

**SECTION 26 00 00  
GENERAL ELECTRICAL REQUIREMENTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Section Includes
  - 1. General electrical requirements.

**1.02 PERMITS, FEES AND SERVICE CHARGES**

- A. The CONTRACTOR shall obtain all electrical permits required to complete the work and pay all associated fees.
- B. The CONTRACTOR shall coordinate and provide for the installation and operation of franchise utility service (including any telephone and/or leased lines specified) as required during construction, startup, testing, and operation of the work until substantial completion.

**1.03 CONTRACTOR'S RESPONSIBILITY FOR FIELD VERIFICATION OF EXISTING CONDITIONS**

- A. The CONTRACTOR shall obtain all electrical permits required to complete the work and pay all associated fees.
- B. The CONTRACTOR shall coordinate and provide for the installation and operation of franchise utility service (including any telephone and/or leased lines specified) as required during construction, startup, testing, and operation of the work until substantial completion.

**1.04 INTENT OF DRAWINGS AND SPECIFICATIONS**

- A. Riser and other diagrams are schematic and are intended to show the approximate location of equipment, and the general alignment of conduits and piping, and shall not be used for obtaining quantities. Dimensions given on the plans shall take precedence over scaled dimensions and all dimensions whether in figures or scaled, shall be verified in the field.
- B. The electrical drawings do not show complete details of the site conditions. The CONTRACTOR shall check actual conditions.
- C. The exact location of apparatus, fixtures, equipment, conduit, and piping shall be ascertained by the CONTRACTOR in the field, and the work shall be laid out accordingly. Should the CONTRACTOR fail to ascertain such locations or coordinate with work performed by other trades, the work shall be changed at no additional cost to the OWNER when so ordered by the ENGINEER. The ENGINEER reserves the right to make minor changes in the location of conduit, piping and equipment up to the time of installation without additional cost to OWNER.
- D. CONTRACTOR shall provide all labor, materials, equipment, machinery, and tools necessary to provide all electrical equipment specified and shown on the Drawings. All items not specified in detail or shown on the Drawings but necessary for complete installation shall be provided by the CONTRACTOR.

**1.05 SUBSTITUTION REQUESTS FOR MECHANICAL, HVAC, PROCESS, OR OTHER EQUIPMENT IMPACTING THE ELECTRICAL DESIGN**

- A. The CONTRACTOR shall be responsible for including the cost impact to the electrical systems for substitution requests and/or value engineering for mechanical, HVAC, process, or other equipment made by other trades. The costs to the overall substitution request or value engineering solution must be included in the total number provided to the OWNER. The CONTRACTOR is responsible for coordinating the substitution requests or value engineering proposals made by other trades.
- B. Any substitution request and/or value engineering solution which impacts the electrical design but does not include the costs shall be unacceptable.
- C. Failure of other subcontractors to include the electrical cost impact shall not be the basis for a change order. The CONTRACTOR shall be responsible for coordinating the total costs of all substitution requests and/or value engineering solutions prior to presenting them to the ENGINEER or OWNER. When these requests are received by the ENGINEER or OWNER to review and approve, the ENGINEER and OWNER shall assume the cost impact to electrical has been included.

**1.06 SUBMITTALS**

- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
  - 1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
  - 2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260519.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  - 3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Submittals shall be in accordance with the requirements of these Contract Documents and shall include the following:
  - 1. Submittals shall include information and literature as required for all equipment and materials provided under this and related sections.
  - 2. Shop Drawings: Shop drawings shall include the following along with any special requirements listed in the individual Specification Sections:
    - a. Installation instructions and drawings
    - b. Wiring schematics with termination point identification.
    - c. Motor information
    - d. Materials of construction
    - e. Manufacturer's name and model
    - f. Manufacturer's catalog data
    - g. Supplementary structural framing for electrical equipment including design loads, member size and location. When supplementary framing is indicated, verify that dimensions are suitable for the equipment furnished. Provide additional strength when equipment furnished is heavier than that specified.
  - 3. Manufacturers' Literature: Literature indicating the compliance of the products with the Specifications shall be included with all submittals. This shall include catalogs and other

descriptive bulletins. Relevant portions of the literature shall be clearly identified by highlighting or underlining.

4. Test Logs: The CONTRACTOR shall submit test logs as outlined below and as specified in subsequent electrical sections and drawings.
    - a. A log of the complete results of tests for shorts and grounds for each circuit. All circuits and tests shall be clearly identified.
    - b. A log of complete results of insulation resistance measurements of each circuit. All circuits and tests shall be clearly identified.
  5. Operation and maintenance information for all equipment furnished and/or installed.
  6. Programming instructions for any controllers or other programmable equipment. Copies of the any required software, including registration cards, shall be provided with the O&M manuals.
- C. Deferred Submittals
1. Submittals for seismic bracing/anchoring and wind loads shall be a deferred submittals. Engineering of the seismic bracing and anchoring system shall be provided by a licensed Engineer in the State of Oregon. Submittals shall include calculations and drawings, including connection types/materials/sizes, load, maximum load, dimensions, etc.
- D. The CONTRACTOR shall indicate on the submittals all variances from the Specifications.
- E. Record Drawings. After the completion of construction, the CONTRACTOR shall provide one set of "as-built" drawings to the ENGINEER as specified herein showing the location of buried conduits and all changes or deviations from the original drawings.
- F. Final inspection certificates shall be submitted prior to final payment.

#### **1.07 COORDINATION OF WORK**

- A. The CONTRACTOR shall plan his work in coordination with the other trades and with the power and telephone utility authorities.
- B. The CONTRACTOR shall field verify all dimensions of equipment to be installed or provided by others so that correct clearances and connections may be made between the work installed by the CONTRACTOR and equipment installed or provided by others.
- C. The CONTRACTOR shall arrange all conduit runs so that they do not interfere with piping, structural members, etc.
- D. All working measurements shall be taken from the sites, checked with those shown on the drawings, and if they conflict, reported to the ENGINEER at once, and before proceeding with the work. Should the CONTRACTOR fail to comply with this procedure, he shall alter his work at his own expense as directed by the ENGINEER.
- E. No additional payments will be allowed where obstructions in the work of other trades, or work under this contract requires offsets to conduit runs.
- F. The CONTRACTOR is responsible for all alterations in the work to accommodate equipment differing in dimensions or other characteristics from that shown or specified.
- G. The CONTRACTOR shall provide all temporary power necessary for existing site equipment and for all construction needs.

**1.08 SUPERVISION**

- A. The CONTRACTOR shall maintain adequate supervision of the work and shall have a responsible person in charge at the site during all times that work under this contract is in progress, or when necessary for coordination with other work.

**1.09 CODES**

- A. Work shall conform to the National Electrical Code (NEC), and State Codes and other applicable codes, even though not specifically mentioned for each item. These shall be regarded as the minimum standard of quality for materials and workmanship.

**1.10 CONTRACTOR'S RECORD DRAWINGS & AS-BUILTS**

- A. The CONTRACTOR shall maintain a neatly marked set of record drawings showing the locations of all buried conduits and other utilities encountered or installed during construction. The final locations of panels, field mounted instruments and panels, terminal boxes, junction boxes, receptacles, light switches and other materials included in the work shall be shown, as well as conduit routing between them to the extent it differs from the design drawings. Record drawings shall be kept current with the work as it progresses and shall be subject to inspection by the OWNER's Representative at any time. Failure to keep field record drawings current may result in the issuance of a stop work order or delay in the processing of pay requests until the record drawings are made current.
- B. The CONTRACTOR shall provide one complete set of as-built electrical schematics for all panels and equipment provided, including PLC I/O schematics as applicable, panel elementary diagrams, interconnecting wiring diagrams, wire numbers, termination strip locations and numbers. These shall be in the same format and style as those in the Contract Documents and submittal requirements.
- C. All information shown on the CONTRACTOR's field record drawings and as-built schematics shall be subject to verification by the OWNER's Representative. If significant errors or deviations are noted by the OWNER's Representative, new as-builts shall be completed at the CONTRACTOR's expense.

