Instruction Booklet **IB022003EN** Effective April 2018 Revision #3

Instructions for installation, operation, and maintenance of Type MVS-ND, metal-enclosed switchgear assemblies: 4.76 kV or 15.0 kV class

Indoor MVS-ND
Switchgear Assembly

Outdoor MVS-ND
Switchgear Assembly

Contents

Powering Business Worldwide

Instructions for installation, operation, and maintenance of Type MVS-ND, metal-enclosed switchgear assemblies: 4.76 kV or 15.0 kV class

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.

Instruction Booklet IB022003EN

Effective April 2018

Revision #3

Instructions for installation, operation, and maintenance of Type MVS-ND, metal-enclosed switchgear assemblies: 4.76 kV or 15.0 kV class

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.

Introduction

Purpose

This instruction book is expressly intended to cover the installation, operation, and maintenance of medium voltage switch (type MVS-ND) metal-enclosed switchgear. It is not encompassing of all possible contingencies, variations, and details that may arise during installation, operation, or maintenance of this equipment.

If further information is desired by the purchaser regarding this particular installation or application information, contact the local Eaton sales office, see the appropriate section of Eaton's Consulting Application Guide, and review the appropriate industry standards.

Description and application

The type MVS-ND metal-enclosed switchgear assemblies consists of one or more vertical sections of metal-enclosed switchgear as defined in industry standard American National Standards Institute/ Institute of Electrical and Electronic Engineers (ANSI/IEEE®) C37.20.3. Typically, each vertical section contains an air insulated, three-pole, gang-operated, quick-make, quick-break, load interrupter switch. It can be applied in combination with power fuses and many other protective devices to provide safe, economical switching and overcurrent protection where infrequent disconnecting means is required.

Documentation references

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

For MVS-ND mounting to a foundation: Job Floor plan Document.

Refer to the customer drawing package documentation for order specific information. For further information on installation and application, refer to the applicable descriptive bulletins, publications, and/or industry standards. Download Eaton information from www.eaton.com.

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.

Terminology

Metal-enclosed load interrupter switchgear

This is an assembly of metal vertical sections as defined in ANSI/IEEE C37.20.3.

Load interrupter switch

The basic switching and fault-closing device used in metal-enclosed, load interrupter switchgear.

Fuse

A device used in conjunction with a load interrupter switch to provide overcurrent and short-circuit protection.

Safety precautions

⚠ WARNING

ONLY QUALIFIED ELECTRICAL WORKERS WITH TRAINING AND EXPERIENCE ON HIGH VOLTAGE CIRCUITS SHOULD BE PERMITTED TO WORK ON THIS EQUIPMENT. THEY SHOULD BE FAMILIAR WITH THE WORK TO BE PERFORMED, THE SAFETY EQUIPMENT REQUIRED, AND THE HAZARDS INVOLVED.

1. Read and understand these instructions before attempting any assembly, operation, or maintenance of an MVS-ND switchgear assembly.
2. Disconnect all low voltage and medium voltage power sources before working on the equipment per Occupational Safety and Health Act (OSHA) and local lockout and tagout procedures. Verify voltages have been removed, ground both load and line side connections. Observe the National Fire Protection Association's (NFPA®) Publication #70 that is commonly known as the National Electrical Code (NEC®), OSHA, and local procedures and standards. This includes visual inspections while the vertical section door is open, making any adjustments inside or outside the switchgear vertical section, performing maintenance, or installing replacement parts.
3. The vertical section door cannot be opened with the switch in the CLOSED position. In addition, the switch cannot be closed with the vertical section door open.
4. Before opening the door of the vertical section, look through the window on the door to ensure that all three main blades and flicker blades are OPEN. If necessary, use an additional suitable light source.

⚠ WARNING

DEFEATING OR DISENGAGING SAFETY INTERLOCKS ON AN MVS-ND SWITCH THAT IS PROPERLY INSTALLED IN AN MVS-ND SWITCHGEAR ASSEMBLY AND CONNECTED TO A POWER SOURCE MAY RESULT IN PROPERTY DAMAGE, BODILY INJURY, OR DEATH. DO NOT DEFEAT OR DISENGAGE ANY SAFETY INTERLOCKS WHEN THE SWITCHGEAR IS IN SERVICE.

Before energizing the switchgear assembly:

5. Make sure the MVS-ND switchgear assembly is securely fastened to a true and level surface according to the floor plan of the customer drawings.
6. Always be sure that all hardware is in place and secured by tightening or using safety fasteners before putting an MVS-ND switch into operation. See Duplex switchgear configuration on Page 13.
7. Confirm that all arc chutes and barriers are installed.
8. Confirm that no tools or other objects are left inside the vertical section.
9. Confirm that all devices, doors, and covers 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

Switchgear identification

A nameplate is located inside the small access door of each type MVS-ND switchgear vertical section (see Figure 1). Contained on this nameplate are the Eaton master parts list number and all the necessary switchgear ratings. This information should be given to the Eaton sales office if a question should arise concerning the switchgear or if renewal parts are required. This information is sufficient for Eaton to find the manufacturing information for the switchgear.

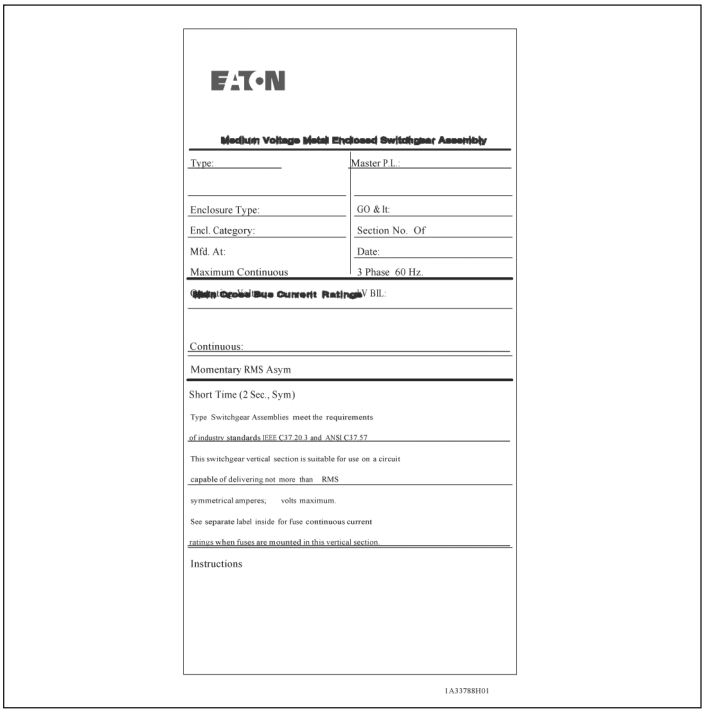


Figure 1. Typical Nameplate.

