection shall include areas within and adjacent to the work of any discipline or trade performing work for the contract.

1.04 POWER OUTAGES

A. The facility will continue its normal operation during construction; the Contractor shall schedule electrical system(s) outages with the Owner's Representative. Electrical systems(s) outages to Owner occupied areas shall not be permitted from 8:00 a.m. to 6:00 p.m. on any day of the week unless scheduled and approved by the owner in advance.

A. Cutovers must make alternative arrangements to deliver power to the load at all times

B. Cutovers must be accomplished in a minimum of 4 hours.

C. Submit a written request for a power outage at least ten days in advance identifying the areas and systems that will be affected, time and duration of the power outage. The Contractor shall receive written authorization to proceed with the outage and shall re-notify the Owner verbally at least one hour prior to the outage and also notify the Owner when the outage is completed.

D. Temporary generator(s) will be required for any work that takes the existing generator system out of service or off-line from any portion of the emergency power distribution. Temporary generation shall include automated controls and wiring to interface with the existing system.

E. Unscheduled Outages: In the event that the Contractor's work causes or contributes to an electrical system(s) outage (or other system fault), the Contractor is responsible for immediately correcting the problem. Included (as examples) shall be any premium time required to stay on the job site until problem is corrected and air freight for parts not locally available. Any damage resulting from performance of work under this contract shall be repaired to assure continuing facility operation and integrity, at no increase in contract cost.

PART 2 - PRODUCTS

2.01 EXISTING MATERIALS

A. All materials which are a part of the building shall remain the property of the Owner.

2.02 EXISTING MATERIALS NOT TO BE REINSTALLED

A. In coordination with the Architect, these materials shall be made available for his inspection and decision as to whether the Owner will retain possession. Items selected for retention shall be

turned over to the Owner. These items shall be delivered to a location on the premises selected by the Owner. Take reasonable care to avoid damage to this material. If the Contractor fails to conform to this requirement, he shall purchase and turn over to the Owner replacement material of like kind and quantity.

B. All material not selected for retention by the Owner and debris shall be legally disposed of by the Contractor.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

A. Examine the structure, building, and conditions under which electrical work is to be installed for conditions detrimental to proper and timely completion of electrical work. Do not proceed with work until deficiencies or detrimental conditions have been corrected. Report deficiencies or detrimental conditions of existing electrical work which might be unsuitable to connect with or receive other work. Failure to so report shall constitute acceptance of other work as being fit and proper for the reception of electrical work.

B. Field trace all existing circuitry affected by the project to determine:
   1. Source of supply or information collection point within the project area
   2. Load or termination within the project area
   3. Load or termination outside the project area, but supplied from or connected to equipment within the project area
   4. Loads supplied from and located outside of the project area, but have circuitry within the project area.

3.02 REMOVAL

A. All removal work required under this contract is not shown on the electrical drawings. Refer to work of other divisions for contract work that may affect existing electrical systems. Coordinate work between trades prior to bid.

B. Switchboards, panelboards, signaling and communication systems, other electrical equipment free standing or surface mounted, raceway (exposed) and conductors; which are not presently in service or will not be in service as a result of this contract shall be removed.

C. Contractor shall remove all floor, wall or ceiling mounted outlet devices in the "Removal" or "Demolition Area" indicated on the drawing, even if the equipment/or device is not individually shown on the project drawings. Unused flush mounted devices, outlet and other boxes in finished areas shall be removed from wall and the remaining hole patched to match adjacent wall surfaces.

D. Unused raceways and wire shall be removed back to source if accessible, otherwise cut flush at ceiling, floor or wall and fill with grout.

E. If Contractor questions whether a particular device is to be removed notify the Architect noting type and location of device. If so directed the Contractor shall maintain the existing device in service without any change in contract price.

F. Contractor shall divert all electrical demolition materials including, but not limited to copper and aluminum cabling, fixture ballasts and lamps, enclosures, raceways and bus ducts, to either a local recycling station or to the on-site recycling station as provided by the General Contractor or Owner.

3.03 EXISTING SYSTEMS MAINTAINED

A. Maintain existing systems not identified for demolition. Maintaining existing systems includes relocating the systems to coordinate with work of this contract, when work of this contract cannot be done while the existing system is in its present location.

B. Any existing wiring serving devices to remain in service and which may be affected by work performed under this contract shall be rerouted to maintain circuit continuity. Contractor shall

assume the risk of maintaining existing systems, except relocation of wiring of #2 AWG and above shall be considered an additional cost if not shown to be relocated. If such wiring is found the Contractor shall notify Architect Owner's Representative of wiring location, reason it must be removed and cost of relocation and receive the Owner's approval before proceeding with the work.

C. Examine drawings of all disciplines to determine where work of other trades will or is likely to require relocation of existing systems. Remove and relocate electrical equipment in the way of work of other trades. Exact relocation requirement of existing systems to remain to be based on detailed coordination with other trades. Contractor to provide proposed locations of relocated devices to Owner's Representative for approval prior to commencement of work.

D. Relocation of any system shall be permanent.

E. Re-route existing circuits that are affected as a result of this contract that serve devices to remain in service.
   1. Power Circuits (Including removal or relocation of existing panelboards).
      a. Prior to demolition work trace out and identify each branch circuit and feeder circuit that serves loads in occupied areas.
      b. Provide temporary wiring, schedule outage and reconnect loads to temporary wiring.
      c. Provide new wiring in new location.
      d. Schedule outage, disconnect temporary wiring, and connect loads to new wiring. Remove temporary wiring.
      e. Outage for each circuit shall not be more than 20 minutes.

   2. Signal and Communication Systems
      a. Prior to demolition trace out and identify device and systems being served.
      b. Provide temporary wiring to maintain operation of system throughout facility.
      c. Schedule outage and connect to temporary wiring and test system.
      d. Provide new wiring on new location.
      e. Schedule outage, disconnect temporary wiring, and reconnect to new wiring. Remove temporary wiring.
      f. Outage for each system shall not be more than 20 minutes.

3.04 TEMPORARY ELECTRICAL SYSTEMS

A. Provide temporary lighting, exit lighting, and fire notification in areas of construction that will have ongoing or intermittent public access. Temporary lighting shall comply with IES standards and other provisions of these specifications. Selected light fixtures must have battery backup to allow for egress at all times. Indicate path to nearest exit with exit signs. All temporary systems shall be removed after they are no longer in operation.

B. Removing, temporary installation, and reinstalling in ceilings of light fixtures, speakers, detectors, exit signs and other electrical equipment is not shown on the drawings. The Contractor shall investigate the ceiling demolition work and include appropriate temporary work in the bid. The sequence of work shall be (1) Remove and store fixtures, detectors and speakers along with removal of ceiling, (2) Provide temporary support for wired fixtures and devices to be reinstalled in new ceiling at approximately the same location. Use chains for lighting fixture support. (3) Clean and reinstall in the new or replaced ceilings. Provide new lamps when so noted. Provide temporary relocation of exit signs to original location when exit is reactivated.

3.05 WORK OUTSIDE OF REMODEL AREAS

A. Provide new wiring systems in concealed ceiling spaces, unless the structure is open to the floor below.

B. Route wiring around obstructions and provide pull boxes per code. Carefully remove, store or temporarily hang and re-install in undamaged condition all electrical equipment, lighting fixtures

and ceiling tiles where access to perform work is required. Clean prior to re-installation. Provide new lamps when so noted.

3.06 NEW DEVICES IN REMODEL AREAS

A. Provide flush mounting for devices in existing walls. Fish conduit in wall. Where existing boxes are indicated to be reused, extend box as necessary and provide new devices and plates.

B. Contractor is cautioned that the existing building contains concrete walls. New devices may require cutting and patching, and it shall be the responsibility of the contractor to provide all cutting and patching required for the installation of the Division 26 work. Contractor shall investigate existing areas prior to bid and shall include all costs of such work in the bid.

C. This facility has wiring embedded in raceways in concrete slabs. Provide new concealed wiring to last outlet or pull box before homerun to panel.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.03 DEFINITIONS

A. VFC: Variable frequency controller.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Alcan Products Corporation; Alcan Cable Division.
   2. Alpha Wire.
   3. Belden Inc.
   4. Encore Wire Corporation.
   5. General Cable Technologies Corporation.
   6. Southwire Incorporated.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 and Type SO.

2.02 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   2. Gardner Bender.
   3. Hubbell Power Systems, Inc.
   4. Ideal Industries, Inc.
   5. Ilsco; a branch of Bardes Corporation.
   6. NSi Industries LLC.
   7. O-Z/Gedney; a brand of the EGS Electrical Group.
   8. 3M; Electrical Markets Division.
   9. Tyco Electronics.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper, stranded..

B. Branch Circuits: Copper, stranded

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material.

C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches (150 mm)** of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.08 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test and Inspection Reports: Prepare a written report to record the following:
   1. Procedures used.
   2. Results that comply with requirements.
   3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Stranded Conductors: ASTM B 8.
   2. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   4. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, **1/4 by 4 inches (6.3 by 100 mm)** in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.02 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solder less compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Provide all grounding and bonding required by NFPA 70, as adopted by the local authority having jurisdiction. Detailed aspects of code requirements for grounding and bonding may not be indicated within the contract documents, however, all aspects of code compliance are the responsibility of the contractor.

B. Conductors: Install stranded copper conductor.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
   2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

D. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Connections to Structural Steel: Welded connectors.

3.02 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.04 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3.06 SIZE OF GROUND WIRE

A. As required by National Electric Code. Where ground wire is exposed to physical damage protect with rigid non-ferrous conduit as permitted by applicable code.

3.07 CONNECTION TO THE POWER GROUND BUS

A. Furnish and install connections in accordance with the codes; including but not limited to:
   1. Raceway system
   2. Panelboard
   3. Electrically operated equipment and devices.

B. No device or equipment shall be connected for electrical service which has a neutral conductor connected to a grounding conductor or to the frame within the device or equipment.

3.08 METHOD OF CONNECTIONS

A. Make all ground connections and ground cable splices by thermal welding or copper compression set type connectors U.L. listed for grounding purposes. Grounding lugs, where provided as standard manufacturer's items on equipment furnished, may be used.

3.09 EXPANSION FITTINGS

A. In conduit runs requiring an expansion fitting, a bonding jumper shall be installed around the fitting to maintain continuous ground continuity.

3.10 GROUNDING FOR PANELBOARD FEEDERS

A. Provide a grounding bushing with ground conductor sized in accordance with NEC table 250.122 to the grounding bus in the panelboard and switchboards.

3.11 PANELBOARD BONDING

A. Provide a bonding conductor not smaller than #10 AWG between the ground bus in the normal and emergency panels and/ or two or more emergency panelboards fed from separate transfer switches, serving the same individual patient vicinity in accordance with NEC 517.14.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260548 - "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.02 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Concrete bases (housekeeping pads) for electrical equipment.

