

# Instructions for installation, operation, and maintenance of 27 kV type VacClad-W arc resistant metal-clad switchgear

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**⚠ WARNING**

**HAZARD OF ELECTRICAL SHOCK OR BURN. OPERATING THE SWITCHGEAR ASSEMBLY OUTSIDE OF ITS RATINGS MAY CAUSE FAILURE RESULTING IN PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH. THE SWITCHGEAR ASSEMBLY MUST BE OPERATED WITHIN ITS NAMEPLATE RATINGS.**

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**⚠ WARNING**

**HAZARDS OF ARC FLASH, ARC BLAST, AND ELECTRIC SHOCK EXIST WHEN THIS EQUIPMENT IS ENERGIZED, WHICH MAY LEAD TO DEATH OR SEVERE INJURY.**

**ALL WORK ASSOCIATED WITH THIS ELECTRICAL EQUIPMENT MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL AS DEFINED IN NFPA-70. CONSULT NFPA-70E, OSHA, AND ANY OTHER APPLICABLE REGULATION PERTAINING TO OPERATOR SAFETY PRIOR TO SERVICING EQUIPMENT. THE QUALIFIED PERSONNEL MUST FOLLOW ALL APPLICABLE PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS.**

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**VERIFY NO VOLTAGES ARE PRESENT ON ALL INCOMING AND OUTGOING CONDUCTORS, AND ANY ENERGY SOURCES CONTAINED WITHIN THE EQUIPMENT PRIOR TO SERVICING, THEN GROUND (CONNECT TO EARTH) ALL INCOMING AND OUTGOING CONDUCTORS ATTACHED TO THIS EQUIPMENT AND TO ANY INTERNAL ENERGY SOURCES.**

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**⚠ DANGER**

**ALL APPLICABLE SAFETY CODES, SAFETY STANDARDS, AND SAFETY REGULATIONS MUST BE ADHERED TO WHEN INSTALLING, OPERATING, OR MAINTAINING THIS EQUIPMENT.**

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## Instructions for installation, operation, and maintenance of 27 kV type VacClad-W arc resistant metal-clad switchgear

### Section 1. Introduction

#### 1.1 Purpose

This instruction booklet covers the installation, operation, and maintenance of a 27 kV type VacClad-W arc resistant metal-clad switchgear indoor housing assembly. It is not encompassing of all possible contingencies, variations, and details that may arise during installation, operation, or maintenance of this equipment.

#### 1.2 Application and description

The Eaton 27 kV type VacClad-W arc resistant metal-clad switchgear indoor housing assembly provides centralized control and protection of medium voltage power equipment and circuits in industrial, commercial, and utility installations involving generators, motors, and feeder circuits. Arc resistant switchgear provides additional protection in the event of an internal arcing fault. Eaton's arc resistant switchgear meets or exceeds ANSI/ Institute of Electrical and Electronics Engineers (IEEE) C37.20.2 as they apply to metal-clad switchgear and IEEE Guide C37.20.7 for arc resistant rating Type 2. The assemblies also conform to CSA C22.2 No. 31. type VCP-W vacuum circuit breakers meet or exceed all ANSI and IEEE standards applicable to AC high voltage circuit breakers rated on a symmetrical current basis. The switchgear also exceeds all seismic requirements contained in the International Building Code and the California Building Code.

#### 1.3 Documentation reference

Refer to the customer drawing package for order specific information. For further information on installation and application, refer to the applicable technical data, publications, and/or industry standards. Download Eaton electronic information from [www.eaton.com](http://www.eaton.com).

For receiving, handling, storing and installation instructions: IB022014EN.

For plenum and duct installation: IB48077.

For VCP-W breaker: IB131006EN.

For switchgear mounting to a foundation: Job Floorplan Document.

For breaker lifting device: IB02100002E.

For sample ground and test device: Refer to document received with the device.

For AMPGARD medium voltage motor control centers: IB48057.

#### 1.4 Eaton contact information

For additional information about Eaton products, please call 1-800-525-2000 or log onto [www.eaton.com](http://www.eaton.com). Additional medium voltage switchgear information regarding Pricing/Aftermarket, Customer Service, Engineering/Technical Information, or Warranty, can be found by calling 1-800-345-4072.

Eaton Electrical Services and Systems (EESS) can be reached at 1-800-498-2678.

If further information is desired regarding this particular installation or application information, contact the local Eaton sales office, reference Eaton's Consulting Application Guide, or the appropriate industry standards.

### 1.5 Modifications to switchgear

#### **⚠ CAUTION**

**MODIFICATIONS TO THE SWITCHGEAR ENCLOSURE CAN COMPROMISE THE ARC RESISTANT PROPERTIES OF THE SWITCHGEAR. DOORS THAT OPEN TO ENCLOSED LOW VOLTAGE COMPARTMENTS ARE THE ONLY PARTS THAT MAY BE MODIFIED FOR MOUNTING COMPONENTS DUE TO THE TYPE 2 ARC RESISTANT RATING. ANY OTHER MODIFICATION COMPROMISES COMPLIANCE WITH IEEE C37.20.7. PLEASE CONTACT THE FACTORY WITH ANY RELATED QUESTIONS.**

### 1.6 Safety precautions

#### **⚠ WARNING**

**ONLY QUALIFIED ELECTRICAL PERSONNEL WITH TRAINING AND EXPERIENCE ON HIGH VOLTAGE APPARATUS SHALL BE PERMITTED TO WORK ON THIS EQUIPMENT. THEY SHALL BE FAMILIAR WITH THE WORK TO BE PERFORMED, AS WELL AS INDUSTRY AND LOCAL SAFETY PROCEDURES AND STANDARDS.**

1. Read and understand these instructions before attempting installation, operation, or maintenance of the switchgear assembly.
2. Disconnect all low voltage and medium voltage power sources to the switchgear assembly before working on the equipment per Occupational Safety and Health Act (OSHA) and lockout procedures. Verify that the voltage has been removed. Ground load and line side connections. Observe National Electrical Code (NEC), OSHA, and local procedures and standards. This includes visual inspections while any door is open, making any adjustments inside or outside the enclosure, performing maintenance, or installing replacement parts.
3. Never leave a breaker in an intermediate position in its compartment. Always continue to lever the breaker to the fully connected position, the "Test" position, or fully withdrawn position. Do not attempt to open the door unless the breaker is in the "Disconnect" position.
4. Never try to disconnect or open the secondary circuit of a current transformer that is generating secondary current. In this situation, the transformer develops a dangerous high voltage across the secondary terminals.

#### **⚠ CAUTION**

**BEFORE ATTEMPTING ANY WORK, EITHER DE-ENERGIZE AND GROUND THE CIRCUIT BY OPENING THE BREAKER OR SHORT-CIRCUIT THE SECONDARY OF THE CURRENT TRANSFORMER.**

5. The user is responsible for conforming to all applicable code requirements with respect to grounding the switchgear assembly.

#### **⚠ CAUTION**

**BEFORE ENERGIZING THE SWITCHGEAR ASSEMBLY, ENSURE THAT THE FOLLOWING ITEMS 6 THROUGH 10 ARE TRUE.**

6. The switchgear assembly is secured on a true and level surface according to the floor plan of the customer drawings.
7. Confirm all hardware is in place and tightened per Table 3.
8. Confirm no tools or objects are left inside the enclosure.
9. Confirm all devices, covers, doors, panels, etc., are secured.
10. Before start up, perform a field power frequency withstand (Hi-Pot) test, using test voltages given in Table 1.

**Table 1. Power Frequency Withstand Test Voltages.**

<b>Rated Maximum Voltage (kV)</b>	<b>Power Frequency Withstand (rms) (kV)</b>
4.76	14.25
8.25	27
15.0	27
27.0	45
38.0	60

11. For additional safety information and safe-use practices for your VCP-W circuit breaker, refer to IB131006EN.

## Section 2: Installing indoor switchgear

For information regarding the receiving, handling, storing, and installation of the equipment, please reference IB022014EN: Instructions for receiving, handling, storing and installation of medium voltage switchgear, in addition to the customer drawing package.

Instruction bulletins and drawings are located inside the first vertical section and online at [www.eaton.com](http://www.eaton.com).

The detail box contains kits, bus, splice-plates, boots, tape kits for taping cable to riser joints, and the hardware required for installation of the switchgear.

### 2.1 Floor requirements

The finished foundation surface shall be flat and level within 0.06 inch [1.6 mm] in 36 inches [914 mm] in any direction, left to right, front to back, and diagonally. Alternatively, a local flatness "FF" value of 50 or higher and an accompanying "FL" value of 37 to 40 as defined in industry standard ASTM-E1155-96 and industry standard ACI 117-90 may be used to establish the flatness and levelness of the finished foundation.

### 2.2 Power cable installation or close-coupling with other equipment

When connecting power cables to metal-clad switchgear, or when connecting metal-clad switchgear to other equipment (for example, MV MCC, power transformer, non-seg bus duct), all connection points must be insulated after the connections are made (refer to the section on field taping procedure for general guidance), and minimum electrical clearances between live parts in adjacent phases (phase-to-phase) and from live parts to ground (phase-to-ground) as recommended in Table 2, must be maintained to preserve dielectric withstand capability of the metal-clad switchgear.

**Table 2. Minimum Clearance Chart for Insulated Connections.**

kV Rating of the MVA Switchgear	Phase-to-Phase In. (mm)	Phase-to-Ground In. (mm)
27	6 (152.4)	6 (153.4)

### 2.3 Installation procedure

#### Step 1

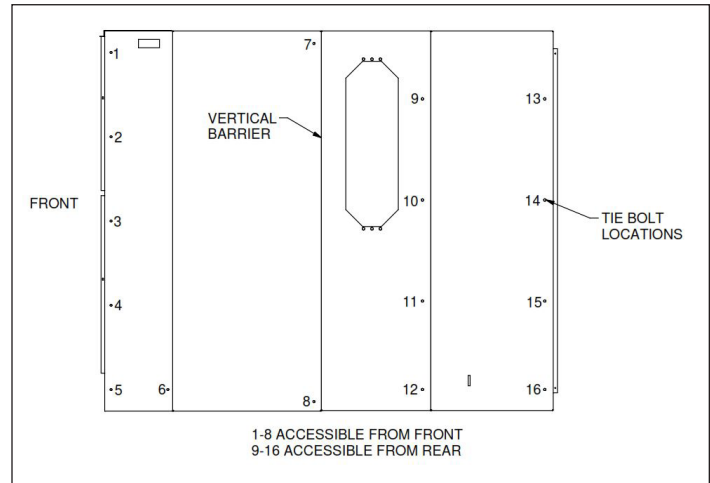
Bolt the groups together through the tie bolt holes, leaving the hardware loose, until all sections are placed using the following procedure.

