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LET'S BE PACIFIC™

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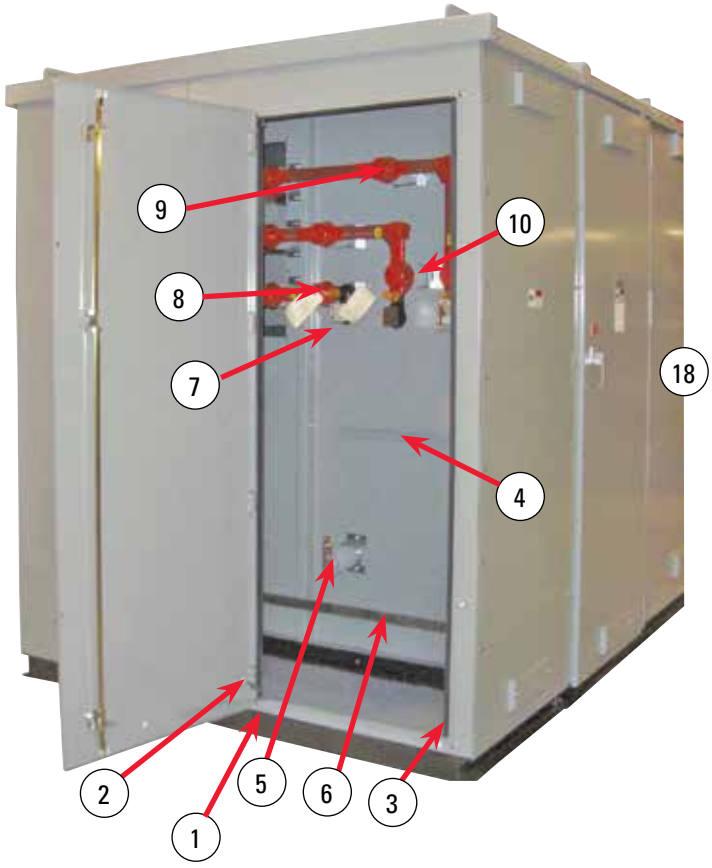
ME Switchgear with Vacuum Circuit Breaker and Auto-jet® II Switch with Ground Position

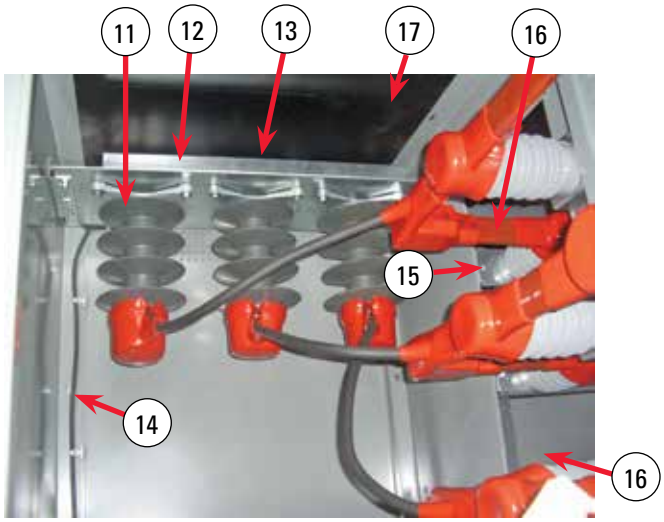
Federal Pacific has the capability to engineer, fabricate and assemble complex switchgear assemblies to meet demanding switching performance criteria and exacting installation limitations. The switchgear assembly featured in this newsletter illustrates these specification performance requirements. The lineup is configured in a back-to-back arrangement that has incoming, metering, protection and isolation bays in the front. The incoming bay (Bay 1), which opens on the left end of the lineup (in the photo below), includes the cable-termination bus behind the door along with transition bus and surge arresters in the left section that extends through an opening into the rear compartment. The compact arrangement compresses the length of the assembly to better fit the available space at the installation.

