Transfer Switches — Medium Voltage

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Medium Voltage Transfer Switch

Reliability and Control with Vacuum Technology and Microprocessor-Based Logic

Medium Voltage Vacuum Breaker Transfer Switch

Eaton's electrical business is an innovator of low and medium voltage manual transfer switches and has expanded these capabilities into medium voltage automatic transfer switches (MV ATS) that combine proven vacuum technology and microprocessor-based logic.

Why Use Vacuum Circuit Breakers Instead of Load Interrupter Switches for Automatic Transfer?

- Vacuum circuit breakers are suitable for multiple switching (5000 to 10,000 or even more) operations between sources involved in automatic transfer system. Duty cycle of load interrupter switch is limited (5 to 50 operations) by ANSI C37.22.
- Vacuum circuit breakers are rated for load current switching as well as interrupting fault currents, where as the load interrupter switches are rated for load current switching only.
- Vacuum circuit breakers allow use of various relay schemes (for example, phase and ground overcurrent, under and overvoltage, under and overfrequency, directional overcurrent, directional power, differential, etc.) for protection and coordination as desired for a given application. Relaying schemes are either not possible or very limited when using load interrupter switches.
- Drawout circuit breakers are easily maintainable.

Metal-Clad

Compartmentalized with drawout circuit breaker switches (CBS). The metal-clad assembly and all components are designed, manufactured and tested in accordance with the latest applicable standards of NEMA® SG-4 and SG-5, and but not limited to IEEE C37.20.2. UL® and CSA® listings are available.

The MV ATS style is perfect for any emergency or backup system and suitable for service entrance use. It provides reliable automatic transfer to standby power when:

- The normal power source fails.
- Peak shaving is used.
- The power source is unreliable.
- Backup power is mandated by code or local regulations.

Eaton manufactures all MV ATS basic components and provides one year full warranty, eliminating problems that can arise with multiple warranties for a single piece of equipment. Assembly and manufacturing is completed in ISO® certified facilities.

Seismic Qualified

Eaton's medium voltage circuit breaker transfer switch assemblies are seismically tested or qualified by analysis based on actual testing done on similar equipment, to exceed the requirements based upon the following 2006 IBC parameters:

- Site Classification D (Also covers Site Classification A, B and C):
  - F_a = 1.0 (and higher for lower values of S_S)
  - F_v = 1.5 (and higher for lower values of S_1)
- Spectral Response Accelerations:
  - S_S = 256% g, and S_1 = 124% g
  - S_{MS} = 2.56 g, S_{M1} = 1.86 g
  - S_{DS} = 1.7 g, S_{D1} = 1.24 g
- Eaton's test criteria:
  - Frequency range: 1 to 100 Hz
  - Peak front-to-back and side-to-side spectral accelerations in the frequency range of 3 to 12 Hz plotted at 5% damping are greater than 2.5 g (Z_{DS}). The vertical capabilities are at least 2/3 that of the horizontal. These levels exceed the required 2006 UBC seismic levels for the entire continental United States with the exception of areas near the New Madrid fault zone.

Standard Control Features

- Lights:
  - Normal position
  - Emergency position
  - Normal source available
  - Emergency source available
- Undervoltage/overvoltage, underfrequency/overfrequency sensing on Source 1.
- Undervoltage/overvoltage, underfrequency/overfrequency sensing on Source 2.
- Six timers:
  - TDNE = Time Delay Normal to Emergency
  - TDEN = Time Delay Emergency to Normal
  - TDES = Time Delay Engine Start
  - TDEC = Time Delay Engine Cooldown
  - TDEF = Time Delay Emergency Failure
  - TDN = Time Delay Neutral
- Programmable engine test mode and test run timer.
- Source-1 available — one Form C contact.
- Source-2 available — one Form C contact.
- Communication capability via PowerNet™.
- Real-time clock and date.
- 5H = Phase reversal on Source 2.
- 26H = Phase reversal on Source 1.
- 26D = Go to Emergency feature.
- 10B = Preferred source selector for use on systems comprised of utility/utility or utility/generator.
- 16B = Overcurrent lockout feature.
- 23J = Plant Exerciser with fail-safe feature.
- 29J = Automatic or manual pushbutton re-transfer selection.
- 46 = PT ratio set points
- 47E = Closed Transition with Default to In-Phase Transition with Default to Time Delay Neutral.

Note: Feature 47E is only included for Closed Transition Switches.

Additional Options

- Overcurrent protection:
  - Normal
  - Emergency
- Cutler-Hammer® IQ DP-4000 metering: normal and emergency.

- Cutler-Hammer IQ Analyzer metering: normal and emergency.
- Space heater.
- Closed transition with sync check.
- Partial discharge insulgard relay.
- Communications:
  - INCOM
  - Modbus
  - Ethernet

Circuit Breaker Switches

Switching is provided by Eaton's Cutler-Hammer VCP-W Vacuum Circuit Breakers in ANSI voltages of 5 kV, 15 kV, 27 kV and 38 kV.

Circuit breaker switches (CBS) are horizontal drawout types up to 27 kV. The 38 kV CBS is a roll-on-the-floor design and rolls directly in and out of the bottom compartment.

The CBS includes five major components: vacuum interrupter pole units, stored energy mechanism, push rod assembly, primary disconnecting contacts, and removable glass polyester insulating barriers.

Vacuum Interrupters

Each CBS includes three vacuum interrupters, separately mounted in a self-contained, self-aligning pole unit that is easily removed. A direct reading contact erosion indicator is clearly visible when the CBS is withdrawn from the compartment. Each vacuum interrupter pole unit is mounted on glass polyester supports for 5 kV and 15 kV ratings and epoxy supports for 27 kV and 38 kV ratings.

The unique, patented nonsliding current transfer system from the movable vacuum interrupter stem to the CBS consists of a series of tin-plated, high conductivity copper leaf conductors. The conductors are swaged onto the movable vacuum interrupter stem and provide:

- Improved current flow because the multi-point contact offers very low electrical resistance.
- No required maintenance because the current transfer from the movable stem to the CBS primary conductor is a nonsliding and nonrolling design.
- Longer vacuum interrupter life.

Operation

Operation is by a motor-charged stored energy spring mechanism charged by a universal electric motor, or a manual levering tool in an emergency. The stored energy mechanism is a true mechanically and electrically trip-free design, meaning that while holding a mechanical trip command, the breaker contacts will not close or touch while receiving an electrical or mechanical close command.

Each CBS is electrically operated by these control voltages: 120 Vac close and ac capacitor trip, or 48 Vdc, 125 Vdc or 250 Vdc. ac control voltage is derived from potential transformers connected in the line side of each CBS. The dc control voltage is provided by the user.

Controls and indicators are functionally grouped on the front control panel and include: closing spring status, close and trip button, operation counter, contact status indicators, and a "T" handle latch (located at the bottom of the control panel). Each CBS includes a control switch and red and green lights to indicate the CBS contact position.

Contacts

Primary disconnects are silver-plated copper. Secondary contacts are silver-plated and automatically engage in the CBS operating position. They can be manually engaged in the CBS test position.

Safety

Double deadfront shields isolate the operator from high voltage when the CBS is energized. The CBS can be connected or disconnected with the compartment door closed by a manually operated levering device.

Safety interlocks provide for the mechanism to be held mechanically trip-free during racking. Closing springs will discharge automatically when the CBS is being withdrawn.

Maintenance

The stored energy mechanism and control components are easily accessible and can be inspected by removing the front panel. Minor maintenance when required, such as lubricating the mechanism and accessing the control components, is simplified.

Operation Sequence

Transfer is initiated by the Cutler-Hammer IQ Transfer microprocessor-based logic door mounted device.

Two IQ Transfer models, Open or Closed Transition, are available.

Both models are identical except that the closed transition IQ Transfer will not initiate the transfer until both power sources are synchronized in voltage, frequency and phase angle.

If a power source is lost, the closed transition IQ Transfer will operate in the open mode.

IQ Transfer capabilities include:

- Continuous monitoring of all three phases of all loads and voltage on the source and bus.
- Generator testing under load.
- Simplified, custom programming on the faceplate keypad to meet specific user requirements. There are no DIP switches to set.
- Visual status indications of both sources and the load.
- Easy-to-use:
  - At-a-glance overview of the MV ATS status and parameters and key diagnostic data.
  - Real-time values for volts and frequency can be viewed on the LED display plus the power source in use.
  - Displays historical information including Source 1 and Source 2 run time, available time, and connected time, load energized time, number of transfers, and the date, time and reason for the last 16 transfers.

