Masterclad™ 27 kV Class Medium Voltage Switchgear

Indoor Switchgear

Class 6055

6055–40 Rev. 02
05/2024

Legal Information

The information provided in this document contains general descriptions, technical characteristics and/or recommendations related to products/solutions.

This document is not intended as a substitute for a detailed study or operational and site-specific development or schematic plan. It is not to be used for determining suitability or reliability of the products/solutions for specific user applications. It is the duty of any such user to perform or have any professional expert of its choice (integrator, specifier or the like) perform the appropriate and comprehensive risk analysis, evaluation and testing of the products/solutions with respect to the relevant specific application or use thereof.

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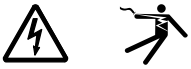
Safety Information

Read these instructions carefully and examine the equipment to become familiar with the device before attempting to install, operate, service, or maintain it. The following special messages may appear throughout this user guide or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Electrical equipment should be transported, stored, installed, and operated only in the environment for which it is designed.

Introduction

This instruction bulletin contains instructions for receiving, handling, storage, installation, operation, and maintenance for the Masterclad 27 kV drawout, metal-clad switchgear manufactured by Schneider Electric. This equipment is designed for use with the 27 kV drawout circuit breaker, which uses vacuum technology.

For information on the 27 kV circuit breakers, refer to instruction bulletin 6055-41.

The switchgear assembly consists of individually-grounded steel compartments. Each compartment has doors, barriers, and removable access panels to isolate the separate working functions. All the circuit breakers, relays, meters, and other components are factory-assembled, wired, and tested as an assembly. The user normally makes only the external control, ground, and power connections at the terminations, and reconnects the wiring and busbars at the shipping breaks.

Each assembly is custom designed to specifications. Standard enclosures and bus configurations are arranged according to customer specifications.

Complete customer drawings are furnished for each Masterclad switchgear assembly. The drawings include floor plans, front elevations, one-line diagrams, control schematics, and wiring diagrams.

Figure 1 - 27 kV Masterclad Indoor Switchgear with Circuit Breaker

Product Overview

This section contains a basic overview of the workings of the Type VR, 27 kV switchgear and the identification of certain components.

A Masterclad switchgear line-up assembly consists of individual switchgear bays that are bolted together. The number of bays in an assembly depends on customer specifications.

Each switchgear bay is a separate rigid, self-contained, bolted structure made of heavy gauge steel. A switchgear bay consists of:

- Front section with secondary control devices
- Circuit breaker compartment
- Main bus compartment
- Cable compartment
- Drawout voltage transformer (optional)
- Control power transformer (optional)
- Fuse drawout section (optional)
- Surge arrestor (optional)

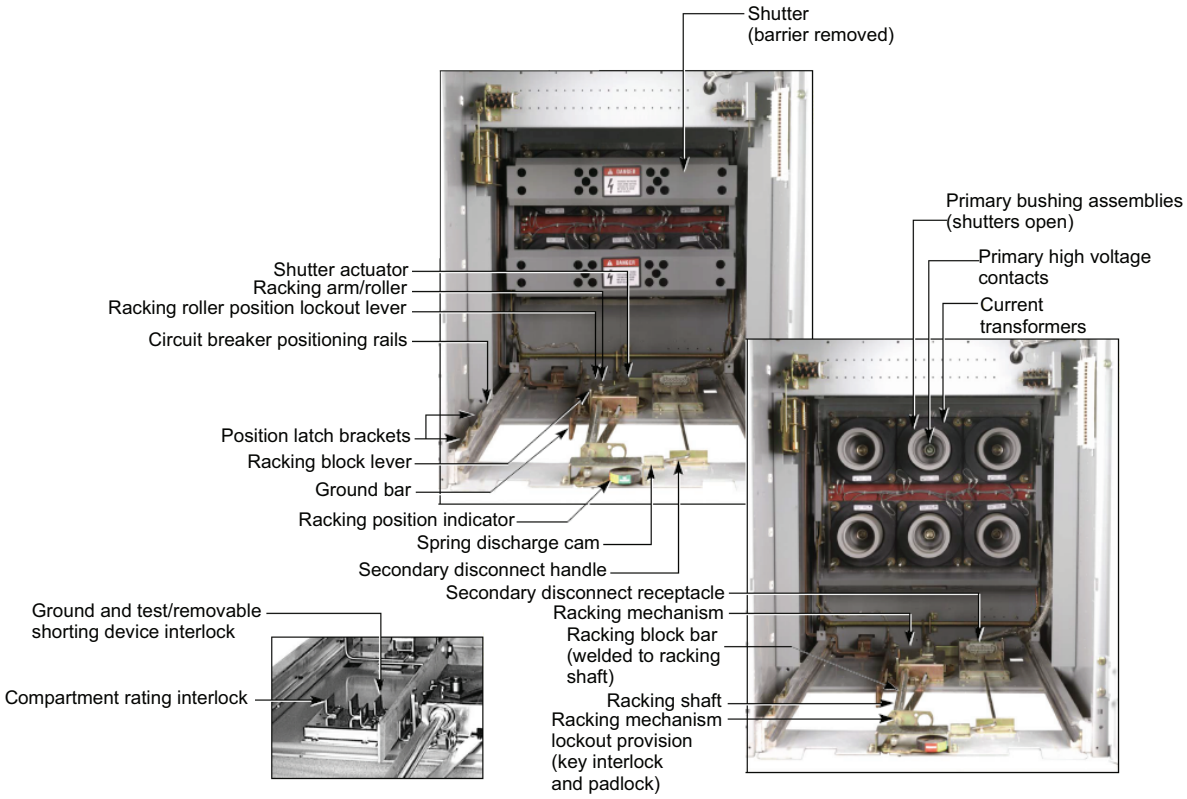
Front Section with Secondary Control Devices

The front section includes the front hinged doors with instruments, relays, control switches, terminal blocks, fuse blocks, and other required secondary control devices. It also houses the wiring space for inter-unit connection and customer control wiring connection.

Circuit Breaker Compartment

The circuit breaker compartment contains separate, but coordinated, features.

Figure 2 - Circuit Breaker Compartment



Circuit Breaker Positioning Rails

Positioning rails, mounted on the side walls of the circuit breaker compartment, capture and align the rollers on the circuit breaker to guide the circuit breaker into the circuit breaker compartment.

The racking mechanism is located on the circuit breaker compartment floor. It is operated by a removable racking handle inserted into the front of the circuit breaker compartment so that it can be racked with the door closed. The circuit breaker engages in a gear-driven racking arm. As the arm rotates, it moves the circuit breaker into or out of the **TEST/DISCONNECT** or the **CONNECTED** position.

Secondary Disconnect Receptacle

The secondary disconnect receptacle is located on the lower right floor of the compartment. The molded insulating receptacle contains 24 contacts and two tapered guide pins. Control power can be connected in the test position by rotating the secondary disconnect handle and pulling it forward.

Racking Position Indicator

The racking position indicator, located beside the racking port, indicates if the circuit breaker is in the **TEST/DISCONNECT**, **TRANSPORT**, or **CONNECTED** position. When the door is open, two arrows that line up with the front cover are visible on the left rail and indicate the position of the circuit breaker.

Primary Contacts

The primary contacts are housed in primary bushing assemblies that are covered at the open end by the shutter when the circuit breaker is in the **TEST/DISCONNECT** position.

Current Transformer

Window-type, 600 V, rated single- or multi-ratio current transformers are located around either the line or load primary 27 kV insulated bushings. A maximum of four current transformers, depending on accuracy, can be mounted per phase-two on the line, two on the load.

Ground Contact Bar

A ground bar, located on the bottom of the circuit breaker compartment, is directly connected to the main ground bus. Sliding contact fingers, located on the underside of the circuit breaker, engage before the circuit breaker reaches the **TEST** position and remain continuously grounded.

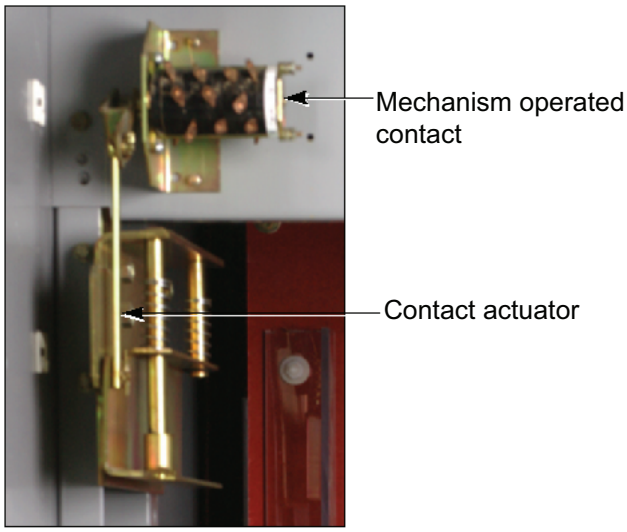
Mechanism Operated Contacts (Optional)

Mechanism operated contacts (MOCs) are compartment-mounted auxiliary contacts that are operated by the circuit breaker mechanism (see Mechanism Operated Contacts (MOCs), page 10). Like circuit breaker mounted auxiliary contacts, they indicate whether the circuit breaker is in the **OPEN** or **CLOSED** position. They operate in the **CONNECTED** and/or **TEST/DISCONNECTED** positions. Refer to the customer order drawings shipped with your equipment.

> **NOTE:** The NORMALLY-OPEN “A” contacts and the NORMALLY-CLOSED “B” contacts furnished are not convertible.

The MOC unit is mounted on the left side of the circuit breaker compartment. It is operated by a mechanism that is driven vertically by a roller on the left side of the circuit breaker.

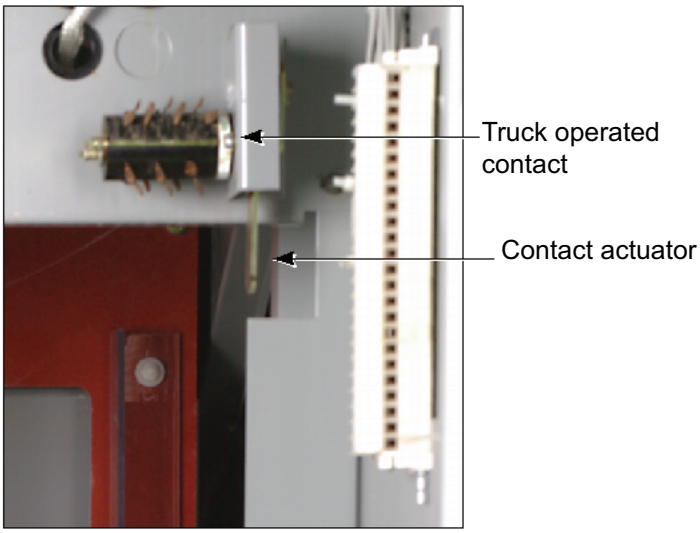
Figure 3 - Mechanism Operated Contacts (MOCs)



Truck Operated Contacts (Optional)

The truck operated contacts (TOCs) (see Truck Operated Contacts (TOCs), page 10) indicate whether the circuit breaker is in the **CONNECTED** or **TEST/DISCONNECT** position in the circuit breaker compartment.

Figure 4 - Truck Operated Contacts (TOCs)



The TOC unit does not distinguish between the circuit breaker being in the **TEST/ DISCONNECT** position or withdrawn completely from the compartment.

The TOC unit is mounted on the right side of the horizontal steel barrier in the top of the circuit breaker compartment. It is operated by a spring-loaded lever. This lever is activated, just before the circuit breaker reaches the **CONNECTED** position, by a pin on the upper right side circuit breaker frame.

Interlocks

NOTICE

INTERLOCK DAMAGE

- Do not test interlocks by hand. Test interlocks by moving the circuit breaker over the compartment-mounted operating cams.
- Do not operate interlocks in an incorrect sequence.

Failure to follow these instructions can result in equipment damage.

Circuit Breaker Compartment Interlocks

The circuit breaker compartment contains the following interlocks:

- A racking block bar (see Circuit Breaker Compartment, page 8) welded to the racking shaft hits an interlock pin on the circuit breaker when it is closed. This interlock mechanism stops a closed circuit breaker from being racked into or out of the circuit breaker compartment.
- The racking arm actuates an interlock located underneath the circuit breaker. This interlock mechanism is designed to stop a circuit breaker from being closed when it is between the **TEST/DISCONNECTED** and **CONNECTED** positions.
- A racking roller position lockout lever (see Circuit Breaker Compartment, page 8) located on the racking gear box stops the circuit breaker from being inserted into the circuit breaker compartment when the racking roller is not in the **TEST/ DISCONNECT** position.
- A racking block lever (see Circuit Breaker Compartment, page 8) does not allow racking mechanism operation when the circuit breaker is not in the circuit breaker compartment. The shutter cannot be opened unless the circuit breaker is in the circuit breaker compartment.
- A spring discharge cam (see Circuit Breaker Compartment, page 8) discharges the closing springs when the circuit breaker is inserted or withdrawn from the circuit breaker compartment.
- A racking mechanism lockout provision (see Circuit Breaker Compartment, page 8) is furnished in each compartment for locking circuit breakers, VT drawout units, or CPT fuse drawouts out of the **CONNECTED** position.

  The racking mechanism lockout provision is in the center of the compartment floor and has padlock provisions as standard. It can be equipped with a key interlock when specified by the customer.

  The racking mechanism lockout helps prevent the racking of circuit breakers, VTs, or CPTs when they are in the disconnected position. Circuit breakers, VTs, or CPTs can be stored in the disconnected position with the racking mechanism locked.

Compartment Rating Interlock

The compartment rating interlocks (see Circuit Breaker Compartment, page 8) block insertion of circuit breakers with incorrect current, voltage, or interrupting ratings into the compartment. The stationary interference brackets are mounted on the floor of the compartment and the mating part of the interlock system is mounted on the underside of each circuit breaker.

Ground and Test / Removable Shorting (RS) Device Interlock

Each circuit breaker compartment may have permissive interlocks (see Circuit Breaker Compartment, page 8) that helps block the insertion of a ground and test or a RS device not intended for use in that circuit breaker compartment. The permissive interlocks are beside the compartment rating interlock on the circuit breaker compartment floor. Refer to the specific Schneider Electric ground and test and RS device instruction bulletins.

Voltage Transformer and Fuse Drawout Units

The voltage transformer (VT) and fuse drawout units are self-contained drawers. As the drawout units are racked into the compartments, the drawers roll on two positioning rails mounted on the sides of the compartment. The rails capture and align rollers on drawout units.

Floating, drawer-mounted, self-aligning contacts engage the stationary primary contacts as the drawer is racked into the connected position.

A ground contact bar, located on the left guide rail, is directly connected to the main ground bus.

A sliding contact finger, located on the left side of the drawout units, engages the ground bar when the drawout unit is in the **DISCONNECTED** position and remains continuously grounded.

A static discharge ground contact, mounted in the top of the compartment, grounds the primary fuse contact tabs during withdrawal from the **CONNECTED** position to the **DISCONNECTED** position.

Control power transformers (CPTs) are always stationary mounted. Depending on the size of the transformer, they can be mounted remotely or within the switchgear.