- A. Obtain the tie bolt hardware kit located in the shop order detail box. Install a flat washer on bolt end, insert the bolt through a hole, then install a flat washer, split-lock washer, and nut. Torque the hardware per the specifications contained in Table 3 once all the units are placed

**Table 3. Bolt Tightness Values for All Hardware Connections.**

Bolt Size In. (mm)	0.25 (6.35)	0.31 (7.87)	0.38 (9.65)	0.50 (12.7)	0.62 (15.75)
<b>Bolt Material</b>	<b>Torque Value in Foot Pounds (N•m)</b>				
High-strength steel	5 (6.78)	12 (16.27)	20 (27.12)	50 (67.8)	95 (128.82)
Silicon bronze	5 (6.78)	10 (13.56)	15 (20.34)	40 (54.24)	55 (74.58)

- B. Remove the rear covers or open the rear doors (if applicable) of the cells on the side of the shipping split. Install tie bolts between the shipping splits. Refer to Figure 1 for the tie bolt locations. Bolt holes #9 - #16 can be accessed from the rear module.
- C. Open all the front doors. Refer to Figure 1 for the tie bolt locations. Insert and tighten the tie bolts between the front upright members at each shipping split. Bolt holes #1 - #8 can be accessed from the front module.



**Figure 1. Typical Tie Bolt Locations.**

#### Step 2

Check the entire lineup to make sure it is level and plumb prior to securing the switchgear base to the foundation.

#### Step 3

Remove all shipping blocks or braces located inside the switchgear.

- A. Remove all shipping bracing (painted yellow) for dynamic flaps, components, and bus support.
- B. Examine all meters, relays, etc., and remove any shipping blocks or braces.
- C. Remove the lifting angles from top of the units and discard them.

#### Step 4

Connect the ground bus.

- A. The standard ground bus is a 0.25 in. x 2 in. (6.4 mm x 50.8 mm) copper bus bar bolted to the cross members of the frame in the bottom of each switchgear unit. The ground bus runs through the center of each unit, through the length of the entire switchgear assembly. Install a ground link and hardware (ground link located in the detail box) to connect the shipping sections.

- B. Connect the switchgear assembly to the station ground. Solderless terminals are provided on the ground bus at each end of the switchgear for this purpose. The connection shall be made as direct as possible. The connection shall be large enough to carry the ground fault current of the installation. Never encase the ground bus in a metal conduit.

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**⚠ CAUTION**

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**THE SWITCHGEAR INSTALLATION MUST BE PROPERLY GROUNDED.**

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**Note:** For the design and installation of a grounding system, refer to Electrical Power Distribution for Industrial Plants (IEEE Std 141); Grounding of Industrial and Commercial Power Systems (IEEE Std 142); and the NFPA 70, Articles 100, 200, and 250.

For generating stations and larger substations, the ground resistance should be 1 ohm or less. For industrial plants and small substations, the ground should be less than 5 ohms (the NEC states that the ground resistance should never exceed 25 ohms).

**Step 5:**

Connect the high voltage bus between the shipping sections.

- A. Remove the horizontal metal barriers from the cable compartment in the rear of the switchgear. Remove the bus barriers. Also remove any other components, such as cable termination devices, surge protective devices, and so on, that interfere with access to the bus compartment.

**Note:** The rear assembly of the switchgear may vary.

- B. Obtain the section of bus that was removed to separate the groups for shipping. Each section is labeled and shipped in the carton with the detail box.
- C. The surfaces in the bus joints are plated. Clean the plated surfaces of the bus section with isopropyl alcohol if necessary.

**Note:** Plating may show signs of tarnish over time. This does not affect the functionality.

- D. Slide the section of main bus through the supports in the side of the vertical section. Slide the rubber snubber along the bus until it fits inside the opening in the bus support.

When the bus section is disconnected for shipping, the splice plates and hardware are left bolted to the end of the bus in each of the adjoining vertical sections. Sandwich the end of the disconnected section between the splice plates and fit the other end of the section between the splice plates on the end of the bus in the adjacent section. Bolt the splice plates together on each end of the bus section. Do not tighten until all joints throughout the line-up are installed.

- E. Repeat these steps for each section of bus at each shipping break.
- F. Torque the bolts in the bus joint to the values shown in Table 3. Make sure all structure and tie bolts are torqued prior to torquing bus joint bolts.
- G. Insulate each bus joint with plastic joint covers or insulating tape for unusual configurations.

**Step 6**

Connect the control wires.

- A. Reconnect the wiring that was disconnected at the factory for shipping. The wiring as well as the connecting points are labeled.
- B. Connect the remote apparatus wiring to the terminal blocks located in the control compartment, or within the front of the vertical section.

**Step 7**

Replace the metal barriers and any other parts that were removed to gain access to the main bus compartments.

**Step 8**

Connect the main power cables.

- A. Before connecting a cable, determine its phase. The switchgear system is supplied with connections for phasing 1-2-3, left to right (viewed from the front) unless indicated otherwise on the shop order drawings.
- B. If two systems are to be paralleled, make sure the phase rotation and the phase angles match. They must be the same to prevent damaging the equipment. The phase rotation must conform to the phase rotation on the shop order drawing so that the instruments, meters, and relays will operate properly.
- C. When forming cables to fit inside the cable compartment, avoid sharp bending or kinking. Make sure cables do not rest on sharp corners or edges that could damage the insulation.
- D. Follow the instructions of the cable manufacturer to determine what minimum bending radius is permitted. Follow the instructions on insulating the joints so the insulation will taper properly through the correct gradient. The insulation will vary with the type and size of the cable and with the service voltage for which it was designed.
- E. NEMA 2-hole patterns are usually furnished. The connection must be insulated according to the recommendation of the cable manufacturer.
- F. If potheads or other types of terminators are furnished, follow the instructions of the manufacturer when connecting the cable to them. Tape (or otherwise insulate) the entire joint, including the flexible connectors.
- G. If zero sequence transformers are used pass the power cables through the transformer (refer to Figure 26) for proper installation.
- H. Replace all metal barriers, vertical section of the bus barrier, and any other components removed during installation of the high-voltage bus at the shipping splits. Replace them in the reverse order in which they were removed.
- I. Close all rear covers then install and tighten all bolts.

**Step 9**

Inserting of the extension rails.

The breaker compartment has a safety interlock assembly on the compartment levering assembly, located on the inside of both the left and right hand rail assemblies. The purpose of the safety interlock assembly is to prevent the breaker from being removed from the compartment without the extension rails in place. In order to insert or remove a breaker, a set of extension rails must be inserted into the left and right hand rail assemblies. This is achieved by inserting the appropriate rail, identified with a label, diagonally into the slot such that the extension rail when lowered places the safety interlock assembly in a horizontal position and the rolling surface of the compartment rail and extension rail are flush. In this position, the breaker can be inserted or removed from the breaker compartment (see Figures 2 and 3).



Figure 2. Insertion of the Draw-out Extension Rails.



Figure 3. Lifting and Setting the Breaker in the Housing.

### Step 10

Checking pan operation.

- A. To operate the breaker at this time ("Test" position mode), it is necessary to connect the secondary harness with the breaker.

**Manual secondary:** For a manually engaged secondary harness, pull the secondary plug handle forward until the secondary receptacle located on the compartment levering pan fully mates with the secondary breaker wiring plug.

In this position, the breaker control circuit can be tested offline (breaker is not connected to the primary circuit).

- B. Movement of the breaker from the "Disconnect" position to the "Connect" position.
1. As the breaker is racked from "Disconnect", it will automatically open if it is closed.
  2. To prevent damage with a manually engaged secondary, the breaker secondary control plug must be manually engaged with the receptacle on the compartment levering system, before the breaker is moved to the "Connect" position.
  3. Rotate the levering crank in a clockwise direction until the torque limiter on the levering crank "breaks free." As a check, the red indicator on the levering system can be seen through the window on the front of the levering system.
- C. Movement of the breaker from the "Connect" position to the "Disconnect" position.
1. As the breaker is racked from "Connect", it will automatically open if it is closed.
  2. Insert the levering crank onto the hex drive nut on the levering system. In order to engage the hex drive nut, you must push in the levering system slider.
  3. Rotate the levering crank in a counter-clockwise direction until the breaker is in the "Disconnect" position.

**Note:** The breaker secondary control receptacle on the compartment levering system is automatically disengaged from the breaker secondary plug when moved to the "Disconnect" position.

### Step 11

Test the breaker and cell interface per IB131006EN.

### Step 12

Installing the draw out assembly in the auxiliary compartment (usually shipped installed).

- A. Using a portable lifting device, place the drawout assembly onto the extension rails (see Figure 4 for typical lifting of a drawout device and Figure 5 for typical auxiliary drawers).





Figure 4. Lifting and Setting the Auxiliary onto the Extension Rails.