Open Transition Transfer

When the system is operating from the normal source, the IQ Transfer indicates real-time values for volts and frequency on the front panel LED display with an indication of the power source in use. The IQ Transfer continuously monitors either single-phase or 3-phase voltages for Source 1, Source 2 and the load. The IQ Transfer allows system configuration selection for Source 1/Source 2 as Utility/Generator, or Dual Generator, or Dual Utility.

When Source 1 voltage or frequency is detected to be below user-programmed set points, transfer to Source 2 is initiated. The transfer occurs when Source 2 voltage and frequency are detected to be within programmed parameters.

While the load is connected to Source 2, the IQ Transfer continues to monitor Source 1. When Source 1 voltage and frequency return to within programmed parameters of Source 1, and after a programmed time delay, load transfer back to Source 1 is initiated.

The load transfer back to Source 1 is open type because the Source 2 circuit breaker switch is opened first after which the Source 1 circuit breaker switch is closed.

IQ Transfer

IQ Transfer

Closed Transition Transfer

When the system is operating from the normal source, Eaton's Cutler-Hammer IQ Transfer indicates real-time values for volts and frequency on the front panel LED display with an indication of the power source in use. The IQ Transfer continuously monitors either single-phase or 3-phase voltages for Source 1, Source 2 and the load. The IQ Transfer allows system configuration selection for Source 1/Source 2 as Utility/Generator, or Dual Generator, or Dual Utility.

The IQ Transfer provides for selection of closed transition enabled or disabled.

When enabled, it is possible for load to be transferred from Source 1 to Source 2 without interruption of power to the load when both sources are available. The source paralleling during load transfer is less than 100 milliseconds.

When disabled, the two sources cannot operate in parallel.

When Source 1 voltage or frequency is detected to be below the user-programmed set points, transfer to Source 2 is initiated. The transfer occurs when Source 2 voltage and frequency are detected to be within the programmed parameters.

While the load is connected to Source 2, the IQ Transfer continues to monitor Source 1. When Source 1 frequency and voltage return to within programmed limits of Source 1, and after a programmed time delay, the load is transferred back to Source 1.

When the closed transition mode is enabled, Source 1 is closed first, then Source 2 is opened without power interruption to the load. When in the disabled mode, Source 2 is opened first and then Source 1 is closed.

Note: See **Page 12.0-6** for IQ Transfer programming selections and ratings.

Bus and Bus Insulation

Bus

The main bus is copper. A set of either 1200 A or 2000 A main bus is provided with provisions for future extension.

Bolted bus connections are silver-plated for positive contact and low resistance. Each joint is insulated with easily-installed boots. The bus is braced to withstand fault currents equal to the close and latch rating of the circuit breakers. All bus, bus supports and connections will withstand stresses produced by currents equal to the momentary ratings of the circuit breakers.

Temperature rise of the bus and connections conforms to ANSI standards and is documented by factory testing.

The copper ground bus extends the entire length of the MV ATS. An optional fully rated neutral bus (insulated or noninsulated) extends the entire length of the MV ATS.

Bus Insulation

The main bus is insulated with epoxy, applied in the fluidized bed process. When applied in this process, the epoxy is nonhygroscopic, inert, and track, mold and fungus resistant.

Thermal and electrical performance is enhanced because the epoxy is bonded directly to the bus bar conductor, eliminating the air gap between insulation and conductor. Heat transfer is greatly improved resulting in the bus system running cooler. No air gap exists for insulation damage or corona discharge.

The main bus supports are glass polyester for 5 kV and 15 kV ratings (except 63 kA rating) and cycloaliphatic epoxy for 27 kV and 38 kV ratings. The main bus supports for 63 kA ratings are porcelain.

Terminations and Secondary Wiring

Eaton's Cutler-Hammer MV ATS includes terminal blocks for secondary wire terminations plus an inventory of spare terminal connections. One control circuit cutout device is provided in each CBS housing.

Secondary wire is #14 AWG, Type SIS rated 600 Vac, 90°C. The wires terminate on terminal blocks, identified on marker strips numbered in agreement with the connection diagrams.

Incoming line and feeder cable lugs are provided.

Protective Relays

Customer-requested protective relays can be provided and installed in the MV ATS. Refer to **Section 4**.

Partial Discharge Sensing and Monitoring

Refer to Section 5.3 for details of partial discharge sensing and monitoring option.

Metering

Customer-requested metering can be provided. Associated instrument transformers are included.

Current transformers are provided and wired to shorting-type terminal blocks.

Potential transformers are provided including primary and secondary fuses with disconnecting means for metering.

A choice of Cutler-Hammer microprocessor-based metering is available, such as IQ Series, or Power Xpert. Refer to **Section 2**.

Enclosure Construction

Metal-clad integrity provides maximum circuit separation and safety through isolated grounded metal compartments, complete isolation of all conductors, and no live parts are exposed when a door is opened.

Communications

When the IQ Transfer is provided with a Cutler-Hammer IPONI communication network interface, an MV ATS can be included on a PowerNet communications network, providing for remote monitoring and control using a PC.

Outdoor Enclosures

Two outdoor enclosure styles are available.

- Aisleless, mounted on an integral base frame with a weatherproof enclosure for field assembly. A weatherproof door is provided on the circuit breaker switch drawout side.
- Sheltered aisle mounted on an integral base frame with a weatherproof enclosure for field assembly. The enclosure is extended on the circuit breaker switch drawout side to form an operating and/or maintenance aisle with sufficient space to permit interchange of circuit breaker

switches. A weatherproof door with an inside quick release latch mechanism is located at each end of the inside, even when locked from the outside. Interior lights, light switches, and duplex ground fault receptacles are provided in the aisle.

Each vertical section is provided with tubular-type space heaters operated at half voltage for long life. 500 or 250 volt rated heaters are used at 240 or 120 volts respectively. Power is furnished from a control power transformer mounted in the MV ATS.

As an option, heaters can be wired to provide temporary heating during storage.

Auxiliary Equipment

Voltage and Control Power Transformers

Voltage transformers are drawout-drawer mounted for ratings up to 27 kV.

Control power transformers up to 15 kV, 15 kVA, single-phase are drawout-drawer mounted.

Voltage transformers for 38 kV rating and control power transformers for 27 kV and 38 kV ratings are fix mounted with primary fuses in drawout doors.

Up to three voltage transformers can be mounted in a drawer.

Drawers are in enclosed auxiliary compartments and can be withdrawn on rails for easy inspection, testing and fuse replacement. When a drawer is withdrawn, the fuses are automatically disconnected, grounded, and primary bus stabs isolated by glass polyester shutters.

A mechanical interlock is provided so that the secondary circuit breaker must be open before the control power transformer drawer or control power transformer primary fuse drawer can be withdrawn.

Current Transformers

Ring-type current transformers are provided with thermal and mechanical ratings coordinated with the circuit breakers. Current transformer accuracy meets ANSI standards.

Standard current transformer location on the bus side and line side of the 5 kV, 15 kV and 27 kV CBS units provide front accessibility so that adding or changing transformers can be accomplished when an Eaton's Cutler-Hammer MV ATS is de-energized without breaking the high voltage connections and primary insulation.

Shorting terminal blocks are provided on each current transformer secondary.

Nameplates

External engraved nameplates are screw mounted on the face of each MV ATS assembly for each main and feeder circuit. Nameplates are laminated plastic with black 0.2-inch (5.1 mm) high characters on a white background.

A master nameplate includes MV ATS designation, voltage and ampere ratings, short circuit rating, manufacturer's name, and shop order number.

Internal engraved nameplates are screw mounted within the MV ATS to identify control components such as fuse blocks, relays, pushbuttons and switches.

Finish

Standard finish, inside and out, is a thermosetting, polyester powder paint (ANSI 61 gray) applied electrostatically to all metal parts (steel and aluminum) that are first precleaned and phosphatized.

This finish provides excellent mechanical strength and scratch resistance, resists chalking caused by the sun's ultraviolet rays, and meets the salt spray requirements of ASTM B-117.

Accessories

Provided for testing, inspection, maintenance and operation.

