Instruction Booklet **IB02200001E** Effective June 2016 Revision #3

Instructions for installation, operation, and maintenance of 5/15 kV type VacClad-W metal-clad switchgear indoor housings

Contents

Powering Business Worldwide

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Instructions for installation, operation, and maintenance of 5/15 kV type VacClad-W metal-clad switchgear indoor housings

Read and understand these instructions before attempting installation, operation, or maintenance of this equipment. This equipment must be installed and serviced only by qualified electrical personnel. Retain this document for future use.

⚠ 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.

⚠ WARNING

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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.

DO NOT ATTEMPT ANY WORK ON THIS EQUIPMENT SUCH AS INSTALLING COMPONENTS, PERFORMING ANY EXAMINATIONS, PERFORMING ANY ADJUSTMENTS, PERFORMING ANY SERVICING, OR PERFORMING ANY MAINTENANCE WHILE IT IS ENERGIZED. BEFORE PERFORMING ANY WORK, FOLLOW ALL APPROPRIATE HAZARD ASSESSMENT AND ENERGY CONTROL PRECAUTIONS AND PROCEDURES.

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.

⚠ DANGER

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

Section 1: Introduction

1.1 Purpose

This instruction bulletin covers the installation, operation, and maintenance of a 5/15 kV Type VacClad-W 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

An Eaton 5/15 kV Type VacClad-W 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. Several built-in interlocks and safety features are provided.

The construction of the 5/15 kV type VacClad-W metal-clad switchgear allows for the placement of circuit breakers in the upper or lower positions. Breakers may be constructed as direct roll-in breakers or non-direct roll-in breakers. The design of the VCP-W direct roll-in breaker is constructed by adding a wheel kit to the standard VCP-W breaker. The upper position can be populated with any combination of auxiliary/auxiliary or a direct roll-in breaker. It is also possible to have up to four auxiliary modules in any one vertical section. The auxiliary modules can be a drawout VT, drawout CPT, or drawout fuse assembly.

If a lineup of switchgear is supplied with direct roll-in circuit breakers, both the upper and lower circuit breakers are supplied with direct roll-in wheel kits.

1.3 Documentation reference

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

For VCP-W breaker: IB131006EN.

For switchgear mounting to a foundation: Job Floor plan Document.

For breaker lifting device: IB02100002E.

For sample Ground and Test Device: Refer to the document received with the device.

For AMPGARD medium voltage motor control centers: IB48076.

Refer to the customer drawing package for order specific information.

For further information on installation and application, refer to the applicable descriptive bulletins and/or industry standards publications. Download Eaton electronic information from www.eaton.com.

1.4 Eaton contact information

For additional information about Eaton products please call 1-800-525-2000 or log onto 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.

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1.5 Safety precautions

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 the Occupational Safety and Health Act (OSHA) and lockout procedures. Verify that the voltage has been removed. Ground the load and line side connections. Observe National Electrical Code® (NEC®), OSHA, and local procedures and standards. This includes visual inspections while the 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 crank 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 producing current, because the transformer develops a dangerous high voltage if it is open circuited.

⚠ WARNING

BEFORE ATTEMPTING ANY WORK, EITHER DE-ENERGIZE 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:

6. The switchgear assembly is secured on a true and level surface according to the floor plan of the customer drawings.
7. Confirm that all hardware is in place and tightened per Section 2.1, Table 2.
8. Confirm that no tools or objects are left inside the enclosure.
9. Confirm that all devices, covers, doors, panels, and so on are in place.
10. Before start up, perform a field power frequency withstand (Hi-Pot) test, using test voltages given in Table 1.
11. For additional safety information and safe-use practices for your VCP-W circuit breaker, refer to IB131006EN

Table 1. Power Frequency Withstand Test Voltages

Rated Maximum Voltage (kV)	Power-frequency Withstand (rms) (kV)
4.76	14.25
8.25	27
15.0	27
27.0	45
38.0	60

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 upper compartment door of the first vertical section and online at 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 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 the bolt end, insert the bolt through a hole, and then install a flat washer, split-lock washer, and nut. Torque the hardware per the specifications contained in Table 2, once all units are placed.

Table 2. Bolt Tightness Values for All Hardware Connections.

Bolt Size inches (mm)	0.25 (6.35)	0.31 (7.87)	0.38 (9.65)	0.50 (12.7)	0.62 (15.75)
Bolt Material	**Torque Value in Foot Pounds (N•m)**				
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 #13 - #20 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 - #12 can be accessed from the front module.

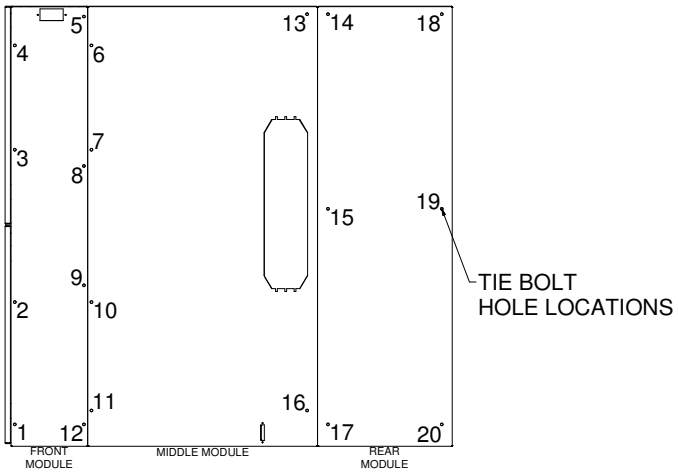


Figure 1. Typical Tie Bolt Locations.

Step 2: Check the entire lineup to make sure it is level and plumb prior to bolting or welding the base members of the vertical section frame, front, and rear to the foundation.

Step 3: Remove all shipping blocks or braces.

A. Examine all instruments, meters, relays, etc., and remove any shipping blocks or braces.

B. 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 x 2.00 inch (6.4 x 50.8 mm) (0.25 x 3.00 inch [6.4 x 76.2 mm] for equipment designed for 63 kAIC) copper busbar 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 #8276A77H01, located in detail box) to connect the shipping sections (see Figure 2).

Figure 2. Ground Bus Installation.

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.

⚠ CAUTION

THE SWITCHGEAR INSTALLATION MUST BE PROPERLY GROUNDED.

Note: For the design and installation of a grounding system, refer to Electrical Power Distribution for Industrial Plants (Institute of Electrical and Electronics Engineers [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 switchgear may vary.

Figures 3 and 4 show the removal of the necessary barriers (typical).

Figure 3. Main Bus Installations with Bus Barriers Installed. Viewed from the rear with the rear covers removed (typical 1-hi construction shown).

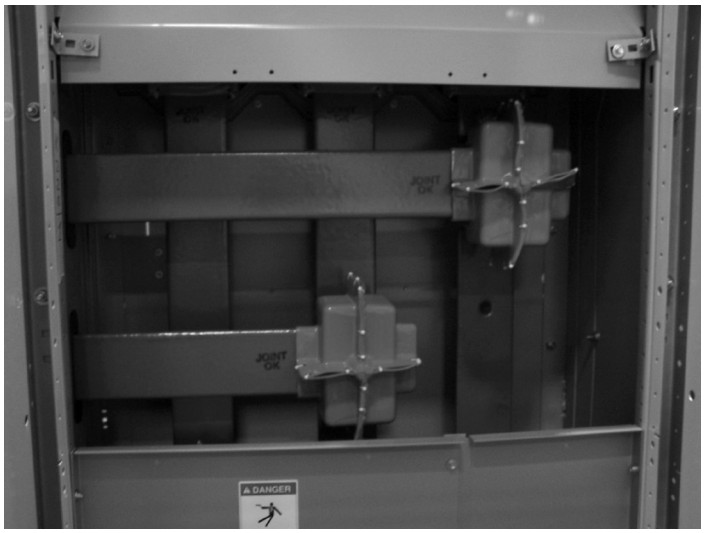


Figure 4. Main Bus Installation with the Barriers Removed.

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. See Figure 4. 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 splice plate to the values shown in Table 2. Make sure all structure and tie bolts (see Steps 3 and 4) 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, as viewed from the front, unless indicated otherwise on the shop order drawings.

B. If the two systems are to be paralleled, make sure the phase rotation and the phase voltages are the same. Make sure the phase angle difference between the voltages is zero. 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. Follow the instructions of the cable manufacturer to determine what minimum bending radius is permitted when forming cables to fit inside the cable compartment, and avoid sharp bending or kinking. Make sure the cables do not rest on sharp corners or edges that could damage the insulation.

D. Terminate power cables in accordance with cable manufacturer's instructions and cable termination manufacturer's instructions.