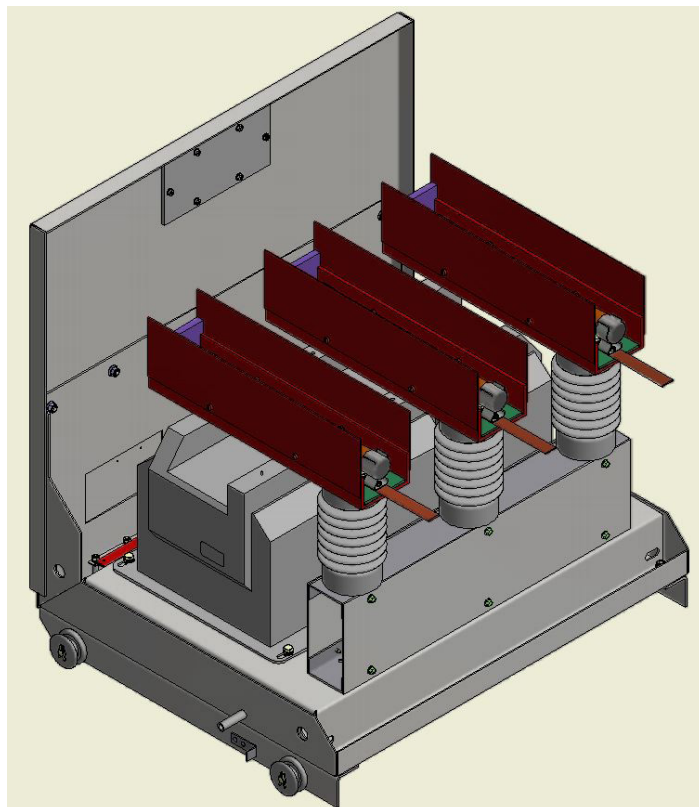


Figure 5. Typical Auxiliary Drawers.

### Step 13

Check the voltage transformers and draw-out fuses in the auxiliary compartments.

- A. The draw-out primary fuses are mounted in separate drawers in the auxiliary compartments. They are adjusted in the factory and shipped installed in the switchgear.
- B. Insert extension rails into each side of the auxiliary compartment per Figure 2. Unlatch and pull the drawer out of the compartment (rollers on the sides of the drawers ride on the extension rails).
- C. Check to make sure the primary contacts and secondary contacts are engaged when the drawer is closed. Use the “lighting out” or “ringing” method. They should engage when drawer is within 1.0 in. (25.4 mm) of being closed.
- D. Check the fuses for continuity. Make sure there is proper contact in the fuse clips.
- E. Suspended from inside the top of the compartment are three flexible, grounding straps. As the drawer is pulled open, watch inside to make sure they contact the fuses and ground them.
- F. Make sure the mechanical interlock or the key interlock is working properly for control power transformers. When the interlock is working, it should be impossible to pull the drawer out without first opening the main secondary breaker.

### Step 14

Perform loading check on both the control and primary circuits to assure the system is ready for operation.

## Section 3: Description of arc resistant VacClad-W switchgear

### 3.1 Arc resistant switchgear general discussion

Arc resistant metal-clad switchgear is metal-clad switchgear tested for resistance to the effects of arcing due to an internal fault. The occurrence of arcing inside switchgear produces a variety of physical phenomena. For example, the arc energy resulting from an arc developed in air at atmospheric pressure will cause a sudden pressure increase inside the enclosure and localized overheating. This results in both severe mechanical and thermal stresses on the equipment. Moreover, the materials involved in or exposed to the arc may produce hot decomposition products, either gaseous or particulate, which may be discharged to the outside of the enclosure.

IEEE guide C37.20.7, provides procedures for testing the resistance of metal-clad and metal-enclosed medium voltage switchgear under conditions of arcing due to an internal fault. The arc resistant switchgear is classified by accessibility types in the document as follows.

- **IEEE Std C37.20.7-2007** – IEEE Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults.
- **Accessibility type 1**  
Switchgear with arc resistant designs or features at the freely accessible front of the equipment only.
- **Accessibility type 2**  
Switchgear with arc resistant designs or features at the freely accessible exterior (front, back, and sides) of the equipment only.
  - **Type 2B**  
Switchgear with arc resistant features inside control compartments in addition to the Type 2 requirements.

The IEEE Guide defines internal arcing short-circuit current as the maximum value of the RMS symmetrical prospective current applied to the equipment under conditions of an arcing fault for the arcing duration specified by the manufacturer. The preferred value of the internal arcing short-circuit current is the rated short-time current of the equipment. **The preferred arcing duration is indicated as 0.5 sec at the rated power frequency of the equipment.**

A single test is done to verify resistance of switchgear against pressure as well as burn through. The actual values (which may be higher or lower than the preferred values) of the internal short-circuit current and arcing duration are specified by the manufacture on the equipment ratings nameplate.

Arc resistant features are intended to provide an additional degree of protection to the personnel performing normal operating duties in close proximity to the equipment while the equipment is operating under normal conditions. Several conditions must be met for the equipment to perform as required. These conditions are considered normal operating conditions for proper application of arc resistant switchgear designs and are as follows.

1. All doors and covers providing access to high-voltage components are properly closed and latched.
2. A plenum and duct assembly is properly installed on top of the switchgear, when applicable.
3. Pressure relief devices are free to operate.
4. The fault energy available to the equipment does not exceed the rating of the equipment (short-circuit current and duration).
5. There are no obstructions around the equipment that could direct the arc fault products into an area intended to be protected.
6. The equipment is properly grounded.

The equipment may be used without additional protection where the fault level and the fault duration are within the equipment ratings. When coupled with other protective schemes, selected to operate within the rated duration of the equipment, the damaging effects of the arcing fault associated with fault duration can be minimized.

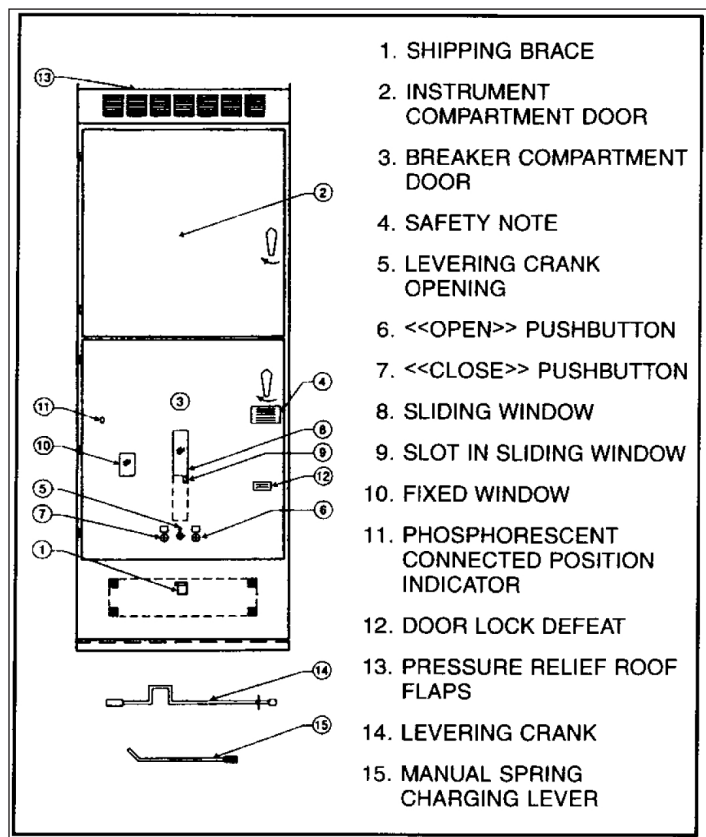


Figure 6. Switchgear Features and Interlocks.

### 3.2 Descriptions of breaker compartment door features and interlocks

Refer to Figure 6.

#### 1. Shipping brace

Remove the orange shipping brace before the breaker is put into service, but only after the enclosure is in its final and permanent position. The safety flap must remain open during normal breaker operation in order to provide adequate ventilation. Do not put a breaker into service with the safety flap closed. The safety flap will automatically close in the event of an internal arc. Failure to remove the shipping brace will prevent automatic closure of the safety flap during an internal arc.

#### 2. Low voltage controls compartment door

The low voltage controls compartment door must be closed when breaker is in service. This compartment can be used to mount protective relays, meters, and other control lights and devices.

#### 3. Breaker compartment door

All connection and disconnection of the breaker must be done with the door closed. The breaker door is interlocked with the breaker to prevent opening of the door while the breaker is connected. The door can only be opened when the breaker has been completely racked out to the "Test"/"Disconnected" position. A second interlock prevents the racking in of the breaker if the door is not closed.

Do not rack in breaker with the door open as this negates the arc resistance feature and will prevent the door from properly closing afterwards, due to mechanical interference with the locking mechanism.

#### 4. Safety note

Important note: All doors and panels must be properly closed and fastened for the arc-resistant feature of the switchgear to be operative.

#### 5. Levering crank opening

The breaker must be connected and disconnected with the breaker door closed and using the levering crank. With the door closed, lift the cover to expose the hexagon head of the levering-in screw. Insert the levering crank and rotate clockwise to connect the breaker, and counterclockwise to move the breaker to the "Test" position.

#### 6. Open pushbutton

With the door closed, press the right button to open the breaker main contacts.

#### 7. Close pushbutton

With the door closed, press the left button to close the breaker main contacts.

#### 8. Sliding window

This window is used for observing:

- Breaker position - connected or disconnected;
- Spring status - charged or discharged; and
- Phosphorescent marker.

#### 9. Slot in sliding window

Manual spring charging lever is inserted through the slot to manually charge the breaker springs. A vertical up and down movement of the lever will charge the breaker springs (approximately 38 movements are required).

#### 10. Fixed window

This window is used to observe:

- Breaker operations counter;
- Breaker contact position (open or closed); and
- The phosphorescent marker (see 11).

#### 11. Phosphorescent marker

The phosphorescent marker is only visible through the fixed window when the breaker is in the "Connect" position and serves to indicate such.

#### 12. Door lock defeat

The breaker compartment door is automatically locked closed when the breaker is moved from the "Test" position to the "Connect" position. In case of an emergency, it is possible to defeat the door interlock while the breaker is in the "Connect" position. Be aware that by opening the breaker door while the breaker is in the "Connect" position defeats all safety features of the arc-resistant switchgear. Remove the nameplate to expose a spring-loaded locking bar. Push the spring-loaded locking bar inward until it clears the locking tab on the door. The door can now be opened.

Important: In order to re-close the door after defeating the interlock, the levering-in assembly must be moved to the "Test" position. Failure to do so will prevent the door from closing properly.