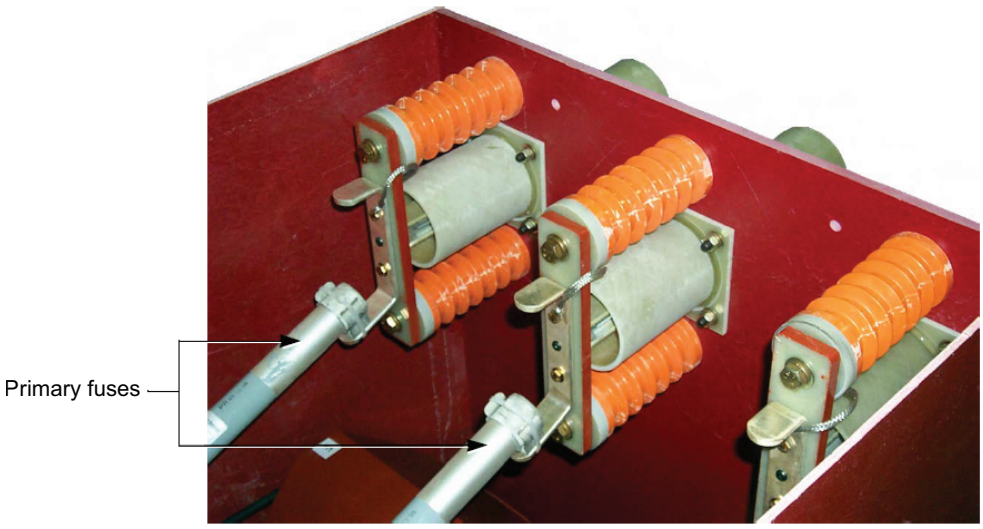
Drawout Voltage Transformers

Drawout voltage transformers supply voltage indication for metering and relaying purposes. Primary current-limiting fuses are mounted on each voltage transformer.

When drawout voltage transformers are in the **CONNECTED** position, the secondary contacts, mounted on the bottom rear of the drawer, engage fixed compartment floor-mounted secondary contacts.

Secondary fuses for the voltage transformers are in the front control compartment. Refer to the customer order drawings shipped with the equipment.

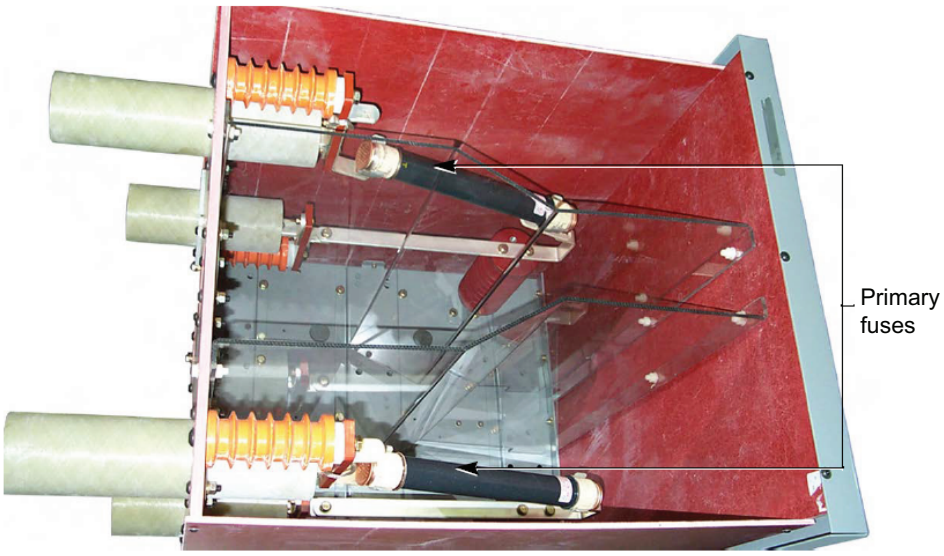
Figure 5 - Drawout Voltage Transformer



Fuse Drawout Unit for the Stationary Control Power Transformers

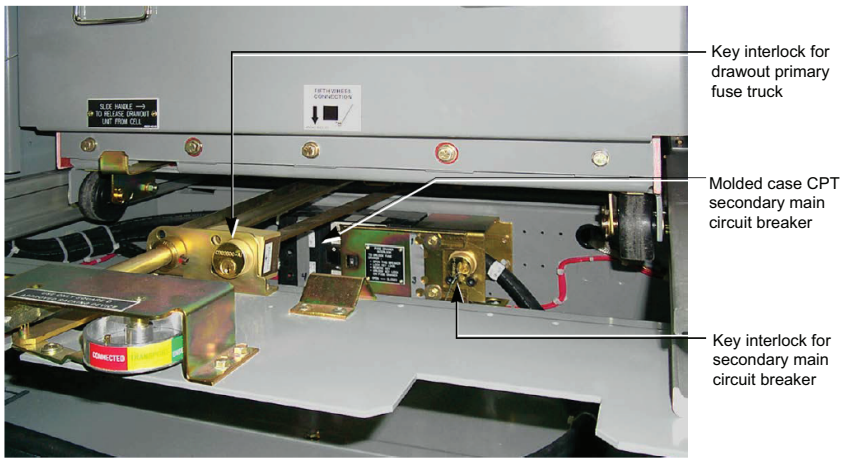
Drawout fuses are provided for stationary control power transformers. Fixed mounted CPTs are supplied when AC control power is required. The primary current-limiting fuses are mounted in the drawer and withdrawn as an assembly.

Figure 6 - Drawout Primary Fuses for Stationary Control Power Transformer



The fuse drawout truck is interlocked with the CPT secondary-main circuit breaker by a key interlock system. The CPT secondary-main circuit breaker and key interlocks are mounted below the primary fuse drawout unit. Two keys are shipped inserted in the interlock barrels. See CPT Primary Fuse Drawout Unit Interlocks, page 39 for instructions for operating the key interlocks.

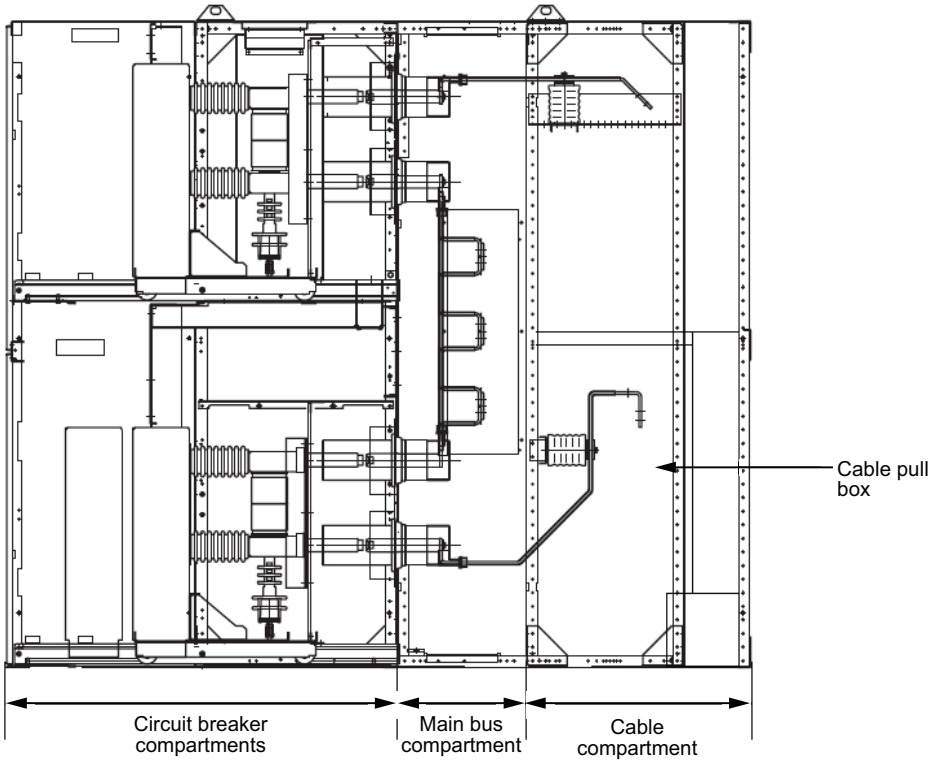
Figure 7 - Key Interlocks for Drawout Primary Fuses and Secondary Circuit Breaker



Main Bus Compartment

The main bus compartment is in the center of the switchgear. It is isolated from other compartments by the main bus compartment cover, which consists of removable metal access plates. The main bus compartment is accessible from the back through the cable compartment and from the front through the circuit breaker compartment. The main bus is available in copper only.

Figure 8 - Bus Compartment



Each busbar has epoxy insulation rated for 221°F (105°C) operation. Glass polyester barriers with epoxy insert pass-throughs are used to separate the bus compartments between adjacent circuit breaker compartments. Bus boots insulate the connection in the main bus compartment, overlapping the epoxy insulation on the busbars. The busbar insulation and boots form an integral insulating system for the equipment to meet its dielectric ratings. The busbar insulation must not be damaged or modified. Boots must be in place before operating the equipment.

Cable Compartment

Each circuit breaker in a vertical section has a separate cable compartment, accessible by removing a steel cover on the back. Insulated load connectors are provided for terminating cables. As standard, the load connectors are punched for terminating two cables per phase with a NEMA two-hole pattern.

A ground bus in the cable compartment has lugs on each end for the assembly ground. This ground bus is connected to each circuit breaker compartment ground contact bar and to the individual ground bars in each cable compartment. All instrument transformer, metering, and relaying grounds are also connected to this common ground system.

Conduit must enter the cable compartments, in the areas shown on the customer drawings (see Main Bus Connections, Side View, page 34), from either the top or bottom of the cable compartment. A removable steel cable pull box (see Bus Compartment, page 14) is provided to isolate cables when two circuit breakers are installed in one vertical section.

Conduit should be stubbed in the concrete as part of the site preparation before the assembly is installed, but top entrance conduit must be installed after the assembly is in place. The top covers can be removed, punched to fit the conduit, and put back in place.

The front conduit area is for the bottom circuit breaker when all cables enter from below, and for the top circuit breaker when all cables enter from above. The cable pull box may be removed to install the rear cables first. The cable pull-box must be reinstalled to provide isolation. When required, zero-sequence current transformers (see Bus Compartment, page 14) are conveniently located in each cable compartment.

Various cable termination systems are used. These are detailed on the customer's plans and specifications. Solderless or compression lugs (provided upon request) can be supplied on the load connectors. Tape and insulating material necessary for completing the field connection at the lug pad are not supplied with the assembly.

Schneider Electric provides lugs upon request. Tape and associated material for insulating cable terminations are not supplied.

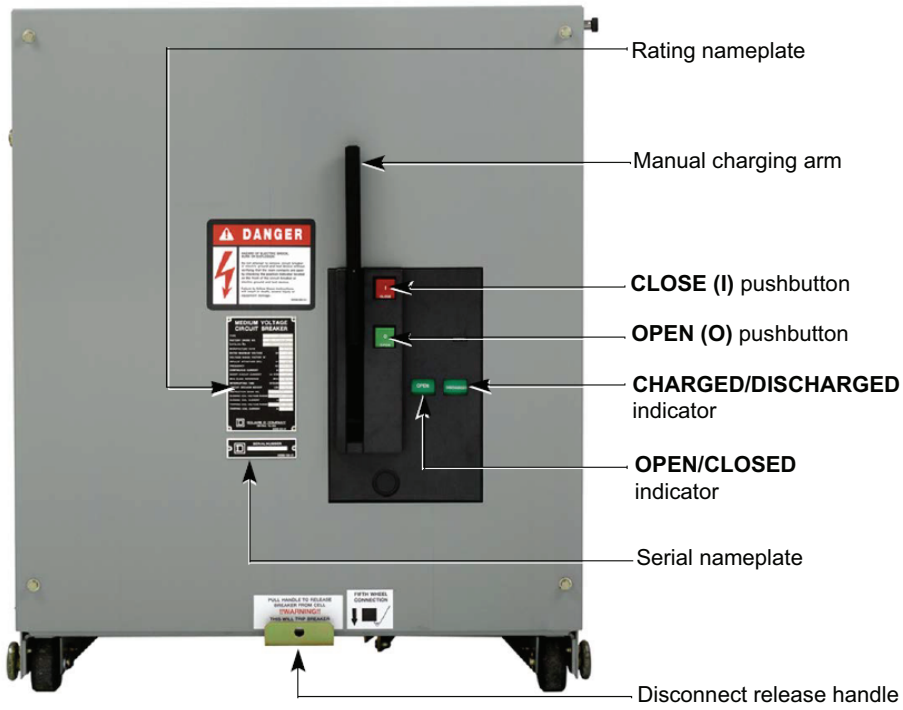
Surge Arresters

Surge arresters are furnished only when listed in the user's specifications. The vulnerability of the incoming and outgoing lines to lightning strikes or other high voltage transient conditions determines their type and justification. Surge arresters, when specified, are mounted in the incoming and outgoing cable compartments. Surge arresters must remain disconnected from the main bus during start-up testing. Surge arresters are shipped from the factory disconnected from the main bus to help prevent damage during hi-pot testing prior to energizing. Connect surge arrestors after hi-pot testing and before energization.

Circuit Breaker Product Overview

This section contains a basic overview of the workings of the Type VR, 27 kV circuit breaker designed for use with the Masterclad switchgear.

Figure 9 - Circuit Breaker, Front View with Circuit Breaker Cover



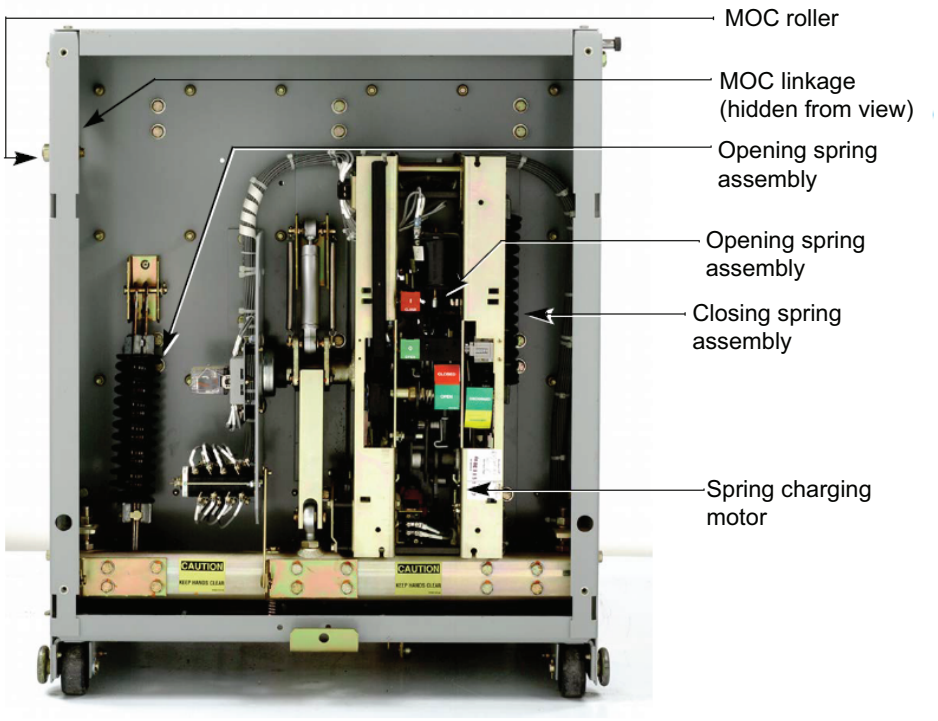
Rating Nameplate

The rating nameplate is located on the front of the circuit breaker and shows the circuit breaker rating.

Indicators

The **OPEN (O)** / **CLOSED (|)** indicator (see Circuit Breaker, Front View with Circuit Breaker Cover, page 16) shows whether the vacuum interrupter contacts are **OPEN (O)** or **CLOSED (|)**. The **CHARGED**/**DISCHARGED** indicator shows whether the closing springs are charged or discharged.

Figure 10 - Circuit Breaker, Front View without Circuit Breaker Cover



Operating Mechanism

The operating mechanism is a stored energy-type mechanism. It uses spring assemblies to perform circuit breaker openings and closing functions.

