SECTION 26 24 13 – SWITCHBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of switchboard work is indicated by Drawings, Specifications and Schedules. Switchboard shall be provided with the following:

1. Automatic single phase loss protection with automatic reset.
2. Power meter.
3. Transient voltage surge suppression.

B. Provide product demonstration and startup as listed in part 3.

1.2 CODES AND STANDARDS

A. Electrical Code Compliance: Applicable local code requirements of the authority having jurisdiction NEC, including Article 384, as application to installation and construction of switchboards.

B. UL Compliance: UL 486A, 486B, and 489. Provide switchboards and components which are UL-listed and labeled.

C. ANSI and IEEE Compliance: Applicable switchboard requirements of ANSI and IEEE Standards.

D. NEMA Compliance: Stds Pub/No.'s SG-3, SG-5, and PB 2.1

1.3 SUBMITTALS

A. Layout and Shop Drawing Review

1. The Contractor shall be responsible for reviewing the Shop Drawings with the Bid Drawings and the field conditions. Any differences between the Shop Drawings and the Bid Drawings or field conditions shall be brought to the immediate attention of the Engineer. Any code clearance related problems after installation of equipment shall become the Contractor’s responsibility.
2. When utility metering is contained in the main switchboard, the Contractor is responsible for submitting Shop Drawings to the local utility and obtaining approval prior to ordering equipment.

B. Product Data: Include rated capacities, furnished specialties and accessories.

C. Submit shop drawings indicating the following:

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

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include schematic and wiring diagrams for power, signal, and control wiring.
8. Top and bottom conduit entrance / exit locations with dimensions.
9. Electrical characteristics of equipment.
10. Specified ratings.
11. Bill-of-material.
12. Shipping splits and weights.

D. Submit product data for each component and accessory specified.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 "Operation and Maintenance Data," include the following:

a. Routine maintenance requirements for switchboards and all installed components.
b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
c. 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.

1.5 COORDINATION

A. Provide coordination study to provide proper settings for all breaker settings throughout the switchboard(s). Refer to Division 26 “Coordination Studies” for additional information and requirements.

B. 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.

C. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall coordinate delivery of switchboard with the project Schedule.

B. The Contractor shall receive, unload, and store if Contractor is not ready for switchboard installation at site. Any expense associated with moving of switchboard or storing switchboard shall become the responsibility of the Contractor.

C. The Electrical Contractor shall be responsible for any damage to the switchboard once it has been delivered to the site.

PART 2 - PRODUCTS

2.1 EQUIPMENT MANUFACTURER

A. Square D Company. – Base Bid

B. GE by ABB. – Alternate Bid

C. No Other Manufacturers will be considered.

D. Manufacturer must be able to provide SINGLE PHASE LOSS PROTECTION WITH AUTOMATIC THROW OVER.

E. Manufacturer must be able to meet physical size requirements shown on plans.

F. Contractor shall provide minimum Shop Drawing copies as stated in the project documents.

G. All above manufacturers must still be able to meet design size requirements shown on drawings or will not be acceptable.

2.2 GENERAL

A. Except as otherwise indicated, provide switchboards and ancillary components of types, sizes, characteristics, and ratings indicated, which comply with Manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for complete installation.

B. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

C. Utility Metering Compartment (where required in the gear by the local utility): Barrier compartment and section complying with utility company's requirements; hinged sealable door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

2.3 SHORT CIRCUIT CURRENT RATING

A. Switchboard as a complete unit shall be given a short circuit rating 65,000 or as otherwise noted on Drawings. The switchboard shall be fully rated. Series rated equipment will not be accepted. All circuit breakers installed in switchboard shall be rated for stated AIC above or as otherwise noted.

2.4 AC DEAD-FRONT DISTRIBUTION SWITCHBOARDS

A. Provide factory-assembled, dead-front, metal-enclosed, self-supporting, front accessibility only secondary power switchboards, of types, sizes, electrical ratings and characteristics indicated; consisting of vertical panel units, and containing circuit-breakers of quantities, ratings and types indicated. Provide main bus with material outlined below and connections to switching devices and circuit-breaker branches of sufficient capacity to limit rated continuous current operating temperature rise of no greater than 65º C above average ambient temperature of 30º C; with main bus and tap connections silver-surfaced and bolted tightly

according to Manufacturer's torquing requirements for maximum conductivity. Brace bus for short-circuit stresses up to maximum interrupting capacity. Provide accessibility of line and load terminations from front of switchboard. Prime and coat switchboard with Manufacturer's standard finish and color. Equip units with built-in lifting eyes.