E. It is necessary to insulate all power cable connections to the switchgear terminals with suitable insulating media such as insulating tape, insulating boots, heat shrink insulation materials, insulating barrier systems, or other suitable materials to maintain the metal-clad switchgear insulation requirements as dictated in the applicable industry standards. This insulating media is not included in the standard scope of supply by Eaton. Refer to Section 10 for field taping instructions.

F. If potheads or other types of terminators are furnished, follow the instructions of the manufacturer when connecting the cable to them. Use the flexible connectors to connect the aerial lugs to the conductors. This will keep strain off the insulators of the pothead or the terminator. Tape (or otherwise insulate) the entire joint, including the flexible connectors. See Section 11.

G. If zero sequence current transformers are provided, pass the power cables through the transformer's window. Refer to Figure 38.

H. Replace all metal barriers and any other components removed during hookup of the high voltage bus. Replace them in the reverse order from which they were removed.

I. Replace all rear covers or close doors.

Step 9. Inserting breaker

A. Lower compartment direct roll-in-breaker
Push the breaker into the breaker compartment until the breaker T-handle latches over the moving block on the levering screw assembly. In this position, the breaker is considered in the Disconnect position .

B. Upper compartment or non-direct roll-n-breaker

1. The breaker compartment has an interlock assembly on the compartment levering assembly, located on both the left and right hand rail assemblies . The purpose of the interlock assembly is to prevent the breaker from being removed from the compartment without the extension rails in place .

2. In order to insert or remove a breaker a set of extension rails must be inserted into the left hand 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, unlocks the interlock allowing an installed circuit breaker to roll forward. The rolling surfaces of the compartment rail and extension rail are flush.

3. In this position, the breaker can be inserted or removed from the breaker compartment (see Figure 5 and Figure 6).

Figure 5. Insertion of the Drawout Extension Rails.

Figure 6. 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.

Automatic secondary: For an automatically engaged secondary harness, rack the breaker into the test position identified by the Breaker position indication (BPI) label.

In these positions, the breaker control circuit can be tested offline. (Breaker is not connected to the primary circuit.)

B. Movement of the breaker from the Disconnect or Test position to the Connect position.

1. As the breaker is racked from Disconnect or Test, 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 connected 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, or until the breaker cover plate aligns with the connect position location given on the BPI label (item 7) if so equipped.

C. Movement of the breaker from the Connect position to the Disconnect or Test 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 Test or 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. This applies to both the direct roll-in breakers and non-direct roll-in VCP-W circuit breakers.

Step 12: Check the drawout voltage transformers, control power transformers, or fuse truck assemblies in the auxiliary compartments.

A. Before installing the drawout assembly into the enclosure, check the fuses for continuity. Make sure there is proper contact in the fuse clips.

B. Insertion of the extension rails:
The drawout auxiliary assembly compartment has an interlock assembly on the compartment levering assembly located on the inside of both the left and right hand rail assemblies. The purpose of the interlock assembly is to prevent the drawout auxiliary assembly from being removed from the compartment without the extension rails in place. In order to insert or remove an auxiliary drawout assembly from its position, a set of extension rails must be inserted into the left hand 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, unlocks the interlock allowing the auxiliary drawout assembly to roll forward. The rolling surfaces of the compartment rail and extension rail are flush. In this position, the auxiliary draw out assembly can be inserted or removed from the auxiliary compartment (see Figure 5).

C. Installation of drawout assembly into the auxiliary compartment:

1. Using a portable lifting device, place the drawout assembly onto the extension rails. (See Figure 7 for typical lifting of a draw out device and Figures 8, 9, and 10 for typical auxiliary drawers mounted on the extension rails.) Ensure all four wheels are on the extension rails before removing the yoke.

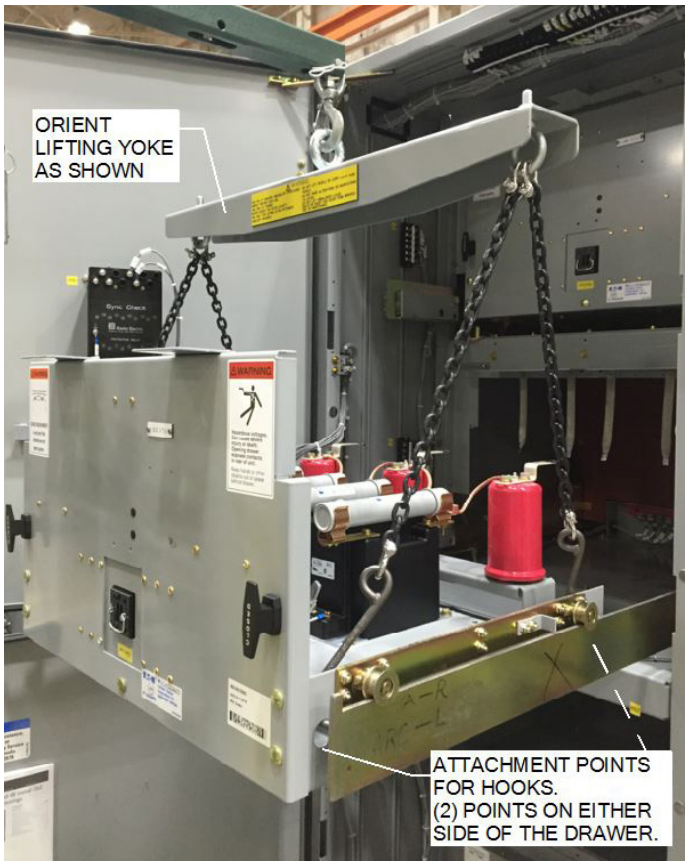


Figure 7. Lifting and Setting the Auxiliary onto the Extension Rails.

2. Push the drawout assembly into the compartment until the drawout assembly comes to a complete stop. Turn the two handles on the auxiliary drawout assembly to latch the assembly into place. In this position, the auxiliary drawout assembly is in the Connected position.
3. A cell interlock will be equipped on all CPT and/or fuse drawers (optional for VT drawers) and is mounted to the drawer (Refer to the bottom drawer of Figure 8). To engage the interlock, push the interlock bar up and turn on the secondary control breaker. For some applications, the secondary control breaker may be mounted separate from the drawer and a Kirk lock may be used. Refer to the scheme for proper Kirk lock operation.

D. Withdrawal of drawout assembly into the Disconnect position:

1. A cell interlock will be equipped on all CPT and/or fuse drawers (optional for VT drawers) and is mounted to the drawer (Refer to the bottom drawer of Figure 8). To disengage the interlock, turn off the secondary control breaker and push the interlock bar down. For some applications, the secondary control breaker may be mounted separate from the drawer and a Kirk lock may be used. Refer to the scheme for proper Kirk lock operation.
2. Turn the two handles to unlatch the drawout assembly and then pull drawout assembly out until it comes to a full stop. If the extension rails are removed, the assembly will stop on the interlock. The installation of the extension rails will allow the drawout assembly to be removed from the enclosure.

Figure 8. Typical Auxiliary with Drawers Mounted on the Extension Rails.

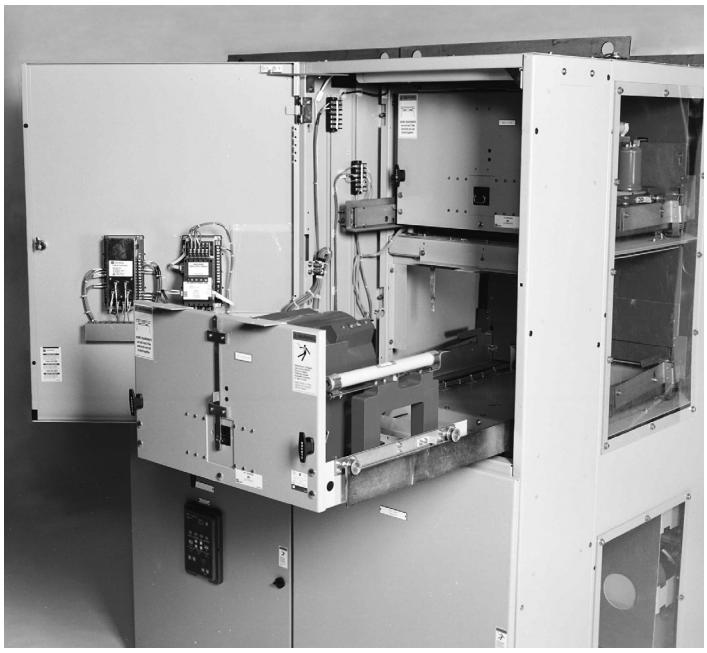


Figure 9. Drawout Drawer for Control Power Transformer on the Extension Rails.