⚠ WARNING

EXCEEDING NAMEPLATE RATINGS OF MVS-ND SWITCHGEAR COULD CAUSE PROPERTY DAMAGE, SEVERE INJURY, OR DEATH. MVS-ND SWITCHGEAR MUST BE OPERATED WITHIN ITS NAMEPLATE RATINGS.

Safety features

Type MVS-ND load interrupter switchgear has several built-in features to reduce hazards and to provide proper operating sequences.

1. A door interlock prevents opening the enclosure's front door while the load interrupter switch is in the closed position.
2. A switch interlock prevents manual operation of the switch's operating mechanism with the door open.
3. A viewing window is provided to visually verify the switch contact position.
4. Provisions for padlocking the switch in the open or closed position.
5. Provisions for padlocking the main door handles closed.
6. Mechanical indicators show whether the switch mechanism is open or closed.
7. Key interlocks, when provided, force a sequence of operation.

⚠ WARNING

OPERATING AN MVS-ND OR MVS-ND SWITCH WITH A KEY INTERLOCK BOLT EXTENDED WILL RESULT IN EQUIPMENT DAMAGE AND MAY ALSO EXPOSE A PERSON TO BODILY INJURY OR DEATH. THE KEY MUST BE INSERTED INTO THE INTERLOCK AND ROTATED TO RETRACT THE LOCKING BOLT BEFORE OPERATING AN MVS-ND SWITCH.

Ratings and standards

Table 2. MVS-ND Switchgear Voltage and Frequency Ratings, RMS Values

Description	4.76 kV Class	15 kV Class
Rated maximum design voltage	4.76 kV	15 kV
Impulse withstand voltage, BIL ①	60 kV	95 kV
Power frequency withstand voltage	19 kV	36 kV
Rated frequency	60 Hz	60 Hz

① Basic Impulse Level (BIL).

Table 3. MVS-ND Switchgear Main Bus Current Rating for Short-Circuit Capability of 63.8 kA Peak for 10 Cycles.

For the Main Bus Continuous Current Rating Related Capability	800 A Rating	1200 A Rating
Momentary current rating, kA peak	65	65
Short-time current rating, 2 seconds, kA symmetrical	25	25

Table 4. MVS-ND Switchgear Main Bus Current Rating for Short-Circuit Capability of 97 kA Peak for 10 Cycles.

For the Main Bus Continuous Current Rating Related Capability	800 A Rating	1200 A Rating
Momentary current rating, kA peak	99	99
Short-time current rating, 2 seconds, kA symmetrical	38	38

Table 5. MVS-ND Switch Standards.

Description	Standards Document
Underwriters Laboratories (UL) or Canadian Standards Association (CSA) listing to:	ANSI/IEEE C37.20.3 ANSI C37.57
CSA listing only to:	CAN/CSA C22.2 No 31

Installation

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

Refer to shipping list for location of the bus, hardware, and all other joining and installation material.

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.

Joining type MVS-ND enclosures

Access to MVS-ND switchgear vertical sections containing switches

Each MVS-ND switch is shipped from the factory in the closed position to maintain alignment during shipping and handling. When handling MVS-ND switchgear, confirm the switches are in the closed position. The safety interlocking prevents opening of the door of the vertical section when the switch is closed.

In order to gain access to the interior, be sure the switchgear is on a true and level surface according to the floor plan of the customer drawings. To open a manually operated MVS-ND switch, insert the operating handle and push down. When the switch opens, the door may be opened.

Identification of shipping splits

Refer to the front view on the switchgear assembly drawing supplied with the switchgear. Beneath this view, shipping splits will be identified in relation to group numbers for each vertical section. Normally, shipping sections will not exceed 90 in. (2286 mm) in width.

Procedures for joining MVS-ND enclosures at shipping splits

During the following steps, please refer to Figure 2.

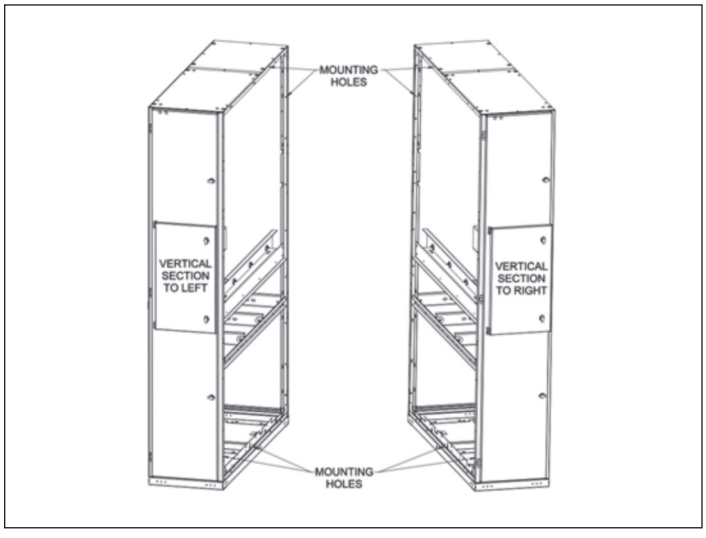


Figure 2. Joining the MVS-ND Enclosures.

Step 1: Obtain the tie bolt hardware located in the shop order detail box. All tie bolt hardware is installed from the right-hand sidewall of the left-hand vertical section into the left-hand sidewall of the right-hand vertical section.

Step 2: Open the front door, remove screen barriers and roof sheets. There are (18) 0.88 in. (22.35 mm) diameter clearance holes in each vertical section. Install a ¼-20 self-tapping screw through each of the clearance holes and secure into the left-hand sidewall of the right-hand vertical section.

Step 3: Make the main and ground bus connections using the links and hardware furnished. The busbar is silver-plated. To ensure a proper electrical connection, care should be taken to protect the plating from damage. DO NOT use joint compound.