**PART 2 PRODUCTS****2.01 PORTABLE OR DETACHABLE PARTS**

- A. The CONTRACTOR shall retain in his possession and shall be responsible for all portable and detachable parts or portions of installations such as fuses, key locks, adapters, blocking chips and inserts until completion of his work.
- B. These parts shall be delivered to the ENGINEER and an itemized receipt obtained. This receipt, together with 2 copies of the final inspection certificate, shall be attached to the CONTRACTOR's request for final payment.
- C. All equipment shall be demonstrated to operate in accordance with the requirements of this specification and the manufacturer's recommendations.

**2.02 NEW PRODUCTS**

- A. All products shall be new without defects and covered by Manufacturer's warranty. Products shall be re-used only where indicated on the Drawings.

- B. All products shall be listed, labeled, and certified by a testing agency approved by the state of Oregon.
- C. All equipment of the same type and capacity shall be by the same manufacturer.

### **PART 3 EXECUTION**

#### **3.01 IDENTIFICATION**

- A. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.

#### **3.02 WORKMANSHIP & COORDINATION**

- A. All work shall be performed by personnel skilled in the particular trade in a workmanlike manner. Workmanship shall conform to the standards of the NEC and the National Electrical Installation Standards (NEIS).
- B. The ENGINEER shall be the sole judge as to whether or not the finished work is satisfactory; and if in his judgment any material or equipment has not been properly installed or finished, the CONTRACTOR shall replace the material or equipment whenever required, and reinstall it in a manner entirely satisfactory to the ENGINEER without any increase in cost to the OWNER.
- C. The CONTRACTOR shall coordinate and verify the installation of all equipment furnished by him to other trades, or equipment provided and installed by other trades that is connected to the electrical or control systems. Work shall include the furnishing of all labor, materials, and equipment required for the installation of a complete and operable system as hereinafter specified and as indicated on the drawings. The Contract Documents are complementary and what is called for by anyone shall be as binding as if called for by all. Unless otherwise specifically stipulated, the term "furnished and installed complete" shall be considered a part of this section.
- D. Controls and systems shall be complete with transformers, switches, relays, contactors, control valves, control devices, instrument piping, fittings, valves, control wiring, thermometers, pressure gauges, thermostats, damper operators, miscellaneous control cabinets to fill the intent of the Specifications and shall provide control for the various units and systems. All control valves and motorized dampers shall be provided with position indicators.
- E. Unless otherwise specified or shown on the drawings, switches or relays shall be installed in, or adjacent to the motor starter or other electrical device to which they are to be connected. Control and interlock wiring shall be included as necessary from breakers specified herein or shown on the drawings.
- F. Each control schematic intended to control a series of motor operated louvers, fans, and thermostats shall contain a switch for maintenance to meet the NEC requirements regarding disconnect switches for motors. This switch shall be local if any unit controlled is out of sight of the switch. This switch shall disconnect all power to all motor operated devices within the circuit.

**3.03 TEMPORARY HEATING, LIGHTING AND POWER**

- A. The CONTRACTOR shall provide all heat, lighting and power required to construct and protect the work until the work is placed in service by the OWNER for beneficial use of the OWNER. Temporary heaters shall be provided as required to keep the work area and all new electrical components dry.
- B. The source for temporary power shall be from the electric utility or OWNER approved CONTRACTOR supplied auxiliary power units. The installation for electric power shall meet the requirements of local authorities and of OSHA.
- C. The CONTRACTOR shall obtain all permits and pay all costs for connecting temporary power service at no expense to the OWNER.

**3.04 SUPPORT BACKING**

- A. Provide any necessary backing required to properly support all fixtures and equipment installed under this contract.

**3.05 CUTTING, PATCHING AND FRAMING**

- A. The CONTRACTOR shall determine in advance the locations and sizes of all sleeves, chases, and openings necessary for the proper installation of his work.
- B. Whenever practical, inserts or sleeves shall be installed prior to covering work. Cutting and patching shall be held to a minimum. All required holes in concrete construction shall be made with a core drill and patched with non-metallic non-shrink grout.
- C. Cutting, fitting repairing and finishing of carpentry work, metal work, or concrete work, and the like, which may be required for this work shall be done by craftsmen skilled in their respective trades. When cutting is required, it shall be done in such a manner as not to weaken walls, partitions, or floors; and holes required to be cut in floors must be drilled without breaking out around the holes.

**3.06 ACCESS PANELS**

- A. The CONTRACTOR shall provide all access panels in hard ceilings to allow NEC-required access to junction boxes, pull boxes, and light fixtures. The CONTRACTOR shall submit to the ENGINEER for approval floor plans (1/8" = 1'-0" scale minimum) which clearly indicate proposed access panel locations.

**3.07 COMMISSIONING**

- A. Commissioning of the facility shall be completed prior to substantial completion.
- B. CONTRACTOR shall provide for realistic durations in the progress schedule for the commissioning activities.
- C. Provide the labor, medium, chemicals, tools, equipment, instruments and services required for, and incidental to, completing commissioning.
- D. Demonstrate satisfactory operation within the facility of the equipment and systems in actual operation as a functional unit.

- E. Conduct commissioning for a period of fourteen (14) continuous days without significant interruption.
- F. The commissioning verification period shall restart with the correction of each significant interruption.
- G. Correct defects in material and workmanship immediately following their discovery.
- H. Provide for maintenance until substantial completion. This includes the required maintenance activities during the commissioning verification period.
- I. Perform maintenance pursuant to the operation and maintenance data requirements for the new facility during and following the commissioning verification period and prior to issuance of a certificate of substantial completion.
- J. As of the date of substantial completion, OWNER's staff shall be responsible for operation and maintenance of the new facilities. This excludes any issues identified as warranty matters.

### **3.08 TESTS**

- A. The CONTRACTOR shall furnish all labor, material, instruments and tools to make all connections for testing of the electrical and instrumentation installation. All equipment shall be demonstrated as operating properly prior to the acceptance of the work. All protective devices shall be operative during testing of equipment. The tests shall be made under the supervision of the ENGINEER. All deficiencies or unsatisfactory conditions as determined by the ENGINEER or inspecting authorities shall be corrected by the CONTRACTOR in a satisfactory manner at his own expense.
- B. After visual inspection of joints and connections and the application of tape and other insulating materials, all sections of the entire wiring system shall be thoroughly tested for shorts and grounds. A log of results for each circuit shall be kept by the CONTRACTOR and presented to the ENGINEER.
- C. A phase rotation check shall be made to demonstrate that all power receptacles, service feeders, main power feeders and auxiliary power generators have the same A - B - C phase rotation and ground relationships.
- D. Equipment shall be tested by operating all electric motors, relays, controls, switches, heaters, etc., sufficiently to demonstrate proper installation and electrical connections. Control and emergency conditions shall be artificially simulated where necessary for complete system or subsystem.

### **3.09 CLEANING AND TOUCH-UP PAINT**

- A. Upon completion of work, all electrical equipment shall be cleaned.
  - 1. Vacuum all dirt, metal shavings, and foreign materials from all enclosures. The use of compressed air shall not be acceptable.
  - 2. All stains, dirt, and fingerprints shall be removed from switchboards, motor control centers, panelboards, light fixtures, enclosures, and all other electrical equipment covers.
- B. Provide touch-up paint on equipment that has been scraped, scratched, or chipped during construction. Paint color shall match color of equipment.

**3.10 COORDINATION OF STARTUP AND ADJUSTING, COMMISSIONING, DEMONSTRATION AND TRAINING, AND OPERATION AND MAINTENANCE DATA.**

- A. Reference Section 260001 - Commissioning, 260110 - Operation and Maintenance Data, and 260115 - Demonstration and Training, for detailed requirements.

END OF SECTION



**SECTION 26 01 10  
OPERATION AND MAINTENANCE DATA****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Definitions.
  - 2. General requirements.
  - 3. Submittal procedures.
  - 4. Content requirements for manuals.
  - 5. Supplements.