Standard Accessories

- Maintenance tool for manually charging the circuit breaker closing spring and manually operating the shutter.
- Levering crank for moving the circuit breaker between test and connected positions.
- Test jumper for electrically operating the circuit breaker while out of the compartment.
- Lifting yoke for lifting the circuit breaker on or off compartment rails.

Note: For 5 kV, 15 kV and 27 kV circuit breakers.

- Rail extensions and rail clamps.

Note: For 5 kV, 15 kV and 27 kV circuit breakers.

Optional Accessories

- Portable lifting device for lifting the circuit breaker on or off the rails.

Note: For 5 kV, 15 kV and 27 kV circuit breakers.

- Ramp for rolling a circuit breaker directly onto the floor from the lower compartment.

Note: For 5 kV, 15 kV and 27 kV circuit breakers.

- Test cabinet for testing electrically operated circuit breakers' outside housing.
- Dockable transport dolly for moving a circuit breaker outside of the cabinet.

Note: For 5 kV, 15 kV and 27 kV circuit breakers.

- Electrical levering device.

Factory Testing

Circuit Breaker Switch Element

- Alignment test with master cell to verify all interfaces and interchangeability.
- Circuit breaker operated over a range of minimum to maximum control voltage.
- One-minute dielectric test.

Circuit Breaker Switch Housing

- Alignment test with master circuit breaker to verify interfaces.
- One-minute dielectric test on primary and secondary circuits.
- Operational sequence test to verify operation of wiring, relays and other devices.
- Final inspection and quality check.

Three certified copies of the factory test reports are provided.

Test Witnessing

As an option, all factory tests can be witnessed by the customer or customer representative.

Installation

Complete installation, startup, testing and long-term maintenance is available from Eaton Electrical Services & Systems (EESS).

Table 12.0-1. IQ Transfer Programming Selections

Parameters	Set Points	IQ Transfer	
		Open Transition	Closed Transition
Time Delay Normal to Emergency Time Delay Emergency to Normal Time Delay Engine Cool-Off	0 to 1800 Seconds 0 to 1800 Seconds 0 to 1800 Seconds	✔ ✔ ✔	✔ ✔ ✔
Time Delay Engine Start Time Delay Neutral ①	0 to 120 Seconds 0 to 120 Seconds or Based on Load Voltage Decay (10 to 30% of Nominal Voltage)	✔ ✔	✔ ✔
Closed Closed Transition Frequency Differential Closed Transition Voltage Deviation	Enabled or Disabled 0.0 to 0.3 Hz 1 to 5% (Voltage)	— — —	✔ ✔ ✔
1-Phase In-Phase Frequency Differential Synchronized Time	Enabled or Disabled 0.0 to 3.0 Hz 1 to 60 Minutes	— — —	✔ ✔ ✔
Load Sequencing ① Pretransfer Signal Device ①	0 to 10 Devices 0 to 20 Seconds (Up to 10 Devices)	✔ ✔ ✔	✔ ✔ ✔
Plant Exerciser ① Preferred Source Selector ① Sensing System Selection	Load or No Load Transfer (Selectable) Source 1 or Source 2 or None 3-Phase or 1-Phase Utility/Generator or Utility/Utility or Generator/Generator	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔

① Optional parameters.

Table 12.0-2. IQ Transfer Ratings

Input Control Power Range	65 Vac rms to 160 Vac rms, 50/60 Hz		
Voltage Measurements of:	Source 1 V_{AB} Source 1 V_{BC} Source 1 V_{CA}	Source 2 V_{AB} Source 2 V_{BC} Source 2 V_{CA}	Load V_{AB} Load V_{BC} Load V_{CA}
Voltage Measurement Range Voltage Measurement Accuracy Frequency Measurement for:	0 to 790 Vac rms, 50/60 Hz ± 2% of Nominal Range Source 1 and Source 2		
Frequency Measurement Range Frequency Measurement Accuracy Undervoltage Sensing	40 Hz to 60 Hz ± 0.1 Hz Source 1 and Source 2		
Undervoltage Dropout Range Overvoltage Dropout Range ② Underfrequency Dropout Range ② Overfrequency Dropout Range ②	50 to 90% of Nominal Range 105 to 120% of Nominal Voltage 90 to 100% of Nominal Frequency 100 to 120% of Nominal Frequency		

Contact Outputs

Two Form A Contacts for Generator Start	5 A, 250 Vac 5 A, 30 Vdc
Four Form A Contacts for Control Functions	10 A, 250 Vac 10 A, 30 Vdc
Form C Contacts for Control Functions	10 A, 250 Vac 10 A, 30 Vdc

Front Panel Indications

Mode Automatic Test Program	 Blinking LED Indicates Automatic Operation Illuminated LED Indicates Unit is in the Test Mode Illuminated LED Indicates Unit is in the Program Mode Blinking LED Indicates the User is Viewing Set Points in the Program Mode
LED Lights Source 1 Available: Amber Source 1 Connected: Green Source 1 Preferred: Red Load Energized: Red	 Source 2 Available: Amber Source 2 Connected: Green Source 2 Preferred: Red
LED Display History Information Set Points Real-Time Clock	 — — —

Environmental Temperature Range

Operation Storage	-20°C to +70°C -30°C to +85°C

② Optional.

Drawout Vacuum Circuit Breakers

Refer to Tables 5.4-1, 5.4-2 and 5.4-3 in Section 5.4 for available VCP-W, VCP-WC and VCP-WG circuit breakers.

Please note maximum available continuous current is limited to 2000 A for medium voltage transfer switch.

Typical One-Line Diagram

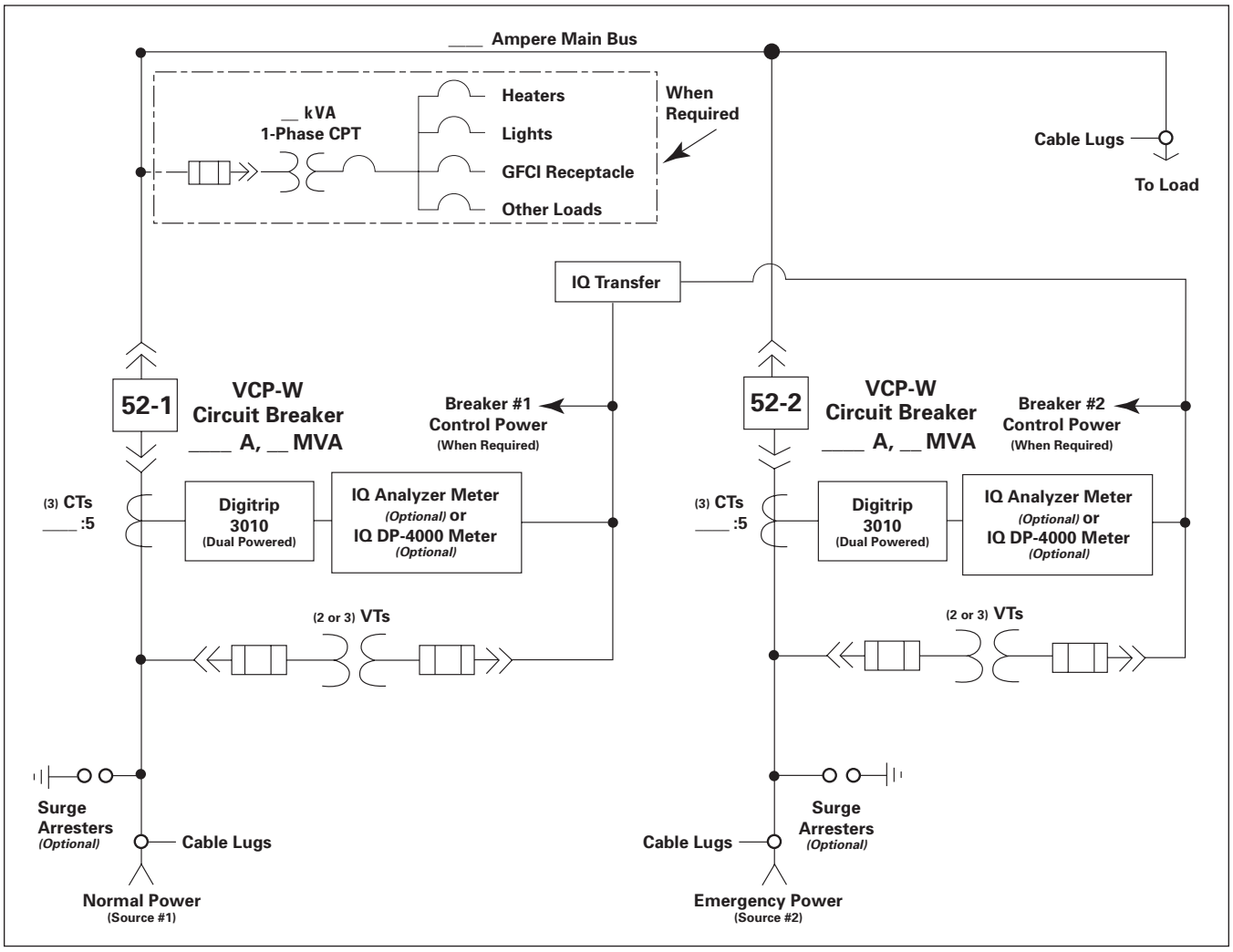

Figure 12.0-1. Typical MV ATS One-Line Diagram — Using Vacuum Breakers

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Layout Dimensions in Inches (mm)