1.03 REFERENCES

A. ASTM A325: American Society for Testing and Materials - Standard Specification for Structural Bolts.

B. ASTM A603: American Society for Testing and Materials - Standard Specification for Zinc-Coated Steel Structural Wire Rope.

C. IBC: International Building Code. as adopted and amended by local jurisdiction.

D. ICC: International Code Council.

E. MFMA-3: Metal Framing Manufacturers Association's Metal Framing Standards Publication.

F. MSS SP-58: Manufacturers Standardization Society of the Valve and Fittings Industry Standard for Pipe Hangers and Supports - Materials, Design, and Manufacture.

G. NECA 1: National Electrical Contractors Association Standard Practices for Good Workmanship in Electrical Contracting.

H. OSHPD: Office of Statewide Health Planning and Development.

1.04 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.05 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents plus 25% spare space capacity.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.06 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.
   3. Shop Drawings: Show fabrication and installation details and associated structural calculations for the following:
      a. Trapeze hangers. Include Product Data for components.
      b. Steel slotted channel systems. Include Product Data for components.
      c. Nonmetallic slotted channel systems. Include Product Data for components.
      d. Equipment supports.
      e. Light fixtures greater than 50 pounds.

1.07 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.08 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.09 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation.
      f. Unistrut; Tyco International, Ltd.
      g. Wesanco, Inc.
   2. Finishes:
      a. Plated Coatings: Zinc Plated. Fitting and accessories - zinc plated
      b. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3. Fitting and accessories - hot-dip galvanized or stainless steel where hot-dip galvanized is not available.
      c. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4. . Fitting and accessories - PVC coated or stainless steel where PVC coated is not available

d. High Performance Coatings: Manufacturer's standard epoxy or acrylic coating applied according to MFMA-4.

3. Channel Dimensions: Selected for applicable load criteria.

B. Aluminum Slotted Support Systems: Structural-grade, factory-formed, aluminum channels and angles. Comply with MFMA-3, factory-fabricated components

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. GS Metals Corp.
   d. ERICO International Corporation.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles
4. Rated Strength: Selected to suit structural loading and applicable seismic forces.

C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: NOT ALLOWED
2. Mechanical-Expansion Anchors: NOT ALLOWED
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 SUPPORT INSTALLATION -GENERAL

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts or use expansion anchor fasteners.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
   6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.02 HANGERS AND SUPPORTS FOR RACEWAYS

A. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 3/8 inch (10 mm) in diameter.

B. Suspended ceiling systems: Do not attach raceways to ceiling suspension system hangers.

C. Raceways 3/4" (20mm) and smaller serving equipment located within ceiling cavity or mounted on or supported by the ceiling grid system may be supported by dedicated #12 ga. galvanized, soft annealed mild steel wire hangers. Two raceways maximum per hanger. Attach raceways to wires with clips manufactured for the purpose.

D. Raceways 1" and larger: Provide lay-in pipe hangers on 1/4" (6mm) or larger all threaded rods attached to metal ceiling inserts or to structural members at not greater than spacing noted above and within 12" (300mm) of each change in direction.

E. Multiple Raceways or Cables: When more than two raceways will use the same routing, group together on a channel trapeze support system supported by threaded rods attached to metal ceiling inserts or structural members. Size supports for multiple raceways for 25% future capacity. Trapeze shall be sized in accordance with SMACNA Guidelines with conduit weight taken to be as listed for same size pipe filled of water.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

F. Raceway Support Methods: In addition to methods described in NECA 1, EMT [EMT, IMC, and RMC] may be supported by openings through structure members, as permitted in NFPA 70.

3.03 VERTICAL CABLE SUPPORTS

A. Provide cable support for vertical cable runs as required by NFPA 70.

3.04 SUPPORT FOR LIGHT FIXTURES

A. Provide support system designed by registered engineer for all light fixtures over 50 pounds.

B. Recessed mounted type fixtures less than 20 pounds installed in lay-in ceiling: Provide four support clips, Caddy #515 or similar , (one each corner) which lock light fixture to ceiling tees after light fixture is installed. In addition, provide for each light fixture **two** #14 earthquake chains or #12 wires secured located at diagonally opposite fixture corners and attached to structural members above suspended ceiling.

C. Recessed mounted type fixtures less than 50 pounds installed in lay-in ceiling: Provide four support clips, Caddy #515 or similar , (one each corner) which lock light fixture to ceiling tees after light fixture is installed. In addition, provide for each light fixture **four** #14 earthquake chains or #12 wires (one in each corner) installed taut and secured to structural members above suspended ceiling.

D. Recessed mounted type fixtures installed in plaster or gypsum ceiling. Provide support chains or wires similar to lay-in ceiling requirements except also provide plaster frame compatible with light fixture. Attach support wires/chains to plaster frame.

E. Surface mounted type fixtures less than 50 pounds installed on suspended ceilings: Provide metal carrying channels above suspended ceiling spanning between ceiling support channels. Attached fixture through ceiling to carrying channels. In addition, provide for each light fixture **four** #14 earthquake chains or #12 wires installed taut from metal carrying channels to structural members above suspended ceiling.

F. Surface mounted type fixtures less than 20 pounds installed on suspended ceilings: Provide support frame above suspended ceiling. Attached fixture through ceiling to support frame. In addition, provide for each light fixture **two** #14 earthquake chains or #12 wires secured located at diagonally opposite fixture corners of plaster frame secured to structural members above suspended ceiling.

G. Surface mounted type fixtures less than 50 pounds designed to be supported from fixture junction box:
   1. Provide hanger bars between structural members. Attach junction box directly to hanger bars.
   2. Attach heavy formed steel straps to the outlet box by means of threaded stems with locknuts, or directly to the outlet box where the light fixture is specifically so designed. Support junction box from structure with 1/4" threaded rod.

H. Pendant mounted type fixtures less than 50 pounds:
   1. For fixtures with rigid pendants, provide swivel ball aligners at canopy.
   2. Where mounted below suspended ceiling, support fixture from structural members above ceiling by means of minimum 1/4" threaded stems with locknuts.

3.05 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.06 COATINGS

A. Touchup: Clean field cuts, field welds and abraded areas of PVC, Epoxy and Acrylic coated products. Re-coat exposed areas immediately after erecting hangers and supports. Follow manufacturer's instructions for repair of coated products.

B. Hot Dip Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Surface raceways.
   5. Boxes, enclosures, and cabinets.

B. Related Sections
   1. Section 260529 - Hangers and Supports for Electrical Systems
   2. Section 260544 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling
   3. Section 260548 - Vibration and Seismic Controls for Electrical Systems

1.03 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. EMT: Electrical metallic tubing.

C. ENT: Electrical nonmetallic tubing.

D. EPDM: Ethylene-propylene-diene terpolymer rubber.

E. FMC: Flexible metal conduit

F. GRC: Galvanized rigid steel conduit.

G. HDPE: High Density Polyethylene

H. IMC: Intermediate metal conduit.

I. LFMC: Liquidtight flexible metal conduit.

J. LFNC: Liquidtight flexible nonmetallic conduit.

K. NBR: Acrylonitrile-butadiene rubber.

L. RNC: Rigid nonmetallic conduit.

M. RTRC: Reinforced Thermosetting Resin Conduit

1.04 REFERENCES

A. American National Standards Institute (ANSI)

B. National Electrical Manufacturers Association (NEMA)

C. Underwriters Laboratories, Inc. (UL)

D. National Fire Protection Association (NFPA)

1.05 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
      a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Qualification Data: For professional engineer and testing agency.

D. Source quality-control test reports.

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Allied Tube & Conduit; a Tyco International Ltd. Co.
   4. Anamet Electrical, Inc.; Anaconda Metal Hose.
   5. Electri-Flex Company.
   6. Manhattan/CDT/Cole-Flex.
   7. Maverick Tube Corporation.
   8. O-Z/Gedney; a brand of EGS Electrical Group.
   9. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:

      a. Material: Steel.

b. Type: Setscrew. Die Cast fittings are not acceptable.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Square D; a brand of Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers**:** Screw-cover type.

E. Finish: Manufacturer's standard enamel finish.

2.03 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
a. Wiremold Company (The); Electrical Sales Division.
b. .

2.04 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Box extensions used to accommodate new building finishes shall be of same material as re-cessed box.

F. Device Box Dimensions: **4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)**.

G. Gangable boxes are allowed.

H. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Interior Panels: Steel; all sides **finished with** manufacturer's standard enamel.

I. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Comply with the following indoor applications: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed, Not Subject to Severe Physical Damage: EMT.
   3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
      a. Loading dock.
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
      c. Mechanical rooms.
      d. .
   4. Concealed in Ceilings and Interior Walls and Partitions: EMT .
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   6. Damp or Wet Locations: GRC.
   7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
   8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communica-tions Cable: EMT
   9. Boxes and Enclosures: NEMA 250, Type 1.

B. Minimum Raceway Size: **3/4-inch (21-mm)** trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10. Cast metal fittings are not acceptable
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. INSTALLATION

H. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

I. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

J. Complete raceway installation before starting conductor installation.

K. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.

L. Arrange stub-ups so curved portions of bends are not visible above finished slab.

M. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

N. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

O. A. Support conduit within 12 inches (300 mm) of enclosures to which attached.

P. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

Q. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

R. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

S. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

T. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

U. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

V. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

W. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

X. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Y. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

Z. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

AA. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Where otherwise required by NFPA 70.

BB. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

CC. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminairesand equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

DD. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

EE. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

FF. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

GG. Locate boxes so that cover or plate will not span different building finishes.

HH. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

II. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

JJ. Set metal floor boxes level and flush with finished floor surface.

KK. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.02 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.03 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.04 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.02 SUMMARY

A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   3. Sleeve-seal fittings.
   4. Grout.
   5. Silicone sealants.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:
   1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
   2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:
   1. Material: Galvanized sheet steel.
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
      b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Insert manufacturer's name; product name or designation:
    a. Advance Products & Systems, Inc.
    b. CALPICO, Inc.
    c. Metraflex Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.
3. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
    1. Manufacturers: Subject to compliance with requirements, provide products by the following:
        a. Presealed Systems.

B. Cable/conductor sealing fittings(for use where sealing ends of conduits were cables emerge in application involving higher fluid or gas pressures than can be handled by standard sealing bushings):
    1. Material: Body: malleable or ductile lron casting with hop dip galvanized finish. Sealing disc is canvas Bakelite
    2. Manufacturers: O-Z Gedney RA Series.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
    1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
    2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260529 - Hangers And Supports For Electrical Systems for commonly used electrical supports and installation requirements.

