

SECTION 16660 GROUND-FAULT PROTECTION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY:

- A. Extent of ground-fault protection work is indicated by drawings and schedules, and by requirements of this section.
- B. Applications of ground-fault protection units required for project include the following:
 - 1. Single service disconnect.
 - 2. Feeder and branch circuits.

1.2 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on ground-fault protection devices and associated components including, but not limited to, types, sizes, basic ampere ratings, and control voltages.
- B. Shop Drawings: Submit layout drawings of installed ground-fault protection devices and accessories including sensors, current monitors, and test panels.
- C. Wiring Diagrams: Submit ground-fault protection systems wiring diagrams showing, but not limited to, splices, connectors, and interconnections to equipment. Include routing and spatial relationships to adjacent electrical power and signal wiring.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ground-fault protection units of types, ratings and characteristics required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing ground-fault protection work similar to that required for this project.
- C. Codes and Standards:
 - 1. UL Compliance: Comply with applicable requirements of Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors", and Std 1053, "Ground-Fault Sensing and Relaying Equipment." Provide ground-fault protection systems and components which are UL-listed and labeled.
 - 2. IEEE Compliance: Comply with applicable recommended practice of IEEE Standards 142, 241 and 242 pertaining to ground-fault protection devices.
 - 3. NEMA Compliance: Comply with NEMA Stds Pub No.'s PB 2.2 and AB 1, pertaining to construction and installation of ground-fault protection devices and molded-case circuit-breakers.
 - 4. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NFPA No.'s 70 and 70B, pertaining to construction and installation of ground-fault protection devices.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver ground-fault protection units properly packaged in factory-fabricated containers.
- B. Store ground-fault protection units indoors, in clean, dry space. Retain units, until installed, in original cartons and protect from dirt, weather, construction debris and traffic.
- C. Handle ground-fault protection units properly to avoid abrading, cracking, and breaking.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide ground-fault protection units of one of the following (for each type of unit):
 - 1. Allen-Bradley Co.
 - 2. ASEA/Brown Boveri Electric Inc.
 - 3. Federal Pacific Electric Co.
 - 4. General Electric Co.
 - 5. Gould Inc.
 - 6. Square D Co.
 - 7. Westinghouse Electric Corp.
 - 8. Siemens

2.2 GROUND-FAULT PROTECTION SYSTEMS AND DEVICES:

- A. General: Except as otherwise indicated, provide ground-fault protection systems, including devices and components, of types, sizes, characteristics, and ratings indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for applications indicated.
- B. Circuit Interrupters/Circuit Breakers: Provide 1 inch wide module bolt-on panelboard circuit breakers, with integral ground-fault circuit interrupters, UL-rated Class A, Group 1; 20-amperes ratings, 2-pole construction, 120/240-volts, 60 Hz, 10,000 AIC. Provide units with solid-state ground-fault sensing and signaling, with 5 milliamperes ground-fault sensitivity trip level, with accuracy of plus or minus 1 milliampere. Equip with PUSH-TO-TEST capability. Provide modules which mate and match panelboards in which they are located.
- C. Ground-Fault Protection Systems:
 - 1. General: Provide ground-fault protection systems for grounded electrical systems, 600-volts, 60Hz, comprised of current monitor, shunt trip relaying equipment, including solid-state relays, and static ground-fault current sensors of sufficient size to encircle phase conductors and neutral conductor of circuit to be monitored. Select GFP systems with monitor panels, and low-voltage power circuit-breakers; select units which function properly in conjunction with other elements of GFP system. Provide ground-fault current sensitivity and time-current response characteristics as indicated. Construct system components and devices with the following features:

2. **Current Sensors:** Provide zero-sequence current sensors with rectangular windows for feeder and branch devices and ground return sensors for main service device; inputs compatible to relay. Construct sensor of split-core construction which can be opened to expedite its installation or removal without disturbing the electrical conductors being encompassed. Provide test windings in sensor for testing the operation of ground-fault protection unit including sensor pick-up, relay and circuit protection devices.
3. **Ground-Fault Relay:** Provide solid-state ground-fault signaling relay with silicon controlled rectifier (SCR) output, to be used with electric or shunt trip, which requires no external source of electrical power, drawing its energy to operate ground-fault protection system directly from output of current sensor. Select relays capable of sensing ground currents which causes the interrupter to open after current reaches a magnitude value for time period indicated. Provide relay with adjustable pick-up current sensitivity range from 10 mA to 200 mA for ground-fault currents from 100 to 1200 amperes, with calibrated dial to show pick-up point settings. Provide factory-set time delay which is adjustable from instantaneous to 15-seconds and which also prevents tampering with setting after installation.
4. **Circuit Breakers:** Provide molded-case circuit breakers of sizes and ratings indicated. Construct with thermal and magnetic elements for conventional overload and fault-current protection; and with ground-fault trip mechanism capable of being activated by ground-fault relay which causes opening of circuit when ground-fault occurs of the magnitude indicated.
5. **Monitor Panels:** Provide monitor panels with ground-fault indicators, control power indicators and TEST and RESET buttons, and with control circuitry capable of providing means for testing system with, or without interruption of service. Construct ground-fault system which can not be left in an INACTIVE, or OFF state.

PART 3 EXECUTION

3.1 EXAMINATION:

- A. Examine areas and conditions under which ground-fault protection systems and devices are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF GROUND-FAULT PROTECTION DEVICES:

- A. Install ground-fault protection devices as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that ground-fault protection devices comply with requirements. Comply with applicable requirements of NEC and NEMA standards for installation of ground-fault protection devices to ensure that devices fulfill requirements.
- B. Coordinate with other electrical work, including electrical wiring work, as appropriate to properly interface installation of ground-fault protection devices with other work.
- C. Install ground-fault protection devices complying with electrical winding polarities indicated.
- D. Fasten ground-fault sensing devices without mechanical stresses, twisting, or misalignment being exerted by clamps, supports, bus bars or cables.

- E. Install ground-fault sensing windows symmetrically encircling power conductor bus bars or cables. Maintain clearances between conductors and ground-fault sensor body as recommended by device manufacturer.

3.3 GROUNDING:

- A. Provide grounding connections for ground-fault systems and units as indicated. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with torque values specified in UL Standard 486A.

3.4 ADJUSTING:

- A. Set field-adjustable GFP devices for pickup and time sensitivity ranges as indicated by short circuit and overcurrent study, subsequent to installation of devices.
- B. Perform Ground fault coordination study. Set field-adjustable pick-up and time-sensitivity ranges accordingly.

3.5 FIELD QUALITY CONTROL:

- A. Upon completion of installation of ground-fault protection devices and after electrical circuitry has been energized, demonstrate capability, and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 16660