Construction Contracts Administration, Procurement, Contracts, & Materials Management (PCMM)
Oregon State University, 644 SW 13th Ave., Corvallis, Oregon 97333
T 541-737-4672 | **F** 541-737-5546

August 4, 2017

Oregon State University
Construction Contracts Administration
Radiation Center Power Upgrade

ADDENDUM NO. 2

THIS ADDENDUM IS BEING ISSUED for clarification and/or revisions of the specifications as noted. This document is hereby made a part of the Contract Documents to the extent as though it was originally included herein.

TECHNICAL SPECIFICATIONS:

Item 1	BID FORM – REPLACE in its entirety with the attached "***REVISED 8/4/2017 BID FORM". Note bid due date has been extended to August 29, 2017.
Item 2	Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables" – REPLACE in its entirety with the attached Section 26 05 19, dated August 3, 2017.
Item 3	Section 26 05 26 "Grounding and Bonding for Electrical Systems" – REPLACE in its entirety with the attached Section 26 05 26, dated August 3, 2017.
Item 4	Section 26 05 29 "Grounding and Bonding for Electrical Systems" – REPLACE in its entirety with the attached Section 26 05 29, dated August 3, 2017.
Item 5	Section 26 05 33 "Raceways and Boxes for Electrical Systems" – REPLACE in its entirety with the attached Section 26 05 33, dated August 3, 2017.
Item 6	Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" – REPLACE in its entirety with the attached Section 26 05 44, dated August 3, 2017.
Item 7	Section 26 05 53 "Identification for Electrical Systems" – REPLACE in its entirety with the attached Section 26 05 53, dated August 3, 2017.
Item 8	Section 26 22 00 "Low Voltage Transformers" – DELETE in its entirety.

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Item 9 Section 26 24 13 "Switchboards" – REPLACE in its entirety with the attached Section 26 24 13, dated August 3, 2017.

Item 10 Section 26 24 16 "Panelboards" – DELETE in its entirety.

DRAWINGS:

Item 11 Sheet E0.00 "OSU Cover Sheet" – DELETE in its entirety.

Item 12 Sheet E0.10 "Legend and Abbreviations" – REPLACE in its entirety with the attached Sheet E0.10 "Legend and Abbreviations" – Electrical", Revision 1, dated August 2, 2017.

Item 13 Sheet ED1.00 "Demolition Site Plan" – DELETE in its entirety.

Item 14 Sheet E1.00 "Site Plan - Electrical" – DELETE in its entirety.

Item 15 Sheet E3.0 "Floor Plan - Electrical" – REPLACE in its entirety with the attached Sheet E3.0, Revision 1, dated August 2, 2017.

Item 16 Sheet E5.0 "One-Line Diagram" – REPLACE in its entirety with the attached Sheet E5.0 "Single-Line Diagram – Electrical", Revision 1, dated August 2, 2017.

Item 17 Sheet E5.1 "Feeder Schedules" – ADD the attached Sheet E5.1 "Feeder Schedules", Revision 1, dated August 2, 2017.

Item 18 Sheet E9.01 "Details – Electrical" – REPLACE in its entirety with the attached Sheet E9.01, Revision 1, dated August 2, 2017.

Item 19 Sheet A1.01 "New Site Wall" – DELETE in its entirety.

QUESTIONS/CLARIFICATIONS:

Item 20 **Q:** Will there be a second walk through offered?
A: No.

Item 21 With revisions to specifications and drawings as outlined above, coordination with Pacific Power is no longer required.

Item 22 With revisions to specifications and drawings as outlined above, there is no longer

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any non-electrical exterior work; a new enclosure or changes to existing enclosure are no longer required.

END OF ADDENDUM NO. 2

OREGON STATE UNIVERSITY

BID FORM

PROJECT: RADIATION CENTER POWER UPGRADES

BID CLOSING: TUESDAY, AUGUST 29, 2017 AT 2:00 PM LOCAL TIME

BID OPENING: TUESDAY, AUGUST 29, 2017 AT 2:00 PM LOCAL TIME

FROM: _____
Name of Contractor

TO: Oregon State University ("Owner")
Construction Contract Administration
644 SW 13th Ave.
Corvallis, Oregon 97333

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

BASIC BID A: Labor and Material to perform all Work

_____ Dollars ($_____)

BASIC BID B: Overhead and Profit represented as a lump sum

_____ Dollars ($_____)

BASIC BID C (Combination of Basic Bids A and B):

_____ Dollars ($_____)

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

- Notice of Opportunity
- Supplemental Instructions to Bidders
- Sample Contract
- OSU General Conditions
- Prevailing Wage Rates
- Instructions to Bidders
- Bid Bond
- Performance Bond and Payment Bond
- Supplemental OSU General Conditions
- Payroll and Certified Statement Form

• Plans and Specifications • Drawings and Details
• ADDENDA numbered ____ through____, inclusive *(fill in blanks)*

2. The work shall be completed within the time stipulated and specified in Division 1, Section 01 11 00, 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 or its surety on any Bond furnished with the Bid 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. Accompanying herewith is Bid Security which is equal to five (5) percent of the total amount of the Basic Bid.

12. The Undersigned further agrees that the Bid Security accompanying the Bid is left in escrow with the Owner; that the amount thereof is the measure of liquidated damages which the Owner will sustain by the failure of the Undersigned to execute and deliver the above-named Agreement Form, Performance Bond and Payment Bond, and, that if the Undersigned defaults in either executing the Agreement Form or providing the Performance Bond and Payment Bond within twenty (20) calendar days after receiving the Contract Documents, then the Bid Security may become the property of the Owner at the Owner's option; but if the Bid is not accepted within thirty (30) calendar days of the time set for the opening of the Bids, or if the Undersigned executes and timely delivers said Agreement Form, Performance Bond and Payment Bond, the Bid Security shall be returned.

13. 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)

14. The undersigned certifies, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall disclose such activities.

c. The undersigned shall require that the language of this certification be included in the award documents of all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, United States Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

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.

[remainder of page left blank intentionally]

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 - Signature

_____
Sole Individual - Printed Name

or 2) _____
Partner

or 3) _____
Authorized Officer of Corporation - Signature

_____
Authorized Officer of Corporation Printed Name

(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 *****

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

C. Class 1 Control Circuits: Type THHN-THWN, in raceway.

D. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. 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.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

D. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

E. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 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 and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 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."

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

    a. Feeders to all motors over 1 HP

    b. Feeders and branch circuits to all Mechanical Equipment

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 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. 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.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.2 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.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 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.

C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 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.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. 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.

B. 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.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, 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. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. 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.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

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.

2.2 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

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

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 New Concrete: Bolt to concrete inserts.
2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
3. To Existing Concrete: Expansion anchor fasteners.
4. 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.
5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. 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.

3.3 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.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. NBR: RNC: Rigid nonmetallic conduit

I. ARC: Aluminum rigid conduit.

J. GRC: Galvanized rigid steel conduit.

K. IMC: Intermediate metal conduit.

1.3 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.

2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Republic Conduit.
7. Robroy Industries.
8. Southwire Company.
9. Thomas & Betts Corporation.
10. Western Tube and Conduit Corporation.
11. 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. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel or aluminum.

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: Compression.

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.

J. Joint Compound for IMC, GRC: 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.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 as shown on drawings, unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, 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: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a Pentair company.
7. Hubbell Incorporated; Killark Division.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group.
12. RACO; a Hubbell Company.

13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

J. Gangable boxes .

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: GRC, IMC, or EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: 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
4. Exposed and Subject to Severe Physical Damage: GRC or IMC. 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. Electrical rooms.
e. Warehouse spaces

5. Concealed in Ceilings and Interior Walls and Partitions: EMT.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
7. Damp or Wet Locations: GRC or IMC.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel or nonmetallic in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) to devices with 3/4-inch (21-mm) minimum homerun.

D. 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. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. 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.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. 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.

B. 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.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. 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.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. A. Support conduit within 12 inches (300 mm) of enclosures to which attached.

I. 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.

J. 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.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. 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.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. 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.