**1.02 DEFINITIONS**

- A. Maintenance Operation.
  - 1. Routine operation required to ensure satisfactory performance and longevity of the equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands and other routine adjustments.

**1.03 GENERAL REQUIREMENTS**

- A. Provide operation and maintenance data for items listed in Supplement 260110 – A, “Schedule of Equipment Requiring Operation and Maintenance Data”.
- B. In addition to the composite of manuals for individual equipment items or systems, provide a consolidated summary of required routine scheduled maintenance and scheduled preventative and predictive maintenance for the project, with reference to where detailed information may be found. Include safety information and emergency plans and procedures. The summary shall be in a separate binder from the other equipment and system binders.
- C. Comply with the following format relating to the Operation and Maintenance Manual:
  - 1. All binders shall be “D” ring type with one-touch ring locking mechanism.
  - 2. Overlay material shall be crystal clear poly.
  - 3. Binders shall be black poly.
  - 4. Binders shall be nominally sized for 75 percent fill per volume with a maximum binder depth of four (4) inches and a minimum depth of one (1) inch.
  - 5. Submit example binder cover sheet for approval by ENGINEER.
  - 6. Submit example spine insert for approval by ENGINEER.
  - 7. Paper: twenty (20) pound minimum, white for typed pages, 8.5 x 11 inches.
  - 8. Text: Manufacturer’s printed data, or neatly typewritten. Facsimiles transmitted via fax machine shall be unacceptable.
  - 9. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
  - 10. Provide fly-leaf for each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment. Provide with heavy section dividers with numbered plastic index tabs.
  - 11. Provide each manual with a title page, typed table of contents with consecutive page numbers. Plan contents of entire set, identified by volume number, in each binder.
  - 12. Material shall be suitable for reproduction with quality equal to the original. Photocopying of material will be acceptable except for material containing photographs.
  - 13. Table of contents shall be neatly typewritten, arranged in a systematic order, containing as a minimum the following data:

- a. CONTRACTOR, name of responsible principle, address and telephone number.
  - b. List of each product required to be included and indexed to content of each volume.
  - c. List of each product, name, address and telephone number of subcontractor, supplier, installer and maintenance contractor as appropriate.
  - d. Provide local source and phone number of supply for parts and replacement.
  - e. Identify each product by product name, model number and other identifying numbers or symbols as set forth in the Contract Documents.
14. Product data:
- a. Include only those sheets that are pertinent to the specific product provided.
  - b. Clearly annotate each sheet to identify specific product or part installed, data applicable to the installation and delete references to inapplicable information.
15. Drawings; supplement product data with drawings as necessary to clearly illustrate the following:
- a. Relationship of component parts of equipment and systems.
  - b. Control and flow diagrams.
  - c. Coordinate drawings with project record documents to assure correct illustration of completed installations.
  - d. CONTRACTOR shall not use project record documents as maintenance manual drawings.
  - e. Provide reinforced punched binder tabs.
  - f. Reduced 11 x 17 inch drawings shall be folded to 8.5 x 11 inch format.
  - g. Where reduction to 11 x 17 inch is impractical, fold and place the 8.5 x 11 inch envelopes that are bound in the binder.
  - h. Identify specification Section and product on drawings and envelopes.

#### **1.04 SUBMITTAL PROCEDURE**

- A. Compile the required data, arrange as specified herein and insert data in the number of volumes necessary. The volumes shall be submitted as a complete set. Partial or incomplete manuals shall be rejected by the ENGINEER.
- B. Preliminary Manuals:
  1. Submit three copies to ENGINEER for review and approval well before the starting and adjusting activities commence.
  2. If accepted:
    - a. One copy will be returned to the CONTRACTOR.
    - b. One copy will be forwarded to the OWNER.
    - c. One copy will be retained in the ENGINEER's file.
  3. If rejected:
    - a. Two copies will be returned to the CONTRACTOR with ENGINEER's comments for revision.
    - b. One copy will be retained in the ENGINEER's file.
    - c. CONTRACTOR shall be required to resubmit three revised preliminary manuals for ENGINEER's review.
- C. Final Manuals:
  1. Submit two copies to ENGINEER for review and approval before final completion.
  2. If accepted:
    - a. CONTRACTOR will be so notified.
    - b. CONTRACTOR shall provide a complete set of the final manual on CD-ROM. Data written specifically for the manual will be presented in MS Word format. Manufacturer data (per-printed data) will be presented in Adobe PDF format.
  3. If rejected:

- a. At the ENGINEER's discretion either all but one copy of the manuals will be returned to the CONTRACTOR for revisions or all copies will be retained by the ENGINEER and the necessary revision data will be requested from the CONTRACTOR.

### 1.05 CONTENT REQUIREMENTS FOR MANUALS

- A. The Operation and Maintenance Manuals shall normally consist of no less than four volumes outline below.
- B. Volume 1 – Facility Overview.
  1. All sheets in volume 1 shall have sheet protectors.
  2. All materials in volume 1 shall be copied onto a CD and provided to the ENGINEER.
  3. Include instructions and procedures for handling, storage, maintenance during storage, assembly, erection, installation, adjusting, testing, operating, shut down in emergency, troubleshooting, maintenance, interface with other equipment and as may otherwise be required.
  4. Organize in a consistent format under separate heading for each different procedure.
  5. Provide a logical sequence of instructions for each procedure.
  6. Provide an information sheet for the OWNER's personnel which include the proper procedures in the event of a failure and instances that might affect the validity of warranties or bonds.
  7. Content for each unit (or common units) and system:
    - a. Description of unit and component parts including controls, accessories and appurtenances. Detail their function, normal operating characteristics and limiting conditions. Provide performance curves, engineering data, nameplates data and test forms. Provide a complete commercial number and nomenclature for replaceable parts.
  8. Operating Procedures:
    - a. Start-up and break-in routine and normal operating instructions.
    - b. Test procedures and results of factory tests where required.
    - c. Regulation, control, stopping and emergency instructions.
    - d. Description of operation sequence by control manufacturer.
    - e. Shutdown instructions for both short and extended durations.
    - f. Summer and winter operating instructions as applicable.
  9. Maintenance and Overhaul Procedures:
    - a. Routine operations
    - b. Guide to troubleshooting.
    - c. Disassembly, removal, repair, reinstallation and reassembly.
  10. Installation Instructions including alignment, adjusting, calibrating and checking.
  11. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list and diagrams required for maintenance.
  12. Parts list by generic title and manufacturer's part number.
  13. Name, location and telephone number of nearest supplier and spare parts warehouse.
  14. Where applicable identify installed spares and other provisions for future work (e.g. reserved panel space, unused components, wiring and terminals).
  15. Manufacturer's printed operating and maintenance instructions.
  16. Charts of valve tag numbers along with the location and function of each valve.
  17. Manufacturer's certifications including calibration data sheets and specified calibration procedures or methods for installed equipment.
  18. Warranty forms and information for all installed equipment provided by the CONTRACTOR.
  19. Circuit directories for all panels including electrical, control and communication.
  20. List of adjustable electrical relay settings, control and alarm settings.

- C. Volume 2 – Equipment Manuals.
1. Table of contents shall have a sheet protector.
  2. Table of contents and index sheets shall be of colored card stock.
  3. Manuals for individual equipment shall not be divided between separate binders.
  4. List function, normal operation, characteristics and limiting conditions.
  5. Complete commercial part number and nomenclature of replaceable parts.
  6. Maintenance procedures including routine operations, guide to troubleshooting and adjustments.
  7. Manufacturer's printed operation and maintenance instructions.
  8. List of manufacturer's spare parts and recommended quantities to be maintained in storage.
  9. Contents for Maintenance Summary Manual:
    - a. Compile individual maintenance summaries for each applicable equipment item, respective unit or system and for components or subunits.
    - b. Format shall include use of the Supplement 260110 – B "Maintenance Summary" provided. Each Maintenance Summary may take as many pages as required. Supplement shall be typewritten and shall include detailed lubrication instructions and diagrams showing points to be greased or oiled, recommended type, grade and temperature range of lubricants and frequency of lubrication.
    - c. Include a list and quantity of manufacturer's recommended consumable and spare parts that should be stored on site.
- D. Volume 3 – Drawings
1. As-built drawings associated with the project shall be provided. This includes, but is not limited to, manufacturers supplied drawings. All drawings shall be provided on 11 x 17 inch sheets folded to 8.5 x 11 inch size and bound in this volume. A complete and detailed index shall be provided that includes a list of all drawings in the volume and the drawings shall be tabbed in a fashion that provides clear and concise identification.