Closing Spring Assembly

The closing spring assembly closes the circuit breaker when the **CLOSE (|)** pushbutton is pressed or when the close coil (see Trip and Close Coils, page 23) is energized. The spring assembly is charged (compressed) mechanically by the manual charging arm or electrically by the spring charging motor. When the control power is applied to the circuit breaker, the spring charging motor is energized. The charging motor turns the gear assembly which drives the ratchet assembly and compresses the closing spring assembly (see Left Side of Mechanism, page 22).

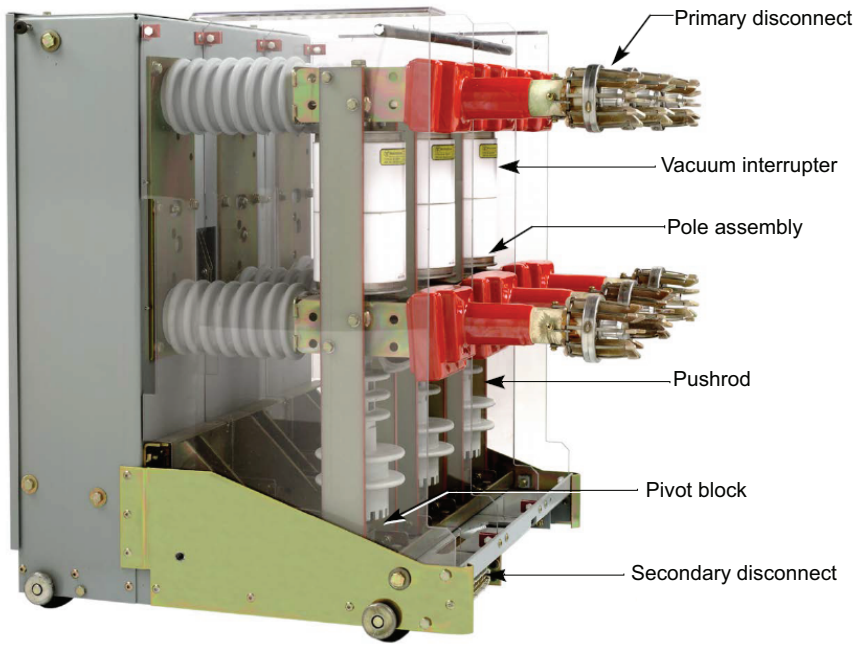
Opening Spring Assembly

The opening spring assembly opens the circuit breaker when the OPEN (O) pushbutton is pressed, or the opening coil is energized. The spring assembly is compressed whenever the circuit breaker is in the CLOSED (|) position.

Vacuum Interrupters

Vacuum interrupters are mounted vertically at the rear of the circuit breaker frame and perform the circuit breaker interruption.

Figure 11 - Circuit Breaker, Side View



Primary Disconnects

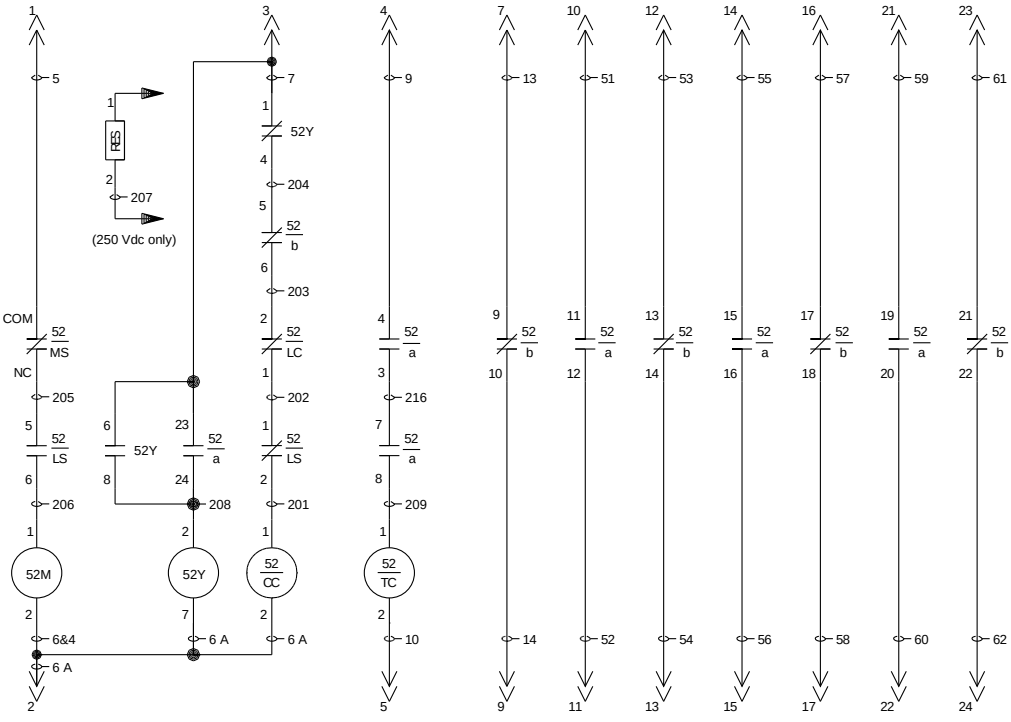
The primary connection to the associated switchgear is through the six primary disconnects mounted horizontally at the rear of the circuit breaker.

NOTE: Never use the primary disconnects as handles when moving the circuit breaker.

Control Circuit

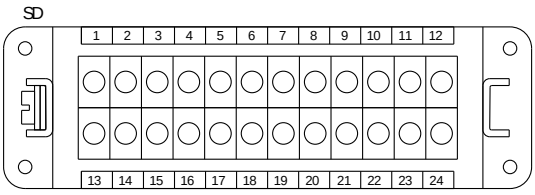
A typical schematic diagram for the control circuit of the Type VR circuit breaker is shown in Typical Control Circuit Schematic (Shown with Closing Spring Assembly Charged and Power OFF), page 19. The control circuit design may vary, depending upon customer requirements. Always refer to the specific schematic diagram for the specific Masterclad switchgear in question.

Figure 12 - Typical Control Circuit Schematic (Shown with Closing Spring Assembly Charged and Power OFF)



LEGEND

52M	Spring Charging Motor
52Y	Anti-Pump Relay
52/a	Aux. Switch, Open When Breaker Open
52/b	Aux. Switch, Closed When Breaker Open
52/CC	Close Coil
52/LC	Latch Check Switch
52/LS	Motor Limit Switch
52/MS	Motor Cutoff Switch
52/TC	Trip Coil
RES	Resistor (250Vdc Closing Only)



Rear View of Circuit Breaker Control Plug

1 = 5 (MS-COM)	9 = 14 (AS-10)	17 = 58 (AS-18)
2 = 6A (Y-7)	10 = 51 (AS-11)	18 = 28 (TBM-11)
3 = 7 (Y-1)	11 = 52 (AS-12)	19= 29 (TBM-12)
4 = 9 (AS-4)	12 = 53 (AS-13)	20 = 27 (TBM-13)
5 = 10 (TBM-10)	13 = 54 (AS-14)	21 = 59 (AS-19)
6 = 4 (TBM-4)	14 = 55 (AS-15)	22 = 60 (AS-20)
7 = 13 (AS-9)	15 = 56 (AS-16)	23 = 61 (AS-21)
8 = 8A (TBM-8)	16 = 57 (AS-17)	24 = 62 (AS-22)

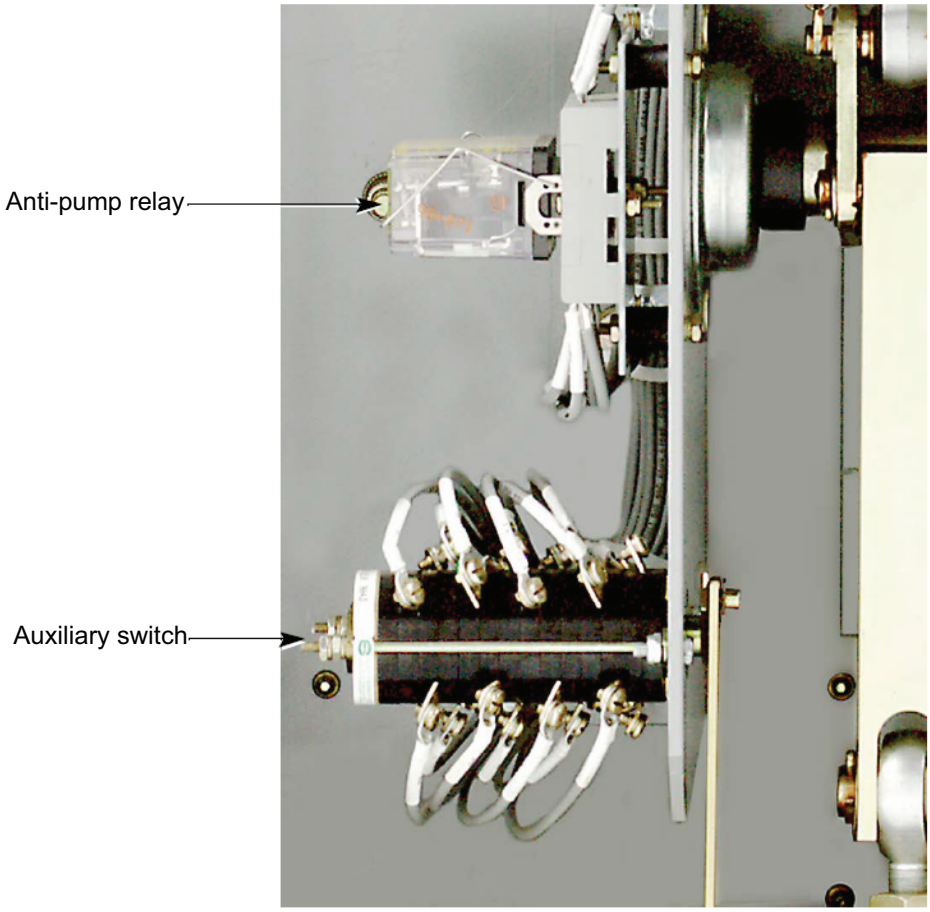
Auxiliary Switch

The auxiliary switch (see Auxiliary Switch and Anti-Pump Relay, page 20) is a multi-stage switch used to operate circuits that depend on the position of the circuit breaker contacts. The schematic diagram in Typical Control Circuit Schematic (Shown with Closing Spring Assembly Charged and Power OFF), page 19 illustrates how each of the auxiliary switch contacts interconnect with the circuit breaker circuitry. The auxiliary switch functions as follows:

- Two Type-a auxiliary contacts connect in series with the trip coil. Because these stages are **OPEN (O)** when the circuit breaker is in the **OPEN (O)** position, the auxiliary contacts de-energize the trip coil when the circuit breaker is in the **OPEN (O)** position.
- The Type-b contact, connected in series with the closing coil, opens to de-energize the closing coil when the circuit breaker main contacts are in the **CLOSED (|)** position.

As shown, several Type-a and Type-b contacts are provided for optional use.

Figure 13 - Auxiliary Switch and Anti-Pump Relay

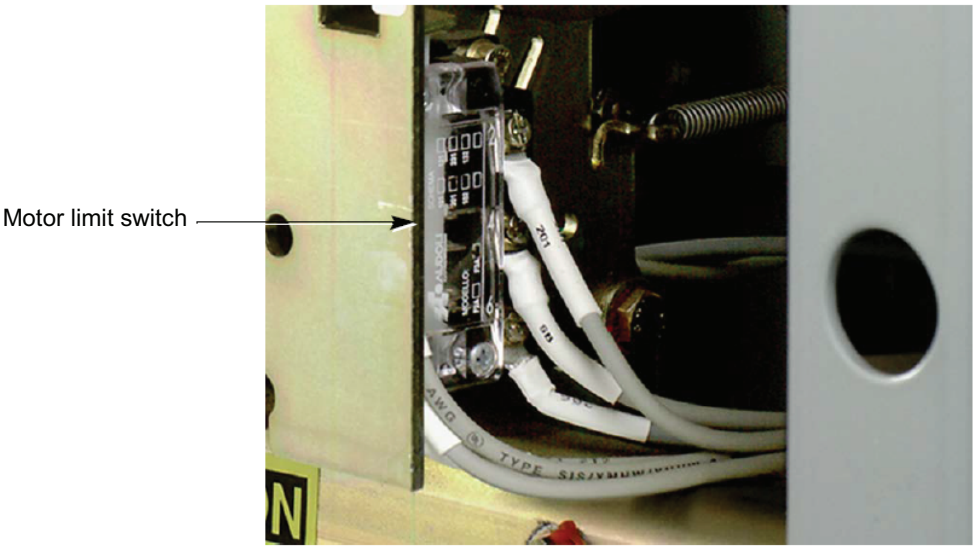


Motor Limit Switch

The motor limit switch (see Motor Limit Switch, page 21) energizes the spring charging motor (see Circuit Breaker, Front View without Circuit Breaker Cover, page 17) when a closing spring charging operation is required. The motor limit switch de-energizes the spring charging motor when the closing springs reach the fully charged position.

As shown in the schematic diagram, the motor limit switch is connected to the motor in the normally **OPEN (O)** position. (see Typical Control Circuit Schematic (Shown with Closing Spring Assembly Charged and Power OFF), page 19). When the closing springs are in the discharged position, the motor limit switch cam actuates the motor limit switch. This energizes the motor and disables the closing coil. Once the closing springs are fully charged, the cam allows the switch to assume the **OPEN (O)** position, de-energizing the spring charging motor.

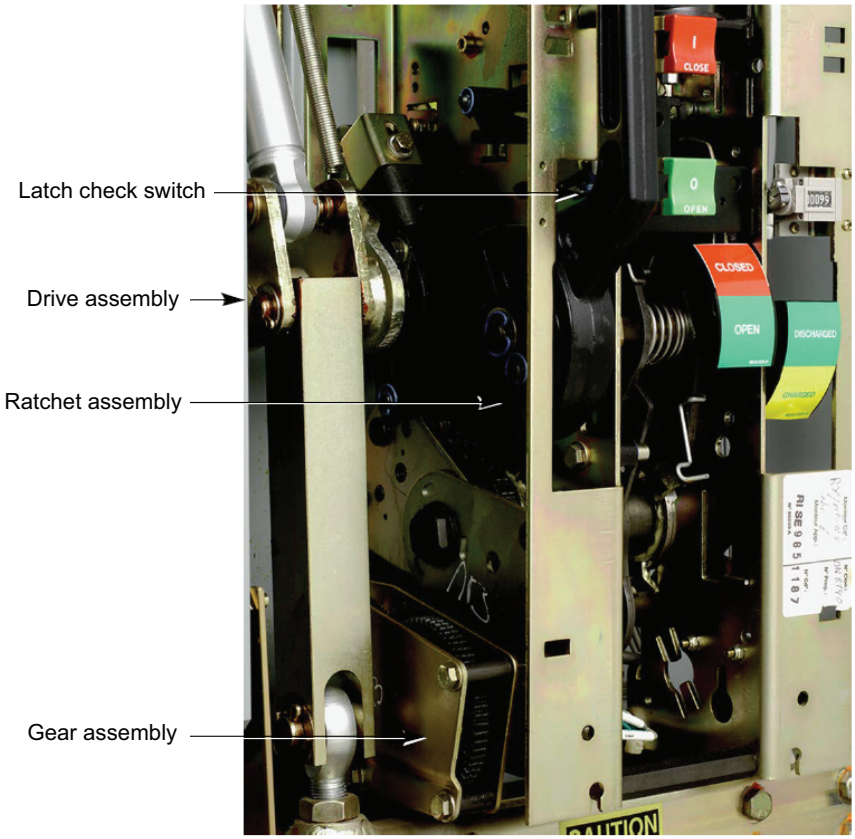
Figure 14 - Motor Limit Switch



Spring Charging Motor

When energized by the closing of the motor limit switch, the spring charging motor (see Left Side of Mechanism, page 22) drives the series of connected gears. These gears in turn raise and lower the ratchet assembly to compress the closing springs to the charged and latched position. When the closing springs are fully charged, the motor limit switch contacts reopen, de-energizing the spring charging motor.