⚠ CAUTION

CLEANING BUS JOINTS WITH ABRASIVE OR CHEMICAL CLEANSERS MAY REMOVE PLATING, WHICH MAY CAUSE JOINT OVERHEATING. TO CLEAN THE SURFACES, WIPE THEM WITH CLEAN, DRY CLOTH.

Step 4: Bolted connections should be tightened to the torque values given in MVS-ND switchgear bolt tightness for bus connections on Page 13.

Installation of roof caps on outdoor units

Roof caps are necessary to complete the roof of all outdoor MVS-ND switchgear assemblies. Those not factory installed are shipped on the switchgear in a "shipping" position or cartons that are shipped separately.

The following procedure and accompanying figures detail the work to be done to install each cap.

Step 1: Remove the lifting lugs from the MVS-ND switchgear assembly.

Step 2: Place a roof cap (intermediate or end) in position. Install the hardware on vertical end surfaces to hold the roof cap in place.

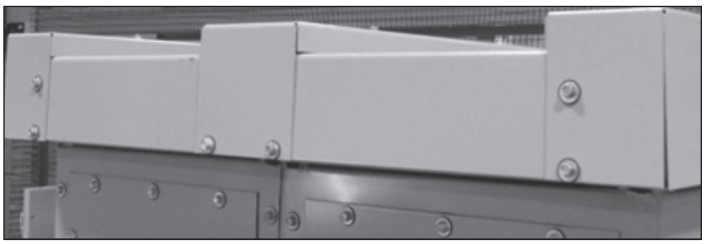


Figure 3. Installation of Roof Caps on Outdoor Units.

Step 3: Continue this procedure until all roof caps have been installed.

Connection of Type MVS-ND switchgear to the transformer

Physical connection

Indoor assemblies, dry type, cast coil type, or liquid filled type transformers

Holes are pre-drilled in the side of the MVS-ND structure to match the holes provided in the transformer case. Hardware is provided in the MVS-ND switchgear where it will be connected to the transformer. Remove this hardware and retain it for fastening the switchgear to the transformer.

Move the MVS-ND switchgear to match the holes on the side that will face the transformer to the matching holes in the transformer case. Minor misalignment may be corrected with a tapered guiding rod of some kind. Insert the hardware and tighten. Use extreme caution in moving the MVS-ND switchgear to prevent damage.

Outdoor throat connection, liquid filled transformers

Step 1: Remove the sealing ring flange from MVS-ND switchgear throat and set it aside.

Step 2: The switchgear and transformer should be brought together to give a spacing of approximately 0.5 in. (12.7 mm) between throat flanges.

Step 3: Apply the double adhesive tape supplied with MVS-ND switchgear to outside surfaces of both flanges.

Step 4: Press felt supplied with MVS-ND switchgear into place on adhesive tape.

Step 5: Reinstall sealing ring removed in Step 1.

Medium voltage electrical connections

Connection by cables supplied with type MVS-ND switchgear or transformer

- The supplied cables are NOT factory pre-cut to the proper length. The installer MUST cut the cables to fit.
- Factory cables are unshielded. For 15 kV applications, they must be properly separated from each other, from all grounded metal parts, and from the transformer bushings/terminals of other phases. For 4.76 kV applications, it is only necessary to install cables so they will not be damaged from sharp edges, points, etc.
- Phasing of main conductors in type MVS-ND switchgear conforms to industry standards, which is 1, 2, 3, front to rear, top to bottom, and left to right at connection points unless otherwise noted on the drawings. The installer is responsible for maintaining continuity of phasing throughout the system.
- Lugs are provided with the switchgear for terminating the cables to the transformer bushings/terminals or to the MVS-ND switchgear terminals.

Connection by busbar

- Splice plates and hardware are furnished with the MVS-ND switchgear. The transformer manufacturer supplies a flexible connector if the transformer is a dry type or cast coil. If the transformer is liquid filled type, MVS-ND provides the flexible connector.
- Busbar is plated. To ensure a proper electrical connection, care should be taken to protect the plating from damage. Refer to Procedures for joining MVS-ND enclosures at shipping splits on Page 6.
- All copper connections should be tightened according to the specifications given in MVS-ND switchgear bolt tightness for bus connections on Page 13.

Connections to AMPGARD medium voltage motor control center (MCC)

Step 1: Holes are pre-drilled in the side of the MVS-ND switchgear structure to match holes provided in the AMPGARD MCC. Bolt the units together using hardware furnished with the MVS-ND switchgear.

Step 2: Make the bus connections as detailed in Connection by busbar.

Connections to an MVA metal-clad switchgear assembly

Indoor switchgear

Follow the same procedure as given in Connections to AMPGARD medium voltage motor control center (MCC).

Outdoor switchgear

Step 1: Position the units side by side. The holes in MVS-ND side sheet around bus cutout will match the holes in metal-clad switchgear flange.

Step 2: Press the sponge neoprene gasketing tape supplied with MVS-ND switchgear onto flange to form a weather-tight seal.

Step 3: Join the enclosures using the bolts supplied with MVS-ND switchgear. The opposite side of the metal-clad switchgear flange has nuts in place for ease of connection.

Step 4: Make the bus connections as detailed in Connection by busbar.

Connection of customer power cables

Figure 4 through Figure 6 show the suggested means for connection of the incoming or exiting cables (maximum of two per phase, 500 kcmil) in MVS-ND switchgear. All necessary materials to perform the cable installation are to be provided by others unless specifically noted otherwise in the detailed instructions below, or where specifically purchased with the switchgear assembly. To install the incoming and exiting cables, follow these instructions.

Switchgear terminals

For incoming power, the terminals are usually located at the top of the switch in a vertical section. For outgoing circuits, the terminals are beneath the switch. Each terminal pad has a two-hole pattern suitable for either a single-hole terminal or a terminal with a two-hole National Electrical Manufacturers Association (NEMA) drilling pattern. The terminal lugs for the cable, if purchased with the switchgear, will be bolted to the switchgear terminals. If the terminal lugs are not there, then they are to be provided by others. The terminals of the switchgear are not suitable to support the weight of the cable. It will be necessary to support the weight of the cable with a cable support angle.

⚠ WARNING

FAILURE TO INSTALL THE CABLE SUPPORT MAY RESULT IN DAMAGE TO THE SWITCHGEAR TERMINALS, WHICH IN TURN MAY RESULT IN MAJOR EQUIPMENT DAMAGE AND CAUSE SEVERE PERSONAL INJURY OR DEATH.

