Instruction Booklet **IB02201004E** Effective October 2017 Revision #4

Instructions for installation, operation, and maintenance of 38 kV type VacClad-W, 150 BIL switchgear indoor housings

Contents

Powering Business Worldwide

Disclaimer of warranties and limitation of liability

This instruction booklet is published solely for information purposes and should not be considered all-inclusive. If further information is required, you should consult an authorized Eaton sales representative.

The sale of the product shown in this literature is subject to the terms and conditions outlined in appropriate Eaton selling policies or other contractual agreement between the parties. This literature is not intended to and does not enlarge or add to any such contract. The sole source governing the rights and remedies of any purchaser of this equipment is the contract between the purchaser and Eaton.

NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, OR WARRANTIES ARISING FROM THE COURSE OF DEALING OR USAGE OF TRADE, ARE MADE REGARDING THE INFORMATION, RECOMMENDATIONS, AND DESCRIPTIONS CONTAINED HEREIN.

In no event will Eaton be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect,incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information, recommendations and description contained herein.

Instructions for installation, operation, and maintenance of 38 kV type VacClad-W, 150 BIL 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

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.

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 booklet covers the installation, operation, and maintenance of a VacClad-W 38 kV, 150 basic insulation level (BIL) 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

Eaton's VacClad-W 38 kV, 150 BIL 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 VacClad-W 38 kV, 150 BIL switchgear provides the end user with a wide verity of lineup configurations to suit application and space requirement needs. A breaker vertical section is of one-high type construction, designed such that a breaker is easily rolled in and out of the section without the need of a lifting apparatus. A single transformer section can house up to two sets of transformers in a stacked configuration.

Transformer sections are of drawout type construction. The transformers are mounted on a drawer that can be easily inserted and extracted from the vertical switchgear section. This provides a convenient way to replace transformer fuses and to perform maintenance on the transformer cell. A transformer drawer is rolled into a lower cell without the need of a lifting apparatus. A lifting apparatus is required to load a transformer drawer in an upper cell. See the Optional accessories section for details on an optional lifting apparatus for this application.

1.3 Documentation reference

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

For VCP-W breaker: IB3A74792.

For switchgear mounting to a foundation: Job floor plan document.

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

Refer to the customer drawing package for order specific information. For more information on installation and application, refer to the applicable descriptive bulletins, and/or industry standards publica-tions. 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.

1.5 Safety precautions

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 and any additional instructions identified in this document 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 the door is open, making any adjustments inside or outside the enclosure, performing maintenance, or installing replacement parts.
3. Never leave a breaker or transformer drawer in an intermediate position in its compartment. Always crank the breaker or transformer drawer 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 carrying load current. In this situation, the transformer develops a dangerous high voltage.

⚠ CAUTION

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 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 torqued per Section 2.3, Table 3.
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.

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

11. For additional safety information and safe-use practices for your VCP-W circuit breaker, refer to IB3A74792.

Section 2: Installing indoor switchgear

For information regarding the receiving, handling, storing, and installatioin 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 booklets 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 in. (1.6 mm) in 36 in. (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 installations 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 MVS Switchgear	Phase-to-Phase in. (mm)	Phase-to-Ground in. (mm)
38	8.25 (209.6)	8.25 (209.6)

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 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 3, once all units are placed.

Table 3. Bolt Torque 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)
Bolt Material	**Torque 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 sides of all the shipping split. Remove from these sections the angled metal barrier and vertical main bus barrier from the cable compartment in the rear of the switch-gear (see Figure 3). Remove any other components such as pot-heads, surge suppressors, and so on, that interfere with access to these barriers.

Note: The rear assembly of the switchgear may vary.

Install tie-bolts in the rear module section between the shipping splits. See Figure 1 for the tie-bolt locations. Bolt holes #14 - #30 can be accessed from the rear module. Holes 31-33 are used for fiber optic cables. If not used, fill with tie-bolt hardware.

C. Open all the front doors at the shipping split sections. Install tie-bolts in the mid and front module sections between the shipping splits. See Figure 1 for the tie-bolt locations. Bolt holes #1 - #13 can be accessed from the front module.

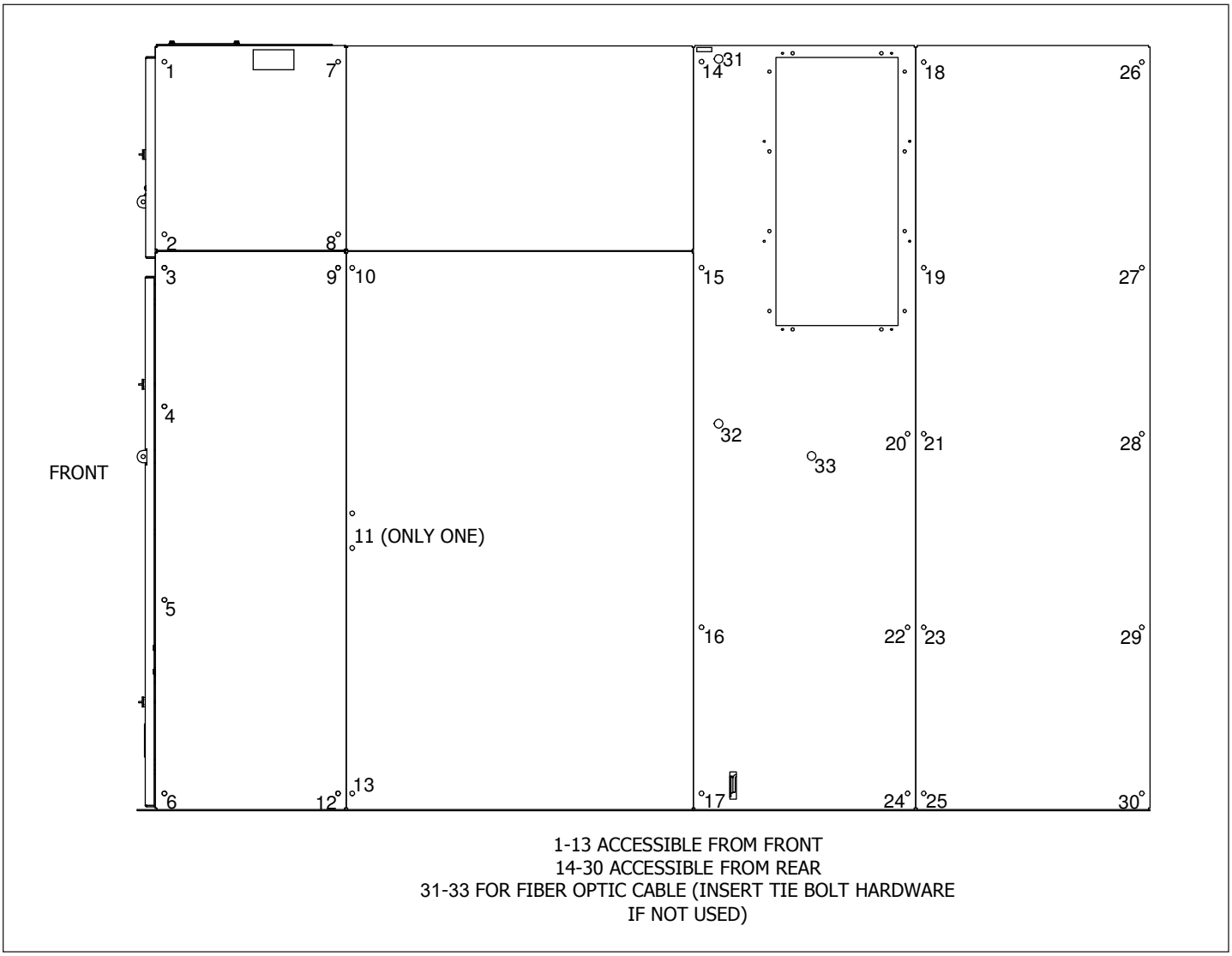


Figure 1. Tie-bolt Locations.

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 and lifting angles.

A. Examine all meters, relays, and so on, and remove any shipping blocks or braces.

B. Remove the lifting angles from top of the units and discard them.

C. Additional bracing is provided in the auxiliary module to secure the transformer drawers during shipment. The bracing is painted yellow. Remove this bracing.

Step 4: Connect the ground bus.

A. Ground bus is located in the rear of the equipment. The standard ground bus is a 0.25 × 2.00 in. (6.4 × 50.8 mm) 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 the ground links and hardware (located in detail box) to connect the ground bus at the shipping sections (see Figure 2). Torque the hardware per the specifications contained in Table 3.

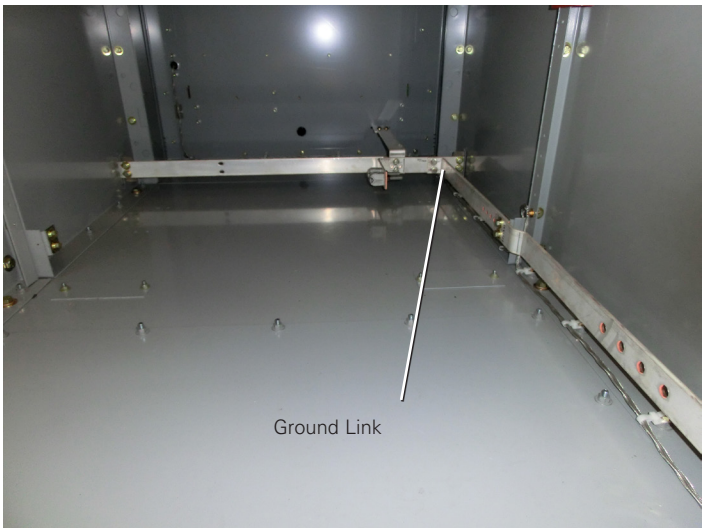


Figure 2. Ground Bus Installation.