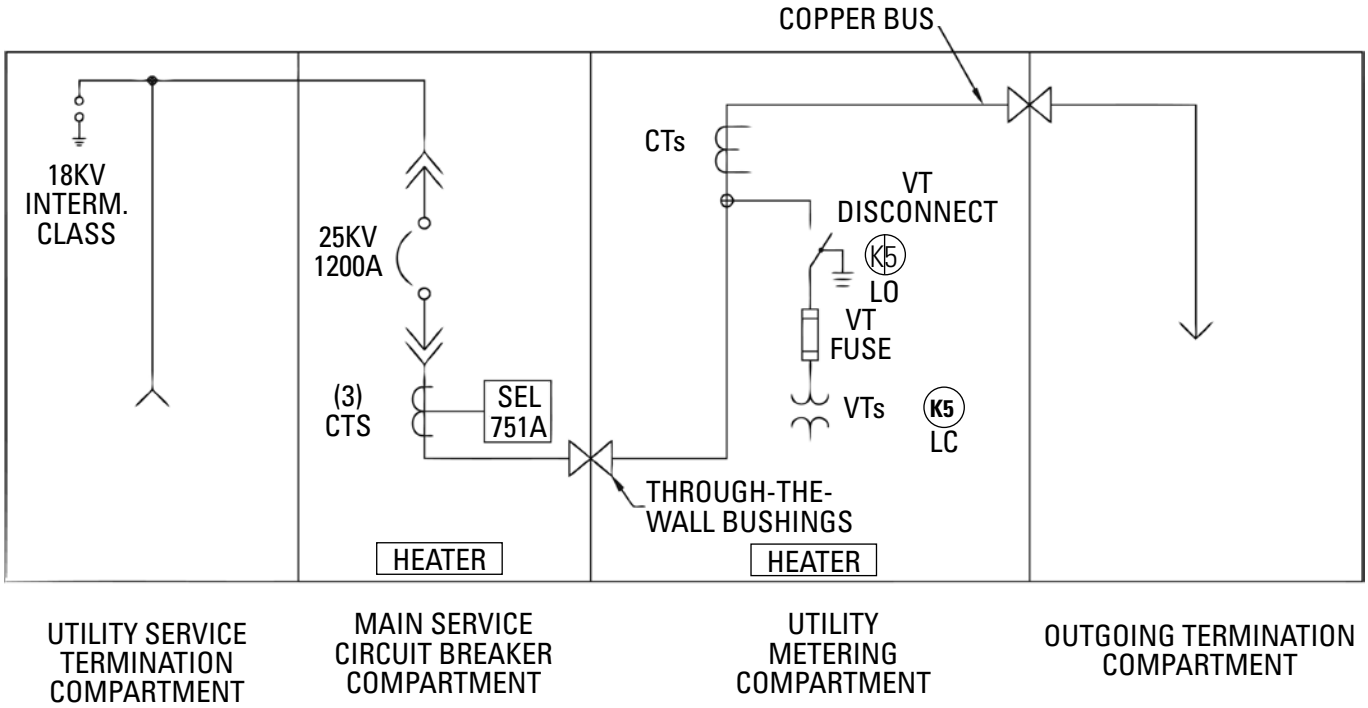
The protection bay (Bay 2) includes a vacuum circuit breaker in combination with a Federal Pacific Auto-jet® II switch that serves as a load-interrupter switch, ground switch and visible disconnect for the fused-voltage transformer circuit that provides control power for all low-voltage circuits and input for utility revenue metering. The choice of using a relayed vacuum circuit breaker for protection centers on the need for a component with a fast response, high continuous current capability, optimum short-circuit interrupting performance and extensive frequent switching operations. In addition, the relayed vacuum circuit breaker has the potential to be upgraded (with the addition of light sensors) to provide arc-flash mitigation. By using a fast-response VCB and adding optical sensors, personnel exposure to an arc flash can be reduced which simultaneously limits the incident energy reducing PPE requirements.

Figure 1. This six-bay lineup of 25kV Manual Metal-Enclosed Switchgear is arranged in a back-to-back configuration with four (4) bays in the front (in the two top photos taken from the left side and from the right side) and two (2) bus-transition bays in the rear (in the photo at left). The configuration allows the medium-voltage distribution switchgear with a vacuum circuit breaker to better match the available space at the installation site.