Figure 15 - Left Side of Mechanism



Latch Check Switch

The latch check switch indicates that the circuit breaker is ready for subsequent operation.

Anti-pump Relay

If the closing coil circuit is continuously energized, the anti-pump relay (see Auxiliary Switch and Anti-Pump Relay, page 20) helps ensure that the circuit breaker does not “pump” **OPEN (O)** and **CLOSED (|)** if a a trip signal is also present. The anti-pump relay performs this function by allowing the closing coil to activate only if:

The circuit is energized,

The closing springs are fully charged,

And the spring charging motor is de-energized.

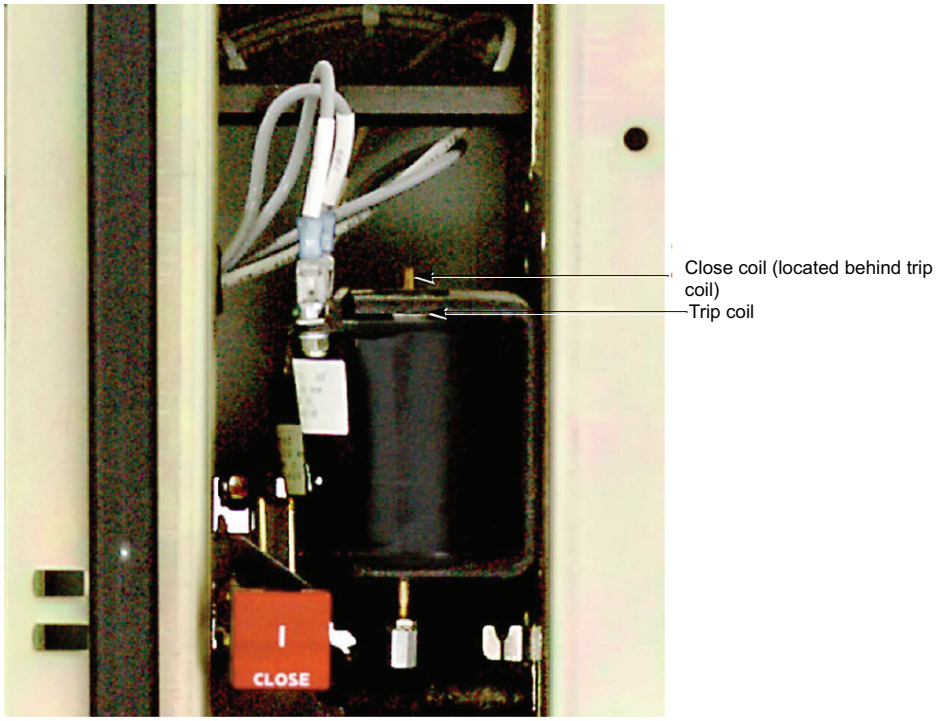
The anti-pump relay activates when the close circuit is energized while the circuit breaker is closed. If the close circuit is energized continuously, the anti-pump relay remains in the energized position after the 52/a auxiliary contact closes during the closing operation. When the anti-pump relay is energized, a pair of its normally-closed contacts, in series with the close coil, open to help ensure that the close coil cannot be energized. The close coil activates only when the close circuit is de-energized (de-energizing the anti-pump relay), then energized again.

Trip and Close Coils

The standard location of the trip and close coils is in the upper center of the operating mechanism. When energized by the switchgear or remote circuitry, these coils release the open or close latches located inside the mechanism.

NOTE: Optional tripping and closing functions could require that these coils be located on the outside of the mechanism frame. To access the trip and close coils, unclip the mechanism cover from the mechanism frame.

Figure 16 - Trip and Close Coils



Motor Cutoff Switch

The motor cutoff switch is located under the base of the Type VR circuit breaker. The motor cutoff switch de-energizes the spring charging motor circuit during the installation of the circuit breaker or its removal from the compartment.

Safety Precautions

This chapter contains important safety precautions that must be followed before attempting to install, service, or maintain electrical equipment. Carefully read and follow the safety precautions outlined below.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462 or local equivalent.
- Only qualified personnel familiar with medium voltage equipment are to perform work described in this set of instructions. Workers must understand the hazards involved in working with or near medium voltage circuits.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on it.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Before performing maintenance on this device, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power. Check interconnection diagrams and make sure there are no backfeed potential sources.
- The complete assembly arrangement determines if the top or bottom contacts are the line side; both can be energized when the circuit breaker is removed from the compartment. Identify the line side contacts for each circuit breaker compartment.
- Disconnect all high voltage to the switchgear before accessing the horizontal bus compartment.
- Never disconnect the main trip source of energized equipment.
- Do not open a circuit breaker door unless the circuit breaker is open.
- Handle this equipment carefully and install, operate, and maintain it correctly so that it functions properly.
- Do not make any modifications to the equipment or operate the system with interlocks and safety barriers removed. Contact your local Schneider Electric representative for additional instructions if the equipment does not function as described in this manual.
- Use out-of-service tags and padlocks when working on equipment. Leave tags in place until the work is completed and the equipment is ready to be put back into service.
- Carefully inspect your work area and remove any tools and objects left inside the equipment before energizing the switchgear.
- Replace all devices, doors, and covers before connecting the power to this equipment.
- All instructions in this manual are written with assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

⚠ **WARNING:** This product can expose you to chemicals including Nickel compounds, which are known to the State of California to cause cancer, and Bisphenol A (BPA), which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Moisture Contamination Avoidance and Mitigation

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Store the equipment in a clean, dry (including no condensation), well-ventilated area with an ambient temperature of approximately 70°F (21°C).
- If heaters are furnished in the assembly, energize them from an external source. When energizing heaters from an external source, remove the primary and secondary overcurrent protective devices from the control power transformer.
- If heaters are not installed in the assembly, and the area is cold and damp, use a temporary heating source within the assembly. A minimum of 200 W of heat per section is recommended.
- Avoid greasy, smoky heaters that can deposit carbon on insulation, which could lead to tracking and insulation breakdown.
- If moisture, condensation, or chemical ingress is observed, do not energize the equipment. If the equipment is already energized, de-energize it immediately.

Failure to follow these instructions will result in death or serious injury.

⚠WARNING

FIRE HAZARD

Remove all flammable material in the vicinity of the heaters, such as packaging, accessories in boxes, and documentation, before energizing the heaters.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Shipping, Receiving, and Storage Requirements

This equipment does not achieve its ratings until it is installed per record/as-built drawings, installed per the instructions contained in this document, and has operational environmental controls with appropriate settings to help mitigate environmental influences. This equipment can also be stored in a climate-controlled area that uses both heating and cooling to maintain acceptable environmental conditions. Indoor and outdoor rated equipment is not suitable for outdoor storage.

- The equipment should be treated as if it is in storage until it is installed and operational. The storage area should be clean, dry (75% or less relative humidity), and climate controlled with proper ventilation.
- To keep the equipment dry, the use of heaters is required in some cases (for example, during seasonal or low periods of electrical loading and equipment de-energization):
  - Consult the engineer of record for the appropriate environmental control settings or means to mitigate environmental influences.
  - If so equipped, set the thermostats and/or humidistats to mitigate condensation. A minimum of 200 W of heat per section is recommended.
  - If heaters are used with the equipment that were not included in the equipment by Schneider Electric, they must be clean and free of debris and grease. Greasy and/or smoky heaters can contaminate electrical insulation and lead to dielectric breakdown and/or tracking.
- Shipping packaging is not suitable for and cannot be used by itself for equipment storage unless otherwise indicated on the shipping packaging labeling.

- When receiving equipment, the equipment may be at a lower temperature than the ambient air temperature. Allow time for the equipment temperature, including the temperature of internal components, to rise to the ambient air temperature before making openings in or otherwise disturbing the packaging. Condensation can occur on and inside the equipment if warm air contacts cold surfaces of the equipment. Moisture damage can occur, destroying the dielectric capabilities of the equipment and rendering it unusable.
- The factory shipping wrap around the equipment on shipping pallets is not suitable for non-enclosed over-the-road transportation that risks exposing the equipment to the elements. The factory shipping wrap around the equipment should remain on the equipment until the equipment is ready to be inspected and stored or inspected and installed. After receiving the equipment and allowing it to acclimate to the environment, remove the packaging and inspect the equipment for damage that may have occurred in transit. If damage is found or suspected, immediately file a claim with the carrier and notify your Schneider Electric representative.
- Follow these guidelines every time the equipment is moved to a new storage location or to its final destination.

Installation, Operation, and Maintenance Requirements

This equipment does not achieve its ratings until it is installed per record/as-built drawings, installed per the instructions contained in this document, and has operational environmental controls with appropriate settings to help mitigate environmental influences. This equipment can also be operated in a climate-controlled area that uses both heating and cooling to maintain acceptable environmental conditions. Indoor and outdoor rated equipment is not suitable for outdoor storage.

In some cases (such as seasonal electrical loading, de-energized equipment, and standby/alternate power sources), the heat generated by equipment loading is insufficient to prevent condensation and alternate heat sources are required. Set any environmental controls such as a thermostat or humidistat so as to mitigate condensation and to always remain operational. Consult the engineer of record for the appropriate environmental control settings.

Exposure to Moisture, Chemicals, and Condensation

If liquids such as moisture, chemicals, and condensation contact the electronics, circuit breaker, fuses, bussing, or other electrical components, do not attempt to clean or repair the equipment as this may lead to unrepairable damage. If the equipment is energized, de-energize it. If equipment is not energized, do not energize it. Contact the Schneider Electric Customer Care Center at 888-778-2733.

Technical Specifications

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- If signs of moisture contamination are present, do not follow the instructions in this section.
- If signs of moisture contamination are present, proceed to Moisture Contamination Avoidance and Mitigation, page 25.

Failure to follow these instructions will result in death or serious injury.

Receiving

Masterclad 27 kV indoor switchgear is shipped on skids in protective crates or wrapping. Circuit breakers are usually shipped in their respective compartments in the closed and connected position. As an option (upon request), circuit breakers can be shipped on pallets.

Upon receipt, check the packing list against the equipment received to ensure that the order and shipment are complete. Claims for shortages or errors must be made in writing to Schneider Electric within 60 days after delivery. Failure to give such notice will constitute unqualified acceptance and a waiver of all such claims by the purchaser.

Immediately inspect the equipment for any damage that may have occurred in transit. If damage is found or suspected, file a claim with the carrier immediately and notify Schneider Electric. Delivery of equipment to a carrier at any of the Schneider Electric plants or other shipping point constitutes delivery to the purchaser regardless of freight payment and title. All risk of loss or damage passes to the purchaser at that time.

Handling

The switchgear is shipped in sections of one or two bays. Each bay has four lifting lugs bolted onto the top. If more than two bays are shipped as one section, lifting channels or frames may be bolted onto the top.

⚠CAUTION

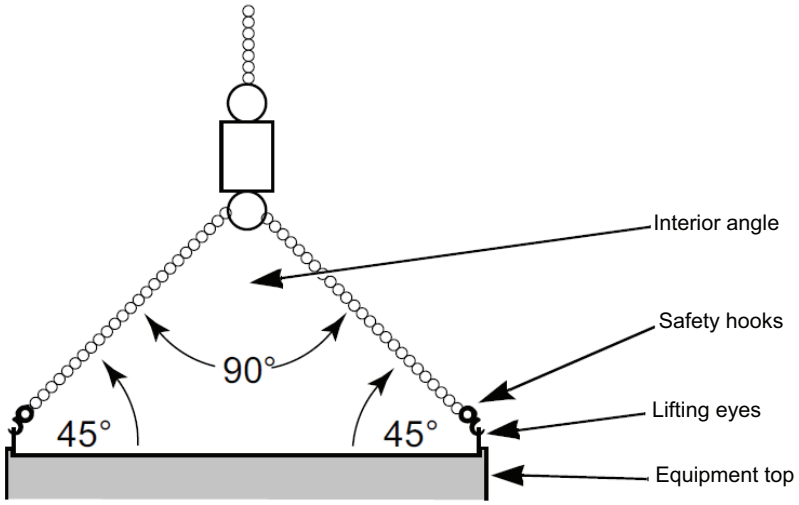
IMPROPER LIFTING OF EQUIPMENT

If moving by crane, the interior angle of the lifting sling should not exceed 90°. Angles greater than 90° apply greater inward pressure of lifting lugs which can damage or dislodge lifting lugs from switchgear.

Failure to follow these instructions can result in injury or equipment damage.

Put a crane hook through each of the four holes to lift and move the sections. Use load-rated cables or chains with safety hooks or shackles. A spreader bar may be necessary to maintain proper angles for lifting.

Figure 17 - Lifting Sling



To help prevent structure damage, rig the lifting sling so that the minimum angle between lifting cables or chains and the top of the equipment is 45°, and the maximum interior angle is 90°. If a crane is not available, contact Schneider Electric before using any other lifting method. Rollers may be placed under the skids if approved moving equipment is not available or space prohibits the use of approved moving methods.

⚠CAUTION

EQUIPMENT DISTORTION

- Do not remove the skids until the shipping sections are in the final location.
- Do not maneuver the switchgear directly on rollers, always incorporate a pallet under the switchgear.
- Always use the skids to help prevent switchgear distortion or damage.

Failure to follow these instructions can result in injury or equipment damage.

After the equipment has been placed in position, remove, and discard the lifting lugs. Screw the bolts back into place to cover the mounting holes.

Storage

Keep equipment in a clean, dry, well-ventilated area. Circuit breakers should be protected from dust, foreign objects, and rodents. If space heaters are furnished in the assembly, energize them from an external source. Refer to schematic and wiring diagrams for a logical connection point, and for voltage and power requirements.

If space heaters are not installed in the assembly, and the area is cold and damp, use a temporary heating source within the assembly. A minimum of 200 W of heat per circuit breaker compartment is recommended. Avoid greasy, smoky heaters that can deposit carbon on insulation, causing tracking and eventual insulation breakdowns.

If the space heaters are normally energized from a control power transformer, open the control power transformer secondary circuit breaker, remove the primary current limiting fuses, and install an out-of-service tag before energizing the space heaters. This helps prevent backfeed to the main bus through the control power transformer.

⚠WARNING

UNINTENTIONAL BACKFEED CURRENT TO PRIMARY CIRCUIT

When energizing space heaters from a remote source, remove the primary current limiting fuses of the control power transformer.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Site Selection and Preparation

Proper site selection is essential for reliable operation of the assembly. Carefully compare the plans and specifications with the customer drawings provided. Be sure to:

- Always provide adequate ventilation so the ambient temperature around the assembly does not exceed 104°F (40°C). Clean, dry, filtered air should be supplied.
- Provide adequate lighting in both the front and back aisle spaces. Also, provide convenient outlets in both areas for electrical hand tool use.
- Provide adequate floor drainage.
- Provide adequate safeguards against water damage. Route sewer, water, and steam lines so they do not pass over or near the assembly; dripping liquids may damage the insulation.
- Make sure the site can support the weight of the complete switchgear unit. The weight of the average switchgear unit, including the circuit breaker is 3000 lb. (1360 kg). Refer to Approximate Switchgear and Component Weights, page 29 to determine approximate switchgear and component weights for handling and structural considerations.