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 NEC, 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 rear covers or open the rear doors (if applicable) of any remaining cells that were not opened during prior steps. Remove from these sections the angled metal barrier and vertical main bus barrier from the cable compartment in the rear of the switchgear (see Figure 3). Also remove any other components such as potheads, surge suppressors, and so on, that interfere with access to these barriers.

Note: The rear assembly of 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 (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 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 (see Figure 5).

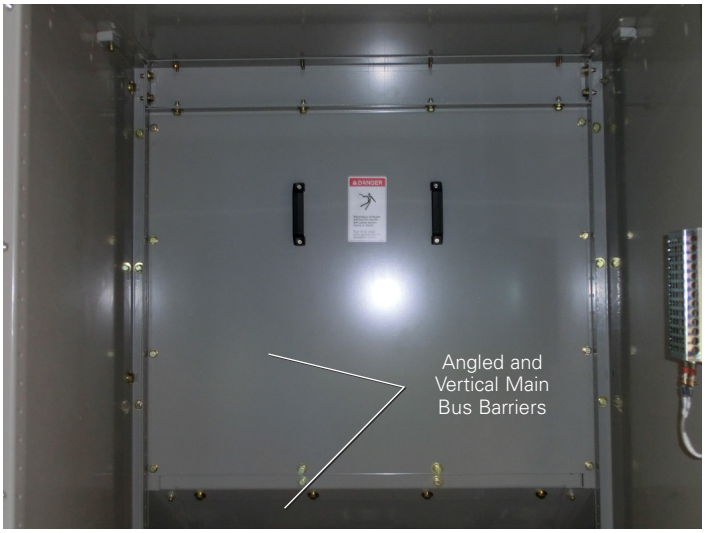


Figure 3. Main Bus Installation – Bus Barriers Shown.

Figure 4. Main Bus Installation – Barriers Removed Showing the Main Bus Connections.

Figure 5. Main Bus Installation – Barriers Removed Showing the Bus Joing Insulating Boots.

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, is labeled.

B. Connect the wiring to the remote apparatus and to the terminal blocks located in the control compartment or within the front of the vertical section.

Step 7: Replace the angled metal barriers, vertical main bus barriers, and any other parts that may have been 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 the two systems are to be paralleled, make sure the phase rotation and the phase angles are the same. 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 the 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 cable, and with the service voltage for which it was designed.

E. Solderless connectors 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 manufacturer's instructions when connecting the cables to them. Use the flexible connectors to connect the arial 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 the Metal-clad switchgear field taping procedure [38 kV] section in this manual).

G. If zero sequence transformers are used, pass the power cables through the transformer (refer to Figure 35).

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: Check the operation of the levering in system in each of the breaker compartments. Refer to the breaker Instructional Booklet, IB3A74792, for additional details on manual and electrical operation checks of the breaker.

A. Push the breaker into the breaker compartment until the breaker lift/pull handle latches over the moving block on the racking screw. Channels are provided on the floor sheet to assist in the alignment of the breaker wheels as it is moved into the compartment. In this position, the breaker is considered in the Disconnect position.

B. In order to place the breaker in the Test position mode, you must pull the secondary plug handle forward until the secondary plug, located on the compartment levering pan, fully mates with the breaker secondary plug. In this position, the breaker compartment control circuit can be tested offline (breaker is not connected to the primary circuit).

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

1. Before the breaker can be moved from the Disconnect or Test position to the Connect position, the breaker must be open.

2. Insert the levering crank onto the hex drive nut on the racking screw. In order to engage the hex drive nut, you must push a safety slider in and out of the way of the hex nut.

Note: If the breaker is closed, you will not be able to push the safety slider in to engage the hex drive nut. You must trip the breaker by means of either the Open pushbutton on the front of the breaker or electrically using the control circuit.

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.

D. Movement of the breaker from the Connect position to the Disconnect position:

1. Before the breaker can be moved from the Connect position to the Disconnect or Test position, the breaker must be open.
2. Insert the levering crank onto the hex drive nut on the racking screw. In order to engage the hex drive nut, you must push the safety slider in and out of the way of the hex nut.

Note: If the breaker is closed, you will not be able to push the safety slider in to engage the hex drive nut. You must trip the breaker by means of either the Open pushbutton on the front of the breaker or electrically using the control circuit.

3. Rotate the levering crank in a counter-clockwise direction until the breaker is in the Test of the Disconnect position.

Note: The secondary plug on the compartment pan assembly is automatically disengaged from the breaker secondary plug.

Step 10: Test the breaker and cell interface per IB3A74792.

Step 11: Check the drawout transformer drawers in the auxiliary compartments.

A. Unbolt and remove the front covers of the auxiliary compartments. The covers are removed by lifting upward and outward toward the user (see Figures 6 and 7).

B. The transformer drawers are shipped installed in the switchgear in the Disconnect position. There are yellow shipping braces located in the auxiliary compartments. This bracing secures the transformer drawer to the cell for shipping purposes only. Remove these braces and angles (see Figure 7).

C. Remove the transformer drawers from the auxiliary compartments. Refer to the portable lift device instructions in the optional accessories section of this document for proper removal of the drawers from the units prior to performing the following actions. After removing the drawers, check for any damage to the transformers, transformer fuses and fuse tubes, drawers, and cell parts.

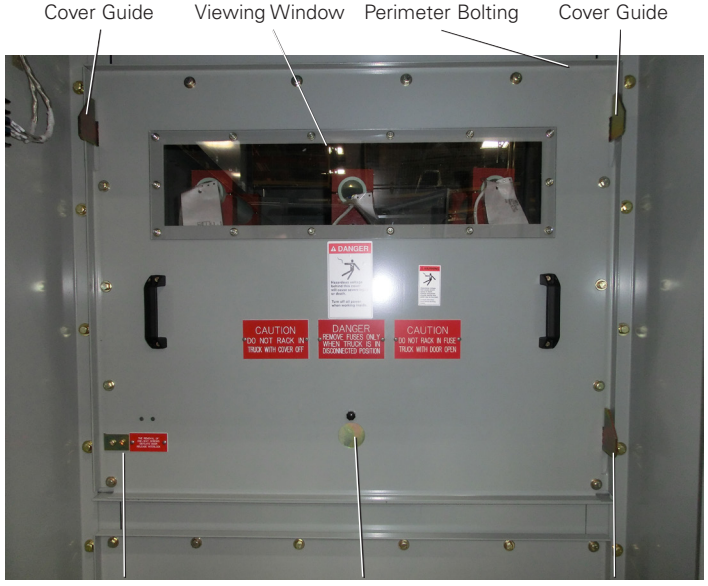


Figure 6. Auxiliary Compartment with Front Cover Installed.

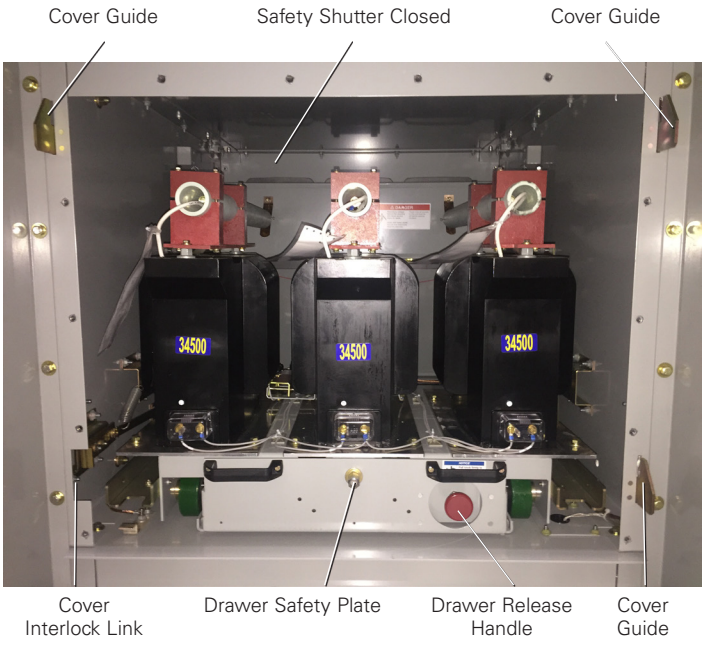


Figure 7. Auxiliary Compartment with Cover Removed and Drawer in the Disconnect Position.

D. The voltage transformer fuse is an integral part of the transformer. The fuse is located inside of a fuse tube mounted on top of the transformer. The transformer(s) are mounted on a drawer (see Figure 8). Check the fuses for continuity. At one end of the fuse tube is a contact spring and at the other is a contact plate. Continuity can be checked between the two ends. See the Transformers and primary fuses section of this manual for directions on how to gain access and replace fuses.

NOTICE

DO NOT HANDLE THE FUSE TUBES FOR PURPOSES OTHER THAN CHANGING OUT FUSES. DOING SO, MAY CAUSE DAMAGE TO THE FUSE TUBES AND MATING PARTS.

E. Installation of the transformer drawer into auxiliary compartment:

1. Confirm that the transformer drawer is in the fully retracted position prior to moving it into the compartment. The drawer is fully retracted when the upper-half section of the drawer is butted up against the lower-half section of the drawer (see Figure 9).
2. Refer to the portable lift device instructions in the optional accessories section of this document for details on lifting and moving transformer drawers using the portable lifter. Move the drawer to its location with a portable lifting device for upper compartments, or roll it to its location directly on the floor for lower compartments.