O. 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.

P. 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 24 inches (600 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. 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.

R. 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.

S. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

T. Expansion-Joint Fittings:

1. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for 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.

V. 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 top of box unless otherwise indicated.

W. 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.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. 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.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

BB. Set metal floor boxes level and flush with finished floor surface.

CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 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."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 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 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 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.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 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).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

2.3 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.

2.4 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.

PART 3 - EXECUTION

3.1 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

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. 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.
4. 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.

3.2 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.

3.3 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 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways and conductors.
2. Labels.
3. Tags.
4. Cable ties.
5. Fasteners for labels and signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:
1. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Color for Neutral: White or gray.
4. Color for Equipment Grounds: Green.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

C. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

    a. 1-1/2 by 6 inches (37 by 150 mm)for raceway and conductors.
    b. 3-1/2 by 5 inches (76 by 127 mm)for equipment.
    c. As required by authorities having jurisdiction.

2.4 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and 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, and 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, and 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.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. 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

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

I. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

J. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

K. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

L. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits: Identify with self-adhesive raceway labels.

1. Locate identification 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. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."

END OF SECTION 260553

SECTION 262413 - SWITCHBOARDS

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. Service and distribution switchboards rated 600 V and less.
2. Disconnecting and overcurrent protective devices.
3. Instrumentation
4. Control power
5. Accessory components and features
6. Identification

1.03 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards 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."

1.04 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.

5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.

6. Detail utility company's metering provisions with indication of approval by utility company.

7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

8. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces. 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.

D. Arc flash hazard analysis report shall be provided by the manufacturer supplying the equipment.

E. Operation and Maintenance Data: For switchboards 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. Routine maintenance requirements for switchboards and all installed components.

2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards 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 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Handle and prepare switchboards for installation according to NECA 400 and NEMA PB 2.1.

1.07 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

1.08 COORDINATION

A. Coordinate layout and installation of switchboards 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. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.09 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: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D, a brand of Schneider Electric

2. Eaton

3. Siemens.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, group mounted.

2. Branch Devices: Group mounted.

3. Sections front and rear aligned.

C. Nominal System Voltage: 480Y/277 V.

D. Main-Bus Continuous: As shown on the Drawings.

E. Indoor Enclosures: Steel, NEMA 250, Type 1.

F. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface. Doors shall have provisions for locking handles or provisions for padlocks.

G. Utility Metering Compartment: Not required.

H. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

I. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

J. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, with tin-plated aluminum or copper feeder circuit-breaker line connections.

2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with compression connectors for outgoing circuit conductors.

Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.

3. Ground Bus: 1/4-by-2-inch hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections.

5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

K. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.02 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents. No series rating.

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 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.

b. Long- and short-time pickup levels.

c. Long- and short-time time delay adjustments.

d. Ground-fault pickup level, time delay, and I2t response.

4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

B. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.

3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.03 ACCESSORY COMPONENTS AND FEATURE

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install switchboards and accessories according to NECA 400 and NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete Miscellaneous Cast-in-Place Concrete."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Install filler plates in unused spaces of panel-mounted sections.

E. Install overcurrent protective devices and transient voltage suppression devices.

1. Set field-adjustable switches and circuit-breaker trip ranges.

F. Torque logs are required at each service and/or distribution location to ensure good connections.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and details in the construction documents.

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Arc flash hazard analysis shall be performed to identify the shock hazard and appropriate personnel protective equipment (PPE) required at each switchboard in accordance with the following standards:
    a. IEEE 1584: IEEE Guide for Performing Arc-Flash Hazard Calculations
    b. NFPA 70: National Electric Code
    c. NFPA 70E: Electrical Safety Requirements for Employee Workpalces

B. Report results of tests and inspections in writing. Attach a label or tag to each tested component indicating satisfactory completion of tests.

C. Arc flash hazard analysis report shall be provided by the manufacturer supplying the equipment.

D. Provide arc flash warning labels for all the equipment evaluated. Labels must be UV protected.

E. Studies shall use computer program software. Manual calculations are not acceptable.

END OF SECTION

ELECTRICAL LEGEND

REFER TO DETAILS FOR MOUNTING HEIGHTS OF DEVICES
NOT ALL SYMBOLS, ABBREV., ETC. ARE NECESSARILY USED ON THIS PROJECT.

LIGHTING

SYMBOL	DESCRIPTION
	SHADING OF ANY LUMINAIRE INDICATES CONNECTION TO ALTERNATE POWER SOURCE (EMERGENCY, UPS, STANDBY, ETC.) PER CIRCUITING INDICATED
	SUSPENDED LINEAR LUMINAIRE (SIZE VARIES)
	WALL MOUNTED LINEAR LUMINAIRE (SIZE VARIES)
	BATTERY POWER EMERGENCY UNIT EQUIPMENT (SEE LUMINAIRE SCHEDULE FOR QUANTITY OF HEADS) - WALL, CEILING MOUNTED.
	ILLUMINATED EXIT SIGN. SHADED QUADRANT INDICATES FACES, ARROWS AS SHOWN
1A 3c / 1A 3A	LUMINAIRE MARKING CONVENTION LEGEND: 1A = LUMINAIRE TYPE IDENTIFICATION, SEE LUMINAIRE SCHEDULE. 3c = CIRCUIT NUMBER 'c' LOCAL SWITCH LETTER) THAT SERVES THE LUMINAIRE. (LOWERCASE 3A = CIRCUIT NUMBER/UPPERCASE LETTER INDICATES LOW VOLTAGE RELAY OR LIGHTING CONTACTOR THAT SERVES THE LUMINAIRE. COMBINATION

POWER DEVICES

SYMBOL	DESCRIPTION
	SINGLE RECEPTACLE - WALL, CEILING
	DUPLEX RECEPTACLE - WALL, CEILING
	DOUBLE DUPLEX RECEPTACLE - WALL, CLG
L5-15R	SPECIAL PURPOSE RECEPTACLE -WALL, CEILING NEMA CONFIGURATION AS NOTED
AB	RECEPTACLE TYPE SHOWN -WALL -ABOVE COUNTER BACKSPLASH.
GFI	DUPLEX RECEPTACLE - WALL - WITH INTEGRAL GROUND FAULT CIRCUIT INTERRUPTER
WP	RECEPT. TYPE SHOWN W/ WEATHERPROOF COVER AND INTEGRAL GROUND FAULT CIRCUIT INTERRUPTER
+42"	RECEPT. TYPE SHOWN AT SPECIAL HEIGHT
	EQUIPMENT MOUNTED ELECTRICAL CONNECTION TO IN-SLAB RACEWAY VIA FLEXIBLE METAL CONDUIT. MOUNT EXISTING JUNCTION BOX TO NEW CASEWORK AS INDICATED ON DRAWINGS. REPLACE EXISTING ELECTRICAL CONDUCTORS AS REQUIRED.
	TELE/POWER POLE, POWER POLE
	TWO-PIECE SURFACE METAL RACEWAY WITH RECEPTACLES AS NOTED, LENGTH AS INDICATED ON THE DRAWINGS AND WITH ALL FITTINGS AS REQUIRED.
	TWO OR THREE COMPARTMENT SURFACE METAL RACEWAY WITH RECEPTACLES AND OUTLETS AS INDICATED, LENGTH AS INDICATED ON THE DRAWINGS. PROVIDE ALL FITTINGS AS REQUIRED.