## **PART 2 PRODUCTS – NOT USED**

### **PART 3 EXECUTION**

#### **3.01 SUPPLEMENTS**

- A. Supplement 260110 – A, "Schedule of Equipment Requiring Operation and Maintenance Data".
- B. Supplement 260110 – B, "Maintenance Summary Form".

END OF SECTION 26 01 10

**Supplement 26 01 10 – A**  
**Schedule of Equipment Requiring Operation and Maintenance Data**

Item No.	Section	Manual (M) Data Sheet (D)	Description
1.	260913	D	Electrical Power Metering

END OF SUPPLEMENT

**Supplement 26 01 10 – B  
Maintenance Summary Form**

ProjectName \_\_\_\_\_  
ProjectNumber \_\_\_\_\_  
Equipment \_\_\_\_\_  
Equipment ID Number \_\_\_\_\_  
Manufacturer \_\_\_\_\_  
Name Plate Data \_\_\_\_\_  
Manufacture’s Local Supplier Name \_\_\_\_\_  
Phone \_\_\_\_\_  
Address \_\_\_\_\_

Maintenance Requirements

Maintenance Requirements	Frequency Required	Lubricant if Required

END OF SUPPLEMENT

**SECTION 26 01 15  
DEMONSTRATION AND TRAINING****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes.
  - 1. Definitions.
  - 2. General Requirements.
  - 3. Supplements.

**1.02 DEFINITIONS**

- A. Training Requirements.
  - 1. The following topics shall be covered at a minimum:
    - a. Equipment schematics.
    - b. Control strategy.
    - c. Troubleshooting procedures.
    - d. Recommended maintenance and periodic testing procedures.
    - e. Advanced start-up procedures.
    - f. Control Input/Output (I/O) and communications review.
    - g. Proper use and function of selector switches, reset buttons, speed controls, E-stops, etc.
  - 2. Training shall require one session for each type of process equipment.
- B. Manufacturer's Representative / Factory Trained Technician.
  - 1. Shall be an authorized service division employee of the manufacturer.

**1.03 GENERAL REQUIREMENTS**

- A. Provide training for OWNER's personnel for items listed in Supplement 260115 – A, "Schedule of Equipment Requiring Demonstration And Training".
- B. Utilize Manufacturer's Representative to conduct training sessions.
- C. CONTRACTOR shall have an employee familiar with the details of the installation attend the training sessions.
- D. The Manufacturer's Representative and CONTRACTOR shall provide the demonstration and training required to meet the performance specified herein. No costs in addition to the original Bid shall be incurred by the OWNER to meet this requirement.
- E. Schedule and coordinate training sessions to accommodate the following:
  - 1. Provide fourteen (14) day written notice to the ENGINEER for approval prior to proposed training sessions.
  - 2. Do not schedule training sessions for Monday, Friday, Saturday, Sunday or a Holiday.
  - 3. No more than two (2) different types of equipment training sessions shall be scheduled for any one (1) day.
  - 4. The Manufacturer's Representative shall utilize the operation and maintenance manuals as a basis for instruction. Should the need for additional data become apparent during instruction, CONTRACTOR shall prepare and insert the additional data into the operation and maintenance manual within seven (7) business days.

5. OWNER reserves the right to video tape the training session. The OWNER agrees that the video tape shall only be used for training employees.
  6. Provide the material, data, and training aids including, but not limited to, the copying of any documents, screens, viewers, etc. required for training session.
  7. Provide an outline of the topics for discussion during the training session and copies of the operation and maintenance manuals for all training session participants.
  8. OWNER will provide the CONTRACTOR with the number of participants at each training session seven (7) days after receipt of the proposed training session schedule.
- F. ENGINEER shall not authorize the commencement of the demonstration and training sessions until after successful demonstration of the Functional Test Certification, approval of the test reports submitted from Section 260108 – Electrical Testing.
- G. Should the CONTRACTOR fail to meet the scheduled training session date, OWNER shall be entitled to notification of a new date complying with the requirements indicated herein.
- H. Training sessions shall be scheduled to allow for appropriate progression of the training material. If knowledge of certain equipment is necessary to adequately comprehend the operational and maintenance aspects of another piece of equipment, the training session shall be scheduled to provide for this requirement.
- I. Training sessions shall meet the following general requirements:
1. Training sessions shall be completed before commissioning.
  2. CONTRACTOR shall provide the labor, process medium, chemical, tools, equipment and instruments necessary to accommodate demonstration of the equipment. CONTRACTOR may not rely on adequate water, wastewater, storm water or other normal process flows, etc. as they may not be available.
  3. The content of the training sessions shall be specific to the products installed.
  4. The training sessions shall be developed to allow for appropriate presentation of information and hands-on operation and maintenance opportunities for the OWNER's staff.

**PART 2 PRODUCTS – NOT USED**  
**PART 3 EXECUTION**

**3.01 SUPPLEMENTS**

- A. Supplement 260115 - A, "Schedule of Equipment Requiring Demonstration and Training".  
END OF SECTION



**Supplement 260115 – A**  
**Schedule of Equipment Requiring Demonstration and Training**

<b>Item No.</b>	<b>Section No.</b>	<b>Description</b>
1.	26 09 13	Electrical Power Monitoring
2.		Other items as may be specified in individual Sections.

END OF SUPPLEMENT

**SECTION 26 05 02  
MINOR ELECTRICAL DEMOLITION****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes.
  - 1. Removal of existing electrical equipment, wiring and conduit in areas to be remodeled. Removal of designated construction, dismantling, cutting and alterations for completion of the Work.
  - 2. Disposal of materials.
  - 3. Storage of removed materials.
  - 4. Identification of utilities.
  - 5. Salvaged items.
  - 6. Protection of items to remain as identified in the schedules at the end of this Section.
  - 7. Relocate existing equipment.
  - 8. Removal of temporary electrical equipment prior to completion of the Work.

**1.02 SUBMITTALS**

- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
  - 1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
  - 2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260502.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  - 3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data.
  - 1. Pursuant to Section 013300 Submittal Procedures.
  - 2. Manufacturer's data including materials of construction, methods of installation and related information for each item specified.
- C. Shop Drawings.
  - 1. Provide shop drawings indicating the location and construction of temporary work. Describe demolition procedures related to items listed in the schedules at the end of this Section.

**1.03 CLOSEOUT SUBMITTALS**

- A. Refer to the Contract Documents for general closeout submittal requirements.
- B. Project Record Drawings shall be provided that record actual locations of capped conduits and equipment abandoned in place.

**1.04 SEQUENCING**

- A. Sequencing of the Work shall be as noted in the Contract Documents.

**1.05 SCHEDULING**

- A. Refer to the Contract Documents.
- B. Coordinate the schedule of noisy, malodorous and dusty work with the ENGINEER.

**1.06 COORDINATION**

- A. Refer to Contract Documents.
- B. Conduct demolition to minimize interference with adjacent or occupied areas.
- C. Coordinate demolition work with other trades.
- D. Coordinate and sequence demolition so as not to cause shutdown or interruption of operation of surrounding areas.
- E. Arrange timing of shutdowns with the OWNER. Do not shutdown any utility service without prior written approval. Keep shutdown periods to a minimum.
- F. Identify salvage items in cooperation with the OWNER.

