PART 1  GENERAL

1.01  SCOPE
   A. The Contractor shall furnish and install the unitized power center(s) as specified herein and as shown on the contract drawings. The unitized power center shall consist of a primary incoming termination compartment or primary load interrupter switch as shown, a ventilated dry-type transformer, and a secondary distribution section(s).

1.02  RELATED SECTIONS
   A. Section 16901- Microprocessor Based Metering Equipment

1.03  REFERENCES
   A. The three-phase unitized power centers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and ANSI.

1.04  SUBMITTALS – FOR REVIEW/APPROVAL
   A. The following information shall be submitted to the Engineer:
      1. Master drawing index
      2. Front view elevation
      3. Floor plan
      4. Top view
      5. Single line
      6. Schematic diagram
      7. Nameplate schedule
      8. Component list
      9. Conduit entry/exit locations
     10. Assembly ratings including:
         a. Short-circuit rating
         b. Voltage
         c. Continuous current
         d. Basic impulse level for equipment over 600 volts
         e. kVA
     11. Major component ratings including:
         a. Voltage
         b. Continuous current
         c. Interrupting ratings
12. Cable terminal sizes
13. Impedance for transformers

B. Where applicable, the following additional information shall be submitted to the Engineer:
   1. Key interlock scheme drawing and sequence of operations

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes prior to final payment.
   1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
   2. Wiring diagrams
   3. Certified production test reports
   4. Installation information
   5. Seismic certification and equipment anchorage details as specified

1.06 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
D. **Provide Seismic qualified equipment as follows:
   1. The equipment and major components shall be suitable for and certified by actual seismic testing** to meet all applicable seismic requirements of the 2006 International Building Code (IBC). Equipment certification acceptance criteria shall be based upon the ability for the equipment to be returned to service immediately after a seismic event within the above requirements without the need for repairs.
   2. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.
      a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.
      b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
      c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

**Note to Spec. Writer - Optional**
1.07 REGULATORY REQUIREMENTS
A. Unitized Power Center shall be listed and labeled.

1.08 DELIVERY, STORAGE AND HANDLING
A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.
B. Each unitized power center assembly that contains secondary distribution in front of the transformer section shall be shipped in one piece. Designs shown on the contract drawings that employ a separate secondary switchboard shall be split into shipping groups, where possible, for handling as indicated on the drawings or per the manufacturer’s recommendations. Shipping groups shall be designed to be shipped by truck, rail or ship. Shipping groups shall be bolted to skids. Accessories shall be packaged and shipped separately. Each unitized power center shipping group shall be equipped with lifting eyes for handling by crane. Where cranes are not available the unitized power center shall be suitable for skidding in place on rollers using jacks to raise and lower it.

1.09 OPERATION AND MAINTENANCE MANUALS
A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Eaton
B. ☐
C. ☐

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS
A. The primary switch section ratings shall be as follows:

Nominal System Voltage ☞ [three-] [four-] kV three-phase ☜
System Grounding ☞ [solid] [resistance or ungrounded]
Basic Impulse Level ☞ [60] [95] kV
Bus/Switch Continuous Current 600 Amperes
Switch Load-Break Current 600 Amperes

Note to Spec. Writer – Insert data in blanks
Note to Spec. Writer – Select one
Momentary and Fault-Close Current
- [100 kA asymmetrical with fuses] [40 kA asymmetrical without fuses]
Two Second Current
- 25 kA symmetrical RMS without fuses

B. The transformer ratings shall be as follows:

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>kVA Rating</td>
<td>______ / ______ [AA] [AA/FA] [AA/FFA]</td>
</tr>
<tr>
<td>Frequency</td>
<td>60 Hz</td>
</tr>
<tr>
<td>Temperature Rise</td>
<td>______ degrees C</td>
</tr>
<tr>
<td>Nominal Voltage, Primary</td>
<td>______ kV</td>
</tr>
<tr>
<td>Primary BIL Rating</td>
<td>______ kV</td>
</tr>
<tr>
<td>Primary Winding Configuration</td>
<td>Delta</td>
</tr>
<tr>
<td>Nominal Voltage, Secondary</td>
<td>______ Volts</td>
</tr>
<tr>
<td>Secondary Winding Configuration</td>
<td>[Solidly Grounded Wye][Delta]</td>
</tr>
<tr>
<td>Secondary BIL Rating</td>
<td>10 kV</td>
</tr>
</tbody>
</table>