1.02 SUMMARY

A. This Section includes the following:
   1. Delegated design for seismic supports including:
      a. Seismic calculations
      b. Seismic attachments
      c. Restraint cables
      d. Hanger rod stiffeners
      e. Anchorage bushings and washers

1.03 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.04 SEISMIC DESIGN PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:
   1. Occupancy Category as Defined in IBC: II.
   2. Seismic Design Category as Defined in IBC: D.
   3. Site Class as Defined in the IBC: B.
   4. Peak Spectral Response Acceleration (Ss) = 0.81
   5. Design Spectral Response Acceleration (SDs) = 0.540
   6. Importance Factor for non-structural seismic design per the following table:

Element	Importance Factor	Reason
Normal Branch Building Power Distribution - panels	1.0	
Normal Branch power distribution -raceway greater than 2 1/2 inches	1.5	Continued Operation
Normal Branch power distribution - raceway 2 1/2 inches or less	Exempt	
Generator systems including all ancillary equipment	1.5	Life Safety
Emergency Branch Building Power Distribution - panels	1.5	Life Safety
Emergency Branch power distribution -raceway greater than 2 1/2 inches	1.5	Life Safety
Emergency Branch power distribution - raceway 2 1/2 inches or less	Exempt	
Lighting Interior - served from Life safety or Critical branch	1.5	Life Safety
Lighting Interior - served from normal branch	1.0	
Lighting Control	1.0	
Nurse/Patient Communication Systems	1.5	Life Safety
Grounding systems	1.0	
Isolated Power System	1.5	Continued Operation
UPS Systems	1.5	Continued Operation
Battery Systems	1.5	Hazardous materials
Fire Alarm System	1.5	Life Safety
Smoke Control System Power and Control	1.5	Life Safety
Smoke Damper Power and Control	1.5	Life Safety
Public Address	1.0	
Elapsed Time Clocks	1.0	
Clock Correction System	1.0	
Communication Infrastructure - Cable trays, racks, IDF/MDF equipment	1.5	Continued Operation
Communication raceway greater than 2 ½ inches and Fiber Optic risers	1.5	Continued Operation
Communication raceway less than 2 1/2 inches or less	1.0	
Voice/Data Cabling	1.0	
Local Intercom Systems	1.0	
Access Control System	1.0	
Television Distribution System	1.0	
CCTV Surveillance System	1.0	
Television Distribution Raceway System	1.0	
Wireless Local Area Network (WLAN)	1.0	

7. Importance Factor for non-structural seismic design per the following table:

Element	Importance Factor	Reason
Normal Building Power Distribution - panels	1.0	
Normal Branch power distribution -raceway greater than 2 1/2 inches	1.0	
Normal Branch power distribution - raceway 2 1/2 inches or less	Exempt	
Generator systems including all ancillary equipment	1.5	Life Safety
Emergency Branch Building Power Distribution - panels	1.5	Life Safety
Emergency Branch power distribution -raceway greater than 2 1/2 inches	1.5	Life Safety
Emergency Branch power distribution - raceway 2 1/2 inches or less	Exempt	
UPS Systems	1.0	
Battery Systems	1.5	Hazardous materials
Lighting Interior - served from Life safety or Critical branch	1.5	Life Safety
Lighting Interior - served from normal branch	1.0	
Lighting Control	1.0	
Grounding systems	1.0	
Fire Alarm System	1.5	Life Safety
Smoke Control Systems Power and Control	1.5	Life Safety
Smoke Damper Power and Control	1.5	Life Safety
Public Address	1.0	
Communication Infrastructure - Raceways, Cable trays, racks, IDF/MDF equipment	1.0	
Voice/Data Cabling	1.0	
Access Control System	1.0	
Television Distribution System	1.0	
CCTV Surveillance System	1.0	
Television Distribution Raceway System	1.0	
Wireless Local Area Network (WLAN)	1.0	

1.05 COMPONENTS EXEMPT FROM SEISMIC REQUIREMENTS

A. In accordance with ASCE 7 paragraphs 13.1.4, 13.6.1 and 13.6.5.5.6 the following electrical items are exempt from seismic requirements:
   1. All electrical components
   2. Electrical components when the importance factor is 1.0
   3. Electrical components when the importance factor is 1.0 **and any of the following occur:**
      a. Electrical components weighing less than 20 lbs if flexibly connected.
      b. Electrical components weighing less than 5 lbs/foot if flexibly connected.
      c. Electrical components weighing less than 400 lbs. and mounted less than 4 feet above the floor if flexibly connected.
      d. Pendant light fixtures if free to rotate and swing without hitting other components and if sufficiently supported (1.4 times operating weight).
   4. Electrical components when the importance factor is 1.5 **and any of the following occur:**
      a. Conduits 2 ½" and smaller
      b. Conduits, bus duct or cable tray mounted from trapeze assembly where weight of assembly is 10 lbs/foot or less.

1.06 SUBMITTALS

A. Product Data: For the following:
   1. Seismic Restraint Components: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by **an evaluation service member of ICC-ES**.
      b. Annotate to indicate application of each product submitted and compliance with requirements.
   2. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Provide design of support, attachment and seismic restraint for the following:
      a. All electrical equipment not exempted in paragraph 1.5 above.
      b. Attachments into concrete
      c. Welded attachments
      d. Pendant light fixtures weighing more than 20 pounds if not free to swing in all directions.
      e. Conduits greater than 2 1/2" diameter with importance factor of 1.5.
      f. Trapeze conduit racks with importance factor of 1.5 where weight of supported assembly exceeds 10 lbs/ft.
      g.
   2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select seismic restraints.
      a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.
      b. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
   3. Seismic-Restraint Details: Provide details of field fabricated supports.
      a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
      b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events
      c. Preapproval and Evaluation Documentation: By **an evaluation service member of ICC-ES**, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
   4. Seismic Restrain Ratings: Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and.

F. Field quality-control test reports.

1.07 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.01 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amber/Booth Company, Inc.
   2. California Dynamics Corporation.
   3. Cooper B-Line, Inc.; a division of Cooper Industries.
   4. Hilti Inc.
   5. Loos & Co.; Seismic Earthquake Division.
   6. Mason Industries.
   7. TOLCO Incorporated; a brand of NIBCO INC.
   8. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by **an evaluation service member of ICC-ES**.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least **four** times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: **ASTM A 603 galvanized**-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

I. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless

steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.02 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
   1. Powder coating on springs and housings.
   2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
   3. Baked enamel or powder coat for metal components on isolators for interior use.
   4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SEISMIC APPLICATIONS

A. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:
   1. Install seismic restraints on electrical equipment per deferred design requirements.
   2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
   3. Install seismic-restraint devices using methods approved by **an evaluation service member of ICC-ES** providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: Anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least **four** of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Verify snubber minimum clearances.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

B. Adjust active height of spring isolators.

C. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.07 MISCELLANEOUS

A. Coordinate with other trades and structural engineer to ensure mounting attachment points for seismic restrained springs and seismic snubbers called out in this specification will withstand forces generated from the maximum acceleration rating of the restrained springs and snubbers.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Equipment identification nameplates.
   2. Identification for conductors, cables AC and MC cables
   3. Identification for raceways.
   4. Underground-line warning tape.
   5. Warning labels and signs.
   6. Instruction signs.
   7. Receptacle Identification Labels
   8. Miscellaneous identification products.

1.03 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A13.1 "Scheme for Identification of Piping Systems"

B. Occupational Safety and Health Administration (OSHA). 29 CFR - Labor Chapter XVII Part 1910-145 "Occupational and Safety Health Standards" 1992.

C. Washington Administrative Code (WAC) 296-24 Part B-2 "Safety Color Code for Marking Physical Hazards."

1.04 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.05 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.06 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Note that equipment names and room numbers shown on the Contract Drawings may not be final names and numbers. Confirm all final naming prior to label manufacture.

C. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

D. Coordinate installation of identifying devices with location of access panels and doors.

E. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT NAMEPLATES

A. Materials:
   1. Engraved plastic laminate - three-layer laminated plastic with punched or drilled holes for screw mounting
   2. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed
   3. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process.
   4. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Overlay shall provide a weatherproof and UV-resistant seal for label.
   5. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm)

B. Dimension
   1. Nameplate minimum of 1 3/4" high by 5" wide.
   2. Lettering height for panel or equipment identifier @ 1/4".
   3. Lettering height for remaining lines @ 1/8" high with 1/8" spacing between lines.
   4. Normal System: White letters on black background.
   5. Emergency System: White letters on orange [red] background.
   6. Life Safety System - <Insert Color> letters on <Insert Color> background.
   7. Critical Branch System - <Insert Color> letters on <Insert Color> background.
   8. Equipment Branch System - <Insert Color> letters on <Insert Color> background.
   9. Optional Standby Branch System - <Insert Color> letters on <Insert Color> background
   10. Comply with ANSI 13.1.

C. Panelboard Nameplates
   1. Provide engraved plastic nameplate for each new panelboard with the following information:

      Line 1: Panelboard Name

      Line 2: Source from which panel is fed (e.g.Fed From SWBD 4N2A)

      Line 3: Transfer switch from which panel is fed (if applicable)

      Line 4: Amps, voltage, phase and wire

D. Disconnects, Starters, Combination Starters and Other Devices
   1. Provide phenolic nameplate for each device with the following information:

      Line 1: Load served

      Line 2: Panelboard and circuit number from which device is fed

      Line 3: Fuse size or breaker size as applicable

2.02 CONDUCTOR, CABLE AND AC AND MC CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each conductor and cable size.

B. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor or cable it identifies and to stay in place by gripping action.

E. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

2.03 RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1, for minimum lettering size and for minimum length of color field for each raceway size.

B. Color for Raceway Carrying Fire Alarm Circuits:
   1. White Letters on an red field
   2. Legend: "FIRE ALARM " with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

G. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

2.04 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch (6.4-mm) grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.05 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with [black letters on white face] <Insert colors>.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.06 RECEPTACLE AND SWITCH IDENTIFICATION LABELS

A. Materials (Where engraved device faceplates are not used)
1. Engraved plastic laminate - three-layer laminated plastic with punched or drilled holes for screw mounting
2. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed
3. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process.
4. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Identification
1. Label emergency receptacle and switch device plates with "EMERGENCY" above the receptacle with the panelboard and circuit number supplying them below the receptacle. Label lettering shall be approximately 3/16" high, red filled characters.
2. Label normal receptacle cover plates in Critical Care Areas as defined in the NEC, with the circuit number supplying them below the receptacle with 3/16" high, black filled letters.
3. Label normal receptacle and switch cover plates with the circuit number supplying them below the device using 3/16" high, black filled letters.
4. For all receptacles other than 15 and 20 amp, 120 volts, provide separate nameplate with ampere rating, voltage and phase.
5. Provide labels on faceplates of all owner furnished equipment and equipment furnished under other divisions with circuit number, and "EMERGENCY" (where applies) as specified in this section. This includes but is not limited to: headwalls, gas columns and booms, patient consoles, medical rail systems, custom casework with electrical devices, etc.