E. Check the following drawout assembly functions:

1. When the auxiliary drawout assembly is fully inserted into the Connect position, check to make sure the primary contacts and secondary contacts are engaged when the auxiliary drawout assembly is Connected. Use a low voltage continuity testing device to verify the contacts are engaged. They should engage when auxiliary drawout assembly is within 1.00 inch (25.4 mm) of being fully in the Connect position.
2. Suspended from inside the compartment are three flexible, grounding straps. As the auxiliary drawout assembly is withdrawn to the Disconnect position, ensure that the grounding straps contact the fuses to momentarily ground them.

Step 13: Perform loading check on both the control and primary circuits to assure the system is ready for operation.

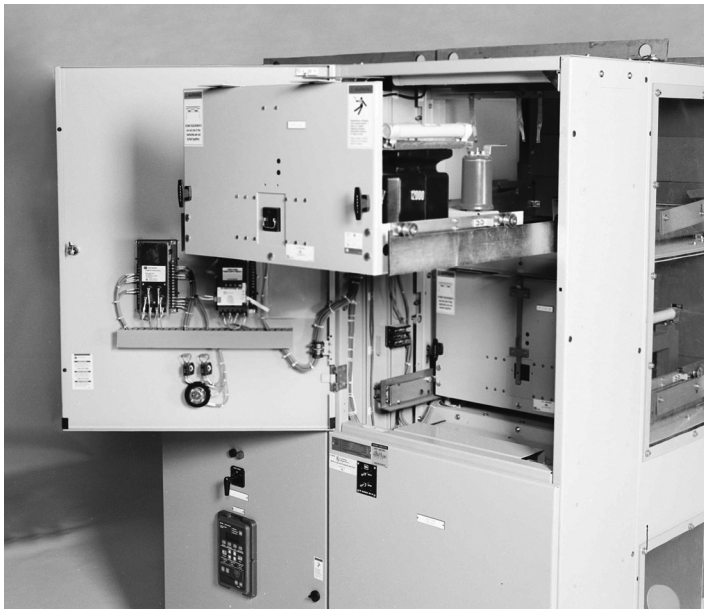


Figure 10. Drawout Drawer for Voltage Transformer on the Extension Rails.

Section 3: Description of VacClad-W switchgear

3.1 Safety features

Eaton's VacClad-W switchgear is manufactured with several built-in interlocks. These built-in features are intended to protect personnel working on the equipment.

⚠ WARNING

MAKING SWITCHGEAR INTERLOCK INOPERATIVE MAY DAMAGE PROPERTY AND MAY CAUSE SEVERE INJURY OR DEATH.

Figure 11. Typical 5/15 kV Switchgear Assembly.

1. 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 rating than the rating of the compartment, or if the voltage and continuous current characteristics do not match, the coding plate on the compartment will prevent the entrance of the breaker into the compartment.

Note: Even with the coding plates, it is possible to put a breaker into the compartment who's 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 the same.

2. Automatic shutter:
   An automatic shutter, shown in Figures 12 and 13, covers the primary disconnecting contacts when the breaker is withdrawn from the connect position. The shutter prevents persons who are working on the switch-gear from accidentally touching the primary contacts. Shutters also cover the stationary disconnects for auxiliary drawout assemblies.

⚠ WARNING

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

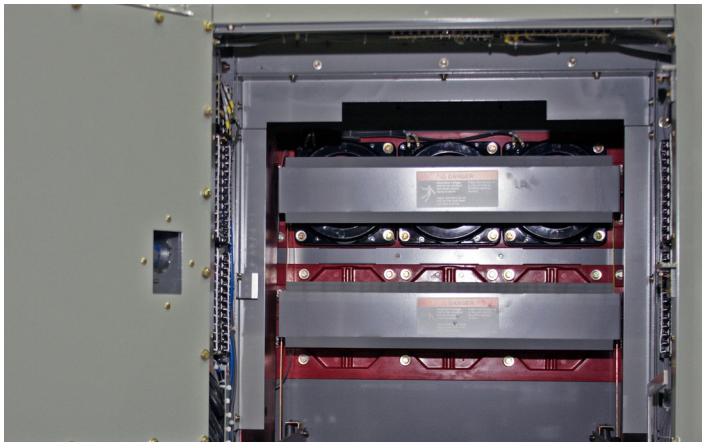


Figure 12. Automatic Shutters - Ring Type CTs with Shutters Closed and CT Barrier Removed.

Figure 13. Automatic Shutters - Ring Type CTs with Shutters Open and CT Barrier Removed.

3. Polyester CT barrier:
   An optional polyester CT barrier restricts inadvertent access to the CT's (see Figure 14). To remove the CT barrier, remove the two 9 inch bolts located at the top of the barrier.

Figure 14. Ring Type CTs with Shutters Closed and CT Barrier in Place.

4. Ring-type current transformers:

   The ring-type current transformers are mounted over the primary contact insulating high voltage terminal on the rear wall of the breaker compartment. There is space for a maximum of four standard accuracy transformers per phase (two on each high voltage terminal of the breaker).

They are mounted so they can be reached from the front of the enclosure (see Figures 11 and 12). This makes it possible to add or to change transformers when the switchgear is de-energized and grounded. The polarity marks on the transformers show the relative instantaneous polarity in the primary and secondary windings. The equipment's electrical drawings show how to connect the transformers to give the polarity needed to operate relays, instruments, and meters.

5. Key interlocks:

   Key interlocks are supplied whenever a defined sequence of operation is required to ensure safe operation and access within the switchgear assembly, or with the switchgear assembly and external devices. Two typical applications within a switchgear assembly involve dummy circuit breaker elements and drawout fuse trucks. The operation of any key interlock scheme is described on the shop order drawings.

   For auxiliary drawer interlocks refer to Section 2.1. The cell interlock can be seen on the front of the bottom drawer in Figure 8

   For the circuit breaker pan key interlock refer to Figure 15.

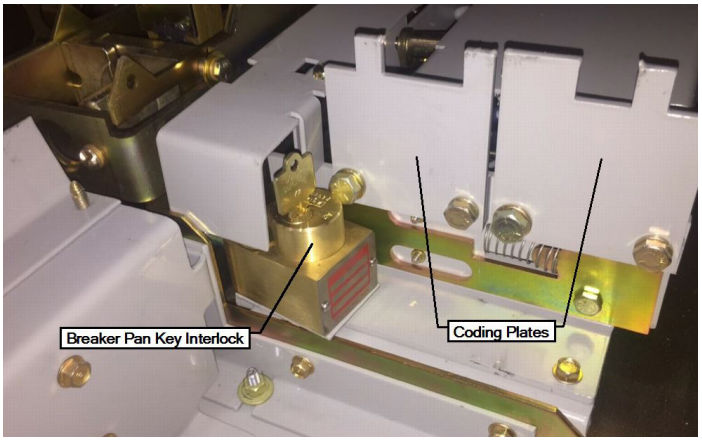


Figure 15. Circuit Breaker Pan Key Interlock

⚠ 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 BECAUSE IMPROPER USE OF SPARE KEYS WILL DEFEAT THE INTERLOCKING SCHEME.

6. Lockout-tagout features:

   a. Shutter LOTO
   Lockout-Tagout provisions are featured in the rear of the circuit breaker pan assembly. This assembly controls the opening of the shutters. In order to lockout the shutters in the closed position, a Padlockable Shutter kit is required (Refer to Figure 16).

   The padlockable Shutter Pin (Eaton Part# 1C19648) should be inserted into these provision holes according to the steps in Figure 17.

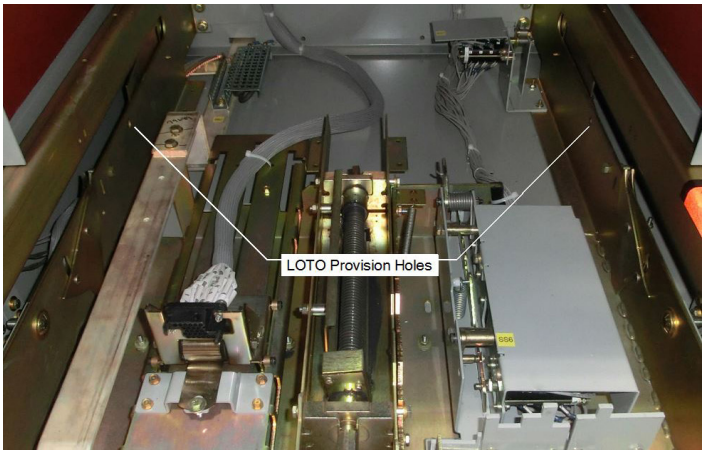


Figure 16. Lockout-tagout Provision Holes in the Circuit Breaker Pan.