**PART 2 PRODUCTS – NOT USED****PART 3 EXECUTION****3.01 EXAMINATION**

- A. Verify wiring and equipment scheduled for demolition serve only abandoned process and facilities.
- B. Verify termination points for demolished services.

**3.02 DEMOLITION**

- A. Items scheduled for demolition shall be legally disposed of by the CONTRACTOR.
- B. Remove exposed abandoned conduit.
- C. Disconnect electrical systems in walls, floors and ceilings scheduled for removal.
- D. Reconnect equipment being disturbed by renovation work and required for continued service.
- E. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, switches, receptacles, conduit, and conductors which are not part of the completed project.
- F. Install temporary wiring and connections necessary to maintain existing systems in service during construction.

- G. Remove, relocate and extend existing installations to accommodate new construction.
- H. Repair adjacent construction and finishes to original condition that are damaged during demolition and extension work.
- I. Remove abandoned grounding and bonding components, fasteners, supports and electrical identification components. Cut embedded support elements flush with wall, floors and ceilings.
- J. Provide watertight knockout seals in panels, enclosures, gutters, or junction boxes where conduit is removed.
- K. Clean and repair existing equipment scheduled to be reinstalled.
- L. Protect and retain power to existing active equipment remaining.
- M. Cap abandoned empty conduit at both ends.

### **3.03 WALL, FLOOR AND CEILING PENETRATIONS**

- A. Seal concrete penetrations originally occupied by removed conduit with suitable grout material. Paint to match existing concrete.
- B. Repair holes in plaster or drywall assemblies. Provide all sheet rock, drywall, joint compound, sanding, etc. to repair the assembly to original condition. Paint to match existing assembly.

### **3.04 FIRESTOPPING**

- A. Where existing firestopping sealants, pillows, or other material are removed to facilitate the installation of new cabling, the firestopping shall be restored to a Code-compliant installation. All fire rated penetrations shall be fully sealed upon completion of work, regardless of the state of the existing installation.

### **3.05 SALVAGE ITEMS**

- A. Remove and protect items scheduled to be salvaged. Coordinate with OWNER where you are to locate these items

### **3.06 REUSEABLE ELECTRICAL EQUIPMENT**

- A. Unless specifically identified for reuse, no used electrical equipment, conduit, conductors, components of any sort scheduled for demolition, disposal or salvage shall be installed for reuse on the project.
- B. Electrical equipment identified specifically as being reused on the project shall be cleaned and protected until such time as it is reinstalled.

### **3.07 SCHEDULES**

- A. Salvage the following equipment to the OWNER at a location they identify. Coordinate the delivery of the salvaged items to the location identified by the OWNER at a time they have pre-approved.
  - 1. None.

- B. Dispose of the following equipment and its associated components.
  - 1. All electrical systems identified as demolition.
  
- C. Reuse the following items.
  - 1. All electrical devices and equipment identified as Remove (RR) and Re-install (RD).

END OF SECTION

**SECTION 26 05 19**  
**LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes.
1. The section includes the requirements for conductors and cables used to conduct potentials of 600 volts and less.
  2. All conductors and cables shall be installed in conduit or approved raceways regardless of which Division the conductors or cables are specified.

**1.02 REFERENCES**

- A. The following is a list of Standards which may be referenced in the Section.
1. American Society for Testing and Materials (ASTM).
    - a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
  2. National Electrical Contractors Association, Inc. (NECA): National Electrical Installation Standards (NEIS).
  3. National Electrical Manufacturers Association (NEMA).
    - a. WC 3, Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
    - b. WC 5, Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
    - c. WC 7, Cross Linked-Thermosetting Polyethylene Wire and Cable for the Transmission and Distribution of Electrical Energy.
    - d. WC 55, Instrumentation Cables and Thermocouple Wire.
  4. National Fire Protection Association (NFPA). 70, National Electrical Code (NEC).
  5. Underwriters Laboratories, Inc. (UL).
    - a. 13, Standard for Power-Limited Circuit Cables.
    - b. 44, Standard for Safety Rubber-Insulated Wires and Cables.
    - c. 62, Standard for Safety Flexible Cord and Fixture Wire.
    - d. 510, Standard for Safety Insulating Tape.
    - e. 854, Standard for Safety Service-Entrance Cables.
    - f. 910, Standard for Safety Test Method for Fire and Smoke Characteristics of Electrical and Optical Fiber Cables Used in Air Handling Spaces.
    - g. 1277, Standard for Safety Electrical Power and Control Tray Cables.
    - h. 1581, Standard for Safety References for Electrical Wires, Cables and Flexible Cords.

**1.03 SUBMITTALS**

- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
  2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260519.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be

in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.

3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

B. Product Data.

1. Pursuant to Section 013300 Submittal Procedures.
2. Manufacturer's data including materials of construction, weight, and related information for each item specified in PART 2 PRODUCTS.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

A. **NM Type Cable (260519.C55)**

1. Shall be rated 600 volts and conform to applicable requirements of NEMA.
2. Conductors shall be stranded copper.
3. Shall be provided with grounding conductor.
4. Insulation type shall be rated 90-degree C, PVC material.
5. Southwire, or approved equal.

### **2.02 ACCESSORIES**

A. **Colored Tape (260519.T01).**

1. Colored tape shall be used to identify individual conductors larger than # 6 AWG.
2. 3M colored tape, or approved equal.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

A. General.

1. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.
2. Conductor and cable installations shall meet or exceed the NECA National Electrical Installation Standards.
3. CONTRACTOR shall not exceed the manufacturer's recommendations for maximum pulling tensions or minimum bending radii for respective conductors or cables.
4. Pulling compound is recommended for all conductor or cable installations and shall be used on all installations requiring a mechanical pulling device.
5. CONTRACTOR shall not exceed the manufacturer's recommended pulling tensions on all conductor or cable installations requiring the use of a mechanical pulling device. Should the pulling tensions be exceeded, and the conductor or cable becomes damaged, the conductor or cable shall be removed from the raceway and discarded. It shall not be reused under any circumstance on the project. The CONTRACTOR shall be responsible to make the alterations necessary before attempting to re-pull new conductors or cables.
6. Immediately after pulling in conductors or cables, the pulling compound shall be completely removed from the conductors or cables, from boxes, enclosures, floors, walls, etc.
7. Conductor and cable installations shall be continuous without splices or intermediate terminations unless specifically identified on the Drawings or prior written approval from the ENGINEER.

8. Where conductors or cables are routed in boxes enclosures or cable tray they shall be neatly bundled with cable ties at intervals not to exceed 12 inches on center. The tension for the cable ties shall be set with a tool specifically manufactured for that purpose and of the same manufacturer as the cable tie. Side cutters, linemen pliers and similar tools shall not be used to cut the tail end of the cable tie. The CONTRACTOR shall only use the tool specifically manufactured for this purpose and of the same manufacturer as the cable tie.
9. Conductors and cables shall not be installed until the raceway, boxes, enclosures, conduit bushings, etc. have all been installed. Where conductors or cables have been installed prior to meeting this requirement, the ENGINEER shall at their discretion elect to have the conductors or cables removed, disposed of and replaced with new product.
10. Should the outer jacket of any conductor or cable be damaged in any way, they shall be removed, disposed of and replaced with new product.
11. An equipment grounding conductor shall be installed in all raceways. Size shall be as identified on the Drawings or the NEC, whichever is greater, but in no case shall it be less than # 16 AWG for under 50 volts and no less than # 14 for 50 volts or above.

END OF SECTION



**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes.
1. The section includes requirements for grounding electrodes, equipment grounding and electrical bonding.