NOTICE

DO NOT HANDLE THE FUSE TUBES LOCATED ON TOP OF THE TRANSFORMERS WHILE MOVING IN THIS MANNER. THIS MAY CAUSE DAMAGE TO THE FUSE TUBES AND MATING PARTS.

3. From the floor or from the portable lifter, roll the transformer drawer into the auxiliary compartment until the drawer latches into place. An audible "clicking" noise can be heard when the drawer latches in place. Pull back on the drawer to confirm it is fixed and latched in place. In this position, the drawer and transformer(s) are considered in the Disconnect position (see Figure 7).
4. Verify the primary shutters remain closed (see Figure 7).

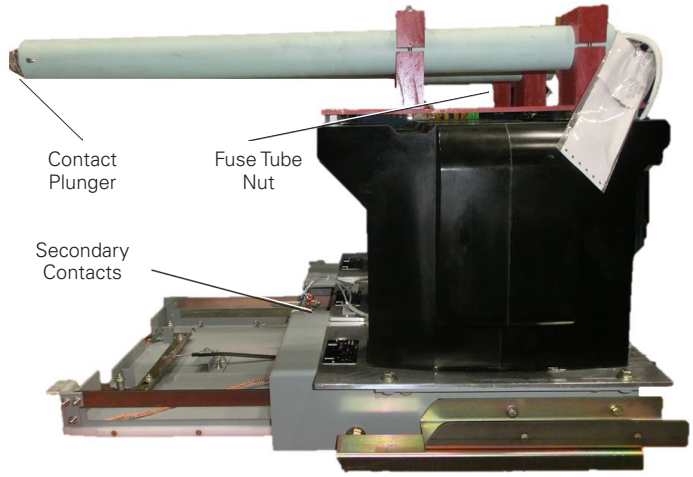


Figure 8. Transformer Drawer.

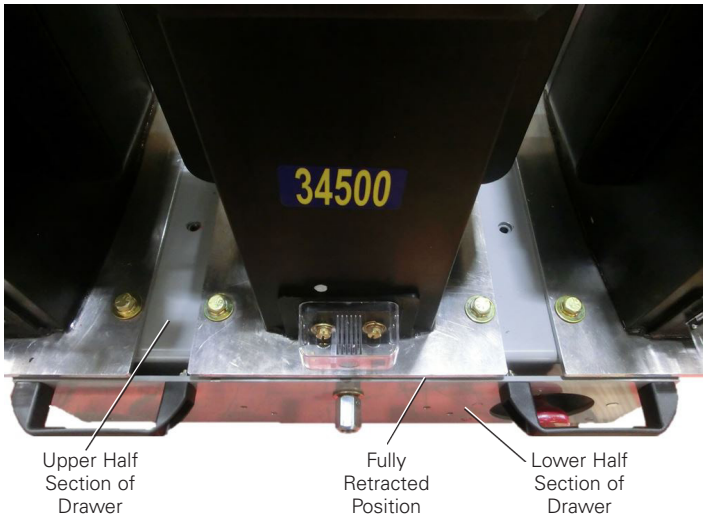


Figure 9. Transformer Drawer in the Retracted Position.

F. Install the front cover and check the transformer fuse static ground plunger devices:
   1. Install and bolt the front compartment cover in place. Lift the cover in line with the compartment and align the slots on the cover with the protruding brackets on the compartment side sheets (see Figures 6 and 7). Push the cover into place and allow the cover to drop down to its final bolting location. Bolt the cover in place. The transformer drawer is fitted with a safety plate that blocks access to the racking screw until the drawer is in the compartment and the front compartment cover is in place (see Figure 7).

G. Movement of the transformer drawer from the Disconnect position to the Connect position:
   1. Rotate the racking cover plate knob to expose the nut at the front of the racking screw on the transformer drawer (see Figure 6).
   2. Place the socket of the levering crank through the cover and onto the racking screw nut. Rotate the levering crank clockwise until the transformer drawer is in the Connect position. The Connect position is reached when the torque limiter on the levering crank "breaks" free. Check to make sure the primary and the secondary contacts (see Figure 8) are engaged when the transformer drawer is in the Connect position. Use the "lighting out" or "ringing" methods to verify.
   3. Verify that the primary shutters are open and have operated properly. The shutters can be viewed from within the closed compartment through the viewing window on the front cover.
   4. The front cover can not be removed when a transformer drawer is in the Connect position. The transformer drawer must be in the Disconnect position to remove the cover. When the drawer is moved to the Connect position, a mechanical linkage system on the compartment side sheet, operated by a bracket on the transformer drawer, engages a link with a bracket on the bottom left corner of the front cover, preventing the cover from being removed (see Figures 6 and 7).

H. Movement of the transformer drawer from the Connect position to the Disconnect position:
   1. Rotate the racking cover plate knob to expose the nut at the front of the racking screw on the transformer drawer (see Figure 6).
   2. Place the socket of the levering crank through the cover and onto the racking screw nut. Rotate the levering crank counter-clockwise until the transformer drawer stops and is in the Disconnect position.
   3. Verify that the primary shutters are closed and have operated properly. The shutters can be viewed from within the closed compartment through the viewing window on the front cover.
   4. The front cover can now be unbolted and removed because the drawer is in the Disconnect position.

I. Disengaging and removing the transformer drawer from the auxiliary compartment. Refer to the portable lift device instructions in the optional accessories section of this document for proper positioning of the lifting device prior to performing the following actions:
   1. With the portable lifting device in position and the transformer drawer in the Disconnect position, grasp and firmly pull the red drawer release handle on the front of the drawer (see Figure 7). This will unlatch the drawer from the compartment.
   2. Pull the drawer onto the pan on the lifting device and latch the drawer in place on the lifter.
   3. When removing the drawer from a lower compartment, it is only necessary to unlatch the drawer, pull, and roll the drawer directly onto the floor.

Step 12: Perform loading check on both the control and primary circuits to ensure the system is ready for operation.

Section 3: Description of VacClad-W switchgear

3.1 Safety features

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

⚠ CAUTION

NEVER MAKE INTERLOCKS INOPERATIVE. DOING SO CAN DAMAGE PROPERTY AND CAUSE SEVERE INJURY.

1. Coding plates (see Figure 15)
   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 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 the same.

2. Automatic shutter
   Automatic safety shutters in the breaker compartment, shown in Figures 10 and 11, cover the primary disconnecting contacts when the breaker is withdrawn from the operating position (Connect position) to the Disconnect or Test positions. The shutters prevent persons who are working on the switchgear from accidentally touching the primary contacts. Provisions are provided to lock the breaker compartment shutters open or closed. Shutters also cover the primary disconnecting contacts for drawout transformers (see Figure 7).

⚠ CAUTION

NEVER MAKE INTERLOCKS INOPERATIVE. DOING SO CAN DAMAGE PROPERTY AND CAUSE SEVERE INJURY. DO NOT MANUALLY RAISE OR REMOVE THE SHUTTER UNLESS THE MAIN CONTACTS ARE DE ENERGIZED AND SAFETY PROCEDURES HAVE BEEN INITIATED TO MAKE SURE THE CIRCUITS CANNOT REENERGIZE. FAILURE TO EXERCISE CAUTION MAY RESULT IN BODILY INJURY AND PROPERTY DAMAGE.

Figure 10. Breaker Compartment with Shutters Closed.

Figure 11. Breaker Compartment with Shutters Latched Open.

3. Ring type current transformers
   The ring type current transformers are mounted so they slip over the primary disconnecting contact insulating high voltage terminals at the rear wall of the breaker compartment. There is space for a maximum of four standard accuracy transformers per phase (two on each side of the breaker) or two high accuracy per phase (one on each side of the breaker).
   The current transformers are mounted so they can be reached from the front of the enclosure (see Figure 11). The polarity marks on the current transformers show the relative instantaneous polarity in the primary and secondary windings. The diagrams show how to connect the transformers to give the polarity needed to operate relays and instruments.

4. 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. The circuit breaker pan is equipped with provisions to mount the kirk key to it. Refer to Figure 13 for the location of these provisions.

⚠ 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 THEY ARE NOT AVAILABLE TO OPERATING PERSONNEL. THIS PROCEDURE IS NECESSARY BECAUSE IMPROPER USE OF SPARE KEYS WILL DEFEAT THE INTERLOCKING SCHEME.

5. Lockout-tagout (LOTO) features

   Shutter LOTO

   Lockout-tagout provisions are featured on the top and bottom shutters. In order to lockout the shutters in the closed position, a LOTO option can be inserted through the provisions on the shutter bracket and the enclosure bracket (see Figure 12).

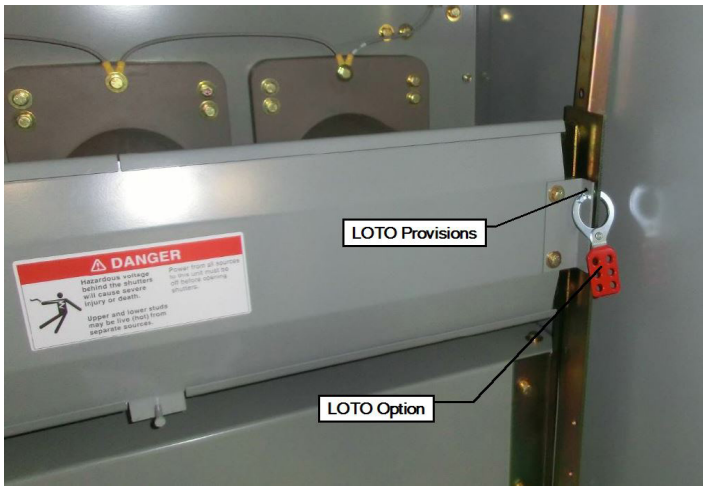


Figure 12. Lockout-Tagout Provision for Shutter LOTO.