2.5 ENCLOSURES

A. Construct dead-front switchboards, suitable for floor mounting, with front accessibility only, and conduit accessibility as indicated. Provide welded steel channel framework; hinge wireway front covers to permit ready access to branch circuit-breaker load side terminals. Coat enclosures with Manufacturer's standard corrosive-resistant finish. Enclosure shall be designed for installation with rear against wall. Enclosure shall be front and rear aligned.

B. Barriers: Between adjacent switchboard sections.

2.6 ARC ENERGY REDUCTION

A. For any circuit breaker rated for 1200A, or can be adjusted to 1200A, the following shall be provided:

1. Documentation shall be made available, at the switchboard, regarding the Arc Energy Reduction methodology.
2. The applicable breaker or fused bucket shall be provided with an energy-reducing maintenance switch setting with local status indicator.

2.7 ELECTRONIC TRIP MAIN CIRCUIT BREAKER(S)

A. Electronic trip units with LSI (Long time, Short time and Instantaneous) protection, size as specified on the drawings. Circuit breakers shall have interrupting, close and latch, and 30-cycle withstand ratings that meet the application requirements. Interrupting rating shall be available up to 200 kAIR RMS without fuses. Close and latch ratings up to 170kA peak current. Thirty-cycle withstand rating available up to 100 kA to provide maximum coordination with downstream circuit breakers. An adjustable rating plug (range of 0.4-1 times the sensor plug value) and a field-replaceable sensor plug (available in standard amperage steps from 50% to 100% of the frame size) shall determine the ampere rating of the circuit breaker.

B. Circuit Breaker:

1. Circuit breaker shall be fixed type, electrically operated.
2. All circuit breaker operating mechanisms are to be two-step, fully- stored energy devices for quick-make, quick-break operation with a maximum of a five-cycle closing time. Open-close-open (O-C-O) cycle shall be possible without recharging. Motor operator shall automatically charge when circuit breaker is closed. Actuation of the operating handle or an operation cycle of the circuit breaker motor is to charge the closing springs (step one) and operation of a local "close" button is to close the circuit breaker contact (step two). Closing the circuit breaker contacts shall automatically charge the opening springs.
3. The case of the circuit breaker shall be a polyester thermoset material providing high dielectric strength.
4. Current-carrying components shall be completely isolated from the accessory mounting area and double insulated from the operator with accessory cover in place.
5. Each phase inside the circuit breaker shall be completely isolated from other phases and ground by polyester thermoset material.
6. Padlocking provisions shall be furnished to receive up to three padlocks when circuit breaker is in the disconnected position, positively preventing unauthorized closing of the circuit breaker contacts.

7. Provisions for up to two key locks shall be furnished allowing locking in the disconnected position. Provisions for locking in the connected, test and disconnected positions by padlock or key lock shall be available as an option.
8. Located on the face of the circuit breaker shall be buttons, with optional lockable clear cover, to open and close the circuit breaker and indicators to show the position of the circuit breaker contacts, status of the closing springs, and circuit breaker position in the cell. An indicator shall show "charged-not OK to close" if closing springs are charged but circuit breaker is not ready to close.
9. Circuit breaker must be equipped with an interlock to discharge the stored energy spring before the circuit breaker can be withdrawn from its cell. Circuit breaker must provide a positive ground contact check between the circuit breaker and cell when the accessory cover is removed while the circuit breaker is in the connected, test or disconnected positions.
10. Primary connectors that can be rotated to provide flexible vertical or horizontal connections shall be available as an option. Front connections shall also be available for shallow depth equipment designs.
11. Ready-to-close contact must be available to indicate remotely that the circuit breaker is "ready to close." The circuit breaker is ready to close when it is open, spring mechanism is charged, a maintained closing order is not present, a maintained opening order is not present, and the circuit breaker is in an operational position.
12. The closing time shall be less than or equal to 70 milliseconds for rating <4000A.
13. Secondary wiring shall be front accessible and available in cage clamp or ring terminal connections. Secondary wiring must not be accessible when switchgear door is closed.
14. Circuit breakers shall be equipped with metal filters to reduce effects of an interruption outside the circuit breaker.
15. The circuit breaker shall be equipped with a safety interlock which keeps the circuit breaker open if the trip unit is not installed.
16. Circuit breaker shall provide long service life. The 3200 A circuit breaker frame and those of lower ratings must be certified to perform a minimum of 10,000 operations without maintenance. The 4000 A, 5000 A and 6000 A frames must be certified to 5,000 operations without maintenance.
17. Circuit breaker shall be equipped with a visual contact wear indicator.
18. Circuit breaker shall be equipped with anti-pumping function: If opening and closing orders occur simultaneously, the circuit breaker shall remain in the open position. After fault tripping or intentional opening using the manual or electrical controls, the closing order must first be discontinued, then reactivated to close the circuit breaker.
19. Circuit breaker arc chutes containing asbestos will NOT be accepted.
20. Shunt trip and shunt close coils shall be designed for continuous-duty.