SIGNAL DEVICES

SYMBOL	DESCRIPTION
	TERMINAL/MOUNTING BOARD, 8' HIGH X WIDTH AS SHOWN, FIRE TREATED.
	SIGNAL SYSTEM EQUIPMENT ENCLOSURES AS NOTED- SURFACE, RECESSED MOUNTED
	COMBO TELEPHONE/DATA OUTLET - WALL
W	TELEPHONE OUTLET - WALL, W = USE HIGHER MOUNTING HEIGHT PER MOUNTING HT. DETAIL
	DATA OUTLET - WALL

REFERENCE SYMBOLS

SYMBOL	DESCRIPTION
12	KEYED NOTE REFERENCE
12/5.4	BRANCH CIRCUIT OR FEEDER NOMINAL AMPACITY & TYPE; REFER TO BRANCH CIRCUIT AND FEEDER SCHEDULES FOR WIRE AND CONDUIT SIZES & QTY.
1 / E4.1	REFER TO DETAIL NO. ON DRAWING INDICATED NOT ALL DETAIL REFERENCES ARE SHOWN, ALL DETAILS APPLY TO ALL APPLICABLE SITUATIONS, UON.
2 / E4.1	ELEVATION TAG: REFER TO ELEVATION NUMBER ON DRAWING INDICATED
2 / E4.1	SECTION TAG: REFER TO SECTION NUMBER ON DRAWING INDICATED
K112	KITCHEN EQUIPMENT REFERENCE, REFER TO KITCHEN EQUIPMENT SCHEDULE
CH 1	MECHANICAL EQUIPMENT IDENTIFICATION TAG
EQUIP NAME	EQUIPMENT BY OTHERS IDENTIFICATION TAG

DISTRIBUTION & EQUIPMENT

SYMBOL	DESCRIPTION
	BRANCH CIRCUIT PANELBOARDS, SURFACE AND RECESS MOUNTED, SOLID= 120/208V. HATCHED= 277/480V., DASHED EQUIP. = FUTURE
	MOTOR CONTROL CENTER W/ CODE CLEARANCES SHOWN, DASHED EQUIP. = FUTURE
	TRANSFORMER WITH CODE CLEARANCES SHOWN
	SERVICE AND/OR DISTRIBUTION EQUIPMENT WITH CODE CLEARANCES SHOWN
	CONNECTION TO MOTOR PROVIDED BY OTHERS
VFD	CONNECTION TO MECHANICAL FURNISHED VARIABLE FREQUENCY DRIVE WITH INTEGRAL DISCONNECT ELECTRICAL TO INSTALL VFD EQUIPMENT
F	DISCONNECT SWITCH - SIZE AS NOTED OR IF NOT SHOWN SIZE PER CONNECTED MOTOR SIZE AND MOTOR DISCONNECT SCHEDULE
C	FUSED DISCONNECT SWITCH, SIZE AS NOTED, SIZE FUSE PER MANUFACTURER'S RECOMMENDATIONS
	ENCLOSED CIRCUIT BREAKER DISCONNECT SWITCH., TRIP SIZE AS NOTED.
	DISCONNECT W/ MAGNETIC MOTOR STARTER (CONTROLLER) OR CONTACTOR., SIZE PER LOAD SERVED. NEMA SIZE #1 MINIMUM.
	MAGNETIC MOTOR STARTER (CONTROLLER) OR CONTACTOR, SIZE PER LOAD SERVED. NEMA SIZE #1 MINIMUM.
	ELECTRICAL CONNECTION, EQUIPMENT PROVIDED BY OTHERS, SHADED = ON ALT. POWER SOURCE NOTED
	ELECTRICAL CONNECTION TO EQUIPMENT WITH INTEGRAL DISCONNECT THAT IS PROVIDED BY OTHERS, SHADED = ON ALT. POWER SOURCE NOTED
	EQUIPMENT OR TERMINAL ENCLOSURE AS NOTED, SURFACE AND RECESS MOUNTED

WIRING

SYMBOL	DESCRIPTION
	WIRING CONCEALED IN CEILING OR WALL. LINE WEIGHT TOP TO BOTTOM= NEW, EXISTING TO REMAIN, FUTURE
	WIRING CONCEALED IN FLOOR OR UNDER GRADE OR ROUTED IN CEILING SPACE OF FLOOR BELOW. LINE WEIGHT TOP TO BOTTOM= NEW, EXISTING TO REMAIN, FUTURE
	EXISTING WIRING TO BE REMOVED
T	TELEPHONE SYSTEM CONDUIT
MV	MEDIUM VOLTAGE CONDUIT
G	BARE GROUNDING GRID OR CONDUCTORS, UON.
GC	GROUNDING CONDUCTOR(S) ROUTED IN CODE SIZED CONDUIT, UON.
	STROKES INDICATE QUANTITY OF #12 AWG. CONDUCTORS, UON. NOTE: WIRING STROKES FOR 20A BRANCH CIRCUITS ARE NOT SHOWN ON DRAWINGS. CONTRACTOR SHALL USE INFORMATION IN PANEL AND BRANCH CIRCUIT SCHEDULES TO PROVIDE REQUIRED CIRCUITING.
	GROUND
	GROUND, ISOLATED
	HOT
	NEUTRAL
L1A-1,3	HOME RUN WIRING TO INDICATED DESTINATION, 3/4"C. MIN, OR AS OTHERWISE NOTED. CONTRACTOR SHALL USE CIRCUIT SIZES NOTED IN RESPECTIVE SCHEDULES AND INFORMATION IN THE FEEDER AND BRANCH CIRCUIT SCHEDULES.
	CONDUIT RUN TURNED UP THROUGH FLOOR OR CEILING, CORE & FIREPROOF AS REQUIRED.
	CONDUIT RUN TURNED DOWN THROUGH FLOOR OR CEILING, CORE & FIREPROOF AS REQUIRED.
	JUNCTION BOXES, WALL, CEILING AND FLUSH FLOOR MOUNTED. 4" SQ. BOX MIN., LARGER IF REQUIRED
	FLEXIBLE CONDUIT CONNECTION

SWITCHING CONTROLS

SYMBOL	DESCRIPTION
S*	SINGLE POLE SWITCH (SUPERSCRIPT DENOTES SIMILARLY MARKED LUMINAIRES CONTROLLED TOGETHER)
S_3	THREE WAY SWITCH
S_4	FOUR WAY SWITCH
S_T	MOTOR-RATED THERMAL OVERLOAD SWITCH
S_{DIM}	LIGHTING CONTROL OVERIDE SWITCH, SEQ. NUMBER
PC	PHOTOCELL
OS	OCCUPANCY SENSOR - WALL MOUNTED
OS	360 DEGREE OCCUPANCY SENSOR - CEILING MTD.
OS	180 DEGREE OCCUPANCY SENSOR - CEILING MTD.