Table 1 - Approximate Switchgear and Component Weights

Switchgear and Components	Weight
Switchgear unit	2450 lb. (1111 kg)
Circuit breaker–1200 A, 16/25/40 kA	550 lb. (250 kg)
Circuit breaker–2000 A, 16/25/40 kA	550 lb. (250 kg)
Circuit breaker–2750 A, 16/25/40 kA	750 lb. (340 kg)
VT drawout unit (2) 27 kV	350 lb. (159 kg)
VT drawout unit (3) 27 kV	450 lb. (204 kg)
CPT fixed mounted–15/25 kVA kVA three-phase	750 lb. (340 kg)
CPT fixed mounted–37.5/50 kVA three-phase	750 lb. (340 kg)
CPT fuse drawout unit (3) 27 kV	150 lb. (68 kg)
Three intermediate arresters–27 kV	180 lb. (82 kg)

Foundation

The switchgear is designed for installation on a concrete pad. Refer to the factory order drawings for any additional mounting details which may be required on specific orders. The pad must be flat and leveled to 0.06 in. (1.6 mm) per square yard to help ensure proper alignment and to help prevent distortion of the gear.

Provide a seven ft. (2.1 m) wide aisle space in front of the mounting pad, flush with and finished to the same tolerance as the mounting pad. This level surface is necessary for the circuit breaker lift truck and for inserting the circuit breakers into the bottom compartment.

Figure 18 - Floor Plan for Switchgear Rated Up to 50 kA

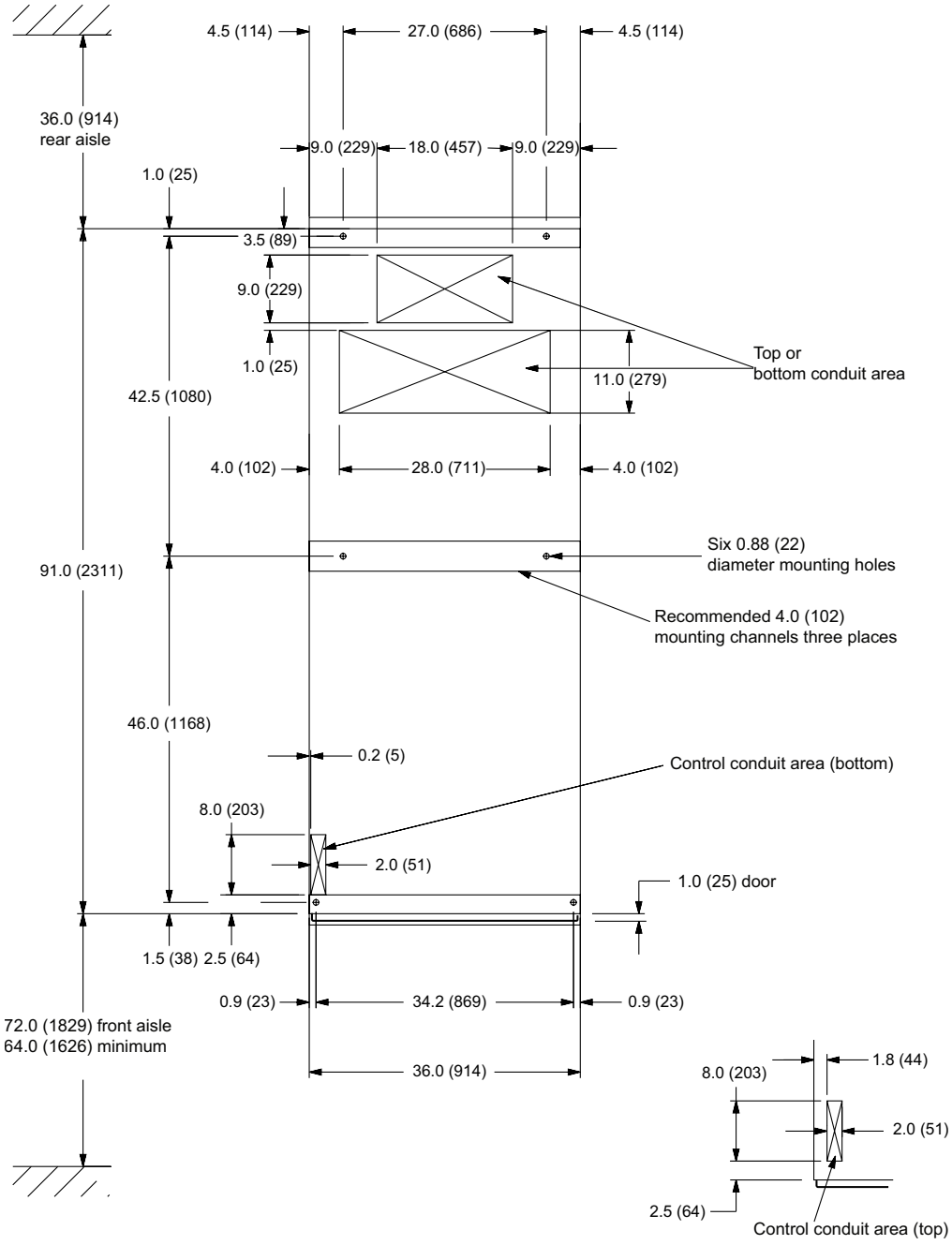
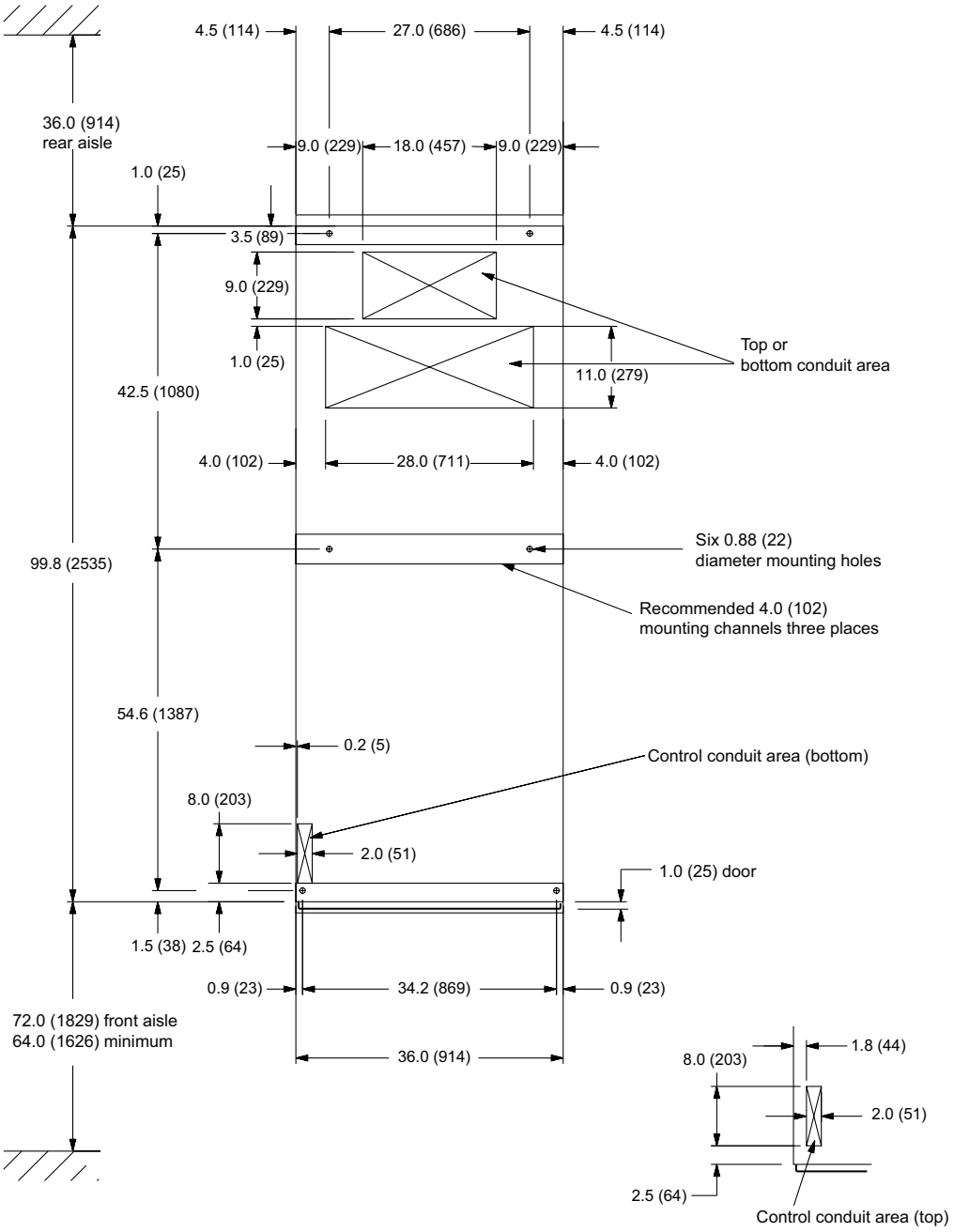


Figure 19 - Masterclad Extended Floor Plan for 63 kA-Rated Switchgear



NOTE: A minimum of three ft. (1 m) is necessary on the right end facing the front of the line-up. This space is necessary for door clearance, with door hinges on the right side of the door, when removing the circuit breakers. Typically, a minimum of three ft. (1 m) is necessary at the rear of the lineup for cable connections.

Stub conduits a maximum of one inch. (25 mm) above floor level. To simplify moving the switchgear into place, keep the conduit flush with the surface of the floor. Position the conduit accurately so that there is no mechanical interference with the assembly frame. Eliminate continuous loops of reinforcing rod or structural steel that do not enclose all conductors of the same circuit. Floor Plan for Switchgear Rated Up to 50 kA, page 30 and Masterclad Extended Floor Plan for 63 kA-Rated Switchgear, page 31 illustrate typical floor plans. Refer to the customer order drawings before using the typical foundation specifications. Customer order drawings are created to comply with specific customer requirements and therefore supersede the information provided here.

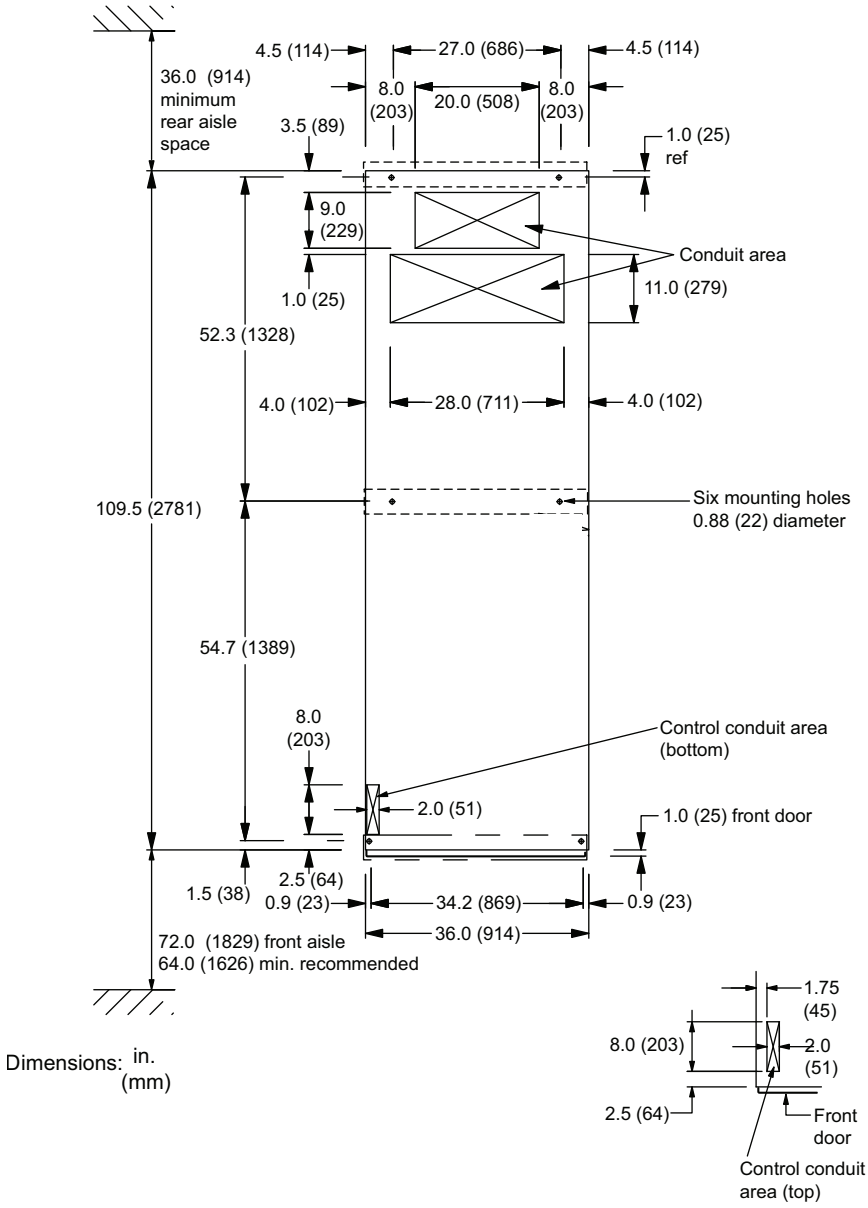
Conduit Location

Refer to the applicable drawings illustrating the typical floor plan before using the typical foundation specifications.

Conduits should be stubbed a maximum of one inch (25 mm) above floor steel. Conduit placement should be very accurate to minimize mechanical interference with the switchgear floor steel.

Avoid continuous loops of reinforcing rod or structural steel that do not enclose all conductors of the same circuit.

Figure 20 - Typical Floor Plan (Not for Construction)



Installation

Pre-Installation Procedures

1. The switchgear may be shipped in one or more shipping sections. Review the assembly drawings to verify that switchgear sections will be assembled in the correct order.
2. Verify that the conduit placement on the foundation is accurate according to customer drawings. Error in conduit placement may prohibit the proper installation of switchgear as described in this section (see the note below).
3. Sweep the pad and remove debris before installing any sections.

Switchgear Installation

NOTE: When more than two shipping sections are involved, any error in conduit location can cause a cumulative error significant enough to prohibit the proper installation by the assembly sequence described in this section. To lessen cumulative error, unload and install the center shipping section first and work toward either end.

1. Move the sections, with skids attached, into place. Install the shipping section that allows the most maneuverability first. If rollers must be used, move with the skid in place. Remove the skid only when the switchgear is in proper position on the pad. Lower the first section onto the pad. Do not pry directly on the structure, doors, or covers.
2. Before proceeding, verify:
   - The conduits are in the center of the cutouts.
   - The back of the unit is perpendicular to the pad and has proper clearance.
   - The mounting holes line up with the mounting channels.
3. Move an adjacent switchgear shipping section into place.
4. Level each section before installing the next. Install steel shims, when necessary, between floor channels and switchgear.
5. Verify that the switchgear sections are level, aligned, and fit snugly together. If the sections do not fit properly, lift the most recently placed section by crane, remove any obstructions, and re-install.
6. Bolt switchgear shipping sections together.

   NOTE: All shipping sections must be bolted together in place before bolting them to the channel sills or installing the horizontal main bus.
7. Repeat steps 4–5 for additional switchgear shipping sections.
8. Verify that all switchgear shipping sections are in the correct position according to the job drawing after all sections are bolted together.
9. Install all cable compartment floor plates to create a barrier between cable compartment and space below the switchgear.

Main Bus Installation

A typical main bus assembly is shown in Main Bus Assembly, page 34. The side and rear views (see Main Bus Connections, Side View, page 34) of the assembly show the general arrangement of the main bus and riser. Main Bus Connections, Side View, page 34 shows the bus connections and orientation of the filler and splice plates.

