SECTION 16060
GROUNDING

PART 1 - GENERAL

1.01 PROVISIONS INCLUDED

A. The general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 General Requirements, apply to work specified in this Section.

B. Requirements of Section 16050, "Basic Electrical Materials and Methods," apply to this Section.

1.02 SUMMARY

A. Work Included: Furnishing and installation of the solid grounding system for protection of life, equipment and circuits, including all bus bars, bar cable, ground rods, clamps, connectors, bolts, and supports.

1. Examine drawings, criteria sheets, and other Sections of the specifications for requirements which affect work under this Section.

2. Coordinate grounding with other work of this contract.

B. Related Work Specified in Other Sections:

1. Raceways, Section 16130.
2. Conductors, Section 16120.
3. Panelboards, Section 16441.
4. Motor starters, Section 16420.
5. Disconnect switches, Section 16410.
6. Lighting, Section 16500.

1.03 REFERENCES

A. National Fire Protection Association: NFPA 70, "National Electrical Code".

B. UL 467, Electrical Grounding and Bonding Equipment.

1.04 SUBMITTALS

A. Product data for ground rods, connectors and connection materials, and grounding fittings.

B. Report of field tests and observations certified by the testing organization.

PART 2 - MATERIALS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by the following:
   1. Erico Products, Inc.
   2. O-Z/Gedney Co.
   3. Thomas & Betts Corp.
   4. Ideal Industries, Inc.

2.02 GROUNDING MATERIALS

A. Bare cable: Soft drawn copper, Class AA stranding per ASTM B8, shall be standard 4/0 AWG unless indicated otherwise, for installation in soil or embedded in concrete.

B. Insulated Cable: Soft drawn copper, Class B stranding with green polyvinyl chloride insulation jacket.

C. Ground rods: Copper clad steel, a minimum of 3/4 inch diameter by 10 feet long.

D. Bus and Bars: Soft copper, cross not less than 1/4 inch thick by 1 inch wide, ASTM B 187.

2.03 MISCELLANEOUS MATERIALS

A. Hardware: Clamps, connectors, bolts, washers, nuts, and other hardware used with the grounding system shall be high-strength, high conductivity copper alloy.

B. Exothermic welded connections: Provided in kit form based on the specific application and selected for the specific types, sizes and combination of the conductors.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide equipment grounding system as shown on the drawings. Equipment grounding system shall be designed so metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in proximity to electrical circuits operate continuously at ground potential and provide low impedance path for possible ground fault currents.

B. System shall comply with Article 250 of the referenced electrical code, modified as shown on the drawings and as specified.

C. Provide insulated copper ground conductor in the conduit from the ground bus of the building main service equipment to main metallic water service entrance pipe . Connect ground conductor to the main metallic pipe by means of ground clamps.

D. Provide separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit. Install grounding conductor in common conduit with related phase or neutral conductors, or both. Parallel feeders installed in more than one raceway shall have individual full size green insulated equipment ground conductors in each.

E. Determine numbers and sizes of screw terminals for equipment grounding bars in panelboards and other electrical equipment. Provide screw terminals for active circuits, spares and spaces.

F. Provide green, insulated equipment ground conductor in same raceway with associated phase conductors, as follows:

1. From main service ground bus in service entrance equipment to ground bus in all distribution panels, power and lighting panels, etc., size as shown on the drawings.

2. From green ground terminals of receptacles to green outlet box machine screw and to panelboard grounding bus. (Receptacles with special cast boxes and factory designed and approved ground path do not require separate ground jumper.)

3. From panelboard ground bus to green machine screw in ceiling outlet box, through flexible conduit to ground terminal on lighting fixtures. From green machine screw in ceiling outlet box through flexible conduit to green machine screw in switch outlet box.

4. From panelboard ground bus to green machine screw in disconnect switch through flexible conduit to ground terminal in connection box mounted on single phase motor.

5. From equipment ground bus in the panel through conduit and flexible conduit to ground terminal in connection box mounted on three-phase motors. Ground conductors for motors with separate starters and disconnect devices shall originate at ground bar in panelboard and shall be bonded to each starter and disconnect device enclosure.

6. From dry type transformer neutrals to the building water pipe or main service ground bus by means of copper wire, as scheduled on the drawings.

7. From panelboard ground bus to electric water heater. Bond this conductor to heater units, piping and connected equipment and components.

G. Grounding system materials shall be installed according to the drawings and the requirements which follow:

1. Conduit Grounding: All grounding bushings within all enclosures, including equipment enclosures, shall be bonded together and connected internally to the enclosure grounding lug or grounding bus with a bare copper conductor. Grounding bushings shall be grounded with conductors sizes in accordance with the referenced Electrical Code, but not smaller than 12 AWG.

2. Equipment Grounding: All electrical equipment shall be connected to the grounding system with copper grounding conductor. The term "electrical equipment" shall include all enclosures containing electrical connections or bare conductors, except individual devices

such as solenoids, pressure switches, and limit switches shall be exempt form this requirement, unless the device requires grounding for proper operation. Most other equipment will be furnished with grounding pads and/or grounding lugs, which the Contractor shall connect to the grounding system. All ground connection surfaces shall be free of paint and cleaned immediately prior to connection. The contractor shall furnish all grounding material not furnished with the equipment.

3. Grounding cable connection to the grounding rods shall be of the thermal fusion type, as well as all connections direct buried in soil.

4. Equipment Grounding Conductor: Provide separate insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

5. Nonmetallic Raceways: Install an insulated equipment grounding conductor in non-metallic raceways.

H. Signal and Communication: For telephone, alarm and communication systems, provide a No. 6 AWG minimum insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet and central equipment location.

END OF SECTION 16060