2.07 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
   3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
   4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
   3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
   4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
   5. Color: Black.

2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.

G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.02 EQUIPMENT IDENTIFICATION:

A. On each unit of equipment, install unique designation nameplate that is consistent with naming used in wiring diagrams, schedules, and the Operation and Maintenance Manual.

B. In addition to equipment listed in Part 2 provide nameplates for:
   1. Access doors for concealed electrical devices
   2. Transformers
   3. Substations
   4. Enclosed over-current protective devices
   5. Electrical cabinets, enclosures and terminal cabinets
   6. Contactors
   7. Variable speed drives
   8. Battery -inverters, battery racks, UPS equipment
   9. Power-generating units
   10. Monitoring and control panels and equipment
   11. <insert equipment>

C. Confirm all final naming prior to label manufacture.

D. Labeling Instructions:
   1. Indoor Equipment: [Adhesive film label] [Adhesive film label with clear protective overlay] [Self-adhesive, engraved, laminated acrylic or melamine label] [Engraved, laminated acrylic or melamine label].
   2. Outdoor Equipment: Engraved, laminated acrylic or melamine label with screw fasteners
   3. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   4. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

3.03 CIRCUIT CONDUCTOR IDENTIFICATION

A. Power-Circuit Conductor Identification, 600 V or Less:
   1. For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   2. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      b. Colors for 208/120-V Circuits:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral: White
         5) Equipment Ground: Green
         6) Isolated Ground: Green with yellow tracer
      c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

   3. Conductors to Be Extended in the Future: Attach self adhesive label to conductors and list source.

B. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use metal tags **with circuit designation**. For conductors to be extended in the future, attach self metal tag to conductors and list source. Install

tags at all points of accessibility including manholes, padmounted switches and interior switchgear. Firmly attach all tags to each cable phase using plastic tie wraps. Position tags so that they are clearly legible to the observer.

C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

3.04 RACEWAY IDENTIFICATION

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings:
   1. Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:
      a. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
      b. Wall surfaces directly external to raceways concealed within wall.
      c. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than [**30**] <**Insert number**> A, and [**120**] <**Insert number**> V to ground: Identify with [**self-adhesive vinyl label**] [**self-adhesive vinyl tape applied in bands**].
   1. Install labels at [**10-foot (3-m)**] [**30-foot (10-m)**] maximum intervals.
   2. Install minimum one label per enclosed room.

C. System Identification Color-Coding Bands for Raceways: Each color-coding band shall completely encircle raceway. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

D. Junction Box Color Coding
   1. Color Code all junction and pull boxes installed in accessible ceiling spaces and exposed in unfinished areas using spray paint on the box and entire cover in the following manner:

System	**Color**
480 Volt Power	Brown
277 volt lighting	Yellow
120/208 volt	Unpainted
Emergency Power	Orange
Clock & Program	Green
Fire Alarm	Red
Telephone/Network	Black
Nurse Call	Light Blue
Public Address	Silver
Television	Gold
Access Control	Gray
Intercom	White

   2. Use black felt tip marker **[self adhesive vinyl labels]** following painting to indicate the circuit numbers in 1" (25mm) high letters contained within.

3.05 WORKING CLEARANCE IDENTIFICATION

A. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated.

B. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

3.06 UNDER GROUND LINE IDENTIFICATION

A. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, and communication,**.**
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for direct-buried cables, cables in raceway and duct banks..

B. Underground-Line Warning Tape Installation: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

3.07 POSTED DRAWINGS AND OPERATING INSTRUCTIONS

A. Mount drawings and operating procedures on the wall immediately adjacent to the main piece of equipment for which the instructions apply. If sufficient wall space is available, mount directly to one of the sheet metal panels of the equipment.

B. Color Coding Sign: Install instructional sign for the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

C. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

3.08 WARNING SIGNS

A. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: [**Self-adhesive warning labels**] [**Baked-enamel warning signs**] [**Metal-backed, butyrate warning signs**].
   1. Comply with 29 CFR 1910.145.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.
      c. <Insert items>.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Sections include the following:
   1. Section 260519 Low Voltage Electrical Power Conductors and Cables
   2. Section 262726 Wiring Devices
   3. Section 265100 Interior Lighting

1.02 SUMMARY

A. This Section includes the following lighting control devices:
   1. Indoor occupancy sensors
   2. Time switches
   3. Control Relays

1.03 DEFINITIONS

A. LED: Light-Emitting Diode

B. PIR: Passive Infrared

C. DT: Dual Technology

1.04 SUBMITTALS

A. Make submittals in accordance with Section 260500 - Common Work Results For Electrical.

B. Product Data: Provide clearly marked and legible data sheets for each item of equipment being installed on the project. This shall include each major replaceable component that is part of a larger assembly. Data sheets should clearly indicate:
   1. Equipment manufacturer, make, model number, size, nameplate data, etc.
   2. Dimensional and performance data for specific unit provided as appropriate
   3. Required environmental operating parameters
   4. UL, FM and ETL listing and category
   5. Manufacturer contact information including address, telephone number, facsimile number, email address, web site address and contact person or persons.
   6. Local manufacturer’s representative contact information including address, telephone number, facsimile number, email address, web site address and contact person or persons.

C. Shop Drawings: Show installation details for occupancy sensors.
   1. Lighting plan showing location, orientation, and coverage area of each sensor. This plan shall take into consideration the size and use of each space as well as the specific capabilities of submitted manufacturer's equipment to provide proper coverage to the areas of control.
   2. Interconnection diagrams showing field-installed wiring.

D. Label List: Submit list of proposed text for all labels prior to manufacturing for review and approval by Owner’s representative.

E. Warranty: Submit a copy of product warranty that complies with contract document requirements. Where these requirements exceed manufacturer’s standard warranty include cost of extended warranty in contract price.

F. Maintenance Requirements: Submit maintenance requirements manual or guidelines. This document should detail the requirements necessary to comply with the warranty. This is required for the submittal process and is in addition to the O&M requirements.

G. Samples: Provide sample devices and finishes plus other samples when requested, as part of the submittal process.

H. Commissioning Checklist: Submit a copy of the proposed commissioning checklist to be utilized for this project.

I. Commissioning Results: Submit a copy of the completed commissioning documents.

1.05 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.06 QUALITY ASSURANCE

A. Qualifications
   1. Manufacturer shall have been in the business of manufacturing and providing service for lighting control equipment for similar capabilities and size, under the same name and ownership, for a minimum of three years preceding bid date of the project.
   2. All components and assemblies shall be factory pre-tested prior to installation.
   3. Factory trained technicians shall be on site for start-up, commissioning and training.
   4. Factory trained technicians shall be available for telephone support twenty four (24) hours a day, seven (7) days a week.
   5. Lighting control devices must be approved by the CEC (California Energy Commission).

B. Regulatory Requirements
   1. Underwriters Laboratories: Provide U.L. listed lighting control equipment.
   2. Code of Federal Regulations: 47 CFR - FCC All assemblies are to be in compliance with FCC emissions standards specified in Part 15 for Class A application.

1.07 WARRANTY

A. Manufacturer's Warranty: The manufacturer shall provide a written warranty agreeing to provide parts to replace any portion of the lighting control system equipment that fails due to material or workmanship for a period of twelve months from warranty commencement.

B. Warranty Commencement: Warranty shall begin at the point of substantial completion of the system installation, which is defined as the date when commissioning and owner training has been completed and the owner obtains beneficial use of the system.

C. Warranty Replacement Parts: The manufacturer shall be able to ship replacement parts within 24 hours for any component that that fails due to material or workmanship during the warranty period.

PART 2 - PRODUCTS

2.01 INDOOR OCCUPANCY SENSORS

A. Subject to compliance with the contract documents, provide products from one of the following manufacturers:
   1. Bryant Electric; a Hubbell company.
   2. Cooper Industries, Inc.
   3. Hubbell Building Automation, Inc.
   4. Leviton Mfg. Company Inc.
   5. Lightolier Controls.
   6. Lithonia Lighting; Acuity Lighting Group, Inc.
   7. Lutron Electronics Co., Inc.

8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.

B. General Operation
   1. The Occupancy Sensor system shall sense the presence of human activity within the desired space and fully control the on/off function of the loads automatically. Sensors shall turn on the load within 2 feet of entrance and shall not initiate "on" outside of entrance.
   2. Use sensing technologies as required for each space to provide optimal coverage based upon the space and configuration of the equipment located in the space. Upon detection of human activity by the detector, a Time Delay shall be initiated to maintain the light on for a field adjustable pre-set period.
   3. Mounting
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay (when required): Externally mounted through a 1/2 inch knockout in a standard electrical enclosure or integral to the sensor.
      c. Time Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   4. Line Voltage Sensors
      a. Sensor shall be a self-contained dual voltage device capable of directly switching loads upon detection of human activity.
      b. Sensor must be rated for 800 watts at 120 VAC, suitable for incandescent light fixtures, fluorescent light fixtures with magnetic or electronic ballasts, or 1/6 hp motors or rated for 1000 watts at 277 VAC, suitable for fluorescent light fixtures with magnetic or electronic ballasts, or 1/3 hp motors minimum. Sensor shall be capable of parallel wiring for 3-way switching applications.
      c. Sensor Time Delay shall be factory set for typical applications, and field adjusted during commissioning. Sensor must provide a LED motion indicator.
   5. Low Voltage Sensor
      a. Sensors must be designed to work in conjunction with remote power packs, relays, or other control systems. Sensors must operate with a Class 2, low voltage wiring strategy. Sensors must be capable of being parallel wired for multi-sensor applications.
      b. Sensor must provide a transistor output, returning the voltage input rectified to DC, to control remote power packs, relays, or other control systems. Sensor must be available with an optional single pole, double throw signal relay capable of being wired open on occupancy, or closed on occupancy. Sensor Time Delay shall be factory set for typical applications, and field adjusted during commissioning. Sensor must provide a LED motion indicator.

C. Switch-Box Occupancy Sensors
   1. General
      a. Sensor must not protrude out from the cover plate more than 0.37 inches, and recess into the switch box more than 1 inch. Sensor must surface mount to single gang switch box, and accept accessory plates for multi-gang installations. Sensor must provide an Off/Auto override switch, (2 switches if 2-pole device).
      b. Optional 2-Pole units must be available. Manual or Auto ON shall be configurable for both poles.
   2. Passive Infrared (PIR) Technology
      a. PIR sensing, incorporating a combination of heat and movement sensing to detect occupancy in the area of coverage.
   3. Dual Technology (DT)

a. Sensing must incorporate PIR with ultrasonic monitoring. Both PIR and Ultrasonic motion sensing shall initiate an ON condition and either technology sensing motion shall keep the ON state.
b. Either technology shall be able to be disabled during commissioning if necessary for the specific application.