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 15).
3. Insert a LOTO option (see Figure 14) into the circuit breaker pan LOTO provisions (see Figure 13).
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.

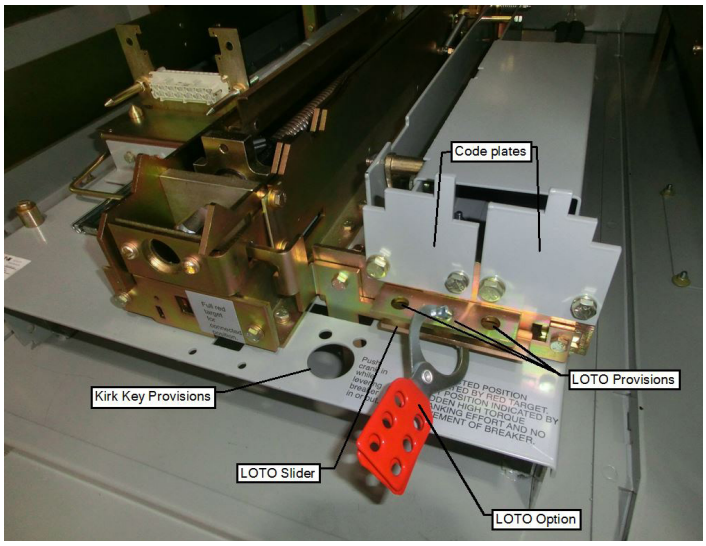


Figure 13. Lockout-Tagout Provision for Circuit Breaker Lockout.

Figure 14. Several Acceptable Lockout-Tagout Options.

Note: The LOTO options shown in Figure 14 only include a handful of accepted options. Other options may also work with the breaker pan LOTO provision.

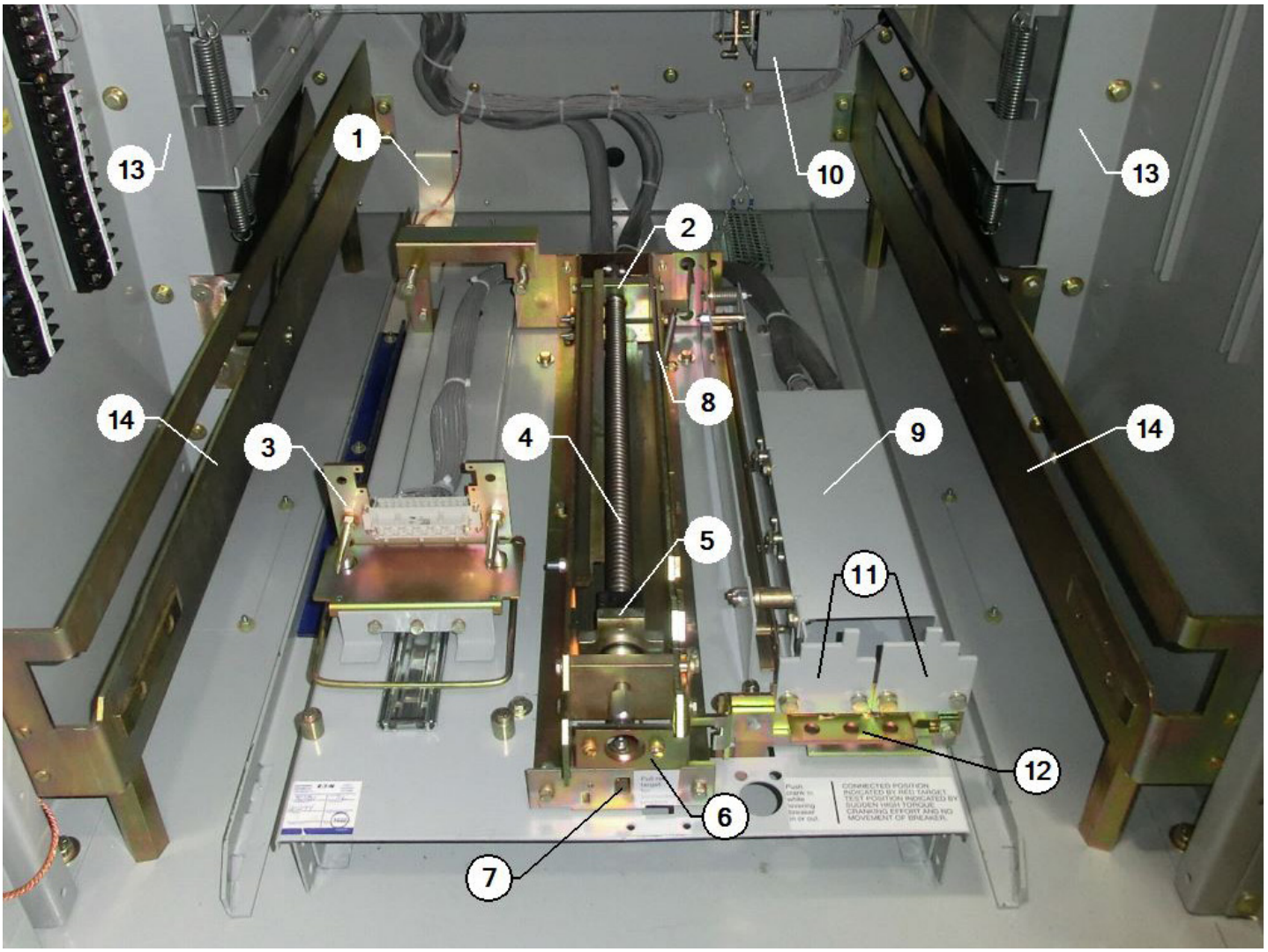


Figure 15. Pan Assembly.

3.2 Breaker pan assembly

Figure 15 callouts

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. Secondary disconnect assembly – Consists of a secondary plug handle, slider assembly, secondary plug, and control wires. The control wiring is arranged for pullout disconnecting by means of a female receptacle (secondary plug) 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 Instructional Booklet IB3A74792 for more description).
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. 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.
8. Slider interlocks prevent removing a closed breaker.
9. The mechanism operated cell (MOC) switch is an assembly of switches that is operated by a lever on the breaker mechanism. Refer to the shop order drawings for the number of NO and NC contacts provided. The MOC switch is activated by the breaker closing. It extends a lever out the bottom of the breaker mechanism pushing down on the lever of the operating mechanism on the MOC assembly. This, in turn, transmits the motion to operate the switch.
10. The truck operated cell (TOC) switch has nine poles. Four contacts make and five contacts break as the breaker is levered to the Connected position. As the breaker is being levered into the Connect 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 Connect position.
11. Coding plates – See Safety features.
12. Optional provision for padlocking (up to three locks) a breaker in any position.
13. Metal framework provides a closed barrier to the primary compartment when the breaker is connected.
14. Rail on which the breaker rolls.

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.

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 the American National Standards Institute (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 the Safety precautions section of this manual.

⚠ 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 ENSURE THAT PERSONNEL DO NOT COME IN CONTACT WITH ENERGIZED HIGH VOLTAGE PARTS. FAILURE TO DO SO COULD 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 crew expecting to work on them is ensured 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 provision 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 primary disconnecting contacts (spouts) are located behind the automatic safety shutters in the breaker compartment. Upper and/or lower spouts can be exposed by manually opening the shutters (see Figures 10 and 11). Do not expose any contacts unless all upper and lower high voltage parts are de-energized.

⚠ WARNING

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

6.2.3 Current transformers

Window type current transformers are installed over the stationary primary disconnecting contacts (spouts) in the front of the unit (see Figure 11). All primary circuits must be de-energized prior to gaining access to any current transformers.

⚠ WARNING

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

6.2.4 Tranformers and primary fuses

A. Removing transformers from the auxiliary compartment and replacing fuses:

   1. Follow the instructions in the Installation procedure section of this manual, to remove the transformer drawer from the auxiliary compartment. With the transformer(s) removed from the unit, unscrew the contact spring retaining screws (2) located at the end of the fuse tube. Remove the fuse from the tube and replace with a new fuse. Reinstall the contact spring on the new fuse and install the contact retaining screws (see Figure 8).

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 ensure 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 COULD 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.

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 is not required under normal conditions. However, abnormal local conditions such as high humidity, salt-laden atmosphere, corrosive gases, or severe circuit operating conditions may demand the use of lubricants. All mechanical parts have been lubricated during assembly with molybdenum disulphide grease (Eaton 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 15) – 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 16). This should be done at least every three years.

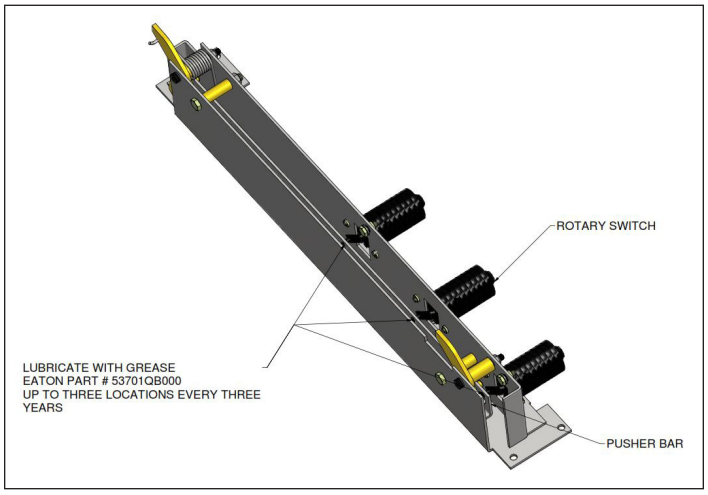


Figure 16. Lubrication Locations for the MOC Switch.