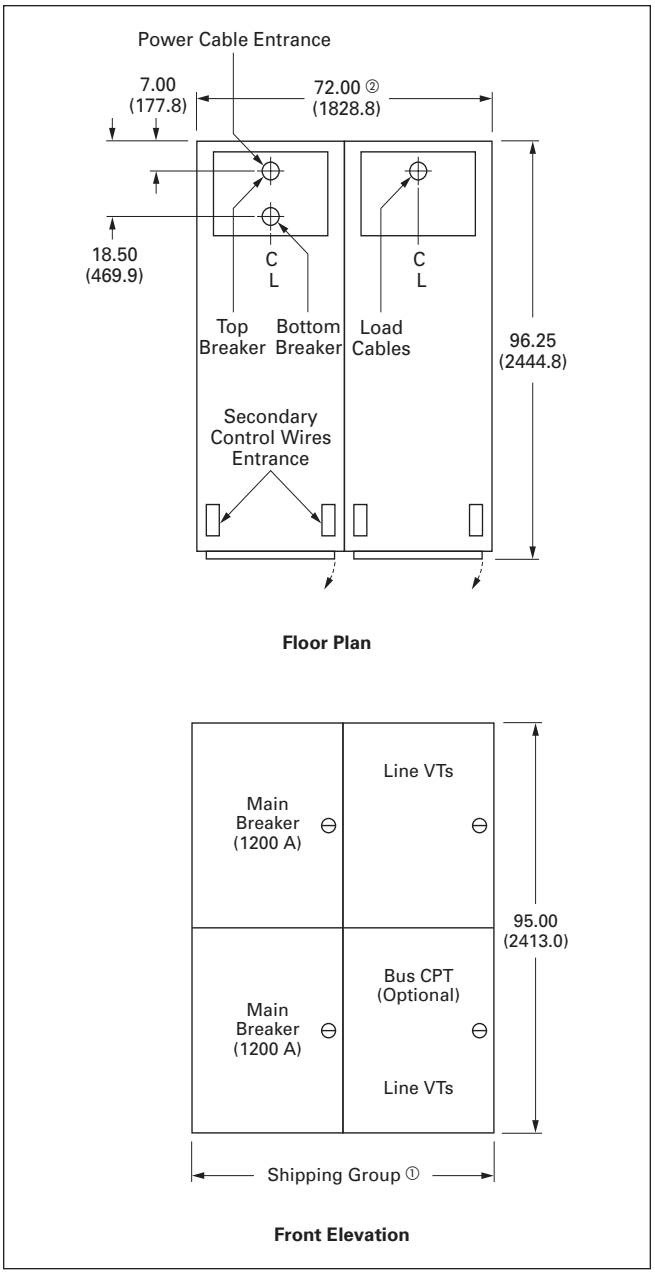

Figure 12.0-2. Indoor 5 kV or 15 kV, 1200 A Main Breakers

① Circuit breakers are packaged and shipped separately.

② Indoor 5 kV, 1200 A, 250 MVA rating is available in narrow design with overall width of 52.00 inches (1320.8 mm).

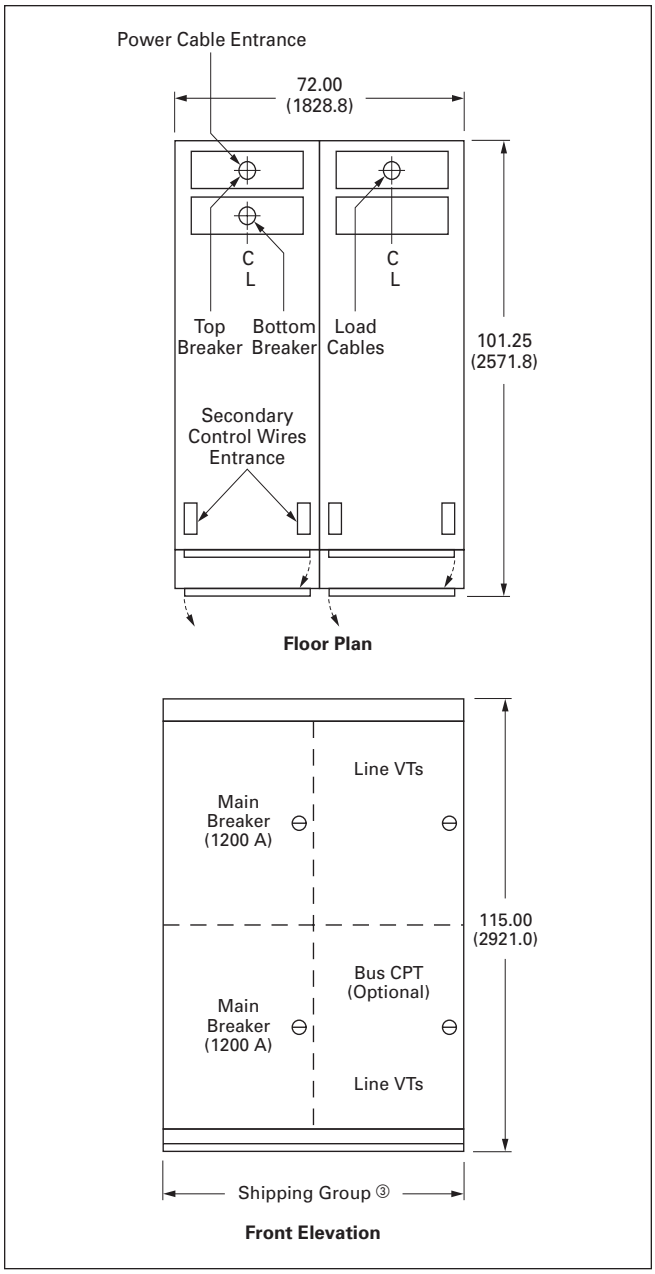

Figure 12.0-3. Outdoor Aisleless 5 kV or 15 kV, 1200 A Main Breakers

③ Circuit breakers are packaged and shipped separately.