ABBREVIATIONS

(E)	EXISTING TO REMAIN
(F)	FUTURE
(R)	EXISTING TO BE REMOVED
(RL)	EXISTING TO BE RELOCATED
AB	ABOVE COUNTER BACKSPLASH
ACU	AIR CONDITIONING UNIT
AC	ALTERNATING CURRENT
A, AMP	AMPERES
AF	AMPERE (RATED) FUSE OR CB FRAME
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AIC	EQUIPMENT SHORT CIRCUIT INTERRUPT RATING (RMS SYM. AMPS)
AL	ALUMINUM (ALLOY)
ALC	AUTOMATIC LIGHTING CONTROL
AS	AMPERE (RATED) SWITCH
AT	CIRCUIT BRKR TRIP SETTING (AMPS)
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
BAT	BATTERY
BG	BELOW GRADE
BRKR	CIRCUIT BREAKER
C	CONDUIT (CIRCULAR RACEWAY)
CAB	CABINET
CB	CIRCUIT BREAKER
CFM	CUBIC FEET PER MINUTE
CKT	CIRCUIT
CLG	CEILING
CO	CONDUIT ONLY
CPT	CONTROL POWER TRANSFORMER
CT	CURRENT TRANSFORMER
CU	COPPER
DC	DIRECT CURRENT
DISC	DISCONNECT
DIA	DIAMETER
DIV	DIVISION
DP	DISTRIBUTION PANEL
DPDT	DOUBLE POLE DOUBLE THROW
DPST	DOUBLE POLE SINGLE THROW
DWG	DRAWING
E.EMERG	EMERGENCY
EF	EXHAUST FAN
EMT	ELECTRICAL METALLIC TUBING
ENCL	ENCLOSURE
EO	ELECTRICALLY OPERATED
EOL	END OF LINE
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
FA	FIRE ALARM
FAA	FIRE ALARM ANNUNCIATOR
FBO	FURNISHED BY OTHERS
FC	FOOT CANDLES
FF	FLUSH FLOOR MOUNTED
FLA	FULL LOAD AMPERES
FLEX	FLEXIBLE
FPB	FAN POWERED BOX
FSD	FIRE/SMOKE DAMPER
FW	FLUSH WALL MOUNTED
FU	FUSE
GEN	GENERATOR
GFI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
GRAP	GENERATOR REMOTE ANNUNCIATOR PNL
GRC	GALVANIZED RIGID STEEL CONDUIT
HLO	HANDLE LOCK-ON(OFF)
HP	HORSEPOWER
HPF	HIGH POWER FACTOR
HTR	HEATER
HZ	HERTZ (CYCLES PER SECOND)
IES	ILLUMINATING ENGINEERING SOCIETY
IBC	INDIVIDUAL BRANCH CIRCUIT
ID	INSIDE DIAMETER
IG	ISOLATED GROUND
IMC	INTERMEDIATE METAL CONDUIT
KCMIL	THOUSAND CIRCULAR MILS
KO	KNOCK OUT
KW	KILOWATTS
KVA	KILOVOLT-AMPERES
LTG	LIGHTING
LCP	LIGHTING CONTROL PANEL
MAX	MAXIMUM
MCA	MINIMUM CIRCUIT AMPERES
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MO	MANUAL OPERATOR
MTD	MOUNTED
MTR	MOTOR
-N-	NEUTRAL (GROUNDED CONDUCTOR)
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
-NEG	NEGATIVE
NEMA	NATIONAL ELECTRICAL MFGR'S ASSOC.
NL	NIGHT LIGHT (UNSWITCHED)
NO	NORMALLY OPEN
NTS	NOT TO SCALE
NP	NAMEPLATE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED, OWNER INSTALLED
OS	OCCUPANCY SENSOR
P	POLE
PB	PUSHBUTTON
PH	PHASE
PNL	PANEL
+ POS	POSITIVE
PRI	PRIMARY
REQD	REQUIRED
RNC	RIGID NONMETALLIC CONDUIT (PVC)
RS	RAPID START
RST	REMOTE STATION TRANSMITTER
S.A.D.	SEE ARCHITECTURAL DRAWINGS
SEC	SECONDARY
SN	SHEET NOTE
SOL	SOLENOID
SPDT	SINGLE POLE DOUBLE THROW
SPST	SINGLE POLE SINGLE THROW
SUB	SUBSTATION
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TB	TERMINAL BOARD
TDC	TIME DELAY CLOSING
TDO	TIME DELAY OPENING
TEL	TELEPHONE
TYP	TYPICAL
UL	UNDERWRITERS LAB
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTX	UTILITY TRANSFORMER
V	VOLTS
VA	VOLT-AMPERES
VFD	VARIABLE FREQUENCY DRIVE
W	WATT
W/	WITH
W/O	WITHOUT
WP	WEATHERPROOF, SEE RECEPT. SYMBOL
XFR	TRANSFORMER
XP	EXPLOSION PROOF
Z	ZONE
", IN	INCHES
', FT	FEET
>	GREATER THAN
<	LESS THAN
≥	GREATER THAN OR EQUAL TO

ELECTRICAL DESIGN CRITERIA

1. STATE OF OREGON ELECTRICAL SPECIALTY CODE (OREGON AMENDED VERSION OF 2014 NATIONAL ELECTRIC CODE)
2. AMERICANS WITH DISABILITIES ACT (ADA)
3. NFPA 101, LIFE SAFETY CODE: 2007
4. OREGON ADMINISTRATIVE RULES (OAR): 2016
5. OREGON STATE UNIVERSITY (OSU) FACILITIES SERVICES CONSTRUCTION STANDARDS: JUNE 2014

ELECTRICAL DRAWING LIST

GENERAL NOTES

A. REFER TO DETAIL DRAWINGS FOR ADDITIONAL INFORMATION. ALL DETAILS APPLY FOR ALL APPLICABLE SITUATIONS WHETHER REFERENCED OR NOT, UON.

B. THE CIRCUITING SHOWN IS DIAGRAMMATIC. THE DRAFTING METHOD WHICH MOST SIMPLY CONVEYS THE CIRCUITING INTENT IS EMPLOYED. WHERE DEVICES OR EQUIPMENT ARE SHOWN UNCONNECTED; CONNECT (IN A MANNER CONSISTENT WITH THE MATERIALS AND METHODS INDICATED IN THE SPECIFICATIONS AND DRAWINGS.

C. CIRCUIT SIZES ARE NOT SHOWN ON THE PLANS. CONTRACTOR SHALL USE CIRCUIT SIZES INDICATED IN NOTES OR RESPECTIVE SCHEDULES (PNL, MCC, ETC.) AND INFORMATION IN THE FEEDER AND BRANCH CIRCUIT SCHEDULES.

D. INSTALL ALL EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS. THESE DRAWINGS ARE DIAGRAMMATIC.

E. THE EXISTING BUILDING INCLUDING PORTIONS OF THE RENOVATED AREA SHALL REMAIN IN SERVICE DURING THE CONSTRUCTION PHASE OF THIS PROJECT. ANY MODIFICATIONS TO THE EXISTING ELECTRICAL SYSTEMS THAT MAY REQUIRE THE TEMPORARY INTERRUPTION OF EXISTING SERVICES SHALL BE COMPLETED AFTER NORMAL WORKING HOURS. PRE-SCHEDULE ANY SERVICE INTERRRUPTIONS WITH THE OWNER PRIOR TO STARTING ANY WORK. DO NOT DISTURB THE EXISTING DEPARTMENTS IN THE EXISTING BUILDING COMPLEX.

F. EXISTING WIRING WHERE SHOWN ON THE DRAWINGS IS BASED ON AVAILABLE AS-BUILT DRAWINGS AND FIELD INFORMATION. CONTRACTOR SHALL VERIFY EXISTING INSTALLATIONS AND THE TIME FOR DOING SO SHALL BE INCLUDED IN THIS BID.

G. WHERE NOTED AS OWNER-SUPPLIED ON DRAWINGS, CONTRACTOR SHALL RECEIVE, INSTALL, AND CONNECT EQUIPMENT PER MANUFACTURER'S REQUIREMENTS. PRIOR TO INSTALLATION OF OWNER-SUPPLIED EQUIPMENT, CONTRACTOR SHALL INSPECT/TEST EQUIPMENT AND INFORM PROJECT MANAGER OF ANY DEFECTS. FAILURE TO DO SO SHALL MEAN THAT THE EQUIPMENT IS IN GOOD WORKING CONDITION. CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLATION AND TESTING OF SUCH EQUIPMENT.

H. ALL CONDUITS TO BE INSTALLED 90° TO BUILDING LINES - NO EXCEPTIONS.

I. ALL EQUIPMENT TO BE SEISMICALLY BRACED, ANCHORED AND SUPPORTED PER SEISMIC CODES AND STANDARDS. SUBMIT ANCHORAGE AND BRACING CALCULATIONS FROM LICENSED STRUCTURAL ENGINEER. USE FIRM SUCH AS ISAT TO PREPARE CALCULATIONS.

J. PROVIDE WATERPROOF WALL PENETRATIONS FOR ALL EXTERIOR WALL PENETRATIONS.

K. CONTRACTOR TO FIELD VERIFY EXISTING CONDITION PRIOR TO PREPARING BID.INCLUDE IN BID ALL REQUIRED ITEMS REQUIRED TO IMPLEMENT THE INTENT OF THIS SCOPE OF WORK.

L. IF ANY CONFLICTS BETWEEN DRAWINGS AND SPECS, PROVIDE GREATER QUANTITY AND GREATER COST AND INFORM ENGINEER OF THE CONFLICT.

M. DO NOT SUBSTITUTE WITH DIFFERENT METER THAN SEL MANUFACTURER.

NOTE: NOT ALL SYMBOLS OR ABBREVIATIONS ARE APPLICABLE TO THIS PROJECT. REFER TO DETAILS AND NOTES FOR MOUNTING HEIGHTS.