#### 13. Pressure relief roof flaps

In the event of an internal arc, the explosion gasses and debris are projected through the pressure relief roof flaps. It is essential that the roof flaps are not prevented from opening by any physical obstruction after installation.

#### 14. Levering crank

This crank is used to rack the breaker in and out. The socket is designed to prevent hot gasses from escaping the front module. **Do not** use any other tool to replace the levering crank.

#### 15. Manual spring charging lever

This lever is used to manually charge the breaker.

### 3.3 Instructions

In order to obtain proper coordination and maintain required clearances, the following instructions must be followed:

1. Bus bar must be installed.
2. Proper hardware supplied and located In the cubicle near each joint must be used.
3. Each bolt must be tightened according to Table 3.

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**⚠ WARNING**

**USING WRONG HARDWARE MAY RESULT IN REDUCED CLEARANCE AND/OR CAUSE DAMAGES.**

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### 3.4 Safety features

Eaton VacClad-W switchgear is manufactured with several built-in features. These interlocks are intended to protect persons working on the equipment. Never make these interlocks inoperative. Doing so can damage property and cause severe injury.

#### Coding plates

A coding plate is fastened to the bottom front edge of the breaker compartment. There is also a coding plate fastened to the front of the breaker. If the breaker has a lower interrupting rate than the rating of the compartment, or if the voltage continuous current characteristics do not match, the coding plate on the compartment will prevent the entrance of the breaker into the compartment.

---

**⚠ CAUTION**

**EVEN WITH THE CODING PLATES, IT IS POSSIBLE TO PUT INTO THE COMPARTMENT A BREAKER WHOSE CONTROL WIRING IS NOT COORDINATED WITH THAT OF THE COMPARTMENT. ALWAYS CHECK THE SHOP ORDER DRAWING TO MAKE SURE THE CONTROL WIRING OF THE BREAKER AND THE COMPARTMENT ARE BOTH THE SAME.**

---

#### Automatic shutter

An automatic shutter, shown in Figure 10, covers the primary disconnecting contacts when the breaker is withdrawn from the "Connect" position. The shutter prevents persons who are working on the switchgear from accidentally touching the primary contacts. Shutters also cover the stationary disconnects for draw-out transformers and primary fuses.

A roller on the breaker raises the shutter when the breaker is levered into the "Connect" position. When the breaker is levered out, the shutter closes by spring action.

#### Polyester CT barrier

An optional polyester CT barrier restricts inadvertent access to the CT's (see Figure 9). To remove the CT barrier, remove the two 9 in. (228.6 mm) bolts located at the top of the barrier.

---

**⚠ CAUTION**

**DO NOT MANUALLY RAISE OR REMOVE SHUTTER UNLESS MAIN CONTACTS ARE DE-ENERGIZED, GROUNDED, AND SAFETY PROCEDURES HAVE BEEN INITIATED TO MAKE SURE THE CIRCUITS CAN NOT BE RE-ENERGIZED. FAILURE TO EXERCISE CAUTION MAY RESULT IN BODILY INJURY AND PROPERTY DAMAGE.**

---

#### Door interlock

A bracket is fastened to linkage connected to the levering-in assembly, preventing the breaker door from opening when the breaker/drawer is in "Connect" position. This interlock can be defeated by removing the lock defeat name plate.

## Instructions for installation, operation, and maintenance of 27 kV type VacClad-W arc resistant metal-clad switchgear

### Ring-Type Current Transformers

The ring-type current transformers are mounted so they slip over the primary contact insulating tube on the rear wall of the breaker compartment. There is space for a maximum, of four standard accuracy transformers per phase (2 on each side of the breaker). A polyester CT barrier, shown in Figure 9, restricts unconscious access to the CT's.

They are mounted so they can be reached from the front of the enclosure (see Figure 10 & 10a). This makes it possible to add or to change transformers when the switchgear is de-energized and grounded without handling high voltage connections or breaking the primary insulation. The polarity marks on the transformers show the relative instantaneous polarity in the primary and secondary windings. The diagrams show how to connect the transformers to give polarity needed to operate relays and instruments.

### Key Interlocks

Keylock interlocks are often supplied in conjunction with disconnecting switches, dummy elements and special compartments to which access is to be denied unless the circuit breakers controlling the power to these no-load-switching devices have been withdrawn to the test position. The operation of key interlock schemes is generally described by a note or keying chart on the shop order assembly drawings.

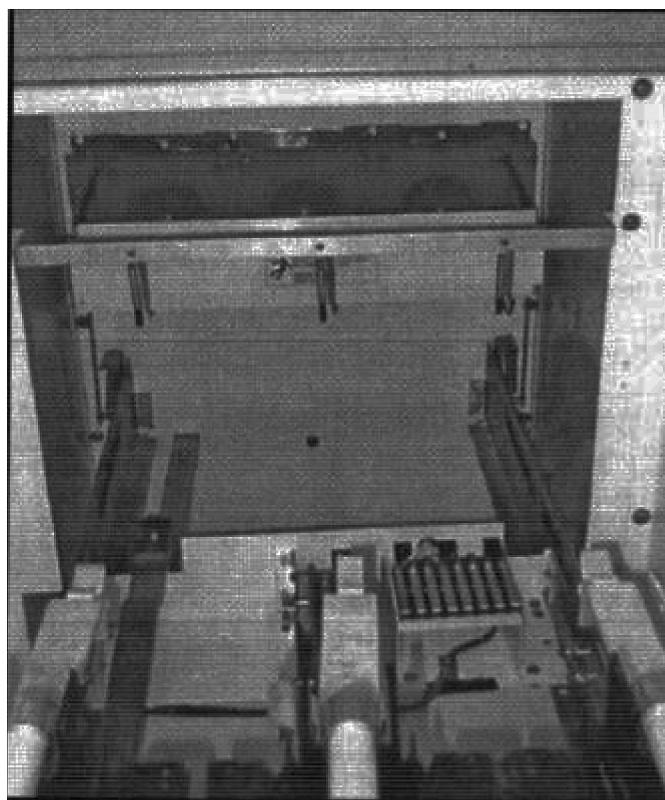


Figure 7. Auxiliary Compartment with Primary Shutters Closed.

The circuit breaker pan is equipped with provisions to mount a Kirk key to it. Refer to Figure 8 for the location of these provisions.

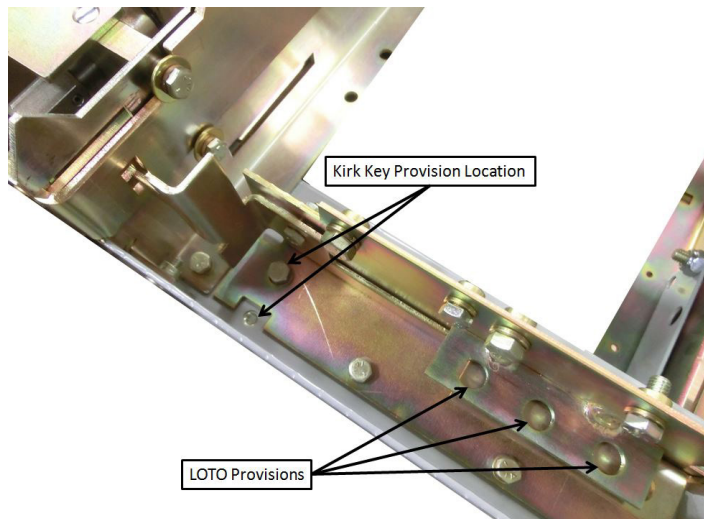


Figure 8. Circuit Breaker Pan Key Interlock.

**⚠ CAUTION**

TO FACILITATE MANUFACTURE AND INSTALLATION PROCEDURES, A KEY IS USUALLY SUPPLIED WITH EACH LOCK. BEFORE PLACING SWITCHGEAR WITH KEY INTERLOCKS IN OPERATION, THE KEY SCHEME MUST BE CAREFULLY CHECKED; AND ONLY THE PROPER KEYS LEFT IN THE LOCKS. ALL EXTRA KEYS MUST BE REMOVED AND DESTROYED OR STORED WHERE NOT AVAILABLE TO OPERATING PERSONNEL. THIS PROCEDURE IS NECESSARY SINCE IMPROPER USE OF SPARE KEYS WILL DEFEAT THE INTERLOCKING SCHEME.



Figure 9. CT Barrier (Shutters Blocked Open).



Figure 10. Breaker Primary Disconnect Shutters (CT Barrier Removed).

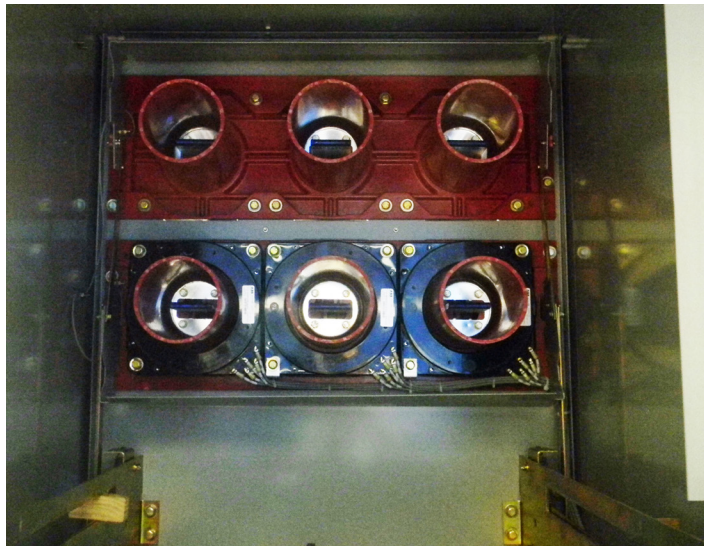


Fig. 10a Ring Type CT's (Shutters Blocked Open).