Cable electrical stress relief devices

The design of MVS-ND switchgear is based upon the use of "preformed" type electrical stress relief devices such as 3-M Quickterm-II®, Raychem® heat shrink termination systems, etc. The stress relief devices are to be provided by others.

Lacing cord or other equivalent materials/means

The cables must be lashed together to restrain the cables if a short circuit should occur. This material is to be provided by others. For large cables and/or cable reverse loops, it may also be necessary to lash the cable bundle(s) to a support channel.

⚠ WARNING

FAILURE TO LASH THE CABLES TOGETHER MAY RESULT IN DAMAGE TO THE SWITCHGEAR, WHICH IN TURN MAY RESULT IN MAJOR EQUIPMENT DAMAGE AND CAUSE SEVERE PERSONAL INJURY OR DEATH. THE CABLE MUST BE LASHED TOGETHER AS INSTRUCTED IN THIS DOCUMENT.

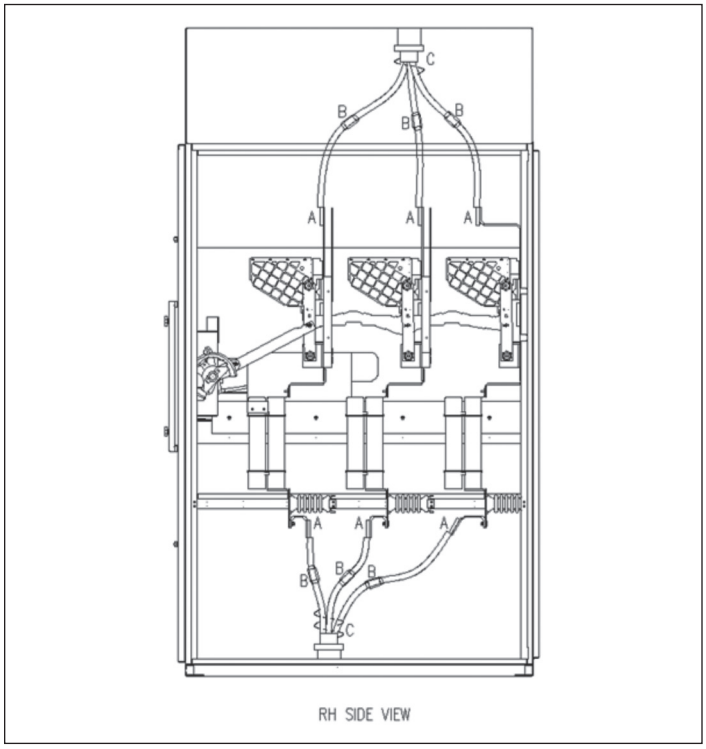


Figure 4. Top Cable Entrance, Bottom Cable Exit (or Reverse).

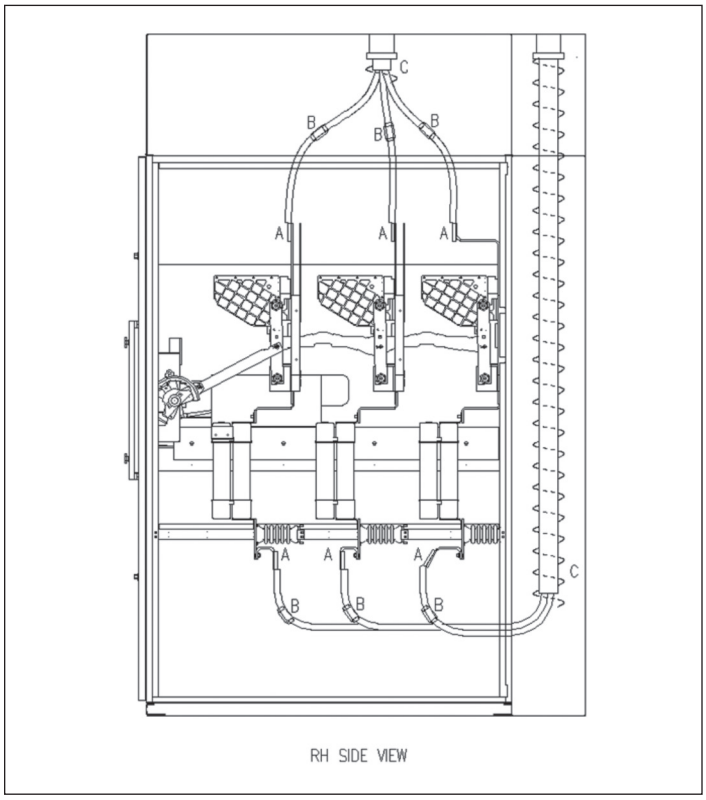


Figure 5. Top Cable Entrance, Top-rear Cable Exit (or Reverse).

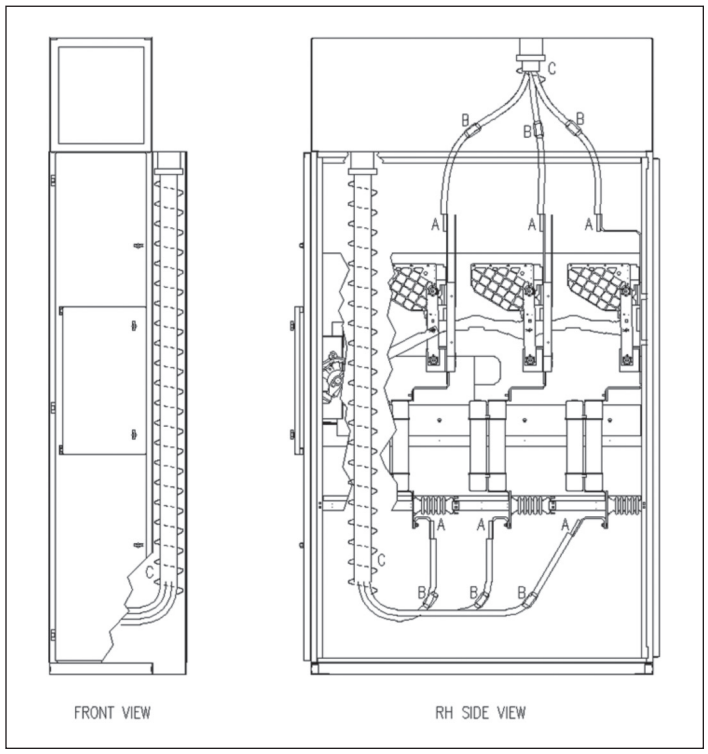


Figure 6. Top Cable Entrance, Top-side Cable Exit (or Reverse).