Figure 21 - Main Bus Assembly

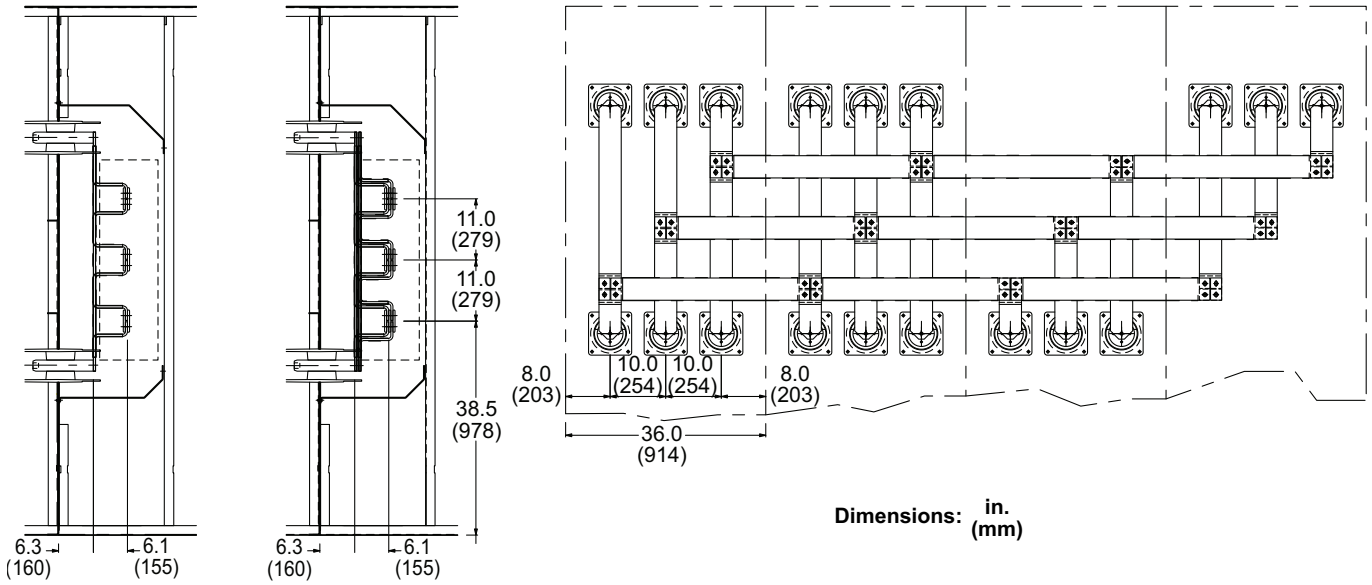


Figure 22 - Main Bus Connections, Side View

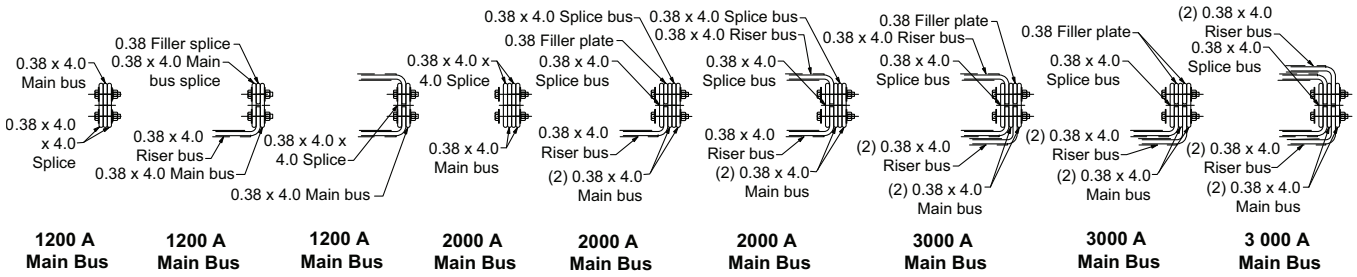
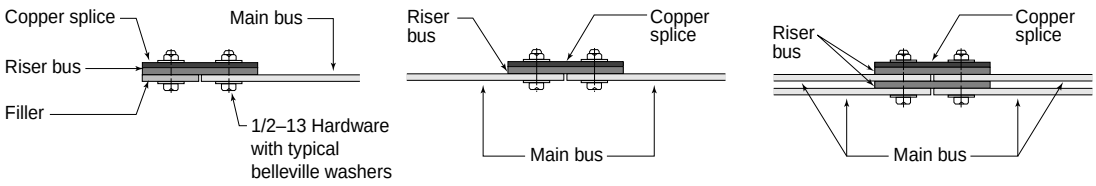


Figure 23 - Main Bus Connections, Top View



Bus Bar Installation

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

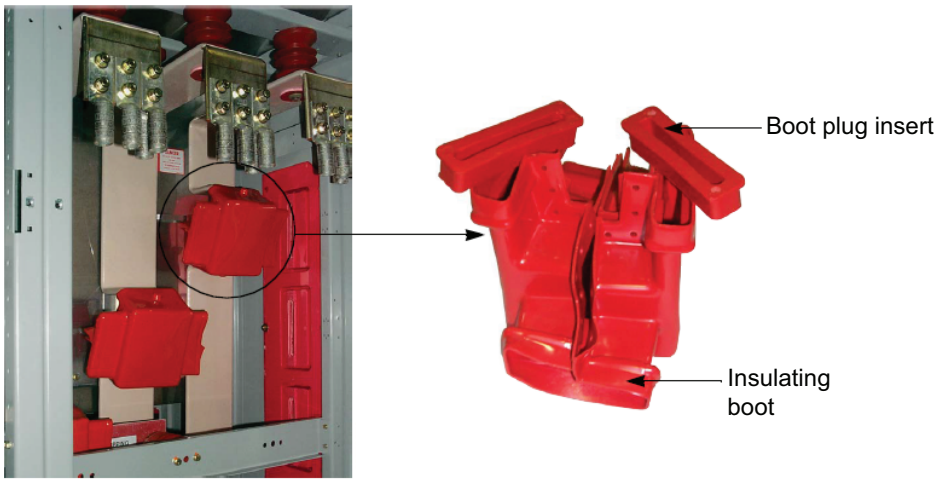
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462 or local equivalent.
- Turn off all power supplying this equipment before working on it.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Before performing maintenance on this device, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power. Check interconnection diagrams and make sure there are no backfeed potential sources.

Failure to follow these instructions will result in death or serious injury.

To install bus bars:

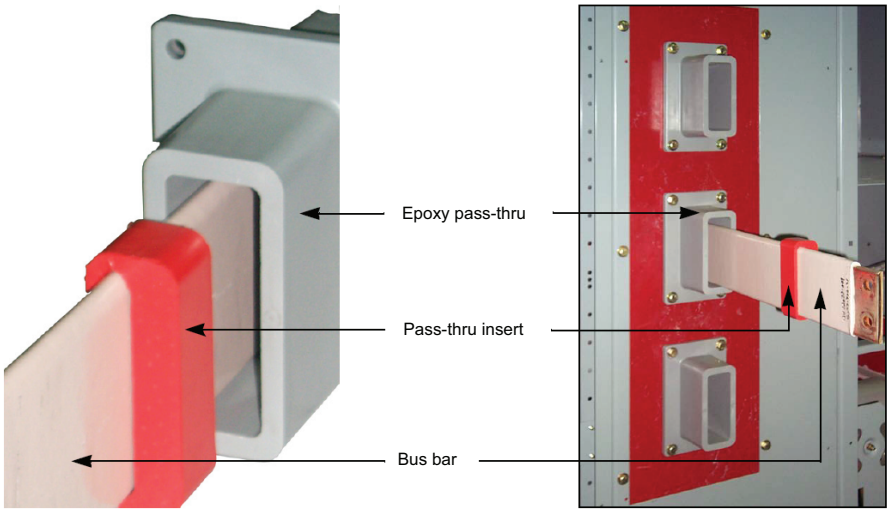
1. Remove the main bus covers and the insulating boots. Do not remove the boot plug inserts.

Figure 24 - Insulating Boots and Boot Plug Inserts



2. Before installing the main bus, slide the pass-through inserts onto the main bus. Install one phase at a time by sliding the bus bars through the epoxy pass-throughs.

Figure 25 - Pass-through Inserts on the Main Bus (left) and Bus Bars Through Epoxy Pass-throughs (right)



3. Loosely bolt the horizontal bus to the vertical bus (see Main Bus (with rear bus cover removed), page 37).

   NOTE: Do not bend or force the bus bars to make this connection. The through bushings and the divided insulating barrier may be loosened if necessary. They have sufficient clearance and adjustment to allow for minor field misalignment of shipping sections.

4. Tighten the bolts connecting the bus joints only after all three bus bars are in place and properly aligned. Using a torque wrench, tighten bolts for bus bar connections in accordance with bolt torque specifications.

Table 2 - Bolt Torque

Bolt Size	Mechanical Joints	Bus Bar Connections
1/4 - 20	7 lb-ft. (9.45 N•m)	—
5/16 - 18	14 lb-ft. (18.91 N•m)	—
3/8 - 16	21 lb-ft. (28.36 N•m)	30 lb-ft. (40.52 N•m)
1/2 - 13	42 lb-ft. (56.72 N•m)	55 lb-ft. (74.28 N•m)

5. Replace the insulating boots with plugs. Slide the pass-through inserts into the epoxy pass-throughs. Reinstall the main bus covers.

Figure 26 - Main Bus (with rear bus cover removed)

Circuit Breaker Installation and Removal

⚠CAUTION

INCORRECT RATING OF CIRCUIT BREAKER

Check the customer order drawings and nameplates on the circuit breaker compartment to verify that the circuit breaker is installed into the proper circuit breaker compartment.

Failure to follow these instructions can result in injury or equipment damage.

Refer to Schneider Electric Bulletin 6055-41 for circuit breaker installation and removal procedures.

Voltage Transformer (VT) Drawout Unit Inspection

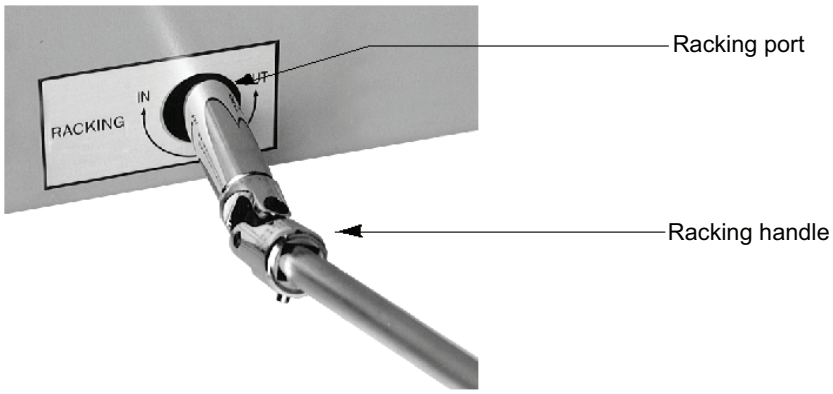
Inspect the voltage transformer drawout unit before energization. Follow the steps below to perform the inspection.

Racking the VT Drawout Unit Out of the CONNECTED Position

Follow steps 1–4 to rack the VT drawout unit from the **CONNECTED** position to the **DISCONNECTED** position.

1. With the VT compartment door closed, insert the Schneider Electric racking handle into the racking port and engage the handle onto the racking shaft.

Figure 27 - Racking Handle Engaged onto Racking Shaft



⚠WARNING

RACKING MECHANISM DAMAGE

Never force the primary fuse drawout unit into or out of the primary fuse drawout unit compartment. If the racking mechanism is not operating easily, inspect the equipment and remove any foreign objects or debris or contact Schneider Electric.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

2. Rotate the racking handle counterclockwise.

   NOTE: If the VT drawout unit does not easily rack out of the **CONNECTED** position, contact Schneider Electric.

3. Verify that the grounding contact chains, extending from the ground bar at the top on the VT drawout compartment, touch the fuse ground tabs on the VT drawout unit as it moves from the **CONNECTED** position to the **DISCONNECTED** position.
4. Continue rotating the racking handle counterclockwise until VT drawout unit is fully racked to the **DISCONNECTED** position.

Inspecting the Fuses

Visually inspect fuses for possible damage. Replace the fuses if necessary. See Replacing the Fuses, page 53.

Racking the VT Drawout Unit Into the CONNECTED Position

After inspecting the VT drawout unit follow the steps below to rack it to the **CONNECTED** position:

1. Close the VT drawout unit compartment door.
2. Insert the Schneider Electric racking handle into the racking port and engage the handle onto the racking shaft.
3. Rotate the racking handle clockwise until VT drawout unit is fully racked to the **CONNECTED** position.

   NOTE: If the VT drawout unit does not easily rack into the **CONNECTED** position, rack the unit to the **DISCONNECT** position, remove any objects or debris from the compartment. Repeat steps 2 and 3. If results are not satisfactory, contact Schneider Electric.

Control Power Transformer (CPT) Primary Fuse Drawout Unit Inspection

Inspect the CPT primary fuse drawout unit before energization. Follow the steps below to perform the inspection.

CPT Primary Fuse Drawout Unit Interlocks

The CPT primary fuse drawout unit is interlocked with a molded case CPT secondary main circuit breaker by a key interlock system. The key interlock scheme uses two locks and one key.

NOTE: The equipment is shipped with a key in each key interlock. Remove the key from the interlock for the fuse drawout truck for use as a spare. Store it in a secure location. The key interlock for the primary fuse drawout truck is located on the racking mechanism. See Key Interlocks for Drawout Primary Fuses and Secondary Circuit Breaker, page 40 and the racking mechanism lockout shown in Circuit Breaker Compartment, page 8.

Racking the CPT Primary Fuse Drawout Unit to the DISCONNECTED Position

Follow steps 1–7 to rack the fuse drawout unit from the **CONNECTED** position to the **DISCONNECTED** position.

1. Place the molded case CPT secondary main circuit breaker in the **OPEN (O)** position. The circuit breaker is mounted on the compartment frame below the drawout unit
2. Turn the key to extend the CPT secondary main circuit breaker key interlock bolt to lock it in the **OPEN (O)** position.
3. Remove the key.
4. Insert the key into the racking mechanism key interlock of the primary fuse drawout unit.

5. Withdraw the key interlock bolt on the racking mechanism.

Figure 28 - Key Interlocks for Drawout Primary Fuses and Secondary Circuit Breaker

6. With the CPT compartment door closed, insert the Schneider Electric racking handle into the racking port and engage the handle onto the racking shaft (see Racking Handle Engaged onto Racking Shaft, page 38).

⚠WARNING

RACKING MECHANISM DAMAGE

Never force the primary fuse drawout unit into or out of the primary fuse drawout unit compartment. If the racking mechanism is not operating easily, inspect the equipment and remove any foreign objects or debris or contact Schneider Electric.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

7. Rotate the racking handle counterclockwise until primary fuse drawout unit is fully racked to the **DISCONNECTED** position.

NOTE: If the primary fuse drawout unit does not easily rack out of the **CONNECTED** position, contact Schneider Electric.

Inspecting the Fuses

Visually inspect fuses for possible damage. Replace the fuses if necessary. See Replacing the Fuses, page 53.

Racking the CPT Primary Fuse Drawout Unit to the CONNECTED Position

After inspecting the primary fuse drawout unit, follow the steps below to rack it to the **CONNECTED** position:

1. Close the primary fuse drawout unit compartment door.
2. Insert the Schneider Electric racking handle into the racking port and engage the handle onto the racking shaft.

