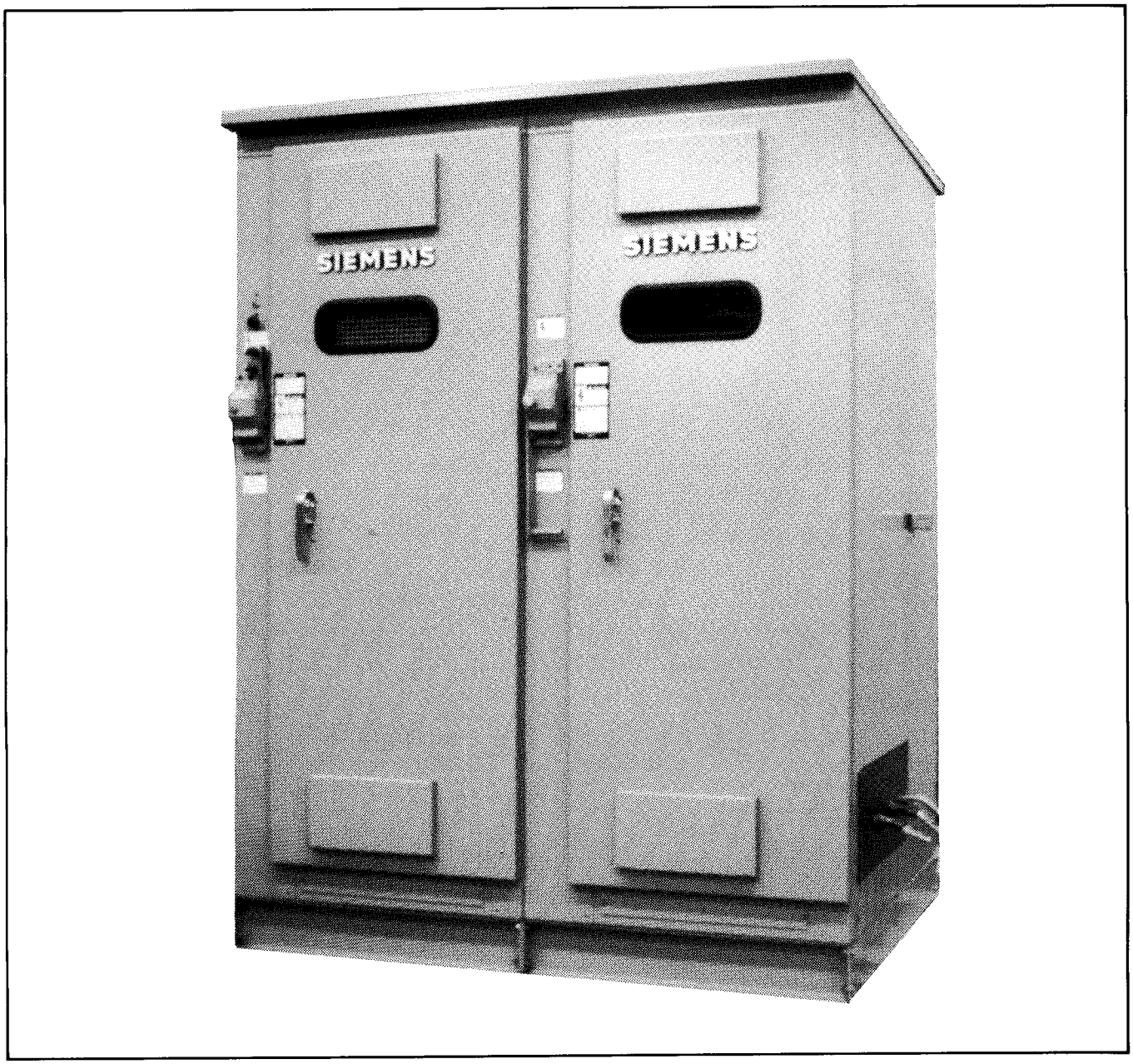
SIEMENS

Type QR Metal-Enclosed Load Interrupter Switches

5 kV and 15 kV

Instructions
Installation
Operation
Maintenance
SG-3428



Preface

This equipment contains hazardous voltages. Severe personal injury or property damage can result if safety instructions are not followed. Only qualified personnel should work on or around this equipment after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained herein. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation and maintenance.

