Medium Voltage Arc-resistant Switchgear

SafeGear®

Installation and Maintenance Manual

Bulletin No. IB3.2.5-7C

ABB Power T&D Company Inc.

INSTRUCTIONAL BOOKLET

SafeGear®
Medium Voltage, Arc-Resistant, Switchgear

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Chapter 1

Introduction

GENERAL INSTRUCTIONS

Read these instructions carefully before installation and use as a guide during installation and initial operation.

File these instructions with other instruction books, drawings and descriptive data of the switchgear. Keep this book available for the installation, operation, and maintenance of this equipment. Use of these instructions will facilitate proper maintenance of the equipment, and prolong it's useful life.

SCOPE OF INSTRUCTIONS

The instructions are general in nature. They cover requirements for installation, setup, checkout and maintenance as applied to ABB SafeGear,® medium-voltage, arc-resitant, switchgear. These instructions do not attempt to cover all variations and combinations of equipment and installations.

Information on particular installations appears in the following:

- Bills of Materials that list electrical devices and equipment.
- Single line drawings showing power connections.
- Floor plan, representing available space for power and control conduits.
- Special construction details.
- Elementary and schematic diagrams.
- Connection diagrams.

Chapter 2

Important Safety Notes and Warnings

Equipment operation depends on proper handling, installation, and maintenance. Neglecting fundamental requirements may lead to personal injury, failure of the equipment and property damage.

Safety as described in this instruction book involves two conditions:

- Personal injury.
- Product or property damage.

SAFETY NOTATIONS

Safety notations alert personnel to possible death, injury or property damage situations. The safety notations appear before the step in which the condition applies. The four hazard levels are:

DANGER

*"**Danger**" indicates a hazardous situation that has a **high probability of death**, severe injury, and substantial property damage.*

WARNING

*"**Warning**" indicates a hazardous situation that has **some probability of severe injury**, and substantial property damage.*

CAUTION

*"**Caution**" indicates a hazardous situation that **may result in** minor or **moderate injury** and/or property damage.*

*"**NOTICE**" indicates a statement of company policy as it relates to the safety of personnel or protection of property*

Personnel installing, operating, or maintaining this equipment must have thorough knowledge of all applicable local, regional, industry, governmental, and OSHA safety procedures as well as commonly accepted safe working practices. Personnel working in, or around this equipment must also exhibit common sense and good judgement regarding the potential hazards for themselves and other personnel in the area. These instructions are intended for use by fully qualified personnel and are not a substitute for adequate training, experience, and supervision.

Should clarification or additional information be required, refer the matter to your ABB Power T & D Company sales office. When communicating with ABB regarding the product covered by this Instruction book, always reference the ABB assigned Shop Order (S.O.) number or Serial Number.

Chapter 3

Receiving and Handling

RECEIVING

Before shipment, the equipment is inspected and marked with it's number and position. The factory ships circuit breakers separately.

Upon receipt of the equipment, examine the shipment for damage or loss. Check the contents against the packing list before discarding any packing material. Notify ABB and the carrier at once of any discrepancies. If there is damage from improper handling, file a claim for damages at once with the carrier and notify ABB.

Note: ABB standard shipments are "FOB Factory." ABB is not responsible for damage, after delivery of the equipment to the carrier.

HANDLING

For structural integrity, all doors and panels must be in place and securely fastened before moving the equipment.

Do not move or transport the frames with circuit breakers or other drawout equipment installed in the modules.

Before energizing the heaters, remove all the packing materials from the switchgear. Open the breaker or cutout device that controls the heaters when using a separate power source.

STORAGE

Leave the equipment on the shipping base.

Store all equipment indoors in a well-ventilated area.

The storage building should have a well-drained paved floor. The temperature should be above 60°F. The air should be dry (approximately 50% maximum humidity).

The sections ship wrapped in plastic for protection during shipment only. Remove the plastic wrap after placing into storage. Cover with heavy wrapping paper or other moisture barrier. Use materials that will not trap moisture inside the unit. Do not cover louvered openings.

For long term storage, or in high-humidity, use heaters (optional) to keep the interior dry. Bring power for the heaters to the load terminals of the device that controls the heater circuits. See Figure 1.

NOTE: The device must remain open when using a separate power source.

Figure 1: Heater load terminals. Remove before bolting sections together.

Store circuit breakers upright in their original shipping carton. Do not stack. Do not store circuit breakers in the switchgear.

Chapter 4

Site Preparation

GENERAL

Before installing, consult all drawings furnished for the particular order. The drawings show top and front views of the lineup, primary and secondary connection diagrams, and Bills of Materials. Study these drawings and the following recommendations before preparing the site plan drawings.

LOCATION

Locate the lineup in accordance with local regulations. Clearances at the front should allow installation and removal of the drawout equipment. Provide rear access for making connections before start-up and for periodic inspections and maintenance. The recommended minimum clearances appear on the drawings.

Table 1

Recommended Minimum Ceiling Height*

RATING	FEET
25 kA	12
36 kA	14
50 kA	16

* Try to maintain approximately 4 feet from the top of the equipment to any obstruction.

FOUNDATION

The factory supplies floor plan drawings for each installation. The floor must be straight and level within ¼ inch over the full length and depth of the switchgear. The finished floor under the line-up and in front of the line-up should be smooth.

Install power and secondary (control) conduits before moving the units to the site. Available space for the conduits appears on the floor plans supplied with the units. Conduits should not extend more than one inch above the station floor level. Plug conduit openings before pouring concrete.

Chapter 5

Indoor/Outdoor Installation

GENERAL

Metal-enclosed and metal-clad switchgear ships in sections. Indoor sections ship on throw away steel bases.

Unload the units as close to the installation site as possible. Secure all doors and panels. Raise the units with jacks and move on rollers with the shipping bases attached or with an overhead hoist and spreader bar. Do not move the shipping splits with drawout units installed. See Figures 2 through 7.

Use of fork lift trucks for jacking or placing the jacks other than as described may result in stress distortions and irreparable damage to the equipment.

Do not remove the shipping bases until the units are set in place. Moving the units without the shipping base will cause irreparable damage and a hazardous condition.

In many locations the best way of moving the equipment is with jacks and rollers.

1. **Do not remove the shipping base.** Make sure that all doors and panels are secure. Move the unit near the site. Raise the unit by jacks placed under the front and rear corners, inside the shipping bases. See Figure 2.

Figure 2: Position jacks under the front and rear corners.

2. Raise the unit enough to position a roller under the shipping base. Repeat the operation at the other end. See Figure 3.

Figure 3: Position rollers under shipping base.

3. Push the unit toward its final position, while another person puts a third roller under the forward end. Move a roller from the rear to the front until the unit is in place. See Figure 4.

Figure 4: Move a roller from the rear to the front.

4. For lateral moving, raise the units by jacks as described in step 1. Place the rollers laterally with steel channels (not furnished) on the rollers. See Figures 5 and 6. Carefully push the unit onto a third roller and move a roller from the rear to the front until the unit is in place.

Figure 5: Position rails on rollers as shown for lateral moving.

Figure 6: Carefully push the unit onto a third roller.