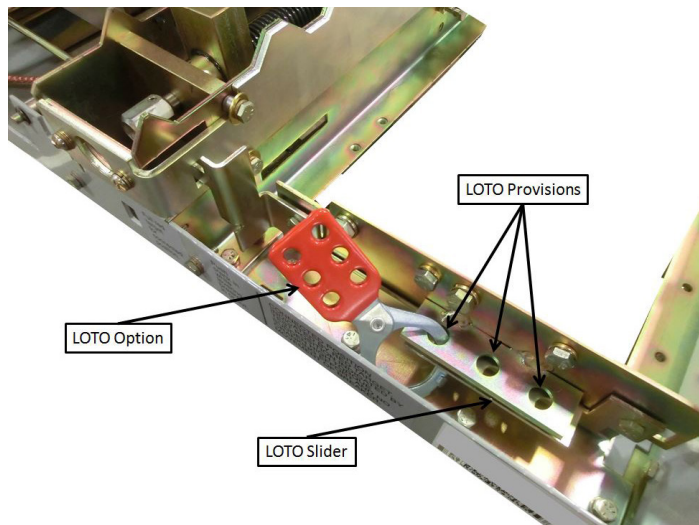


Figure 12. Lockout-Tagout Provision for Circuit Breaker Lockout.

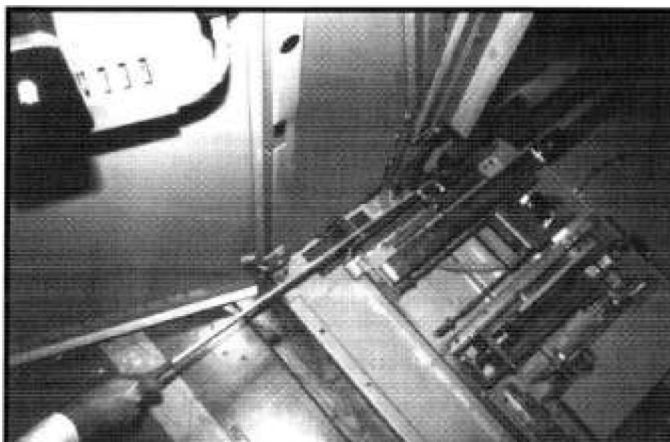


Figure 11. Manually Opening Cubicle Shutters Over Primary Disconnects Using Maintenance Tool.

Lockout-tagout features

**Circuit breaker pan LOTO**

Lockout-Tagout (LOTO) provisions are featured in the front of the circuit breaker pan assembly to prevent movement of the breaker.

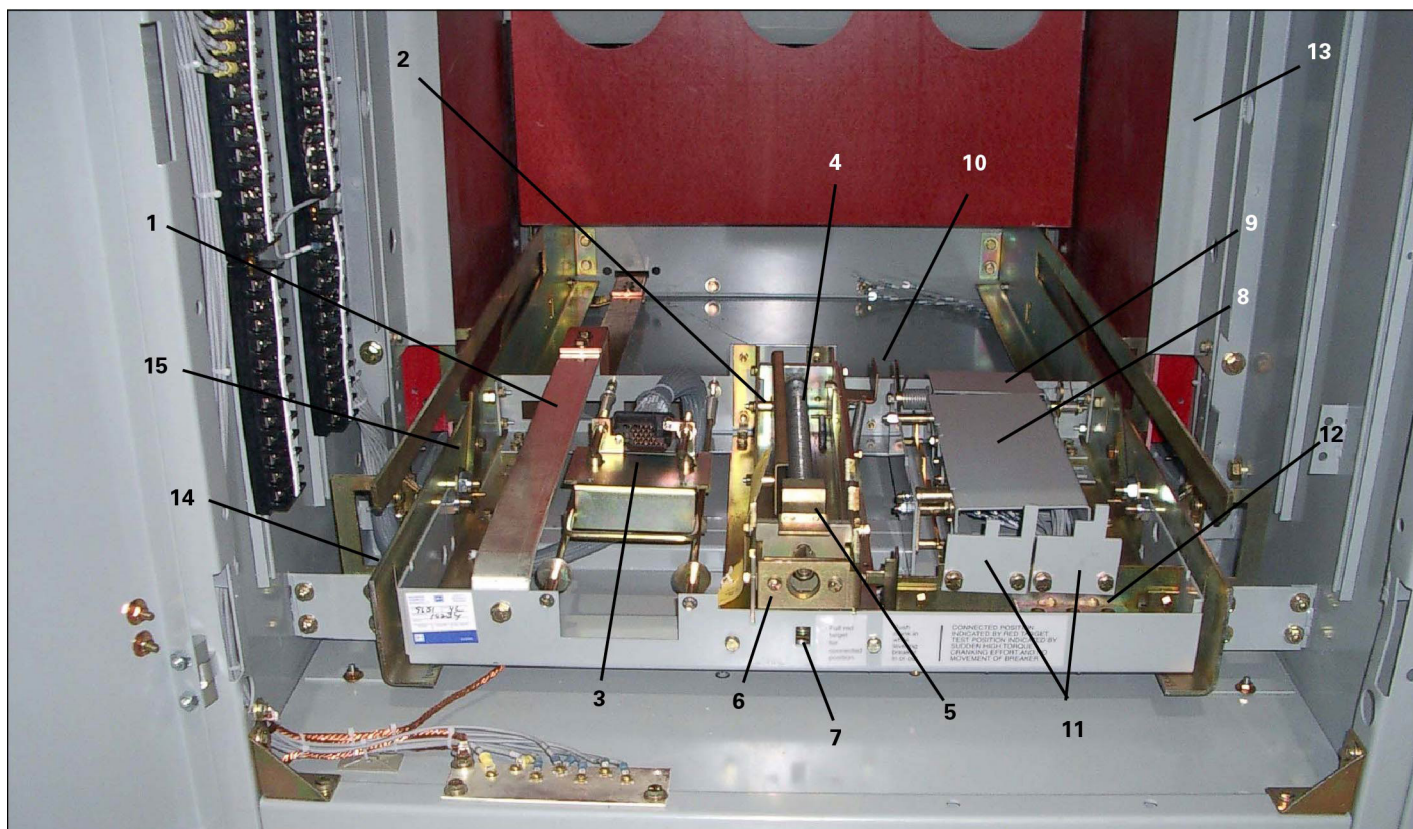
1. Move the breaker to the fully withdrawn position.
2. Move the LOTO slider to the left in order for the LOTO slider to engage the slider used for racking (Refer to #6 in Figure 14).
3. Insert a LOTO option (refer to Figure 13) into the circuit breaker pan LOTO provisions (See Figure 12).
4. When it is safe to do so, remove the lock to allow the LOTO slider to move to the right, when racking the breaker is required.



Figure 13. Several Acceptable Lockout-tagout Options.

**Note:** The LOTO options shown in Figure 13 only includes a handful of accepted options. Other options may also work with the breaker pan LOTO provision.

### 3.4 Breaker pan assembly



**Figure 14. Pan Assembly.**

#### Description of Figure 14 callouts

1. Ground bus - Grounds the breaker in all positions.
2. Breaker hold down angle - Prevents removal of the breaker in any position other than the "Test" and/or "Disconnect" positions.
3. Secondary assembly - The control wiring is arranged for pull-out disconnecting by means of a 25-point female receptacle arranged to connect to a male plug on the breaker. The secondary disconnect is the connection for the control leads between the removable breaker and the stationary housing. See the breaker instruction book for further description.
4. & 5. Racking screw and moving block - Permit breaker insertion and withdrawal.
6. Slider assembly - Used with 9 to prevent levering a closed breaker. May be used in conjunction with 12 to padlock a breaker in any position.
7. Flag indicator - Indicates when the breaker is in the fully connected position.
8. MOC switch assembly - The mechanism-operated compartment switch (MOC switch) is an assembly of switches that is operated by a lever on the breaker mechanism. It can contain as many as 12 normally closed and 15 normally open contacts (beneath the cover) in the standard design. The MOC switch is activated by the breaker closing. It extends a lever out the bottom of the mechanism pushing down on the plunger of the operating mechanism. This, in turn, transmits the motion to operate the switch.
9. TOC switch assembly - The truck operated cell switch (TOC switch) has nine poles in the normal design – four contacts make and five break as the breaker is levered to the "Connect" position. As the breaker is being levered into the "Connect" position, a bracket on the breaker pushes the TOC switch lever during the last 1 in. (25.4 mm) of travel. As a result, the TOC switch can be used to electrically indicate whether or not the breaker is in the "Connect" position (beneath the cover).
10. Closed breaker interlock - Used to prevent withdrawal of a closed breaker from the "Connect" to the "Disconnect" position.
11. Code plates - See safety features Section 8.3.
12. Padlock provision - Optional provision for padlocking (up to four locks) a breaker in any position.
13. Picture frame - Seals the primary compartment when breaker is connected.
14. Rail assembly - Rail on which the breaker rolls.
15. Teeter-totter assembly - Prevents breaker withdrawal from the cell without the extension rails in place.

## Section 4: Adjusting and testing

1. After the switchgear has been installed and connected to the apparatus it is to control, give it a final check before it is put into service.

**Note:** Make sure the apparatus being controlled is not connected to the system while the tests are being carried out.

The testing equipment will depend on the size and type of installation. Use portable voltmeters. Use a low voltage continuity testing device to verify correct continuity of circuits.

2. Examine all wiring circuits to make sure they have not been damaged or loosened during shipment or installation.
3. Make sure all the connections are correct before the equipment is operated. Test the continuity of connections between the switchgear and remote apparatus such as instrument transformers, auxiliary switches and remote control, and interlock circuits.
4. Coordinate the settings of the relays with other parts of the system in accordance with the standards or operating practice of the purchaser.
5. If the covers are removed from meters, relays, or other devices for installation or test, handle them carefully. Replace the covers as soon as possible to keep dust and dirt out of the components.
6. Perform a loading check of the control circuits. Before energizing the control circuits, check the control bus with an ohmmeter to make sure there are not short circuits in the control wiring. If an ohmmeter is not available, connect a small fuse in series with the source of the control power. This will protect the control wiring against damage. (The fuse should be one-fourth the normal rating of the circuit.)
7. Make sure all exterior doors and covers are properly secured prior to energization.

