S&C PMX™ Modular Metal-Enclosed Switchgear

Outdoor Distribution (13.8 kV and 25 kV)

Instructions for Installation

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S&C ELECTRIC COMPANY

Specialists in Electric Power Switching and Protection

Instruction Sheet 627-500
April 11, 2005 ©2005
Supersedes Instruction Sheet 627-500 dated 1-19-04

INTRODUCTION

General

The following instructions are for installation of manual or power-operated S&C PMX Modular Metal-Enclosed Switchgear rated 13.8 kV or 25 kV.

An assembly of PMX Switchgear may incorporate many types of components, such as interrupter switches, power fuses, switch operators, a source-transfer control, voltage sensors, current sensors, meters, etc., depending on user requirements.

Instructions for operation of each S&C component are provided in a separate S&C instruction sheet. For each switchgear assembly, the applicable instruction sheets, drawings, and wiring diagrams are bound in a folder entitled "Instruction Manual." This instruction manual is located in a holder inside the appropriately marked switchgear-module door.

Qualified Persons

⚠ CAUTION

The equipment covered by this publication must be selected for a specific application and it must be installed, operated, and maintained by qualified persons who are thoroughly trained and who understand any hazards that may be involved. This publication is written only for such qualified persons and is not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Each assembly of S&C PMX Modular Metal-Enclosed Switchgear is provided with an "INSTALLATION AND OPERATION INFORMATION KIT" located in the holder inside the switchgear-module door on which the label "Installation and Operation Information Kit Inside This Bay" is affixed. The "INSTALLATION AND OPERATION INFORMATION KIT" includes applicable instruction sheets covering installation of the switchgear assembly and operation of components, plus drawings and wiring diagrams. All personnel involved with installation and operation of the switchgear assembly should be thoroughly familiar with the contents of the "INSTALLATION AND OPERATION INFORMATION KIT."

This equipment has been provided with comprehensive access control and operating features to minimize hazards. **However, since this equipment contains high voltage, there are hazards inherently present such that the following precautions should be observed at all times. FAILURE TO OBSERVE THESE PRECAUTIONS MAY RESULT IN SERIOUS INJURY OR DEATH.**

1. Padlocks must be installed and secured on all door handles and manual switch operating handles at all times unless a switch is being operated.
2. Snaplocks must be in place and the keys must be removed.
3. Key interlocks (if applicable) must be in place. Check the operating sequence of key interlocks to verify proper sequencing. After the switchgear is installed, destroy all duplicate keys or make them accessible *only* to authorized persons so that the key interlock scheme will not be compromised. Key interlocks are not security locks.
4. Mechanical cable interlocks are provided to prevent access to fuses unless the switch is open and to prevent operation of stored-energy switch operators when the module door is open. Do not attempt to operate any switch when the enclosure door is open. Periodically, verify that these interlocks are functional. Refer to the instructions under "INTERLOCKS" on page 33.
5. Do not apply any undue force to any handle when attempting to open or close a door or cover. The use of undue force may damage the handle or latching mechanism, or an interlock mechanism may be jammed. Do not attempt to close doors in an effort to reset interlocks. Instead, follow the instructions under "INTERLOCKS" on page 33.

⚠ CAUTION—Continued

6. Do not remove or obscure any of the "CAUTION," "DANGER," or other precautionary signs and labels.
7. Make certain hanging barriers are in place unless work is being performed inside a module.
8. Make certain all switchgear modules are properly grounded.
9. Make certain fuses are disconnected from all power sources (including backfeed) before being inspected or replaced.
10. Test for voltage and install suitable grounding equipment before touching any device that is to be inspected, serviced, or repaired. Voltage testers suitable for this purpose are available from S&C.
11. Always assume both sets of power terminals on switch, fuse, or terminal connections are energized unless proved otherwise by test or visual evidence.
12. Disconnect all voltage transformers and voltage sensors when external voltage is used to test any secondary-side wiring or when heaters are energized for temporary storage. Do not disconnect voltage limiters from voltage sensors when the switchgear is energized.

Read this Instruction Sheet

Read this instruction sheet thoroughly and carefully before installing or operating your S&C PMX Modular Metal-Enclosed Switchgear. Familiarize yourself with "SAFETY INFORMATION" on pages 5 through 7.

Retain this Instruction Sheet

This instruction sheet is a permanent part of your S&C PMX Modular Metal-Enclosed Switchgear. Designate a location where you can easily retrieve and refer to this publication.

Proper Application

⚠ CAUTION

The equipment in this publication must be selected for a specific application. The application must be within the ratings of the equipment. Ratings for this gear are listed on a ratings label located on the outside of the switchgear.

Warranty

The warranty and/or obligations described in S&C's standard conditions of sale, as set forth in Price Sheet 150, plus any special warranty provisions, as set forth in the applicable product-line specification bulletin, are exclusive. The remedies provided in the former for breach of these warranties shall constitute immediate purchaser's or end user's exclusive remedy and a fulfillment of all seller's liability. In no event shall seller's liability to immediate purchaser or end user exceed the price of the specific product which gives rise to immediate purchaser's or end user's claim. All other warranties whether express or implied or arising by operation of law, course of dealing, usage of trade or otherwise, are excluded. The only warranties are those stated in Price Sheet 150, and THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY EXPRESS WARRANTY OR OTHER OBLIGATION PROVIDED IN PRICE SHEET 150 IS GRANTED ONLY TO THE IMMEDIATE PURCHASER AND END USER, AS DEFINED THEREIN. OTHER THAN AN END USER, NO REMOTE PURCHASER MAY RELY ON ANY AFFIRMATION OF FACT OR PROMISE THAT RELATES TO THE GOODS DESCRIBED HEREIN, ANY DESCRIPTION THAT RELATES TO THE GOODS, OR ANY REMEDIAL PROMISE INCLUDED IN PRICE SHEET 150.

The seller's warranties do not apply to major components not of S&C manufacture, such as surge arresters, current-limiting fuses, instrument transformers, relays and meters, low-voltage circuit breakers, remote terminal units, and terminators. However, seller will assign to immediate purchaser or end user all manufacturers' warranties that apply to such components.

Understanding Safety-Alert Messages

There are several types of safety-alert messages which may appear throughout this instruction sheet as well as on labels and tags attached to the PMX Switchgear. Familiarize yourself with these types of messages and the importance of the various signal words, as explained below.

⚠ DANGER

"DANGER" identifies the most serious and immediate hazards which *will likely* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices which *can* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices which *can* result in minor personal injury or product or property damage if instructions, including recommended precautions, are not followed.

NOTICE

"NOTICE" identifies important procedures or requirements that, if not followed, *can* result in product or property damage if instructions are not followed.

Following Safety Instructions

If you do not understand any portion of this instruction sheet and need assistance, contact your nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C's website www.sandc.com. Or call S&C Headquarters at (773) 338-1000; in Canada, call S&C Electric Canada Ltd. at (416) 249-9171.

NOTICE

Thoroughly and carefully read this instruction sheet before installing your S&C PMX Modular Metal-Enclosed Switchgear.

Replacement Instructions and Labels

If you need additional copies of this instruction sheet, contact your nearest S&C Sales Office, S&C Authorized Distributor; S&C Headquarters, or S&C Electric Canada Ltd.

It is important that any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

Enclosure Security

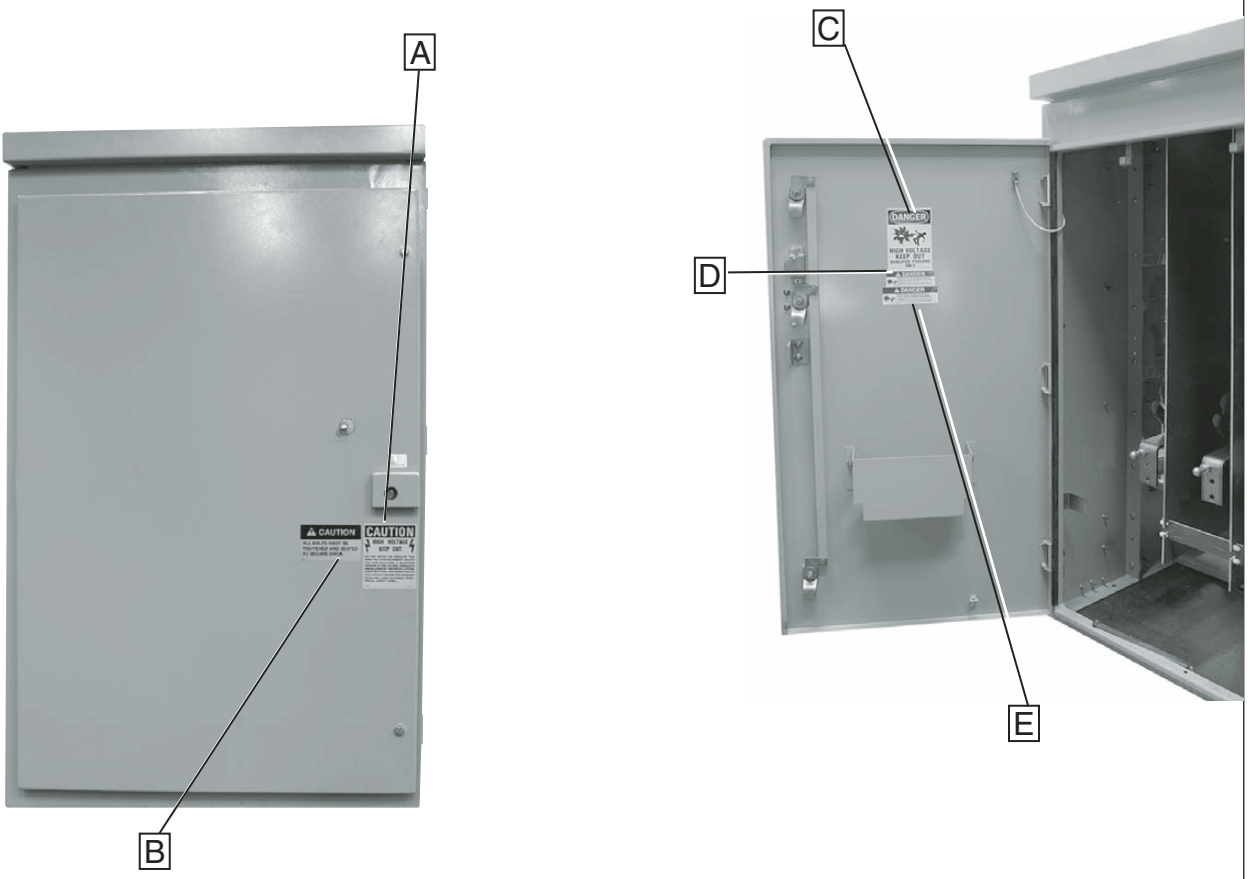
S&C PMX Switchgear incorporates many provisions to minimize hazards to qualified persons and to the general public. Each module is fabricated from 11-gauge steel sheet and is free-standing, and self-supporting. There are always double walls between adjoining modules. Provisions for future bus extension are closed with a panel that is secured internally.