3. Rotate the racking handle clockwise until primary fuse drawout unit is fully racked to the **CONNECTED** position.

If the CPT primary fuse drawout unit does not easily rack into the **CONNECTED** position, rack the unit to the **DISCONNECT** position, remove any objects or debris from the compartment. Repeat steps 2 and 3. If results are not satisfactory, contact Schneider Electric.

High-Potential (Hi-Pot) Testing

Before making external power connections, perform a high-potential (hi-pot) test on the bus and circuit breakers as an assembly. To prepare for this test:

1. Disconnect surge arresters.
2. Withdraw the voltage transformer drawer and drawout fuse (if provided).
3. Place each of the circuit breakers in its proper circuit breaker compartment in the connected position. Charge their springs manually, and then close each circuit breaker by using the **CLOSE (I)** pushbutton.

Use a reliable transformer-type tester with a built-in voltmeter and milliampmeter for hi-pot testing. Capacitor loaded bench-type testers with neon bulb indicators do not have sufficient capacity to give reliable results.

Refer to One Minute Hi-Potential Test[1], page 41 for the nominal test values for dry, clean, new assemblies. Field hi-pot tests are made at 75% of factory test voltages in accordance with ANSI standards.

Table 3 - One Minute Hi-Potential Test[1]

Assembly Rated Maximum Voltage	Factory Test Voltage (AC)	Field Test Voltage	
		AC	DC
27 kV	60 kV	45 kV	63 kV

If satisfactory results are not obtained, locate the problem, correct it, and rerun the test before proceeding. If results are acceptable, the power cables, ground wires, external wiring, and battery (if supplied) can be connected to the assembly. If results are not acceptable, contact Schneider Electric.

Phasing

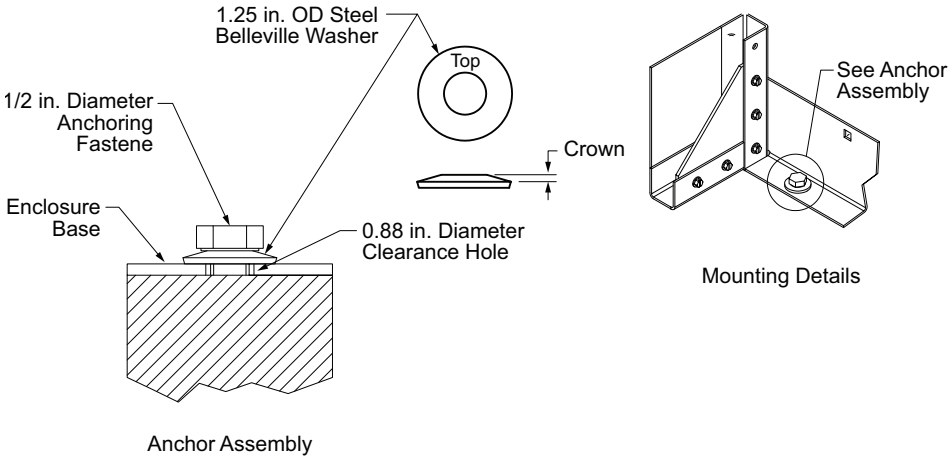
In accordance with NEMA standards, all bus within the switchgear is phased A-B-C left to right, top to bottom, and front to back when viewing the assembly from the front (the circuit breaker compartment side). If, for any reason, the bus must be phased differently, the different phases will be identified on the bus with a label.

1. AC voltages are 60 Hz rms symmetrical.

Equipment Anchorage for Non-Seismic Applications

The equipment enclosure provides anchorage tie-down points to accept anchor attachments to the building structure or foundation. Masterclad 27 kV Metal-Clad indoor enclosures provide enclosure base frame clearance holes to accept bolted anchorage attachments as shown in Non-seismic Switchgear Anchor Assembly, page 42. Four anchors are required for each section, two in the front and two in the rear located per Typical Floor Plan (Not for Construction), page 32.

Figure 29 - Non-seismic Switchgear Anchor Assembly



Equipment Installation for Seismic Applications

Introduction Seismic Certification

Seismic certification is an optional feature on the Masterclad 27 kV Metal-Clad product line and provides seismic conformance options to any of the North American and International building codes and seismic design standards identified in List of Supported Regional Building Codes and Seismic Design Standards, page 43. Masterclad 27 kV Metal-Clad that is seismically certified has been certified to the seismic requirements of the listed code per the manufacturer's certificate of compliance (CoC). Equipment compliance labels and CoC's are provided with all seismically certified Masterclad 27 kV Metal-Clad. Refer to the equipment CoC for certification details and applicable seismic parameters. To maintain the validity of this certification, the installation instructions provided in this section must be followed.

Table 4 - List of Supported Regional Building Codes and Seismic Design Standards

Country / Region	Code Reference ID	Code Name
North American Codes		
Canada	NBCC	National Building Code of Canada
Mexico	CFE MDOC-15	Civil Works Design Manual, Earthquake Design
United States	IBC per ASCE 7 CBC per ASCE 7 UFC per DoD	International Building Code—IBC California Building Code—CBC Uniform Facilities Criteria—UFC
International Codes		
Argentina	INPRES-CIRSOC103	Argentinean Standards for Earthquake Resistant Constructions
Australia	AS 1170.4-2007 (R2018)	Structural design actions, Part 4: Earthquake actions in Australia
Chile	NCh 433.Of1996	Earthquake resistant design of buildings
China	GB 50011-2010 (2016)	Code for Seismic Design of Buildings
Colombia	NSR-10 Título A	Colombian Regulation of Earthquake Resistant Construction
Europe	Eurocode 8 EN1998-1	Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings
India	IS 1893 (Part 1) : 2016	Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings
Indonesia	SNI 1726:2019	Earthquake Resistance Planning Procedures for Building and Non-building Structures
Japan	Building Standard Law	The Building Standard Law of Japan
New Zealand	NZS 1170.5:2004+A1	Structural design actions, Part 5: Earthquake actions – New Zealand
Peru	N.T.E. - E.030	National Building Code, Earthquake-Resistant Design
Russia	СП 14.13330.2018	Building norms and regulations: Construction in seismic regions
Saudi Arabia	SBC 301	Saudi Building Code, Loads & Forces Requirements
Taiwan	CPA 2011	Seismic Design Code and Commentary for Buildings
Turkey	TBEC-2018	Turkey Buildings Earthquake Standard

Responsibility for Mitigation of Seismic Damage

The Masterclad 27 kV Metal-Clad equipment is considered a nonstructural building component as defined by regional building codes and seismic design standards. Equipment capacity was determined from tri-axial seismic shake-table test results in accordance with the International Code Counsel Evaluation Service (ICC ES) Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components (ICC-ES AC156).

An equipment importance factor, I_p, that is greater than one ($I_p > 1.0$) is assumed and indicates that equipment functionality is required after a seismic event and after seismic simulation testing. This importance factor is applicable for designated seismic systems (for example, special certification) servicing critical infrastructure and essential buildings where post-earthquake equipment functionality is a requirement.

Incoming and outgoing bus, cable, and conduit must also be considered as related but independent systems. These distribution systems must be designed and restrained to withstand the forces generated by the seismic event without increasing the load transferred to the equipment. For applications where seismic hazard exists, it is preferred that bus, cable, and conduit enter and exit the bottom of the equipment enclosure.

Seismic certification of nonstructural components and equipment by Schneider Electric is just one link in the total chain of responsibility required to maximize the probability that the equipment will be intact and functional after a seismic event. During a seismic event the equipment must be able to transfer the inertial loads that are created and reacted through the equipment's force resisting system and anchorage to the load-bearing path of the building structural system or foundation.

Anchorage of equipment (for example, nonstructural supports and attachments) to the primary building structure or foundation is required to validate seismic conformance. The construction site structural engineer or engineer of record (EOR) or the Registered Design Professional (RDP) is responsible for detailing the equipment anchorage requirements for the given installation. The installer and manufacturers of the anchorage system are responsible for assuring that the mounting requirements are met. Schneider Electric is not responsible for the specification and performance of equipment anchorage systems.

Tie-down Points for Rigid Floor Mounted Equipment

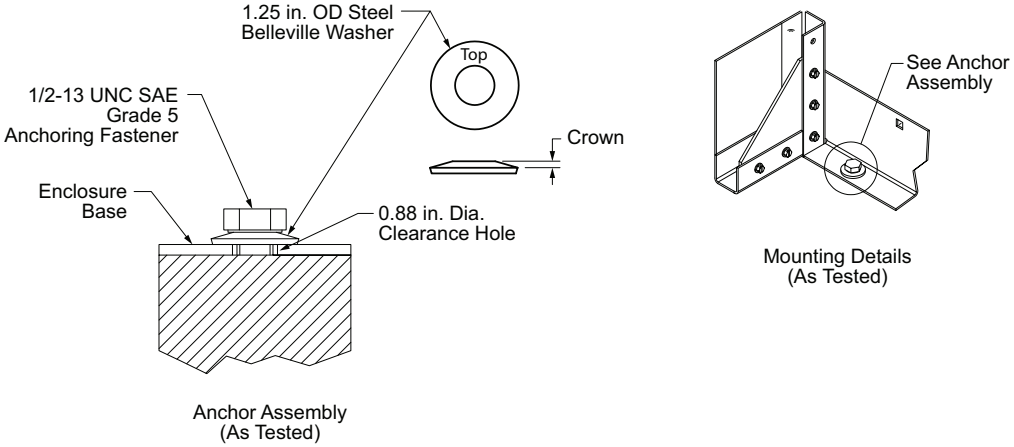
The equipment enclosure provides anchorage tie-down points to accept anchor attachments to the building structure or foundation. Masterclad 27 kV Metal-Clad indoor enclosures provide enclosure base frame clearance holes for bolted anchorage attachments. Equipment installations must be anchored using all enclosure tie-down points as shown in Typical Floor Plan (Not for Construction), page 32.

Equipment installations using welded supports and attachments in lieu of bolted supports and attachments must ensure the weld locations are distributed similarly to the locations of enclosure anchorage clearance holes. Welded supports and attachments must be properly sized so that the weldment withstand capacity exceeds the earthquake demand at location of equipment installation. Precautions shall be made to properly vent and shield the equipment enclosure during the field welding process. Schneider Electric is not responsible for equipment damage caused by field welded supports and attachments.

Anchorage Assembly Instructions

The bolted anchor assembly view depicted in Switchgear as Tested Anchor Assembly, page 45 illustrates the equipment's as-tested attachment to the seismic shake-table test fixture. The equipment seismic rated capacity, as stated on the Schneider Electric CoC, was achieved with the identified size and grade attachment hardware. For bolted attachments, the use of factory supplied Belleville conical spring washers, are required to maintain seismic conformance. Field installed equipment attachment and support detailing shall be in accordance with the anchorage system requirements as defined by the construction site EOR or RDP.

Figure 30 - Switchgear as Tested Anchor Assembly



Cable Connections

Be very careful when making up all types of cable terminations, as terminations are critical to the successful operation of the electrical distribution system. Avoid sharp turns, edges, or corners so as not to damage the cable insulation. Follow the cable manufacturer's recommendations for minimum bending radius. These instructions vary from manufacturer to manufacturer.

Solderless or compression-type cable lugs are the most common method for connecting power cables to metal-clad switchgear. When making the terminations for each type of power cable, follow the cable manufacturer's instructions.

Insulating the Cable Connections

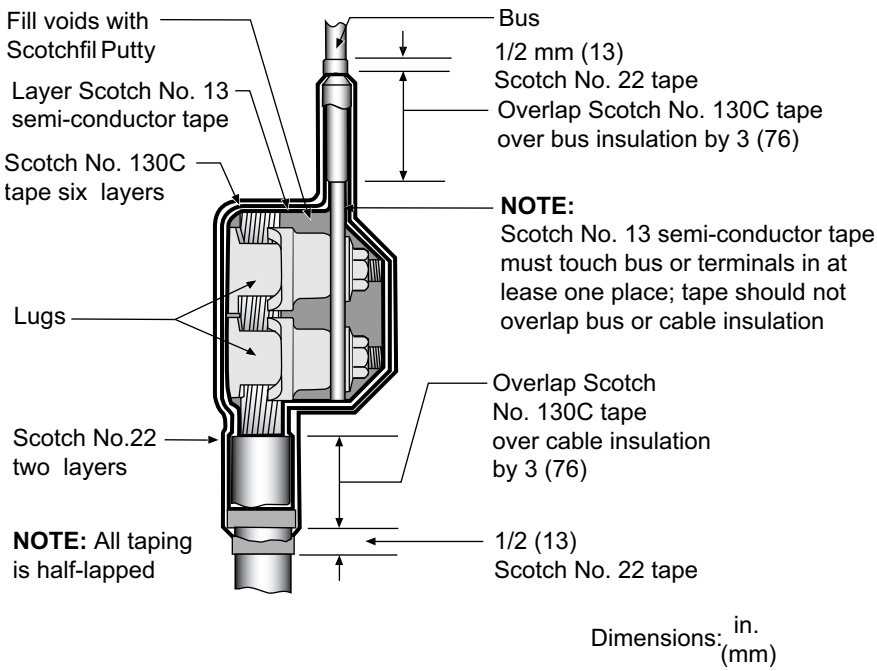
Power cable connections must be insulated according to the switchgear kV rating and must meet the 27 kV system hi-pot dielectric requirements (see High-Potential (Hi-Pot) Testing, page 41).

Before making cable connections, install the cable compartment floor plates.

Insulating putty and tape (provided by customer) or other insulating means may be used to insulate the power cable connections.

1. Place insulating putty, such as 3M® Scotchfil®, around the lugs and bolts to reduce the concentrated field created by their irregular shapes (see Power Cable Connection Insulation, page 46). Apply a layer of Scotch® No. 13 (or equivalent) semiconducting tape over the insulating putty. Half-lap the tape, which layer must extend onto the conductor. Do not extend the tape up over the bus epoxy insulation. Apply Scotch No. 130C (or equivalent) tape over the No. 13 tape. Half-lap this tape for six layers. Extend the tape three inch (76 mm) up over the bus insulation and cable insulation.
2. Apply two layers of Scotch Brand No. 22 tape (or equivalent), extending the tape up over the No. 130C tape in all directions. The tape and other insulating materials for completing these field connections are not supplied with the switchgear.
3. If potheads or cable terminators are supplied for terminating power cables, follow the pothead manufacturer's instructions for terminating the cables in these devices. To facilitate installation of the power cables, the bus side is not taped. After the cables are installed, insulate the pothead-to-bus connections according to the cable lug insulation instructions in this section.

Figure 31 - Power Cable Connection Insulation



Operation

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462 or local equivalent.
- Only qualified personnel familiar with medium voltage equipment are to perform work described in this set of instructions. Workers must understand the hazards involved in working with or near medium voltage circuits.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment using a properly rated voltage sensing device to confirm power is off.
- Before performing maintenance on this device, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power. Check interconnection diagrams and make sure there are no backfeed potential sources.
- Never disconnect the main trip source of energized equipment.
- Do not open a circuit breaker door unless the circuit breaker is open.
- Handle this equipment carefully and install, operate, and maintain it correctly so that it functions properly.
- Be aware of potential hazards, wear personal protective equipment, and take adequate safety precautions.
- Do not make any modifications to the equipment or operate the system with interlocks and safety barriers removed. Contact your local Schneider Electric representative for additional instructions if the equipment does not function as described in this manual.
- Use out-of-service tags and padlocks when working on equipment. Leave tags in place until the work is completed and the equipment is ready to be put back into service.
- The complete assembly arrangement determines if the top or bottom contacts are the line side; both can be energized when the circuit breaker is removed from the compartment. Identify the line side contacts for each circuit breaker compartment.
- Disconnect all high voltage to the switchgear before accessing the horizontal bus compartment.
- Carefully inspect your work area and remove any tools and objects left inside the equipment before energizing the switchgear.
- Replace all devices, doors, and covers before connecting the power to this equipment.
- All instructions in this manual are written with assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Training of personnel for final start-up can be provided. Contact your local Schneider Electric field sales representative for information.