**1.02 SUBMITTALS**

- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
  2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260526.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data
1. Pursuant to Section 013300 Submittal Procedures.
  2. Manufacturer's data including materials of construction, methods of installation and related information for each item specified in PART 2 PRODUCTS.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. **Compression Connectors (260526.C20).**
1. Compression connections shall be provided as shown on the drawings and as required for bonding end-use equipment.
  2. Compression connections shall be compress-deforming type, extruded copper material.
  3. Compression connections shall be tin electroplated for corrosion resistance.
  4. Compression connections shall be ring-type connectors. Forked connectors shall not be used on grounding conductors.
  5. Provide Burndy products, or approved equal.
- B. **Mechanical Connectors (260526.C21).**
1. Mechanical connectors shall be provided as shown on the drawings and as required for bonding to pipes.
  2. Mechanical connectors shall be UL 467 Listed, copper material.
  3. Mechanical connectors shall be sized to match the pipe being bonded.
  4. Mechanical connector clamps shall permit parallel or 90° cable connection.
  5. Mechanical connectors installed below-grade shall include silicon bronze hardware.
  6. Provide Burndy GAR3902 series for above-ground installations, or approved equal.

7. Provide Burndy GAR-BU series for below-grade installations, or approved equal.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. General.
  1. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.
  2. Bond separately derived systems, including generators, to the grounding electrode system.
  3. Maintain equipment ground continuity throughout the facility by means of a grounding conductor routed in all raceways.
  4. Provide grounding conductors pursuant to Section 260519. Conductors shall be copper and shall be sized per the Drawings or the NEC, whichever is greater.
  5. Provide ground bushings for all conduits that do not terminate in a hub type fitting and install at the source of power with a bonding conductor fastened to the ground bushing.
  6. Provide ground bar kits as shown on the Drawings and where two (2) or more grounding conductors are terminated in a box or enclosure.
  7. Install ground rods at the locations and in the number shown on the Drawings or per the NEC, whichever is greater.
  8. Bond the grounding electrode system to all metallic water and wastewater piping.
- B. Grounding Conductors.
  1. Brush grounding conductors clean of debris before connections are made.
  2. Strip insulated conductor insulation in a neat, workman like manner where insulated conductors are used.
  3. Fasten all conductors securely.
- C. Connections.
  1. Install connectors according to the manufacturer's directions, using the proper dies, tools, etc. designed specifically for this purpose.
  2. Provide compression connector type connections to ground rods, re-bar, building steel, end use equipment and bolt to the equipment using washers and split lock washers for secure fastening. Bolts shall be grade 5 for grounding connections and shall be tightened to the manufacturer's recommend torque.

END OF SECTION

**SECTION 26 05 29  
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. This section includes requirements pertaining to electrical equipment anchoring and electrical equipment hanging and support.

**1.02 SUBMITTALS**

- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
  2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260529.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data.
1. Pursuant to Section 013300 Submittal Procedures.
  2. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS.
  3. Seismic calculations and drawings.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. **Hot Dipped Galvanized Hardware (260529.H11).**
1. Bolts shall be hot dipped galvanized steel and sized for the load served and have a hex head unless specifically specified otherwise elsewhere.
  2. Nuts shall be hot dipped galvanized steel hex nut.
  3. Washers shall be hot dipped galvanized steel, USS pattern flat washers.
  4. Split lock washers shall be hot dipped galvanized steel.
  5. Threaded rods and couplings shall be hot dipped galvanized steel.
  6. Eye-bolts, u-bolts, bent-bolts and similar connecting hardware shall be hot dipped galvanized steel.
- B. **Hot Dipped Galvanized Anchors (260529.A11).**
1. Wedge or stud anchors installed in concrete or masonry shall be hot dipped galvanized steel and sized for the load served.
  2. Toggle type fasteners shall only be used in hollow sheetrock wall. The wing part of the fastener may be mild steel, but the bolt shall be hot dipped galvanized steel.

**C. Hot Dipped Galvanized Beam Clamps (260529.B11).**

1. Beam clamps shall be hot dipped galvanized steel and sized for the load served.

**D. Hot Dipped Galvanized Strut Channel (260529.S11).**

1. Strut channel shall be hot dipped galvanized after fabrication and shall be a minimum of 12 gauge.
2. Strut channel shall have factory pre-drilled holes.

**2.02 SEISMIC BRACING****A. Seismic Anchoring and Bracing Products (260529.S90).**

1. Provide seismic bracing for the vertical and lateral restraint of all conduits, conduit racks, raceways, cable trays, required by the International Building Code and Oregon Structural Specialty Code.

**PART 3 EXECUTION****3.01 INSTALLATION****A. General.**

1. Hardware shall be set to a torque as recommended by the manufacturer.
2. Washers and split lock washers shall be installed on all bolts, threaded rods and anchors.
3. Lead or plastic type anchors are prohibited from use on the project.
4. When threaded rods are installed in drop-in type anchors, a washer, split lock washer and a jamb nut shall be installed at the anchor to ensure stability.
5. When channel (strut) is installed as a hanger or support from threaded rod, washers, split lock washers and jamb nuts shall be installed on both sides of the strut to lock it in place.
6. Cut ends of channel, strut, threaded rods or other cut fittings shall be filed smooth before installation.
7. Cut ends of hot dipped galvanized channel and strut shall be coated with three coats of cold galvanizing compound after the channel has been filed to prohibit rust.
8. Concrete anchors shall be installed as per the manufacturer's directions and set using the manufacturer's supplied tool.
9. Threaded rod shall not extend more than one (1) inch beyond the channel, strut or other material it is supporting.
10. Hangers and supports shall be installed level and plumb.
11. Hangers and supports shall be installed per the National Electrical Code, Building Code and Structural Code and shall be designed to safely support the load. The ENGINEER may request the CONTRACTOR provide a copy of their design calculations for the seismic requirements and the load served.

**B. Seismic Anchoring and Bracing**

1. The design of the seismic anchoring and bracing system shall be by a licensed Structural Engineer in the State of Oregon. The CONTRACTOR shall arrange and pay for the services of the licensed Engineer.
2. Wet stamped and signed calculations and drawing of the seismic anchoring and bracing system shall be submitted to the Architect and Engineer for review and approval.

END OF SECTION

**SECTION 26 05 33  
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes
  - 1. The Section includes the requirements pertaining to conduits and fittings used to contain electrical conductors and cables.
  - 2. All conductors and cables shall be installed in conduit or approved raceways regardless of which Division the conductors or cables are specified.

**1.02 REFERENCES**

- A. The following is a list of standards which may be referenced in this Section.
  - 1. American National Standards Institute (ANSI).
    - a. C80.1, Rigid Steel Conduit-Zinc Coated.
  - 2. American Society for Testing Materials (ASTM).
    - a. A123 E1, Standard Specification for Zinc-Coated (Galvanized) Coatings on Iron and Steel Products.
  - 3. National Electrical Contractors Association (NECA).
    - a. National Electrical Installation Standards (NEIS).
  - 4. National Electrical Manufacturers Association (NEMA).
    - a. TC 3, PVC Fittings for use with Rigid PVC Conduit and Tubing.
    - b. TC 6, PVC and ABS plastic Utilities Duct for Underground Installation.
  - 5. Nation Fire Protection Association (NFPA).
    - a. 70, National Electrical Code (NEC).
  - 6. Underwriters Laboratories, Inc. (UL).
    - a. 6, Standard for Safety Rigid Metal Conduit.
    - b. 514B, Standards for Safety Fittings for Conduit and Outlet Boxes.
    - c. 651, Standard for Safety Schedule 40 and 80 PVC Conduit.
    - d. 651A, Standard for Safety Type EB and Rigid PVC Conduit and HDPE Conduit.
    - e. 1660, Standard for Safety Liquid-Tight Flexible Nonmetallic Conduit.
    - f. 360, Standard for Safety Liquid-Tight Flexible Metallic Conduit.
    - g. 797, Standard for Safety Electrical Metallic Conduit.

**1.03 SUBMITTALS**

- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
  - 1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
  - 2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260533.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  - 3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

- B. Product Data.
  - 1. Pursuant to Section 013300 Submittal Procedures.
  - 2. Manufacturer's data including materials of construction, equipment weight and related information for each item specified in PART 2 PRODUCTS.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. **Non-metallic (PVC) Boxes (260553.B60)**
  - 1. Shall be UL Listed, PVC, non-metallic.
  - 2. Carlon, or approved equal.