Doors are constructed of 11-gauge hot-rolled, pickled and oiled steel sheet. Door-edge flanges overlap with door-opening flanges and are formed to create a mechanical maze that guards against water entry and discourages tampering or insertion of foreign objects, but allows ventilation to help keep the enclosure interior dry. Each door is equipped with a door handle. The door handle is padlockable and incorporates a hood to protect the padlock shackle from tampering.

Access Control

Access is from the front and rear only. Doors providing access to power fuses are mechanically or key interlocked with the associated interrupter switch. Doors and hinged-bolted panels providing access to high-voltage components are provided with flush-mounted key-operated snaplocks and have provisions for padlocking. In addition, the hinged-bolted panels are secured by a pentahead bolt provided with a protective hood, midway between the top and bottom of the panel. Hex bolts are provided to secure the door near the top and bottom.

Location of Safety Labels



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Number
A	⚠ CAUTION	High Voltage—Keep Out	G-4900R2
B	⚠ CAUTION	All Bolts Must Be Tightened	G-9055
C	⚠ DANGER	Danger—High Voltage—Keep Out	G-6500
D	⚠ DANGER	Danger—Switches May Be Energized By Backfeed	G-6501
E	⚠ DANGER	Danger—Fuses May Be Energized By Backfeed	G-6502

Packing

Each module is fastened to its own wooden skid. Fuses, end-fittings, and splice-plate kits are packaged separately.

At the first opportunity, remove all packing materials (cardboard, paper, foam padding, etc.) from the outside of the module. This will prevent the finish from being damaged by rainwater absorbed by the packing materials and will also prevent wind-induced abrasion from loose cardboard.

Inspection

Examine the shipment for external evidence of damage as soon after receipt as possible, preferably before removal from the carrier's conveyance. Check the bill of lading to make sure that all shipping skids, crates, and containers listed thereon are present.

If there is visible loss and/or damage:

1. Notify the delivering carrier immediately.
2. Ask for carrier inspection.
3. Note condition of shipment on all copies of the delivery receipt.
4. File a claim with the carrier.

If concealed damage is discovered:

1. Notify the delivering carrier within 15 days of receipt of shipment.
2. Ask for a carrier inspection.
3. File a claim with the carrier.

Also, notify S&C Electric Company in all instances of loss and/or damage.

Handling

⚠ WARNING

When handling PMX Switchgear with an overhead hoist, observe standard lifting practices as well as the general instructions below. **Failure to follow these precautions can result in serious personal injury or equipment damage.**

Step 1

Make sure that the lifting tabs are securely bolted to the module before lifting it.

Step 2

Use 6-foot or longer hoist slings of equal length to prevent overstressing the enclosure during lifting.

Step 3

Arrange the hoist slings so as to distribute the lifting forces equally between the lifting tabs. See Figure 1.

Step 4

Avoid sudden starts and stops.

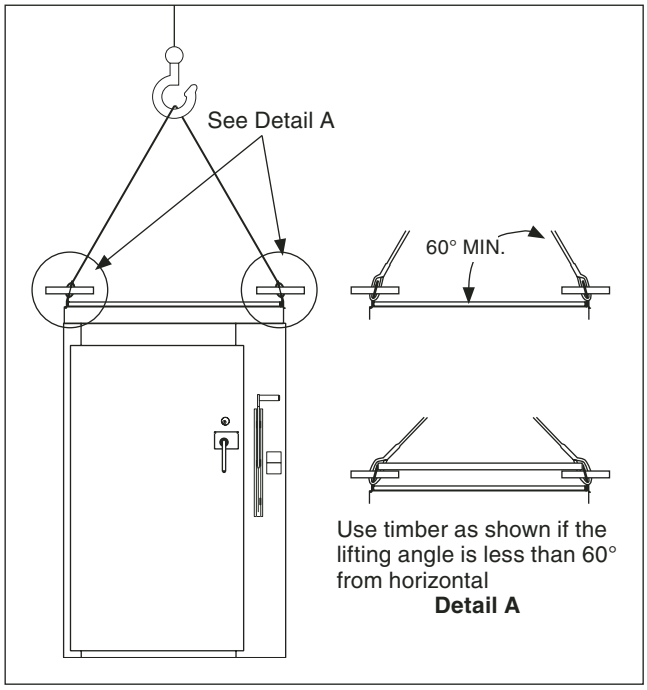


Figure 1. Hoisting arrangements.

BATTERY STORAGE

Remote supervisory modules of PMX Switchgear may include an S&C Battery Charger and battery packs. When furnished, the battery charger and battery packs are installed in the switch operator.

NOTICE

Remote supervisory modules of PMX Switchgear furnished with a battery charger and battery packs should preferably be installed and energized immediately. If the modules cannot be installed immediately, store them in a clean, cool, dry room, or remove the battery packs and store them in a cool, dry place. See S&C Instruction Sheet 669-515 for instructions on removing the battery packs. **Storing the battery packs at high temperatures will reduce their operating life.**

If the battery packs are not removed while the gear is in storage, make sure the power on/off switch on the battery charger is in the "OFF" position. See Figure 2. **The power will be drained from the battery packs if the switch is in the "ON" position.**

If the gear is not placed in service by the date shown on the tag attached to the switch operator containing the battery packs, the battery packs must be charged as instructed on page 11. **The battery packs will be damaged if allowed to discharge completely.**

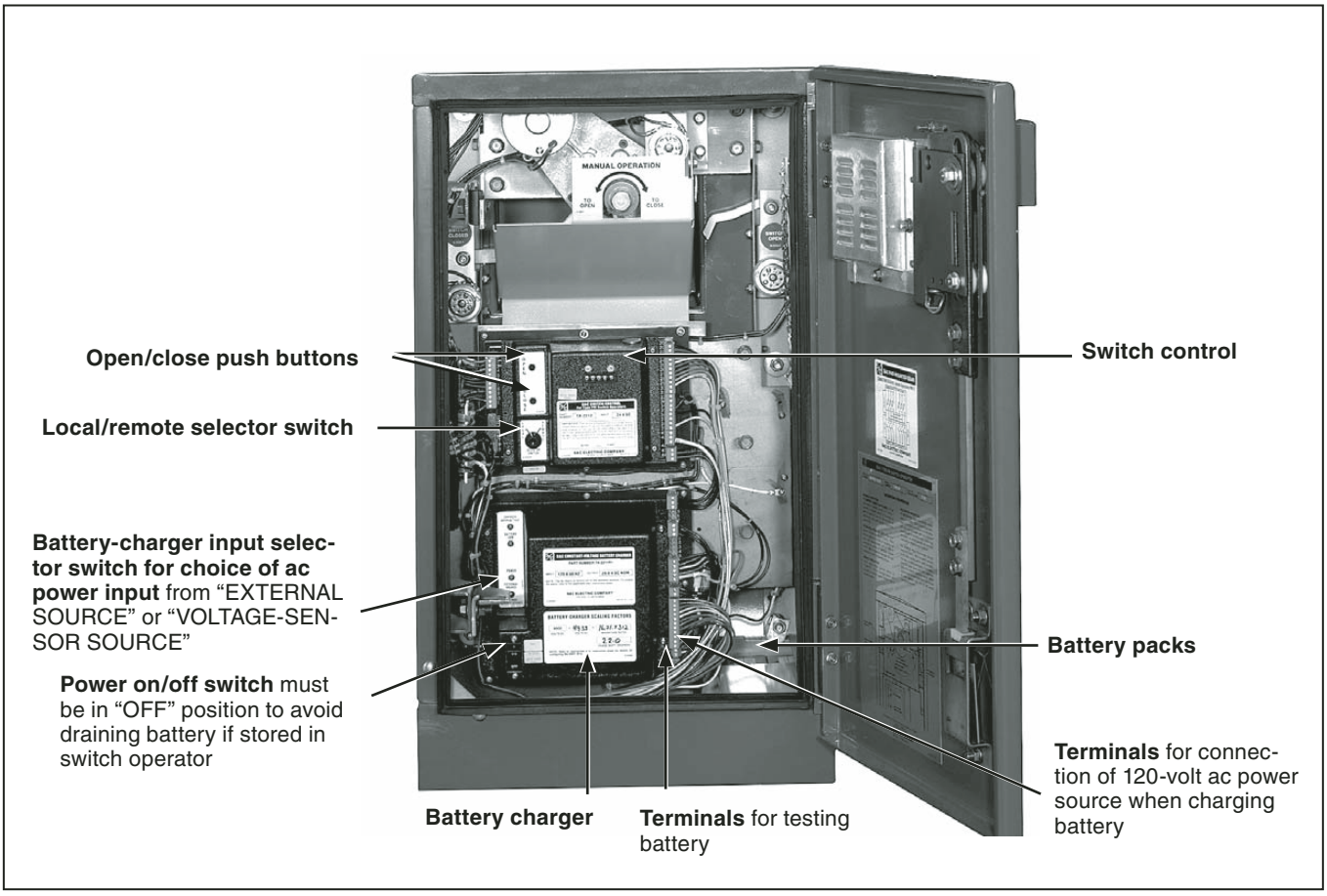


Figure 2. Interior view of Type PM Switch Operator showing battery packs and battery charger.

Charging the Battery

If the PMX Switchgear has not been placed in service by the date shown on the tag attached to the switch operator containing the battery, the battery charger must be connected to a transformer-isolated 120-volt ac power source to charge the two 12-volt dc battery packs. See Figure 2. To connect a 120-volt ac power source to the battery charger, proceed as follows:

1. Open the switch operator door as described under "Access to Interior" on page 12.
2. Make sure that the power on/off switch on the battery charger is in the "OFF" position.
3. Using a voltmeter, check the open-circuit voltage of each battery pack by placing the probes on the appropriate "1" and "2" terminals on the battery charger. One set of terminals is provided for each battery pack. See Figure 2.
   a. If the open-circuit voltage of either battery pack is less than 10 volts dc, both battery packs must be replaced. Refer to S&C Instruction Sheet 669-515 for instructions on replacing the battery packs. Then proceed to Step 7 below.
   b. If the open-circuit voltage of each battery pack is 10 volts dc or greater, continue with Step 4 below.
4. Place the battery-charger input selector switch in the "EXTERNAL SOURCE" position.
5. Connect a transformer-isolated 120-volt ac power source to the two terminals marked "EXT/AC" on the battery charger. Place the power on/off switch on the battery charger in the "ON" position and charge the battery for 24 hours.
6. After charging the battery, place the power on/off switch on the battery charger in the "OFF" position. Then disconnect the 120-volt ac power source, and place the battery-charger input selector switch in the "VOLTAGE-SENSOR SOURCE" position.
7. Secure the switch operator door.

Access to Interior

To Open Doors and Panels

Enclosure Door

Step 1

The non-removable manual handle rotates for door opening. As illustrated in Figure 3, open the door by moving the handle clockwise 90° until door is unlatched.

Step 2

Pull the door open and secure it with the doorstop.

⚠ CAUTION

Do not apply undue force to any door handle when attempting to open a door. The use of undue force may damage the door handle and latching mechanism, or an interlock may be jammed. Verify that the snap locks are unlocked and that opening the door is in the sequence dictated above.

Rear Access Panel

Step 3

The rear access panel employs a pentahead/hexhead bolting scheme. There are three bolts located on the panel: Two hexhead bolts located each at the top and the bottom, and a pentahead bolt in the middle covered by a protective hood; see Figure 4. Using the appropriate socket wrench or tool, loosen and remove the bolts by rotating the tool counterclockwise.