Section 8: 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.

Section 9: Accessories

9.1 Standard accessories

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

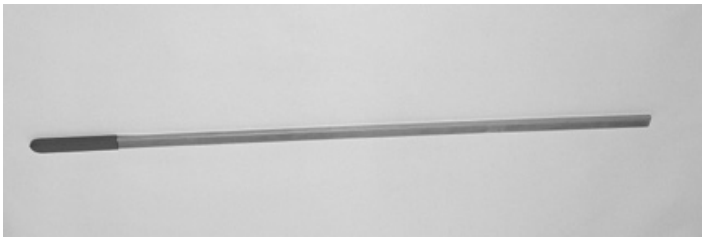


Figure 17. Breaker Spring Charging Handle.

Breaker spring charging handle is used for manually charging the breaker closing spring.

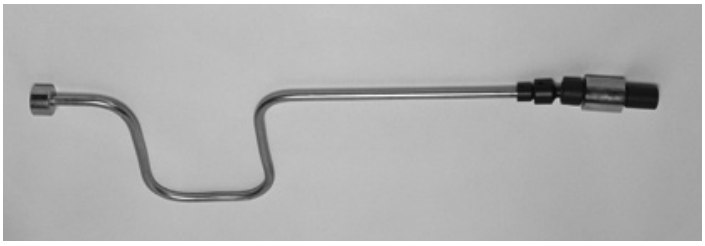


Figure 18. Levering Crank.

A levering crank is used for moving the breaker or a transformer drawer between the Disconnect and the Connect positions.

Figure 19. Fifth Wheel.

The fifth wheel is used to maneuver the circuit breaker.

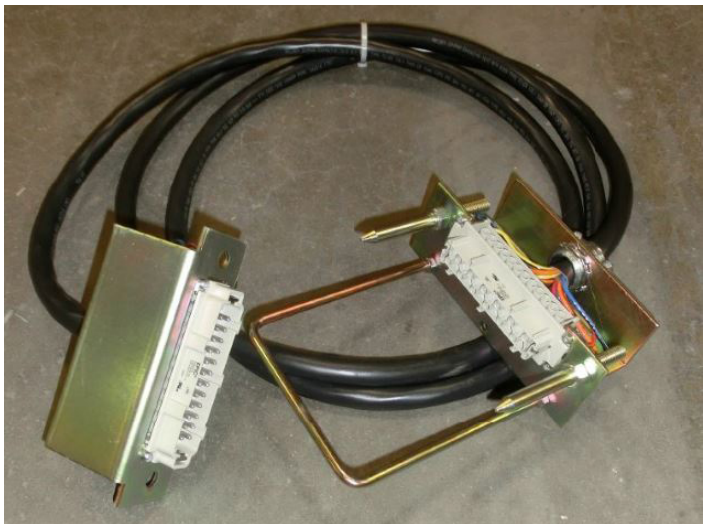


Figure 20. Test Jumper.

A test jumper is used for electrically operating the circuit breaker outside its compartment.

9.2 Optional accessories

9.2.1 Test cabinet

A test cabinet is used for electrically opening and closing of the breaker when it is outside its housing. The cabinet includes terminals for control power connections, a set of pull-out fuse blocks for control power disconnect, necessary control equipment, and a cable harness. Control equipment normally includes "Close" and "Trip" pushbuttons, and a capacitor trip device when applicable. One end of the cable harness is connected to terminals inside the test cabinet. The other end of the cable is provided with a socket that matches the secondary disconnect block on the breaker.

To operate the circuit breaker, rated control power is connected to the test cabinet control terminal blocks, and test cabinet cable socket is manually engaged with the secondary disconnect on the breaker. The breaker can then be opened and closed via push-buttons provided on the test cabinet. The test cabinet can be mounted on the wall.

Figure 21. Test Cabinet.

9.2.2 Portable lifter and transformer pan

Refer to Figure 23. The portable lifter is an optional accessory. It is equipped with a winch and a retractable overhead boom and hook system that can be used to lift and maneuver many objects on site. When equipped with a pan (an additional accessory), it is specifically designed to maneuver a transformer drawer to the installation area, and to lift, insert, and remove the drawer from an auxiliary compartment. The following instructions detail the steps necessary to operate the lifter and transformer pan with a transformer drawer.

A. Securing the lifter pan to the lifter.

1. Expand the lifter base legs so they span the lifter pan. To do this, unscrew and remove the adjustment bolts and pull each leg outward until the third hole in each leg is in line with each mating through hole. This exposes two of the three leg holes as shown in Figure 22. Screw the bolts back into the legs and tighten firmly.
2. Move the lifter up against the lifter pan, straddling the pan with the lifter legs. Maintain an approximate equal distance between each leg and each side of the pan (see Figure 23).
3. Rotate the winch clockwise (see Figure 23) until the lifter bar moves all the way up into the pan bracket as shown in Figure 24.

Figure 22. Adjusting the Lifter Legs.

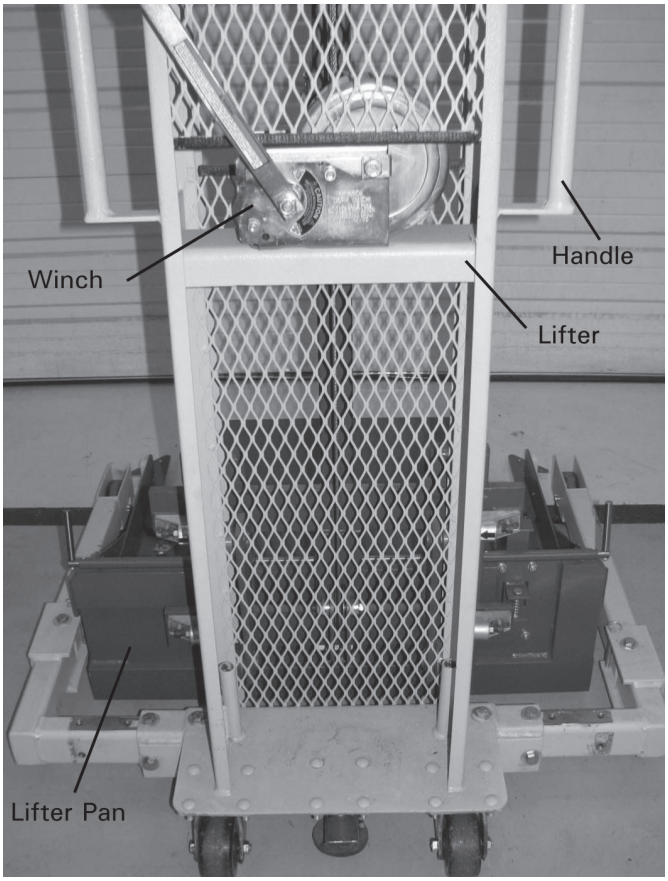


Figure 23. Mating Lifter Pan to Lifter.

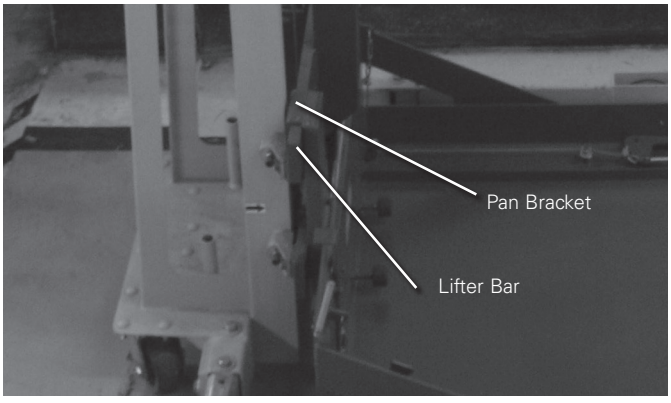


Figure 24. Correct Connection of Lifter Bar to Pan Breaker.

B. Securing the transformer drawer to the lifter pan:

1. Lock the lifter in place by stepping down on the lifter brake pedal (see Figure 25).
2. Confirm that the transformer drawer is in the fully retracted position. The drawer is fully retracted when the upper section of the drawer is butted up against the lower section of the drawer (see Figure 9).
3. Roll the drawer onto the lifter pan and up against the rubber stops. Use the pan rails as a guide (see Figure 27).

NOTICE

DO NOT HANDLE THE FUSE TUBES AND MATING PARTS WHILE MOVING THE TRANSFORMER DRAWER. THIS MAY CAUSE DAMAGE TO THESE PARTS.