5. Locate the units in their final position. Raise the units to clear the rollers and channels. Remove the rollers and channels, and lower onto wood blocks.

TOWING

Use chains rated for safe handling of the shipping splits. Consult the chain manufacturer or local code requirements for proper safety factors. Attach the chains to the holes at each end of the base (See Figure 7). Secure to the towing equipment. Make sure that the truck bed height and dock height are even, or provide heavy duty steel sheets to bridge between the truck and the dock. Protect the lower edge of the switchgear from damage by the chains.

Figure 7: Towing

LIFTING WITH SLINGS

1. Attach the shackles to the base or use the optional extension plates to the 4 holes provided in the shipping bases. They provide a large hole at each end for attaching a sling and spreader bar assembly.

2. Use a spreader bar to keep the legs of the sling vertical.

3. When using wire rope slings, place a 4" × 4" between the equipment and the sling.

4. Lift and move the equipment to it's final place. Once the unit is set in place, remove the shipping base.

REMOVAL OF THE SHIPPING BASE

Once the units are in their final place, remove the shipping base.

1. Open the equipment doors. Remove the bolts holding the shipping base to the equipment. See Figure 8.

Figure 8: Unbolting the shipping base.

NOTE: Secure all doors and panels before going to the next step.

2. Raise the units to a height that allows removal of the base. Use four jacks for this operation to keep the units uniformly level and prevent distortion.

3. Select four pieces of wood thick enough to permit removal of the jack after lowering. Place one under each corner. Slowly lower one side until it rests on the pieces of wood. Repeat this process on the other side.

Figure 9: Lower the unit onto four pieces of wood.

4. Use a pry-bar to lift each corner enough to remove the four pieces of wood.

Figure 10: Use a pry-bar to remove the pieces of wood.

UNIT SUBSTATIONS

In multi-unit substations, physically identical transformers may have disconnect switches that are key interlocked with secondary breakers. Group the disconnects, switches, transformers, switchgear, and motor control sections by their key.

The interlock sequence depends upon having the locks on the switch and breaker operated by the same key.

NOTE: Avoid unnecessary rework by checking the key numbers before moving each piece of equipment into its final position.

CONNECTIONS

DANGER

Before making primary source connections, verify that the primary cables are de-energized and the equipment is properly grounded.

Unit substations ship in separate sections. Each transformer is a separate section. The factory splits the buses for shipment. Secondary and control wiring end at the shipping split.

Bolt the separate units together. Reconnect the bus and control wiring at the shipping splits. Follow the connection diagram when replacing secondary and control wiring. Bolted joints must be tight.

Complete all internal connections. Make the external connections to control power sources and circuits, to secondary and potential circuits, to feeders, power sources, and to ground.

NOTE: After completing all connections to secondary (control) circuits, follow these circuits and remove temporary connections from current transformer secondaries.

Temporary jumpers protect against voltages that may occur if the current transformer primaries carry currents while the secondary circuits are still not complete. With the secondary circuits connected, remove the jumpers.

NOTE: Failure to remove the jumpers will interfere with meters, relays, or other devices in these circuits.

If shorting Terminal Blocks are used, review the Connection Diagram that was shipped with the unit, for position of shorting screws. See Step 16 on page 25.

CONNECTION TO GROUND BUS

The factory bolts the ground bus bars to each frame. Connect the ground bus bars to the station ground with a cable or bus of larger gage than the housing ground bus.

Do not run cable or bus in conduit. The cable or bus should take the most direct path to ground.

CONNECTION TO CONTROL SOURCE

The control source wiring should be of larger gage than the rest of the control wiring. Connect the control source leads to the terminal blocks.

NOTE: CHECK THE ELECTRICAL PHASING BEFORE CONNECTING.

SECONDARY AND CONTROL CONNECTIONS

The factory wires the secondary and control connections using the connection diagram. The outgoing secondary and control connections are accessible from the control conduit area.

Openings in the side of the switchgear allow control connections between sections. When shipped in groups of several units each, the factory installs cross connections between groups. The factory then disconnects and tags one end of each of the connections. Reconnect according to the connection diagram when the sections are together again.

INSTALLATION OF BUS BAR CONNECTIONS BETWEEN GROUPS

The factory assembles the main bus bar in each section. The splices at the shipping splits are unbolted for shipment. Refer to the General Arrangement Drawings.

The contact surfaces of the bus at bolted joints are plated. Clean contact surfaces with a clean cloth and an OSHA approved solvent. Bolt the bus together. Conductivity of a bolted joint depends on the pressure or torque applied..

*Do not use **alcohol** or **freon**. Limit the use of solvents to removing grease and contamination from primary conductors, insulation, and unpainted metallic surfaces. Use an OSHA approved, non-flammable solvent with a threshold limit of 300 PPM or higher in accordance with local regulations. Use solvents in well-ventilated areas.*

NOTE: Take care not to remove plating.

SETTING THE 2000A AND 3000A CIRCUIT BREAKER MODULE VANES AND DAMPER

Set the Ventilation Vanes (see Figure 11) and Damper (see Figure 12) in the open or operating position before bolting the vertical sections together.

Failure to set the Vanes and Damper in the open or operating position can cause the circuit breaker to overheat.

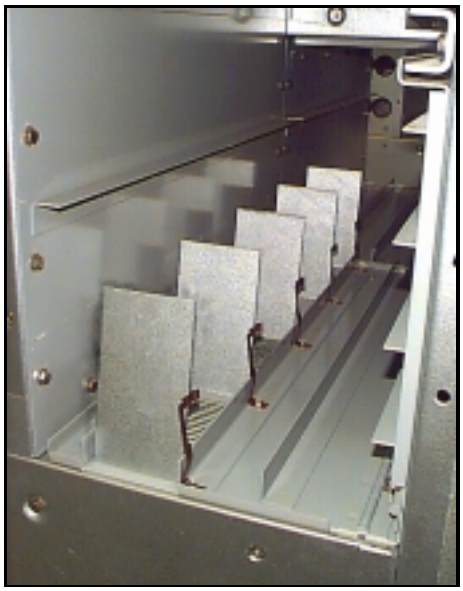


Figure 11: Module Ventilation Vanes

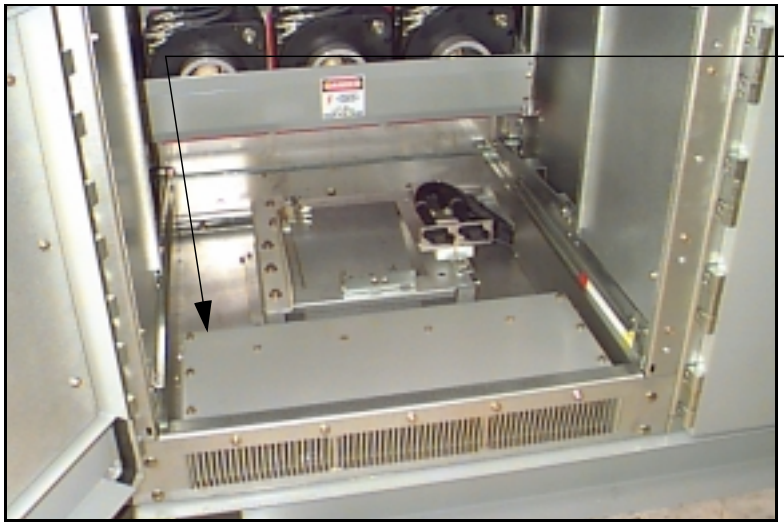


Figure 12: Location of the 2000/3000A Damper

OUTDOOR INSTALLATION: GENERAL

Outdoor installations are in modified enclosures called Power Distribution Centers (PDC's). Due to ceiling height limitations, PDC's have top mounted plenums that exhaust to the end of the enclosure.