Factory installed NORYL® insulation

Factory installed insulation may be NORYL, a high-performance engineering thermoplastic. It can be irreversibly damaged if it comes in contact with certain chemicals. See Electrical parts and insulation check and cleaning on Page 11 for cleaning procedures.

⚠ WARNING

USE OF SOLVENTS, OILS, JOINT COMPOUNDS, OR GREASES ON OR NEAR NORYL INSULATION WILL DESTROY IT. CLEAN ONLY WITH WATER OR ISOPROPYL ALCOHOL.

⚠ CAUTION

ISOPROPYL ALCOHOL IS FLAMMABLE. PROVIDE ADEQUATE VENTILATION AND KEEP AWAY FROM FLAMES AND OTHER IGNITION SOURCES. CONSULT YOUR SAFETY DEPARTMENT BEFORE USING.

Securing MVS-ND switchgear assemblies to foundations

If the switchgear assembly was purchased for seismic applications, follow the instructions on the specific drawings provided for the switchgear assembly that address the anchoring details. Another drawing addresses the load bearing requirements. Indoor or outdoor vertical sections are secured using foundation bolts. Anchors and lag screws may be used in place of J-bolts if desired.

Typical floor plans

Refer to customer drawings for floor plans for installing MVS switchgear in typical and seismic applications.

Connection of space heaters to customers source

Space heaters, when supplied, must be energized to prevent condensation. Heaters are supplied for 120 V or 240 V sources as shown on the drawings.

For switchgear assemblies with or without heater control devices, heaters will be internally wired and brought to a terminal block. A wiring diagram will be furnished with the drawings showing connection points for power.

Switchgear assembly inspection before startup

Each switch is properly adjusted at the factory before shipment. However, vibration and mechanical stresses imposed by transit and installation can adversely affect switch adjustment. Therefore, a final inspection is essential before energizing. If this inspection reveals any defects in adjustment, they should be corrected according to alignment procedures in IB022004EN.

Step 1: Check the bolted bus connections for proper tightness, referring to MVS-ND switchgear bolt tightness for bus connections on Page 13 for torque values.

Step 2: Check to see if the space heaters, if supplied, are energized.

Step 3: Wipe away any dust or dirt that may have accumulated in compartment(s), paying particular attention to insulators and insulating material. If bus is insulated, see Electrical parts and insulation check and cleaning on Page 11 for cleaning procedures.

⚠ WARNING

USE OF SOLVENTS, OILS, JOINT COMPOUNDS, OR GREASES ON OR NEAR NORYL INSULATION WILL DESTROY IT. CLEAN ONLY WITH WATER OR ISOPROPYL ALCOHOL.

⚠ WARNING

NORYL INSULATED EQUIPMENT: ELECTRICAL JOINT COMPOUNDS MUST NOT BE USED ON CONNECTIONS OR TERMINATIONS TO OR FROM THIS EQUIPMENT. DO NOT USE SOLVENTS, OILS, OR GREASES ON OR NEAR THIS EQUIPMENT. WATER AND ISOPROPYL ARE THE ONLY APPROVED CLEANERS FOR THIS EQUIPMENT.

⚠ CAUTION

ISOPROPYL ALCOHOL IS FLAMMABLE. PROVIDE ADEQUATE VENTILATION AND KEEP AWAY FROM FLAMES AND OTHER IGNITION SOURCES. CONSULT YOUR SAFETY DEPARTMENT BEFORE USING.

Step 4: A final thorough inspection should be made to ensure that no tools or other objects are accidentally left inside the enclosure.

⚠ WARNING

DEFEATING OR DISENGAGING SAFETY INTERLOCKS ON AN MVS-ND SWITCH THAT IS CONNECTED TO A POWER SOURCE MAY RESULT IN PROPERTY DAMAGE, BODILY INJURY, OR DEATH. DO NOT DEFEAT OR DISENGAGE ANY SAFETY INTERLOCKS.

Inspection before startup

Each MVS-ND switchgear assembly is functioning properly at the factory before shipment. However, vibration and mechanical stresses imposed by transit and installation can adversely affect the switchgear assembly and its component devices. Therefore, an inspection is essential before energizing. If this inspection reveals the switchgear assembly or any component device has come out of adjustment, the switchgear or its component device should be readjusted according to this instruction bulletin and the associated instruction documents for the component.

Inspection procedures require closing and opening the switch with the main door open. This requires override of the switch safety interlocks. This is described in the switch instruction bulletin IB022004EN.

- When fuse mountings are supplied, check to ensure the fuse mountings are securely fastened
- Perform the recommended procedures in Insulation and conductor maintenance on Page 11 to assure the insulation integrity of the switchgear assembly
- A final, thorough inspection should be made to ensure that no tools or other objects are accidentally left inside the enclosure

Operation

Mechanical safety interlocks

The MVS-ND manually operated switch is equipped with switch interlocks and door interlocks as well as provisions for padlocking in either the open or closed position. See IB022004EN for details of the interlocks and their functions.

Key interlocking

Key interlocks are supplied when specified, but certain MVS-ND switchgear configurations require key interlocks and they are therefore included. Standard schemes are available for locking the switch in the open position or the closed position, as well as locking the main door closed. Numerous other schemes are available for special requirements that must coordinate with upstream or downstream devices supplied by Eaton or other equipment.

Maintenance

⚠ WARNING

FAILURE TO COMPLETELY DISCONNECT THE MVS-ND SWITCHGEAR ASSEMBLY FROM ALL POWER SOURCES PRIOR TO INSPECTION MAY RESULT IN SEVERE INJURY OR DEATH. THE SWITCHGEAR ASSEMBLY MUST BE COMPLETELY DISCONNECTED FROM ALL POWER SOURCES AND GROUNDED BEFORE PERFORMING ANY INSPECTION.

Inspection schedule

The switchgear should be inspected on a regular periodic basis to ensure all components are functioning correctly and the insulation system integrity is being maintained. See the appropriate instruction documents for the component devices.