Bay 1 — Incoming Utility Termination Compartment and Bus Transition to Bay 2
Bay 2 — Main Service Vacuum Circuit Breaker (VCB)
Bay 2R — Bus Transition from VCB to Bay 3R
Bay 3R — Bus Transition to Bay 3
Bay 3 — Utility Metering Compartment with Disconnect Switch on Fused VT
Bay 4 — Outgoing Termination Compartment







SWITCHGEAR ONE LINE DIAGRAM

Figure 2. Bay 1 of the Federal Pacific Metal-Enclosed Switchgear assembly is the incoming cable-termination compartment, which also includes 18kV surge arresters in the left rear of the bay. Also in the left rear is the transition bus into Bay 2R.

1. Automatic Actuating Wind Brace sets door open to prevent inadvertent closure and is manually reset
2. Woven Steel-Mesh Braid is connected from the door to the enclosure to provide a positive bond between these independent surfaces, grounding the door to the enclosure allowing any fault to the door to pass efficiently to the enclosure ground
3. Door Openings Gasketed on three sides to seal the door shut while allowing ventilation at bottom edge
4. Uni-Strut Cable Support below termination bus in cable-entrance bay allows cables to be secured to minimize weight on bus terminals and minimize stress on terminals during through fault (momentary) current conditions
5. Insulated-Neutral Terminal is mounted on through bushing and allows grounding of cable concentric neutrals; through bushing passes through enclosure wall into adjacent bay. A connector is provided to accommodate the #2-4/0 bundles of concentric-neutral wires
6. Ground Bus is continuous in front and back and includes aluminum-body connectors accommodating #6-250MCM cable
7. 1200-ampere silver-flashed termination bus for incoming cables
8. Grounding-ball lugs are also installed on each bus termination and insulated covers keep them clear of contaminants
9. Insulating sleeving and insulating caps over bus joints at bus supports provide construction characteristics that are similar to circuit-breaker switchgear
10. Bus supports are of a cyclo-aliphatic epoxy with self-scouring action to expose material of the same composition if a flashover occurs across the insulator to ground
11. 18kV Intermediate Class surge arresters connected to main bus provide surge suppression for lighting impulse conditions that may occur
12. Galvanized steel formed angle provides support for surge arresters
13. Ground bus and ground leads for surge arresters are hidden from view on top side of support bracket
14. Ground lead from surge arrester runs down wall and terminates on ground bus
15. Galvanized steel is also used for support brackets and mounting angles under bus-support insulators
16. Main bus transitions through opening at top into adjacent bay
17. Insulating no-drip compound keeps moisture from forming on roof during intervals of significant temperature swings
18. Cast-aluminum door handle on all bays are padlockable

Figure 3. Bay 2 is the switching and protection compartment that includes the drawout VCB, the overcurrent relay, the sensing CTs that detect the overcurrent condition and all the associated low-voltage controls. The ground bus is continuous throughout all bays at both the front and the rear. In addition, an insulated terminal is provided in this bay (and in bays 1, 2R, 3 and 3R) for terminating concentric-neutral cables and ground leads from secondary wiring.

1. Galvanized-Steel Panel at top isolates interior while perforations allow ventilation to interior
2. Insulated Main Bus enters Main Service Circuit-Breaker Compartment at top rear and connects to top of Vacuum Circuit Breaker
3. Overcurrent Protection is provided using the SEL-751A with overcurrent input from the CTs. Relay can also optionally accommodate up to four (4) fiber-optic light sensors to provide input to utilize the breaker in an arc-flash detection scheme
4. Low-Voltage Control Compartment mounted in center section of Bay 2 includes:
    - SEL 751A Overcurrent Protection Relay
    - Breaker Control Switch to Close VCB and to Trip VCB open
    - Breaker Lockout Selector Switch – to prevent operation of the VCB when service work is to be performed
    - Breaker Position Indicating Lamps – illuminate to show VCB open, closed, trip positions
    - Hinged Control Panel – all the above control components are mounted on this panel
    - Sliding Latches secure control panel closed
5. Low-Voltage Control Compartment interior is isolated on all sides from medium voltage
6. Hinged Panel over Lower Section of bay is secured in place by sliding latches
7. VCB and Sensing CTs are accessed through the hinged panel at the lower section of the bay
8. 1200-Ampere, 25kV Drawout VCB rated to 25kA short-circuit interrupting provides overcurrent protection to the load circuit; features on the faceplate of the VCB include:
    - Socket for Manual Operation
    - Open/Close Indicator
    - Ready Indicator
    - Close Pushbutton
    - Open Pushbutton
    - Operation Counter
9. Current Transformers rated 1200/5 provide current sensing for the overcurrent protection scheme with input to the relay (at rear of circuit breaker)
10. Drawout Carriage allows VCB to be withdrawn to establish a visible open when service work is to be performed downstream
11. Solid Enclosure Doors Over all Compartments provide weather resistant protection for all components on the interior
12. Heaters for outdoor units are provided in Bay 2 and Bay 3 (not visible)