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T. 541.512.6220 www.glumac.com
Project Manager: JASON DUBOSE
Engineer/Designer: LARRY HENGESH
Job No.: 09.16.01032

EXPIRES: 06/30/19
REGISTERED PROFESSIONAL ENGINEER 17507 OREGON NOV. 15, 1994 LARRY R. HENGESH

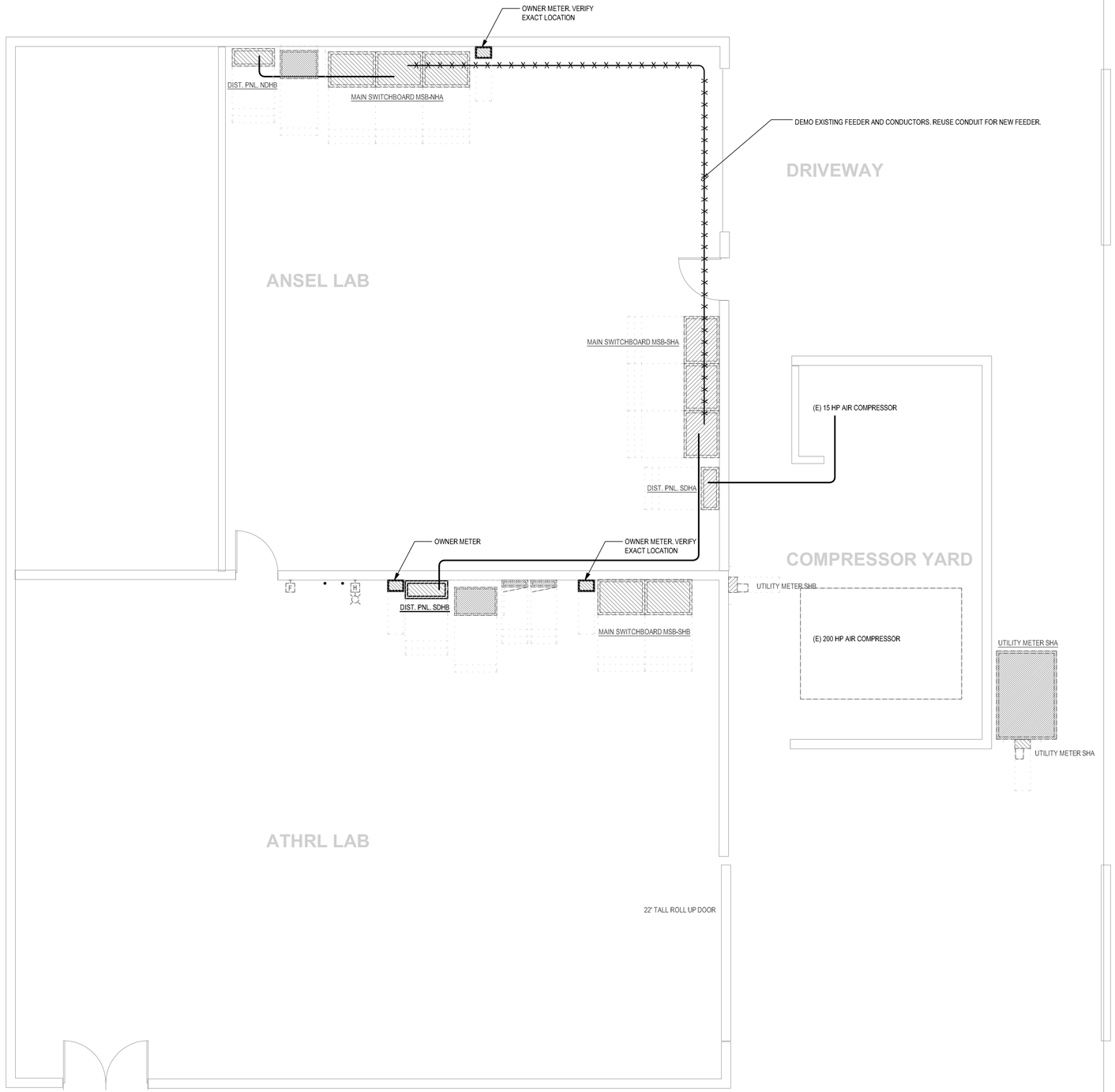
Issue	Date	Description
0	4/12/17	ISSUE FOR PERMIT
1	8/2/17	REISSUE FOR PERMIT/ BID

FACILITY NAME
ATHRL BUILDING
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

SHEET TITLE
LEGENDS AND ABBREVIATIONS - ELCTRICAL

SCALE:
DATE: APRIL 12, 2017

SHEET NUMBER
E0.10



1 FLOOR PLAN - ELECTRICAL

SCALE: 1/4"=1'

SHEET NOTES

A. MAINTAIN MINIMUM 4' CLEARANCE BETWEEN ELECTRICAL DISTRIBUTION EQUIPMENT AND TESTING EQUIPMENT.

KEYED NOTES

1. P

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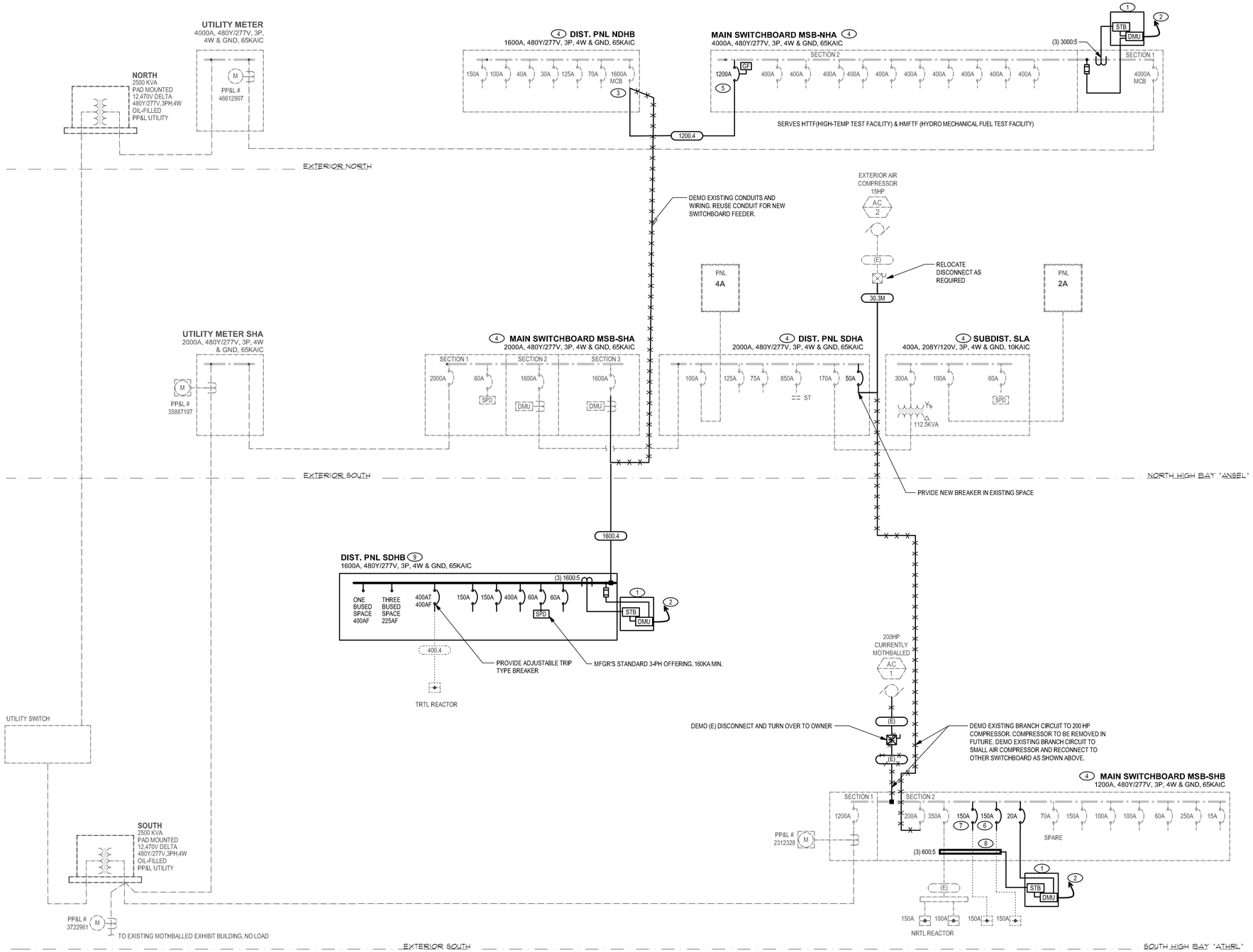
FACILITY NAME
ATHRL BUILDING
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