⚠ CAUTION

THE SHUTTER LOTO DOES NOT LOCKOUT THE USE OF INTEGRAL RACKING WHERE APPLICABLE. USE OF THE INTEGRAL RACKING SYSTEM WHEN THE PADLOCK-ABLE SHUTTER PINS ARE INSERTED INTO THE SHUTTER LOTO PROVISION HOLES MAY CAUSE FAILURE RESULTING IN PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.

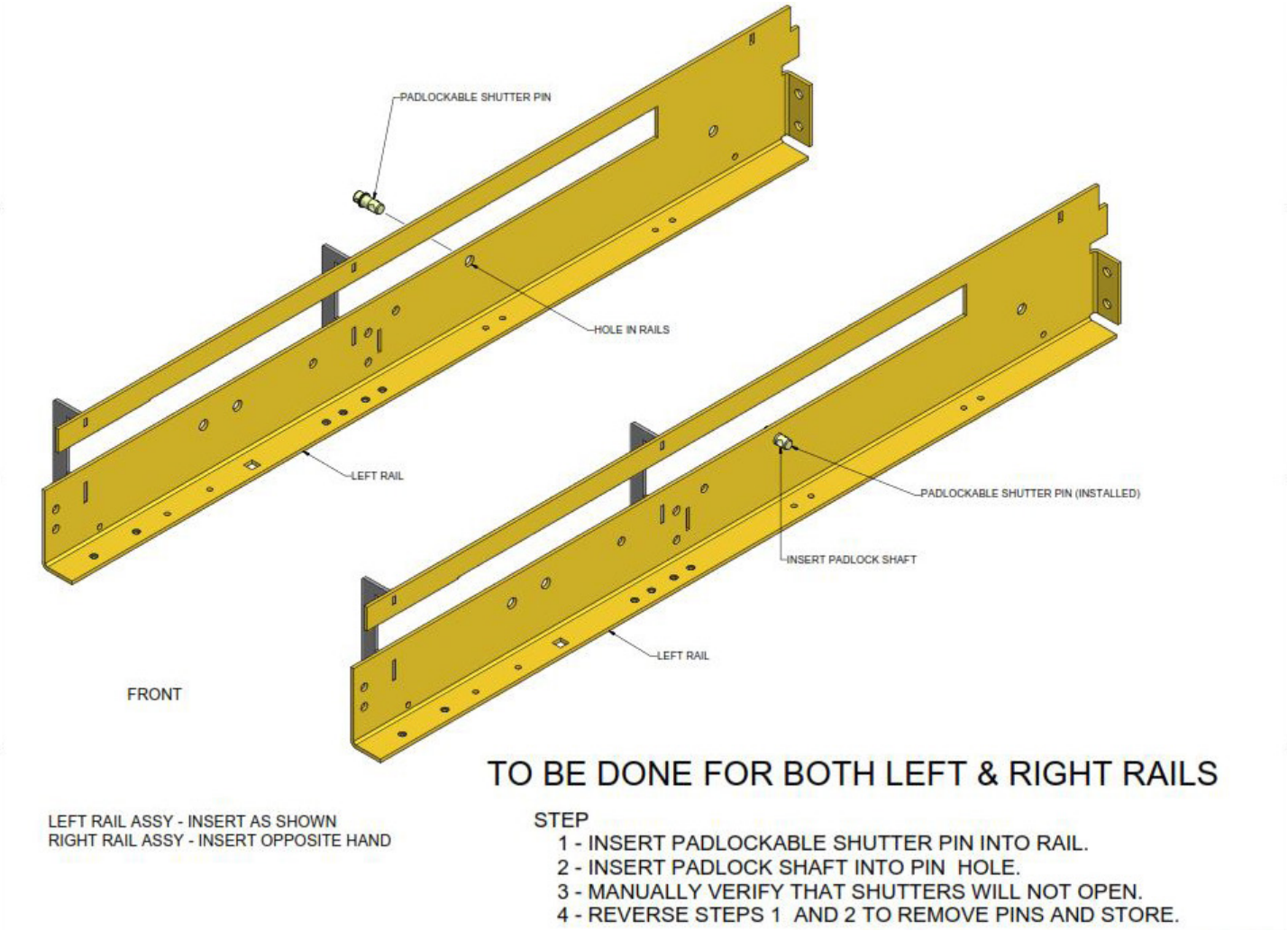


Figure 17. Lockout-tagout Provision Holes in the Circuit Breaker Pan.

b. Circuit breaker pan LOTO
Lockout-Tagout 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 20b).
3. Insert a LOTO option (refer to Figure 19) into the circuit breaker pan LOTO provisions (See Figure 18).
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.

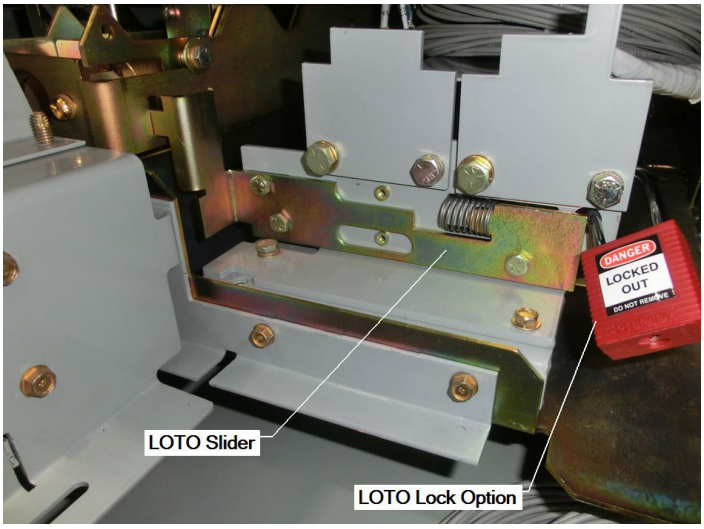


Figure 18. Lockout-tagout Provision for Circuit Breaker Lockout.

Figure 19. Several Acceptable Lockout-tagout Options.

Note: The LOTO options shown in Figure 19 only includes a handful of accepted options. Other options may also work with the Breaker Pan LOTO provision.

3.2 Breaker pan assembly

Callout descriptions for Figures 20a and 20b

1. Grounding contact grounds the breaker in all positions.
2. The levering system prevents removal of the breaker in any position other than the Disconnect (or Test) position.
3. The control wiring is arranged for pullout 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).

   Manual secondary: Figure 20a represents a manually engaged secondary assembly that requires the customer to engage the secondary harness manually when the breaker is in the Disconnect position. When engaged, the breaker will now be in the Test position.

   Automatic secondary: Figure 20b indicates an automatically engaged secondary as offered on the BPI pan assembly and requires no manual input from the customer to engage the secondary harness. The secondary harness will engage automatically when the breaker is levered-in to the discrete Test position.

   The secondary harness will then disengage automatically when the breaker returns to the Disconnect position.
4. Racking screw performs breaker insertion and withdrawal.
5. Moving block couples to breaker for insertion and withdrawal.
6. Slider is used with #8 to prevent levering a closed breaker. May also be used in conjunction with #12 to padlock a breaker in either position.
7. Indicates when the breaker is in the fully connected position.

   Standard indication: Figure 20a represents positive indication of the breaker in the Connect position by use of a red flag that rotates into viewing position when the breaker is fully connected.

   BPI (breaker position indication) Label: Figure 20b represents positive indication of breaker location at any position through use of a colored label mounted on the top flange of the right hand rail assembly. Green indicates the Disconnect position, yellow indicates the Test position and red indicates the Connect position. Upon arriving at any of the three discrete positions; Disconnect, Test, and Connect, there is a black mark that aligns with the breaker cover to indicate exact location.
8. Slider interlocks prevent removing a closed breaker.
9. The breaker MOC (mechanism-operated compartment) switch is an assembly of switches that is operated by a lever on the breaker mechanism. It can contain as many as 15 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 plunger out the bottom of the mechanism and pushes down on the MOC switch operating mechanism. This, in turn, transmits the motion to operate the switch.
10. The TOC switch (truck operated compartment) has nine poles in the normal design – four contacts make and five break as the breaker is levered to the connected position. As the breaker is being levered into the connected position, a bracket on the breaker pushes the TOC switch lever during the last inch of travel. As a result, the TOC switch can be used to electrically indicate whether or not the breaker is in the connected position (beneath cover).
11. Coding plates: (see Safety features, Section 4.1).
12. Provision for padlocking a breaker in any position. Also a location for a key interlock.
13. Metal framework provides a closed barrier to the primary compartment when the breaker is connected.
14. Rail on which the breaker rolls.
15. MR2 Integral racking provisions for inclusion during manufacturing or aftermarket.