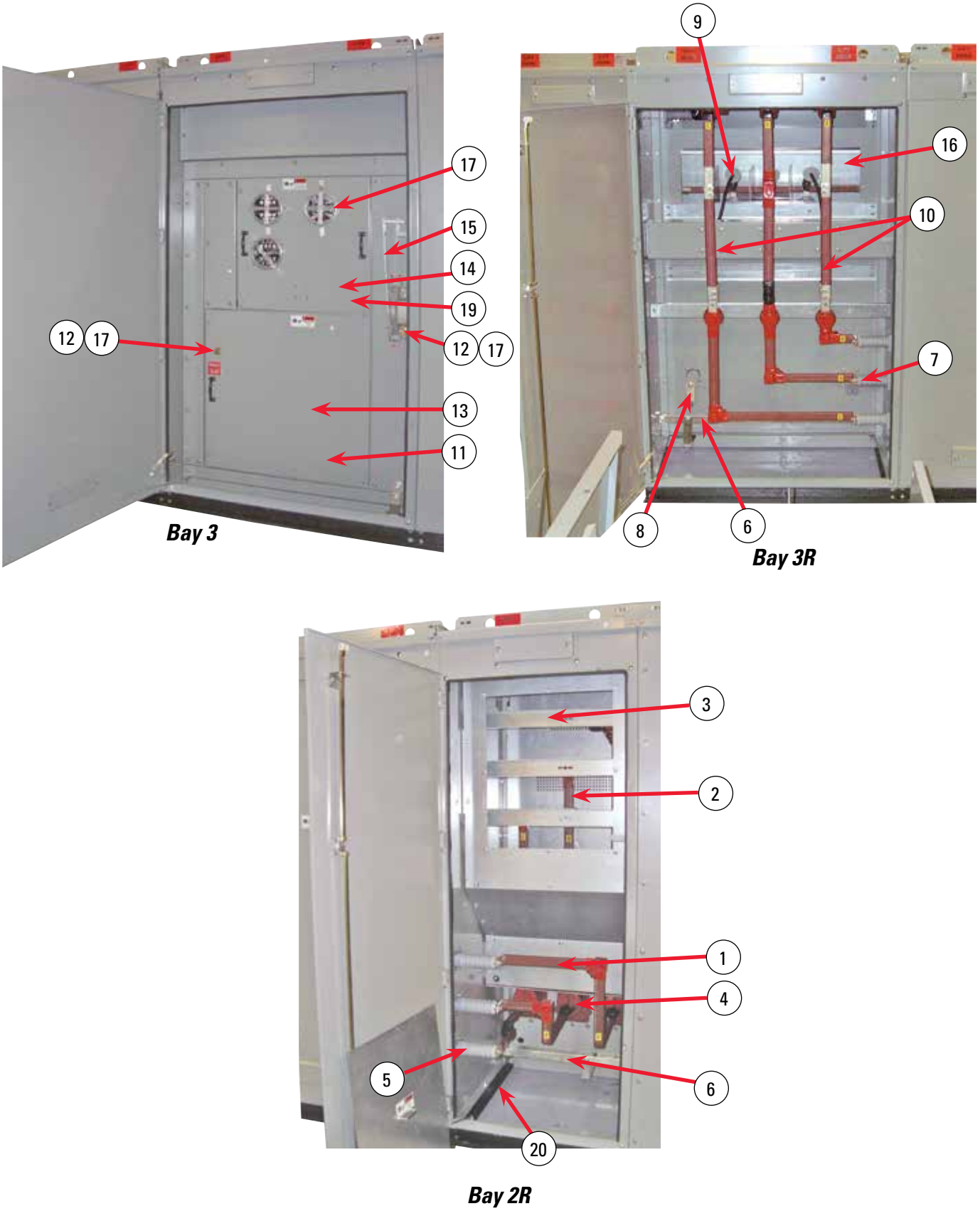
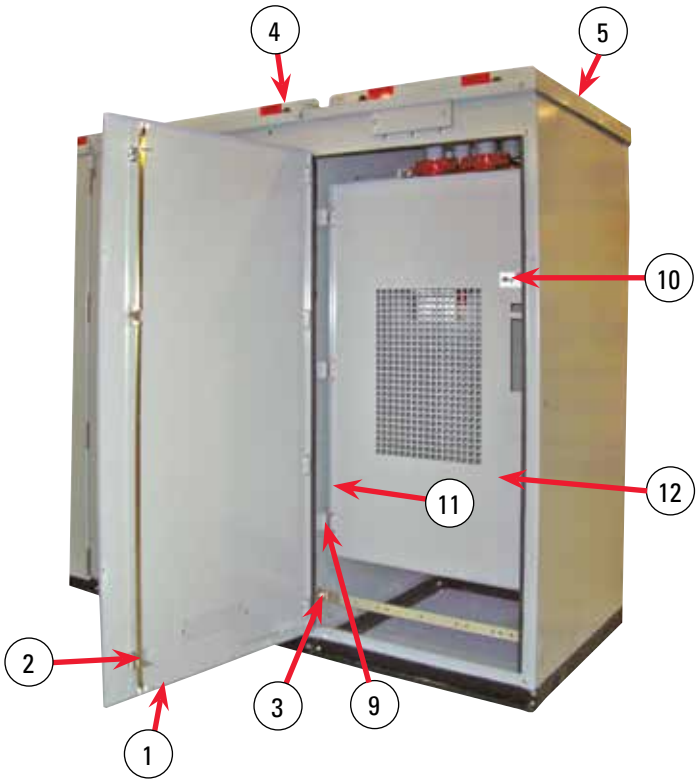