SHEET TITLE
FLOOR PLAN - ELECTRICAL

SCALE: DATE: APRIL 12, 2017

SHEET NUMBER
E3.00



1 **ELECTRICAL SINGLE-LINE DIAGRAM**

SCALE: NTS

SHEET NOTES

A. ALL CIRCUITS ARE 3 PHASE, UNLESS OTHERWISE NOTED.

B. REFER TO DWG. E##### FOR LEGEND FOR TRANSFORMER AND FEEDER SIZES.

C. REFER TO DWG. E#### FOR GROUNDING DETAILS.

D. ALL TRANSFORMERS ARE 480V DELTA PRIMARY TO 208Y/120V SECONDARY, 115 DEGREE C. RISE, U.O.N.

E. ITEMS SHOWN WITH THIN DASH-DOT OR DASHED LINES ARE EXISTING.

F. ITEMS SHOWN WITH SHADED SHORT-DASHED LINES ARE FUTURE.

G. THE VALUE IN THE WIDE HEXAGON IS THE AVAILABLE INTERRUPTING SHORT-CIRCUIT CURRENT (AIC) AT THAT PIECE OF EQUIPMENT.

H. ALL COMPONENTS SHALL BE FULLY RATED. SERIES RATED IS NOT ALLOWED.

KEYED NOTES

1. PROVIDE SEL-735 BASIC RELAY WITH REVENUE CLASS CT'S, SEL SHORTING TERMINAL BLOCK ACCESSORY ON THE CT LEADS, FUSE OR CIRCUIT BREAKER FOR VOLTAGE/ CONTROL POWER LEADS TO THE METER. PROVIDE NEMA-1 HINGED, LOCKABLE FACTORY ENCLOSURE FOR THE METER AND STB'S. MOUNT ENCLOSURE NEAR SWITCHBOARD.
2. ROUTE CAT5 CABLE FROM METER TO OWNER'S LAN SWITCH. ROUTE IN EMT CONDUIT UP TO 8' ABOVE FLOOR. CABLE CAN THEN BE RUN EXPOSED AS REQUIRED. ROUTE ALONG WALL AND PARALLEL OR AT RIGHT ANGLES TO STRUCTURE. SUPPORT 3' ON CENTER.
3. PROVIDE ENGRAVED NAMEPLATE WITH 3 /16" WHITE LETTERS ON RED BACKGROUND: "SWITCHBOARD IS 1600A RATED BUT FEEDER SIZE IS ONLY 1200A." MOUNT NEXT TO MAIN BREAKER.
4. PROVIDE NEW NAMEPLATES WITH NEW EQUIPMENT NAMES.
5. PROVIDE 1200AF BREAKER IN EXISTING SWITCHBOARD SPACE OR REWORK BOARD AS REQUIRED TO ACCOMMODATE THE NEW BREAKER.
6. REPLACE (E) 125A SPARE WITH 150A, 3P BREAKER.
7. ADD 150A, 3P BREAKER TO EXISTING SPACE
8. DISCONNECT AND RECONNECT EXISTING 350A FEEDER CONDUCTORS THRU ONE SET OF CT'S. OWNER TO ROUTE FUTURE CONDUCTORS FROM THE OTHER TWO BREAKERS THRU THE SAME SET OF CT'S TO TOTALIZE THE NRTL LOAD ON ALL THREE BREAKERS. PROVIDE LARGE WINDOW TYPE CT'S TO HELP ACCOMMODATE THE CABLING.
9. PROVIDE MAXIMUM HEIGHT, FULLY BUSED SWITCHBOARD

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Project Manager: JASON DUBOSE
Engineer/Designer: LARRY HENGESH
Job No.: 09.16.01032

EXPIRES: 06/30/19
REGISTERED PROFESSIONAL ENGINEER 17507 OREGON NOV. 15, 1994 LARRY R. HENGESH

Issue	Date	Description
0	4/12/17	ISSUE FOR PERMIT
1 0	8/2/17	REISSUE FOR PERMIT/ BID

FACILITY NAME
ATHRL BUILDING
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

SHEET TITLE
SINGLE-LINE DIAGRAM - ELECTRICAL

SCALE: DATE: APRIL 12, 2017

SHEET NUMBER
E5.00

MOTOR CIRCUIT SCHEDULE

FEEDER TAG	CONDUITS (1) MET	SETS	RNC	CONDUCTORS PER SET PHASE	GROUND (2)	REMARKS
1600.3M	3.00"	5	4.00"	(3) 400 KCMIL	400 KCMIL	-
1400.3M	3.00"	4	4.00"	(3) 500 KCMIL	400 KCMIL	-
1200.3M	2.50"	4	4.00"	(3) 350 KCMIL	350 KCMIL	-
1000.3M	2.50"	3	4.00"	(3) 400 KCMIL	250 KCMIL	-
800.3M	3.00"	2	4.00"	(3) 500 KCMIL	#4/0	-
700.3M	2.50"	2	4.00"	(3) 400 KCMIL	#4/0	-
600.3M	2.50"	2	3.50"	(3) 350 KCMIL	#2/0	-
500.3M	2.50"	2	3.00"	(3) 250 KCMIL	#2/0	-
450.3M	2.50"	2	3.00"	(3) #4/0	#1/0	-
400.3M	3.00"	1	4.00"	(3) 500 KCMIL	#1	-
350.3M	2.50"	1	4.00"	(3) 400 KCMIL	#1	-
300.3M	2.50"	1	3.00"	(3) 350 KCMIL	#2	-
275.3M	2.50"	1	3.00"	(3) 300 KCMIL	#2	-
250.3M	2.50"	1	3.00"	(3) 250 KCMIL	#2	-
225.3M	2.00"	1	3.00"	(3) #4/0	#3	-
200.3M	2.00"	1	2.00"	(3) #3/0	#3	-
175.3M	2.00"	1	2.00"	(3) #2/0	#4	-
150.3M	1.50"	1	2.00"	(3) #1/0	#4	-
125.3M	1.25"	1	1.50"	(3) #1	#4	-
110.3M	1.25"	1	1.50"	(3) #2	#6	-
100.3M	1.25"	1	1.50"	(3) #2	#6	-
90.3M	1.00"	1	1.25"	(3) #4	#6	-
80.3M	1.00"	1	1.25"	(3) #4	#6	-
70.3M	1.00"	1	1.25"	(3) #4	#6	-
60.3M	0.75"	1	1.00"	(3) #6	#8	-
50.3M	0.75"	1	1.00"	(3) #6	#8	-
40.3M	0.75"	1	1.00"	(3) #8	#8	-
30.3M	0.75"	1	1.00"	(3) #10	#10	-
20.3M	0.75"	1	1.00"	(3) #12	#12	-

GENERAL NOTES

A. CONDUCTORS AND CONDUITS SHOWN IN THIS SCHEDULE ARE BASED ON COPPER CONDUCTORS WITH THHN/THWN INSULATION.

B. THIS MOTOR BRANCH CIRCUIT SCHEDULE SHALL BE USED FOR ALL CIRCUITS WHERE THE CIRCUIT BREAKER SIZE PROTECTING THE LOAD IS LARGER THAN THE AMPACITY OF THE CIRCUIT CONDUCTORS. EXAMPLES ARE: MOTORS, CHILLERS, ELEVATORS, FANS, PUMPS, ETC.