Inspection procedure

Wipe away any dust or dirt that may have accumulated inside each switchgear vertical section, paying close attention to insulators and insulating material. If the bus is insulated, see Electrical parts and insulation check and cleaning for cleaning procedures.

Insulation and conductor maintenance

Insulated bus coverings made from NORYL

Insulated bus coverings are made from NORYL, a high-performance engineering thermoplastic. NORYL can be irreversibly damaged if it comes in contact with certain chemicals. Such petroleum containing products as solvents, oils, greases, and electrical joint compounds are especially harmful. Engineering, should not come in contact with the NORYL. Only specified tapes and fillers should be used when insulating busbar joints. See Field taping of electrical connections on Page 14 for details.

Electrical parts and insulation check and cleaning

De-energize primary circuits before removing any enclosure parts. Before cleaning, take "MEGGER" readings between live parts and to ground. Inspect for signs of overheating or weakened insulation. Remove dust from conductors, live parts, insulators, component insulation, live parts, and enclosure surfaces. An industrial grade vacuum cleaner would assist this procedure. Wipe clean with isopropyl alcohol or distilled water only, then wipe dry.

⚠ WARNING

NORYL INSULATED EQUIPMENT: ELECTRICAL JOINT COMPOUNDS MUST NOT BE USED ON CONNECTIONS OR TERMINATIONS TO OR FROM THIS EQUIPMENT. DO NOT USE SOLVENTS, OILS, OR GREASES ON OR NEAR THIS EQUIPMENT. WATER AND ISOPROPYL ARE THE ONLY APPROVED CLEANERS FOR THIS EQUIPMENT.

⚠ CAUTION

ISOPROPYL ALCOHOL IS FLAMMABLE. PROVIDE ADEQUATE VENTILATION AND KEEP AWAY FROM FLAMES AND OTHER IGNITION SOURCES. CONSULT YOUR SAFETY DEPARTMENT BEFORE USING.

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

Periodic high potential tests are not required after initial start-up and are recommended only after repair of high voltage live parts or insulation, or when the trend of "MEGGER" readings indicates it to be advisable. This field test should be made before the main cables are connected and should not exceed the values in Table 6.

Table 6. Field Dielectric Test Values.

kV Class	Test Voltage, 60 Hz AC, Applied for 1 Minute
5	14.25
15	27

The intent of the cleaning procedure is to remove as much dirt, dust, and other foreign material as possible from the insulation with minimum exposure to any solvents. The recommended cleaning procedure is to use a lint-free cloth. In most cases this will be sufficient.

For accumulations that cannot be removed by the above procedure, a lint-free cloth, slightly dampened with water, can be used. Allow the apparatus to dry for at least four hours at room temperature before energizing or testing. If a lint-free, water dampened cloth does not produce satisfactory results, use a lint-free cloth dampened with isopropyl alcohol. Dry the same as when using a water-dampened cloth.

⚠ CAUTION

ISOPROPYL ALCOHOL IS FLAMMABLE. PROVIDE ADEQUATE VENTILATION AND KEEP AWAY FROM FLAMES AND OTHER IGNITION SOURCES. CONSULT YOUR SAFETY DEPARTMENT BEFORE USING.

Fuse replacement

⚠ WARNING

FAILURE TO COMPLETELY DISCONNECT THE MVS-ND SWITCHGEAR ASSEMBLY FROM ALL POWER SOURCES PRIOR TO INSPECTION MAY RESULT IN SEVERE INJURY OR DEATH. THE SWITCHGEAR ASSEMBLY MUST BE COMPLETELY DISCONNECTED FROM ALL POWER SOURCES AND GROUNDED BEFORE PERFORMING ANY INSPECTION.

⚠ WARNING

WHEN ACCESSING FUSES, FAILURE TO ASSURE THAT THE FUSES ARE DE-ENERGIZED MAY RESULT IN EQUIPMENT DAMAGE, BODILY INJURY, OR DEATH. MAKE SURE THAT ALL POWER SOURCES ARE DE-ENERGIZED BEFORE ATTEMPTING TO ACCESS THE FUSES.

Step 1: All devices that could energize the fuse should be opened, padlocked, and tagged so that inadvertent closure cannot create a hazard.

Step 2: The MVS-ND switch should be opened by rotating the handle downward.

Step 3: Before opening the door, look through a window to visually verify that all blades are disengaged from their break jaws.

Step 4: After opening the door, an appropriate medium voltage-sensing device should be used to determine if voltage is present.

Step 5: If no voltage is present, a suitable grounding device should be attached to the fuse terminals to discharge any static charge and assure that the fuse terminals remain at ground potential.

Fuses are removed by removing the bolted fasteners located at both ends of the fuse. Fuses are then free to be removed. When fuses are re-installed, the fasteners should be retightened, referring to MVS-ND switchgear bolt tightness for bus connections on Page 13 for torque values.

Lubrication

Lubrication should be done during routine maintenance. All excess lubrication must be removed with a clean cloth to prevent any accumulation of dust or dirt.

Avoid any lubrication on insulation. Care must be taken to prevent any non-conductive lubricant from reaching any current carrying contact surface. Use conductive grease (Eaton part number 7274A48H02) on moving and sliding contacts. Use mechanical lubricating grease (Eaton part number 53701AI) on moving parts that are not electrical contacts. See IB022004EN for the MVS-ND switch lubrication requirements. For other components see the appropriate instruction documents for those components, for their lubrication requirements.

Duplex switchgear configuration

When supplied, the duplex configuration consists of two vertical sections containing MVS-ND switches connected together by a common bus on the hinge terminals of each switch. This, in turn, is connected to one set of fuses located in one of the switch compartments. This arrangement allows the selection of either of two incoming lines.

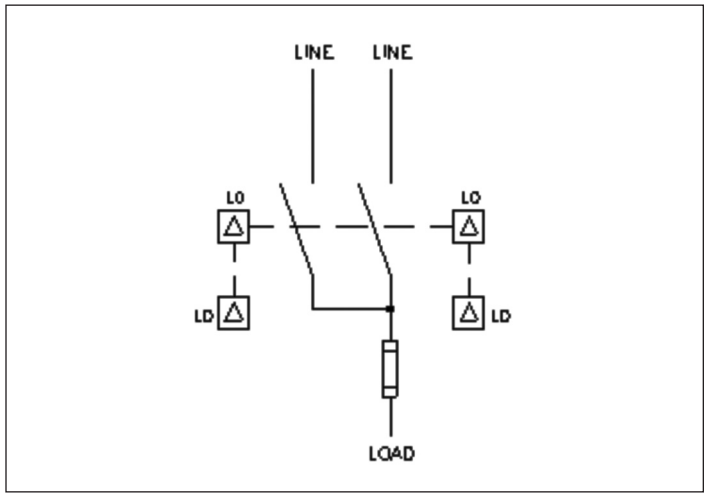


Figure 7. Duplex Selective Switch Operation.