Outdoor installations are shipped in pre-assembled modules. Installation is contracted through ABB Services. It is recommended that PDC's be installed by experienced personnel.

Chapter 6

Testing and Final Inspection

TESTING

DANGER

Disconnect the primary power source

Do not exceed the listed voltages for the voltage class of the equipment under test.

Disconnect the shunt connected coils such as potential transformers.

Do not test solid state sensors or relays with high voltage. Disconnect solid state sensors and relays before applying voltage.

With the system erected, assembled and connected, perform the following 16 step process.

1. Remove packing and shipping materials.

2. Make sure that all internal parts are clean and dry. If moisture is present, blow dry with warm air.

3. Remove any shipping blocks from relays.

4. Check for damaged insulation by applying potential tests to the primary bus. Conduct potential tests phase-to-phase and phase to ground in accordance with “Field Test” values.

Test continued on next page.

Table 1

60 HZ, RMS, WITHSTAND VOLTAGES (1 minute)

Rated	Factory Test	Field Test	DC* Field Test
up to 250 volts	1500	1125	none
4160 volts	19,000	14,250	20,000
7200 volts	36,000	27,000	38,000
13,800 volts	36,000	27,000	38,000

* The column headed “DC Field Test” is a reference for those using dc tests to verify the integrity of connected switchgear. It represents values believed to be appropriate and approximately equivalent to the corresponding power frequency withstand test values specified for each voltage class of switchgear. The presence of this column in no way implies any requirements for a dc withstand test on ac equipment. Also, it does not imply that a dc withstand test is an acceptable alternative to ANSI C37.20 for design, production, or conformance tests. When making dc tests, raise the voltage to the test value in discrete steps and hold for one (1) minute.

5. With the main circuit de-energized and grounded, check the continuity of all circuits after installing the circuit breakers. Energize the control source and operate the equipment. Indicating instruments verify the continuity of current transformer circuits and energizing of the main circuit.

Test continued on next page.

CONTROL CIRCUIT CHECKOUT

DANGER

The breaker or cutout device of the local control power circuit must remain open when using a separate control power source.

The preferred method to check the control circuit is to furnish a separate temporary source of control power of the required control voltage rating. The temporary source must have a properly coordinated backup protective device in the circuit. Set the device to clear any faults that might occur. Initially all circuit breakers should be in the DISCONNECT position and the main circuit de-energized and grounded. When ac control power is from control power transformers in the switchgear, remove all fuses in the transformer circuits. On electrically operated circuit breakers, discharge the springs and place the motor-disconnect-switch in the OFF position.

DANGER

OPEN the circuit breaker before racking.

6. Rack drawout circuit breakers to the DISCONNECT position.

7. Open all normal control power source disconnects, if supplied.

8. Check each control switch or push-button. Make sure that it is in the OPEN position.

9. Connect a temporary control power source to the circuit load terminals in the switchgear. Energize the control circuit from the temporary control power source.

10. Rack one circuit breaker into the TEST position. When the on-off switch is in the ON position, the charging of the closing springs of an electrically operated circuit breaker indicates connection to the control power.

11. Rack the remaining circuit breakers into the TEST position, one at a time.

12. Test all electrically and manually operated breakers for closing and tripping, while they are in the TEST position. Use the optional test set available with the trip unit for testing solid state tripping.

13. De-energize the control circuit. If ac control power is from transformers in the switchgear, remove the temporary separate source of control power. Reinstall all fuses in the transformer circuit.

14. Set all relays, regulators, and other devices for proper operation of loads. The factory does not set the relays.

15. Remove shorting screws from the terminal blocks in the current transformer circuits. See Step 16. Store screws in the tapped holes in the corners of the blocks.

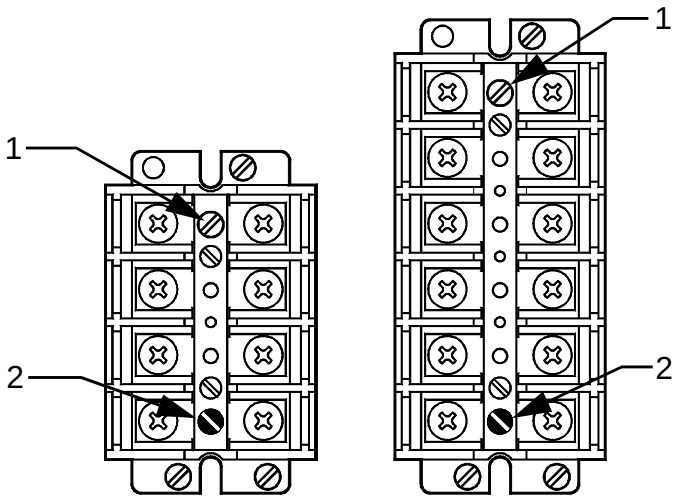
NOTE: Verify the proper phasing of all main circuits according to diagram.

Test continued on next page.

16. To open the short circuiting device:

    a. **Single Ratio** - Remove and store the shorting screw 1.

    b. **Multi Ratio** - Remove the shorting screw 1. Insert shorting screw according to connection diagram. Do not remove the ground screw 2.



Single-Ratio Multi-Ratio

FINAL INSPECTION

DANGER

There are hazards of electrical shocks and/or burns whenever working in or around electrical equipment. Turn off power ahead of the switchgear before performing any inspection or maintenance operations. Check incoming line terminals to verify that the equipment is de-energized and grounded. Check out-going terminals to ensure that no back-feed condition exists.

Once installed and all connections made, perform a final check and test on the equipment and its controls. Check for correct equipment installation and that all connections are complete.

Use extreme care to prevent the controlled equipment from being connected to the system while performing preliminary tests.

Chapter 7

Placing Switchgear Into Service

SAFETY PRECAUTIONS

DANGER

There are hazards of electrical shocks and/or burns whenever working in or around electrical equipment. Turn off power ahead of the switchgear before performing any inspection or maintenance operations. Check incoming line terminals to verify that the equipment is de-energized and grounded. Check out-going terminals to ensure that no back-feed condition exists.

The circuit breakers should be in the TEST position.

When working on switchgear, de-energize and ground the main-bus.

Before energizing any part of the switchgear make a complete check of the mechanical operation of all devices. Remove blocking wedges from relays, circuit breakers, meters, etc. Manually operate all circuit breakers and relays. Moving parts should not bind. Verify that there are no foreign objects in the rear of the equipment. Use compressed, clean, dry air to clean all inside and outside surfaces.