Step 4

Pull the panel open and secure it with the doorstop.

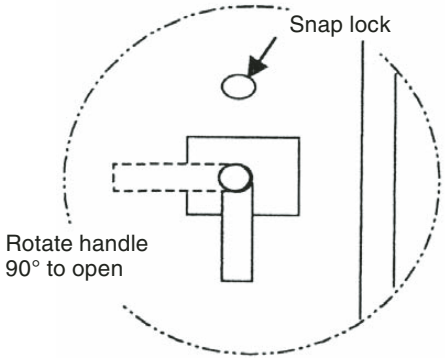


Figure 3. Non-removable manual handle—requires rotation of 90° to open or close door. Handle is padlockable. A snaplock is also pictured.

Figure 4. Pentahead bolts secure the rear access panel.

To Close Doors and Panels

Enclosure Door

Step 5

Release the doorstop, and push and hold the door closed. Then rotate the handle counter clockwise to engage the latch points. See Figure 3.

Step 6

Pull outward on the handle cover to verify that the door has latched securely and insert a padlock into the hasp.

Rear Access Panels

Step 7

Release the doorstop and tighten the three bolts by rotating the wrench, or other appropriate tool, clockwise until the bolts are sufficiently tight.

Step 8

Pull outward on the access panel to verify that the door has latched.

Placement

Step 9

Transport the switchgear to the installation site observing the precautions given under “Handling” on page 9.

Step 10

At the installation site, remove all the separately packaged components, which were shipped within the module, and set them aside.

Step 11

Each module of an assembly is identified by a number on the front of the module See Figure 5. Proper positioning of the module is indicated on the anchor-bolt plan of the “CDA” drawing, enclosed in the waterproof envelope labeled “Instruction Manual.”

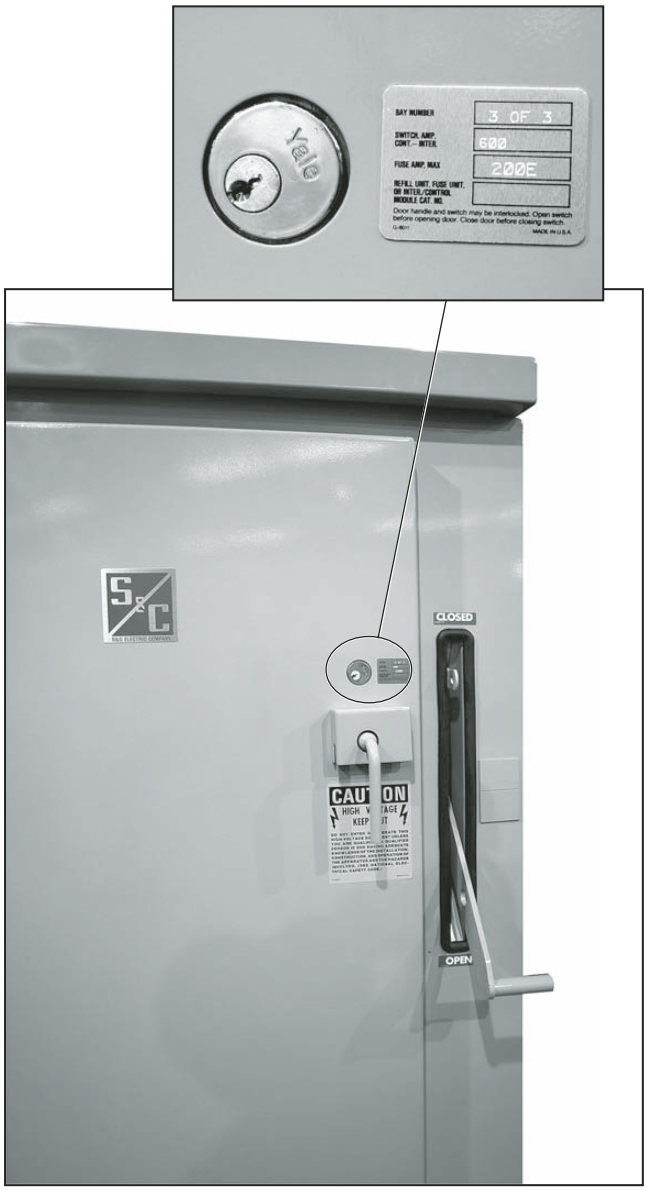


Figure 5. Location of module identification.

When assembling PMX Switchgear, the module having working clearance most affected by adjacent walls should be placed first.

Unbolt the module from its skid and lift observing the precautions given under "Handling" on page 9. Align the channel base so that it is centered on and square with the anchor bolts.

Step 12

Be sure to obtain a weather-tight seal between modules by applying a single thickness of adhesive-backed foam gasketing tape (provided) around exposed edges and roof section between adjoining modules. See Figure 6.

Step 13

Level each module using metal shims as required. Secure each module to the pad using the anchor clips and anchor bolt nuts provided. See Figure 7. Securely tighten the nuts. Make sure the module doors and panels open and close without binding. Binding indicates enclosure distortion which must be corrected by additional shimming.

Figure 6. Apply gasketing tape ⅛ inch from edge.

Figure 7. Installing anchor clips and nuts.

Step 14

Apply resilient grout at the bottom of each module to prevent entry of rodents, insects, or weeds. It is recommended that the grouting be recessed sufficiently from the exterior exposure to permit caulking with a weatherproof compound, applied with a standard caulking gun. A room-temperature vulcanizing (RTV) silicone rubber compound is recommended.

Step 15

On multi-module assemblies shipped in individual modules, align, level, center, check door operation, grout, and caulk succeeding modules in turn, and join modules with the ½″–13 galvanized bolts provided. The bolts may be easily pressed through the gasketing tape. *Do not attempt to draw misaligned modules together with these bolts.* See Figure 8.

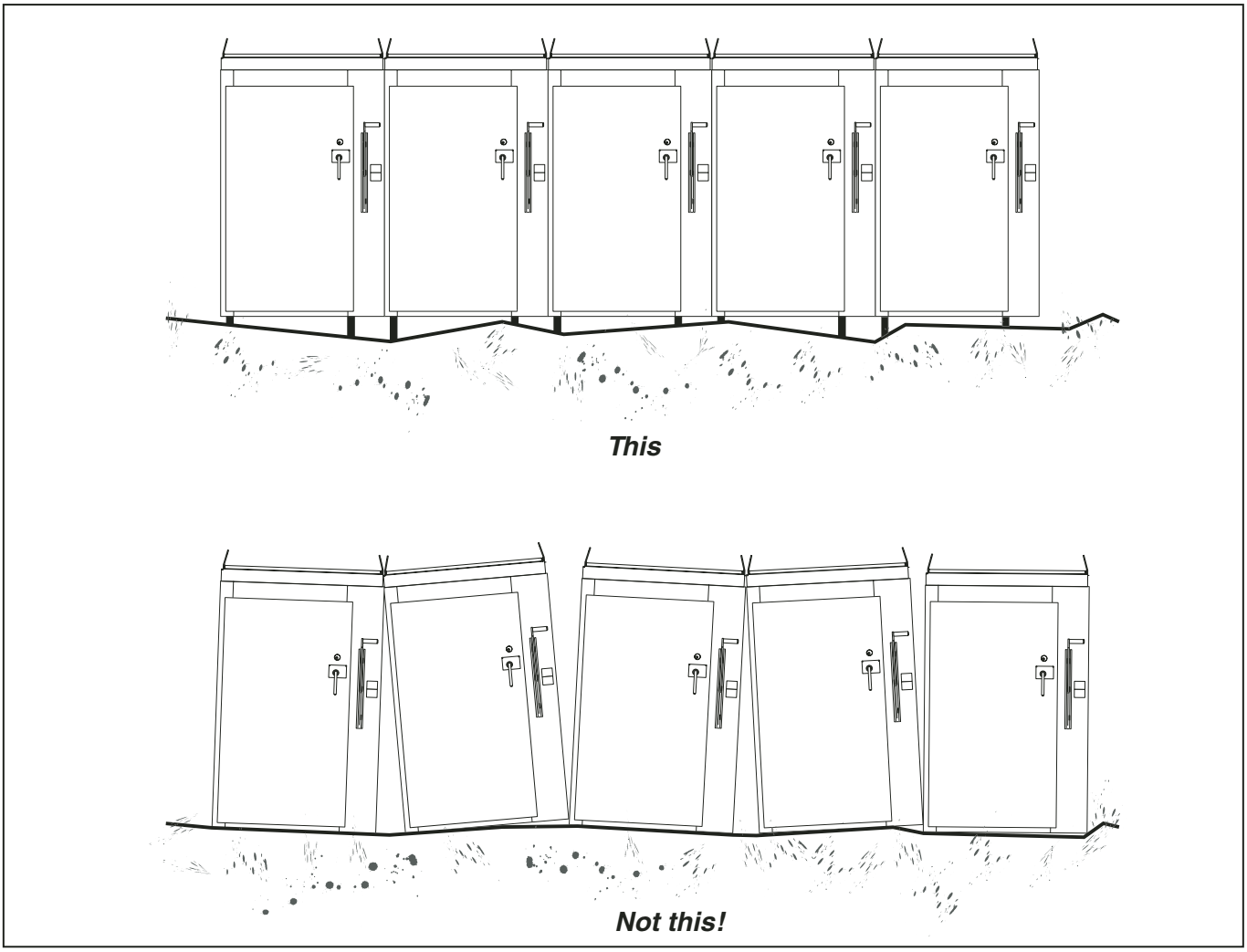


Figure 8. Alignment of PMX Switchgear modules.

Cable Terminations

NOTICE

The roof is heavy. At least two line crew are needed to remove the roof.

Step 16

For each module, remove the ½ × 13 hex-head stainless-steel cap screws, lockwashers, and flat washers that attach the roof section to the module. See Figure 9. Each roof section will have two capscrews, two lockwashers, and two flat washers. In order to remove the roof, grasp with both hands and pull forward until it is stopped by the two neoprene rollers. Then, push down on the roof so that the side channels clear the rollers. Next, continue to pull the roof forward—with the help of the second person—until the roof section is clear of the switchgear. See Figure 10.

Figure 9. Removing bolts for roof section.

Figure 10. Sliding off roof section.

Step 17

Make up the cable terminations. Terminal pads accommodate one or, optionally, two conductors per phase up to 750 kc mil.

Step 18

Slide the roof section back into position the same way it was removed,and securely tighten the bolts.

Preparing for Service

Step 19

The bus construction in PMX Switchgear is typically aluminum, as are the terminal pads of components. Such connections employ Belleville (formed spring-steel) washers. See Figure 11. Check these connections, but do not tighten factory-made connections employing Belleville washers unless they are visibly loose; they have been correctly torqued to 50 foot-pounds at the factory.

NOTE: For modules furnished with copper bus, silver-to-silver connections are provided. These connections employ brass flat washers rather than Belleville washers and should be torqued to 35 foot-pounds since they may have loosened during shipment. Check bus connections and, where necessary, correctly tighten the connecting hardware.