This arrangement is always supplied with key interlocking for safe operation. Key interlocking consists of a lock on each switch to lock the switch in the open position and a lock on each door to lock each door closed. Each of the locks is keyed alike and only one key must be available to operating personnel. Since the key is retained in its lock when a switch is closed or when a door is opened, two things are assured:

- Only one switch may be closed at a time to prevent paralleling of incoming lines
- Both switches must be locked in the open position to unlock either main door, preventing access to energized load side bus or fuses

⚠ WARNING

ONLY ONE KEY SHOULD BE AVAILABLE TO OPERATING PERSONNEL FOR THIS INTERLOCK SCHEME. WHEN SHIPPED FROM THE FACTORY, EACH LOCK WILL HAVE A SEPARATE KEY. ALL EXTRA KEYS MUST BE DESTROYED OR OTHERWISE MADE INACCESSIBLE TO OPERATING PERSONNEL. FAILURE TO DO SO COULD RESULT IN SEVERE INJURY OR DEATH.

MVS-ND switchgear bolt tightness for bus connections

Use the following torque value for tightening bus joints.

Table 7. Bolt Torque Values for Bus Connection.

Recommended Spiralock Applied Torque		
Bolt Size	**ASTM A 449; SAE J429 Grade 5**	
	Dry	
	Nominal Torque	
1/4-20	12 ft-lbs (16.3 N·m)	
3/8-16	45 ft-lbs (61 N·m)	
1/2-13	50 ft-lbs (67.8 N·m)	

MVS-ND switchgear field taping procedure (5/15 kV)

Busbar taping

Materials for taping

Reference Figures 8 and 9 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.

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.

Cable termination taping

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

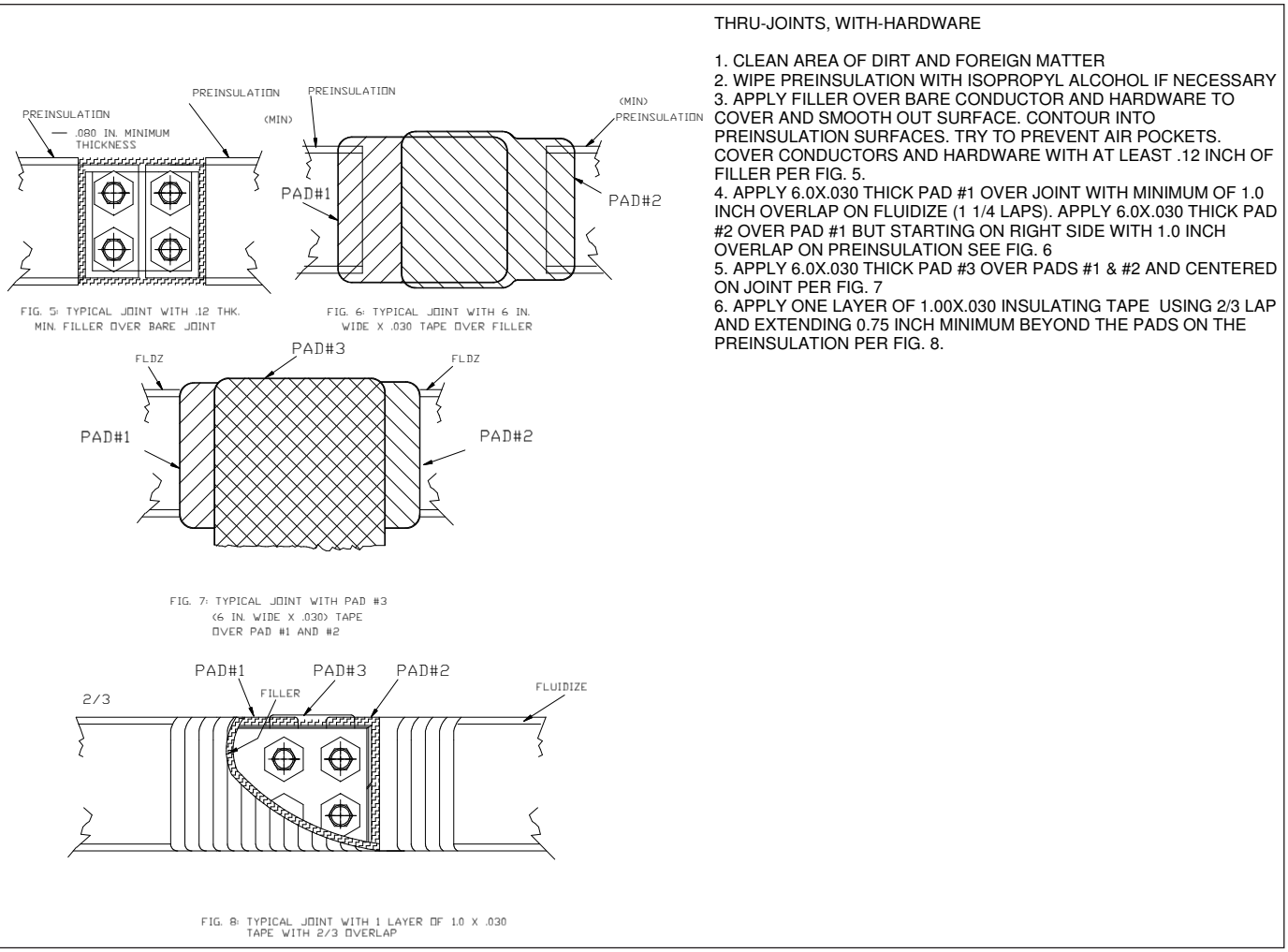
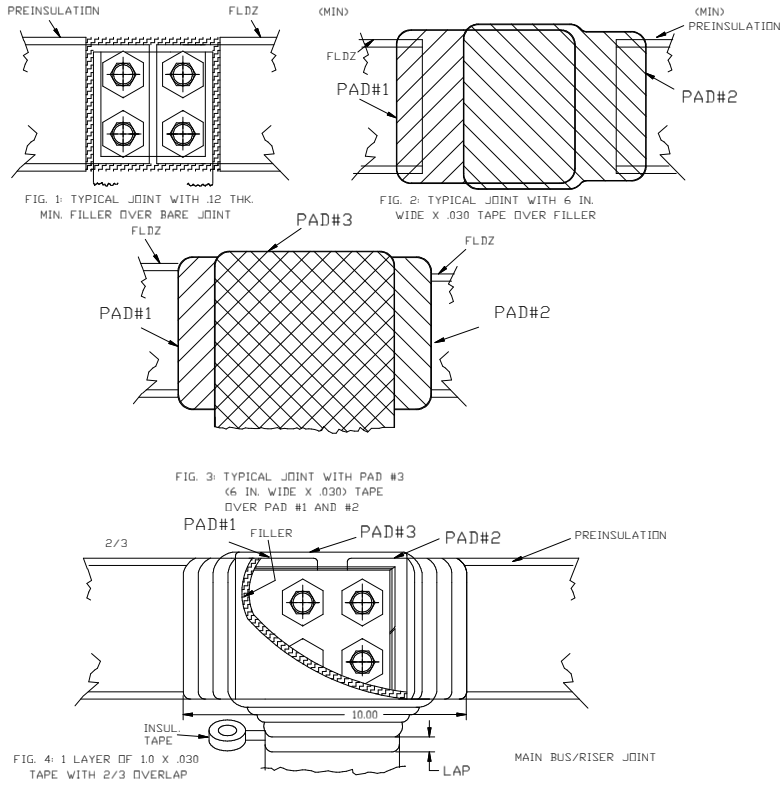