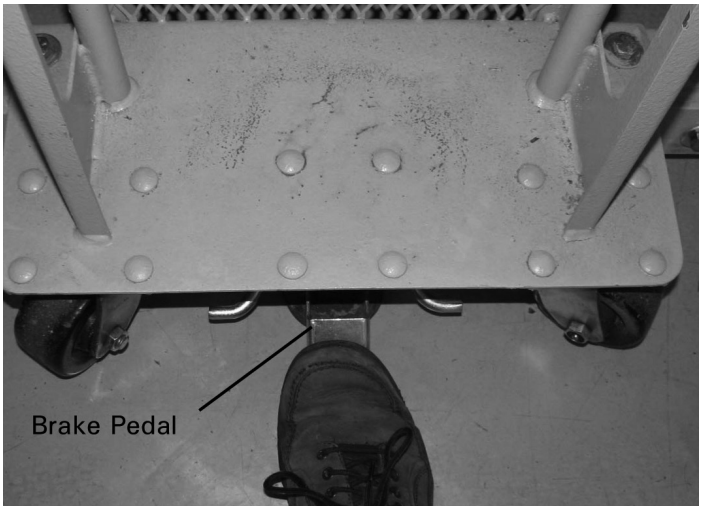
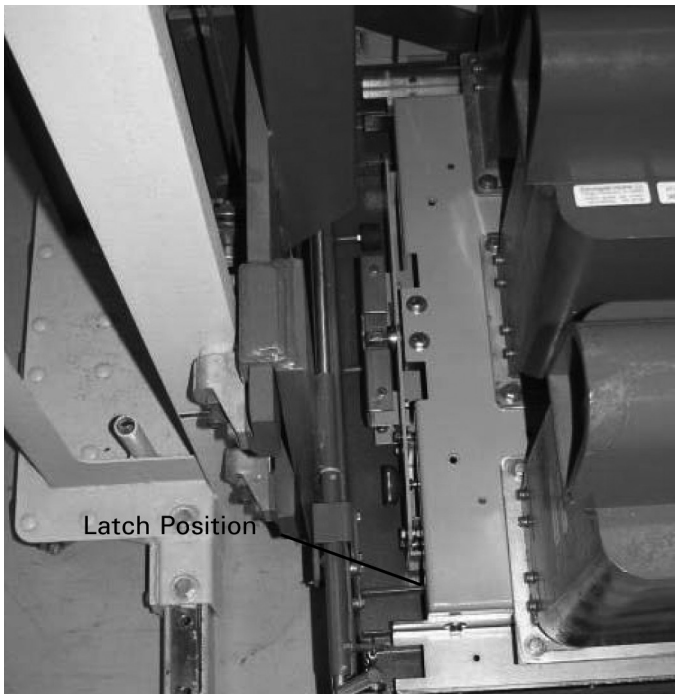


Figure 25. Break Pedal for Locking the Lifter.

4. Make sure the drawer safety latch has secured the drawer to the lifter pan (Figure 27). The safety latch hitches to the underside of the drawer flange. Push on the drawer to confirm it is fixed to the pan.



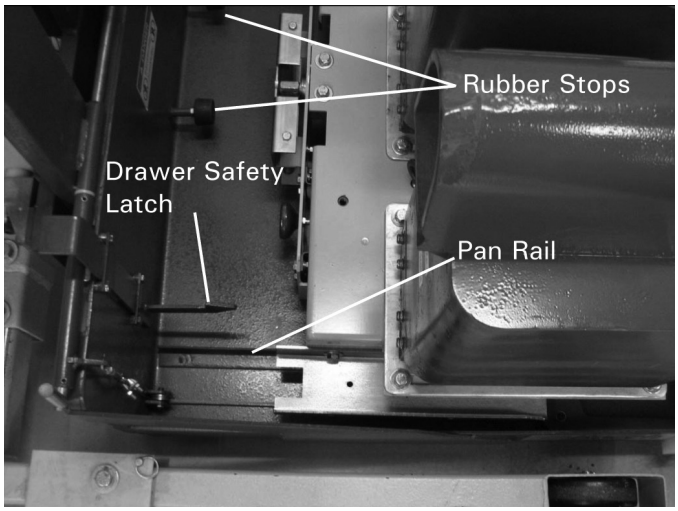


Figure 26. Latching the Transformer to the Lifter Pan.

Figure 27. Releasing the Lifter Brake.

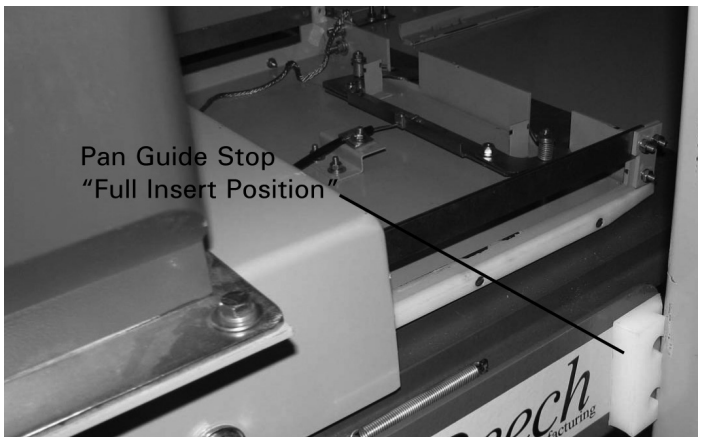
C. Transporting the transformer drawer:

1. Rotate the lifter winch clockwise (see Figure 23) until the lifter pan clears the floor a couple of inches.
2. Release the lifter brake by stepping down on the brake release (see Figure 27).
3. Grasp the lifter handles and push the lifter with the transformer drawer to its installation area (see Figure 23).

D. Installing the transformer drawer into the auxiliary compartment:

Note: It is not necessary to use a lifter to insert a transformer drawer into a lower auxiliary compartment. The drawer can be rolled directly on the floor and into the compartment.

1. Once the lifter with the transformer drawer has been transported to the auxiliary compartment, maneuver the lifter inline with the front of the switchgear so that each side of the lifter pan will clear the switchgear side sheets when the pan is moved into place.
2. Refer to Figure 28. Push the lifter with pan up against the front of the switchgear section. The pan guide-stops will guide the pan into the compartment and align the pan rails into the correct position with the compartment guide rails. The guide-stops butt up against the switchgear side sheets and prevent the lifter from moving too far into the compartment. As the pan is moved into place, pan safety latches bias off the switchgear side sheets and latch to the side sheet flanges when the pan is fully in place. These safety latches, along with the lifter brake, prevent the lifter and pan from backing out of the compartment when the drawer is moved in and out of the compartment.



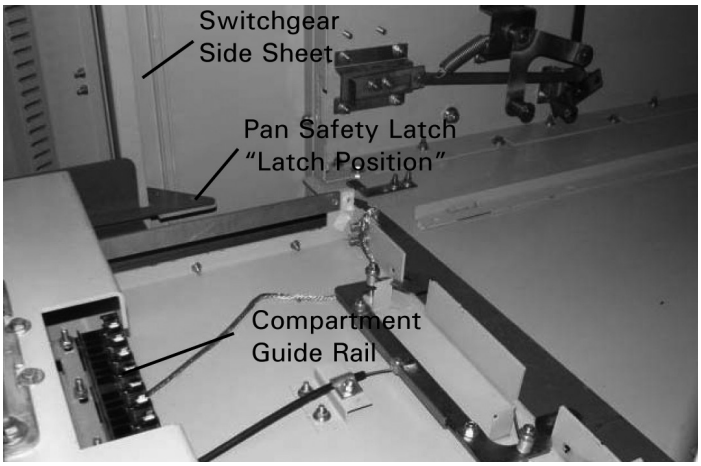
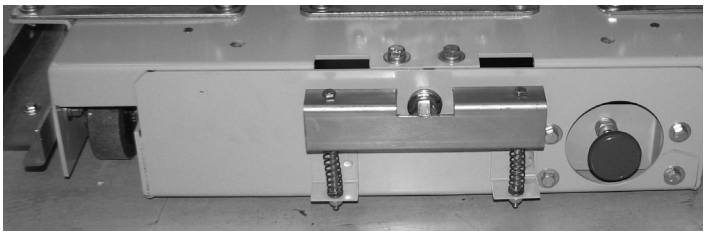


Figure 28. Engaging the Lifter Pan to the Auxiliary Compartment.

3. Lower the lifter pan by rotating the winch counterclockwise until the pan rests on the compartment floor sheet. For an upper compartment, only the front of the pan will rest on the floor of the compartment. In any case, make sure the lifter bar remains in the pan bracket (see Figure 24) and the pan is level with the compartment floor.
4. Lock the lifter in place by stepping down on the lifter brake pedal (see Figure 25).
5. Stand to one side of the lifter (opposite the front switchgear door hinges), push down on the drawer safety latch to release the drawer from the lifter pan (see Figure 29), and push the transformer drawer into the compartment (see Figure 30) until the drawer comes to a stop and latches into place. An audible "clicking" noise can be heard when the drawer latches in place. Pull back on the drawer to confirm it is fixed and latched in place.

Figure 29. Releasing the Transformer Drawer from the Lifting Pan.



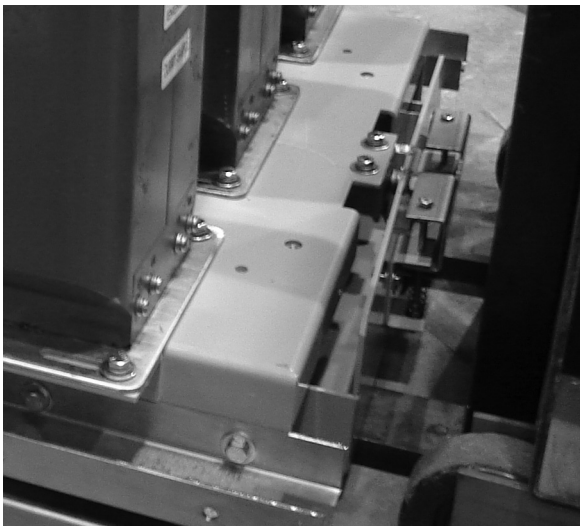


Figure 30. Loading the Transformer Drawer into the Auxiliary Compartment.

6. Release the lifter brake by stepping down on the brake release (see Figure 27).
7. Pull back on the pan safety latch release lever (see Figure 31) to release the safety latches and the pan from the compartment. Pull the lifter out and away from the switchgear unit.