C. PROVIDE NOTED SIZE GROUND CONDUCTOR IN EACH CONDUIT OF CIRCUITS CONSISTING OF MULTIPLE SETS OF PARALLEL CONDUCTORS.

D. NOT ALL CIRCUITS ARE NECESSARILY USED ON THIS PROJECT.

E. NOMINAL AMPACITIES GREATER THAN 100 AMPS ARE FOR 75°C TERMINATIONS.

F. ON CIRCUITS SHOWN WITH A ".6M" SUFFIX, PROVIDE SIX PHASE CONDUCTORS AND ONE GROUND WIRE IN CODE SIZED CONDUIT. INCLUDE 80% DERATING FACTOR ON PHASE CONDUCTOR SIZE.

SCHEDULE REMARKS

(1) "MET"= EMT, GRC (RIGID), RAC, OR PVC COATED GRC TYPE CONDUITS. "RNC"= PVC 40, PVC 80 OR FIBERGLASS TYPE CONDUITS ROUTED UNDERGROUND. REFER TO SIZING ON DRAWINGS IF "RNC" CONDUITS ARE ROUTED ABOVEGROUND. CONDUIT SIZES NOTED ON SINGLE-LINE DIAGRAM OR ON PLANS SUPERSEDE SIZES NOTED ABOVE IF LARGER.

(2) PROVIDE GROUND WIRE NOTED IN ALL MOTOR BRANCH CIRCUITS.

COPPER FEEDER SCHEDULE

FEEDER TAG	CONDUITS MET	SETS	RNC	CONDUCTORS PER SET PHASE/NEUTRAL	GROUND	NOTES
4000.4	3.50"	11	4.00"	(4) 500 KCMIL	500 KCMIL	-
4000.3	3.00"	11	4.00"	(3) 500 KCMIL	500 KCMIL	-
3500.4	3.50"	10	4.00"	(4) 500 KCMIL	500 KCMIL	-
3500.3	3.00"	10	4.00"	(3) 500 KCMIL	500 KCMIL	-
3000.4	3.50"	8	4.00"	(4) 500 KCMIL	400 KCMIL	-
3000.3	3.00"	8	4.00"	(3) 500 KCMIL	400 KCMIL	-
2500.4	3.50"	7	4.00"	(4) 500 KCMIL	350 KCMIL	-
2500.3	3.00"	7	4.00"	(3) 500 KCMIL	350 KCMIL	-
2000.4	3.00"	6	4.00"	(4) 400 KCMIL	250 KCMIL	-
2000.3	3.00"	6	4.00"	(3) 400 KCMIL	250 KCMIL	-
1600.4K	3.50"	5	4.00"	(3) 500 KCMIL, (2) 400 KCMIL-N	#4/0	7
1600.4	3.00"	5	4.00"	(4) 400 KCMIL	#4/0	-
1600.3	3.00"	5	4.00"	(3) 400 KCMIL	#4/0	-
1200.4	3.00"	4	4.00"	(4) 350 KCMIL	#3/0	-
1200.3	3.00"	4	3.00"	(3) 350 KCMIL	#3/0	-
1000.4K	3.50"	3	4.00"	(3) 500 KCMIL, (2) 400 KCMIL-N	#2/0	7
1000.4	3.00"	3	4.00"	(4) 400 KCMIL	#2/0	-
1000.3	3.00"	3	4.00"	(3) 400 KCMIL	#2/0	-
800.4K	3.00"	3	4.00"	(3) 350 KCMIL, (2) 300 KCMIL-N	#1/0	7
800.4	3.00"	3	3.00"	(4) 300 KCMIL	#1/0	-
800.3	2.50"	3	3.00"	(3) 300 KCMIL	#1/0	-
700.4	3.50"	2	4.00"	(4) 500 KCMIL	#1/0	-
700.3	3.00"	2	4.00"	(3) 500 KCMIL	#1/0	-
600.4	3.00"	2	4.00"	(4) 350 KCMIL	#1	-
600.3	2.50"	2	3.00"	(3) 350 KCMIL	#1	-
500.4K	3.00"	2	4.00"	(3) 300 KCMIL, (2) 250 KCMIL-N	#2	7
500.4	2.50"	2	3.00"	(4) 250 KCMIL	#2	-
500.3	2.50"	2	2.50"	(3) 250 KCMIL	#2	-
450.4	2.50"	2	3.00"	(4) #4/0	#2	-
450.3	2.00"	2	2.50"	(3) #4/0	#2	-
400.4K	2.50"	2	2.50"	(3) #4/0, (2)#3/0-N	#2	7
400.4	2.00"	2	2.50"	(4) #3/0	#2	-
400.3	2.00"	2	2.50"	(3) 3/0	#2	-
350.4	3.50"	1	4.00"	(4) 500 KCMIL	#2	-
350.3	2.50"	1	4.00"	(3) 500 KCMIL	#2	-
300.4	3.00"	1	3.00"	(4) 350 KCMIL	#4	-
300.3	2.50"	1	3.00"	(3) 350 KCMIL	#4	-

FEEDER TAG	CONDUITS MET	SETS	RNC	CONDUCTORS PER SET PHASE/NEUTRAL	GROUND	NOTES
250.4	2.50"	1	3.00"	(4) 250 KCMIL	#4	-
250.3	2.50"	1	3.00"	(3) 250 KCMIL	#4	-
225.4K	3.00"	1	3.00"	(3) 250 KCMIL, (2)#4/0-N	#4	7
225.4	2.50"	1	3.00"	(4) #4/0	#4	-
225.3	2.00"	1	2.50"	(3) #4/0	#4	-
200.4K	2.50"	1	2.50"	(3)#4/0,(2)#3/0-N	#6	-
200.4	2.00"	1	2.50"	(4) #3/0	#6	-
200.3	2.00"	1	2.50"	(3) #3/0	#6	-
175.4	2.00"	1	2.50"	(4) #2/0	#6	-
175.3	1.50"	1	2.00"	(3) #2/0	#6	-
150.4K	2.00"	1	2.00"	(3)#2/0,(2)#1/0-N	#6	-
150.4	2.00"	1	2.00"	(4) #1/0	#6	-
150.3	1.50"	1	2.00"	(3) #1/0	#6	-
125.4	1.50"	1	1.50"	(4) #1	#6	-
125.3	1.25"	1	1.50"	(3) #1	#6	-
110.4K	1.50"	1	2.00"	(3) #2,(1)#4/0-N	#6	7
110.4	1.25"	1	1.50"	(4) #2	#6	-
110.3	1.25"	1	1.50"	(3) #2	#6	-
100.4	1.25"	1	1.50"	(4) #2	#8	-
100.3	1.25"	1	1.50"	(3) #2	#8	-
90.4	1.25"	1	1.50"	(4) #2	#8	-
90.3	1.25"	1	1.50"	(3) #2	#8	-
80.4	1.25"	1	1.50"	(4) #4	#8	-
80.3	1.00"	1	1.50"	(3) #4	#8	-
70.4	1.25"	1	1.50"	(4) #4	#8	-
70.3	1.00"	1	1.50"	(3) #4	#8	-
60.4	1.00"	1	1.00"	(4) #6	#10	-
60.3	0.75"	1	1.00"	(3) #6	#10	-
50.4K	1.00"	1	1.50"	(3) #6,(1)#2-N	#10	7
50.4	1.00"	1	1.00"	(4) #6	#10	-
50.3	0.75"	1	1.00"	(3) #6	#10	-
40.4	0.75"	1	1.00"	(4) #8	#10	-
40.3	0.75"	1	1.00"	(3) #8	#10	-
30.4	0.75"	1	1.00"	(4) #10	#10	-
30.3	0.75"	1	1.00"	(3) #10	#10	-
20.4	0.75"	1	1.00"	(4) #12	#12	-
20.3	0.75"	1	1.00"	(3) #12	#12	-
XFR						8
SCHD						9

NOTES:

1. CONDUCTORS AND CONDUITS SHOWN IN THIS SCHEDULE ARE BASED ON COPPER CONDUCTORS WITH THHN/THWN INSULATION.
2. THIS SCHEDULE SHALL BE USED ON ALL FEEDERS SERVING LOADS WHERE THE CIRCUIT BREAKER SIZE MATCHES THE AMPACITY OF ITS FEEDER. USE THE "MOTOR CIRCUIT SCHEDULE" FOR LOADS, SUCH AS MOTORS, PUMPS, FANS, CHILLERS, ETC., WHERE THE CIRCUIT BREAKER SIZE IS LARGER THAN THE AMPACITY OF ITS FEEDER.
3. PROVIDE GROUND WIRE NOTED ABOVE IN ALL FEEDERS AND BRANCH CIRCUITS. WHERE MULTIPLE CONDUITS ARE INDICATED PROVIDE NOTED GROUND WIRE IN EACH CONDUIT.
4. NOT ALL FEEDERS ARE NECESSARILY USED ON THIS PROJECT.
5. NOMINAL AMPACITIES GREATER THAN 100 AMPS ARE FOR 75 DEG..C TERMINALS.
6. "MET"= EMT, IMC, GRC, RAC, OR PVC COATED GRC TYPE CONDUITS. "RNC"= PVC 40, PVC 80 OR FIBERGLASS TYPE CONDUITS ROUTED UNDERGROUND. REFER TO SIZING ON DRAWINGS IF "RNC" CONDUITS ARE ROUTED ABOVEGROUND. CONDUIT SIZES NOTED ON SINGLE-LINE DIAGRAM OR ON PLANS SUPERSEDE SIZES NOTED ABOVE IF LARGER.
7. OVERSIZED (173% MIN.) NEUTRAL FOR FEEDERS CONNECTED TO A K-4 OR HIGHER RATED TRANSFORMER.
8. REFER TO TRANSFORMER SCHEDULE FOR STANDARD PRIMARY AND SECONDARY FEEDER SIZES.
9. REFER TO MCC OR PANEL SCHEDULES FOR FEEDER SIZES TO EQUIPMENT NOTED WITH THIS TAG.

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Project Manager: JASON DUBOSE
Engineer/Designer: LARRY HENGESH
Job No.: 09.16.01032

EXPIRES: 06/30/19
REGISTERED PROFESSIONAL ENGINEER 17507 OREGON NOV. 15, 1994 LARRY R. HENGESH

Issue	Date	Description
0	4/12/17	ISSUE FOR PERMIT
1	8/2/17	REISSUE FOR PERMIT/ BID

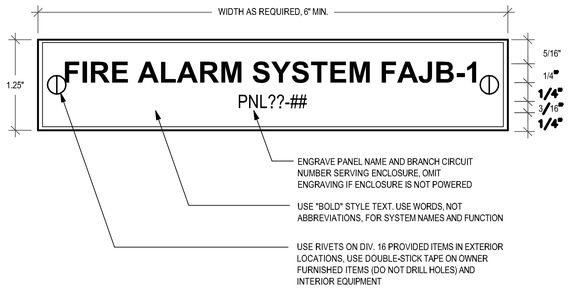
FACILITY NAME
ATHRL BUILDING
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

SHEET TITLE
FEEDER SCHEDULES

SCALE:

DATE: APRIL 12, 2017

SHEET NUMBER
E5.01



NOTES:

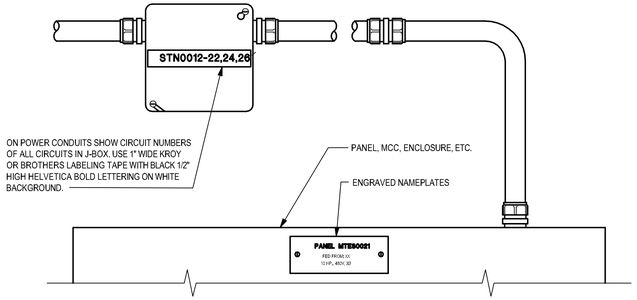
1. REFER TO SPECIFIACTIONS FOR FOR ADDITIONAL INFORMATION AND COLORS FOR DIFFERENT SYSTEMS.
2. PROVIDE ONE NAMEPLATE FOR EACH ENCLOSURE OR J-BOX LARGER THAN 4"
3. CENTER ALL TEXT HORIZONTALLY AND VERTICALLY IF ONLY ONE LINE.
4. TEXT SHOWN ABOVE IS FOR EXAMPLE ONLY. MODIFY TEXT AS REQUIRED TO 4. MATCH EQUIPMENT SPECIFICATIONS.
5. FOR METER ENCLOSURES, 2ND LINE TO BE LIST OF BREAKERS METERED OR "METER FOR ENTIRE SWITCHBOARD"

4 ENCLOSURE INDENTIFICATION NAMEPLATES

SCALE: NONE

16075-10

COLOR LEGEND		
SERVICE	NAMEPLATE COLOR (1)	
	TEXT	BACKGROUND
480V NORMAL	WHITE	BLACK
208/120V NORMAL	BLACK	WHITE



GENERAL NOTES

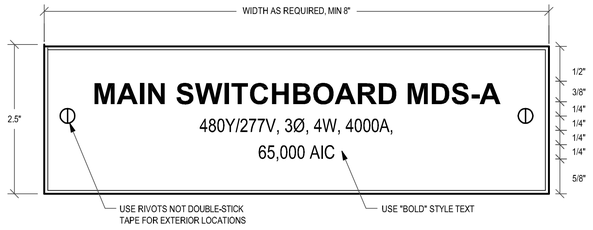
A. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

B. TEXT SHOWN ABOVE IS FOR EXAMPLE ONLY. MODIFY TEXT AS REQUIRED TO MATCH EQUIPMENT SPECIFICATIONS.

2 RACEWAY AND NAMEPLATE IDENTIFICATION

SCALE: NONE

16075-21



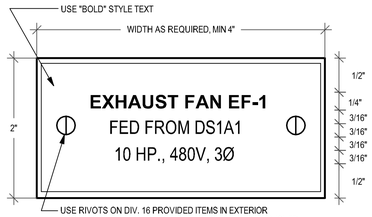
NOTES:

1. SEE DRAWINGS FOR ADDITIONAL NAMEPLATE INFORMATION AND COLORS OF NAMEPLATES FOR DIFFERENT SYSTEMS.
2. TEXT SHOWN ABOVE IS FOR EXAMPLE ONLY. MODIFY TEXT AS REQUIRED TO MATCH EQUIPMENT SPECIFICATIONS.
3. CENTER ALL TEXT HORIZONTALLY

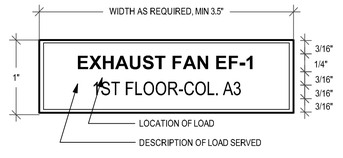
3 MAIN SWITCHBOARD NAMEPLATES

SCALE: NONE

16075-01



GENERAL EQUIPMENT



CIRCUIT BREAKERS IN DIST. PANELS

NOTES:

1. SEE DRAWINGS FOR ADDITIONAL NAMEPLATE INFORMATION AND COLORS OF NAMEPLATES FOR DIFFERENT SYSTEMS.
2. TEXT SHOWN ABOVE IS FOR EXAMPLE ONLY. MODIFY TEXT AS REQUIRED TO MATCH EQUIPMENT SPECIFICATIONS.
3. CENTER ALL TEXT HORIZONTALLY

1 EQUIPMENT IDENTIFICATION NAMEPLATES

SCALE: NONE

16075-03

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REGISTERED PROFESSIONAL ENGINEER 17507 OREGON NOV. 15, 1994 LARRY R. HENGESH

Issue	Date	Description
0	4/12/17	ISSUE FOR PERMIT
0	8/2/17	REISSUE FOR PERMIT/ BID

FACILITY NAME
ATHRL BUILDING
OREGON STATE UNIVERSITY
CORVALLIS, OREGON

SHEET TITLE
DETAILS - ELECTRICAL

SCALE: DATE: APRIL 12, 2017

SHEET NUMBER
E9.01