Figure 8. T-Joint Field Taping Methods.



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 9. Thru-joint Field Taping Methods.

Table 8. 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

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 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, the 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.

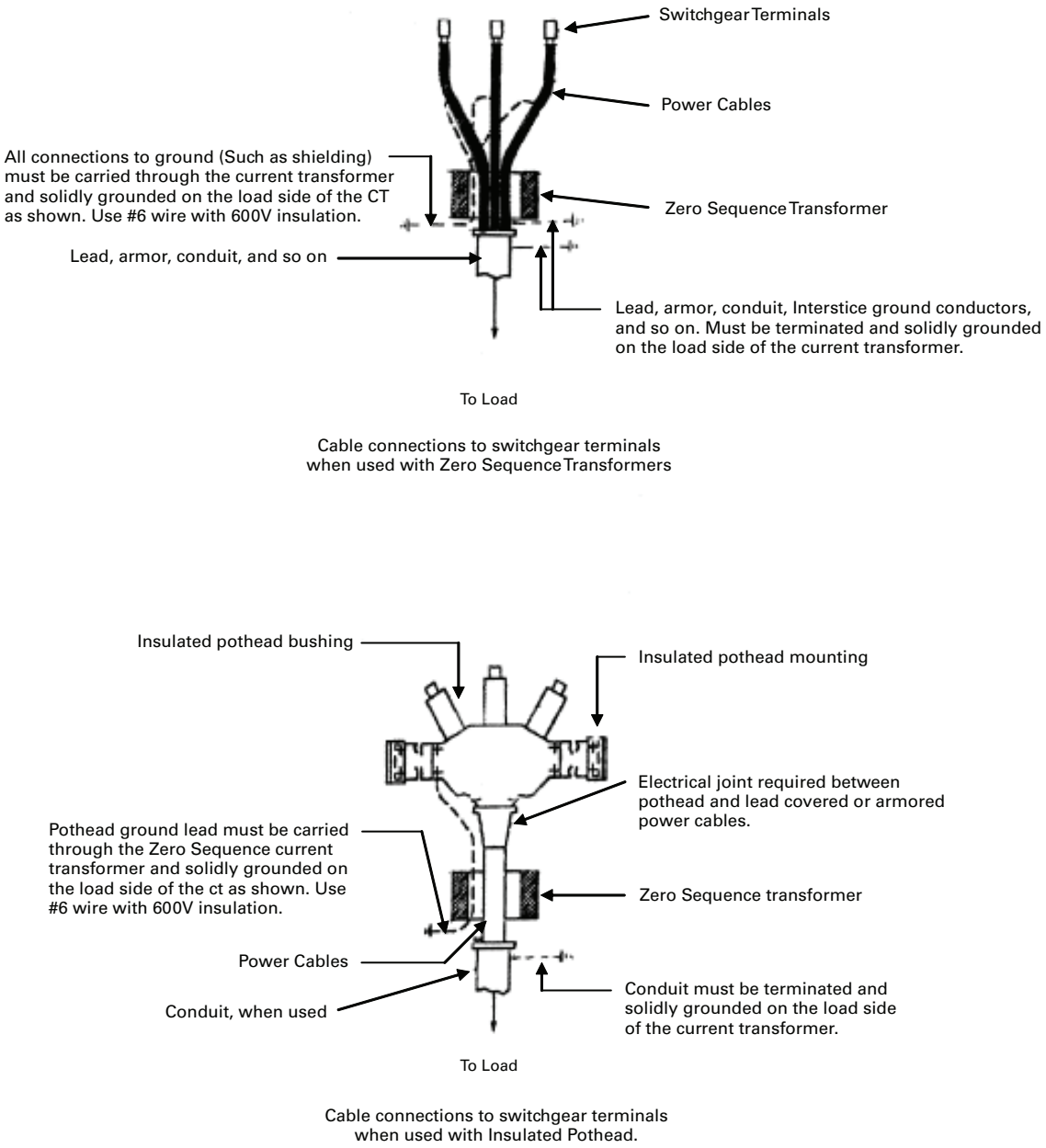


Figure 10. Zero Sequence Current Transformer Connections.

Notes:

Notes:

Notes:

Instruction Booklet IB022003EN
Effective April 2018

Instructions for installation, operation, and maintenance of Type MVS-ND, metal-enclosed switchgear assemblies: 4.76 kV or 15.0 kV class

Eaton
Electrical Sector
1000 Eaton Boulevard
Cleveland, OH 44122
United States
877-ETN-CARE (877-386-2273)
Eaton.com

Printed in USA
Publication No. IB022003EN / TBG001292
April 2018

Powering Business Worldwide