NOTE: For modules employing enhanced fuse handling construction, **do not** attempt to remove the fuse access panel. Follow Steps 3 and 4 on page 12 to remove the rear access panel. Also remove the hanging barrier. The main bus can now be accessed.

For inter-module splices in the main bus and ground bus, splice-plate kits have been provided. These kits contain splice plates, bolts, nuts, washers, a sheet abrasive paper, a tube of Penetrox® A compound, and instructions. For modules furnished with aluminum bus, both bus ends and splice-plates have been pre-abraded and coated with a thin layer of oxidation-inhibiting grease at the factory.

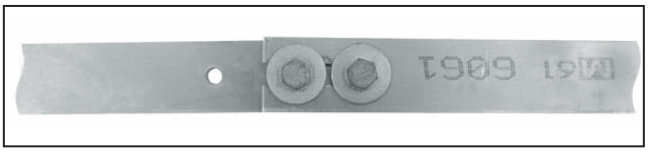


Figure 11. Main bus with Belleville washers (if applicable).

To ensure the highest quality joints, mating surfaces of aluminum bus ends and splice plates should be re-abraded with the abrasive paper provided and immediately coated with a uniform layer of Penetrox A, just prior to making bolted connections.

NOTE: For copper main bus and ground bus, joint surfaces are silver-plated and require no corrosion-inhibiting compounds. Merely wipe surfaces with a clean dry cloth. Do not attempt to remove any discoloration. Such discoloration is characteristic of silver.

⚠ CAUTION

To ensure adequate electrical clearances, splice plates and hardware *must* be installed in the manner described and illustrated in the text and figures that follow. Failure to comply with these instructions may reduce the BIL capability of the switchgear.

Semi-conducting grommets must be installed on the through-bushings before installing splice plates. See Figure 12. Failure to install grommets will result in corona discharge between the bus splice plates and the bushings.

Figure 12. Grommets on the through-bushings.

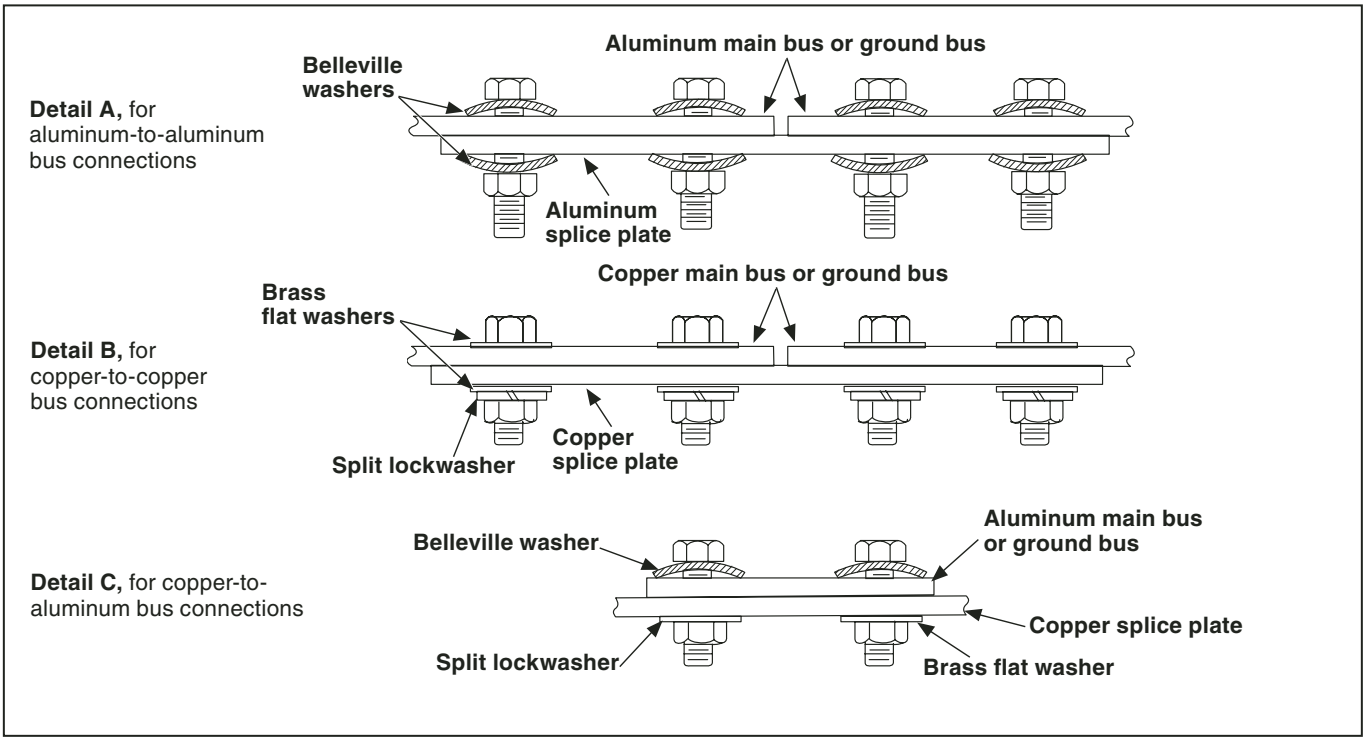


Figure 13. Installation of inter-module bus splices.

Step 20

Make up bus splices as follows. See Figures 13, 14 and 15.

(a) *For aluminum-to-aluminum bus connections:* Place the splice plate on the *bottom* of the ends of the main bus sections, and on the side of the ground bus that faces the interior of the module. Make up the connections using one Belleville washer under the head of each bolt and one Belleville washer under each nut. The bolts *must* be installed with the bolt head on the top side of the main bus. Belleville washers *must* be installed with the outer ring of the cup toward the bus. See Figure 13, Detail A. Tighten all bolts to 50 foot-pounds using a torque wrench. If a torque wrench is not available, tighten until the Belleville washers are flat, then back off one-half turn. Do not use lockwashers with Belleville washers.

(b) *For copper-to-copper bus connections* (which include silver-plated copper connections): Place the splice plate on the *bottom* of the ends of the main bus sections, and on the side of the ground bus that faces the interior of the module. Make up the connections using one brass flat washer under the head of each bolt, and one brass flat washer plus one split lockwasher under each nut. The bolts *must* be installed with the bolt head on the top side of the main bus. See Figure 13, Detail B. Tighten all bolts to 35 foot-pounds using a torque wrench. If a torque wrench is not available, tighten until the split lockwashers are flat.

(c) *For copper-to-aluminum bus connections:* Place the splice plate on the *bottom* of the ends of the main bus sections, and on the side of the ground bus that faces the interior of the module. Make up the connections using one Belleville washer under the head of each bolt, and one brass flat washer under each nut. The bolts *must* be installed with the bolt head on the top side of the main bus. See Figure 13, Detail C. Tighten all bolts to 50 foot-pounds using a torque wrench. If a torque wrench is not available, tighten until the Belleville washers are flat, then back off one-half turn. Do not use lockwashers with Belleville washers.

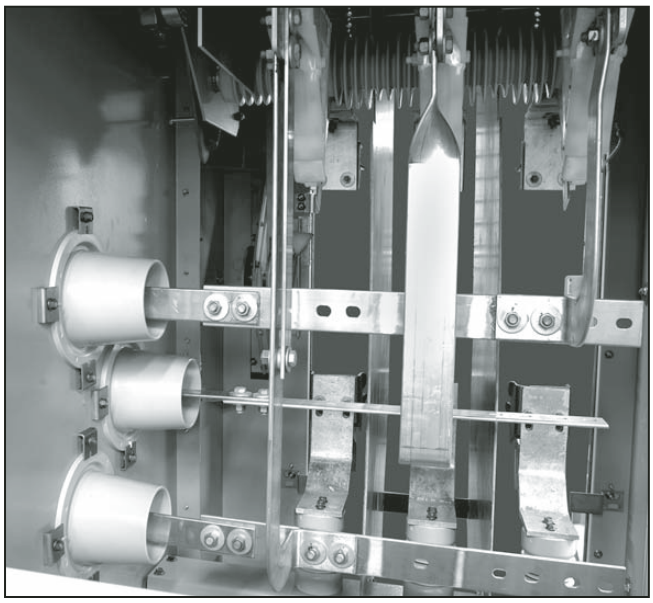


Figure 14. Installation of bus splice plates for through-bushings.

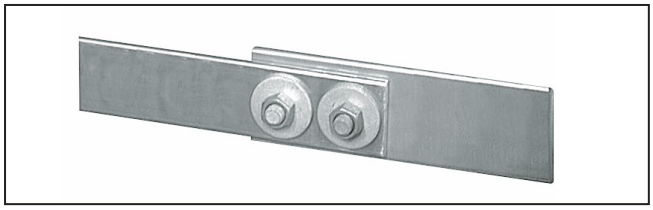


Figure 15. Splice plates must be placed between the main bus and bolts.

Step 21

Connect the ground bus (or ground pad on single module assembly) to the system grounding facility in accordance with the user's standard grounding practice. Use a cable not smaller than 1/0 copper, or equivalent. If the maximum momentary rating of the switchgear is to be realized, the equivalent of 750 kc mil of copper cable is required, in either a single or multiple connection.

Step 22

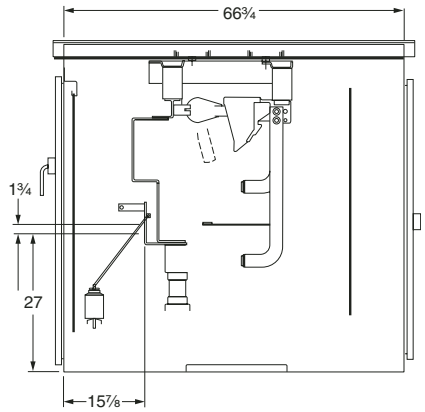
Make up the medium-voltage cable terminations, following the cable-terminator manufacturer's instructions and clearances shown in Figure 16.

⚠ WARNING

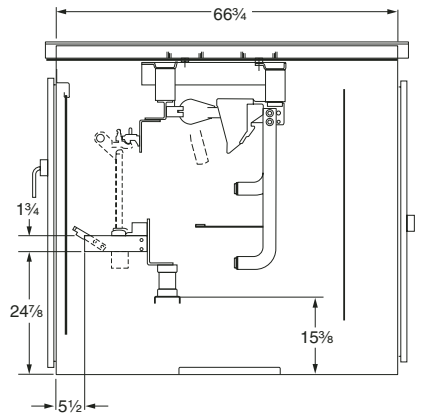
Maintain proper clearances when installing cable terminators. **Failure to maintain proper clearances can result in a flashover, injury, and equipment damage.**

To maintain the rated BIL, the following *minimum* clearances are required:

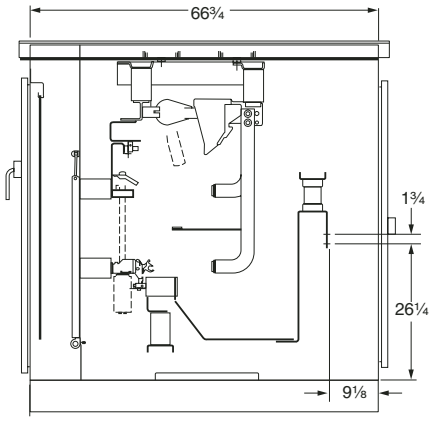
Rating, kV		Minimum Clearances, Inches	
Nom.	BIL	To electrical ground	To insulating barriers
13.8 25	95 125	6 7.5	1 2.25



Detail A, for all modules with switches only



Detail B, for modules with live-front fuse handling



Detail C, for modules with enhanced fuse handling

Figure 16. Dimensions and layout of cable terminations.