Make incoming and outgoing power connections after all other connections are complete. A note on the connection diagram indicates devices that are phase sensitive. Verify the phase sequence of the incoming power source before making connections.

NOTE: The secondary circuits of energized current transformers should never be open circuited.

The contact surfaces of the bus at bolted joints are plated. Clean contact surfaces with a clean cloth and an OSHA approved solvent. Bolt the bus together. Conductivity of a bolted joint depends on the pressure or torque applied.

INSTALLING THE REAR INNER AND EXTERIOR PANELS ON SAFEGEAR

INTERNAL PANELS

	Upper	Lower
Step 1	Position the panel so the 3 holes with weld nuts are at the top.	Position the panel so the 3 holes with weld nuts are at the bottom.
Step 2	Angle the lower end of the panel into the rear of the frame, sliding the lower flange behind the mid-frame channel support. Let the panel slide down until it rests on the mid-frame support	Angle the upper end of the panel into the rear of the frame, sliding the upper flange behind the mid-frame support.
Step 3	Swing the top of the panel in toward the frame until the side flanges are against the frame.	Slide the panel upward and swing the bottom in toward the frame until the side flanges are against the frame.
Step 4	Move the panel upward, sliding the top flange inside the frame, until the 3 holes along the top align with the 3 mating holes in the frame.	Move the panel down, sliding the bottom flange inside the frame, until the 3 holes along the bottom align with the 3 mating holes in the frame.
Step 5	Bolt the panel in place using 5 bolts on each side. Do not place bolts in the 3 top holes at this time.	Bolt the panel in place using 5 bolts on each side. Do not place bolts in the 3 bottom holes at this time.

EXTERIOR PANELS

Step 6	Bolt the exterior panels (upper and lower) in place using 18 bolts in each panel.

Figure 13: Step 1 and 2, Upper Inner Panel.

Figure 14: Step 1 and 2, Lower Inner Panel.

Figure 15: Step 3, Upper Inner Panel.

Figure 16: Step 3, Lower Inner Panel.

Figure 17: Step 4, Upper Inner Panel

Figure 18: Step 4, Lower Inner Panel

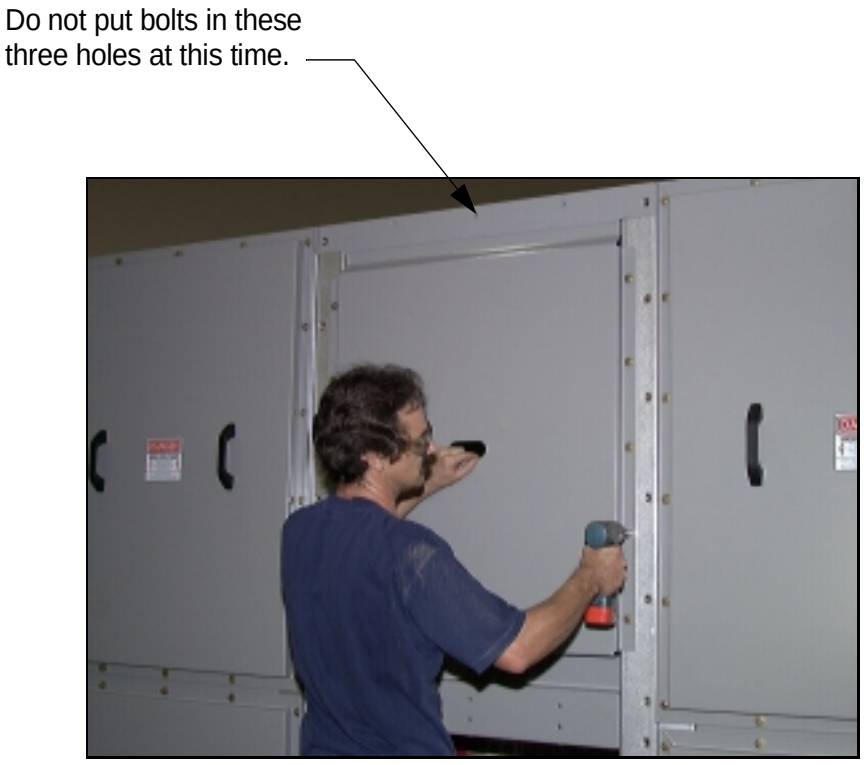


Figure 19: Step 5, Upper Inner Panel

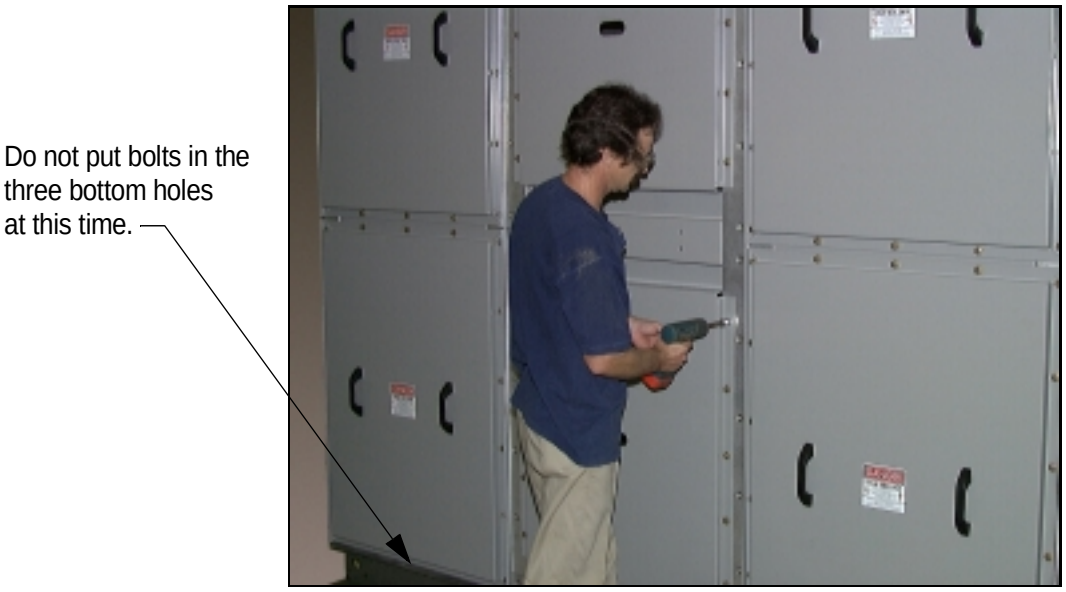


Figure 20: Step 5, Lower Inner Panel

Figure 21: Step 6, Upper Exterior Panel

Figure 22: Step 6, Lower Exterior Panel

ENERGIZING THE MAIN BUS

After completing the control circuit checkout, energize the equipment main bus.

1. Verify that all door and panel hardware is secure.

2 Energize the incoming bus to the equipments main circuit breaker. Observe if operation of instruments and relays are correct.

3. Energize the separate control power source, if furnished.

4. Energize the switchgear main bus by closing the main circuit breaker. Observe if operation of instruments and relays are correct.