Table 12.0-3. Approximate Shipping Weight in Lbs. (kg)

Equipment Type	Switchgear Assembly	Circuit Breaker
Indoor	4,400 (1,998)	350 – 575 (159 – 261)
Outdoor Aisleless	5,600 (2,542)	350 – 575 (159 – 261)

Table 12.0-4. Minimum Recommended Clearances in Inches (mm)

Equipment Type	Front	Side	Rear
Indoor	70.00 (1778.0)	32.00 (812.8)	36.00 (914.4)
Outdoor Aisleless	70.00 (1778.0)	32.00 (812.8)	36.00 (914.4)

Layout Dimensions in Inches (mm)

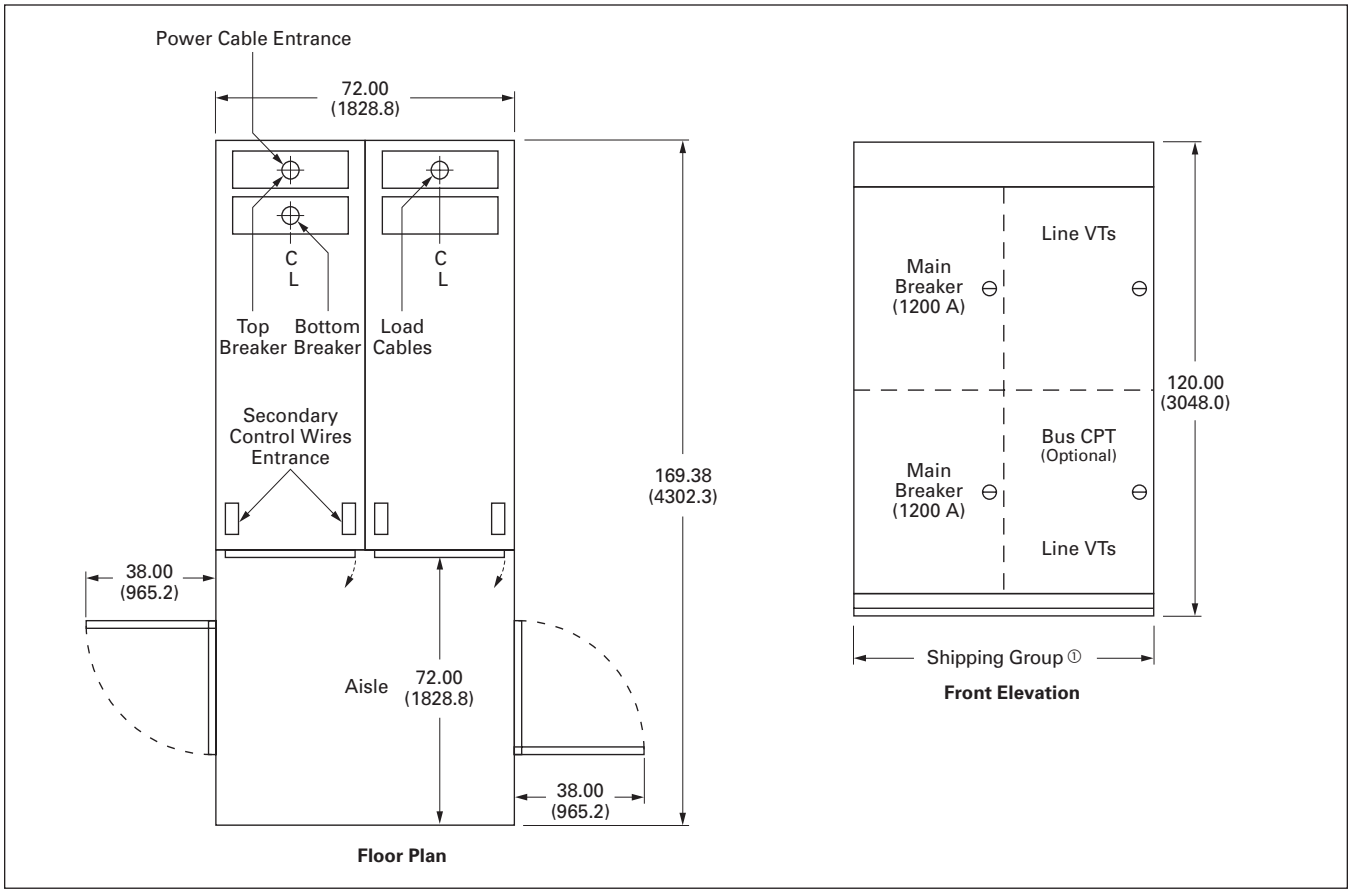

Figure 12.0-4. Outdoor Sheltered Aisle 5 kV or 15 kV, 1200 A Main Breakers

① Circuit breakers are packaged and shipped separately.

Table 12.0-5. Approximate Shipping Weight in Lbs. (kg)

Equipment Type	Switchgear Assembly	Circuit Breaker
Outdoor Sheltered Aisle	8,000 (3,632)	350 – 575 (159 – 261)

Table 12.0-6. Minimum Recommended Clearances in Inches (mm)

Equipment Type	Front	Side	Rear
Outdoor Sheltered Aisle	N/A	38.00 (965.2)	36.00 (914.4)

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Layout Dimensions in Inches (mm)

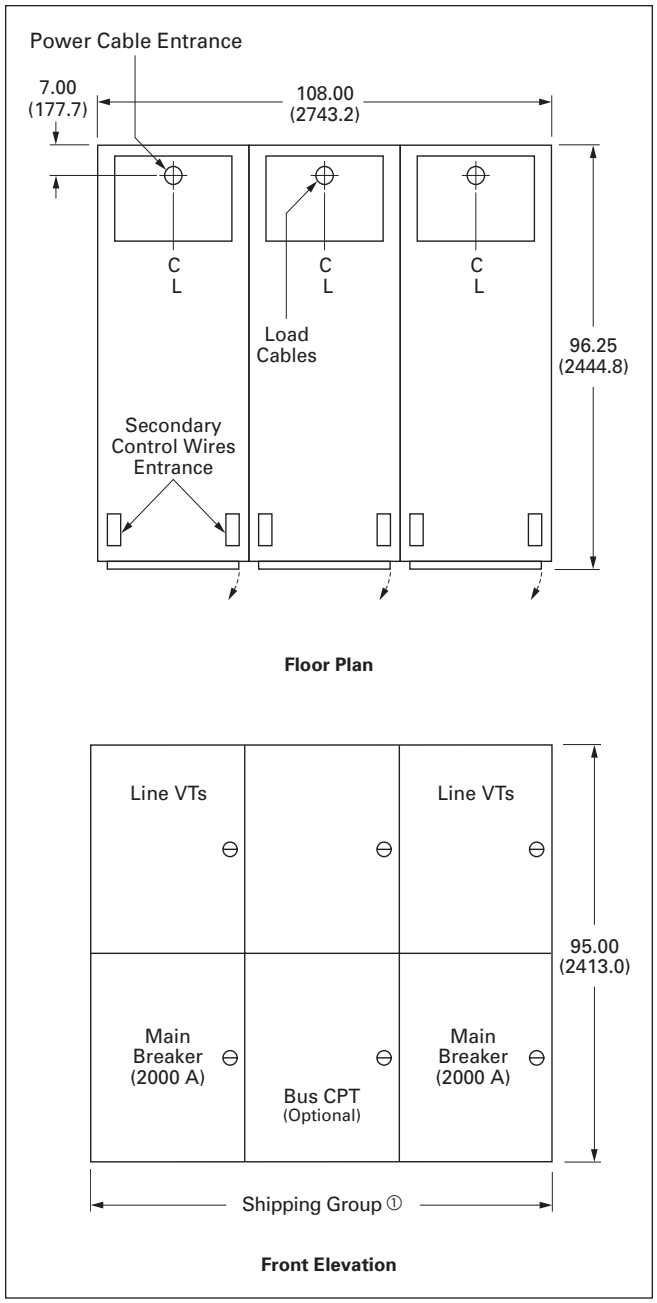

Figure 12.0-5. Indoor 5 kV or 15 kV, 2000 A Main Breakers

① Circuit breakers are packaged and shipped separately.