Qualified Person

For the purpose of this manual and product labels, a qualified person is one who is familiar with the installation, construction and operation of the equipment and the hazards involved. In addition, he has the following qualifications:

(a) Is qualified and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.

(b) Is qualified in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc. in accordance with established safety practices.

Danger

For the purpose of this manual and product labels, **DANGER,** indicates death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning

For the purpose of this manual and product labels, **WARNING,** indicates death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution

For the purpose of this manual and product labels, **CAUTION** indicates minor personal injury or property damage can result if proper precautions are not taken.

Table of Contents

NOTE

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

Switch Ratings

kV	Amperes				BIl kV
Maximum	Cont.	Int.	Momentary	Fault Closing	
4.76	600	600	40,000	40,000	60
4.76	600	600	61,000	61,000	60
4.76	600	600	80,000	61,000	60
15.0	600	600	40,000	40,000	95
15.0	600	600	61,000	61,000	95
15.0	600	600	80,000	61,000	95
4.76	1200	1200	61,000	61,000	60
4.76	1200	1200	80,000	61,000	60
15.0	1200	1200	61,000	61,000	95
15.0	1200	1200	80,000	61,000	95

For all electrically operated switches refer to supplemental instructions.

General Information

These instructions apply to Siemens Type QR indoor and Type OQR Outdoor Metal Enclosed Load Interrupter Switches (LIS) as covered by ANSI Standard C37.20 Metal Enclosed Interrupter Switchgear. This equipment is described in detail in catalog section SG-3111.

A standard 36-inch cubicle (QR-36) can be used individually with an open dry-type transformer, or adjacent to any auxiliary high voltage unit in which proper bus entry and alignment can be made. A 14-inch wide transition unit and a throat are added when the 36-inch wide cubicle is used with liquid-filled or outdoor dry-type transformers.

This equipment has been designed to operate within the limits specified on the rating label. If for any reason the equipment is later used in a different system, or if the short-circuit capacity of the system is increased, the momentary rating of the switch, the interruption capacity of the fuses, and the bus capacity must be checked.

Figure 1. QR-36 Indoor Switch Cubicle.

Figure 2. OQR-36 Outdoor Switch Cubicle.

General Description

The type QR load interrupter switch is a metal enclosed, single throw, gang operated switch which is used on distribution voltages from 2.4 kV to 13.8 kV as a disconnect and circuit interrupter. The interrupter switch differs from a circuit breaker in that it will interrupt its rated full load current, but it will not interrupt overload or fault currents. The switch may be unfused or equipped with current limiting or non-current limiting power fuses to provide fault current interrupting capacity.

The switch is manually operated by a spring-over-center, stored energy operating mechanism through a chain drive and is equipped with an arc chute and quick-make blade. The quick-make closing and quick-break opening energy is supplied by 180 degree rotation of the operating handle. The resulting high speed closing and opening assures safe operation and long life.

An eye-level inspection window is provided through which the position of the switch may be visually checked. The switch operating handle is mounted on the front of the cubicle at chest level.

The metal enclosed load interrupter switch is available in three versions:

Standard switch—two-position (open/closed).

Duplex switch—two 2-position type switches bussed together on the load side, to provide selection of either of 2 incoming services.

Selector switch—two visually identified positions of "line 1," and "line 2." This switch consists of a 2-position (open/close) 600-amp interrupter switch in series with a 2-position (line 1/line 2) disconnect. The disconnect is mechanically interlocked to prevent operation when the interrupter is closed. The interrupter is identical to single feeder units and interrupts its rated load current. The disconnect is mounted in the rear of the compartment and is operated from the front of the unit.

Weights

INDOOR	
QR36	1400 lbs.
QR36 Duplex	2400 lbs.
OUTDOOR	
OQR36	1600 lbs.
OQR Duplex	2800 lbs.
ADDITIONS	
Selector Switch	300 lbs.
14" Transition Unit	300 lbs.

Receiving and Handling

The cubicles are securely blocked and braced for shipment. They are crated, boxed or covered, depending on shipping conditions. Whatever the method of shipment, every precaution has been taken to insure safe arrival of the equipment. If special handling is required, it is so indicated. Although all moving parts are blocked, avoid rough handling when unloading.