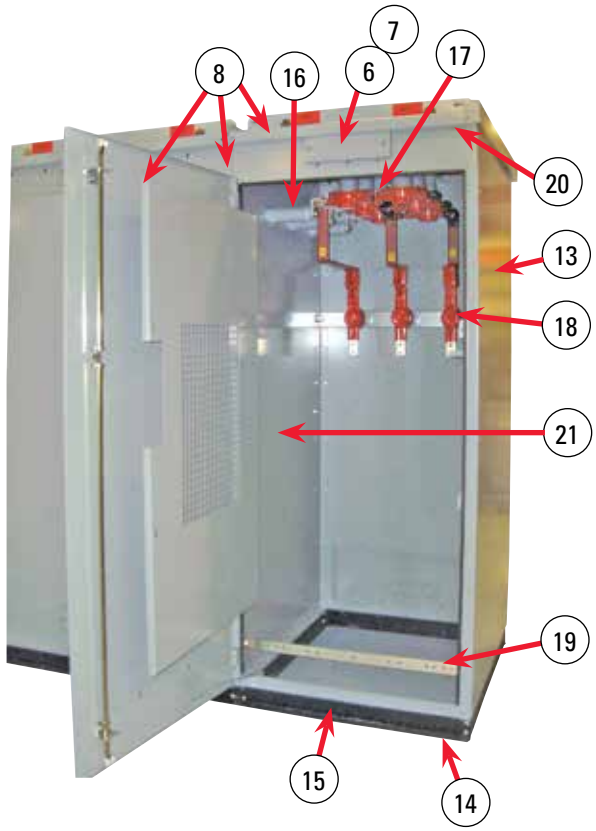