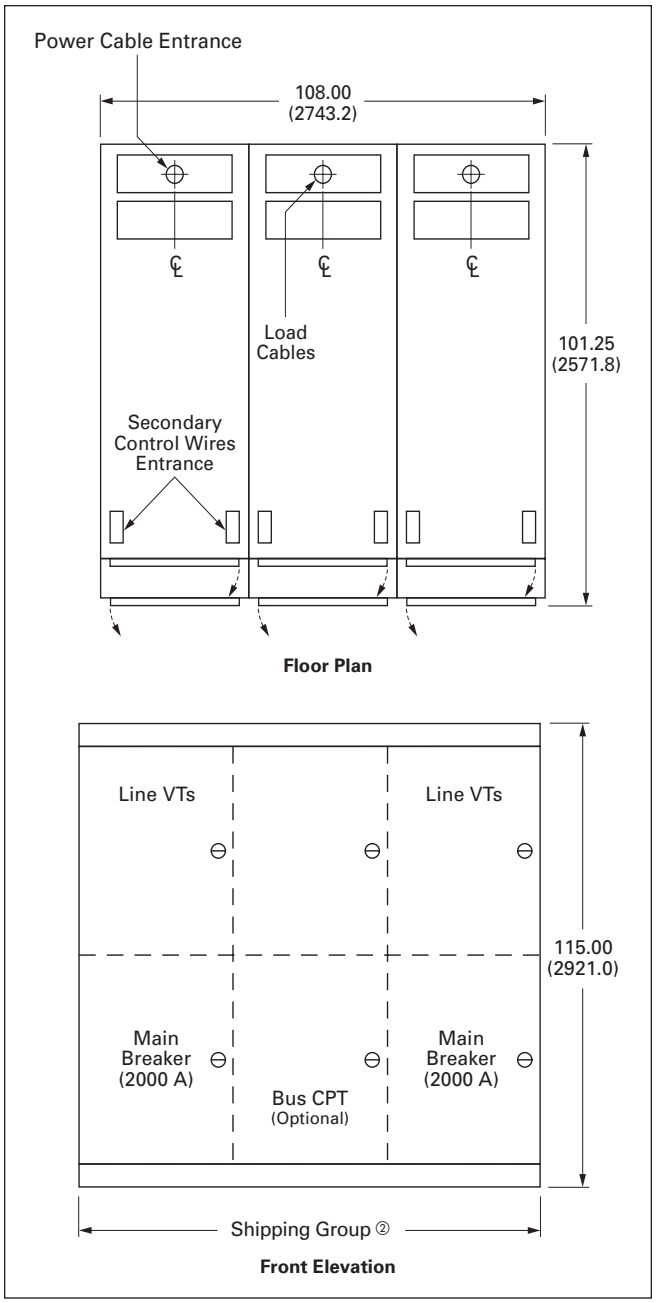

Figure 12.0-6. Outdoor Aisleless 5 kV or 15 kV, 2000 A Main Breakers

② Circuit breakers are packaged and shipped separately.

Table 12.0-7. Approximate Shipping Weight in Lbs. (kg)

Equipment Type	Switchgear Assembly	Circuit Breaker
Indoor	6,900 (3,133)	410 – 575 (186 – 261)
Outdoor Aisleless	8,700 (3,950)	410 – 575 (186 – 261)

Table 12.0-8. Minimum Recommended Clearances in Inches (mm)

Equipment Type	Front	Side	Rear
Indoor	70.00 (1778.0)	32.00 (812.8)	36.00 (914.4)
Outdoor Aisleless	70.00 (1778.0)	32.00 (812.8)	36.00 (914.4)

Layout Dimensions in Inches (mm)

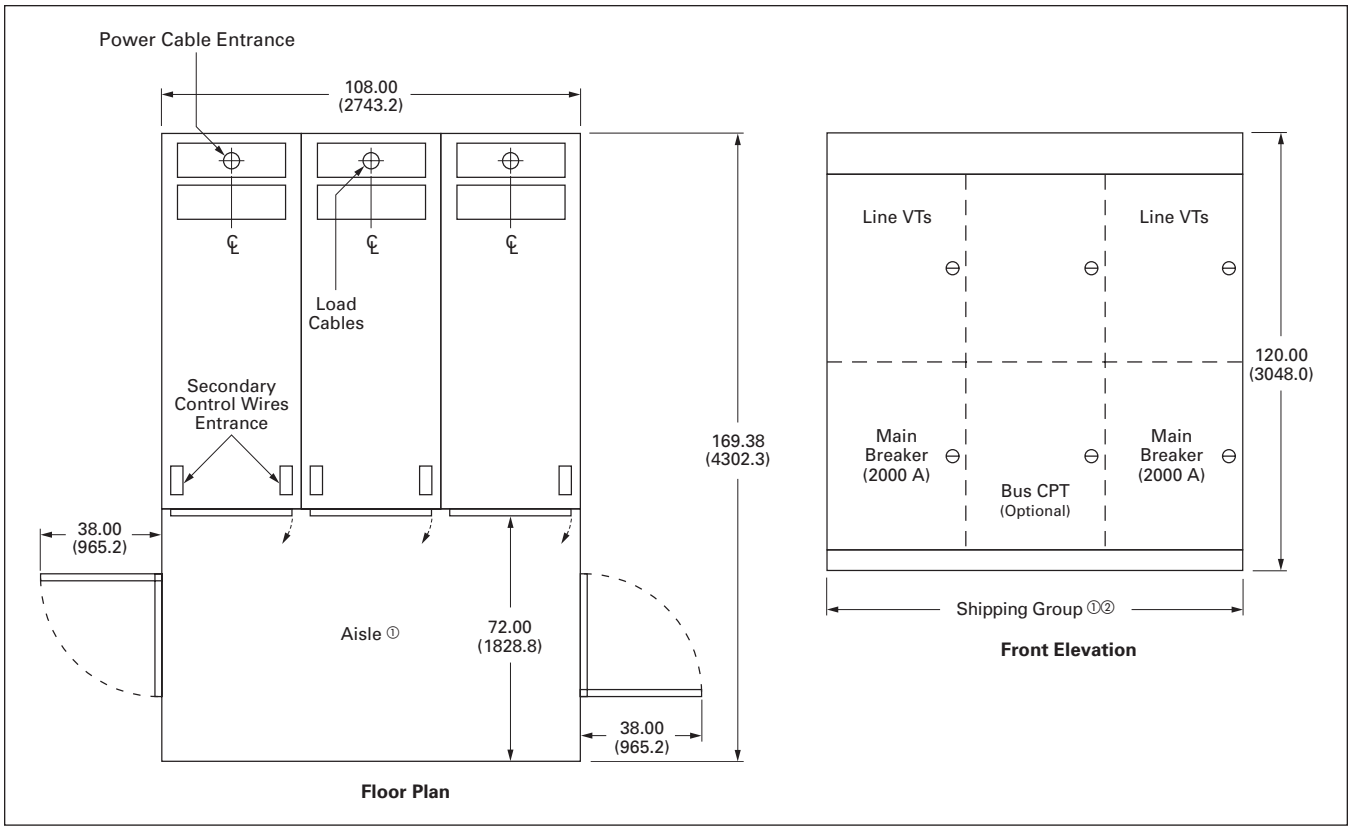

Figure 12.0-7. Outdoor Sheltered Aisle 5 kV or 15 kV, 2000 A Main Breakers

① Aisles shipped separately.
② Circuit breakers are packaged and shipped separately.

Table 12.0-9. Approximate Shipping Weight in Lbs. (kg)

Equipment Type	Switchgear Assembly	Circuit Breaker
Outdoor Sheltered Aisle	12,300 (5,584)	410 – 575 (186 – 261)

Table 12.0-10. Minimum Recommended Clearances in Inches (mm)

Equipment Type	Front	Side	Rear
Outdoor Sheltered Aisle	N/A	38.00 (965.2)	36.00 (914.4)

12

Layout Dimensions in Inches (mm)

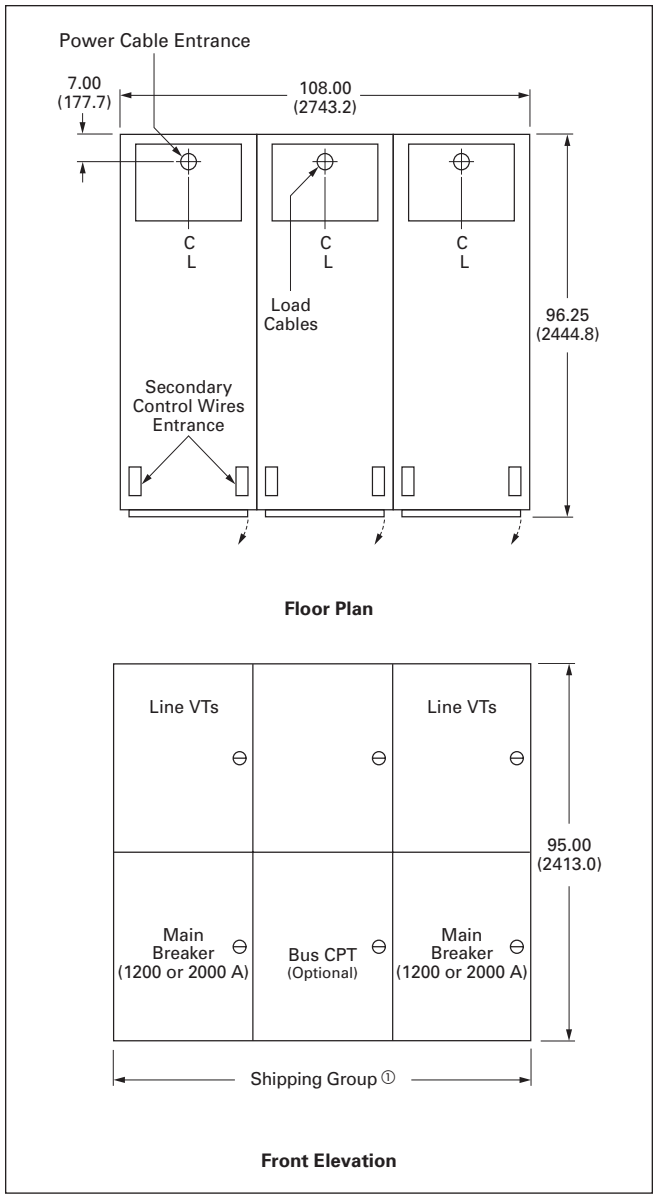

Figure 12.0-8. Indoor 27 kV, 1200 or 2000 A Main Breakers

① Circuit breakers are packaged and shipped separately.