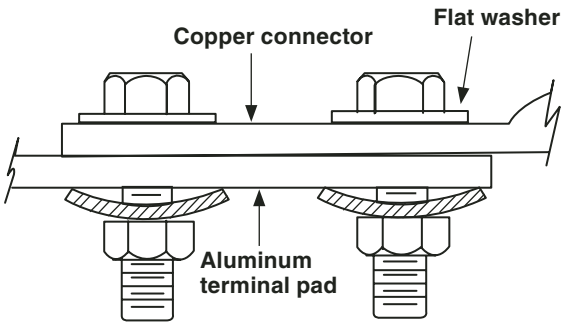
Step 23

Make up the terminal pad connections.

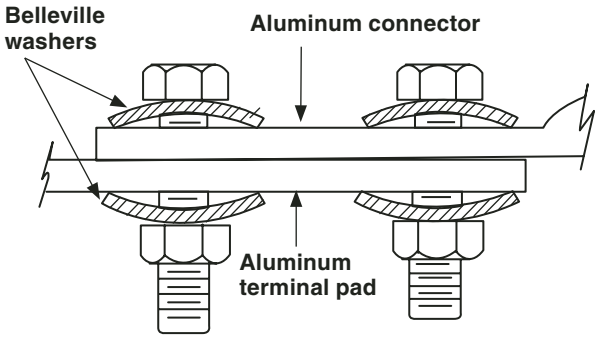
NOTE: Torque values apply only to the ½-inch hardware described and not to connectors used to secure primary leads of voltage transformers or surge arresters to the bus.

(a) *For aluminum terminal pads to tinned-copper or tinned-bronze connectors* (untinned-copper or untinned-bronze connectors are not recommended), use ½-inch galvanized steel hardware, with one Belleville washer (not furnished) against the aluminum terminal pad and one galvanized steel flat washer against tinned connector, as shown in Figure 17, Detail A. Tighten steel bolts to 50 foot-pounds using a torque wrench. If a torque wrench is not available, tighten until the Belleville washers are flat, and then back off one-half turn. Do not use lockwashers with Belleville washers.

(b) *For aluminum terminal pads to aluminum connectors*, use ½-inch aluminum or galvanized steel hardware with two Belleville washers (not furnished) as shown in Figure 17, Detail B. Tighten aluminum bolts to the manufacturer's specifications. Tighten steel bolts to 50 foot-pounds using a torque wrench. If a torque wrench is not available, tighten until the Belleville washers are flat, and then back off one-half turn. Do not use lockwashers with Belleville washers.



Detail A, for aluminum terminal pads to tinned-copper or untinned-bronze connectors

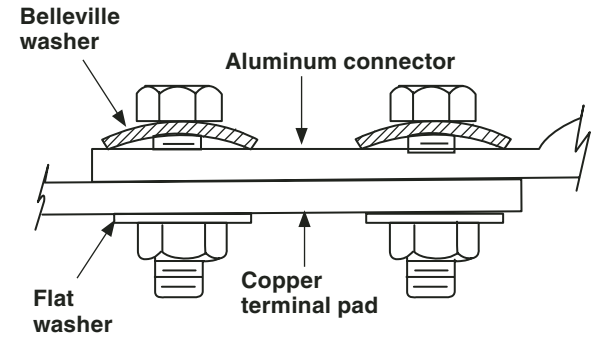


Detail B, for aluminum terminal pads to aluminum connectors

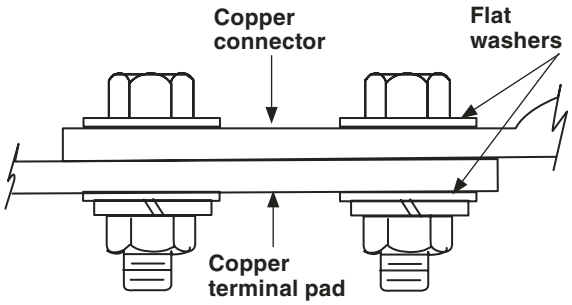
Figure 17. Terminal pad connections for aluminum terminal pads.

(c) *For copper terminal pads to aluminum connectors*, use ½-inch galvanized steel hardware with one Belleville washer (not furnished) against the aluminum connector and one galvanized steel or brass flat washer against the copper terminal pad as shown in Figure 18, Detail A. If the Belleville washer extends beyond the edge of the aluminum connector, the positions of the Belleville washer and flat washer should be reversed, i.e., place the Belleville washer against the copper terminal pad and the flat washer against the aluminum connector. Tighten aluminum bolts to the manufacturer's specifications. Tighten steel bolts to 50 foot-pounds using a torque wrench. If a torque wrench is not available, tighten until the Belleville washers are flat, and then back off one-half turn. Do not use lockwashers with Belleville washers.

(d) *For copper terminal pads to tinned-copper or tinned-bronze connectors*, use ½-inch Everdur or stainless-steel hardware, with one galvanized steel or brass flat washer against each terminal and one split lockwasher under the nut as shown in Figure 18, Detail B. Tighten the bolts to 35 foot-pounds using a torque wrench. If a torque wrench is not available, tighten each bolt until the split lockwasher is flat.



Detail A, for copper terminal pads to aluminum connectors



Detail B, for copper terminal pads to tinned-copper or untinned-bronze connectors

Figure 18. Terminal pad connections for copper terminal pads.

Step 24

If necessary, interphase barriers can be removed to facilitate makeup and connection of cable terminations to switch, fuse, or bus terminals. See Figure 19. *If the interphase barriers are removed, note their positioning to ensure correct reinstallation later.* Make sure the connection of the incoming-power source(s) to the switchgear terminals is in the proper phase sequence.

⚠ CAUTION

When making up connections, avoid placing any intentional strain on switch or fuse terminals. It is important that each cable-terminator connector be flat against the corresponding switch or fuse terminal pad, with the bolt holes in alignment. *Do not use the connecting bolts to pull cables into alignment.* Failure to comply with these precautions may cause misalignment of the switch or fuse.

Step 25

Before connecting cable terminators to the terminal pads, thoroughly wire-brush *aluminum* contact surfaces as shown in Figure 20, to remove any dirt or foreign materials as well as the natural surface oxides. Immediately coat both contact surfaces, to ½-inch beyond the joint, with a uniform layer of Penetrox A.

NOTE: Copper terminals have a thin layer of silver applied to contact surfaces. These surfaces must be prepared as described in the "NOTE" in Step 19 on page 17.

NOTE: For access to the bus when the optional compartmentalization feature is included, remove the barrier shown in Figure 20.

Figure 19. Interphase barriers.

Figure 20. Aluminum terminal pads (compartmentalization option shown).

Step 26

If secondary and control wiring are present, all terminals should be checked for tightness, and the jumpers between terminal blocks of adjacent modules should be reconnected at points where "shipping splits" occur. The individual wires at these blocks are marked to correspond with the adjacent terminal-block marking. Reconnection of these wires should be checked with reference to the applicable "CDR" or "QCDR" wiring diagram included with this instruction manual. If connector plugs and receptacles are used in lieu of terminal blocks at points where shipping splits occur, connect the mating plugs and receptacles.

Step 27

⚠ CAUTION

Remove all temporary jumpers that have been connected across the current-transformer secondaries (if applicable) and remove all shorting screws from the shorting-type terminal blocks. Store all shorting screws for future use in the holes provided in the terminal blocks. **Note:** Failure to remove the shorting screws will make all schemes that rely on output from the CTs inoperative.

Step 28

⚠ WARNING

Switch operators and manual operating handles may be equipped with key and/or mechanical interlocks which, for example, guard against switch operation when the door to the module containing the interrupter switch is open. Check functional operation of mechanically interlocked doors and switch-operating mechanisms. Refer to "INTERLOCKS" on page 33. **Note:** Failure to check and adjust interlocks may result in personal injury or death.

Key interlocks—in which the key is retained in the open position—as shown in Figure 21, are sometimes shipped separately to prevent key breakage during shipment. Install such interlocks with the bolts provided. See the key sequence on the single-line diagram of the "CD" drawing.

Figure 21. Key interlock.

Step 29

Fuse holders, fuse units, end fittings, interrupting modules, etc. are packaged separately.

(a) Assemble these components following the procedure described in the S&C instruction sheet packed with the applicable fuse components.

(b) Install the fuses in the fuse mountings following the appropriate procedure described in the S&C instruction sheet on operation, which is included with this switchgear. See Figure 22.

(c) Make sure that the fuses are fully closed and latched.

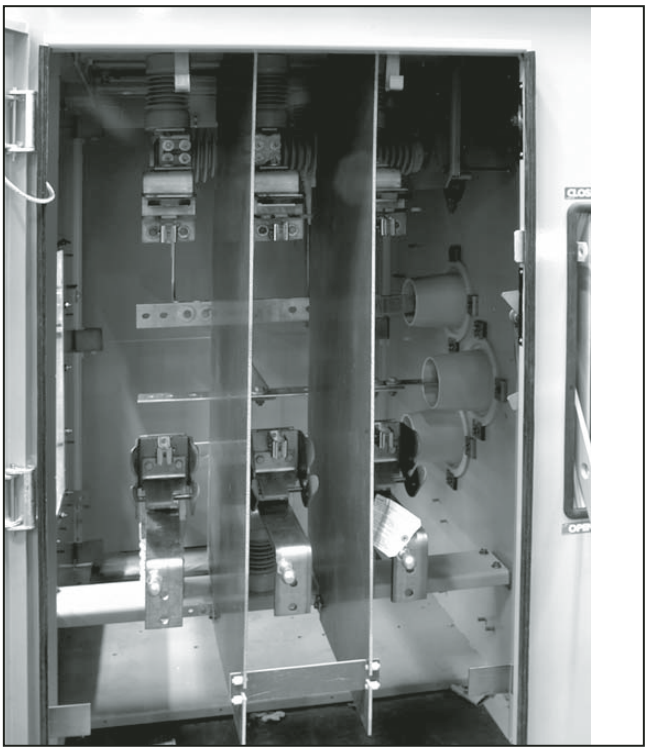


Figure 22. Fuse mountings.

Step 30

For PMX Switchgear furnished with a source-transfer entrance module and the optional overcurrent lockout feature, Catalog Number Suffix "-Y21", six S&C Current Sensors—packed separately—are provided. Connect the leads from the current sensors the module to the terminal block located in the terminal block compartment—behind the bolted panel labeled "Terminal Blocks." See Figure 23.

The bottom plate of the terminal block compartment is removable to facilitate makeup of an entrance hole for the lead wires. If conduit is not used, protect the lead wires from abrasion against the knockout opening with a rubber grommet or by taping. Then apply a suitable compound to fill the space between the lead wires and the opening to prevent entry of moisture or rodents.