## Section 5: Operation of the system

1. Study and be sure to understand the diagrams furnished with each switchgear system.
2. Install the circuit breaker in the "Test" position. Make connections so that the control power connections are coupled. Check that the breaker operates.
3. A green light on the hinged instrument panel on the front of the breaker compartment shows the breaker is open. A red light shows the breaker is closed. Refer to the diagrams supplied with the switchgear for the control scheme details, indicating light colors, and functions.
4. The details of the breaker control schemes vary from one installation to another. They comply with the requirements set forth by IEEE, NEMA, and ANSI. All of the schemes are designed to coordinate electronically with the mechanical design of the breaker.



## Section 6: Inspection and maintenance

### 6.1 Safety precautions

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#### WARNING

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**WHEN INSPECTING, REPAIRING, AND PERFORMING MAINTENANCE ON METAL-CLAD SWITCHGEAR, THE FACT THAT DANGEROUS VOLTAGES MAY EXIST MUST BE KEPT IN MIND; AND PRECAUTIONS MUST BE TAKEN TO ENSURE THAT PERSONNEL DO NOT COME IN CONTACT WITH ENERGIZED HIGH VOLTAGE PARTS. FAILURE TO DO SO COULD RESULT IN PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.**

---

Refer to Safety precautions at the beginning of this booklet.

Some common general precautions for high voltage work area:

#### Connections

All connections should be considered energized until the personnel expecting to work on them is assured that the circuits are de-energized, and until every possible precaution has been taken to see that there is no chance of a circuit being energized while the crew is working.

#### Switches

Switches, which have been opened to de-energize a circuit to permit work on equipment, should be locked or blocked open and a suitable visible warning device placed on them.

#### Grounding

Do not work on parts normally carrying current at high voltage until these parts have been disconnected and grounded to the ground bus. The purchaser should make provisions for connecting adequate, flexible ground leads to every part of the switching equipment.

### 6.2 Access to switchgear parts

#### 6.2.1 High voltage parts

VacClad-W switchgear is a metal-clad design. All major parts of the primary circuit are isolated by grounded metal barriers and enclosed within separate compartments. For example, the circuit breaker, main bus, and primary line and load terminations are isolated from each other and enclosed in separate compartments, which are made from grounded metal barriers and covers. Access to high voltage parts can be gained by removing the covers and barriers. The covers and barriers should not be removed unless the parts to be exposed are de-energized.

#### 6.2.2 Main contacts

Stationary main disconnecting contacts are located behind the automatic safety shutters. Upper and/or lower stationary contacts can be exposed by manually opening the shutters. Do not expose any contacts unless all upper and lower high voltage parts are de-energized.

---

#### WARNING

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**FAILURE TO DO SO MAY RESULT IN DEATH, PERSONAL INJURY, OR PROPERTY DAMAGE.**

---

#### 6.2.3 Current transformers

Window type current transformers are installed over the primary contact insulating tubes in the front of the unit. All primary circuits must be de-energized prior to gaining access to any CTs.

#### 6.2.4 VT and primary fuses

Disconnecting transformers and fuses

Simply pulling out the drawer automatically disconnects and grounds the moving high voltage parts. Shutters automatically cover the primary disconnects.

---

#### WARNING

---

**DO NOT ATTEMPT TO REMOVE THE BACK COVERS OR TO OPEN OPTIONAL REAR DOORS, THE DISCONNECTING ASSEMBLIES, OR THE SHUTTERS UNLESS THE HIGH VOLTAGE CIRCUITS TO THE COMPARTMENT ARE DE-ENERGIZED AND PRECAUTIONS HAVE BEEN TAKEN TO PREVENT ENERGIZATION. FAILURE TO DE-ENERGIZE THE CIRCUIT MAY RESULT IN BODILY INJURY OR DEATH. WHEN ENERGIZED, THE CIRCUIT CARRIES LETHAL HIGH VOLTAGES.**

---

#### 6.2.5 Control equipment

With the exception of apparatus such as current transformers and rear-mounted heaters, control equipment and wiring is generally accessible without exposing high voltage parts.

### 6.3 Inspection and maintenance schedule

To assure high quality service, a definite maintenance schedule, systematically followed, is essential. Plant, operating, and local conditions vary to such an extent that the schedule must be prepared to suit the conditions. However, the following general requirements should be helpful in setting up the program.

---

#### CAUTION

---

**BEFORE ATTEMPTING ANY INSPECTION OR MAINTENANCE BE SURE THAT ALL PRIMARY AND CONTROL CIRCUITS HAVE BEEN DE-ENERGIZED AND GROUNDED AS REQUIRED AND THAT PROPER STEPS HAVE BEEN TAKEN TO BE SURE THAT THEY WILL REMAIN DE-ENERGIZED UNTIL ALL WORK IS COMPLETED. FAILURE TO DO SO COULD RESULT IN BODILY INJURY OR ELECTROCUTION. WHEN ENERGIZED, CIRCUIT CARRIES LETHAL HIGH VOLTAGES AND CURRENTS.**

---

#### 6.3.1 Individual devices

The maintenance schedule for individual devices such as circuit breakers, relays, etc., should be based upon recommendations contained in the individual instruction book for the device. These operations should be coordinated with the overall program to result in the least operating inconvenience and circuit shutdown.

#### 6.3.2 Overall maintenance

The switchgear installation should be given a thorough overall maintenance check at the end of the first year in service because it provides an opportunity to evaluate conditions at an early point in the life of the equipment. Where conditions are abnormal, more fre-

quent inspection and maintenance is necessary. Where conditions warrant, a longer period of time between maintenance periods may be used. The following require attention.

### 1. Buses and connections

De-energize and ground primary circuits and remove cover plates from the primary compartments. Before cleaning, take "MEGGER" readings between phases and to ground. Inspect for signs of overheating or weakened insulation. Remove dust from buses, connections, supports, and enclosure surfaces. A vacuum cleaner with a long nozzle will be of assistance. Wipe clean with distilled water or alcohol, then wipe dry.

After buses have been dusted and wiped clean, take "MEGGER" readings again between the buses, ground, and between phases. Keep a record of these readings for future reference in determining when trends occur that would indicate a lowering of the insulation resistance.

Periodic high potential tests are not required after initial start-up and are recommended only after repair of high voltage buses or installation, or when the trend of "MEGGER" readings indicates it to be advisable. Refer to Table 1.

### 2. Primary disconnecting contacts and primary contact insulating tubes

Remove each breaker from its compartment. De-energize and ground primary circuits and expose primary contacts and their supports. Wipe clean with a cloth moistened in a non-flammable solvent. Inspect for abnormal wear or overheating. Discoloration of the surfaces is not harmful unless corrosion due to atmospheric conditions is severe, leaving deposits on the surface. Check each breaker while it is out of the housing for all items recommended in the instruction book applying to that particular type of breaker.

### 3. Other disconnecting contacts

Inspect all primary and secondary disconnecting contacts such as those on draw-out transformers for abnormal wear, fatigue, or overheating. Replace if necessary. Otherwise treat the same as main disconnecting contacts above.

### 4. Control contactors

Contacts should be maintained in accordance with the instructions or replaced when the surface becomes pitted. Unless repetitive duty has been experienced, little attention should be required.

### 5. Instruments, relays, and other panel mounted devices

Individual devices should be maintained according to the specific instructions supplied for each device. Remove all relay covers and inspect the interiors for dust or dirt. This operation can most readily be performed by relay test personnel during period relay tests.

### 6. Secondary wiring

Check all wiring connections for tightness including those at the current and voltage transformers and at the terminal blocks where circuits leave the switchgear. Make sure that all secondary wiring connections are properly connected to the switchgear ground bus where so indicated.

### 7. Mechanical parts

Visually check and manually operate mechanical moving parts such as the shutter, TOC and MOC switch assemblies, the position interlock, hinged doors, and the draw-out features of the transformers and fuses. Examine mechanical mating parts such as the breaker secondary contacts blocks, side rails, and trippers.

### 8. Ventilation

Check all grillwork and air passages for obstructions and accumulations of dirt.

### 9. Battery and charging equipment

The control battery is such an important item in switchgear operation that it must be given special periodic attention if it is to give reliable service for a long period of time. Periodic inspections and tests are recommended in the battery supplier(s) instructions. At the same time the battery is checked, inspect the battery charger and remove accumulations of dust and dirt. On all chargers having a manual transfer switch for setting the charging rate, check carefully to be sure that the selector switch is returned to the value appropriate for a floating charge at the end of the periodic inspection. Serious damage to the control battery can occur if the charger is left on a high charging rate for an extended period of time.

### 10. Records

The condition of each switchgear unit at the time of inspection should be listed in a permanent record to become a guide for anticipating the need for replacements or for special attention between the regular maintenance periods. MEGGER tests are suggested for checking the insulation. A series of these tests will indicate any tendency toward a reduction in dielectric strength of the insulation. MEGGER readings should be taken before and after cleaning the equipment and, where possible, under similar conditions at successive periods. Records should include the MEGGER reading, the temperature, and the humidity. The readings will vary with the extent and design of the bus structure. In contrast with a small installation, the longer switchgear assemblies will have a more extensive bus structure with a greater number of insulators and, thereby, a longer number of parallel insulation resistance paths to ground which will tend to decrease MEGGER readings. This variation in insulation resistance between different switchgear assemblies emphasizes the value of a series of readings which can be charted to establish a normal insulation level so that progressive weakening of the insulation can be recognized.

### 11. Abnormal conditions

Local conditions such as high humidity, salt-laden atmosphere, corrosive gases, heavy dust, or severe circuit operating conditions, are considered to be abnormal, and will require more frequent inspections.

It should be emphasized that a series of inspections should be made at quarterly intervals until the progressive facts of the local conditions can be analyzed to determine a schedule which will maintain the equipment in satisfactory condition.

In some locations, conditions may be so bad that the frequency of maintenance will interfere with operating and production schedules. In such cases, consideration should be given to the possibility of enclosing the switchgear equipment in a relatively tight room and to supplying a sufficient quantity of clean air to maintain a positive pressure in the room. Under such conditions maintenance schedules may then be established on a more normal basis. Such an arrangement might also provide for cooling the air where the ambient temperature is relatively high, thus further improving operating conditions.

