SECTION 16163

SWITCHBOARDS

# GENERAL

## DESCRIPTION

### This section includes materials and installation of low-voltage switchboards.

## RELATED WORK SPECIFIED ELSEWHERE

### Section 16010: General Electrical Requirements.

### Section 16012: Seismic Restraint for Electrical Equipment.

### Section 16250: Automatic Transfer Switch.

### Section 16938: Power System Study.

## SUBMITTALS

### Submit shop drawings in accordance with the General Conditions.

### Submit ratings and characteristics including voltage ratings, busing arrangement, continuous current ratings, fault current withstand ratings, enclosure type, ratings and arrangement of all overcurrent protective devices.

### Submit outline and dimensional drawings, conduit entry restrictions.

### Submit ground fault protection system field test results.

### All functions and features identified in this specification are to be provided regardless of if they are a standard of the manufacturer. Acceptance of any submittal where required items were not included does not alleviate the Contractor from the need to provide the items per plans and specifications

## UTILITY APPROVAL

### Shop drawings of service sections shall be approved by the serving utility prior to fabrication.

## MANUFACTURERS

### Switchboards shall be manufactured by General Electric, Square D, Cutler Hammer, or equal.

## MEASUREMENT AND PAYMENT

### Payment for the work in this section shall be included as part of the lump-sum bid amount stated in the Proposal.

# MATERIALS

## GENERAL

### Main service switchboard shall be a freestanding, dead-front type low-voltage distribution switchboard utilizing group-mounted circuit protective devices as specified herein and as shown on the drawings. Switchboard shall require front access only.

### Provide switchboards installed indoors with a NEMA 1 gasketed enclosure. Provide switchboards installed outdoors with a NEMA 3R non-walk-in type enclosure. Provide switchboards in NEMA 3RX (316 SS) where shown on the drawings for location with corrosion potential. Provide 10-inch-minimum front access space between the exterior door and the front of the interior switchboard door. Provide thermostatically controlled space heaters in each section and switched fluorescent light in each section. 120 vac power source will be remote.

### Construct sections with a minimum thickness of 12-USSG formed sheet steel and of overall dimensions that will fit within the space limitation indicated in the drawings.

### Provide metering and current transformer space, pull sections, and fully removable front covers of the widths, depths, and heights required by the service utility and as necessitated by the physical requirements of the conduits and cables entering the sections.

### Switchboards shall comply with EUSERC, NEMA PB-2, UL 489 and UL 891 standards. Provide UL label on each switchboard section.

### Provide distribution switchboards with [individually mounted] circuit breakers, fusible switches, space for controls behind hinged lockable doors (common keyed with panelboards), motor starters, transformers, and other equipment as indicated.

### Switchboard shall consist of required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on panels. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

### Provide switchboard with adequate lifting means. Be sure to show switchboard AIC rating on single-line diagram.

### Switchboard shall have short-circuit current rating equal to or greater than kAIC rating shown in the drawings. Minimum rating shall be 65kA.

### Provide switchboard with Infrared (IR) windows on the main incoming cover for IR inspections. IR windows shall be IRISS VP-50 series, Fluke CLV series or equal.

## BUSING

### Provide switchboard with rectangular tin-plated copper busing. Cross busing shall be full capacity. Vertical busing shall be full height and rated for the load to be carried, but in no case less than one-third the capacity of the main bus. Busing shall be braced to withstand 65,000 amperes symmetrical fault current. A copper ground bus with a cross section meeting code requirement but not less than 1/4 by 2 inches shall extend the entire length of the distribution sections of the switchboards.

### Connections shall be tin plated. All hardware used on conductors shall be high-tensile strength and zinc-plated. Provide conical spring-type washers at each bolted bus joint.

### Provide heavy-duty pressure-type terminal lugs for connections of incoming and outgoing cables. Support cables and internal wiring with bolted cleats.

### Dimensions and arrangement of vertical buses in the service section shall comply with the serving utility company requirements. Bus dimensions for services 1,000 amperes and larger shall, in addition, be brought to the attention of the service planner and be specifically requested to be checked by him/her, as the actual dimensions required may be larger than those indicated in the applicable electrical service requirement guidelines.

## MAIN DISCONNECT (main circuit breaker)

### Main disconnect device shall be as indicated in the drawings. Device shall be capable of being padlocked in the off position. Provide zero-sequence ground fault protection by solid-state relays, field adjustable, with continuous time adjustments. Provide reset and test functions by means of pushbuttons and pilot light or mechanical target to indicate that a ground fault has occurred. Main disconnect shunt trip and relay shall operate from a fused 120-volt a-c control source within the main disconnect compartment or shall be integral to the main circuit breaker. The main breaker’s settings shall be set as per Power System Study performed by parties hired by the Contractor.

### Provide circuit breaker with fault current rating equal to or larger than the switchboard rating shown in the drawings.

### Provide a microprocessor-based power monitoring device. Device power monitor shall be Allen Bradley 5000 series. Device shall have the following features:

#### Continuous metering of the three phases of the electrical system.

#### It shall be possible to view on the LED module display the current, voltage, active power, reactive power, power factor, watt-hours, frequency, total harmonic distortion, and demand values.