**Note to Spec Writer:**
Fill in data above from this table.

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>kVA:</td>
<td>112.5, 225, 300, 500, 750, 1000</td>
</tr>
<tr>
<td>Temperature Rise:</td>
<td>150, 115(^A), 80(^A)</td>
</tr>
<tr>
<td>Nominal Primary Voltage:</td>
<td>2400, 4160, 4800, 6900, 7200, 12000, 12470, 13200, 13800</td>
</tr>
<tr>
<td>Primary BIL:</td>
<td>For 1201-2520V: 20 kV</td>
</tr>
<tr>
<td></td>
<td>For 2521-7200V: 30 kV</td>
</tr>
<tr>
<td></td>
<td>For 7201-13800V: 60 kV</td>
</tr>
<tr>
<td>Nominal Secondary Voltage:</td>
<td>208/120 wye(^B), 240 delta(^B), 480/277 wye, 480 delta</td>
</tr>
</tbody>
</table>

\(^A\) Not available for 1000 kVA.
\(^B\) Not available for 1000 kVA, and fan cooled 750 kVA.

2.03 CONSTRUCTION

A. The primary switch, transformer and distribution section shall be combined in a unitized steel structure having internal steel barriers to effectively segregate the sections into separate compartments.

B. The manufacturer shall supply a base attached to the integral assembly to facilitate movement into position by rolling or jacking and to provide the means for bolting the Unitized Power Center securely to the floor.

C. Interconnections between the switch, transformer and the low voltage apparatus shall be factory installed.

D. The entire assembly shall be front accessible and suitable for installation against a wall. Ventilating openings, cable connections and transformer tap changers shall be accessible from the front for normal maintenance. Manufacturer to indicate on drawings any clearance required between the equipment and the wall for ventilation or anchor clips.

\(^\star\) Note to Spec. Writer – Select one
\(^\nearrow\) Note to Spec. Writer – Insert data in blanks
2.04 BUS
A. All primary phase bus conductors must be 600 A silver-plated copper. All secondary phase bus conductors must be silver-plated copper and sized accordingly to meet the secondary load requirements.

B. Ground bus conductor shall be silver-plated copper and be directly fastened to a bare metal surface of each vertical section, and be of a size sufficient to carry the rated two-second current of the switchgear assembly.

C. When the transformer has a three-phase, four-wire secondary, full-size neutral bus shall be included. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

2.05 WIRING/TERMINATIONS
A. The primary switch section shall have provisions for terminating the incoming primary feeder cable. The type of termination, entry location, and the size and type of incoming cable shall be as shown on the drawings.

B. Small wiring, fuse blocks, and terminal blocks within the vertical section shall be furnished as indicated on the drawings. Each control wire shall be labeled with wire markers. Terminal blocks shall be provided for customer connections to other apparatus.

2.06 PRIMARY LOAD INTERRUPTER SWITCH SECTION
A. The primary disconnect switch shall be load interrupting with quick-make, quick-break stored energy manual operating mechanism. It shall be three-pole, two-position gang operated.

B. Current limiting fuses with a short-circuit interrupting rating of 63,000 amperes rms symmetrical shall be supplied fixed mounted on the load side of each switch pole. The fuse continuous current rating shall be in accordance with the manufacturer's recommendation. Fuses shall be of the indicating type removable from the front without special tools.

C. Access to fuses while energized shall be positively prevented through a mechanical interlock system which keeps the section front door held closed when the switch is in the closed position.

D. Any internal parts that remain energized with the switch open shall be guarded by a fixed internal safety barrier to prevent inadvertent contact by operating or maintenance personnel when the door opens. Interphase insulating barriers shall be provided as needed for the voltage class to isolate switch and fuse poles from each other and from grounded metal.