## Section 7: Lubrication

VacClad-W switchgear is designed so that lubrication in usual service is infrequently required under normal conditions. However, unusual service conditions such as high humidity, salt-laden atmosphere, corrosive gases, or severe circuit operating conditions may demand more frequent relubrication. All mechanical parts have been lubricated during assembly with molybdenum disulphide grease (Eaton Electrical Material No. 53701QB). The application of the lubricants should be held to a minimum to reduce the accumulation of dust and dirt.

### 7.1 Where to lubricate

1. MOC Switch – Grease (Eaton Electrical Material No. 53701QB) should be applied to the three locations where the rotary switch assemblies link to the Push Bar assembly (see Figure 15). This should be done at least every 3 years.

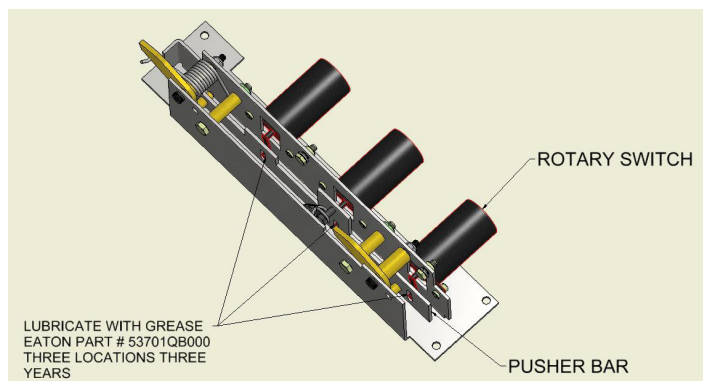


Figure 15. Lubrication Locations for the MOC Switch.

2. Racking screw - With the breaker removed, apply grease (Eaton Electrical Material No. 53701QB) to the racking screw. Grease should be applied with a brush using a motion perpendicular to the axis of the threaded shaft. It is important the grease is applied to the face of the threads. Apply to the length of the exposed threads and then move the nut from disconnect to connect to distribute the grease.

## Section 8: Renewal parts

When ordering renewal or spare parts, include as much information as possible. In many cases the part number of the new part can be obtained from identification on the old part. Always include a description of the part. Specify the rating, housing number and shop order number of the metal-clad housing in which the part is to be used.

## Section 9: Accessories

### 9.1 Standard accessories

Each new VacClad installation is provided with a set of accessories. Depending upon customer's specifications and the nature of the installation, the accessories will include one or more of the following.

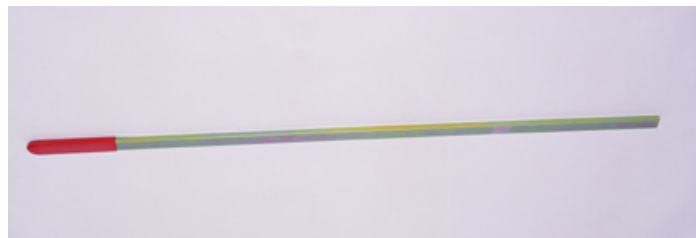


Figure 16. A Maintenance Tool.

The maintenance tool is used for manually charging the breaker closing spring and manually opening the shutter.



Figure 17. A Levering Crank.

The levering crank is used for moving the breaker or auxiliary drawers between the "Disconnect" and "Connect" positions.



Figure 18. Breaker Lifting Yoke.

The breaker lifting yoke is used for attachment to breaker on or off breaker compartment extension rails. IL32-275-1 provides complete instructions.

## 9.2 Optional accessories - test cabinet

### 1. Test cabinet

A test cabinet is used for electrically opening and closing of the breaker when it is outside its housing. For operation of the test cabinet reference IL32-275-4. For operation of the accompanying test jumper, reference IL32-275-5.



**Figure 19. Auxiliary Lifting Yoke.**

The auxiliary lifting yoke is used to lift CPT, fuse, or VT drawout drawers off the extension rails.



**Figure 20. Extension Rails.**

The extension rails are used for extending the cell rails so that a breaker or auxiliary drawer can be rolled out of its compartment on extension rails for maintenance or removal.



**Figure 21. Test Cabinet and Test Jumper.**

2. Portable lift device

The portable lifting device is used for raising or lowering the breaker to the compartment extension rails and either lifting the breaker onto or off the rails (see Figure 22).

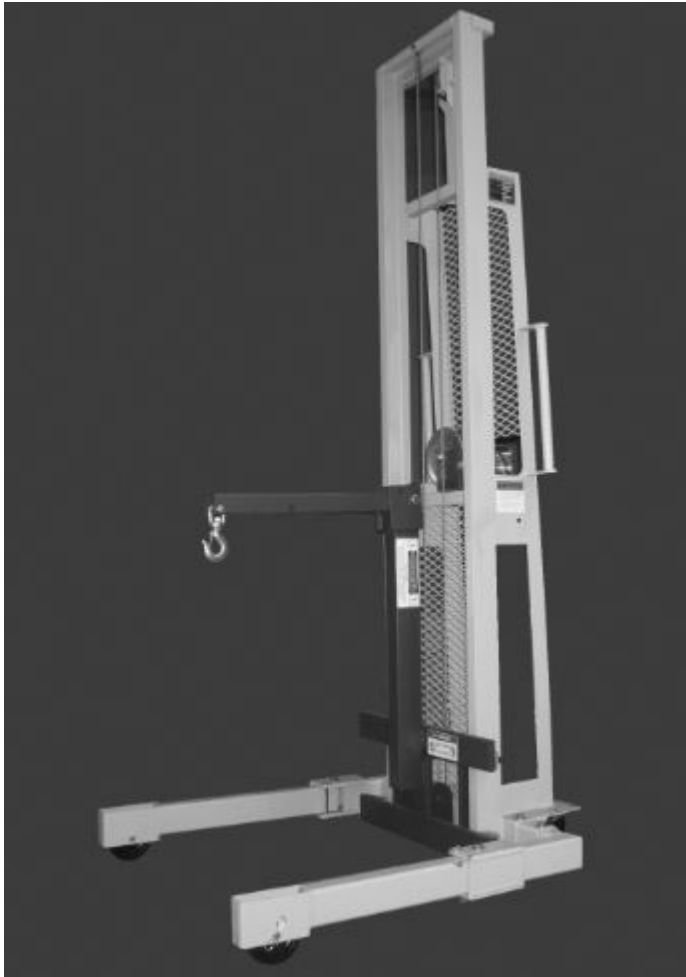


Figure 22. Portable Lift Device.

3. Ground and test device

The ground and test device provides a convenient means to ground a circuit for maintenance work, apply potential for cable testing, and access both bus and line circuits for "phasing out" tests.



Figure 23. VCP-W Manual Ground and Test Device.

## Section 10: Metal-clad switchgear field taping procedure (27 kV)

### 10.1 Busbar taping

#### Materials for taping

Reference Figures 24 and 25 below for details on proper busbar taping.

- Filler: A putty-like material:  
Trade name: Scotchfil® or Nashau® 102. Pieces of insulating tape may be used.
- Insulating tape and pad – High voltage EPR insulating tape:  
Trade name: Scotch® 130C.

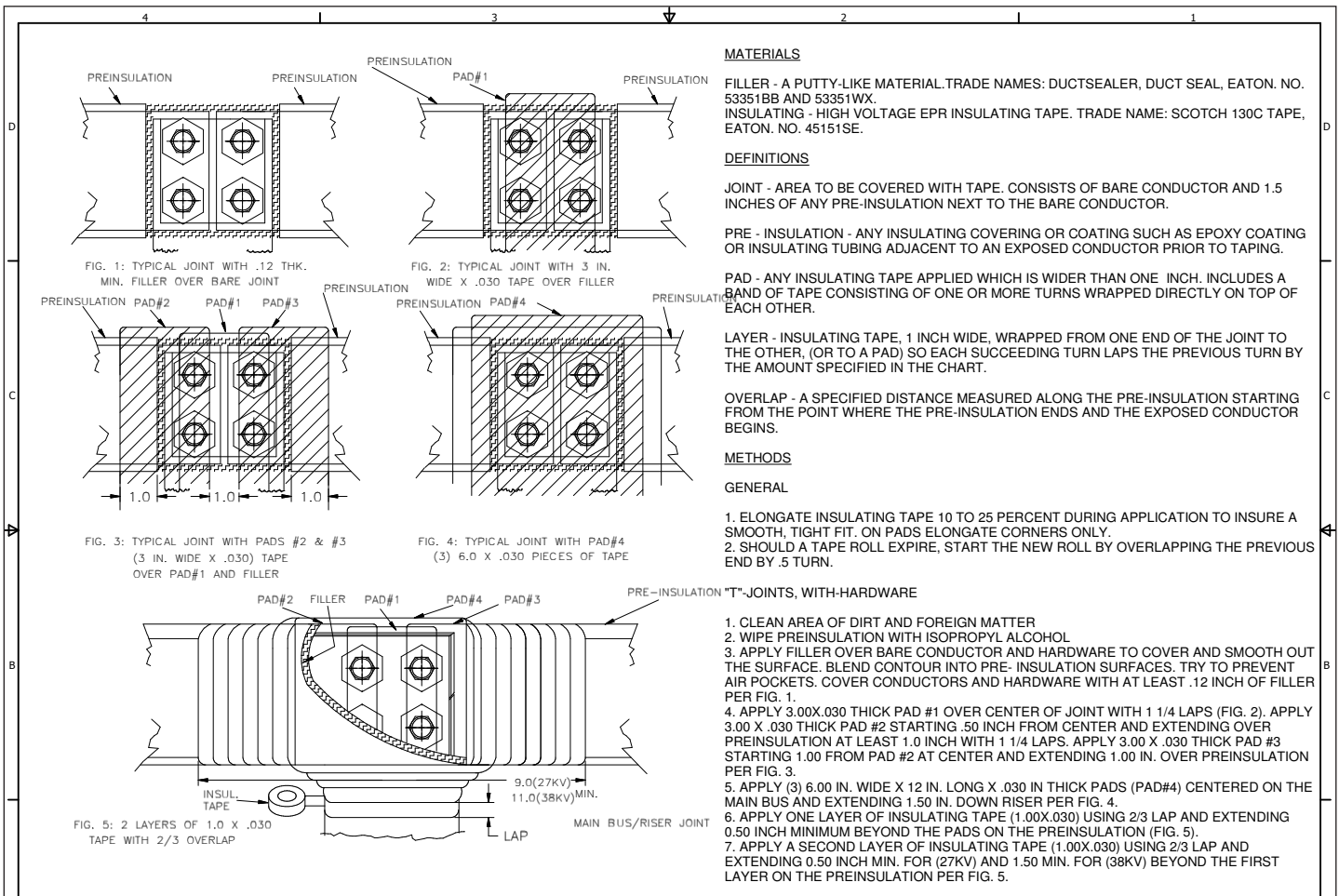


Figure 24. T-joint Field Taping Methods.