5. Rack the circuit breakers to the CONNECTED position.

6. Close the desired feeder and tie-breaker circuit breakers.

Chapter 8

Standard Construction

STANDARD COLOR

The standard paint color is ANSI #61. This finish is electro-static powder paint applied over an iron phosphate coating. This process achieves a smooth, uniform paint finish that conforms to all UL requirements.

GALVALUME

Unpainted parts are made of Galvalume.® Galvalume is a cold rolled sheet steel with a hot dipped coating of aluminum, zinc and silicon. Galvalume greatly exceeds the paint qualifications of ANSI C37.20.2-5.2.8.

BUS SUPPORT INSULATION

The bus supports are glass filled polyester laminate or porcelain. The supports ensure safe operational clearances of bus under normal and abnormal (short circuit) conditions.

PRIMARY DISCONNECT DEVICE

Circuit breaker primary disconnects consist of a circle of fingers compressed by a garter spring, or a set of inline fingers compressed with springs. The springs are outside the current path. The fingers can be inspected by withdrawing the unit. The primary contacts are high pressure, self-aligning devices. All parts are plated to reduce resistance.

SECONDARY DISCONNECTING DEVICES

Circuit breakers have self-aligning disconnects sized for the required current. They make contact in the CONNECTED and TEST position, without the need for a test jumper.

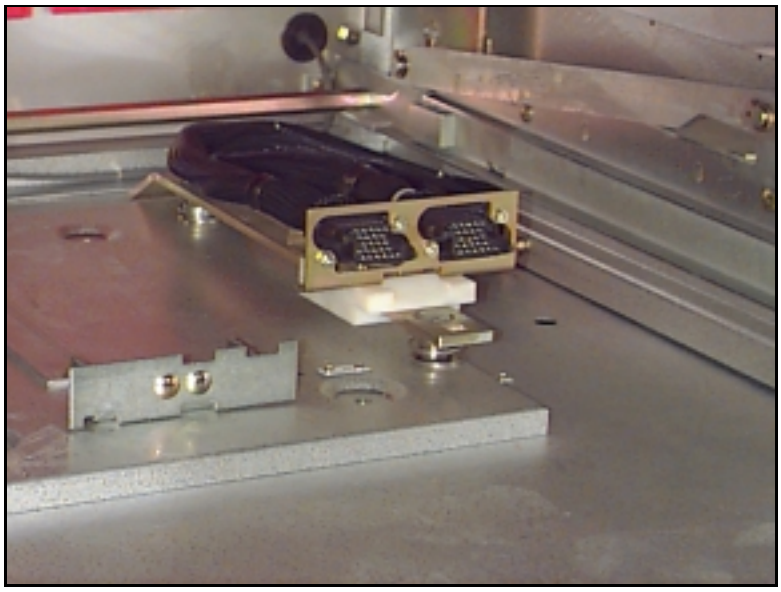


Figure 23: Circuit breaker self-aligning secondaries.

GROUND AND BUS CONTACTS

The ground bus contacts are under the circuit breakers. The circuit breakers are grounded in all positions.

CONTROL WIRES

The main control leads are on the side of the circuit breaker compartment.

CIRCUIT BREAKERS: INSERTING AND REMOVING

Circuit breakers ship separately. The factory installs blocks in the movable parts of breakers with under-voltage release.

All circuit breakers of like rating are interchangeable unless the secondary (control) circuit requires otherwise.

Circuit breakers have three positions in the housing.

1. The DISCONNECT position disengages the main disconnecting devices, and the control contacts on the breaker. They are a safe distance from the stationary part of the devices located on the housings.

2. The TEST position disengages the main disconnecting devices, and engages the control contacts. This position allows operation of the circuit breaker for testing.

3. The CONNECTED position engages the main and control disconnecting devices on the breaker.

Mechanical interlocks prevent moving a circuit breaker from one position to another unless the circuit breaker is open. The interlocks also prevent closing the breaker between positions.

INSERTION

Insertion from the WITHDRAWN to the DISCONNECTED position.

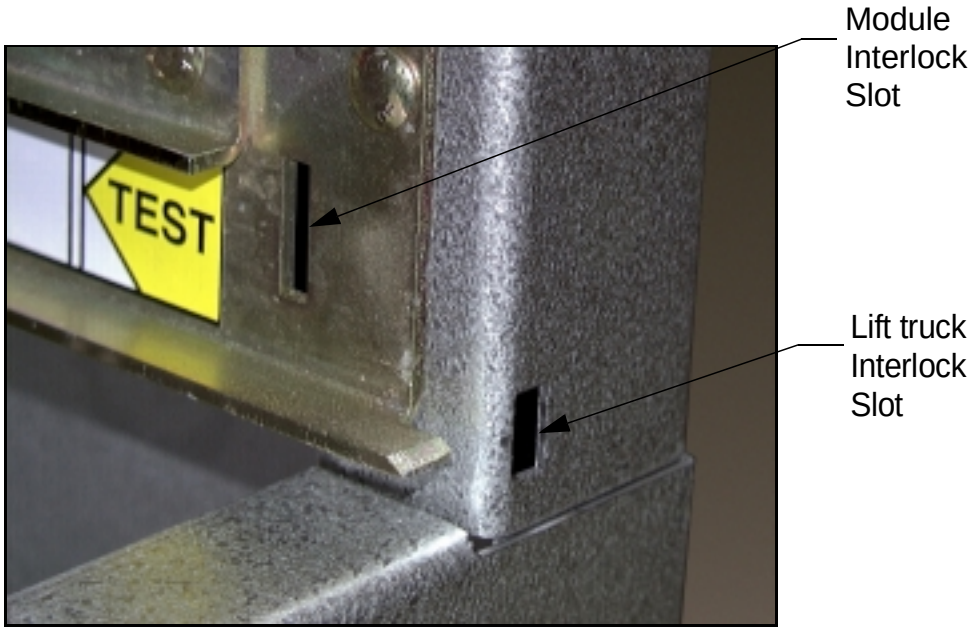


Figure 24: Interlock slots. Right hand shown.

The module interlock tabs must engage the slots in the lift truck platform before releasing the foot-brake and moving the lift-truck. Lower the lift-truck platform before transporting drawout modules with the lift-truck.

1. Align the locking tabs of the lift-truck with the slots in the front of the frame (see Figure 25). Push the lift-truck to the frame to engage the locking tabs with the module. Lower the truck platform slightly to lock in place. The truck platform should be horizontal and aligned with the rails in the module. Set the lift truck brake. Try pulling the lift truck away from the frame. The locking tabs should be set firmly in place and the brake set.