4. Ultrasonic
   a. Ultrasonic sensing incorporating an omni-directional Doppler technology to detect occupancy in the area of coverage.
5. Switch Type:
   a. Single pole
   b. Single pole, dual circuit.
   c. Single pole, manual "on," automatic "off."
   d. Single pole, field selectable automatic "on," or manual "on" automatic "off."
   e. Single pole, dual circuit, manual “on”, automatic “off”.
   f. Single pole, dual circuit, field selectable automatic "on," or manual "on" automatic "off."
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.

D. Ceiling Occupancy Sensors

1. General
   a. Sensor shall be ceiling mounted device, mounted to either a single gang enclosure, or surface mounted to a round surface raceway pancake box.
   b. Time delay shall be set during commissioning and field adjustable.
   c. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
   d. Bypass Switch: Override the "on" function in case of sensor failure.
   e. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
   f. Detection Coverage
      1) Small Room: Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
      2) Standard Room: Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
      3) Large Room: Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
      4) Corridor: Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
2. Passive Infrared (PIR) Technology
   a. PIR sensing, incorporating a combination of heat and movement sensing to detect occupancy in the area of coverage.
   b. PIR sensing must utilize a high density Fresnel domed lens, providing a circular view pattern of 360 degrees.
   c. Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in.
3. Dual Technology (DT)
   a. Sensing must incorporate PIR with Ultrasonic. Both PIR and Ultrasonic motion sensing shall initiate an ON condition and either technology sending motion shall keep the ON state.

E. Wall Mount Occupancy Sensors (low voltage)

1. General
   a. Sensor must be designed for large spaces where the occupants work area is up to 40 feet from the sensor. Sensor must be mounted 8 to 10 feet above the floor, out

of occupants reach. Sensor shall be mounted either flat against the wall or in a corner. For pendant mount fixture applications, sensor must be mounted below the level of the fixture.

b. Sensor time delay shall be set during commissioning and shall be capable of being field modified if necessary.

c. Sensors must be capable of parallel wiring for multi-sensor applications.

2.02 POWER PACKS AND SLAVE PACKS

A. Manufacturer:
   1. Bryant Electric; a Hubbell company.
   2. Cooper Industries, Inc.
   3. Hubbell Building Automation, Inc.
   4. Leviton Mfg. Company Inc.
   5. Lightolier Controls.
   6. Lithonia Lighting; Acuity Lighting Group, Inc.
   7. Lutron Electronics Co., Inc.
   8. NSi Industries LLC; TORK Products.
   9. RAB Lighting.
   10. Sensor Switch, Inc.
   11. Square D; a brand of Schneider Electric.
   12. Watt Stopper.

B. Power Packs and Slave Packs must be designed to power and accept signals from remote Low Voltage Sensors, or other control devices, and directly switch the line voltage of the desired load controlled.

C. Power Packs must accept 120, 240, or 277 VAC utilizing a dual tap transformer.

D. Power Pack and Slave Pack relay switching shall not require more than 3 milliamps of current at 15 to 30 VDC.

E. Power Pack and Slave Pack relay switching shall be performed with a mechanical relay in parallel with an AC Semiconductor to allow relay contacts to switch under a no load condition. Switching capacity shall be 20 amps of all types of loads: Incandescent, Electronic Ballast, Magnetic, or Motor.

F. Power Packs shall be available in combination 2-Pole units capable of switching two independent loads, 20 amps each.

2.03 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Section 260519 - Low Voltage Electrical Power Conductors and Cables.

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 22 AWG, complying with Section 260519 - Low Voltage Electrical Power Conductors and Cables. Provide plenum rated as required.

C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Section 260519 - Low Voltage Electrical Power Conductors and Cables. Provide plenum rated as required.

D. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Section 260519 - Low Voltage Electrical Power Conductors and Cables. Provide plenum rated as required.

PART 3 - EXECUTION

3.01 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Install sensors in accordance with manufacturer's instructions. Do not exceed coverage limits specified in manufacturer's written instructions.

C. Where sensors are integral to light fixtures, coordinate orientation and location of fixture with sensor position.

3.02 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 - Low Voltage Electrical Power Conductors and Cables.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.03 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 - Identification For Electrical Systems.

B. Label time switches and contactors with a unique designation.

3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with manufacturers' commissioning checklist and section 260126 Maintenance and Testing of Electrical Systems.
   2. Operational Test: Verify actuation of each sensor and adjust time delays.

B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 SYSTEM STARTUP AND COMMISSIONING

A. Commissioning shall take place prior to demonstration of system to Owner. After the system has been installed the Contractor shall provide manufacturer’s recommended commissioning with factory trained and authorized technicians on-site, to:
   1. Verify that the contractor has properly installed and interconnected all necessary components.
   2. Verify correct operation of all system components.
   3. Verify that all switch and contact inputs are in compliance with contract requirements.
   4. Occupancy sensors and photo-sensors: Ensure that each sensor is correctly placed and oriented to provide the intended function. Adjust sensor location if unanticipated obstructions are present that impede the proper operation of the device.
   5. Occupancy Sensors: Adjust sensitivity and time delay of the occupancy sensor and test to ensure it provides appropriate response. Set initial time delay for 15 minutes.
   6. Dual Technology Type Occupancy Sensors: If interferences occur, disable either PIR or ultrasonic technology as appropriate for application.
   7. Submit completed verification checklist.

3.06 OWNER'S INSTRUCTIONS AND SYSTEM DEMONSTRATION

A. System Demonstration
   1. Schedule demonstration a minimum of two-weeks prior to system turn over and substantial completion. Schedule with owner's representative and electrical engineer.
   2. Demonstrate complete system operation and contract compliance to designated owner's representative and engineer to prove system is functional and ready for comprehensive training.

B. System Instruction
   1. The Contractor shall after one week (minimum) written notification to Architect conduct an instruction session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner. The session shall be conducted by a Contractor's representative thoroughly familiar with the characteristics of the system. O & M manual information regarding the system shall be turned over to the Architect prior to scheduling the instruction session.
   2. Training shall utilize the following draft documents:
      a. Draft O&M Manual
      b. Contractor's record drawings
   3. The training effort shall validate the O&M Manual and record drawing documentation.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Section 264313 Transient Voltage Suppression for Voltage Electrical Power Circuits.

1.02 SUMMARY

A. Section Includes:
   1. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

A. SVR: Suppressed voltage rating.

1.04 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
      a. Verify space available with equipment sizes and code required working clearances prior to submitting shop drawings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.
   8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field Quality-Control Reports:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards

G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.07 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

B. Provide certified letter from manufacturer indicating availability of replacement parts for a minimum period of ten (10) years.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Square D, General Electric, Cutler Hammer, Siemens, IEM.

2.02 GENERAL REQUIREMENTS FOR DISTRIBUTION, LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush or surface-mounted cabinets, as indicated on drawings or panel schedules.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Key identically. Key per University standards
   4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
   5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
   6. Where two cabinets are located adjacent to each other in finished areas, provide matching trim, same height.
   7. Where remote controlled switch or contactor is mounted in panelboard, mount on same frame as panelboard interior, with dedicated access door and key lock
   8. Finishes:
      a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Same finish as panels and trim.
      c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
   9. Directory Card: Inside panelboard door, mounted in transparent card holder, type written. Hand written is not acceptable.

C. Incoming Mains Location: as determined by contractor unless noted otherwise.

D. Phase, Neutral, and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Panelboards shall have full ampacity bussing throughout and shall be full size in regard to number of possible pole spaces. Bussing shall be identified with phases reading left to right.
   3. Neutral bus shall be mounted independently of equipment ground bus, and in no case shall neutral bus be used as equipment ground bus, or vice versa.
   4. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box and located on back of panelboard. Shall have lug or lugs from equipment grounding conductor from switchboard or distribution board and screw type terminals for connection of equipment green ground wire in same quantity as number of poles in panel.
   5. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
7. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type, UL listed for both steel and aluminum.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
1. Minimum interrupting ratings shall be 14,000 (RMS Symmetrical) at 480/277V and 10,000 (RMS Symmetrical) at 208/120V.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 400 A and larger.
2. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Compressionstyle, suitable for number, size, trip ratings, and conductor materials.
c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

B. Circuit breakers shall be the same manufacturer as panelboard.

C. Where spare is indicated, panelboard shall be provided with the specified branch circuit breaker, full ampacity bussing and mounting hardware. Where space is indicated, panelboard shall be provided with full ampacity bussing and mounting hardware to accommodate future installation of branch circuit breaker.

2.04 NAMEPLATES

A. Engraved nameplates per Section 260553 - Identification for Electrical Systems permanently attached to panelboard front. Include panel name with 1/4" letters, area served, voltage, phase and wire (e.g., 2N1, 208Y/120, 3 phase, 4 wire, 480Y/277, 3 phase, 4 wire) in 1/8 inch characters. When project has more than one switchboard include switchboard fed from (e.g., Fed from SWBD. 4BP).

B. Nameplate color: Normal system - white letters on black.
Emergency system - white letters on red.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Mount top of trim **90 inches (2286 mm)** above finished floor unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Panelboards installed recessed in fire rated walls shall be adequately boxed or backed with fire rated material and shall be approved by Fire Marshal. The final construction shall equal or exceed fire rating of the wall.

G. Locate in dedicated spaces. Coordinate project construction so piping, ducts, etc. are routed around dedicated spaces above and in front of panelboards per code.

H. Verify space available with equipment sizes and code required working clearances prior to installation.

I. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

J. Install filler plates in unused spaces.

K. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

L. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

M. Comply with NECA 1.

3.03 WIRING

A. Conform to applicable sections of these specifications and NEMA PB 1.1. Conductors and terminations per Section 260519 Low-Voltage Electrical Power Conductors and Cables. Coverplates in open knockouts.

B. Panelboards shall be wired and connected after installation at locations shown. Pre-wiring off site and splicing of branch circuit in wireway above or below panelboard is not permitted.

3.04 CIRCUIT INDEX AND LABELS

A. Typed circuit index with odd circuits on left, even circuits on right, listing each circuit by number with complete load designation, (i.e. Receptacle room ___, lights room ___, etc.). Room names/numbers per actual room identification assigned by owner at project completion (assigned room numbers may differ from drawings). Mount inside door with transparent protective cover. Provide number labels on circuit breakers to match index.