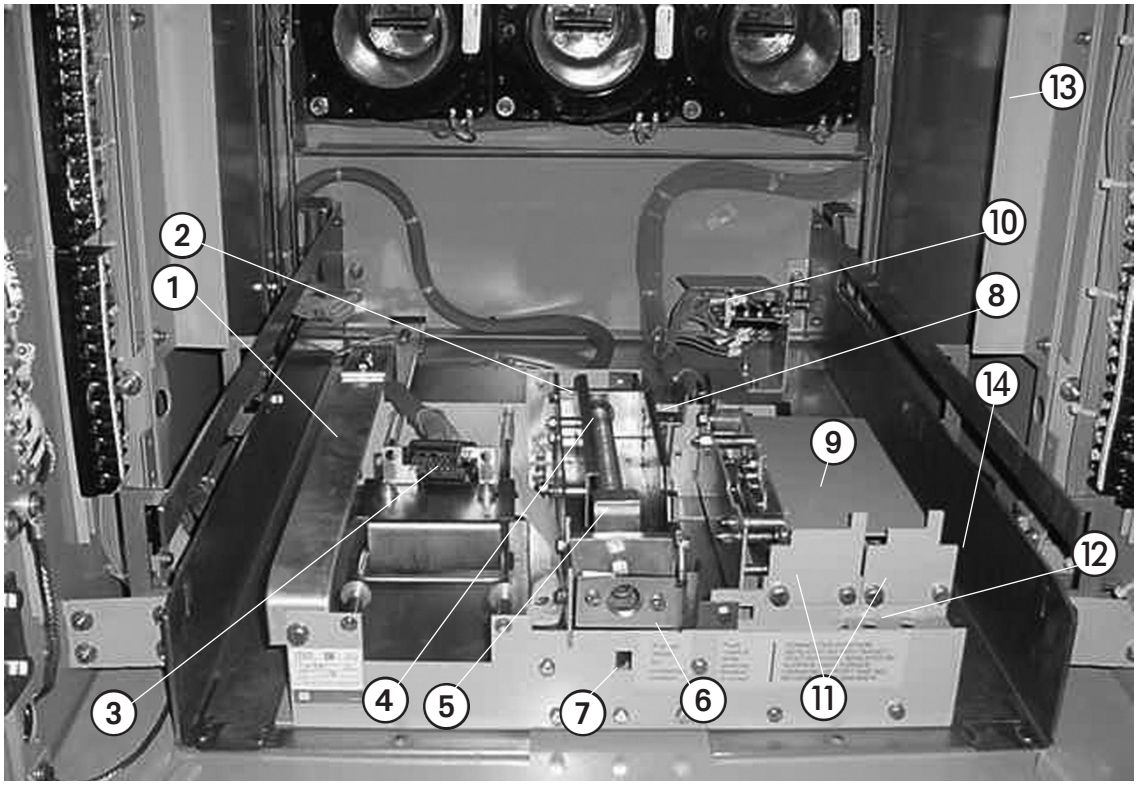


Figure 20a. Pan Assembly.

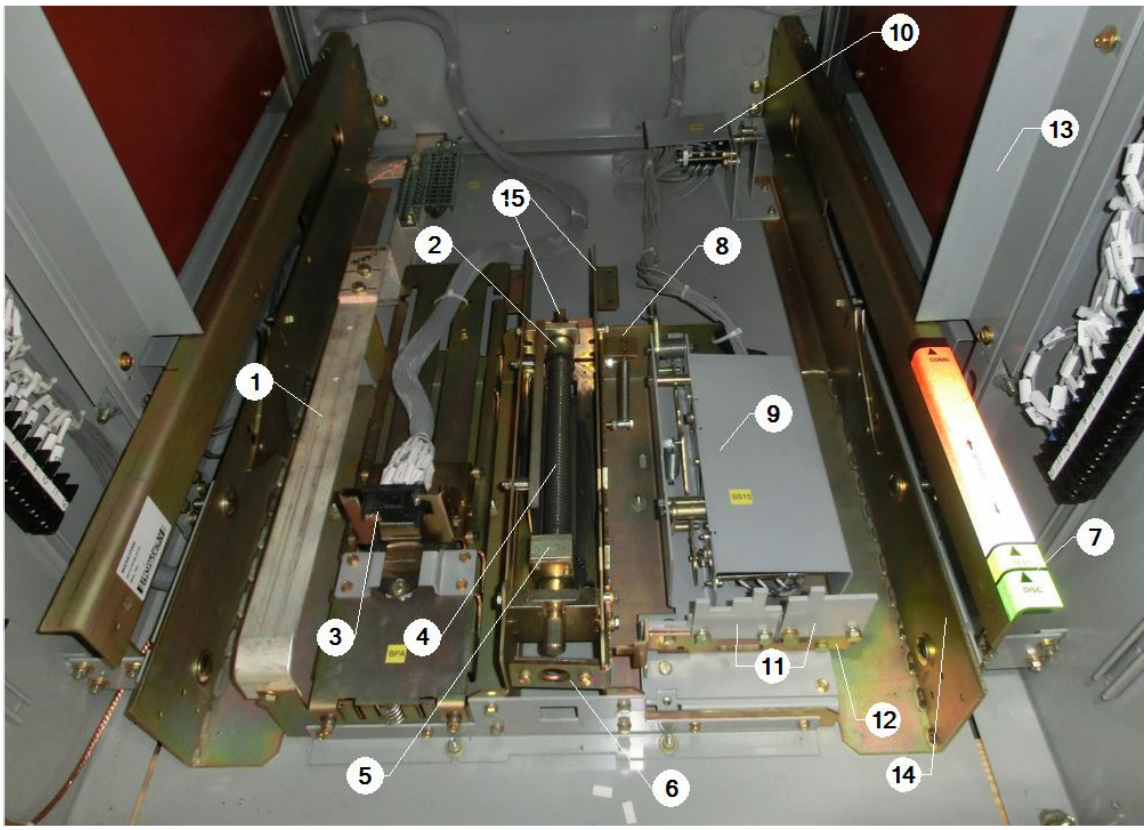


Figure 20b. BPI Pan Assembly.

Section 4: Adjusting and testing

Step 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.

Step 2: Examine all wiring circuits to make sure they have not been damaged or loosened during shipment or installation.

Step 3: Make sure all the connections are correct before the equipment is operated. "Light out" connections between the switchgear and remote apparatus such as instrument transformers, auxiliary switches, and remote control and interlock circuits.

Step 4: Coordinate the settings of the relays with other parts of the system in accordance with the standards or operating practice of the purchaser.

Step 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.

Step 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 no 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).

Section 5: Operation of the system

Step 1: Study and understand the electrical drawings furnished with each switchgear system.

Step 2: Install the circuit breaker in the Disconnect position.

Manual secondary: To engage secondary harness, lift and pull the secondary disconnect forward to engage the control circuit.

Automatic secondary: To engage secondary harness, rack the breaker to the test position to engage the control circuit.

Check that the breaker operates.

Step 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.

Step 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 electrical control schemes are designed to coordinate electrically with the mechanical design of the breaker.

Section 6: Inspection and maintenance

6.1 Safety precautions

Refer to Section 1.6, "Safety precautions."

⚠ WARNING

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

Some common general precautions for high voltage work are:

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 (see Figures 12 and 13). Do not expose any contacts unless all upper and lower high voltage parts are de-energized.

⚠ WARNING

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

6.2.2.1 Manually opening the shutters

1. Insert the breaker maintenance tool (see Figure 22), such that the handle rests on the welded rail support while making contact with the hardware assembly on the manual shutter extension (Refer to Figure 21).