Figure 31. Releasing the Lifter Pan and Lifter from the Auxiliary Compartment.

E. Removing the transformer drawer from the auxiliary compartment:
   1. Follow "A" in this section to secure the lifter pan to the lifter.
   2. Maneuver the lifter inline with the front of the switchgear so that each side of the lifter pan will clear the switchgear side sheets when the pan is moved into place.
   3. Push the lifter with pan up against the front of the switchgear section (See Figure 28). The pan guide-stops will guide the pan into the compartment and align the pan rails into the correct position with the compartment guide rails. The guide-stops butt up against the switchgear side sheets and prevent the lifter from moving too far into the compartment. As the pan is moved into place, the pan safety latches bias off the switchgear side sheets and latch to the side sheet flanges when the pan is fully in place. These safety latches, along with the lifter brake, prevent the lifter and pan from backing out of the compartment when the drawer is moved in and out of the compartment.
   4. Lower the lifter pan by rotating the winch counterclockwise until the pan rests on the compartment floor sheet. For an upper compartment, only the front of the pan will rest on the floor of the compartment. In any case, make sure the lifter block remains in the pan bracket (see Figure 24) and the pan is level with the compartment floor.
   5. Lock the lifter in place by stepping down on the lifter brake pedal (Figure 25).
   6. With the transformer drawer in the Disconnect position and the drawer in the fully retracted position (see Figure 9), stand to one side of the lifter (opposite the front switchgear door hinges), reach into the compartment, and pull firmly on the red drawer release lever (see Figure 7) to release the transformer drawer from the cell.
   7. Pull the drawer, using the red release lever, onto the lifter pan, making sure that the wheels on the drawer roll on the pan between the pan rails. Pull the drawer all the way back on the pan and up against the rubber stops.

NOTICE

DO NOT HANDLE THE FUSE TUBES AND MATING PARTS WHILE MOVING THE TRANSFORMER DRAWER. THIS MAY CAUSE DAMAGE TO THESE PARTS.

   8. Make sure the drawer safety latch has secured the drawer to the lifter pan (see Figure 26). The safety latch hitches to the underside of the drawer flange. Push on the drawer to confirm it is fixed to the pan.
   9. With the transformer drawer fixed to the lifter pan, return to the rear of the lifter and crank the lifter winch clockwise a few turns until the pan comes off the compartment floor a small distance.

⚠ CAUTION

PERFORMING #11 BELOW BEFORE PERFORMING #9 ABOVE WILL CAUSE THE LIFTER PAN TO SUDDENLY DEFLECT WITH AN UNDESIRABLE IMPACT LOADING AS THE LIFTER WITH PAN IS MOVED AWAY FROM THE SUPPORT OF THE COMPARTMENT FLOOR. THE DRAWER WEIGHT ON THE PAN CAUSES A SMALL CANTILEVER DEFLECTION ON THE PAN SUPPORTS WHEN FREE FROM SUPPORT OF THE COMPARTMENT FLOOR.

   10. Release the lifter brake by stepping down on the brake release (see Figure 27).
   11. Pull back on the pan safety latch release lever (see Figure 31) to release the safety latches and the pan from the compartment. Pull the lifter out and away from the switchgear unit.

9.2.3 Manual ground and test device

The manual ground and test device, shown in Figure 32, consists of a drawout element that can be inserted into a circuit breaker compartment in the same manner as the drawout vacuum circuit breaker element. The device includes six terminals and ground bus connections. Each terminal is isolated from each other and the bus connection by insulating the respective front panel. The ground connection is located in the lower front section of the device. The grounding of either upper or lower terminals is accomplished by connecting grounding links (provided with the device) from either the upper or the lower terminals to the device ground connection. Cable testing or "phasing out" testing may be accomplished by connecting suitable test equipment as required, to the terminals.

Because the grounding and test device has no making or interrupting ability, the circuits must be de-energized before the ground is connected or removed.

Refer to IL3A74795 for complete instructions for this device. Read them fully before using the device.

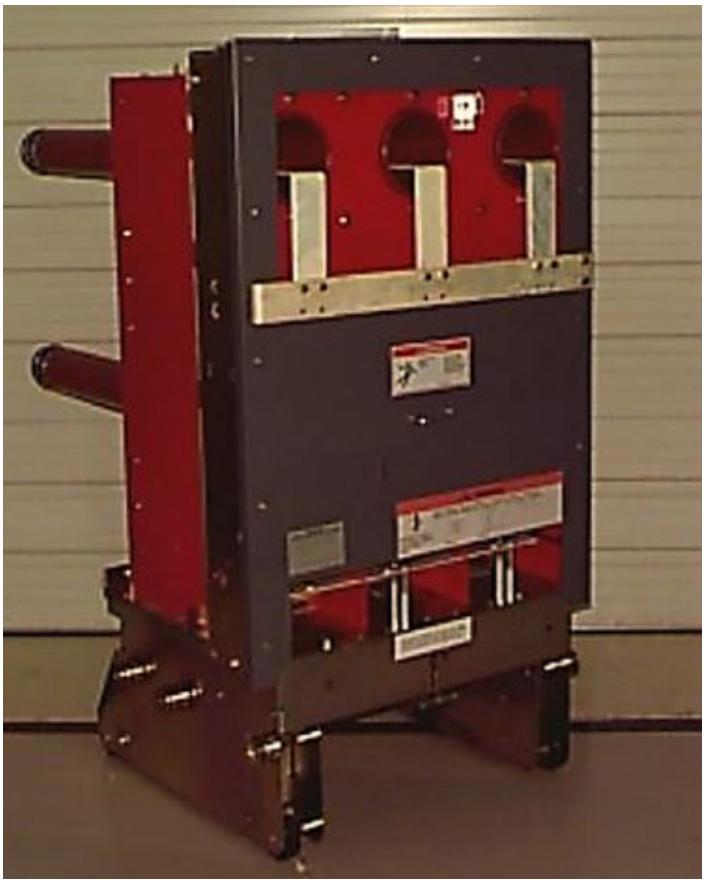


Figure 32. Manual Ground and Test Device.

Section 10: Metal-clad switchgear field taping procedure (38 kV)

10.1 Busbar taping

Materials for taping

Reference Figures 33 and 34 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.

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.

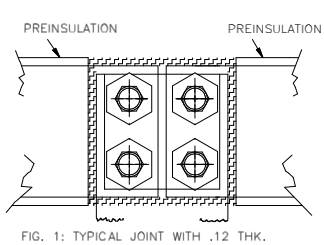


FIG. 1: TYPICAL JOINT WITH .12 THK. MIN. FILLER OVER BARE JOINT

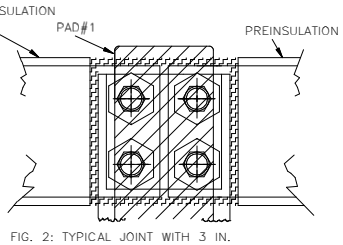


FIG. 2: TYPICAL JOINT WITH 3 IN. WIDE X .030 TAPE OVER FILLER

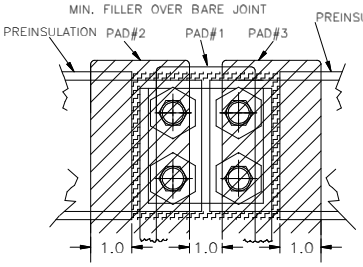


FIG. 3: TYPICAL JOINT WITH PADS #2 & #3 (3 IN. WIDE X .030) TAPE OVER PAD#1 AND FILLER

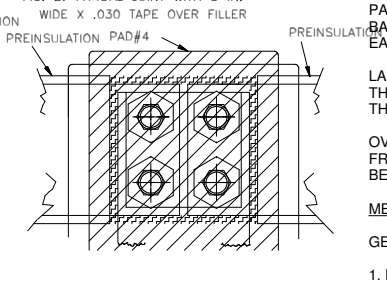


FIG. 4: TYPICAL JOINT WITH PAD#4 (3) 6.0 X .030 PIECES OF TAPE

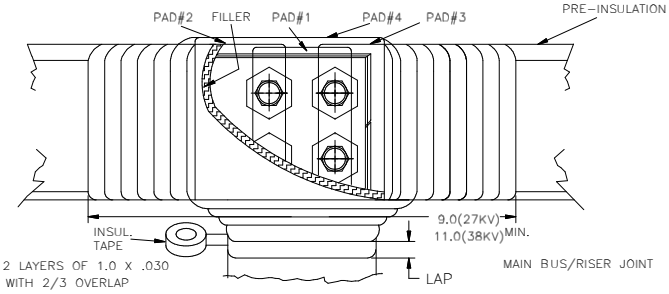


FIG. 5: 2 LAYERS OF 1.0 X .030 TAPE WITH 2/3 OVERLAP

MATERIALS

FILLER - A PUTTY-LIKE MATERIAL.TRADE NAMES: DUCTSEALER, DUCT SEAL, EATON. NO. 53351BB AND 53351WX.
INSULATING - HIGH VOLTAGE EPR INSULATING TAPE. TRADE NAME: SCOTCH 130C TAPE, EATON. NO. 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 APPLIED WHICH IS WIDER THAN ONE INCH. INCLUDES A BAND OF TAPE CONSISTING OF ONE OR MORE TURNS WRAPPED DIRECTLY ON TOP OF EACH OTHER.

LAYER - INSULATING TAPE, 1 INCH WIDE, WRAPPED FROM ONE END OF THE JOINT TO THE OTHER, (OR TO A PAD) SO EACH SUCCEEDING TURN LAPS THE PREVIOUS TURN BY THE AMOUNT SPECIFIED IN THE CHART.