B. Install nameplate as per Part 2.

3.05 GROUNDING

A. Provide per Section 260526 - Grounding and Bonding for Electrical Systems.

3.06 CABINET PAINTING

A. Cabinets furnished prime painted: Field paint to match wall color. (See Division 9 Painting).

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

E. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Perform the following infrared scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
      b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
      c. Instruments and Equipment:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.08 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
   1. Measure as directed during period of normal system loading.
   2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
   3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
   4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.09 CLEANING

A. Prior to final inspection, clean panelboard interiors, adjust trims, covers, hinges and locks and refinish marred or scratched covers to original conditions. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.10 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Twist-locking receptacles.
   3. Wall-box motion sensors.
   4. Snap switches and wall-box dimmers.
   5. Wall-switch and exterior occupancy sensors.
   6. Communications outlets.
   7. Pendant cord-connector devices.
   8. Cord and plug sets.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   2. Cord and Plug Sets: Match equipment requirements.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.06 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 5351 (single), CR5362 (duplex).
      b. Hubbell; HBL5351 (single), HBL5352 (duplex).
      c. Leviton; 5891 (single), 5352 (duplex).
      d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.04 GFCI RECEPTACLES

A. General Description:
   1. Straight blade, feed-through type.
   2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
   3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; VGF20.
      b. Hubbell; GFR5352L.
      c. Pass & Seymour; 2095.
      d. Leviton; 7590.

2.05 TWIST-LOCKING RECEPTACLES

A. Single Convenience Twist-Lock Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; CWL520R.
      b. Hubbell; HBL2310.
      c. Leviton; 2310.
      d. Pass & Seymour; L520-R.

2.06 PENDANT CORD-CONNECTOR DEVICES

A. Description:
   1. Matching, locking-type plug and receptacle body connector.
   2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
   3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
   4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.07 CORD AND PLUG SETS

A. Description:
   1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
   2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
   3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.08 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide the following:
      a. Single Pole:
      b. Cooper; AH1221.
      c. Hubbell; HBL1221.
      d. Leviton; 1221-2.
      e. Pass & Seymour; CSB20AC1.
      f. Two Pole:
      g. Cooper; AH1222.
      h. Hubbell; HBL1222.
      i. Leviton; 1222-2.
      j. Pass & Seymour; CSB20AC2.
      k. Three Way:
      l. Cooper; AH1223.
      m. Hubbell; HBL1223.
      n. Leviton; 1223-2.
      o. Pass & Seymour; CSB20AC3.
      p. Four Way:
      q. Cooper; AH1224.
      r. Hubbell; HBL1224.
      s. Leviton; 1224-2.
      t. Pass & Seymour; CSB20AC4.

2.09 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
   1. 600 W; dimmers shall require no derating when ganged with other devices.

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.10 OCCUPANCY SENSORS

A. Wall-Switch Sensors:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 6111 for 120 V, 6117 for 277 V.
      b. Hubbell; WS1277.
      c. Leviton; ODS 10-ID.
      d. Pass & Seymour; WS3000.
      e. Watt Stopper (The); WS-200.
   2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Wall-Switch Sensors:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; AT120 for 120 V, AT277 for 277 V.
      b. Leviton; ODS 15-ID.
   2. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

C. Long-Range Wall-Switch Sensors:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; ATP1600WRP.
      b. Leviton; ODWWV-IRW.
      c. Pass & Seymour; WA1001.
      d. Watt Stopper (The); CX-100.
   2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. Long-Range Wall-Switch Sensors:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; ATD1600WRP.
      b. Leviton; ODW12-MRW.
      c. Watt Stopper (The); DT-200.
   2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

E. Wide-Range Wall-Switch Sensors:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; ATP120HBRP.
      b. Leviton; ODWHB-IRW.
      c. Pass & Seymour; HS1001.
      d. Watt Stopper (The); CX-100-3.
   2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

2.11 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: **0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel**

2.12 PREFABRICATED MULTI-OUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Wiremold/Legrand.

C. Description:
   1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
   2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish.

E. Multioutlet Harness:
   1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
   2. Receptacle Spacing: [**6 inches (150 mm)**] [**9 inches (230 mm)**] [**12 inches (300 mm)**] [**18 inches (460 mm)**].
   3. Wiring: No. 12 AWG solid, Type THHN copper, [**single circuit**] [**two circuit, connecting alternating receptacles**].

2.13 FINISHES

A. Device Color:
   1. Wiring Devices Connected to Normal Power System: [**Almond**] [**Black**] [**Brown**] [**Gray**] [**Ivory**] [**White**] [**As selected by Architect**] <**Insert color**> unless otherwise indicated or required by NFPA 70 or device listing.
   2. Wiring Devices Connected to Emergency Power System: [**Red**] <**Insert color**>.
   3. TVSS Devices: Blue.
   4. Isolated-Ground Receptacles: [**Orange**] [**As specified above, with orange triangle on face**].

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 RECEPTACLES

A. Hospital Grade: Provide hospital grade receptacles in all patient care areas, operating rooms, patient corridors, work rooms, equipment rooms, utility rooms, patient preparation rooms, exam rooms and nurses stations. Provide 15 amp receptacles in all locations except provide 20 amp receptacles on dedicated 20 amp circuits.

B. Provide surge protection receptacles in the locations shown on the drawings.

C. Provide isolated group receptacles in the locations shown on the drawings.

D. Provide exterior GFCI receptacle within 25’-0” of each roof mounted mechanical equipment, for all outdoor receptacles, and other locations shown on the drawings.

E. Provide safety receptacles in pediatric care areas, alcoholism and substance abuse treatment areas, exam rooms, and waiting areas.

3.03 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.04 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black] -filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
   1. Engrave emergency receptacle device plates with "EMERGENCY" above the receptacle with the panelboard and circuit number supplying them engraved below the receptacle. Engraving shall be approximately 3/16" high, red filled characters.
   2. Engrave normal receptacle coverplates in Critical Care Areas as defined in the NEC, with the circuit number supplying them below the receptacle with 3/16" high, black filled letters.
   3. For all receptacles other than 15 and 20 amp, 120 volts, engrave coverplate or provide separate nameplate with ampere rating, voltage and phase.
   4. The electrical contractor shall be responsible to have faceplates on all owner furnished equipment and equipment furnished under other divisions engraved with circuit number, and "EMERGENCY" (where applies) as specified in this section. This includes but is not limited to: headwalls, gas columns and booms, patient consoles, medical rail systems, custom casework with electrical devices, etc.
   5. For receptacles other than 15 and 20 amp, 120 volts, engrave coverplate or provide separate nameplate with ampere rating, voltage and phase. Minimum lettering size 3/16".

3.05 ENGRAVING

A. Engrave coverplates on all owner furnished equipment and equipment furnished under other divisions with circuit number, panelboard and “emergency” (where applies) as specified in this section. This includes but is not limited to: headwalls, gas columns and booms, patient consoles, medical rail systems, custom casework with electrical devices, etc.

3.06 DIMMERS

A. Install wall box dimmers to achieve circuit rating after de-rating for ganging as required by manufacturer.

B. Do not share neutral conductor on load side of dimmers.

3.07 CLEANING

A. Remove excess plaster from interior of outlet boxes.

B. Clean devices and coverplates after painting is complete. Replace stained or improperly painted devices or coverplates.

3.08 CORD AND PLUG SETS

A. Provide for all cord connected equipment furnished by the Owner or specified in other sections when equipment is not supplied with an integral cord and plug set.

B. For equipment other than 120 volts, 1∅, replace plug furnished with equipment to match receptacle actually installed (within ampacity rating of equipment).

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.

2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Receptacle Polarity Test: Test every receptacle installed or reconnected under this contract with a receptacle circuit tester. Tester shall test for open ground, reverse polarity, open hot, open neutral, hot and ground reversed, hot or neutral and hot open. Rewire receptacles with faults and retest. Submit statement of completed testing signed by the electrician that performed the test.
   6. Ground-Fault Receptacle Circuit Interrupter Tests: Test each receptacle or branch circuit breaker having ground-fault circuit protection to assure that the ground-fault circuit interrupter will not operate when subjected to a ground-fault current of less than 4 milliamperes and will operate when subjected to a ground-fault current exceeding 6 milliamperes. Perform testing using an instrument specifically designed and manufactured for testing ground-fault circuit interrupters. Apply the test to the receptacle. "TEST" button operation will not be acceptable as a substitute for this test. Replace receptacles that do not shutoff power with 7/1000 of an ampere within 1/40th of a second and retest.
   7. Using the test plug, verify that the device and its outlet box are securely mounted.
   8. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Lighting fixture supports.

B. Related Sections:

C. Section 260923 "Lighting Control Devices" for automatic control of lighting, including occupancy sensors., Section 262726 "Wiring Devices" for manual wall-box dimmers and switches.

D. Substitutions:
   1. Bidders requesting approval to provide products other than those specifically listed in the Light Fixture Schedule shall submit requests in writing to the Architect and Lighting Designer ten days prior to the close of the bid period. Approval will be in the form of an addendum to the specifications issued to all registered plan holders. No requests for substitution will be considered after this date.
   2. Substitution request shall include all information required under paragraph 1.5 SUBMITTALS. Requests for approval shall be accompanied by a working fixture sample (including lamps and a cord and plug). Provide the name of at least one installation where each proposed substitute has been installed for at least six months along with the name and phone number of the Architect, Owners representative and the Lighting Designer of Record. If required by the Architect, the proposed substitutes must be installed at the bidder's expense in a location selected by the Architect.

1.03 REFERENCES

A. National Electrical Manufacturer’s Association (NEMA) LE5-1993:
   1. Procedure for determining Luminaire efficiency ratings.

B. Underwriters Laboratories, Inc. (UL):

UL 496:	Edison Base Lampholders
UL 542:	Lampholders, Starter Holders for Fluorescent Lamps
UL 676:	Underwater Lighting Fixtures
UL 924:	Emergency Lighting and Power Equipment
UL 935:	Fluorescent Lamp Ballasts
UL 1012	Power Units Other Than Class 2
UL 1029:	HID Lamp Ballasts
UL 1310	Class 2 Power Units
UL 1570:	Fluorescent Lighting Fixtures
UL 1571:	Incandescent Lighting Fixtures
UL 1572:	High Intensity Discharge Lighting Fixtures
UL 1574:	Track Lighting Systems
UL 1598	Luminaires

1.04 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Unit of luminous flux. Photometrically, it is the luminous flux emitted within a unit solid angle by a point source having a uniform luminous intensity of 1 candela.

G. Luminaire: Complete lighting fixture, including ballast, lamp, housing, parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

1.05 SYSTEM DESCRIPTION

A. Light fixture schedule series numbers are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of lamp, ballast, finish trim, ceiling type, mounting hardware, ceiling trim or special requirements as specified hereinafter or as required by the particular installations. Provide complete fixtures to correspond with the number of lamps, wattage and/or size specified.