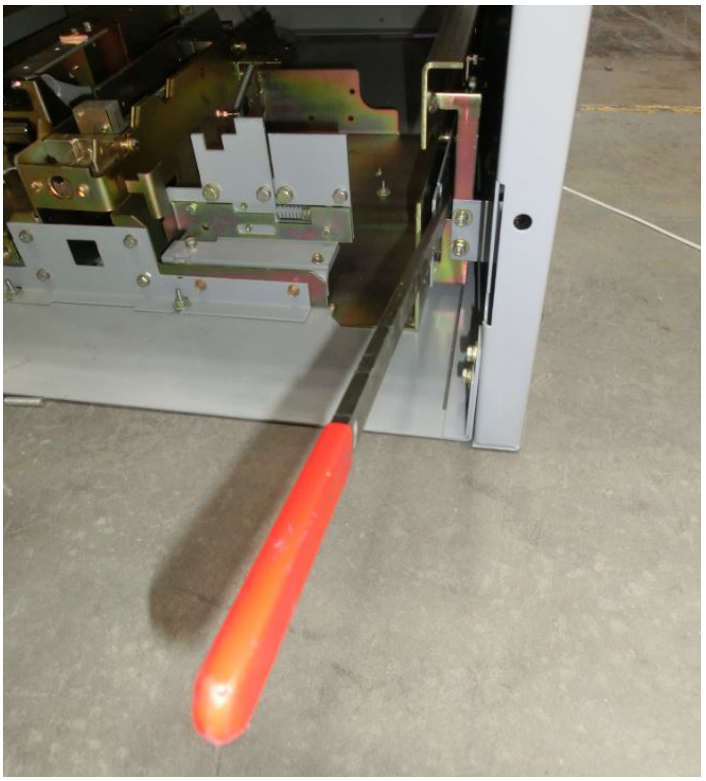


Figure 21. Insertion of Maintenance Tool into the Pan for Manually Opening the Shutters.

2. Push down on the maintenance to open the shutters (Refer to Figure 22).

Note: Shutters will close if pressure is removed from the maintenance tool. Shutters can be locked into place with the shutter lock kit or other manual means.

Figure 22. Hand Operation to Manually Open the Shutters

6.2.3 Current transformers

Window type current transformers are installed over the primary contact insulating tubes in the front of the unit (see Figures 12 and 13). 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 (see Figure 23).

⚠ 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.

Figure 23. Typical VT and CPT Drawer in the Upper Drawout Position.

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.

⚠ WARNING

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 MAY RESULT IN BODILY INJURY OR ELECTROCUTION. WHEN ENERGIZED, CIRCUIT CARRIES LETHAL HIGH VOLTAGE.

6.3.1 Individual devices

The maintenance schedule for individual devices, such as circuit breakers, relays, and so on, 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 frequent 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 the primary circuits and remove the cover plates from the primary compartments. Before cleaning, take megohmmeter (megger) readings between phases and each phase 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 and wipe dry.

   After buses have been dusted and wiped clean, take megger readings again between phases and each phase to ground. 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 the primary circuits and expose the primary contacts and their supports by manually opening automatic safety shutters. 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, resulting in 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 secondary disconnecting contacts, such as those on auxiliary drawout assemblies, for abnormal wear, fatigue, or overheating. Replace if necessary. Otherwise treat the same as the main disconnecting contacts above.

4. Control contactors
   Contacts should be inspected and dressed 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. Relay test personnel can easily perform this operation during periodic relay testing.

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 drawout features of the auxiliary drawout assemblies. Examine mechanical mating parts such as the breaker secondary contacts blocks, guide rails, and trippers. Grease the racking screw and the plunger/operating mechanism of the MOC switch, as called out in Section 4.3, items 4 and 9.

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

9. Battery and charging equipment (optional)
   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 test 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 larger 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. They 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 harsh 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 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 (Refer to #9 in Figure 20b) – 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 24). This should be done at least every 3 years.

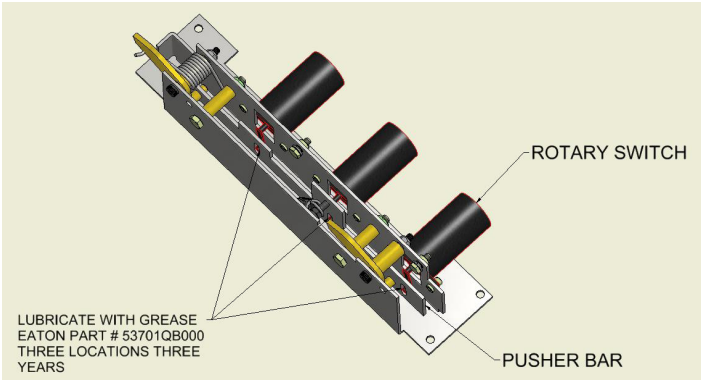


Figure 24. Lubrication Locations for the MOC Switch.

2. Racking Screw (Refer to #4 in Figure 20b) – With the breaker removed, apply grease (Eaton Electrical Material No. 53701QB) to the racking screw (see Figure 25). 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.

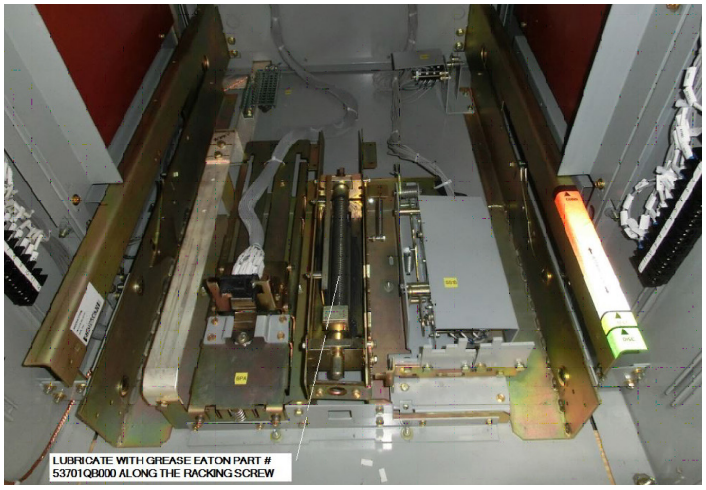


Figure 25. Lubrication Location for the Racking Screw.

Section 9: Renewal parts

When ordering renewal or spare parts, include as much information as possible. In many cases, the style number of the new part can be obtained from identification on the old part. Always include a description of the part. Specify the rating, structure number, and shop order number of the switchgear housing in which the part is to be used. See Reference Guide RP02201001E for renewal parts list.

Section 10: Accessories

10.1 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.

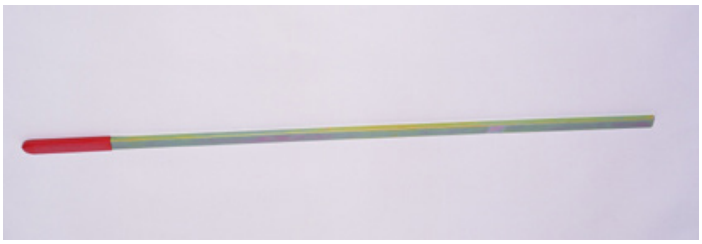


Figure 26. A Maintenance Tool.

The maintenance tool is used for manually charging the breaker closing spring and manually opening the shutter. For proper use of maintenance tool involving manual operation of the shutters, reference section 6.2.2. For other uses involving the circuit breaker, reference the VCP-W Circuit Breaker, IB131006EN.

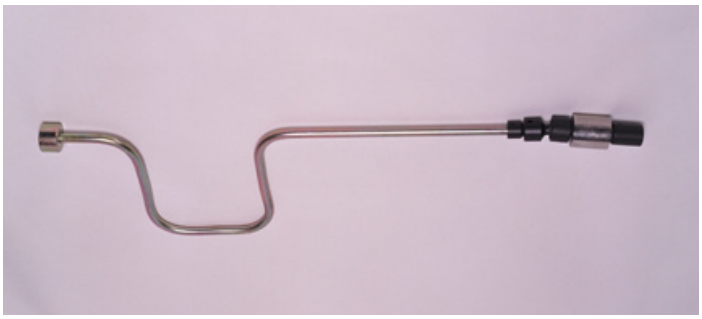


Figure 27. A Levering Crank.

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

Figure 28. Breaker Lifting Yoke.

The breaker lifting yoke is used for attachment to breaker on or off breaker compartment extension rails. I.L. 32-275-1 provides complete instructions.

Figure 29. Auxiliary Lifting Yoke.

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

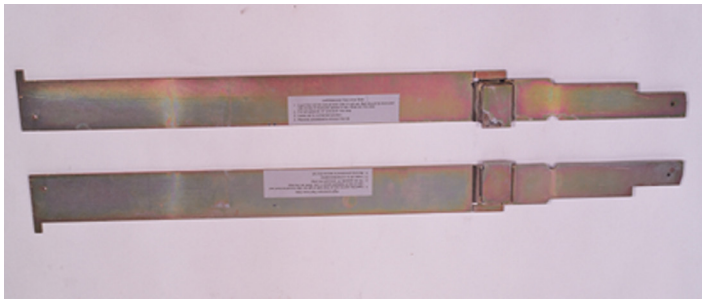


Figure 30. Extension Rails.

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.

10.2 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 I.L. 32-275-4. For operation of the accompanying test jumper, reference I.L. 32-275-5.

Figure 31. 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 32).