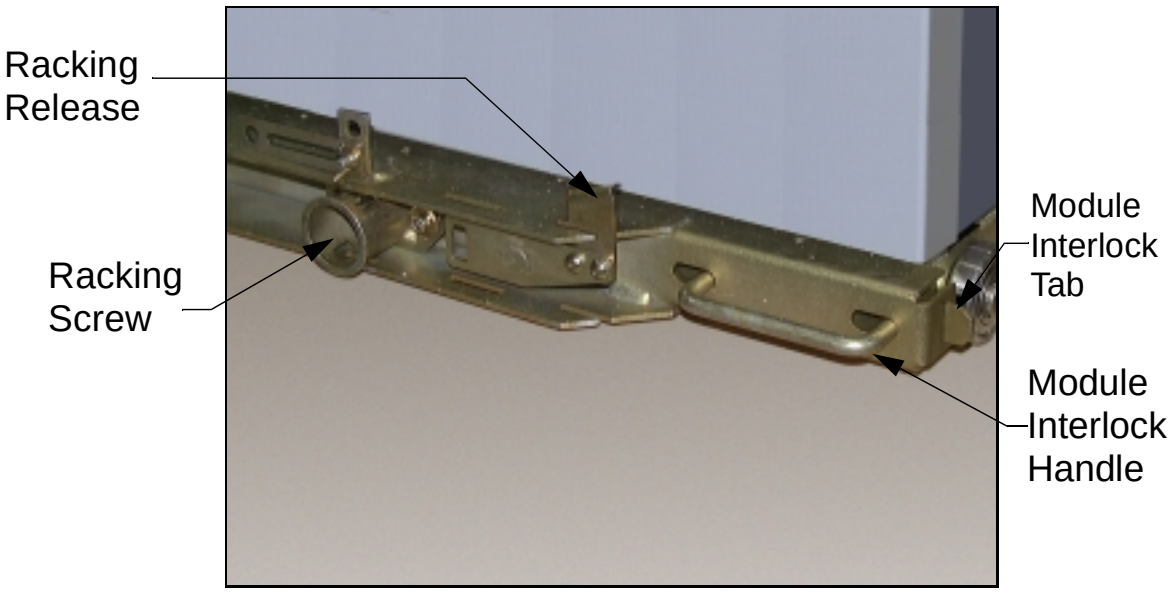


Figure 25: Module Interlock Tabs and Handles.

2. Release the circuit breaker from the lift truck by pulling the handles toward the center of the unit.

3. Push the drawout unit straight into the module.
Keep the unit level as possible.
Do not raise or lift the circuit breaker.

4. Align the Module Interlock Tabs (Figure 25) with the module slots (Figure 24)

5. Engage the Module Interlock Tabs by returning the handles to their outward position.

   a. Verify that the handles are fully outward and the Module Interlock Tabs are in the module slots.

The unit will not rack into the TEST position if the Module Interlock Tabs are not properly engaged with the frame.

a. Push against both sides of the unit to verify that the tabs are locked into position.

a. The circuit breaker is in the DISCONNECTED position.

6. Disengage the lift-truck and move it away from the frame

7. Close the door and secure all door bolts and latching devices.

To rack from the DISCONNECTED position to the TEST Position:

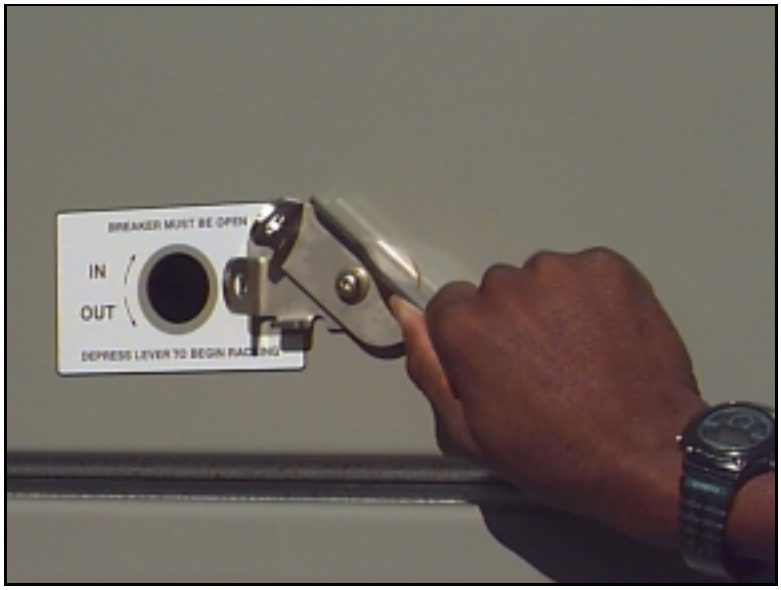


Figure 26: Racking release handle.

8. Press down on the Racking Release Handle.
Engage the racking screw with the Racking Tool and turn clockwise (CW).
Release the handle and continue to rack the unit clockwise into the TEST position.

To rack from the TEST position to the CONNECTED position:

9. Press down on the Racking Release Handle. Engage the racking screw with the Racking Tool. Release the handle and continue to rack the unit clockwise (CW) from the TEST into the CONNECTED position. A slight increase in resistance indicates that the unit is engaging the primary contacts.

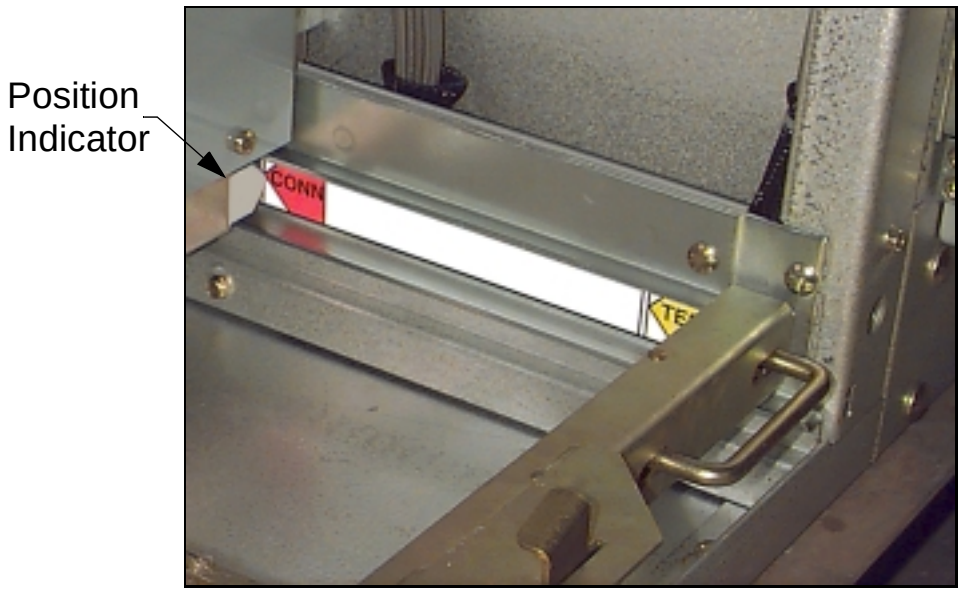


Figure 27: Circuit breaker position indicator.

REMOVAL

1. Do not open the module door.
   The breaker must be OPEN before proceeding to the next step.

2. Press down on the Racking Release Handle. Engage the racking screw with the Racking Tool. Release the handle and continue to rack counterclockwise (CCW), from the CONNECTED position into the TEST position.

To rack from the TEST position to the DISCONNECTED position:

3. Press down on the Racking Release Handle.
   Engage the Racking Screw with the Racking Tool.
   Release the handle and continue racking counterclockwise (CCW), from the TEST position into the DISCONNECTED position.