#### A multi-position keypad shall provide full front panel programmability.

#### All set points shall be stored in EEPROM for permanent storage and data logging.

#### Provide factory-installed Ethernet 100 BaseT communications card capable of transmitting all data, including trip data, over local area network to a designated instrument control panel (TCP) for storage and/or printout.

#### A large LED display shall provide English language description of all values.

### The disconnect shall be permanently marked to identify it as a service disconnecting means, in accordance with NEC Article 230, Part F and shall be 100% rated, capable of carrying continuous loads to 100% of its rating.

### Provide an auxiliary dry contact on main breaker to indicate to RTU when the breaker is closed. Provide a dry contact on the ground fault relay (Part A) for indication to the RTU.

## CIRCUIT BREAKERS

### Circuit breakers shall be molded-case type. Provide quick-make and quick-break toggle mechanism, inverse time trip characteristics, and trip-free operation on overload or short circuit. Automatic tripping shall be indicated by a handle position between the manual OFF and ON position. Provide trip ratings and number of poles as indicated in the drawings. Provide provisions for padlocking external disconnect handles in the OFF position.

### Breakers shall be provided with electronic trip units having long time, short time, ground fault and instantaneous protection with delays.

## MOLDED CASE POWER CIRCUIT BREAKERS

### Circuit breakers with frames 800 amperes and larger shall be of the molded or insulated case type, fixed mounting, electrically operated with a solid-state trip device having an adjustable long time delay, adjustable short time delay, adjustable instantaneous trip, fixed, high-set instantaneous (15X), and a stored-energy close and trip mechanism. Provide integral ground fault protection with adjustable time delay and trip settings.

## NAMEPLATES

### Provide nameplates as specified in Section 16010. Provide a nameplate for each circuit breaker to indicate load served. The main nameplate shall give the switchboard designation in 1/2-inch-high letters. A second line in 1/4-inch-high letters shall indicate the voltage and phases.

## SURGE SUPPRESSORS

### Provide lightning and surge suppressors as shown on the single line diagram. Suppressors shall be listed in accordance with UL-1449, Standard for Safety, Transient Voltage Surge Suppressors and shall comply with ANSI/IEEE C62.41 Category C3 environments. Suppressors shall be solid-state type and shall operate bi-directionally. Surge capacity shall be a minimum of 130,000 amperes/phase with a voltage suppression rating of 1,200 volts L-G for a 480-volt system. Provide an integral 30-ampere disconnect.

## PORTABLE GENERATOR connection

### Provide a Trystar Docking Station per Drawings and Specifications.

## SEISMIC REQUIREMENTS

### The complete assembly including anchoring shall be capable of withstanding seismic forces per Section 16012.

# EXECUTION

## INSTALLATION

### Anchoring methods and calculations are to be provided by a registered engineer. The adjacent sections of the lineup shall also be bolted to each other per manufacturer’s recommendations. The back of the switchboard shall be mounted as close as possible to building wall to prevent buildup of debris behind switchboard.

### Set protective relaying, main and feeder circuit breaker adjustable set points, and time delays in accordance with recommended values from the Power System Study.

### For switchboard provided with backup power from an onsite generator, provide a nameplate indicating that this switchboard is supported by an onsite generator.

## FIELD TESTS

### Ground Fault Protective Equipment: The ground-fault protection system shall be performance tested after installation in accordance with NEC 230-95C. Submit a written record of the test to the DISTRICT’s Representative. Record current pickup level and time delay settings to which the equipment was finally adjusted. Measure and record relay pickup current and the relay time delay at two values above pickup. Test for correct system operation at 57% rated voltage. If relay pickup current is not within 10% of the manufacturer’s calibration marks or fixed setting or relay timing does not conform to manufacturer’s published time-current characteristic curves, repair or replace equipment and repeat test. Relays are to be set by a qualified testing company to meet the requirements of the motors and main switchgear. Obtain switchgear manufacturer fault analysis recommended settings for the main breaker based on site characteristics. Provide copy to EVMWD of relay set points, manufacturer fault analysis and switchgear manufacturer's recommended settings.

### Voltage:

#### When the installation is essentially complete and the plant is in operation, check the voltage at the point of termination of the power company supply system to the project. Check voltage amplitude and balance between phases for loaded and unloaded conditions.

#### If the unbalance (as defined by NEMA) exceeds 1%, or if the voltage varies throughout the day and from loaded to unloaded conditions more than ±5% of nominal, make a written request to the power company that the condition be corrected. If corrections are not made, request from a responsible power company official a written statement that the voltage variations and/or unbalance are within their normal standards.

### Operate each switch and circuit breaker at least three times, demonstrating satisfactory operation each time.

### Portable Generator Receptacle:

#### Provide DISTRICT seven days’ advance notice for receptacle testing.

#### Verify correct voltage on all three motor control center phases while powered from the generator.

#### Bump motors to verify correct phase rotation. Reconnect terminations within the motor control center if rotation is not correct.

## Spares

### Provide six spare fuses of each type and ampere rating installed.

**END OF SECTION**