NOTICE

Openings made into the terminal-block compartment must be sealed with a suitable compound to prevent the entry of moisture or rodents. **Failure to properly seal the openings can result in damage to the electronic equipment.**

NOTICE

For PMX Switchgear furnished with optional switch-terminal adapters (which permit two cables per phase), twelve S&C Current Sensors —packed separately—are provided. Install the current sensors in accordance with the wiring diagram provided. **The automatic source-transfer scheme will not operate properly if only six current sensors are installed.**

Figure 23. Terminal-block compartment.

Step 31

Refer to the applicable wiring diagram and make the appropriate connections from the current sensors (with polarity marked on top) to the terminal blocks. Then attach each current sensor to its associated high-voltage cable as follows:

1. Remove the ¼″– 20 gap nut on the current sensor. With polarity marked on top, open the current sensor and place it around the appropriate high-voltage cable. Now replace and securely tighten the gap nut.
2. Secure the current sensor to the high-voltage cable *at a point below the cable terminator or stress cone* using the plastic wire ties furnished. See Figure 24. The current sensor may be placed against the grounded concentric neutral of the cable—in which case the concentric neutral *must* be brought back through the sensor—or it may be placed against the semi-conducting jacket of the cable— in which case the drain wire of the terminator *must* be brought through the sensor.

The terminal blocks furnished with the optional auxiliary switch, Catalog Number Suffix "-C9"; optional remote-indication feature, Catalog Number Suffix "-Y4"; and optional supervisory control feature Catalog Number Suffix "-Y6" are also located in the terminal block compartment. Refer to the applicable wiring diagram and make the connections as required.

Step 32

Connect the cable concentric-neutral ground wires and ground pads inside the source-transfer module to the system grounding facility in accordance with the user's standard grounding practice. Use the equivalent of 4/0 copper cable (or cable sized in accordance with the user's standard practice) in either a single or a multiple connection to realize the maximum momentary rating of the gear. For a multiple connection, cables smaller than 1/0 copper or equivalent should not be used.

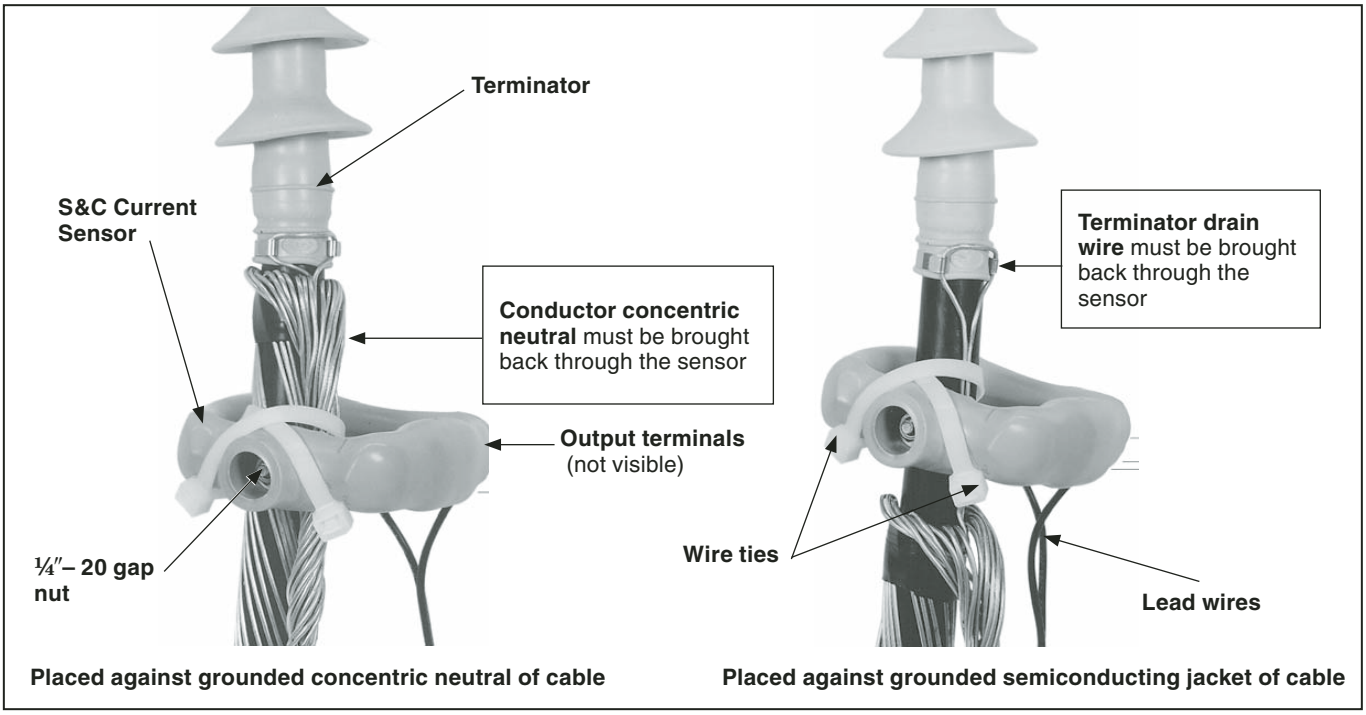


Figure 24. Typical methods for attaching S&C Current Sensor to high-voltage cable.

Step 33

Install and connect surge arresters, if applicable.

Step 34

Sweep debris from the floors of the modules and wipe barriers, insulators, bushings, terminators, switches, and fuses clean with a mineral-spirits solvent. Dry with a clean dry cloth.

Step 35

Check functional operation of key and mechanical interlocks, if furnished.

Step 36

Remove all shipping tapes and "module-number" labels and clean up any remaining adhesives. Wipe down the exterior of the modules with a clean damp cloth.

⚠ CAUTION

Before Walking Away . . .

1. Check the interior of each module for foreign materials, tools, etc., that may have been mislaid on high-voltage bus and supporting members.
2. Make certain that switch operators, if furnished, are coupled to interrupter switches.
3. Make certain that all selector switches on the source-transfer control—if applicable—are in the desired position.
4. Make certain that all fuses are fully closed and latched.
5. Close and securely latch all switchgear module doors.
6 Make certain that all interrupter switches are in the correct positions, open or closed, as dictated by electrical system design.
7. Make certain that all grounding means have been removed.
8. Padlock all doors, handles, switch-operating handles, and covers (if applicable).

Additional instructions on correct positioning of specific components are contained in the S&C instruction sheets for those components. Refer to the instruction manual provided with the switchgear.

Since provisions for future extensions are standard on all PMX Switchgear, additions to existing assemblies may be easily made. To minimize outage time, proceed as follows:

Step 1

De-energize and properly ground the switchgear following the procedures outlined in the "WARNING" on page 36.

Step 2

Remove the end plate from the existing module by removing the appropriate hardware on the inside of the module. See Figures 25 and 26. Also, remove the cover plate for the ground bus. See Figure 27. Apply gasketing between the existing module and the new module. See Step 12 and Figure 6 on page 14.

Figure 25. Interior view of existing module before removal of end plate.

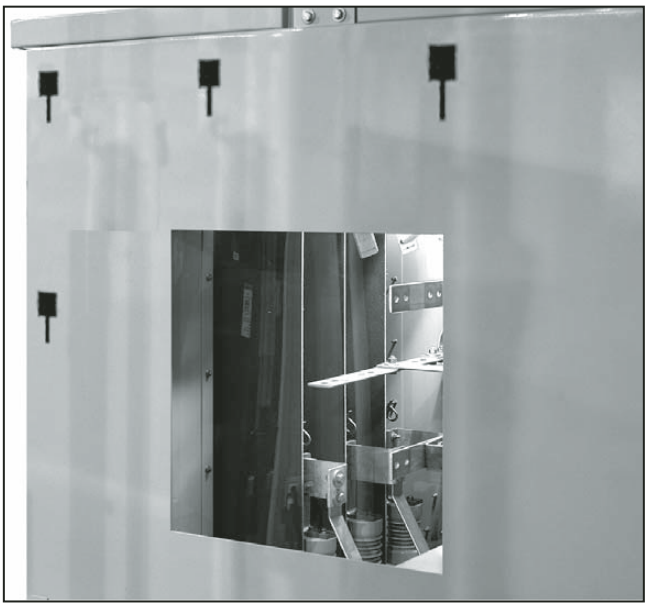


Figure 26. End plate of existing module removed to accept new module.

Figure 27. Exterior view of ground bus plate on existing end module.

Step 3

Move the new module into place immediately adjacent to the existing end module. Complete all bus and cable connections and other operations described in Steps 9 through 36, on pages 13 through 28.

Step 4

Perform the precautionary checks listed under "Before Walking Away" on page 28.

Step 5

Following the procedures outline in the "WARNING" on page 29, make certain all temporary grounds have been removed before re-energizing the switchgear.

S&C PMX Modular Metal-Enclosed Switchgear incorporates S&C's field-proven components for switching and protection of high-voltage power distribution circuits. These components, which are available in a variety of combinations to meet system requirements, are briefly described below. For complete instructions on these components, refer to the applicable S&C instruction sheets in the instruction manual furnished with each assembly of PMX Switchgear. The information that follows is provided for preliminary familiarization with these components.

Mini-Rupter Switch

The S&C Mini-Rupter Switch is a three-pole group-operated interrupter switch. It is applied in PMX Switchgear for switching loads of up to 600 continuous amperes at 13.8 kV and 25 kV. Mini-Rupters used in PMX Switchgear include a quick-make, quick-break mechanism integrally mounted on the switch frame. Instructions for operation of these switches are contained in the S&C instruction sheets for S&C Mini-Rupter Switches.

Power Fuses

S&C Power Fuses—Types SM-4Z, SM-5S, SM-20, and SM-40, as well as Fault Fiter® Electronic Power Fuses are available in PMX Switchgear with live-front construction, in combination with an S&C Mini-Rupter Switch. S&C Power Fuses—Types SME-4Z, SME-20, and SME-40, as well as Fault Fiter Electronic Power Fuses are available in PMX Switchgear with enhanced fuse handling construction in combination with an S&C Mini-Rupter Switch.

Each S&C Power Fuse is equipped with a blown-fuse target, permitting positive visual check of fuse condition without removing the fuse from its mounting. For instructions on installation and operation of fuses, and how to detect a blown fuse, refer to the instruction sheet for the fuse type furnished. For instructions on installation and replacement of refill units, fuse units, or interrupting modules, refer to the S&C instruction sheet included with each refill unit, fuse unit, or interrupting module, as applicable.

Switch Operator—Type PM

Type PM Switch Operators permit power operation of Mini-Rupter Switches in response to opening and closing signals initiated from a remote location. All Type PM Switch Operators include an integral motor for power operating the quick-make, quick-break mechanism of the Mini-Rupter Switch (switch operation is achieved in approximately 3 seconds with nominal control voltage); open/close push buttons for local electrical operation; provisions for local manual operation;a local/remote selector switch that permits local operation when in the "LOCAL" position, while preventing remote operation; auxiliary-switch contacts for remote indication of the switch position; a decoupler to permit operation of the switch operator without affecting the position of the switch; an operation counter; and S&C Penta-Latch Mechanism on the door for access control to the interior of the switch operator.