E. Provision shall be made for operating the switch and storing the removable handle without opening the outer door.

F. Means shall be provided to padlock the switch in the open or closed position.

G. Three distribution class surge arresters shall be provided to protect the transformer from surge voltages equal to or greater than its kV BIL rating. One surge arrester shall be located on the load side of each fuse.

H. Where indicated on the drawings, a key interlock shall be supplied to prevent switch operation unless the associated secondary main device is open.

I. An inspection window shall permit a full view of the position of all three switch blades.
2.07 TRANSFORMER SECTION

A. A three-phase, 60 Hz, ventilated dry-type transformer shall be supplied as part of the unitized assembly. The insulation system shall be based on 220 degree C insulating materials. The maximum ambient temperature shall not exceed 40 degrees C. Transformer impedance shall be manufacturer’s standard.

B. Primary taps shall consist of 2 – 2-1/2% above normal and 2 – 2-1/2% below normal voltage. The tap leads shall be connected to three single-phase tap switches so that taps can be changed from the front without removing covers or unbolting connections. A mechanical interlock system shall prevent access to the tap switches with the primary energized.

C. Transformer windings shall be copper.

D. Provide [forced air cooling fans to increase the transformer kVA capacity by 33-1/3%] [provisions for future forced air cooling fans to increase the transformer kVA capacity in the future by 33-1/3%]. An electronic fan control and temperature sensing unit shall be provided. The relay shall be a three-phase unit utilizing thermocouples to measure the winding temperature of each phase. The relay shall automatically monitor the hottest temperature and display this temperature on a face-mounted digital meter. Display of the other two-phase windings shall be done by pressing a pushbutton on the membrane faceplate of the fan control unit. An audible alarm shall sound when an alarm temperature set point is reached. LED lights shall indicate available power to the fan control system, which phase temperature is being displayed, fans on, overtemperature alarm, and overtemperature trip. System testing and operating set points shall be programmable at the device without connecting any external devices. Control power shall be provided from internal control power transformer mounted in the transformer section.

2.08 DISTRIBUTION SECTION

A. The low voltage distribution section shall be incorporated into the transformer section but barriered from the transformer, or be in a completely separate self-supporting structure as required to mount the apparatus.

B. Main bus shall be rated [250] [400] [600] [800] [1200] [2000] amperes. All bus bars shall be silver-plated copper with bolted connections at joints. The bus bars shall be of sufficient size and braced to exceed maximum let-through current of the transformer. Provide full capacity neutral where a neutral is indicated on the drawings.

C. The low voltage distribution section shall contain molded case circuit breakers arranged in group-mounted construction. The quantities and frame/trip sizes shall be as scheduled on the drawings. Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics and shall be Eaton type or approved equal.

D. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip free. Automatic tripping of the breaker shall be clearly indicated by handle position. Contacts shall be non-welding silver alloy, and arc extinction shall be accomplished by means of DE-ION arc.
chutes. A push-to-trip button on the front of the circuit breaker shall provide a local means of manually exercising the trip mechanism.

E. Circuit breakers shall have a minimum symmetrical interrupting capacity of ______kA or as indicated on the drawings.

F. Where indicated, circuit breakers shall be UL listed for series application.

G. Circuit breakers *[250-] [400-] [600-] ampere frame and below shall be Eaton type with thermal-magnetic trip units and inverse time-current characteristics.

H. Circuit breakers with *[250-] [400-] [600-] ampere through 1200-ampere frame shall be Eaton type with microprocessor-based rms sensing trip units.

1. Each molded case circuit breaker microprocessor-based tripping system shall consist of three current sensors, a trip unit and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True rms sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. The trip unit shall be Eaton type Digitrip 310 or approved equal

2. An adjustable trip setting dial, mounted on the front of the trip unit, or interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed or adjustable as indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed

3. System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:
   a. Adjustable long-time setting (set by adjusting the trip setting dial or the rating plug)
   b. Adjustable short-time setting and delay, with selective curve shaping
   c. Adjustable instantaneous setting
   d. Adjustable ground fault setting and delay. Internal ground fault protection adjustable settings shall not exceed 1200 amperes. Provide neutral ground fault sensor for four-wire loads.