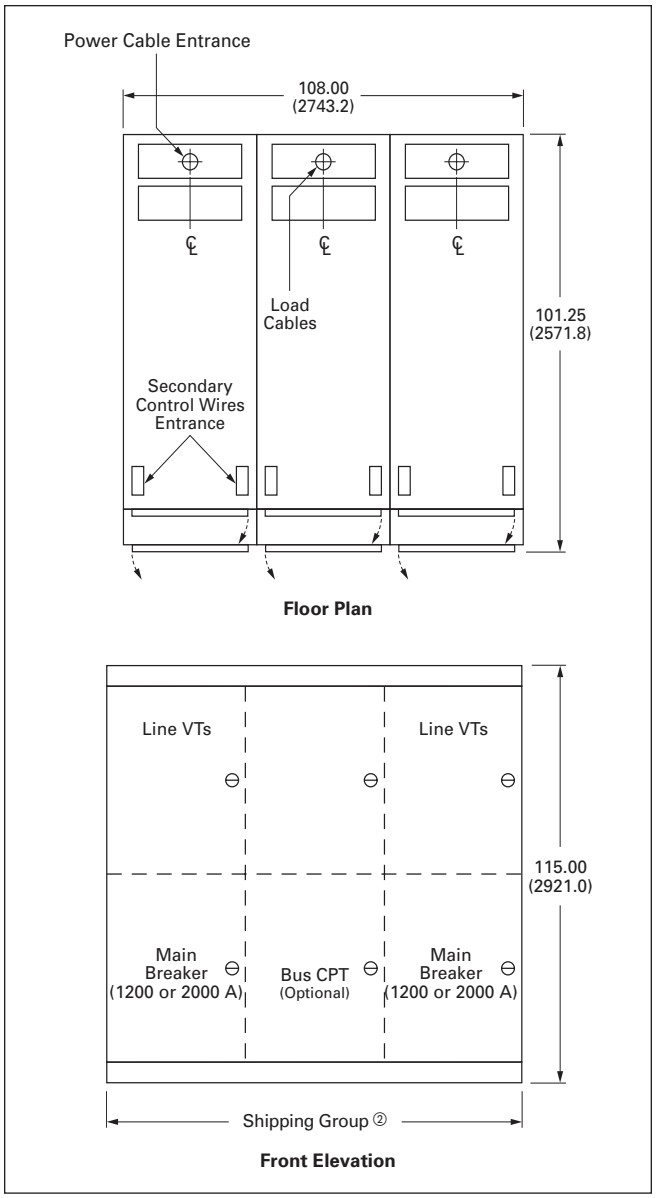

Figure 12.0-9. Outdoor Aisleless 27 kV, 1200 or 2000 A Main Breakers

② Circuit breakers are packaged and shipped separately.

Table 12.0-11. Approximate Shipping Weight in Lbs. (kg)

Equipment Type	Switchgear Assembly	Circuit Breaker
Indoor 1200 A	7,100 (3,223)	415 (188) each
Indoor 2000 A	7,400 (3,360)	475 (216) each
Outdoor Aisleless 1200 A	8,900 (4,041)	415 (188) each
Outdoor Aisleless 2000 A	9,200 (4,177)	475 (216) each

Table 12.0-12. Minimum Recommended Clearances in Inches (mm)

Equipment Type	Front	Side	Rear
Indoor	70.00 (1778.0)	32.00 (812.8)	36.00 (914.4)
Outdoor Aisleless	70.00 (1778.0)	32.00 (812.8)	36.00 (914.4)

Layout Dimensions in Inches (mm)

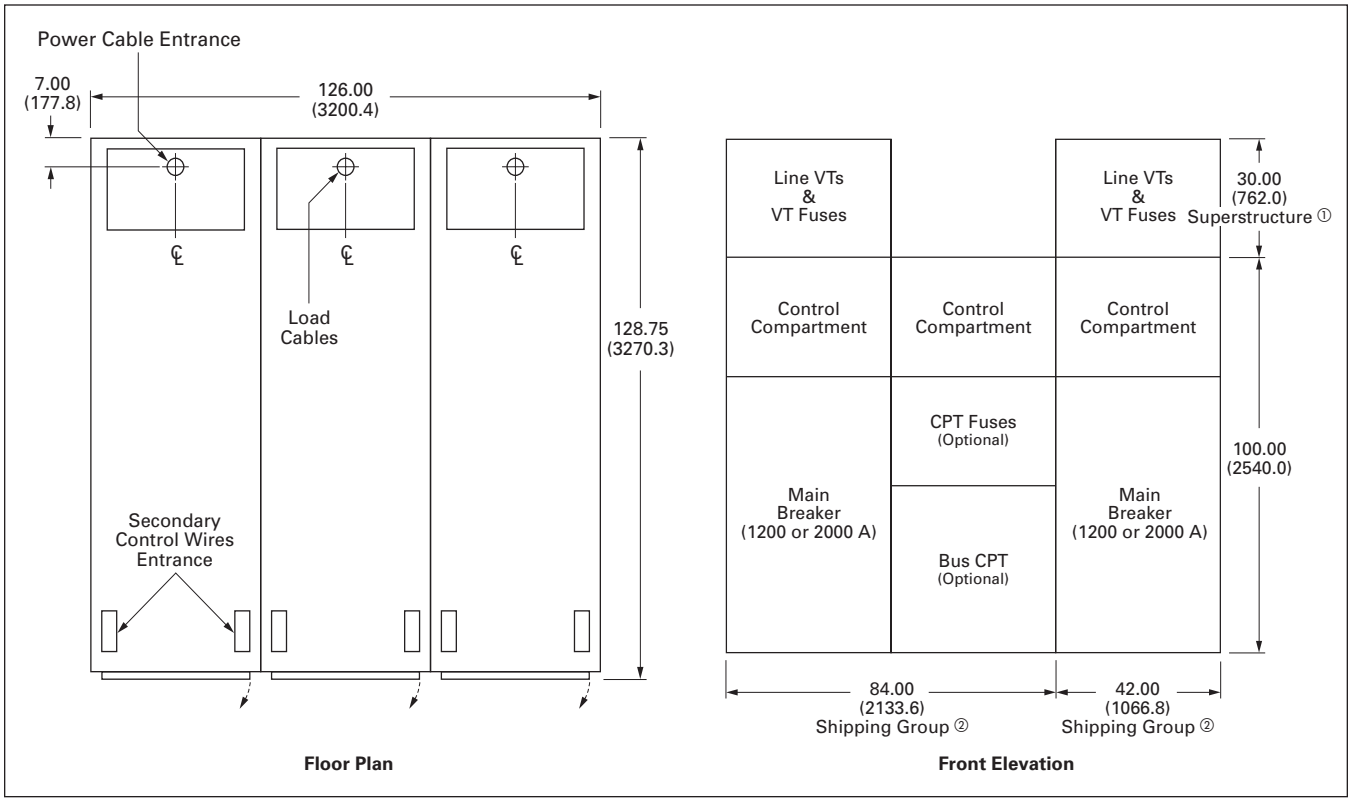

Figure 12.0-10. Indoor 38 kV, 1200 or 2000 A Main Breakers

① Each superstructure is shipped separately.

② Circuit breakers are packaged and shipped separately.