4. Unlatch and/or remove all bolts from the module door. Open the module door.

5. Align the locking tabs of the lift truck with the slots in the front of the frame. Push the lift truck to the frame to engage the locking tabs with the module. Lower the truck platform slightly to lock in place. The truck platform should be horizontal and aligned with the rails in the module. Set the lift truck brake. Try pulling the lift truck away from the frame. The locking tabs should be set firmly in place and the brake set.

6. Release the circuit breaker from the module by pulling the handles toward the center of the unit.

7. Pull the drawout unit straight onto the lift truck platform.
   Keep the unit level as possible.
   Do not raise or lift the circuit breaker.

8. Align the Module Interlock Tabs with the lift truck slots.

9. Engage the Module Interlock Tabs by returning the handles to their outward position.

   a. Verify that the handles are fully outward and the Module Interlock Tabs are in the lift truck slots.

The module interlock tabs must engage the slots in the lift truck platform before releasing the foot-brake and moving the lift-truck. Lower the lift-truck platform before transporting drawout modules with the lift-truck.

INSERTING AND REMOVING AUXILIARY MODULES

Drawout modules are provided for, Potential Transformers, Current Limiting Fuses, and for Control Power Transformers.

Before inserting a unit into a module, remove foreign objects, tools and debris, or obstructions from inside the module.

Insertion and racking of Auxiliary Drawout modules is similar to inserting a circuit breaker. The units do not have a TEST position.

INSERTION

Insertion from the WITHDRAWN to the DISCONNECTED position.

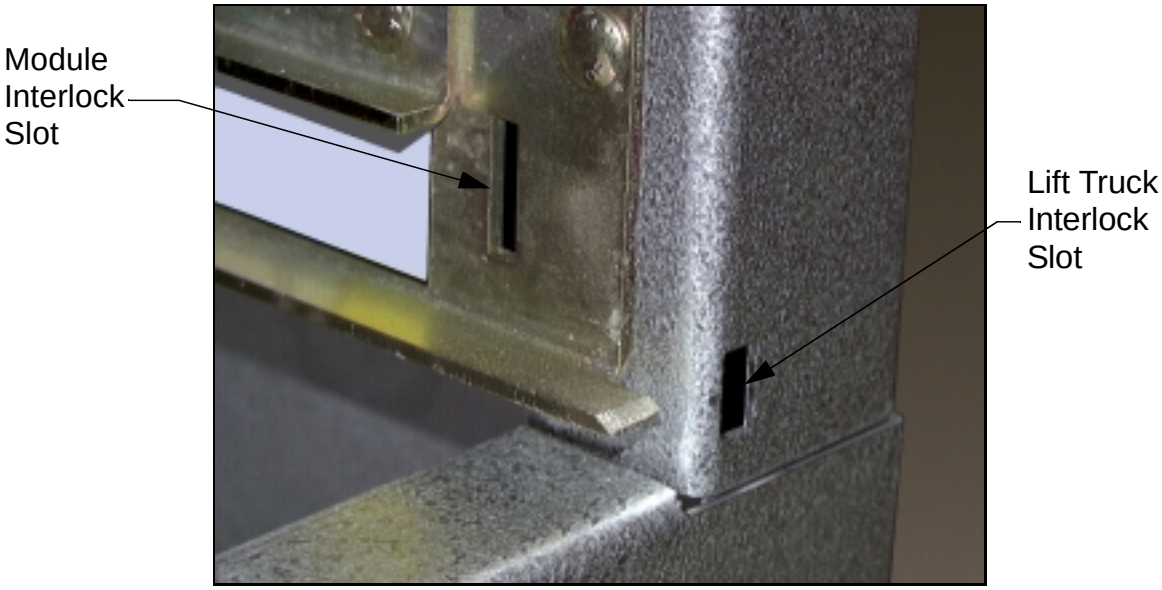


Figure 28: Module Interlock Slots

The module interlock tabs must engage the slots in the lift truck platform before releasing the foot-brake and moving the lift-truck. Lower the lift-truck platform before transporting drawout modules with the lift-truck.

1. Align the locking tabs of the lift truck with the slots in the front of the frame (see Figure 29). Push the lift truck to the frame to engage the locking tabs with the module. Lower the truck platform slightly to lock into place. The truck platform should be horizontal and aligned with the rails in the module. Set the lift truck brake. Try pulling the lift truck away from the frame. The locking tabs should be set firmly in place and the brake set.

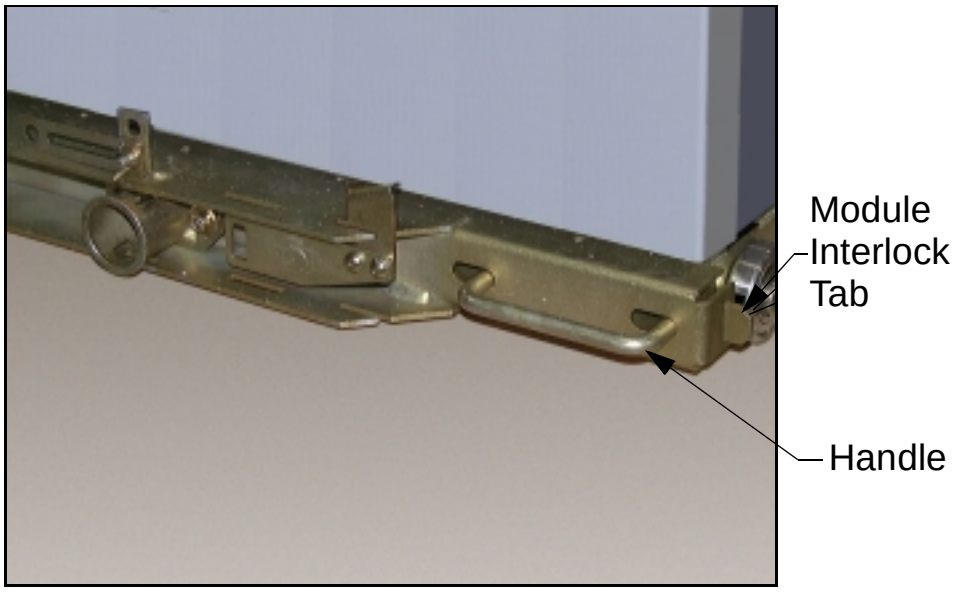


Figure 29: Module Interlock Tabs and Handles.

2. Release the module from the lift truck by pulling the handles toward the center of the unit.

3. Push the drawout unit straight into the module.
Keep the unit as level as possible.
Do not raise or lift the unit.

4. Align the module interlock tabs (Figure 29) with the module slots (Figure 28).

5. Engage the module Interlock tabs by returning the handles to their outward position.

    a. Verify that the handles are fully outward and the module interlock tabs are in the module slots.

    The unit will not rack into the CONNECTED Position if the module interlock tabs are not properly engaged with the frame.

    a. Push against both sides of the unit to verify that the tabs are locked into position.

    a. The unit is now in the DISCONNECTED position.