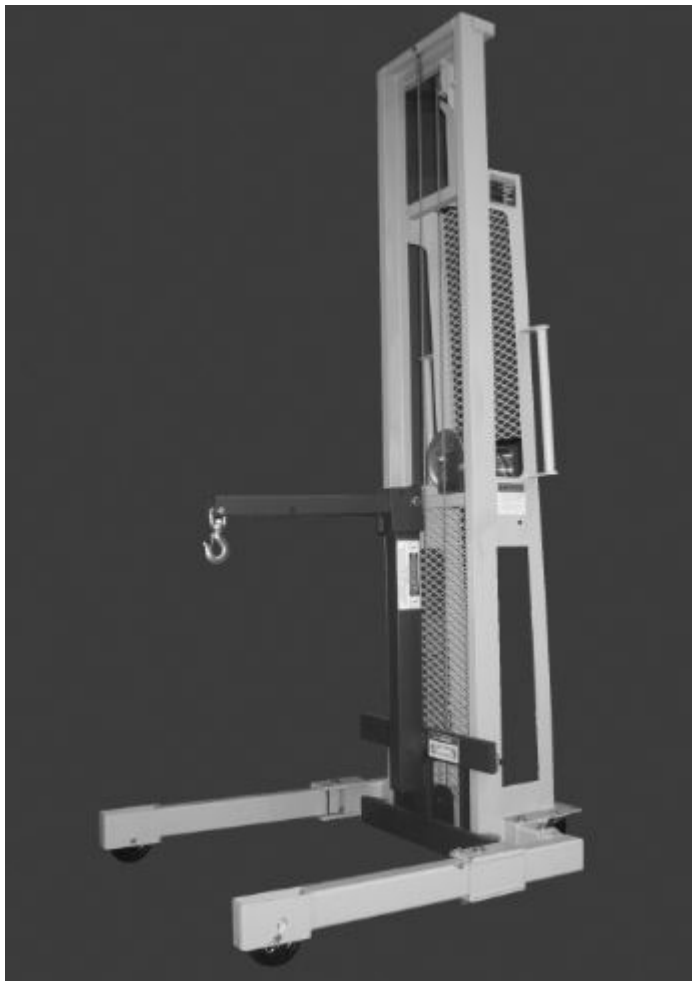


Figure 32. Portable Lift Device.

3. Dockable transport dolly

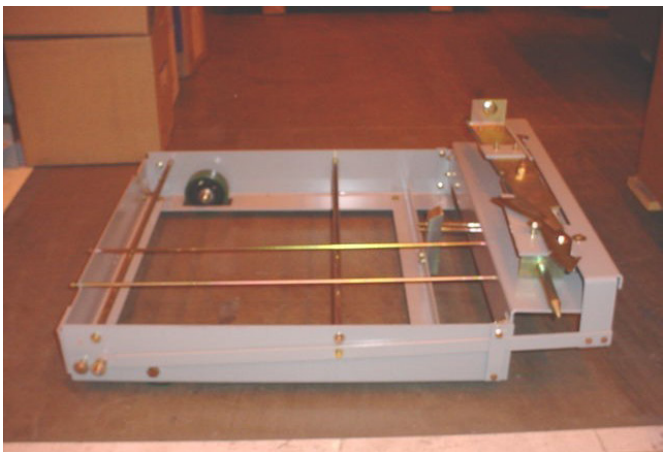


Figure 33. Dockable Transport Dolly.

The Dockable Transport Dolly is used for removing the breaker from the lower compartment without lifting (bottom compartment only). This device "docks" with the lower breaker pan assembly in place of the extension rails. I.L. 32-275-6 provides complete instructions.

4. Breaker ramp assembly

The breaker ramp assembly is used for inserting or removing a breaker from the bottom compartment of a vertical section without the need of any lifting device.

Figure 34. Breaker Ramp Assembly.

5. 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 35. VCP-W Manual Ground and Test Device.

Section 11: Metal-clad switchgear field taping procedure (5/15 kV)

11.1 Busbar taping

Materials for taping

Reference Figure 36 and Figure 37 below for details on proper bus-bar 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.

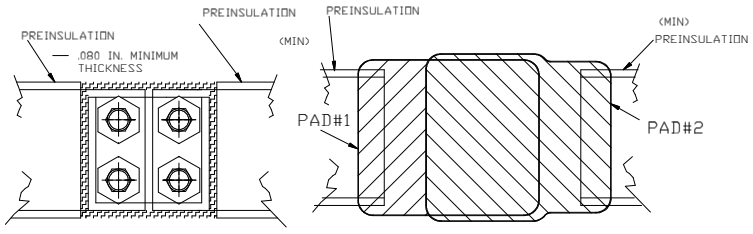


FIG. 5: TYPICAL JOINT WITH .12 THK. MIN. FILLER OVER BARE JOINT

FIG. 6: TYPICAL JOINT WITH 6 IN. WIDE X .030 TAPE OVER FILLER

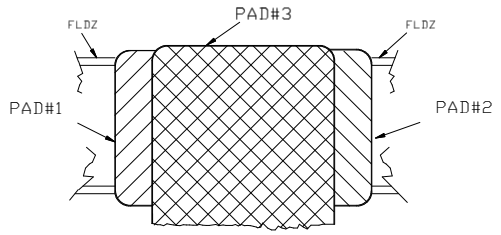


FIG. 7: TYPICAL JOINT WITH PAD #3 (6 IN. WIDE X .030) TAPE OVER PAD #1 AND #2

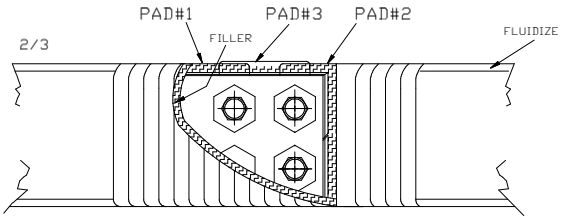


FIG. 8: TYPICAL JOINT WITH 1 LAYER OF 1.0 X .030 TAPE WITH 2/3 OVERLAP

THRU-JOINTS, WITH-HARDWARE

1. CLEAN AREA OF DIRT AND FOREIGN MATTER
2. WIPE PREINSULATION WITH ISOPROPYL ALCOHOL IF NECESSARY
3. APPLY FILLER OVER BARE CONDUCTOR AND HARDWARE TO COVER AND SMOOTH OUT SURFACE. CONTOUR INTO PREINSULATION SURFACES. TRY TO PREVENT AIR POCKETS. COVER CONDUCTORS AND HARDWARE WITH AT LEAST .12 INCH OF FILLER PER FIG. 5.
4. APPLY 6.0X.030 THICK PAD #1 OVER JOINT WITH MINIMUM OF 1.0 INCH OVERLAP ON FLUIDIZE (1 1/4 LAPS). APPLY 6.0X.030 THICK PAD #2 OVER PAD #1 BUT STARTING ON RIGHT SIDE WITH 1.0 INCH OVERLAP ON PREINSULATION SEE FIG. 6
5. APPLY 6.0X.030 THICK PAD #3 OVER PADS #1 & #2 AND CENTERED ON JOINT PER FIG. 7
6. APPLY ONE LAYER OF 1.00X.030 INSULATING TAPE USING 2/3 LAP AND EXTENDING 0.75 INCH MINIMUM BEYOND THE PADS ON THE PREINSULATION PER FIG. 8.

Figure 36. T-joint Field Taping Methods.

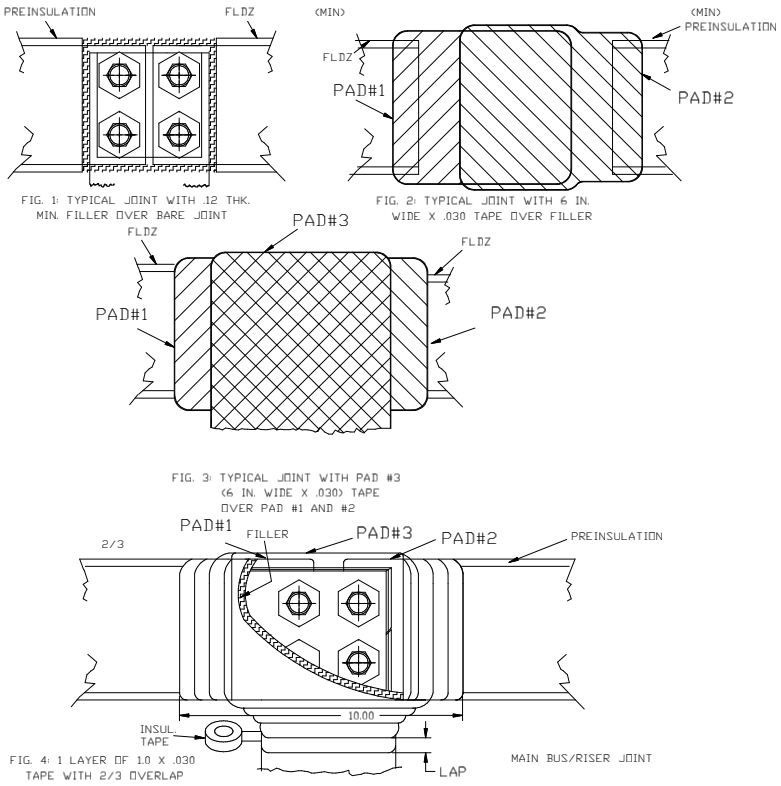
11.2 Using an insulating boot

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.