OVERLAP - A SPECIFIED DISTANCE MEASURED ALONG THE PRE-INSULATION STARTING FROM THE POINT WHERE THE PRE-INSULATION ENDS AND THE EXPOSED CONDUCTOR BEGINS.

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
3. APPLY FILLER OVER BARE CONDUCTOR AND HARDWARE TO COVER AND SMOOTH OUT THE SURFACE. BLEND 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 3.00X.030 THICK PAD #1 OVER CENTER OF JOINT WITH 1 1/4 LAPS (FIG. 2). APPLY 3.00 X .030 THICK PAD #2 STARTING .50 INCH FROM CENTER AND EXTENDING OVER PREINSULATION AT LEAST 1.0 INCH WITH 1 1/4 LAPS. APPLY 3.00 X .030 THICK PAD #3 STARTING 1.00 FROM PAD #2 AT CENTER AND EXTENDING 1.00 IN. OVER PREINSULATION PER FIG. 3.
5. APPLY (3) 6.00 IN. WIDE X 12 IN. LONG X .030 IN THICK PADS (PAD#4) CENTERED ON THE MAIN BUS AND EXTENDING 1.50 IN. DOWN RISER PER FIG. 4.
6. APPLY ONE LAYER OF INSULATING TAPE (1.00X.030) USING 2/3 LAP AND EXTENDING 0.50 INCH MINIMUM BEYOND THE PADS ON THE PREINSULATION (FIG. 5).
7. APPLY A SECOND LAYER OF INSULATING TAPE (1.00X.030) USING 2/3 LAP AND EXTENDING 0.50 INCH MIN. FOR (27KV) AND 1.50 MIN. FOR (38KV) BEYOND THE FIRST LAYER ON THE PREINSULATION PER FIG. 5.

Figure 33. T-joint Field Taping Methods.

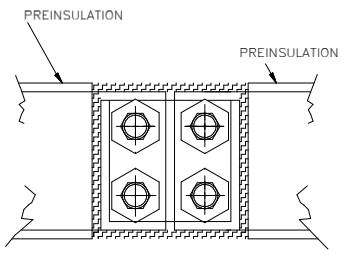


FIG. 6: TYPICAL JOINT WITH .12 THK. MIN. FILLER OVER BARE JOINT

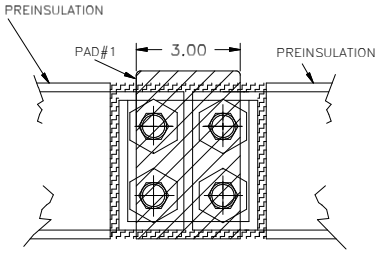


FIG. 7: TYPICAL JOINT WITH PAD#1 3 IN. WIDE X .030 TAPE OVER FILLER

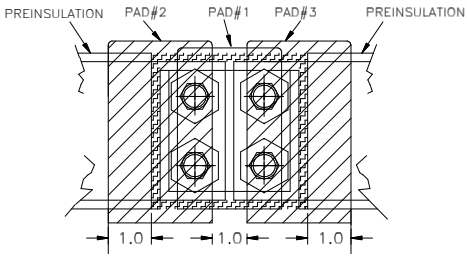
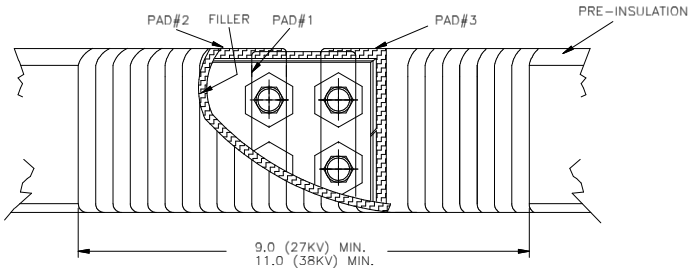


FIG. 8: TYPICAL JOINT WITH PADS #2 & #3 (3 IN. WIDE X .030) TAPE OVER PAD#1 AND FILLER



THRU-JOINTS, WITH-HARDWARE
1. CLEAN AREA OF DIRT AND FOREIGN MATTER
2. WIPE PREINSULATION WITH ISOPROPYL ALCOHOL.
3. APPLY FILLER OVER BARE CONDUCTOR AND HARDWARE TO COVER AND SMOOTH OUT THE SURFACE. BLEND CONTOUR INTO PRE- INSULATION SURFACES. TRY TO PREVENT AIR POCKETS. COVER CONDUCTORS AND HARDWARE WITH AT LEAST .12 INCH OF FILLER PER FIG. 6.
4. APPLY 3.0X.030 THICK PAD #1 OVER CENTER OF JOINT WITH 1 1/4 LAPS (FIG.7).
5. APPLY 3.0X.030 THICK PAD #2 STARTING .50 INCH FROM CENTER AND EXTENDING OVER PREINSULATION AT LEAST 1.0 INCH WITH 1 1/4 LAPS. APPLY 3.00 X .030 THICK PAD #3 STARTING 1.00 FROM PAD #2 AT CENTER AND EXTENDING 1.00 IN. OVER PREINSULATION PER FIG. 8.
6. APPLY ONE LAYER OF INSULATING TAPE (1.00X.030) USING 2/3 LAP AND EXTENDING 0.50 INCH MINIMUM BEYOND THE PADS ON THE PREINSULATION PER FIG. 9.
7. APPLY A SECOND LAYER OF INSULATING TAPE (1.00X.030) USING 2/3 LAP AND EXTENDING 0.50 INCH MINIMUM BEYOND THE FIRST LAYER ON THE PREINSULATION PER FIG. 9.

Figure 34. Thru-joint Field Taping Methods.

Table 4. Taping Chart.

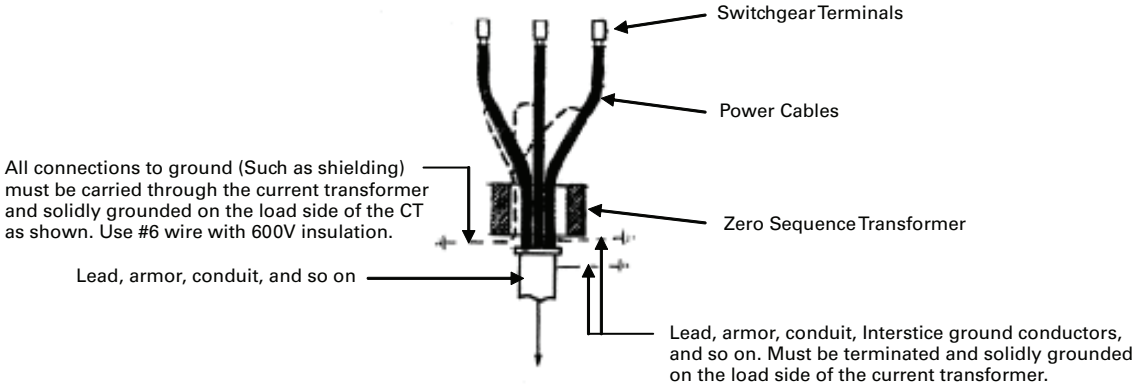
Switchgear Voltage	Pre-insulation or Pad Overlap Minimum		Insulating Tape	
kV	in (mm)	Lap of Tape	Layers	Number of Pads
38	1.50 (38.1)	0.66	2	4

10.4 Responsibility of installer

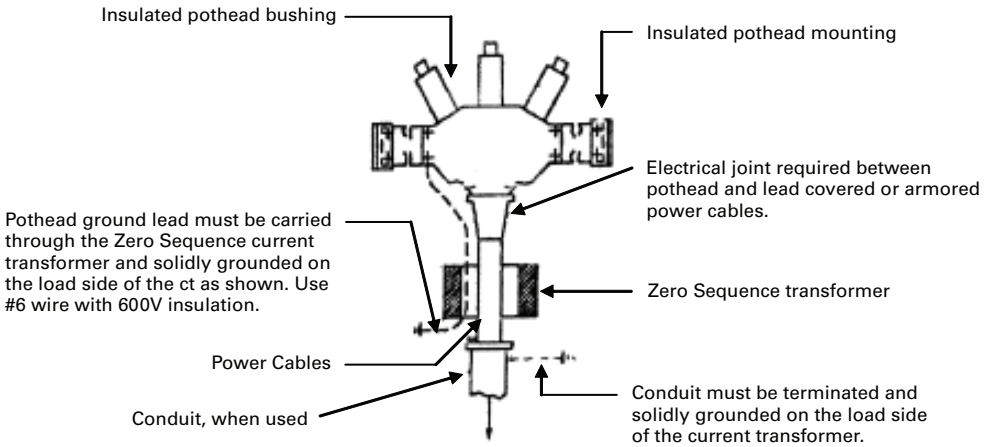
- For incoming or outgoing terminations, these approved materials are not supplied by Eaton and must be obtained and installed by others as identified above in the definitions.
- For connections involving shipping splits within an assembly, or connecting to a transformer, or to an AMPGARD MCC, or to 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 35. Zero Sequence Current Transformer Connections.

Notes:

Instruction Booklet IB02201004E
Effective October 2017
Revision #4

Instructions for installation, operation, and maintenance of 38 kV type VacClad-W, 150 BIL switchgear indoor housings

Eaton
Electrical Sector
1000 Eaton Boulevard
Cleveland, OH 44122
United States
877-ETN-CARE (877-387-2273
Eaton.com

Printed in USA
Publication No. IB02201004E / TBG001315
October 2017

Powering Business Worldwide