Table 12.0-13. Approximate Shipping Weight in Lbs. (kg)

Equipment Type	Switchgear Assembly	Circuit Breaker
Indoor 1200 A Indoor 2000 A	7,400 (3,360) 7,700 (3,496)	1080 (490) each 1140 (518) each

Table 12.0-14. Minimum Recommended Clearances in Inches (mm)

Equipment Type	Front	Side	Rear
Indoor	84.00 (2133.6)	38.00 (965.2)	42.00 (1066.8)

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Table 12.0-15. Available Options

Item Description	
Type of Transfer Logic (Select One)	
OT ①	Open Transition
CT	Closed Transition
IQ Transfer Device (Select One)	
I1 ①	IQ Transfer Device without PONI Card
I2	IQ Transfer Device with PONI Card
Type of Circuit Breaker	
V ①	Type VCP-W Vacuum Circuit Breakers
X	Type VCP-WC, Vacuum Circuit Breakers
Y	Type VCP-WG, Vacuum Circuit Breakers
Circuit Breaker Continuous Current Rating (Select One)	
12 ①	1200 A Breaker
20	2000 A Breaker
Circuit Breaker Voltage and Interrupting Rating (Select One)	
A	4.76 kV, 29 kA rms symmetrical, 250 MVA, K = 1.24
B	4.76 kV, 41 kA rms symmetrical, 350 MVA, K = 1.19
C	4.76 kV, 63 kA rms symmetrical, K = 1
D	8.25 kV, 33 kA rms symmetrical, 500 MVA, K = 1.25
E	8.25 kV, 63 kA rms symmetrical, K = 1
F	15 kV, 18 kA rms symmetrical, 500 MVA, K = 1.3
G	15 kV, 28 kA rms symmetrical, 750 MVA, K = 1.3
H	15 kV, 37 kA rms symmetrical, 1000 MVA, K = 1.3
J	15 kV, 63 kA rms symmetrical, K = 1
K	27 kV, 16 kA rms symmetrical, K = 1
L	27 kV, 22 kA rms symmetrical, K = 1
M	27 kV, 25 kA rms symmetrical, K = 1
N	27 kV, 40 kA rms symmetrical, K = 1
P	38 kV, 16 kA rms symmetrical, K = 1
Q	38 kV, 25 kA rms symmetrical, K = 1
R	38 kV, 31.5 kA rms symmetrical, K = 1
S	38 kV, 40 kA rms symmetrical, K = 1
T	38 kV, 21 kA rms symmetrical, K = 1.65
X	Type VCP-WC, Specify kA Rating
Y	Type VCP-WG, Specify kA Rating
Circuit Breaker Control Voltage (Select One)	
A ①	120 Vac Control Supply from Line VTs
B	48 Vdc Control Supply by Customer
C	125 Vdc Control Supply by Customer
D	250 Vdc Control Supply by Customer
Voltage Transformers (Select One)	
L ①	VTs Connected Line-to-Line
G	VTs Connected Line-to-Ground

Available Options (Continued)

Item Description	
Actual Service Voltage (Select One)	
05A	2300 V
05B	2400 V
05C	3300 V
05D	4000 V
05E	4160 V
05F	4760 V
15A	4800 V
15B	6000 V
15C	6900 V
15D	7200 V
15E	8320 V
15F	11000 V
15G	11500 V
15H	12000 V
15J	12470 V
15K	13200 V
15L	13800 V
15M	14400 V
27A	18000 V
27B	20780 V
27C	20810 V
27D	21000 V
27E	22860 V
27F	23000 V
27G	24940 V
27H	27000 V
27J	28500 V
38A	33000 V
38B	34500 V
XXX	Other — Select Next Closest Voltage Above, and Specify Actual Voltage On the Order
Power System Frequency	
6 ①	60 Hz
5	50 Hz
Standards	
A ①	ANSI/IEEE C37.20.2
B	ANSI/IEEE C37.20.2, CAN/CSA 22.2 No. 31-M89, and EEMAC G83.2
Enclosure (Select One)	
A ①	Indoor, 5 or 15 kV, 36-inch (914.4 mm) Wide Units
B	Outdoor Aisleless, 5 or 15 kV, 36-inch (914.4 mm) Wide Units
C	Outdoor Sheltered Aisle, 5 or 15 kV, 36-inch (914.4 mm) Wide Units
D	Indoor, 27 kV, 36-inch (914.4 mm) Wide Units
E	Indoor, 38 kV, 42-inch (1066.8 mm) Wide Units
F	Indoor, 5 kV 1200 A 250 MVA, 26-inch (660.4 mm) Wide Narrow Design Units
G	Add Space Heaters to Indoor Lineup (Requires CPT Option)

① Factory default item.

Table 12.0-15. Available Options (Continued)

Item Description	
Phase CTs (Select Ratio)	
A	50/5 A, C10
B	75/5 A, C20
C	100/5 A, C20
D	150/5 A, C20
E	250/5 A, C20
F	300/5 A, C50
G	400/5 A, C50
H	500/5 A, C50
J	600/5 A, C100
K	800/5 A, C100
L	1000/5 A, C100
M	1200/5 A, C200
N	1500/5 A, C200
P	2000/5 A, C200
Phase and Ground Overcurrent Relay	
A ①	DT-3010, Dual Powered, 120 Vac Non-Drawout
Metering — Normal and Emergency	
X ①	No Metering
A	IQ DP-4030 without PONI Card
B	IQ DP-4030 with PONI Card
C	IQ Analyzer 6430, without WFD, without PONI Card
D	IQ Analyzer 6430, without WFD, with PONI Card
E	IQ Analyzer 6630, with WFD, without PONI Card
F	IQ Analyzer 6630, with WFD, with PONI Card
CPT (Required for Outdoor and for Indoor with Space Heaters)	
X ①	No CPT
A	5 kV Switchgear CPT, 1-Phase, 15 kVA, 120/240 V Seconds
B	15 kV Switchgear CPT, 1-Phase, 15 kVA, 120/240 V Seconds
C	27 kV Switchgear CPT, 1-Phase, 15 kVA, 120/240 V Seconds
E	38 kV Switchgear CPT, 1-Phase, 15 kVA, 120/240 V Seconds
Surge Arresters	
X ①	No Surge Arresters
A	5 kV Switchgear, Distribution Type Surge Arrester (Low Resistance or Solidly Grounded System), Set
B	15 kV Switchgear, Distribution Type Surge Arrester (Low Resistance or Solidly Grounded System), Set
C	27 kV Switchgear, Distribution Type Surge Arrester (Low Resistance or Solidly Grounded System), Set
D	38 kV Switchgear, Distribution Type Surge Arrester (Low Resistance or Solidly Grounded System), Set
E	5 kV Switchgear, Distribution Type Surge Arrester (High Resistance or Ungrounded System), Set
F	15 kV Switchgear, Distribution Type Surge Arrester (High Resistance or Ungrounded System), Set
G	27 kV Switchgear, Distribution Type Surge Arrester (High Resistance or Ungrounded System), Set
H	38 kV Switchgear, Distribution Type Surge Arrester (High Resistance or Ungrounded System), Set

Available Options (Continued)

Item Description	
Number of Power Cables per Phase	
A ①	1/Phase, Normal, Emergency and Load
B	2/Phase, Normal, Emergency and Load
Power Cable Size (Select One)	
A	1/0
B	2/0
C	3/0
D	4/0
E	250 kcmil
F	350 kcmil
G	500 kcmil
H	750 kcmil
J	1000 kcmil
Source Power Cable Entry Direction (Select One)	
A	Normal Source TOP Entry, Emergency Source TOP Entry
B	Normal Source TOP Entry, Emergency Source BOTTOM Entry
C	Normal Source BOTTOM Entry, Emergency Source TOP Entry
D	Normal Source BOTTOM Entry, Emergency Source BOTTOM Entry
Exit Direction (Select One)	
A	TOP Exit
B	BOTTOM Exit
IQ Transfer Device Control and Other Options (Select All Desired Options)	
X ①	No Option
1	Auto-Manual Selector Switch, Dev 43
2	Plant Exerciser — Load/No Load with Fail Safe
3	Closed Transition with Default to In-phase Transition with Default to Time Delay Neutral
4	Load Shed from Emergency (Consult Factory)
5	Load Sequencing Contacts (Consult Factory)
6	Service Entrance (Consult Factory)

① Factory default item.

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