C. Trip Unit

1. Circuit breaker trip system shall be an electronic trip unit.
2. In electronic trip units, protection functions shall be electronically managed independently of measurement function by a dedicated ASIC (application specific integrated circuit).
3. All trip units shall be removable to allow for field upgrades.
4. Trip Units shall incorporate "True RMS Sensing", and have LED long-time pickup indications.
5. Trip unit functions shall consist of adjustable long-time pickup and delay, short-time pickup and delay, instantaneous, neutral protection and optional ground-fault pickup and delay.
6. It shall be possible to adjust protections with a knob without any power supply or when the main is off.
7. Adjustable long-time pickup (Ir) and delay shall be available in an adjustable rating plug that is UL Listed as field-replaceable. Adjustable rating plug shall allow for nine long-time pickup settings from 0.4 to 1 times the sensor plug (In). Other adjustable rating plugs shall be available for more precise settings to match the application. Long-time delay settings shall be in nine bands from 0.5-24 seconds at six times Ir.
8. Short-time pickup shall allow for nine settings from 1.5 to 10 times Ir. Short-time delay shall be in nine bands from 0.1-0.4 I 2 t ON and 0-0.4 I 2 t OFF.

9. Instantaneous settings on the trip units with LSI protection shall be available in nine bands from 2 to 15 times In. The Instantaneous setting shall also have an OFF setting when short-time pick-up is provided.
10. All trip units shall have the capability for the adjustments to be set and read locally by rotating a switch.
11. Trip unit shall provide local trip indication and capability to indicate local and remote reason for trip, i.e., overload, short circuit or ground fault.
12. Ground-fault protection

    a. Provide where indicated, and at all breakers adjustable to 1200A and larger, regardless if indicated.
    b. Ground-fault protection shall be available for solidly grounded three-phase, three-wire or three-phase, four-wire systems. Trip unit shall be capable of the following types of ground-fault protection: residual, source ground return, and modified differential. Ground-fault sensing systems may be changed in the field.
    c. Ground-fault settings for circuit breaker sensor sizes 1200 A or below shall be in nine bands from to 1.0 times In. The ground-fault settings for circuit breakers above 1200 A shall be nine bands from 500 to 1200 A.

13. Trip units shall be available to provide additional protection by offering adjustable inverse definite minimum time lag (IDMTL). IDMTL provides optimized coordination by the adjustment of the slope of the long-time delay protection.
14. If required by the application, the trip unit shall offer measurement including energy without additional module whatever the protection type (LSI, LSIG).
15. Select the appropriate trip unit (s) for the system performance desired.

2.8 ELECTRONIC TRIP DISTRIBUTION CIRCUIT BREAKER(S)

A. Electronic trip units with LSI (Long time, Short time and Instantaneous) protection, size as specified on the drawings. Interrupting rating shall be available up to 200 kAIR RMS without fuses.