The Penta-Latch Mechanism provides automatic door latching and permits padlocking only when the door is securely latched. The door can be opened only with a pentahead socket wrench or tool. A storage bracket is included for holding the manual operating handle. The handle permits local manual charging and tripping of the quick-make quick-break mechanism in the event control power is not available.

Micro-AT® Source-Transfer Control

An S&C Micro-AT Source-Transfer Controls is used in PMX Switchgear, in conjunction with S&C Mini-Rupter Switches, to provide automatic source transfer for primary-selective systems. This solid-state electronic device includes field-programmable operating-mode selector switches, timer adjustment dials, and test switches. The control is pre-engineered to provide a particular level of source-transfer automation. Monitoring inputs for the Micro-AT Control are typically supplied from each source by three S&C Voltage Sensors. An adjustable burden-resistor assembly, containing secondary burdens for S&C Voltage Sensors and/or secondary fuses for voltage transformers, is an integral part of the Micro-AT Control. Instructions foroperation and adjustment of the source-transfer control and the adjustable burden-resistor assembly are contained in the S&C instruction sheets for the S&C Micro-AT Source-Transfer Control.

Voltage Sensor

The S&C Voltage Sensor produces an output voltage directly proportional to line-to-ground voltage. It has relay accuracy over an ambient temperature range of -40° F to +160° F. In PMX Switchgear, voltage sensors are typically used to replace apparatus insulators at the hinge end of Mini-Rupter Switches where three-phase sensing for detection of open-phase conditions is required; and at the jaw end of Mini-Rupter Switches to provide voltage sensing for automatic source-transfer schemes. The Cypoxy® encapsulated construction of the device assures high cantilever strength, and BIL and dielectric characteristics equivalent to those of the apparatus insulator replaced.

The S&C Voltage Sensor is a constant-current-output device like a current transformer, and therefore primary fusing—which is required by a voltage transformer—is eliminated. Secondary conductors of the voltage sensor are shielded from high voltage by switch and fuse frame channels, and are connected directly to variable burden resistors. These resistors provide for field adjustment of the voltage sensor output to the level required by automatic control devices. Instructions for adjustment of voltage sensor output are included in S&C instruction sheets for the S&C Micro-AT Source-Transfer Control.

Current Sensor

When the optional overcurrent-lockout feature (which prevents a transfer operation that would close a source interrupter switch into a fault) is included with the Type Micro-AT Source-Transfer Control, S&C Current Sensors are provided for attachment to the entrance cables from each source. Refer to the S&C instruction sheet for S&C Current Sensors.

The switchgear assembly may include key or mechanical interlocks on the doors, switch operators, etc. of some modules. Typical interlock schemes—including precautionary measures that must be taken to maintain lock integrity—are discussed below. For the types and locations of interlocks that are included on the switchgear assembly, and for operating descriptions of special interlocking schemes that may have been specified, refer to the "CDA" and "RD" drawings.

Mechanical Interlocks

Mechanical interlocks are included on all PMX Switchgear modules with switches or fuses. These interlocks prevent the module door from being opened when the switch is closed and the switch from being closed when the module door is open. For more information see the S&C instruction sheet on operation included with the switchgear.

⚠ DANGER

Check the functional operation of all mechanical interlocks. **Failure to check these interlocks may result in personal injury or death.**

Key Interlocks

Interrupter switches, whether manually operated or power operated by S&C Switch Operator—Type PM, may include optional key interlocks that guard against paralleling of the power sources. See Figure 28. If such key interlocks are included, do not attempt to close a source interrupter switch unless the other source interrupter switch is open.

Interrupter switches with fuses, whether manually operated or power operated by S&C Switch Operator—Type PM, may include key interlocks that guard against opening the module door unless all source interrupter switches are open (preventing access to the fuses). If such key interlocks are included, do not attempt to open the module door unless all source interrupter switches are open.

⚠ CAUTION

Use of undue force in an attempt to operate switches contrary to the correct sequence dictated by the key interlock scheme may damage handles or latching mechanisms.

Figure 28. Key interlock.

DIELECTRIC TESTING

Rating, kV				Withstand, kV		
System		Applied Line-to-Ground①				
Nom.	Max	Nom.	Max	60-Hz, RMS②	Dc③④	Impulse (BIL)
13.8	17.0	8.3	9.8	36	50	95
25	29	14.4	16.7	60	70	125

① The output voltage of S&C Voltage Sensors, which may be furnished with the switchgear, are normally 20 volt-amperes at 120 volts, 60 hertz with a 720-ohm resistive burden connected across the output terminals and with line-to-ground voltage corresponding to rated nominal system voltage applied to the line terminal.

② Ac tests made on this equipment after shipment by S&C should be conducted at no more than 0.75 times the values shown. When making ac tests, the time duration for application of the test voltage should be limited to less than 10 seconds.

③ The column headed "Dc" is given as a reference only for those making dc tests and represents values believed to be appropriate and approximately equivalent to the corresponding power-frequency withstand test values specified for components of this voltage class. The presence of this column in no way implies any requirement for a dc withstand test on these components.

④ Dc withstand tests made on this equipment after shipment by S&C should be conducted at no more than 0.75 times the values shown. When making dc tests, the test voltage should be raised in discrete steps—one minute per step.

Although only qualified persons should be permitted to operate or maintain high-voltage switchgear, this should pose no problem to the user of PMX Switchgear since the equipment rarely needs attention. Mechanical maintenance is generally not required. The only "maintenance" recommended consists of periodic cleaning and inspection of interrupter-switch, fuse, and bus-support insulators; barriers; cable-terminating devices; and louver filters (if furnished), which should be performed at intervals based on environmental conditions. The integrity of the enclosure finish should be checked and any scratches or chips should be touched up with the appropriate touch-up finish. Also, occasional exercising of interrupter switches, switch operators, and all automatic control equipment, as well as inspection of interlocks for correct functioning, is recommended. Specific recommendations on exercising are included in the S&C instruction sheet applicable to each component, as well as in S&C inspection recommendations provided in the instruction manual furnished with the switchgear. Following exercising of switches, verify the correct functioning of interlock schemes; refer to "INTERLOCKS" on page 33. Fuse replacement is infrequent, because for cable systems there is no exposure to transient faults—only to rare permanent faults. In addition, qualified persons are available promptly from an electrical contractor experienced in high voltage, or (upon prior agreement), from the serving utility.

Enclosure Finish

The responsibility for ensuring that a finish protects the enclosure lies with both the manufacturer and the user. PMX Switchgear is finished with the S&C Ultradur® Finishing System, which provides lasting protection for the enclosure. To retain this protection, the user should take periodic corrective action as follows:

1. Touch up any penetration of the finish to bare metal—such as scratches and abrasions due to shipping or vandalism—to maintain the original integrity. S&C touch-up finish and primer are available in aerosol spray cans—order by Catalog Number: 9999-058 for olive green finish, 9999-080 for light gray finish, and 9999-061 for red-oxide primer. No other finish or primer is approved. The area to be touched up should be cleaned to remove all oil and grease. Sand the area, removing any traces of rust that may be present, and make sure all edges are feathered before applying primer.
2. Provide an occasional simple washdown—such as an automobile would be given—to remove surface contaminants. Use any ordinary mild household detergent solution.

In those cases where the enclosure must be refinished by the user before the finish has weathered—for example, to match other equipment—a special precaution must be taken. The entire surface must be sanded to provide a tooth to bond the new coat to the unusually tough and smooth S&C Ultradur Finish.

⚠ WARNING

When access to high-voltage compartments is required, it must be restricted to qualified persons as described by OSHA regulations and NFPA70E. Also defined in these codes are the procedures qualified persons must follow. These procedures are summarized below:

1. Adhere to prescribed safety rules at all times.
2. Disconnect the fuses, interrupter switches, power switching equipment, their mechanisms, and any other devices from all power sources and all control sources before that device is inspected, serviced, or repaired.
3. Always assume both sets of power terminals on any interrupter switch, fuse, or terminal are energized unless proved otherwise by test or by visual evidence of open-circuit conditions on both terminal ends. **SPECIAL WARNING:** All voltage transformers and voltage sensors must be disconnected when external voltage is used to test any secondary-side wiring or devices, to avoid energizing the high- voltage conductors through the voltage transformers or sensors. Draw out the voltage transformers completely and disconnect the secondary connections if drawout-type transformers are provided. Otherwise, remove the primary fuses of the voltage transformers and disconnect the secondaries by removing the secondary fuses or by disconnecting the secondary leads. For voltage sensors, the secondary leads must be shorted either by removing the plug from the input receptacle and transferring it to the shorting receptacle for applications involving a Micro-AT Source-Transfer Control, or by inserting screws into shorting-type terminal blocks.
4. Test for voltage. Qualified persons should be certain that they have and know how to operate the correct test equipment for determining the voltage on both sets of power terminals for any fuse or interrupter- switch equipment.
5. After the switchgear has been completely disconnected from all sources of power, properly connect grounding leads to both sides of the equipment, that is, to the incoming and to the outgoing phases of the equipment to be maintained.
6. Follow instructions supplied by the manufacturer of the equipment to be maintained or other pertinent information.
7. Make certain the switch-operating handles, operator housings, and metal enclosures are properly grounded. No equipment should be returned to service unless such grounds are properly made.
8. Inspect and, if necessary, adjust interlocks; refer to “INTERLOCKS” on page 33.

NOTE: Occasionally low-voltage components may require maintenance. In the servicing or repair of space heaters, voltage-transformer secondary wiring, and any other components located in the high-voltage compartment, all of the preceding safety procedures apply. The maintenance of other low-voltage components (such as voltmeters, ammeters, relays, etc.), isolated from high-voltage bays, may be performed under the safety rules for equipment rated 600 volts or less. If maintenance is to be performed on ammeters, short-circuit the secondary connections of the associated current transformer at the shorting-type terminal block prior to removal of the ammeter. This may require access to the high-voltage compartment, in which case the foregoing procedures apply.

When returning the equipment to service, observe the following procedures:

1. Reconnect any low-voltage terminals that may have been disconnected when servicing the gear.
2. Close and securely latch each switchgear-module door before energizing the circuit or operating any switching device.
3. Open any grounding switch, or remove other grounding means, before closing the associated interrupter switch(es).
4. Lock interrupter switches in the open or closed position as dictated by the electric power system design.
5. Padlock all doors, switch-operating handles, and covers before leaving the installation site, even momentarily. Observe this procedure even in those cases where the gear is accessible only to qualified persons.