6. Disengage the lift truck and move it away from the frame.

7. Close the door and secure all door bolts and latching devices.

To rack from the DISCONNECTED to the CONNECTED position:

8. Press down on the Racking Release Handle before racking. For auxiliary units without a racking release handle, push the Racking Screw with the Racking Tool and rack clockwise (CW) into the CONNECTED position.

REMOVAL

1. Do not open the module door.

2. Press down on the Racking Release Handle before racking. Engage the racking screw with the Racking Tool. Rack counterclockwise (CCW), into the DISCONNECTED position.

3. Open the module door.

4. Align the locking tabs of the lift truck with the slots in the front of the frame (see Figure 27 and 28). Push the lift truck to the frame to engage the locking tabs with the module. Lower the truck platform slightly to lock into place. The truck platform should be horizontal and aligned with the rails in the module. Set the lift truck brake. Try pulling the lift truck away from the frame. The locking tabs should be set firmly in place and the brake set.

5. Release the unit from the module by pulling the handles toward the center of the unit.

6. Pull the drawout unit straight onto the lift truck platform.
   Keep the unit level as possible.
   Do not raise or lift the circuit breaker.

7. Align the Module Interlock Tabs (Figure 29) with the lift truck slots.

8. Engage the Module Interlock Tabs by returning the handles to their outward position.

9. Verify that the handles are fully outward and the Module Interlock Tabs are in the lift truck slots.

The module interlock tabs must engage the slots in the lift truck platform before releasing the foot-brake and moving the lift-truck. Lower the lift-truck platform before transporting drawout modules with the lift-truck.

Chapter 9

Maintenance

GENERAL

Inspect all switchgear installations at frequent intervals. Perform a visual inspection, front and rear, to see that there is no evidence of loose parts, warping, or undue vibration. Take steps to remedy any deficiencies of this nature that may appear. Keep the assembly dry. Cover to prevent moisture from dripping on equipment. Do not block vents or flaps.

DANGER

There are hazards of electrical shocks and/or burns whenever working in or around electrical equipment. Turn off power ahead of the switchgear before performing any inspection or maintenance operations. Check incoming line terminals to verify that the equipment is de-energized and grounded. Check out-going terminals to ensure that no back-feed condition exists.

CAUTION

Limit the use of solvents to removing grease and contamination from primary conductors, insulation, and from unpainted metallic surfaces. ***Do not use alcohols or freons.*** *Use OSHA approved solvents in accordance with local regulations. Use a non-flammable solvent with a threshold limit of 300 PPM or higher. Use solvents in well-ventilated areas.*

SEMI-ANNUAL INSPECTION

At least twice yearly, perform a through inspection of the switchgear. Emphasize the following checks:

1. Perform an overall visual inspection.
2. Check all indicators, meters and instruments for proper operation.
3. Make sure all bolted connections are secure.
4. Verify operation of heaters and thermostats, if used.
5. Check for undue noise and vibration that might loosen bolted connections.
6. Look for evidence of moisture in the switchgear.
7. Note presence of abnormal ozone odor.

ANNUAL INSPECTION

In addition to the semi-annual inspection, perform the following recommended inspection and maintenance once a year, or sooner, if required by local conditions or regulations.

1. Bolted connections should be tight. Discoloration, excessive corrosion, embrittled or discolored insulation may indicate an overheated connection. If found, follow the procedure described under section “Suspect Joint Maintenance.”
2. Inspect all cables for tight connections and ample support.
3. Inspect control wiring for signs of wear and damage. Replace wire wherever doubtful.
4. Examine resistors and other devices prone to over heating.
5. Open all hinged doors and remove bolted panels.
6. Clean insulation thoroughly.

7. Withdraw and clean all drawout components. (Refer to Circuit Breaker Instruction Booklets before cleaning contacts.)

8. Clean the stationary portion of the switchgear by wiping with a clean cloth. Use dry, compressed air in inaccessible areas.

9. Remove the covers of all panel devices where possible. Check wiring for secure connections. Clean contacts on relays and switches wherever necessary. Replace covers.

10. Remove air filters when used. Flush with clean water if necessary. Coat filters with Randolf Products', Super Coat Adhesive or equivalent.

11. Inspect the gearing of lift devices, if used. For normal operation use a heavy gear lubricant. In very dirty or gritty conditions, use a dry lubricant.

12. Follow the recommendations of any individual device instructions furnished for maintenance of the device.

24 Month Inspection

In addition to the annual inspection, perform the following recommended inspection and maintenance at 24 month intervals, or sooner, if required by local conditions or regulations.

1. Clean the circuit breaker stationary primary contacts. See the maintenance instructions shipped with each unit for detailed instructions.

2. Inspect secondary wiring bundles for signs of discoloration because of heat or chafing. Check for cracked or embrittled insulation. Replace wire whenever doubtful.

3. Inspect primary insulation system for accumulated contamination. Clean insulation with a dry cloth, dry-air, vacuum, or if necessary with an OSHA approved solvent.

4. Check the calibration of protective relays approximately every two years.

5. Follow the recommendations of any individual device instructions furnished for maintenance of the device.

10 YEAR MAXIMUM INSPECTION

In addition to the annual inspections and maintenance, perform the following recommended inspections and maintenance every ten years, or sooner, if required by local conditions or regulations.

1. Disassemble, inspect, clean, lubricate, adjust and calibrate circuit breaker mechanisms as recommended in the instructions furnished with the circuit breaker.

2. Torque all primary conductor connection bolts to recommended values.

3. Tighten all secondary control wire connections. Check for loose lug crimps and broken wire strands.

SUSPECT JOINT MAINTENANCE

1. Open joint and inspect connection surfaces.

2. Clean surfaces with an OSHA approved solvent. Dress contact surfaces that show minor corrosion or pitting by lightly rubbing with a polishing cloth such as “3M Scotch Brite”. Take care to minimize the removal of plating.

3. Replace parts that signs of heavy corrosion, arcing or melting.

4. Replace contact fingers springs after exposure to excess heating at the breaker disconnect.

5. Before assembly, protect contact surfaces with “No-Ox-Id Special A Compound”, a product of Sanchem Chemical Co., or equivalent.

6. Use proper torque in tightening bolted connections. See Table 2.

Table 2

Torque Values for Equipment Hardware

Bolt Size (Inches)	Foot-Pounds (Dry Threads)
3/8	15-35
1/2	30-45

CARE OF FINISH

The finish is strong and durable. Always keep the switchgear clean. Wiping with a clean dry cloth will usually suffice. To remove oil and grease marks, use warm water and soap, and wipe dry with a clean, dry, soft cloth.

Because the color and finish may vary, consult the front sheet of the Bill of Materials before using touch-up paint. The standard paint color is ANSI 61, light gray. A 12 ounce aerosol can of ANSI 61 touch-up paint is available from ABB under part number 88787A00.

RENEWAL PARTS

Previous experience and the number of vertical sections in service are the best guidelines for determining the stocking of replacement parts. Order factory original replacement parts from ABB Power T&D Company Inc., Distribution Systems Division, Sanford, Florida. Specify quantity, part numbers, description, and nameplate data of the device requiring the replacement parts.

For replacement parts, call toll free: 1-800-929-SWGR.

Outside of USA call: 1-407-323-8220, extension “0”.

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY

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