B. Circuit Breakers

1. Circuit breakers shall have voltage and interrupting ratings that meet the application requirements.
2. Circuit breakers shall be constructed using glass reinforced insulating material.
3. Current carrying components shall be completely isolated from the handle, and the accessory mounting area.
4. Circuit breakers shall have an over center, trip-free, toggle-operating mechanism which shall provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
5. From 125 A to 600 A rating frame, MCCBs breaking unit shall be made with a double rotary contact to limit let-through energy on the installation.
6. MCCBs shall be designed to trip the circuit breaker in the event of high-level short-circuit currents. This design shall be independent of the trip unit.
7. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing international I/O markings.
8. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on the face of the circuit breaker.
9. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.
10. Circuit breakers shall be factory-sealed with a hologram quality mark or a tamper evident label and shall have a date code.

11. MCCB's shall be able to receive a device for locking in the isolated position.
12. Electronic components shall withstand temperatures up to 221 °F (105 °C).
13. Circuit breakers shall be UL-listed to accept field installable/removable mechanical type lugs. Lugs shall be UL-listed to accept solid and/or stranded copper and aluminum conductors. Lugs shall be suitable for 194 °F (90 °C) rated wire, sized according to the 167 °F (75 °C) temperature rating in the NEC.
14. Circuit breakers shall be capable of accepting bus connections.
15. For frame ratings, higher than 250 amperes, MCCBs shall be fitted with metallic filters to reduce effects perceptible from the outside during current interruption.
16. For a given MCCB rated frame, MCCBs dimensions shall be the same whatever the AIR.
17. 1200 amperes frame shall be provided in electrically operated version. The operation shall use stored-energy type only and will be equipped with anti-pumping function.
18. Circuit breakers, 600A and larger, shall be equipped with a safety interlock which keeps the circuit breaker open if the trip unit is not installed.

C. Trip Units

1. MCCB's shall be equipped with electronic trip units.
2. Circuit breakers with permanent trip units shall be UL-listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.
3. MCCBs with field interchangeable trip units (600A and larger) shall have trip units that are easily interchangeable and easily secured to the MCCB.
4. The trip units shall not augment overall circuit breaker volume.
5. Electronic Trip Circuit Breakers.

    a. Trip unit shall be true RMS sensing.
    b. Air core current transformers shall be used to ensure accurate measurements from low currents up to high currents.
    c. Electronic trip unit shall be fitted with thermal imaging to protect intermittent short circuits or ground-faults.
    d. The following monitoring functions shall be integral parts of electronic trip units:

        1) A test connector shall be installed for checks on electronic and tripping mechanism operation using an external device.
        2) LED for load indication at 105 percent.
        3) LED for load indication at 90 percent of load for applications 600 amperes and smaller.
        4) LED for visual verification of protection circuit functionality for applications 600 amperes or smaller.
        5) LED for trip indication for applications above 600 amperes.
        6) Trip unit functions shall consist of adjustable protection settings with the capability to be set and read locally by rotating a switch.
        7) Long-time pickup shall allow for adjustment to nine long-time pickup settings. This adjustment must be at least from 0.4 to 1 times the sensor plug (In), with finer adjustments available for more precise settings to match the application.
        8) Adjustable long-time delay shall be in nine bands. At six times Ir, from 0.5 to 24 seconds above 600 amperes, and 0.5 to 16 seconds for 600 amperes and below.
        9) Short-time pickup shall allow for nine settings from 1.5 to 10 times Ir.
        10) Short-time delay shall be in nine bands from 0.1-0.4 I^2t ON and 0-0.4 I^2t OFF.
        11) Instantaneous settings on the trip units with LSI protection shall be available in nine bands.

            a) Above 600 amperes, from 2 to 15 times In
            b) 600 amperes, from 1.5 to 11 times In
            c) 400 amperes from 1.5 to 12 times In

d) 250 amperes and below, from 1.5 to 15 times In

12) Four-pole devices shall be equipped for neutral protection with a three-position setting; neutral not protected, neutral tripping threshold equal to half the phase value, and neutral threshold equal to the phase value.
13) Ground fault settings for circuit breaker sensor sizes 1200 amperes or below shall be in nine bands from 0.2 to 1.0 times In. The ground fault settings for circuit breakers above 1200 amperes shall be nine bands from 500 to 1200 amperes.

e. It shall be possible to fit the trip unit with a seal to prevent unauthorized access to the settings in accordance with NEC Section 240-6(b).
f. Trip unit shall provide local trip indication and capability to locally and remotely indicate reason for trip, i.e., overload, short circuit, or ground fault.
g. Measurement chain shall be independent from the protection chain.
h. The measurements shall be displayed on the breaker itself.