4. The microprocessor-based trip unit shall have both powered and unpowered thermal memory to provide protection against cumulative overheating should a number of overload conditions occur in quick succession

5. When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override

6. Breakers shall have built-in test points for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set. *[Provide one test set capable of testing all breakers 250 ampere frame and above.]*

I. Operating handles shall face the front of the unitized equipment and the complete group mounted assembly shall be front accessible for installation and maintenance of outgoing cables. Conduit space shall be provided for cables exiting the top or bottom of the section.

*° Note to Spec. Writer – Insert data in blanks
*° Note to Spec. Writer – Optional
Outgoing cable shall be confined to front accessible gutters where they do not interfere with the free flow of cooling air.

J. *Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

K. *Feeder breaker energy monitoring.

**Note to Spec. Writer:**
For feeder breaker energy monitoring in 2.08 K, select devices as required from Section 16901.

2.09 OWNER METERING

A. Where indicated on the drawings, provide secondary owner metering mounted on the hinged LV gutter.

B. Provide current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.

C. Provide *pet>potential transformers including primary and secondary fuses* [fused potential taps as the potential source] for metering as shown on the drawings.

D. Microprocessor-based metering system.

**Note to Spec. Writer:**
For owner metering in 2.09 D, select devices as required from Section 16901

2.10 NAMEPLATES

A. A nameplate shall be mounted on the front door of each switch vertical section in accordance with the drawings.

2.11 FINISH

A. Prior to assembly, all enclosing steel shall be thoroughly cleaned and phosphatized. A powder coating shall be applied electrostatically, then fused on by baking in an oven. The coating is to have a thickness of not less than 1.5 mils. The finish shall have the following properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact resistance (ASTM D-2794)</td>
<td></td>
<td>60 Direct/60 indirect</td>
</tr>
<tr>
<td>Pencil hardness (ASTM D-3363)</td>
<td></td>
<td>H</td>
</tr>
<tr>
<td>Flexibility (ASTM D-522)</td>
<td></td>
<td>Pass 1/8-inch mandrel</td>
</tr>
<tr>
<td>Salt spray (ASTM B117-85 [20])</td>
<td></td>
<td>600 hours</td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td>ANSI 61 gray</td>
</tr>
</tbody>
</table>

*Note to Spec. Writer – Optional
*Note to Spec. Writer – Select one
PART 3 EXECUTION

3.01 FACTORY TESTING
A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
B. The manufacturer shall provide three (3) certified copies of factory test reports.
C. Factory tests as outlined above shall be witnessed by the owner’s representative.
   1. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed
   2. The manufacturer shall include the cost of transportation and lodging for up to three (3) owner’s representatives. The cost of meals and incidental expenses shall be the owner’s responsibility

3.02 FIELD QUALITY CONTROL
A. The Contractor shall provide the services of a qualified factory-trained manufacturer’s representative to assist the Contractor in installation and startup of the equipment specified under this section for a period of _______ working days. The manufacturer’s representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.
B. The Contractor shall provide three (3) copies of the manufacturer’s field startup report.

3.03 MANUFACTURER’S CERTIFICATION
A. The Contractor shall provide a qualified factory-trained manufacturer’s representative who shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer’s recommendations.
B. The Contractor shall provide three (3) copies of the manufacturer’s representative’s certification.

3.04 TRAINING
A. The Contractor shall provide a training session for up to five (5) owner’s representative(s) for _______ normal workdays at a job site location determined by the owner.
B. The training session shall be conducted by a manufacturer’s qualified representative and consist of instruction on the assembly, switches, and major components.

3.05 INSTALLATION
A. The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

3.06 FIELD ADJUSTMENTS

*Note to Spec. Writer – Optional
\* Note to Spec. Writer – Insert data in blanks
3.07 FIELD TESTING