B. If there are discrepancies between fixture illustrations and the written description in the fixture schedule, the written description in the fixture schedule shall take precedence.

C. Light fixture voltage shall match voltage of circuit serving the light fixture.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
   3. Ballast, including circuit type (Programmed start, instant start, etc) BF.
   4. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Action Submittals" Article in Division 23 Section "Diffusers, Registers, and Grilles."
   5. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, and Grilles."
   6. Lamps including brand name, product name, rated life, output CCT, and CRI.
   7. Product Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

B. Pendant support system if part of fixture.

C. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
   1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

   2. Provide cut sheets of all fixtures and control devices.

   3. Provide instruction manuals for all control systems.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: **10 for every 100** of each type and rating installed. Furnish at least one of each type.
   2. Ballasts: **One for every 100**of each type and rating installed. Furnish at least one of each type.

1.09 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

E. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.10 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.11 WARRANTY

A. Ballasts: Provide manufacturer’s warranty for a period of not less than five years. Warranty shall include parts and labor to replace defective ballasts.

B. LED Luminaires: Provide manufacturer's warranty for a period of not less than three years for repair or replacement of defective electrical parts, including light source and power supplies.

PART 2 - PRODUCTS

2.01 GENERAL MATERIAL REQUIREMENTS

A. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.

B. For vapor tight installations, painted finishes of fixtures and accessories shall be weather resistant enamel using proper primers or galvanized and bonderized epoxy, so that the entire assembly is completely corrosion resistant for the service intended. Where aluminum parts come into contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.

C. Fixtures shall be free of light leaks and designed to provide sufficient ventilation of lamps to provide the photometric performance required. Ballasts and transformers shall be adequately vented.

D. All sheet metal work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. Finish exposed edges so no sharp or ragged edges are exposed. All miters shall be in accurate alignment with abutting intersecting members.

E. Lampholders shall hold lamps securely against normal vibrations and maintenance handling.

F. Fresnel Lens and Door Assembly:
   1. Lens shall have uniform brightness throughout the entire visible area at angles from 45° to 90° from vertical, without bright spots or striations.
   2. Lens shall have opaque risers painted neutral gray unless otherwise specified in the Light Fixture Schedule.
   3. Finish of regress door shall be matte baked enamel paint in color as selected by the Architect.

G. Light fixtures containing lamps which require protective shielding shall have tempered glass lenses.

H. For adjustable fixtures, provide positive locking devices to fix aiming angle. Fixture shall be capable of being relamped without adjusting aiming angle.

I. Fixtures recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.

J. Safety: Provide safety devices for removable fixture elements (cones, reflectors, lenses, etc.) to support removable elements when not in normal operating position. Safety devices shall be detachable if necessary and shall not interfere with fixture performance, maintenance or the seating of any fixture element, and not be visible during normal fixture operation.

2.02 FLUORESCENT FIXTURES

A. Housing: Minimum code gauge steel or rigid aluminum construction painted after fabrication with high reflectance white paint (min. 89%).

B. Light Shields:
   1. Eggcrate Louvers: Aluminum (unless noted otherwise) continuously bound in a perimeter channel frame. Frame, louver and support shall be painted color as selected by Architect.
   2. Parawedge Louvers: Injection molded plastic with specular silver finish 1/2" x 1/2" x 1/2" cell, unless otherwise specified anti-static finish.
   3. Parabolic Louvers: Provide Alzak aluminum, specular or semi-specular as specified, with a low-iridescent finish.
   4. Flat Translucent Diffusers: Shall be 100% virgin DR acrylic and have matte finish on exterior side (facing away from lamps). Diffuser shall be of thickness specified and shall be of sufficient density to completely obscure lamp image.
   5. Flat Clear Lenses: Injection molded 100% virgin DR acrylic or clear tempered glass, thickness as specified.
   6. Clear Patterned Lenses: Injection molded 100% virgin DR acrylic. For lenses with a male pattern of prisms or cones, specified minimum thickness refers to distance from flat surface to base of pyramids or cones, or to thickness of undisturbed material. For lenses with female pattern, specified minimum thickness refers to overall thickness of material. Lenses shall fully eliminate lamp image when viewed from all directions between 45-90° from vertical. From 0-45° the ratio of maximum brightness (under a lamp) to minimum brightness (mid-point between lamps) shall not exceed 3:1. Minimum thickness shall not be less than 0.125" with a minimum weight of 8 ounces per square foot.

C. Frames:
   1. Supply with concealed hinges and latching. Provide mitered corners with no gaps or light leaks.

D. Lamp Mounting:
   1. Mount lamps used in rapid start circuits 430 ma and below within 1/2" of grounded metal as long as the lamp. For 800 ma and 1500 ma lamps, mount within 1" of grounded metal as long as the lamp.
   2. For rapid start circuits using single lamp ballasts, provide one grounding lamp holder per lamp.

2.03 LIGHT EMITTING DIODE (LED) FIXTURES:

A. Housing: Rigid aluminum construction.

B. Finish: Visible surfaces. Powder coated paint or natural aluminum as specified in Light Fixture Schedule. Color and finish as selected by architect. Concealed parts, (lamp holders, yokes, brackets, etc.) matte black.

C. Lamp Holder Housing: Cast aluminum with integral heat radiating fins to assure cool lamp base operation, with sufficient heat dissipation to meet device manufacturer's guidelines, certification programs, and test procedures for thermal management.

D. Off-state Power: Luminaires shall not draw power in the off state. Exception: Luminaires with integral occupancy, motion, photo-controls or individually addressable fixtures with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

2.04 WIRING

A. Wiring shall be as required by code for fixture wiring.

B. Flexible cord wiring between fixture components or to electrical receptacle and not in wireways shall have a minimum temperature rating of 105°C.

C. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.

D. No internal wiring shall be visible at normal viewing angles, i.e. above 45° from vertical.

E. Master Slave Fixtures: Supply ballasts in adjacent fixtures to operate one or more lamps in the adjacent fixture where required in Drawings or Light Fixture Schedule. For single lamp fixtures, provide a two-lamp ballast for two adjacent fixtures. For three-lamp fixtures, provide one two-lamp ballast for the outboard lamps in each fixture and an additional two-lamp ballast for the center lamp in each of two adjacent fixtures.

F. Tandem Wired Fixtures: For fixtures in continuous rows and where required in Drawings or Light Fixture Schedule, supply ballasts and wiring to control all top or inboard lamps together and control all bottom or outboard lamps together.

G. Provide #18 AWG, 3-wire flexible conduit connections (whips) for dual level switching as shown on Drawings for light fixtures recessed in accessible suspended ceilings. Provide 3-wire whips for all dual level switching. Wire count on wire whips is not shown on Drawings and shall be the responsibility of the Contractor to provide proper wire count for the lighting control as shown on Drawings.

2.05 BALLASTS AND POWER SUPPLIES:

A. Fluorescent General Requirements:
   1. Lamps shall be operated on the type of circuit the lamp was designed for (preheat, rapid start, instant start, programmed start, etc.). T8 lamps shall be operated on rapid start or programmed rapid start ballasts only. Ballasts shall provide normal rated lamp life as stated by lamp manufacturers.
   2. Ballasts shall be HPF (greater than 90%), UL listed, or ETL certified. Magnetic ballasts shall be CBM certified. For projects applying for utility funding, ballasts shall meet utility requirements. Provide ballasts with thermal protection unless otherwise specified. Ballasts shall be Class P.
   3. Confirm voltage requirements with Electrical Drawings. Ballasts shall operate lamps correctly within +/-10% voltage variation without damaging ballasts.
   4. Ratings:
      a. "A" sound rating for 430 ma and 265 ma
      b. "B" sound rating for 800 ma
      c. "C" sound rating for 1500 ma

5. Provide a ballast disconnecting means for all fixtures that utilize double ended fluorescent lamps in accordance with NEC 410.130(G).
6. Low temperature application: Provide ballasts suitable for low starting temperature where light fixture is located in a freezer or refrigerator or other location where ambient air temperature will be below 50 degrees F.
7. Dimming Ballasts: Type required by dimmer manufacturer for proper operation and to maintain UL listing of dimming system components utilized. Total harmonic distortion shall not exceed 20% at any point within the dimming range. For T5HO lamps, ballasts must meet proposed IEC dimming parameters and all other industry requirements to maintain lamp manufacturer's warranties. Ballasts known to meet these parameters are Advance VZT2S54 and REZ2S54 and Lutron FDB-T554 and ECOT554 for one or two lamps for 120 or 277v operation.

B. Electronic Fluorescent Ballasts: In addition to the general requirements, provide electronic ballasts where required in the Light Fixture Schedule as follows:
1. Ballasts in conformance with the following regulatory requirements:
a. EMI and RFI limits set by the FCC (CFR47, Part 18 and FCC Part 18,15j), IEEE Publication 587, Category A (transients).
b. Minimum efficiency standards of Public Law 100-357.
c. Starting sequence consistent with ANSI Standard C82.1-1993.
2. Reduced light output ballasts (ballast factors below 87%) are not acceptable except as noted otherwise in the Light Fixture Schedule.
3. Total harmonic distortion shall be less than 10% of the input current. Current crest factor shall be less than 1.7. Operating frequency shall be between 25 and 60 kHz with no visible flicker.
4. Ballasts shall operate in ambient temperatures up to 105°F (40°C).
5. Rapid start ballasts shall be wired in series (or in parallel if manufactured accordingly).
6. Ballasts for single ended lamps shall be program start, with end of life protection.
7. Where Instant Start ballasts are specified, ballasts shall be UL CC Anti-Arc guard type and meet UL Standard 1598.
8. Manufacturers: Philips Advance, GE, Osram/Sylvania, Universal.

C. LED Power Supplies:
1. Minimum power factor 90%.
2. Minimum operating temperature of -20°C.
3. Output operating frequency shall be minimum 120 Hz.
4. Power supply shall meet FCC requirements for non-consumer use.
5. Sound rating: Class A.
6. Power supply shall comply with IEEE C.62.41-1991, Class A operation.

2.06 LAMPS

A. Each lamp type in the Project shall be manufactured by the same manufacturer.

B. Fluorescent:
1. Medium Bi-pin, T8 rapid start, compact TT , DTT and TRT; 3500K color temperature and 80+ Color Rendering Index (CRI) unless otherwise noted. Use TCLP compliant lamps unless they are unavailable for type of lamp specified (brand names are GE - Ecolux, Osram Sylvania - Ecologic and Philips - ALTO).
2. Manufacturers: General Electric, Philips, Osram Sylvania or as specifically noted in the Light Fixture Schedule.