Figure 4. Bay 3 is the Metering Compartment that includes provisions for the fused-VTs and CTs that provide sensing for the revenue metering scheme. The VT circuit includes an Auto-jet® II load-interrupter switch that includes an integral ground position. When the switch opens, it moves directly into a ground position. Insulated bus is provided throughout the entire switchgear which is typical of construction for circuit-breaker switchgear. Through bushings (in bays at top right and at bottom) isolate the metering bay from Bay 2, which is the circuit-breaker bay, and from Bay 4, which is the outgoing termination bay. Grounding balls are provided on both sides of the current transformers (as well as on the incoming terminations in Bay 1.

1. Compartment 2R (the rear section behind Compartment 2) shows bus connections to adjacent compartments
2. Bus Connections at Top are from Compartment 1 (Incoming Termination Compartment)
3. Each of Three (3) Cross-Support Angles at top provide mounting for a phase of the main-bus connections that drop down to connect to the top terminals of the VCB
4. Three (3) CTs that provide sensing for the overcurrent protection scheme are mounted in the bottom of the compartment
5. Through Bushings on left of Compartment 2R connect to adjacent Compartment 3R, which is at the rear of the Metering Compartment on the outgoing of the VCB
6. Continuous Ground Bus is visible at bottom of Compartments 2R and 3R; Ground Bus penetrates enclosure side walls and into adjacent front compartments
7. Through Bushings on right of Compartment 3R connect to adjacent Compartment 2R and bus moves upward to connect to Disconnect Switch on Fused VTs and Current Transformers used for Revenue Metering Requirements
8. Insulated-Neutral Terminal is mounted on through bushing and allows grounding of cable concentric neutrals; through bushing passes through enclosure wall into front bay (metering compartment). A connector is provided to accommodate the #2-4/0 bundles of concentric-neutral wires
9. Insulated Cable is used to tap from main bus to top of VT disconnect switch; cable passes through porcelain-insulated openings imbedded in clear polycarbonate barrier into the interior and lands on top terminals of disconnect switch
10. Provisions to accommodate two (2) 1200/5 CTs for Revenue Metering to be mounted vertically in Bay 3R with removable links installed for shipment
11. Provisions to accommodate three (3) VTs (not visible) are provided using two unistrut mounting channels located in the bottom of Bay 3.
12. Key Interlock on VT access door is matched to Key Interlock on Switch-Operating Handle to prevent opening access door to VT fuses until the Auto-jet® II Load-Interrupter Switch is open.
13. Current-Limiting Fuses in individual fuse mountings provide protection on the primary side of the Voltage Transformers behind hinged, interlocked cover, which bolts closed
14. 600-Ampere Auto-jet® II Switch is used to switch open and ground the fused-VT circuit; when opened the switch moves directly into a ground position; window to view switch is behind hinged metering panel, which also bolts closed
15. Cast-Aluminum Switch-Operating Handle with heavy-gauge steel lever is chain-coupled to switch for efficient operation, easy movement and long-term durability; key interlock on handle matches to fused-VT access door
16. Viewing Window for Disconnect Switch and Ground Position is located behind meter panel
17. Key Interlocks on access door to fused-VT prevents access to interior of compartment until disconnect switch is open
18. Three (3) Meter Sockets are installed in the hinged Meter Panel in Bay 3 – one four (4) terminal socket, one six (6) terminal socket and one fifteen (15) terminal socket
19. Meter Panel includes provisions for two flexi-test switches
20. Conduit for Low-Voltage Wiring





1. 90° Flange on door overlaps door opening to provide increased security against vandals and the curious
2. Three-point door-latch assembly secures door at top, bottom and at center
3. Doors have stainless-steel hinges and hinge pins for long-life durability and ease of operation
4. Lifting provisions on top of each bay at front and back include cutouts to accommodate lifting hooks
5. Roof has deep overlap with enclosure at top
6. Cover over ventilation louvers accommodate filters to control ingress of contaminants
7. Louvers have stainless-steel screens on interior
8. 11-gauge steel enclosure, door and roof
9. Heavy, hinged, perforated screen allows inspection of terminations and connections without accessing interior
10. DANGER hazard-alerting label on screen warns of imminent exposure to energized components on inside
11. Formed edge on screen adds increased strength and rigidity.
12. Easy to use thumb screws secure screens in position
13. No exposed removable hardware
14. Formed Channel Base
15. Undercoating on Channel Base provides increased corrosion resistance to surfaces in contact with pad
16. Through Bushings isolate metering compartment and outgoing termination compartment II
17. Cyclo-aliphatic epoxy insulators isolate and support phase bus from ground
18. Insulating sleeving on bus and conformal insulating caps over bus connection provide increased isolation for main bus
19. Continuous, silver-flashed copper ground bus extends full width of each bay in front and in rear
20. Undercoating on underside of roof prevents condensation from forming and dripping
21. Double-wall thickness between metering compartment and outgoing termination compartment and between each other bay add strength and rigidity to the assembly while providing excellent isolation if a short-circuit event occur