### 10.2 Using an insulating boot

- Step 1 Clean the area of dirt and foreign matter. Use a clean, dry cloth or, if necessary, dampen slightly with distilled water. Do not use any abrasives or solvents.
- Step 2 Place the boot over the joint so it fits in place. Fasten together with plastic wire ties. Cut off excess ends of plastic wire ties.

### 10.3 Cable termination taping

If cable termination insulation boots are not provided, Eaton recommends using tape material, Trade name: Scotch 130C, for all cable termination insulation. Refer to 3M's taping method instructions, Tape Method for Insulating Bus-Bar Connections 5-35 kV to Meet ANSI C37.20 Requirements, for installation techniques when using this tape.

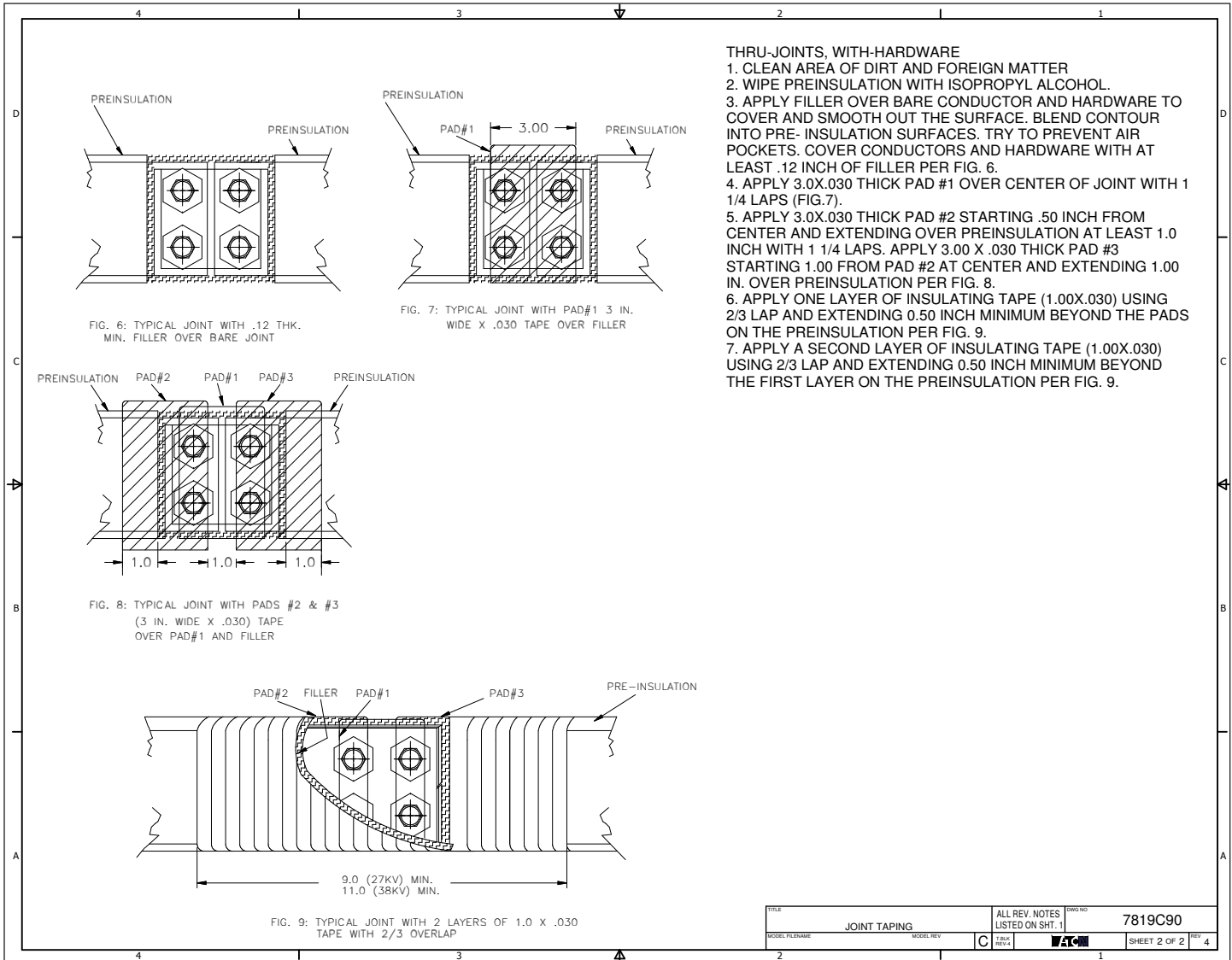


Figure 25. Thru-joint Field Taping Methods.

Table 4. Taping Chart.

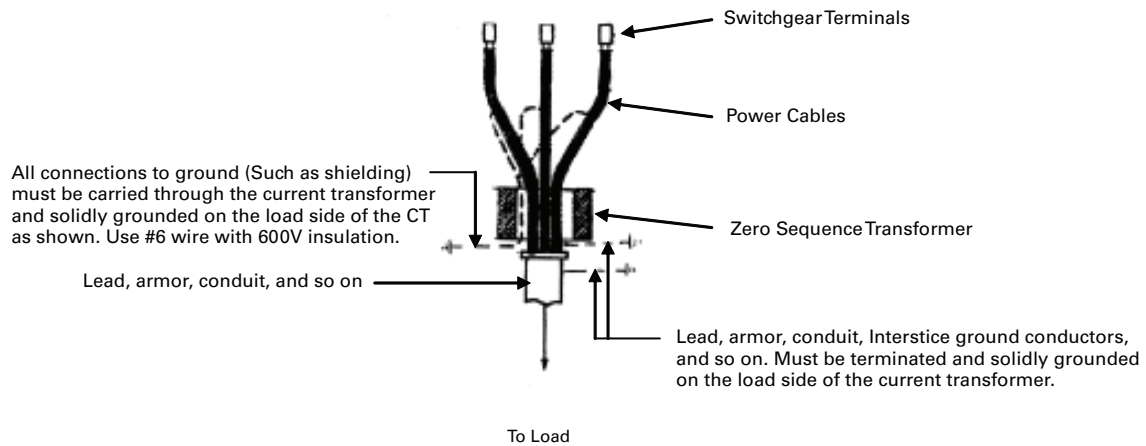
Switchgear kV	Pre-insulation or Pad Overlap Min. In. (mm)	Insulating Tape		
		Lap of Tape	Layers	Number of Pads
27 kV	1.25 (31.8)	0.66	2	3

10.4 Responsibility of installer

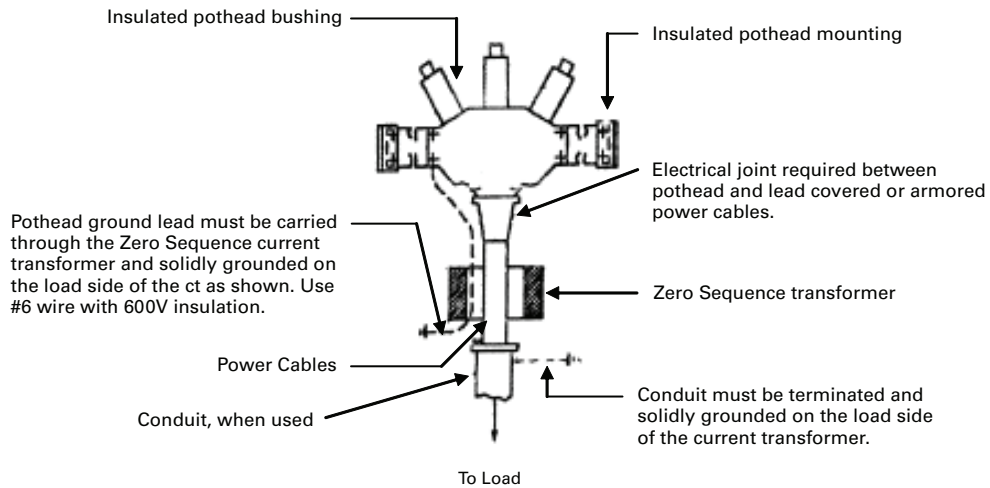
- For incoming or outgoing terminations, these approved materials are not supplied by Eaton and must be obtained and installed by others as identified above in the definitions.
- For connections involving shipping splits within an assembly, or connecting to a transformer, or to an AMPGARD MCC, or to an MVA switchgear assembly, insulating materials will be supplied by Eaton only if necessary. It is the responsibility of the installer to insulate the connections in accordance with these instructions.
- For an assembly that does not have continuous insulating sleeving on the phase bus conductors, cable connections or bus connections to other apparatus, insulation of these connections must be made.

**CAUTION**

**FAILURE TO INSTALL FIELD INSULATION WHERE NECESSARY IN ACCORDANCE WITH THESE INSTRUCTIONS WILL COMPROMISE THE ELECTRICAL RATINGS OF THE SWITCHGEAR ASSEMBLY. INSTALL FIELD INSULATION TO MAINTAIN THE ELECTRICAL RATINGS.**



Cable connections to switchgear terminals when used with Zero Sequence Transformers



Cable connections to switchgear terminals when used with Insulated Pothead.

Figure 26. Zero Sequence Current Transformer Connections.



**Notes:**

**Notes:**

**Notes:**

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