C. Light Emitting Diode Type:
1. LED modules/arrays shall have a minimum CRI of 80 unless otherwise specified in the Light Fixture Schedule.
2. Color temperature variation shall not exceed +/- 100 degrees Kelvin at installation, and +/- 200 degrees Kelvin over the life of the module.
3. LED modules/arrays shall deliver at least 70% of initial lumens, when installed in-situ, for a minimum of 35,000 hours.

4. Acceptable manufacturers: Cree, Philips, Nichia.

2.07 SOCKETS

A. Fluorescent: Suitable for lamp and ballast type employed. Where Instant Start ballasts are specified, supply Circle I sockets designed for Instant Start ballasts.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide mounting accessories and trims as required for wall and ceiling construction types shown in Finish Schedule and on Drawings.

B. Lighting fixtures:
   1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
   2. Install lamps in each luminaire.

C. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

D. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify requirements for maximum distance between ballast and luminaire with ballast manufacturers.

E. Verify weight and mounting method of fixtures and provide suitable supports. Fixture mounting assemblies shall comply with local seismic codes and regulations.

F. Refer to architectural reflected ceiling plans for coordination of lighting fixture locations with mechanical and fire safety equipment. Where conflicts occur, coordinate with Architect prior to installing any of the systems.

G. For fire rated ceilings and walls, provide rated enclosure for recessed light fixture, or coordinate with Architect and Lighting Designer to specify fixture suitable for use in rated ceiling or wall.

H. Install fixtures with vent holes free of air blocking obstacles.

I. Lighting fixtures located in recessed ceilings with a fire resistive rating of 1-hour or more shall be enclosed in an approved fire-resistive rated box equal to that of the ceiling.

J. Adjust aperture rings on all recessed fixtures to be flush with the finished ceiling.

K. Adjust variable position lampholders for proper lamp position prior to fixture installation.

L. Blemished, damaged or unsatisfactory fixtures or accessories shall be replaced.

M. For pendant mounted fixtures, mounting height is from finished ceiling to top of pendant light fixture. For wall mounted fixtures, center on outlet box unless otherwise noted. Verify mounting provisions and other requirements prior to order of light fixtures and provide as required.

N. In accessible suspended ceilings, provide 72" flexible conduit wiring connection (flexible tubing not permitted) from a rigidly supported junction box.

O. All finishes shall be unmarred upon project completion. Repair or replace damaged finishes.

P. Replace all burned out or inoperative lamps at the end of the construction prior to Owner occupancy.

3.02 DIFFUSERS AND ENCLOSURES

A. Remove protective plastic covers from lighting fixture diffusers only after construction work, painting and clean-up are completed. Remove all dirty lamps, reflectors and diffusers; clean and reinstall. When cleaning "Alzak" reflectors, use a manufacturer recommended cleaning so-

lution. Reflectors damaged or impregnated with fingerprints shall be replaced at no cost to Owner.

B. For LED fixtures, whether surface mounted or recessed, remove all construction dirt and dust from heat sink fins to ensure proper dissipation of heat.

3.03 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 12 hours at full voltage per NEMA recommendations or as required by fixture manufacturer.

3.04 ADJUSTMENT OF LIGHT FIXTURES

A. Focus all adjustable light fixtures under the direction of the Lighting Designer during a scheduled period of time prior to the completion of the project, after normal business hours if required. Include all equipment and personnel expenses (including overtime) required for adjustment.

B. Occupancy Adjustments: When requested within **12** months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
   1. Adjust aimable luminaires in the presence of Lighting Designer.

3.05 SUPPORT OF FLUORESCENT LIGHT FIXTURES

A. Recessed type: For light fixtures supported by the ceiling suspension system, provide four Caddy #515 support clips (one each corner) which lock light fixture to ceiling tees after light fixture is installed. In addition, provide for each light fixture two #14 earthquake chains or #12 wires secured at diagonally opposite fixture corners (for fixtures weighing less than 56 pounds) to structural members above suspended ceiling. For plaster or gypsum board ceilings provide plaster frame compatible with light fixture. Contractor shall coordinate fixture trim with ceiling type.

B. Surface Mounted Type:
   1. Where mounted on accessible ceilings, support from structural members above ceiling by means of hanger rods through ceiling or as approved.
   2. Continuous Runs of Fixtures: Laser sight to assure fixtures are straight when sighting from end to end, regardless of irregularities in the ceiling. Where light fixtures are so installed, omit ornamental ends between sections.

C. Pendant Mounted Type:
   1. For fixtures with rigid pendants, supply swivel ball aligners at canopy to comply with local seismic requirements.
   2. Where suspended from accessible ceiling, support fixture from structural members above ceiling by means of hanger rods through ceiling or as accepted.
   3. Continuous Runs of Light Fixtures: Laser sight to assure fixtures are straight when sighting from end to end, regardless of irregularities in the ceiling. Where light fixtures are so installed, omit ornamental ends between sections.
   4. Where pendant is longer than 48 inches (1200mm), brace to limit swinging.

3.06 CEILING LIGHT FIXTURE SUPPORT

A. Where ceiling is of insufficient strength to support weight of lighting fixtures installed, provide additional framing to support as required.

END OF SECTION

SECTION 28 31 11

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Fire-alarm control unit.
   2. Notification appliances.
   3. Addressable interface device.

1.03 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.04 SYSTEM DESCRIPTION

A. Noncoded, UL-certified, bidder designed and placarded addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

B. Extend existing Notifier system to new/relocated devices.

1.05 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. System shall comply with local fire code, building code, mechanical code, electrical code, rules and interpretations as required by the Authority Having Jurisdiction , including the following, but not limited to:
   1. NFPA 70
   2. NFPA 72
   3. City of Eugene
   4. Eugene Fire Department

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
   1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
   2. Include voltage drop calculations for notification appliance circuits.
   3. Include battery-size calculations.
   4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
   5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector

housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.

6. Include alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:
   1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
   2. Shop Drawings shall be prepared by persons with the following qualifications:
      a. Trained and certified by manufacturer in fire-alarm system design.
      b. NICET-certified fire-alarm technician, Level IV minimum.
      c. Licensed or certified by authorities having jurisdiction.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.08 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:
   1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
   2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
   3. Record copy of site-specific software.
   4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
      a. Frequency of testing of installed components.
      b. Frequency of inspection of installed components.
      c. Requirements and recommendations related to results of maintenance.
      d. Manufacturer's user training manuals.
   5. Manufacturer's required maintenance related to system warranty requirements.
   6. Abbreviated operating instructions for mounting at fire-alarm control unit.

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.09 QUALITY ASSURANCE

A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
   1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
   2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

1.11 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

C. No modifications or changes to existing or functioning fire alarm system shall occur without first notifying the owner’s representative

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. Notifier

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
   1. Manual stations.
   2. Smoke detectors.
   3. Duct smoke detectors.
   4. Verified automatic alarm operation of smoke detectors.

B. The activation of any system smoke detector shall initiate an alarm verification operation, whereby the panel will reset the activated detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described elsewhere. The time period for alarm verification reset shall be programmable from 1 to 60 seconds. If no second alarm occurs within the alarm verification time window, the system shall resume normal operation.
   1. The alarm verification shall only occur on smoke detector alarms.
   2. Other activated initiating devices shall be processed immediately
   3. The alarm verification operation shall be selectable by device, not by zone.

C. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Unlock electric door locks in designated egress paths.
4. Transmit an alarm signal to the remote alarm receiving station.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate alarm communication system.
7. Send signal to Mechanical control system that the fire alarm system in in alarm. Shut down air handling systems as per Mechanical Sequence of Operation.
8. Send signal to Mechanical control system and close fire/smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.
10. Activate emergency lighting control.
11. Activate emergency shutoffs for gas and fuel supplies.
12. Record events in the system memory.
13. Record events by the system printer.

D. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
2. Elevator shunt-trip supervision.

E. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

F. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:
1. The existing system is a field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL. Existing system functions to be maintained and expanded to include the new addition.

2.04 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.
1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
1. Mounting Faceplate: Factory finished, white

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
   1. 15/30/75/110 cd, selectable in the field.
   2. Mounting: Wall mounted unless otherwise indicated.
   3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
   4. Flashing shall be in a temporal pattern, synchronized with other units.
   5. Strobe Leads: Factory connected to screw terminals.
   6. Mounting Faceplate: Factory finished, white.

2.05 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
   1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
   2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
   3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

2.06 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. For Class A circuits, provide a minimum of 48" separation between incoming and returning raceways.

C. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
   1. Connect new equipment to existing control panel in existing part of the building.
   2. Connect new equipment to existing monitoring equipment at the supervising station.
   3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

D. Smoke- or Heat-Detector Spacing:
   1. Comply with NFPA 72.
   2. HVAC: Locate detectors not closer than 5 feet (1.5 m) from air-supply diffuser or return-air opening.

E. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn, unless it is integral with audible alarm indicating device. Install wall mounted devices such that the bottom of the lens is not less than 80 inches above the finished floor. Ceiling mount devices allowed where shown and shall be approved for ceiling application. More than two visible notification devices in the same room or adjacent space within the field of view shall flash in

synchronization. Synchronization of devices not in the same field of view is allowed. In corridors where there are more than two devices in any field of view, they shall be spaced a minimum of 55' apart or they shall flash in synchronization.

G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

H. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

3.02 WIRE

A. Non-Power-Limited Circuits: Conductors shall be 600-V rated, 75 deg C, color-coded insulation.
   1. Low-Voltage Circuits: No. 16 AWG, minimum, stranded copper (maximum of seven strands).
   2. Line-Voltage Circuits: No. 12 AWG, minimum, solid or stranded copper.

B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

3.03 RACEWAYS, OUTLETS AND JUNCTION BOXES

A. Shall conform to specification sections "Raceways" and "Outlet and Junction Boxes".

B. Provide 5" square by 2-2/7" deep outlet boxes with plaster ring for all flush mounted notification appliances.

C. All fire alarm cables shall be installed in minimum ¾" conduit.

3.04 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
   1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
   1. Smoke dampers in air ducts of designated air-conditioning duct systems.
   2. Alarm-initiating connection to elevator recall system and components.
   3. Alarm-initiating connection to activate emergency lighting control.
   4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
   5. Supervisory connections at valve supervisory switches.
   6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
   7. Supervisory connections at elevator shunt trip breaker.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.06 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.07 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by the Owner and authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Tests and Inspections:
   1. Visual Inspection: Conduct visual inspection prior to testing.
      a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
      b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
   2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
   3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4. Perform all audible testing prior to inspection by the AHJ. At that testing DB recording shall be done for all spaces within scope. Owner PM notice is required 72 hours before any audible testing
   4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
   5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION