SECTION 16400 - SERVICE AND DISTRIBUTION (600 VOLT & UNDER)

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1.0 SCOPE

This section covers electrical standards for SERVICE AND DISTRIBUTION (600 VOLT & UNDER) that are applicable for all electrical design, construction and installation for the City of Portland (COP, Bureau of Environmental Services (BES), Wastewater Group (WG). The requirements of this section apply to the sections listed below unless specially exempted or superseded by another requirement in that section.

The requirements of SECTIONS 16010 and 16050 shall be considered as part of the requirements of this section.

2.0 MATERIALS AND EQUIPMENT REQUIREMENTS

2.1 SERVICE ENTRANCE GROUND

Provide service entrance ground system, per NEC, and connectors as required to obtain 5 ohm earth resistance as measured by the ratio method.

Where a ground grid is installed, the top of the ground rod shall be 2 feet below finished grade. For below grade connections, provide exothermic welded type of connectors as manufactured by Cadweld, Thermoweld, or equal.

For above grade connections, provide exothermic-welded, compression, or brazed.

2.2 GROUNDING

Ground metal sheathing and any exposed metal vertical structural elements of buildings. Install insulated grounding bushings and grounding connections on all stubbed up conduits.

When making thermite welds, wire brush or file the point of contact to a bare metal surface. Use thermite welding cartridges and molds in accordance with the manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly clean the joint.

2.3 MAIN SERVICE DISCONNECT (CIRCUIT BREAKER/FUSES)

Furnish and install, as appropriate, the correct size (amperage), 600 VAC, 3 phase, circuit breaker or fused disconnect and surge arrestor. The service disconnect shall be in a NEMA 12 enclosure and shall have a UL label "SUITABLE FOR USE AS SERVICE EQUIPMENT".

2.4 SERVICE (UTILITY) ENCLOSURES

All junction boxes, CT cabinets, meter bases and vaults used for utility company purposes, shall satisfy all requirements listed in the current edition of "ELECTRICAL SERVICE REQUIREMENTS" PPL/PGE.

2.5 NON-FUSED SWITCHES, INDIVIDUAL, TO 600 VOLTS

Provide individual switches in NEMA 4X, watertight corrosion resistant stainless steel enclosures unless otherwise indicated. Provide switches that can be locked in the OFF position. Enclosure and switches shall be interlocked to prevent opening the cover with the switch in the ON position. Provide switches which are the quick-make, quick-break, motor rated, load-break, heavy duty (HD) type having external markings clearly indicating ON and OFF positions. Switches shall meet the requirements of UL and NEMA KS 1. A screwdriver operated interlock defeat shall be provided. Provide contacts with NEMA designation rating A600. Provide devices meeting the requirements of NEMA ICS.

2.6 IDENTIFICATION

2.6.1 NON-FUSED SWITCHES, INDIVIDUAL, TO 600 VOLTS

Provide switches having individual, extra large nameplates indicating their specific function, load device name, voltage, etc.

2.6.2 SWITCHBOARDS, SWITCHGEAR, AND PANELBOARD IDENTIFICATION

Labels shall indicate equipment number, power source, voltage, phase, number of wires, delta or wye (if 3- phase).

2.6.3 DISCONNECT SWITCHES

Labels shall indicate equipment number, power source(s) and equipment served.

2.7 DISCONNECT SWITCHES

For motors 50 HP[1] and larger, all safety isolation switches shall be the "visible blade" type, housed in NEMA 4 enclosures for all installations unless otherwise specified. The

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above mentioned switches shall be able to be locked in the open position. The door shall be able to be opened **only** when the switch is in the open position.

All non-fused switches (to 600 V) shall be quick make, quick break, motor rated, load-break, heavy duty (HD) types with external markings that clearly indicate ON and OFF positions.

All switchgear shall be protected from the weather by being located with in a building or under an extended roof (which shall also provide weather protection for maintenance personnel).

2.7.1[2] For motors greater than 10 HP and up to 50 HP, (480 VAC to 600 VAC), installations shall be provided, where practicable, with a Hubbel "Circuit Lock" disconnect (a pin and sleeve type plug).

Example: Part # HBL4100MI5W receptacle and HBL4100P5W plug for 50 HP.
Part # HBL430M5W receptacle and HBL430P5W plug for 20 HP.

2.7.2[3] For motors 1/2 HP to 10 HP, (480 VAC to 600 VAC), installation shall be provided, where practicable, with a Hubbel "Circuit Lock" disconnect (a twist-lock plug).

Example: Part # HBLMITL disconnect switch with HBL2740SW receptacle and HBL2471SW plug.

2.8 TRANSFORMERS

2.8.1 TRANSFORMER IDENTIFICATION

Labels shall indicate equipment number, power source, voltage, phase, number of wires, delta or wye (if 3- phase), and the disconnecting means.

2.8.2 BARRIER POST FOR EQUIPMENT/TRANSFORMER PADS

Provide barrier post as needed for all equipment and transformer pads that are or could be accessible to vehicular traffic. The post shall be 6" steel casing with at least 3' below grade, imbedded in concrete that is at least 18" in diameter and at least 4' above grade. The post shall be concrete filled and rounded in appearance at the top to shed water. The post shall be painted "traffic yellow"

2.8.3 WINDINGS

All transformer windings shall be copper. Aluminum is NOT acceptable.

2.9 PANELBOARDS

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2.9.1 IDENTIFICATION OF PANELBOARD AND SWITCHBOARDS

Labels shall indicate equipment number, power source, voltage, phase, number of wires, delta or wye (if 3- phase). Each distribution circuit in the panelboard shall be labeled with the same data for that circuit.

2.9.1 BUSES

All buses shall be copper. Aluminum is NOT acceptable.

3.0 INSTALLATION REQUIREMENTS

3.1 SWITCHES

Mount for switch operation in the vertical position (up = on, down = off).

3.2 GROUNDING

Unless shown otherwise, make connections of grounding conductors to ground rods at the upper end of the rod with the end of the rod and the connection point below finished grade.

Make connections of sections of outdoor ground mats underground.

Except where specifically indicated otherwise, ground all exposed non-current carrying metallic parts of electrical equipment, raceway systems, and the neutral of all wiring systems, in strict accordance with the NEC, State, and other applicable laws and regulations.

Where grounding conductors are shown, bond the wires to metallic enclosures at each end and to all intermediate metallic enclosures. Connect grounding conductors to all grounding bushings on raceways. Where any equipment contains a ground bus, extend and connect grounding conductors to that bus. Connect the enclosure of the equipment containing the ground bus to that bus. Run ground conductors inside conduits enclosing the power conductors.

The BES wastewater treatment plants use an ungrounded neutral system with a high resistance ground for detecting ground faults. On control transformers and at pump stations, bond the neutral of transformer within a building to the system ground network and to any additional indicated grounding electrodes.

3.3 RECEPTACLES

Mount receptacles with grounding slot down[4], except where horizontal mounting is indicated, in which case mount with neutral slot down[5]. Ground receptacles to boxes with grounding wire, not by yoke or screw contact.

3.4 GROUND ROD TEST

Test, in the Engineer's presence, the ground resistance of the grounding system using the ratio method of testing. Provide copies of reports for all grounding system tests for inclusion in Operation and Maintenance Manuals and for review by the Engineer.

4.0 DOCUMENTATION

Provide neat and legible copies of all tests results and the Coordination Study to the Engineer.

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[5] Rev.2003