2.9 BUSING

A. Provide switchboard busing with sufficient cross-sectional area to fulfill UL 891 pertaining to temperature rise.

B. Construct bus of aluminum with ampacity rating as noted on Drawings and above, and with short-circuit current rating matching that of the rest of the construction.

2.10 POWER METER

A. Provide a Square D power meter catalog number PowerLogic PM8000 series metering device, or equal, mounted in the front of each of the switchboards. Provide power meter, in a NEMA 1 enclosure, at the main switchboard and where indicated on power riser diagram. Meter shall have, at a minimum, the following:

1. High-visibility color graphical display.
2. Direct connect to circuits up to 600 VAC, eliminating the need for voltage (potential) transformers; four metered 5 A nominal current inputs for 3 phase measurement plus neutral.
3. Supported monitoring parameters-full range of 3-phase voltage, current, power, and energy measurements, total harmonic distortion (THD), individual current and voltage harmonics readings, waveform capture, voltage and current disturbances (dip/swell) detection, ability to determine the location of a disturbance (upstream or downstream).
4. COMTRADE-up to 255 COMTRADE disturbance capture files available directly from meter via FTP and providing client notification of new captures through IEC 61850 (RDRE logical node).
5. Power Quality compliance-without using separate software, determine statistical indicators of power quality that include but are not limited to voltage dips and swells, harmonics, and frequency in accordance with EN 50160 power quality standard and provide an indication of pass/fail in a web interface; Third party laboratory tested to the power quality standard IEC 61000-4-30 Class 'S'.
6. User customization-capable of deriving values for any combination of measured or calculated parameters using arithmetic, trigonometric, and logic functions through graphical, flexible object oriented, programmable modules. Modules can be linked together in an arbitrary manner to create functionality such as totalization, efficiency measurements, control functions, load shedding, demand response, power factor correction, and compliance monitoring.
7. Communications capability-multi-port Ethernet and serial communications with at least two Ethernet ports and one RS485 serial port. Functionality through Ethernet connectivity includes email on alarm, e-mail interval energy data, on-board web server, SNMP network management, NTP time synchronization, Ethernet-to-serial RS-485 gateway, Modbus, DNP3, and IEC 61850.

8. On-board logging: non-volatile time stamped on-board logging of input/output (I/O) conditions, minimum and maximum values, energy and demand, maintenance data, alarms, and any measured parameters; trending and short-term forecasting of energy and demand; custom alarming with time stamping in which the meter has the capability of learning set-point limits based on the system behavior; trigger alarms on at least 50 definable power or I/O conditions; use of Boolean logic to combine alarms.
9. Input/outputs-provide at least three 3 digital inputs and 1 digital output for equipment status/position monitoring and equipment control or interfacing with millisecond timestamp. The meter shall accept up to four field installable I/O modules. Provide additional modules as required for application. Each digital I/O module shall provide 6 digital status/counter inputs and 2 Form C relay outputs rated at 250 V, 8 A. Each analog I/O module shall provide 4 inputs configurable to 4-20 mA or 0-30V ranges and 2 outputs configurable to 4-20 mA or 0-10V ranges.
10. Disturbance direction - provide an indication of the location of each power system event as "upstream" or "down Stream" along with the level of confidence of the location.

B. The power meter shall communicate utilizing ModBus over IP. The manufacture shall provide any gateways, etc. as required to meet this requirement. Coordinate communications with the BMS installer.

1. The contractor shall provide a data jack per the communications specifications at the power meter and connect.

2.11 SINGLE PHASE LOSS PROTECTION WITH AUTOMATIC RESET

A. The following describes the automatic mode of the PLC automatic throw over scheme provided for the building main circuit breaker. If Manufacturers can provide sequence without the use of the PLC this will be acceptable.

1. Normal source or phase lost:

a. If the normal source or phase is lost, the PLC automatically opens the load. The circuit breaker after the open delay.
b. PLC.
c. UPS system for reset during power failure.