Preliminary Start-Up Procedures

1. Turn off all main and control power supplying the equipment.
2. Vacuum every compartment. Remove all loose parts, tools, miscellaneous construction items, and litter.
3. Verify that all insulating boots are installed correctly and properly closed. Verify that primary cable connections are properly insulated.
4. Verify that any customer installed low voltage cables with ground shield maintain 6 inches distance from primary conductors.
5. Verify primary cable routing is properly installed as per instructions provided in previous sections.
6. Replace all of the main bus covers and any other barriers or covers that were removed during installation.
7. Install the cable compartment back covers.
8. Connect the battery charger and batteries (if used) to the switchgear control bus according to the order drawings.
9. Unblock all of the relays and set to the relay schedule. Using a relay tester, verify the settings and electrical operation of each relay.
10. Verify that any control power transformer used has the current limiting fuses in place. Pull the drawer out to the withdrawn position.

Installing and Testing Circuit Breakers in the TEST/ DISCONNECT Position

Follow the steps for installing and testing the circuit breaker in the **TEST**/ **DISCONNECT** position outlined in Schneider Electric Bulletin. 6055-41.

Circuit Breaker Preliminary Start-up Procedure

1. Electrically close and open the circuit breaker with the door-mounted circuit breaker control switch. **OPEN (O)** the circuit breaker by temporarily closing the contacts of each protective relay. Reset the relay targets after each operation.
2. Electrically operate from remote control locations and check the remote indicating lights.
3. Operate all electrical interlocks, transfer schemes, lock-out relays, and other control functions to validate proper operation.
4. Remove the temporary source of low voltage power (if used) and make the permanent connection of low voltage power.
5. Follow the steps outlined in “Racking the Circuit Breaker into the CONNECTED Position” in Schneider Electric Bulletin 6055-41.
6. Using the racking handle provided, rack the drawout fuses and drawout voltage transformers into the connected position.
7. Using a properly rated voltage sensing device, verify again that trip voltage is available at the circuit breaker terminals in each compartment.

Energizing the Switchgear

To establish electrical service follow these steps:

1. Energize the incoming high voltage circuits.
2. Close the main circuit breakers.
3. Close the feeder circuit breakers.
4. Energize loads one at a time.

Removing Circuit Breakers

Follow the directions outlined in “Racking the Circuit Breaker Out of the CONNECTED Position” in Schneider Electric Bulletin 6055-41.

Inspection and Maintenance

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462 or local equivalent.
- Only qualified personnel familiar with medium voltage equipment are to perform work described in this set of instructions. Workers must understand the hazards involved in working with or near medium voltage circuits.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on it.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Before performing maintenance on this device, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power. Check interconnection diagrams and make sure there are no backfeed potential sources.
- Use out-of-service tags and padlocks when working on equipment. Leave tags in place until the work is completed and the equipment is ready to be put back into service.
- Do not open a circuit breaker door unless the circuit breaker is open.
- Never disconnect the main trip source of energized equipment.
- Handle this equipment carefully and install, operate, and maintain it correctly so that it functions properly.
- Be aware of potential hazards, wear personal protective equipment, and take adequate safety precautions.
- Do not make any modifications to the equipment or operate the system with interlocks and safety barriers removed. Contact your local Schneider Electric representative for additional instructions if the equipment does not function as described in this manual.
- The complete assembly arrangement determines if the top or bottom contacts are the line side; both can be energized when the circuit breaker is removed from the compartment. Identify the line side contacts for each circuit breaker compartment.
- Disconnect all high voltage to the switchgear before accessing the horizontal bus compartment.
- Carefully inspect your work area and remove any tools and objects left inside the equipment before energizing the switchgear.

Failure to follow these instructions will result in death or serious injury.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Replace all devices, doors, and covers before connecting the power to this equipment.
- All instructions in this manual are written with assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Cleaning Instructions

This equipment contains components manufactured with various materials. Some cleaning agents could damage the integrity of the surface of the component reducing its insulating properties, structural strength or conductivity. Use this guide to determine a compatible cleaning agent for typical materials incorporated in this equipment. Never spray cleaners or use compressed air on or inside the equipment as this will cause the contamination or cleaners to become airborne and could contaminate other components.

- Greased joints:
  - Wipe surface grease away with a clean cloth. Reapply the grease recommended for that assembly, found in the maintenance section of the documentation for that assembly.
- Glass polyester insulator surfaces:
  - Wipe with a clean cloth dampened with denatured alcohol.
  - Use distilled or purified water to moisten the cloth in place of denatured alcohol, but standing/pooling water must be absorbed and not left to air dry.
  - Use care so the liquid does not flow between bus joints.
- Epoxy insulator surfaces:
  - Wipe with a clean cloth dampened with denatured alcohol.
  - Use distilled or purified water to moisten the cloth in place of denatured alcohol, but standing/pooling water must be absorbed and not left to air dry.
  - Remove residue by lightly rubbing with a dry Scotch-Brite non-scratch scour pad followed by wiping with a clean cloth moistened with denatured alcohol, distilled or purified water.
  - Use care so the liquid does not flow between bus joints or between the epoxy coating and bus.
- Ceramic/porcelain insulator surfaces:
  - Wipe with a clean cloth dampened with denatured alcohol.
  - Use distilled or purified water to moisten the cloth in place of denatured alcohol, but standing/pooling water must be absorbed and not left to air dry.
  - Use care so the liquid does not flow between bus joints or between the epoxy coating and bus.
  - Remove residue by lightly rubbing with a multi-functional HV insulator cleaning paste on a clean cloth followed by wiping with a clean cloth moistened with denatured alcohol, or distilled or purified water.
- Poly concrete standoff insulator surfaces:
  - Wipe with a clean cloth dampened with denatured alcohol.
  - Use care so the liquid does not flow between bus joints.
- Plastisol boot surfaces:
  - Wipe with a clean cloth dampened with denatured alcohol.
  - Use distilled or purified water to moisten the cloth in place of denatured alcohol, but standing/pooling water must be absorbed and not left to air dry.
  - Use care so the liquid does not flow inside the boot and between the bus joints.

- Polycarbonate/Lexan surfaces:
  - Wipe with a clean cloth dampened with denatured alcohol.
  - Use distilled or purified water to moisten the cloth in place of denatured alcohol, but standing/pooling water must be absorbed and not left to air dry.
  - Do not wipe in a circular motion, use linear strokes directed toward an exposed edge.
  - Change the water and rinse the cloth often.
  - Dry with a clean cloth.
  - Use denatured alcohol dampened on a clean cloth on the polycarbonate/ Lexan insulation barriers as there is no UV protection applied to the sheet that would cause degradation.
- Silver/tin plated copper surfaces:
  - Wipe with a clean cloth dampened with denatured alcohol.
  - Remove residue by lightly rubbing with a dry Scotch-Brite non-scratch scour pad followed by wiping with a clean cloth moistened with denatured alcohol.
  - Use care so the liquid does not flow between bus joints.
- Powder coated surfaces:
  - Wipe with a clean cloth dampened with denatured alcohol.
  - Use distilled or purified water to moisten the cloth in place of denatured alcohol, but standing/pooling water must be absorbed and not left to air dry.
  - Remove residue by lightly rubbing with a dry Scotch-Brite non-scratch scour pad followed by wiping with a clean cloth moistened with denatured alcohol, or distilled or purified water.
  - Use care so the liquid does not splash or flow into seams or onto other components.
- Control component surfaces:
  - Low voltage wires within this equipment are SIS insulated and may be wiped with a clean cloth dampened with distilled or purified water. Do not use alcohol.
  - Circuit boards can have isopropyl alcohol applied by small brush to remove deposits.
  - Solvents and alcohol (denatured, isopropyl) can damage some plastics, such as amorphous plastics. When in doubt, use a clean dry cloth, or a clean cloth dampened with distilled or purified water and dry completely.
- **NOTES:**
  - Do not use cleaners such as Lectra-Clean™ made by CRC (noted in some of the low voltage equipment manuals). Lectra-Clean can damage some plastics and other components.
  - Do not use chemicals such as Simple Green™ as it can cause corrosion on some parts and in some cases those cleaners describe rinsing the surface after application.
  - Do not splash or spray liquids as they can infiltrate areas that cannot be cleaned or dried properly.
  - Components within the equipment are not rated to be exposed to moisture. Exposure to moisture may cause performance issues to develop over the life of the product.

Main Bus Compartment

1. Turn off all power supplying this equipment. Be sure there is no backfeed through any feeder circuit. Always use a properly rated voltage sensing device to confirm that power is off.
2. Ground the main and feeder circuits.
3. Disconnect and remove fuses.
4. Disconnect and remove the circuit breaker.
5. Remove the front and rear covers from each main bus compartment. Inspect the busbars, primary contact supports, and insulating barrier(s).
6. Remove the insulating boots from the bus joints. Check all busbar connections and torque all 1/2 inch bolts to 55 lb-ft. (74.28 N•m).

   NOTE: Slight discolorations or tarnish of the silver plate is normal. Severe discoloration of the silver plate is an indication of an improper or loose contact and overheating. Clean the discoloration from the contact surfaces of the busbar and primary contact. Use an abrasive pad such as Scotch Brite.
7. Vacuum each compartment to remove dust, spiderwebs, and others. Wipe off the insulation with a clean cloth.
8. Lightly lubricate the moving primary and secondary contacts and fingers with Mobil 28™ red grease, SquareD™ part number 1615-100950T.
9. Lubricate all rollers and sliding parts with Mobil 28 red grease, SquareD part number 1615-100950T.

Replacing the Fuses

To replace damaged fuses in the VT drawout unit or CPT fuse drawout units:

NOTE: When replacing fuses, handle them carefully to avoid breakage. Do not grasp the fuse in the middle. Replace all fuses even if only one is damaged.

1. Follow the procedures outlined in either Voltage Transformer (VT) Drawout Unit Inspection, page 37 or Control Power Transformer (CPT) Primary Fuse Drawout Unit Inspection, page 39 to withdraw the appropriate fuse drawout unit.
2. Wearing personal protective equipment, such as insulated gloves and a face shield, grasp the fuse near the fuse clip and pull while rotating the fuse.
3. Insert the fuses one end at a time into the fuse clips.
4. Follow the racking procedures outlined in either Voltage Transformer (VT) Drawout Unit Inspection, page 37 or Control Power Transformer (CPT) Primary Fuse Drawout Unit Inspection, page 39 to return the unit to the **CONNECTED** position.

Re-Energizing

Install all of the circuit breakers to the **TEST**/**DISCONNECT** position with their secondary disconnects engaged:

1. Remove the ground from the main and feeder circuits
2. Close the compartment doors.
3. Connect the control power source.
4. Close the main source of power and operate each circuit breaker electrically in the **TEST**/**DISCONNECTED** position.
5. If all controls are functioning properly, disconnect the secondary control plugs.
6. Rack the circuit breakers into the **CONNECTED** position.
7. Close the circuit breakers and resume normal operation.

Accessories

MasterClad Lift Truck

One circuit breaker lift truck is required for each:

- Two-high line up.
- Switchgear installed on concrete pads that do not extend beyond the front of the switchgear.
- NEMA 3R outdoor nonwalk-in switchgear.

The cradle is raised and lowered by a self-braking worm and pinion drive system with a winch and wire cable. No ratchet release or locking is required because of the automatic load-retaining clutch feature. Rotating the handle clockwise raises the cradle. Rotating the handle counterclockwise lowers the cradle.

Follow the instructions provided with the Masterclad lift truck to remove a circuit breaker from the circuit breaker compartment with the lift truck.

Figure 32 - Masterclad Lift Truck

Test Cabinet (Optional)

An optional wall-mounted test cabinet (see Wall-Mounted Test Cabinet (Optional), page 56) is furnished when listed in the user's specifications. The test cabinet consists of a small enclosure with:

- A power on-off toggle switch,
- a white light indicating the power is on,
- A red light indicating the circuit breaker is closed,
- A green light indicating the circuit breaker is open,
- Close and open pushbuttons, and
- An eight ft. (2440 mm) cable with a secondary control receptacle that can be plugged directly into the circuit breaker control plug.

Refer to the customer drawings for the external power connections and requirements necessary for the cabinet. A convenient terminal block is provided inside the test cabinet for these connections.

Figure 33 - Wall-Mounted Test Cabinet (Optional)

Ground and Test Devices

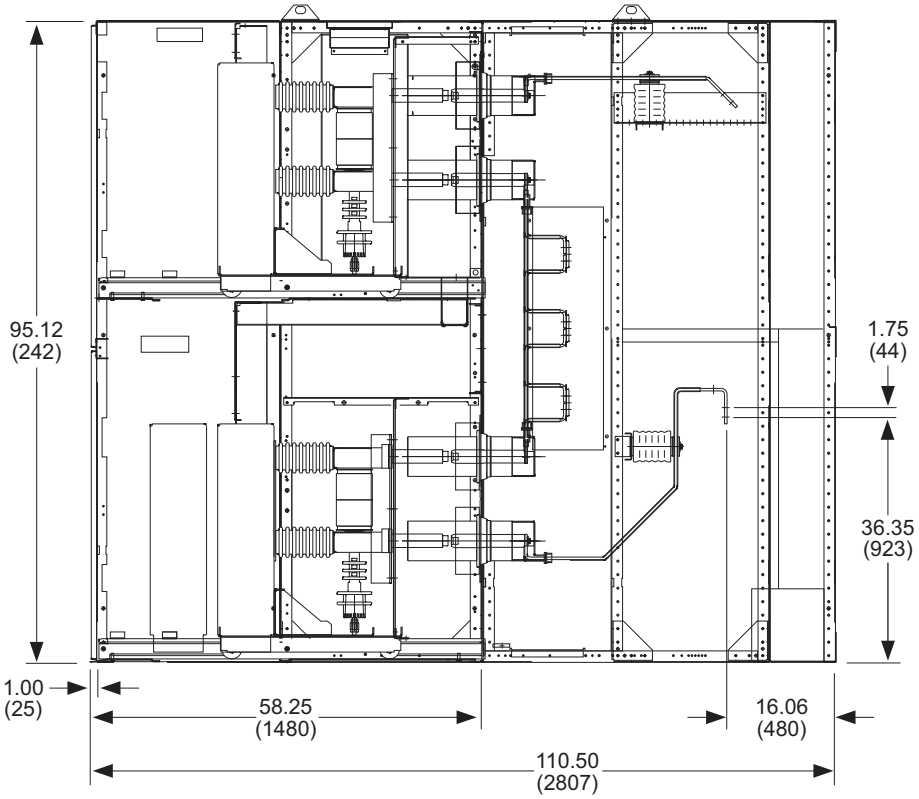
Two types of ground and test devices are available: manual and electrical. Ground and test devices are typically used for:

- Grounding of circuits during maintenance periods and
- Connection points for applying voltage for hi-pot testing and cable testing access to both line side and load side circuits for phase sequence testing.

NOTE: A complete description, operating instructions, and maintenance information are included in a separate ground and test devices instruction bulletin.

Outline Drawing

Figure 34 - Masterclad Indoor Switchgear Outline Drawing



Installation and Maintenance Log

Table 5 - Installation and Maintenance Log

Date	Initials	Actions

Printed in:
Schneider Electric
35 rue Joseph Monier
92500 Rueil Malmaison - France
+ 33 (0) 1 41 29 70 00

Schneider Electric
800 Federal Street
01810 Andover, MA
USA

1 888-778-2733

www.se.com

As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

6055-40 Rev. 02