OPTIONAL FEATURES

Description		Applicable to Modules	Suffix to be Added to Module Number
Finish Color①	Light Gray Outdoor (Standard)	All modules	-A1
	Olive Green Outdoor		-A2
Stainless-Steel Enclosure①		All 13.8-kV modules	-A10
		All 25-kV modules	-A11
Key Interlock②		All modules except Duplex, Remote Supervisory, and Source-Transfer	-C1
Mechanical Cable Interlock between Switch and Door		Manually operated switch	-C6
Auxiliary Switch, 4-PST		All manual modules containing a switch	-C7
		All Source-Transfer Modules	-C9
		All Remote Supervisory Modules	-C10
Compartmentalization		All 13.8-kV modules with incoming or outgoing cables except Source-Transfer and Duplex	-CP1
		All 25-kV modules with incoming or outgoing cables except Source-Transfer and Duplex	-CP2
Fuse Storage		All Fuse and Metering Modules	-E1
Base Spacer①	Mild Steel, 6 inches	All 13.8-kV modules	-K1
	Stainless steel, 6 inches		-K11
	Mild Steel, 12 inches		-K2
	Stainless steel, 12 inches		-K12
	Mild Steel, 6 inches	All 25-kV modules	-B1
	Stainless steel, 6 inches		-B11
	Mild Steel, 12 inches		-B2
	Stainless steel, 12 inches		-B12
Copper Bus①	Main and ground bus	All modules	-L1
	Main and ground bus plus terminal and switch pads		-L2
Power Measurement ION® 6200 Digital Multimeter③		All Metering Modules	-DMM
Fused Voltage Transformers④	Two transformers rated 7.2, 7.62, or 8.4 kV, phase to ground⑤	All 13.8-kV Metering Modules	-DB1
	Three transformers rated 7.2, 7.62, or 8.4 kV, phase to ground⑤		-DC1
	Two transformers rated 12, 13.2, or 14.4 kV, phase to phase⑤		-DE1
	Two transformers rated 14.4 kV, phase to ground⑥	All 25-kV Metering Modules	-DB2
	Three transformers rated 14.4 kV, phase to ground⑥		-DC2
	Two transformers rated 24 or 28 kV, phase to phase⑥		-DE2

① Applies to all modules in the assembly.

② Lock location and coordination scheme must be specified at time of order.

③ External 120-volt ac power source required.

④ Contact your nearest S&C Sales Office for voltages other than 13.8 kV or 25 kV.

⑤ Designed for ABB VIZ-11 transformer..

⑥ Designed for ABB VIZ-20 transformers.

TABLE CONTINUED ►

OPTIONAL FEATURES—Continued

Description		Applicable to Modules	Suffix to be Added to Module Number
Compete Provisions for Fused Voltage Transformers①②	Two transformers, phase to phase	All Metering Modules	-DF2
	Three transformers, phase to ground		-DF3
	Two transformers, phase to phase		-DF5
Mounting Provisions for Fused Voltage Transformers①②	Two transformers, phase to ground		-DF7
	Three transformers, phase to ground		-DF8
	Two transformers, phase to phase		-DF10
Two Window-Type Current Transformers	100/5	All Bus-Tap Metering Modules	-GA1
	200/5		-GA2
	400/5		-GA4
	600/5		-GA6
	800/5		-GA8
	1200/5		-GA12
Three Window-Type Current Transformers	100/5		-GB1
	200/5		-GB2
	400/5		-GB4
	600/5		-GB6
	800/5		-GB8
	1200/5		-GB12
Complete Provisions for Two Window-Type Current Transformers③			-GF1
Complete Provisions for Three Window-Type Current Transformers③			-GF2
Mounting Provisions for Two Window-Type Current Transformers③			-GF3
Mounting Provisions for Three Window-Type Current Transformers③			-GF4
Two Wound-Type (Bar-Type) Current Transformers④	100/5	All 13.8-kV Metering Modules	-GC1
	200/5		-GC2
	400/5		-GC4
	600/5		-GC6
	800/5◆		-GC8
	1200/5◆		-GC12

① Designed for ABB VIZ-11 and VIZ-20 transformer

② To also include installation of customer-supplied voltage transformers, change the first two letters of the option suffix from "-DF" to "-DG."

③ Designed for ABB KIR-11 and KOR-15C transformer.

④ Designed for ABB KIR-11 transformer.

◆ Main bus is rated 600 amperes.

TABLE CONTINUED ►

OPTIONAL FEATURES—Continued

Description		Applicable to Modules	Suffix to be Added to Module Number
Three Wound-Type (Bar-Type) Current Transformers①	100/5	All 13.8-kV Metering Modules	-GD1
	200/5		-GD2
	400/5		-GD4
	600/5		-GD6
	800/5◆		-GD8
	1200/5◆		-GD12
Two Wound-Type (Bar-Type) Current Transformers②	100/5	All 25-kV Metering Modules	-GC21
	200/5		-GC22
	400/5		-GC24
	600/5		-GC26
	800/5◆		-GC28
	1200/5◆		-GC212
Three Wound-Type (Bar-Type) Current Transformers②	100/5	All 25-kV Metering Modules	-GD21
	200/5		-GD22
	400/5		-GD24
	600/5		-GD26
	800/5◆		-GD28
	1200/5◆		-GD212
Complete Provisions for Two Wound-Type (Bar-Type) Current Transformers③④	All ratios except 1200/5	All Metering Modules	-GG1
	1200/5 radios only		-GG2
Complete Provisions for Three Wound-Type (Bar-Type) Current Transformers③④	All ratios except 1200/5		-GG3
	1200/5 radios only		-GG4
Mounting Provisions for Two Wound-Type (Bar-Type) Current Transformers③④	All ratios except 1200/5		-GG5
	1200/5 radios only		-GG6
Mounting Provisions for Three Wound-Type (Bar-Type) Current Transformers③④	All ratios except 1200/5		-GG7
	1200/5 radios only		-GG8
Aluminum Terminal Adapter for Two Cables per Phase, through 750 kc Mil		All Entrance and Cable Enrance Modules	-M1

① Designed for ABB KIR-11 transformer

② Designed for ABB KOR-15C transformer.

③ Designed for ABB KIR-11 and KOR-15C transformer.

④ To also include installation of customer-supplied wound-type (bar type) current transformers, change the first two letters of the option suffix from "-GG" to "-GH."

◆ Main bus is rated 600 amperes.

TABLE CONTINUED ▶

OPTIONAL FEATURES—Continued

Description		Applicable to Modules	Suffix to be Added to Module Number
Surge Arresters, Set of Three	3-kV distribution class, 4.16-kV applications only	All Entrance and Cable Entrance Modules	-NA3
	6-kV distribution class, 4.16-kV applications only		-NA6
	9-kV distribution class, 13.8-kV applications only		-NA9
	10-kV distribution class, 13.8-kV applications only		-NA10
	12-kV distribution class		-NA12
	15-kV distribution class		-NA15
	18-kV distribution class, 25-kV applications only		-NA18
Provisions for Distribution-Class Surge Arresters Rated 3, 6, 10, 12, 15, or 18 kV, Bracket-Mounted			-PA
Viewing Window in Enclosure Door. Includes see-through barrier		All Entrance and Feeder Modules containing a switch	-VW
See-through Barrier. Hangs behind module door		All modules	-LB
Custom Designed Side Sheet on Side Coupled to Transformers—matches Transformer Throat Flange		Transformer Throat Modules	-S
Remote Indication①		All Source-Transfer Modules	-Y4
Test Panel②③			-Y5
Supervisory Control for Common-Bus Applications			-Y6
Communications Card④⑤			-Y8
Overcurrent Lockout⑥⑦	Six sensors, for one conductor per phase on both sources⑧		-Y21
	Nine sensors, for two conductor per phase on one sources⑨		-Y22
	Twelve sensors, for two conductors per phase both sources⑩		-Y23

① Includes a terminal block for user's connections.

② If a three-phase test source is not available, limited testing may be performed using an external, adjustable single-phase source.

③ In instances where a three-phase test source is to be used, an S&C Voltage Limiter—Three-Phase, Catalog Number TA-1741, must be furnished for the test circuit.

④ Requires an IBM PC AT or compatible computer using Intel's 80386 microprocessor, or higher. The computer must have a minimum of 2 Mb of memory, one 3.5-inch 1.44-Mb floppy disk drive, and a hard disk drive with at least 2 Mb of free space. The computer must operate under Microsoft Windows™, Version 3.1.

⑤ Requires Micro-AT Communication Cable, Catalog Number TA-2320 or TA-2321.

⑥ For applications where load feeders are connected to transformers with wye-grounded primary windings, contact your nearest S&C Sales Office.

⑦ Current sensors must not be installed on unshielded cables or on cables where the insulation is exposed but ungrounded (for example, where dielectric tape or heat-shrink tubing is used). These sensors are intended for application at ground potential and may be damaged by the voltage gradient between the cable insulation and ground.

⑧ Six S&C Closed-Gap Current Sensors, Catalog Number TA-1758, are furnished. Each current sensor accommodates a single conductor up to 2½ inches in diameter.

⑨ Three S&C Closed-Gap Current Sensors, Catalog Number TA-1758, and six S&C Closed-Gap Current Sensors, Catalog Number TA-2264, are furnished. Each current sensor accommodates a single conductor up to 2½ inches in diameter.

⑩ Twelve S&C Closed-Gap Current Sensors, Catalog Number TA-2264, are furnished. Each current sensor accommodates a single conductor up to 2½ inches in diameter.

TABLE CONTINUED ►

OPTIONAL FEATURES—Continued

Item		Applicable to Modules	Suffix to be Added to Module Number
Communication and Control Equipment Group①②—includes user-specified remote terminal unit (RTU); user-specified communication device; battery charger; battery packs; voltage sensor for power input to battery charger and single-phase voltage sensing; and current sensors for three-phase current sensing on each power-operated switch③		All Remote Supervisory Modules	Contact your nearest S&C Sales Office
Switch-Control Equipment Group for use with RTU by others②④—includes provisions for mounting of user-furnished and installed RTU, communication device, etc. in low-voltage compartment; current sensors (5-ampere ac output) for three-phase current sensing on each power-operated switch; and voltage sensor (user-selectable 5-volts ac or 69-volt ac output) for single-phase voltage sensing, with power for the switch operators supplied by	User-furnished 24-volt dc source or EnergyLine 5800 Series Switch Control		-Y12
	External control power—user-furnished 120-volt ac source to an S&C Battery Charger and battery packs⑤		-Y13
	Internal control power—S&C-furnished voltage sensor (20 volt-ampere) source to an S&C Battery Charger and battery packs①⑤		-Y14
Switch-Control Equipment Group for use without RTU④⑥—includes provisions in low-voltage compartment for connection of switch operators to user's wiring; with power for the switch operators supplied by	External control power—user-furnished 120-volt ac source to an S&C-furnished ac power supply		-Y18
	External control power—user-furnished 120-volt ac source to an S&C-furnished Battery Charger and battery packs		-Y16
	Internal control power—S&C-furnished voltage sensor (20 volt-ampere) source to an S&C Battery Charger and battery packs①		-Y17

① The S&C Voltage Sensor is mounted on the jaw-contact side of the switch, on the center phase.

② Current sensors must not be installed on unshielded cables or on cables where the insulation is exposed but ungrounded (for example, where dielectric tape or heat-shrink tubing is used). These sensors are intended for application at ground potential and may be damaged by the voltage gradient between the cable insulation and ground.

③ The S&C Battery Charger is factory-calibrated to accommodate the loads furnished in the Communication and Control Equipment Group at the time of shipment. If additional loads are subsequently added. S&C recommends recalibration of the charging output to the batteries to ensure optimal battery life. Refer to your nearest S&C Sales Office.

④ Includes provisions in low-voltage compartment for connection of switch operator to user's wiring.

⑤ The battery charger and battery packs are not intended to provide power to any user-furnished and installed equipment.

⑥ Current and voltage sensing are not included and cannot be provided.