2. Normal source or phase returns - PSS AOn@:

a. In an open transition system, after the source stabilization delay, the normal source closes.

3. The system shall try to reset the main circuit breaker after a period of five (5) minutes. (System shall be capable of setting time between 1 - 30 minutes.) The system shall open the main circuit breaker once sensing single phase loss and five (5) time periods shall start over.
4. Provide the following devices/equipment:

a. Power control transformer.
b. Phase failure relay.
c. Capacitor trip.
d. PLC.
e. UPS system for reset during power failure.

2.12 TRANSIENT VOLTAGE SURGE SUPPRESSION

A. The Contractor shall provide an external surge suppression device mounted beside or on top of the switchboard. Device shall be connected to the electrical system with high performance wiring. Refer to

division 26 “Transient voltage Surge Suppression” for additional information, for acceptable Manufacturers and additional information.

PART 3 - EXECUTION

3.1 GENERAL

A. Install switchboards as indicated, in accordance with Manufacturer's written instructions, and with recognized industry practices; complying with applicable requirements of NEC, NEMA's Stds Pub/No. PB 2.1, and NECA's “Standard of Installation.”

B. Examine areas and conditions under which switchboards and components are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment Manufacturer's published torque tightening values for equipment connectors. Where Manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486 A and B, and the National Electrical Code.

D. Install units with built-in transformers on vibration isolators in accordance with Division-25 section; and comply with Manufacturer's indicated method of installation.

E. The Contractor shall coordinate delivery of equipment to the job site. The Contractor shall be responsible for installation of the equipment once it is at the job site including removing equipment from truck/trailer and storing until switchboard is installed.

F. The Contractor shall provide all cable lugs required to connect distribution feeder cables to switchboard busing.

G. Provide 3½” concrete house cleaning pad unless size is noted otherwise on drawings.

3.2 FIELD QUALITY CONTROL

A. Prior to energization, check switchboards for electrical continuity of circuits, and for short-circuits.

3.3 ADJUSTING AND CLEANING

A. Adjust operating mechanisms for free mechanical movement. Touch-up scratched or marred surfaces to match original finishes.

3.4 GROUNDING

A. Provide equipment grounding connections for switchboards as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.5 IDENTIFICATION

A. The requirements listed below are in addition to the requirements listed in Division 26 “Electrical Identification”.

B. The Contractor shall provide signage to be attached on the switchboard. Switchboard shall be tagged as designated on Drawings. The Contractor shall provide signage for each individual circuit breaker tagged as shown on Drawings and attach to switchboard.

3.6 FLOOR LINE MARKING

A. Provide a 2" yellow floor line marking showing clear working distance on the floor in front of the switchboard with wordage within space which shall be: "Do Not Block This Piece of Electrical Equipment." Working clearance shall be as noted in the N.E.C.

3.7 PROTECTIVE SHIELDS

A. Provide metal protective shield(s) under all piping located within 3’-0” of the switchboard to defect a pipe leak away from the electrical equipment. Shield(s) shall be sized as required to cover the required pipe to prevent water from reaching the switchboard.

3.8 DEMONSTRATION AND START-UP

A. Adjust all adjustable settings as indicated on the drawings. When a coordination study is performed, adjust breakers and ground fault circuit interrupters as required.

B. Ensure phase loss protection is connected and operating.

C. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboard.

D. Single Phase Loss Protection with Automatic Reset

1. The Contractor shall have a qualified factory representative test the reset device in the field to ensure automatic mode device is functional properly as soon as the switchboard is brought on line. The Contractor shall verify that the position switch is in automatic mode after system has been tested. The Manufacturer shall ship Automatic throw over device to the site in Automatic mode. The Contractor shall be responsible for any damage to Owner’s equipment should the device not be operation once the switchboard is brought on line and operational.

E. Integrated Power Meter

1. Manufacturer's representative shall make a minimum of two site visit to ensure proper system installation and operation.

a. The first visit shall consist of an inspection of the low voltage wiring, interface between modules and communications connections.
b. The second visit shall consist of coordinating with the mechanical building management system to coordinate the transmission of required information to the BMS. Finally, the manufacturer's representative shall demonstrate and educate the owner's representative(s) on the system capabilities and operation.

END OF SECTION 26 24 13