### **2.02 ACCESSORIES**

- A. **Firestopping (260533.F90).**
  - 1. Shall be as specified in Division 07 Specifications.
  - 2. Shall be Listed for the conduit, raceway or box being installed.
  - 3. Install per the Manufacturer's instructions.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Boxes
  - 1. Install boxes and enclosures in accordance with the schematic representation as indicated on the Drawings.
  - 2. Install vaults and in-ground box tops (lids) such that they are ½ inch above finished grade to prevent water ingress.
  - 3. Boxes and enclosures shall be mounted level and plumb.
  - 4. Boxes and enclosures shall not be altered, holes drilled, etc. in any way that may compromise the NEMA rating of the enclosure or box.
  - 5. Boxes and enclosures shall be bonded the equipment grounding conductor.
  - 6. Provide a divider whenever a box contains conductors of different potentials that the code requires separation.
  - 7. Surface mounted enclosures and boxes shall be spaced off the surface at least 1/4 inch in damp or wet locations.
  - 8. Enclosures shall be provided whenever a junction or pull box larger than 4 inches square is required.
  - 9. Sheet metal boxes are permitted only in locations where EMT conduit is approved.
  - 10. Enclosures shall be labeled with a nameplate as specified in Section 26 05 53 – Identification for Electrical Systems. The nameplate shall match the callout on the Drawings. If no callout exists, the CONTRACTOR is responsible to meet with the ENGINEER and develop a list of pull box, junction box and termination box nomenclature and their as-built Drawings shall reflect these callouts.

END OF SECTION

**SECTION 26 05 83  
WIRING CONNECTIONS****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes.
1. This Section includes requirements for conductor termination methods.

**1.02 SUBMITTALS**

- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
  2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260583.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data.
1. Pursuant to Section 013300 - Submittal Procedures.
  2. Manufacturer's data including materials of construction, applications and related information for each item specified in PART 2 PRODUCTS.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. **Electrical Spring Connectors (Wire Nuts) (260583.W01).**
1. Provide properly sized spring connectors for the size and number of conductors spliced.
  2. Ideal, 3M, Thomas and Betts, or approved equal.

**2.02 ACCESSORIES**

- A. **Electrical Tape (260583.T40).**
1. General electrical tape shall be premium grade, all weather vinyl electrical insulating tape.
  2. 3M – Scotch 33+, or approved equal.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. General
1. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.

2. Care shall be taken when terminating conductors to avoid kinking, cutting or puncturing the jacket or allowing contamination by grease, oil or water.
3. Care shall be taken when terminating conductors to properly support the conductors and to avoid undue pressure on the connector or utilization equipment.
4. Conductors shall be terminated by use of lugs, pressure type connectors wire nuts or terminal blocks. Wrapping conductors around a screw type terminal is not acceptable.
5. Compression connectors shall be installed using the tool and die provided by the same manufacturer as the connectors and as per their directions.
6. Compressions on connectors used for # 8 AWG conductors and larger shall have a minimum of two (2) circumferential crimps.
7. Indenter type crimps on compression connectors shall not be used on conductors larger than # 10 AWG.
8. Connectors shall be installed as per the manufacturer's directions.
9. Insulated wire ferrules shall be provided for conductors terminated on terminal blocks utilizing a crimping tool provided by the ferrule manufacture specifically for this purpose.
10. Where wire ducts in enclosures exist, conductors shall be grouped together and routed in the wire ducts and shall be fanned out to the terminals.
11. Wire nuts shall be used on conductors # 10 AWG or less and only for splicing conductors at light fixtures, at receptacles and motors. No other splicing of conductors with wire nuts are permitted unless specifically identified on the Drawings.
12. All spare conductors shall be identified individually, neatly coiled and fastened with cable ties. The coil shall be labeled to describe its origin. Spare conductors shall be left long enough to be neatly routed and terminate anywhere within the enclosure.
13. Conductors installed outdoors which are not terminated the same day, shall have heavy wall heat shrinkable end caps installed the same day they are pulled in. The end caps shall remain in place until the day they are terminated.
14. Heavy wall heat shrink tubing shall be installed over splices or over the barrel of connectors installed outdoors.
15. Thin wall heat shrink tubing shall be installed over splices or over the barrel of connectors installed indoors.
16. As connections are set with a torque wrench, a black felt marker shall be used to mark across the bolt, nut or screw indicating the torque has been set.
17. Insulated Mechanical Multi-Tap Connectors shall be utilized for splices located at in-ground lighting and power boxes. It may also be used for motor terminations.

END OF SECTION



**SECTION 260913  
ELECTRICAL POWER MONITORING****PART 1 GENERAL****1.01 SUMMARY**

## A. Section Includes

1. This section includes requirements for electrical metering systems.

**1.02 REFERENCES**

## A. The following is a list of Standards that may be referenced in the Section.

1. NEMA Standard PB 2 Dead front Distribution Switchboards.
2. Underwriters' Laboratories (UL) Standard No. UL 916 Energy Management Systems.
3. Underwriters' Laboratories (UL) Standard No. UL 2808 Energy Monitoring Current Transformers.
4. Underwriters' Laboratories (UL) Standard No. UL 61010-1 Test and Measurement Equipment.
5. IEC 62052-11, 62053-22 Test and Measurement Equipment.
6. ANSI C12.1, C12.20/0.5
7. ANSI/IEEE 802.3
8. National Electrical Code (NEC).

**1.03 SUBMITTALS**

## A. Contractor shall submit all the product data in each section at the same time. Piecemeal submittals will be rejected as incomplete.

1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 260913.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.

## B. Product Data

1. Pursuant to Section 013300.
2. Manufacturer's data including material of construction, equipment weight, and related information for each item specified in PART 2 PRODUCTS.

## C. Shop Drawings

1. Bill of material including a complete listing of all hardware, software, training, software configuration, and start-up services.

2. Equipment shop drawings showing elevation and plan views, compartment arrangement, conduit entry/exit locations, dimensions, weight, and metering layouts.
3. Single line diagrams and point to point compartment wiring diagrams for metering. Show wire and terminal numbers.
4. Product data sheets and catalog numbers for hardware.
5. Detailed points list for each device, sensor or other system listing each data point to be monitored by the EPMS.
6. Provide data register to third parties for external monitoring of the EPMS system.

#### **1.04 QUALITY ASSURANCE**

- A. The equipment furnished under this Section shall be the product of a manufacturer who has produced this same type of equipment for a period of at least 10 consecutive years.

#### **1.05 DELIVERY, STORAGE, HANDLING**

- A. Equipment Handling
  1. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

#### **1.06 SYSTEM DESCRIPTION**

- A. New revenue metering system used for tenant billing. The meters will form a 2-way mesh network and communicate wirelessly. The meters will not require hardwired communications to function.
- B. The CONTRACTOR and Manufacturer shall provide a complete and fully functional system.

#### **1.07 WARRANTY**

- A. Provide manufacturer's standard 5-Year warranty.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. The basis of design is the Leviton VerifEye System.
- B. Basis of design software shall be the VeifEye Building Manager Online.

#### **2.02 PRODUCTS**

- A. **Mini Meter (260913.M01)**
  1. Shall be revenue grade submeter measuring kWh for tenant billing.
  2. Shall be rated for 120/208/240V 1PH/3W, 200A.
  3. Shall be indoor flush mount type.
  4. Shall contain integral AMR transceiver capable of communicating with other meters and wireless repeaters to form a 2-way mesh network.
  5. UL listed for energy usage monitoring.
  6. Meter shall be pulse type meter.
  7. Battery operated, two (2) Double AA Alkaline batteries.
  8. Radio transmitter operates at 902 to 928 MHz up to 10 miles open field range.
  9. Kit includes submeter, enclosure, wireless transceiver, and CTs.
  10. Leviton MDTFW-2SC, or approved equal.

**B. Wireless Repeater (260913.R01).**

1. Shall natively extend range of wireless submetering systems.
2. Radio transmitter operates at 902 to 928 MHz up to 10 miles open field range.
3. 120 VAC power supply input, 5 VDC, 800 ma.
4. Leviton T95RX-000, or approved equal.