11.3 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.



MATERIALS
FILLER - A PUTTY-LIKE MATERIAL.TRADE NAMES: DUCTSEALER, DUCT SEAL, SCOTCHFIL, EATON. NO. 53351BB AND 53351WX.

TAPE - HIGH VOLTAGE EPR INSULATING TAPE. TRADE NAME: SCOTCH 130C TAPE, EATON. 45151SE.

DEFINITIONS
JOINT - AREA TO BE COVERED WITH TAPE. CONSISTS OF BARE CONDUCTOR AND 1.5 INCHES OF ANY PRE-INSULATION NEXT TO THE BARE CONDUCTOR.

PRE-INSULATION - ANY INSULATING COVERING OR COATING SUCH AS EPOXY COATING OR INSULATING TUBING ADJACENT TO AN EXPOSED CONDUCTOR PRIOR TO TAPING.

PAD - ANY INSULATING TAPE WHICH IS WIDER THAN ONE INCH CONSISTING OF ONE LAYER OR MULTIPLE LAYERS WRAPPED DIRECTLY ON TOP OF EACH OTHER.

LAYER - INSULATING TAPE, 1 INCH WIDE, WRAPPED FROM ONE END OF THE JOINT TO THE OTHER, SO EACH SUCCEEDING TURN LAPS THE PREVIOUS TURN BY THE AMOUNT SPECIFIED IN THE METHODS PROCEDURE.

OVERLAP - A SPECIFIED DISTANCE MEASURED ALONG THE INSULATION STARTING FROM THE POINT WHERE THE INSULATION ENDS

METHODS
GENERAL
1. ELONGATE INSULATING TAPE 10 TO 25 PERCENT DURING APPLICATION TO INSURE A SMOOTH, TIGHT FIT. ON PADS ELONGATE CORNERS ONLY.
2. SHOULD A TAPE ROLL EXPIRE, START THE NEW ROLL BY OVERLAPPING THE PREVIOUS END BY .5 TURN.

"T"-JOINTS, WITH-HARDWARE
1. CLEAN AREA OF DIRT AND FOREIGN MATTER
2. WIPE PREINSULATION WITH ISOPROPYL ALCOHOL IF NECESSARY
3. APPLY FILLER OVER BARE CONDUCTOR AND HARDWARE TO COVER AND SMOOTH OUT THE SURFACE. CONTOUR INTO PRE-INSULATION SURFACES. TRY TO PREVENT AIR POCKETS. COVER CONDUCTORS AND HARDWARE WITH AT LEAST .12 INCH OF FILLER PER FIG. 1.
4. APPLY 6.00 X .030 THICK PAD #1 OVER JOINT WITH MINIMUM OF 1.0 INCH OVERLAP ON PREINSULATION. APPLY 6.00 X .030 THICK PAD #2 OVER PAD #1 BUT STARTING ON RIGHT SIDE WITH 1.0 INCH OVERLAP ON PREINSULATION SEE FIG. 2
5. APPLY 6.00 X .030 THICK PAD #3 OVER PADS #1 AND #2 AND CENTERED ON JOINT PER FIG. 3
6. APPLY ONE LAYER OF 1.00 X .030 INSULATING TAPE USING 2/3 LAP AND EXTENDING .75 INCH MINIMUM BEYOND THE PADS ON THE PREINSULATION (FIG. 4).

Figure 37. Thru-joint Field Taping Methods.

Table 3. Taping Chart.

Switchgear Voltage	Pre-insulation or Pad Overlap Minimum		Insulating Tape	
kV	in (mm)	Lap of Tape	Layers	Number of Pads
Up to 5	1.50 (38.1)	0.5	1	1
7.5 and 15	1.50 (38.1)	0.66	1	2

11.4 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.

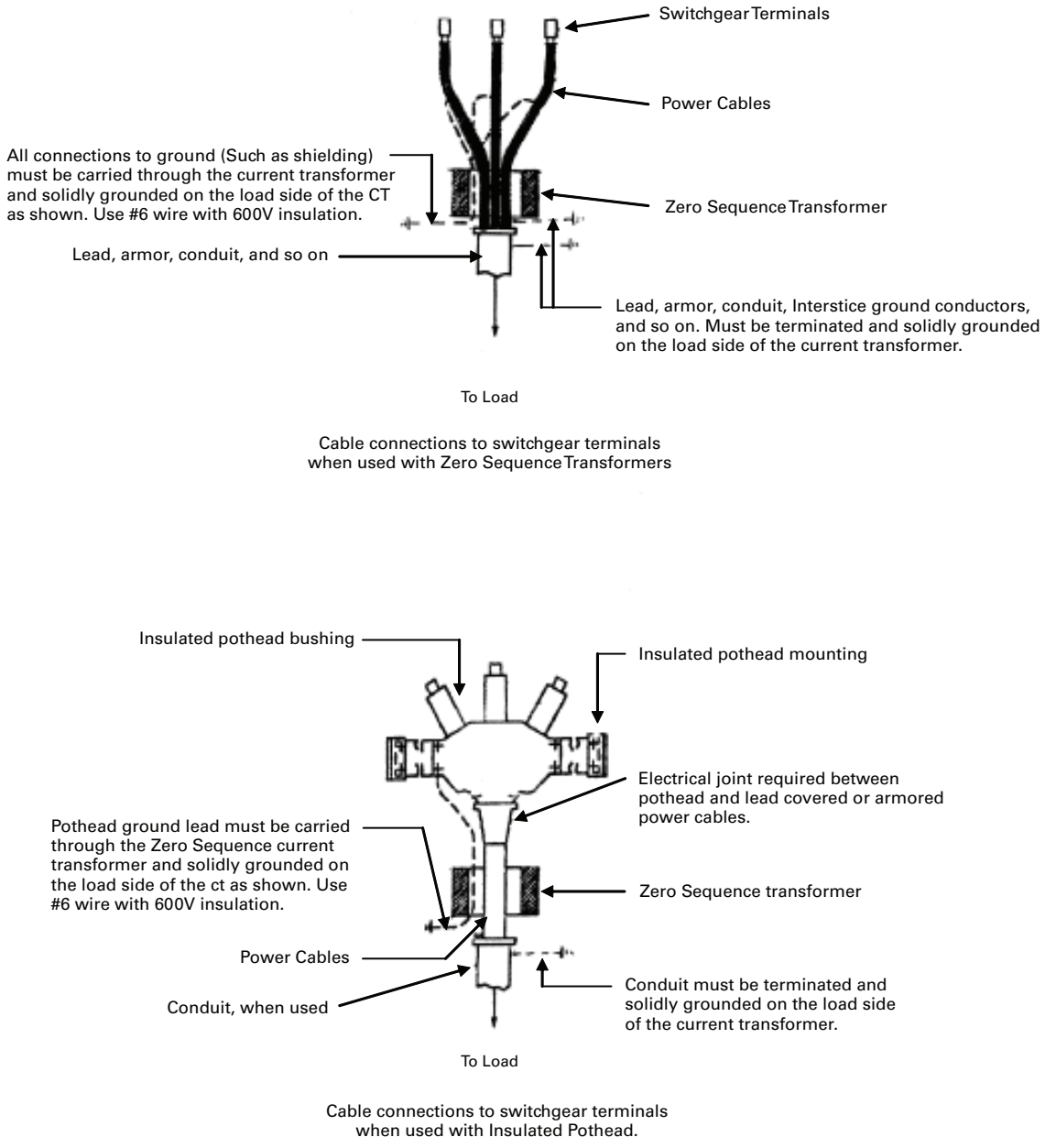


Figure 38. Zero Sequence Current Transformer Connections.

Notes:

Notes:

Instruction Booklet IB02200001E
Effective June 2016
Revision #3

Instructions for installation, operation, and maintenance of 5/15 kV type VacClad-W metal-clad switchgear indoor housings

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