**C. Data Access Point (260913.D01).**

1. Integral radio receiver operating at 902-928 MHz up to 0.75 miles open range.
2. Shall be capable of up to 1000 meter points.
3. 120 VAC power supply input, 5 VDC, 1A.
4. Shall connect to LAN via 10/100 Ethernet connection.
5. Leviton T25DX-102, or approved equal.

**2.03 SOFTWARE LICENSES**

- A. Provide BMO tenant billing software Annual licenses for up to total number of data points (meters).
- B. Each annual license shall be capable of up to 50 data points per license.
- C. Tenant Billing module shall allow metering of each unit and automatic creation of invoices by meter/unit for ease of billing.
- D. Leviton BMOTB-050, or approved equal.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.
- B. Installation shall be in accordance with the manufacturers' instructions.
- C. Field wiring shall be grouped by circuit and tie wrapped. Terminations shall not be stressed.
- D. CONTRACTOR shall install all metering current transformers and current transformer wiring as shown on the Drawings.

**3.02 FIELD QUALITY CONTROL**

- A. Test and verify installation in conformance with Section 260573.
- B. In addition, make the following minimum tests and checks before energizing the equipment:
  1. Megger terminals and buses at two times rated voltage, phase to phase and phase to ground after disconnecting devices sensitive to megger voltage.
  2. Remove all current transformer shunts after completing secondary circuit.
  3. Check all mechanical interlocks for proper operation.
  4. Vacuum clean all interior equipment.
  5. Adjust and test all circuit breakers and relays in accordance with Section 260573.

**3.03 MANUFACTURER'S SERVICES**

- A. The CONTRACTOR shall support the Manufacturer's on site services, including but not limited to, energizing and de-energizing equipment, lockout/tagout, opening and

providing access to enclosures, equipment, and junction boxes, voltage and current measurements, and all other work required for the authorized representative of the Manufacturer to complete their services.

- B. An authorized representative of the Manufacturer shall observe, test, and commission all hardware and ensure that the 2-way mesh network is fully functional.
- C. An authorized representative of the Manufacturer shall provide all software start-up, configuration, and programming. The representative shall ensure that the accounts for all of the tenants have been created and are capable of metering power consumption so the Owner may bill the tenants for consumption.
- D. An authorized representative of the Manufacturer shall provide on-site testing, start-up, calibration, commissioning, and OWNER training.
- E. The authorized representative shall provide a minimum of one day (8 person hours) for start-up, testing and training.
- F. Provide digital copies (via thumb drive or electronic file transfer) of the training material to the OWNER.

#### **3.04 CLEANING**

- A. Thoroughly clean the interior of the metering enclosure of all debris, dirt, and scrap wire prior to energizing.
- B. Use touch-up paint to cover any marks, blemishes, or other damages that occurred during installation.

**END OF SECTION**

**SECTION 26 27 26  
WIRING DEVICES****1.01 SUMMARY**

- A. Section Includes.
  - 1. This Section includes the requirements for wiring devices such as receptacles, toggle switches and devices plates.

**1.02 REFERENCES**

- A. The following is a list of Standards which may be references in the Section.
  - 1. National Electrical Contractors Association (NECA): National Electrical Installation Standards (NEIS).
  - 2. National Electrical Manufacturers Association (NEMA).
    - a. WD1 – General Requirements for Wiring Devices.
    - b. WD6 – Wiring Device Dimensional Requirements.
  - 3. National Fire Protection Association (NFPA): 70.
  - 4. Underwriters Laboratories, Inc. (UL): 1070.

**1.03 SUBMITTALS**

- A. Contractor shall submit all the product data in Division 26 at the same time. Piecemeal submittals will be rejected as incomplete.
  - 1. The product data shall be submitted in PDF format. Each PDF shall only contain products from a single specification section, products in a different specification section shall be in a separate PDF.
  - 2. A submittal is required for each product specified. Each individual product submittal shall have the corresponding Reference Keynote Number (example - 262726.C01) typewritten in the upper right-hand corner of the submittal. The submittals within each PDF shall be in the same sequential order as they are listed in the specification Section. Submittals not containing the Reference Keynote Number will be rejected as incomplete.
  - 3. No typical submittals will be accepted. Each submittal shall be project specific and clearly identify specifically which components or parts are being submitted for approval. Any product submittals, such as a catalog sheet, which do not clearly identify which components or parts are being submitted for approval, will be rejected as incomplete.
- B. Product Data.
  - 1. Pursuant to Section 013300 Submittal Procedures.
  - 2. Manufacturer's data including materials of construction, equipment weight, and related information for each item specified in PART 2 PRODUCTS.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. **General Purpose Receptacles (262726.R01).**
  - 1. Shall be heavy duty specification grade, tamper resistant two-pole, three wire grounding type with screw type terminals suitable for number 10 American Wire Gauge (AWG).
  - 2. Shall be NEMA 5-20R, rated for 20 amperes, 125 volt configuration.
  - 3. Provide duplex or single receptacles as shown on the Drawings.
  - 4. Shall be white in color unless fed from an emergency circuit and in that case the receptacle shall be red in color.
  - 5. Provide Hubbell BR20 Commercial Specification Grade, Leviton, Pass & Seymour, or approved equal.
- B. **Device Plates (262726.P01).**

1. Install white thermoplastic at all indoor locations unless called out otherwise on the drawings.
2. Provide Hubbell, or approved equal.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

#### **A. General.**

1. All identification labeling shall be in compliance with Section 260553 Electrical and Control Identification.
2. Devices shall be bonded to their enclosure and the equipment grounding conductor with a separate grounding conductor attached to the device which will allow the device to be detached from the enclosure without disconnecting the equipment grounding conductor from the enclosure.
3. The use of the mounting yoke as the only method for bonding is unacceptable.
4. Devices that are not installed at the end of the line (circuit) shall be pig-tailed out and the pig-tails shall be connected to the line and load conductors.
5. After the pigtailed conductors are terminated on the device and before it is installed in the enclosure the exposed energized parts shall be wrapped with electrical insulating tape with a minimum of three wraps.
6. As the device is installed in the enclosure, care shall be taken to neatly fold the conductors inside the enclosure so as to not kink, bind or otherwise damage the sheath of the conductors.
7. Terminations on all devices shall be via pressure or compression type connectors. Wrapping conductors around a termination screw and tightening is unacceptable.
8. Mounting heights for receptacles shall be 18 inches to center from finished floor unless called out otherwise on the Drawings or specified at different height to meet minimum code requirements. Where countertops are present, receptacles shall be mounted horizontally and mounted 4 inches to center above the back-splash. The CONTRACTOR is responsible to coordinate with the approved casework submittals. Failure to do so will require the CONTRACTOR to relocate devices at their expense.
9. Mounting height for switches shall be 42 inches to center above finished grade unless called out otherwise on the Drawings or specified at different height to meet minimum code requirements. Where countertops are present, switches shall be mounted 5 inches to center above the back-splash. The CONTRACTOR is responsible to coordinate with the approved casework submittals. Failure to do so will require the CONTRACTOR to relocate devices at their expense.
10. Coordination is the responsibility of the CONTRACTOR. If a conflict exists for the mounting location of devices, the CONTRACTOR shall bring it to the ENGINEER's attention during the rough-in phase and the ENGINEER shall provide direction. Failure to coordinate conflicts during the rough-in phase will result in relocation of devices at the CONTRACTOR's expense.
11. All receptacles fed from emergency panels shall be red in color.
12. Devices shall be installed level and plumb. Devices shall be brought out plumb with the wall surface via UL listed spacers approved for this purpose if necessary.
13. Devices shall be tested for voltage, polarity, ground integrity and in the case of GFCI receptacles, that they operate as intended.
14. The position of devices, as shown on the Drawings, are general locations only unless dimensioned. The CONTRACTOR is responsible to coordinate with various trades to ensure no conflict exists.

END OF SECTION