To facilitate unloading, four (4) angles with lift holes are provided at the top of the switchgear. If angles are removed after installation use mounting hardware to fill in the cubicle top.

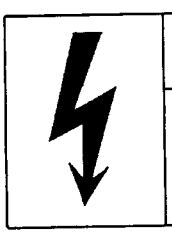
If the angles are removed from outdoor units, be sure to replace the hardware including the weather seal washer into the holes in the roof decks.

To position with rollers, use the shipping skid where possible. If height restrictions required pipe rollers directly under the cubicle. Use a minimum of 3 rollers per section. Place or remove the equipment from the skid or rollers by lifting from the top only.

When removing the rollers, lower the assembly carefully to avoid dropping.

NOTE

Do not remove wooden skids when either rolling units or moving them with a forklift truck.



⚠ CAUTION

Forklift trucks should be used with discretion as improper lift points could cause extreme damage to shipping sections.

When several load center substations are shipped together, each substation is numbered. All crates for a particular substation are numbered the same, in accordance with the "General Arrangement and Floor Plan" drawing of that substation.

Uncrating

Be careful when uncrating equipment. The use of sledge hammers and crowbars may damage the finish and equipment. Use nail pullers.

Check all packing material to insure against accidentally throwing away small parts.

Do not remove identity cards until the switchgear installation is complete.

Inspection

As soon as possible after uncrating, inspect the equipment for any damage which may have occurred in transit. Also check the shipping manifest to be sure all items have been received. If any damage or shortage is detected, note this on the freight bill and contact the carrier immediately.

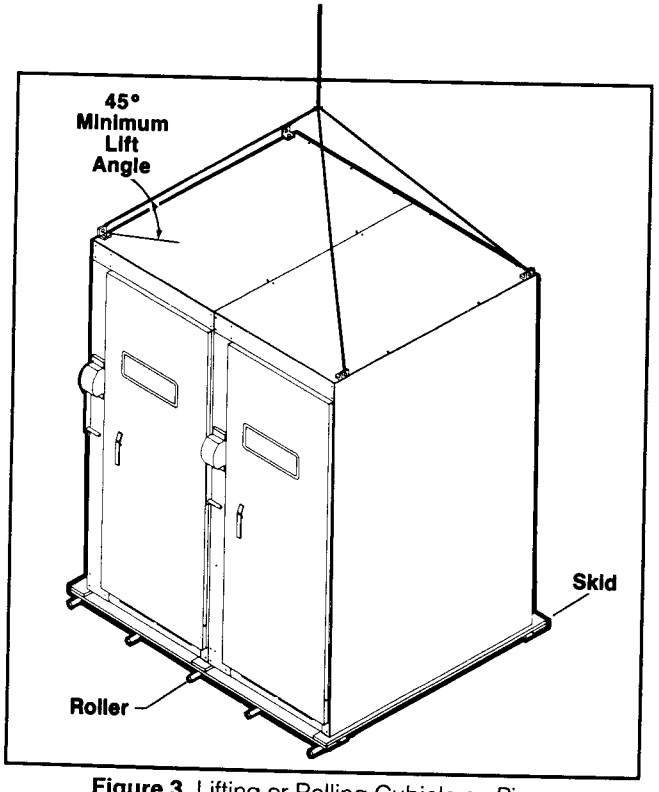


Figure 3. Lifting or Rolling Cubicle on Pipe.

NOTE
This inspection must be made within 15 days after equipment is received or carrier will not allow claim.

Also report any shortage or damage to the nearest Siemens sales office within the 15 day period.

Unusual circumstances may require partial shipment of equipment. In these cases, provisions are made for easy installation of these portions of the complete job.

Storage

If the switches will not be installed immediately, uncrate, inspect and store in a clean, dry place.

Before placing in storage, inspect and grease unfinished steel surfaces, etc., to prevent rusting. Protect mechanism, contacts, etc., from dust and grit with suitable covers. Energize the space heaters to prevent damage from condensation. (Space heaters are standard on all outdoor units and are available as an option on some indoor switch cubicles.)

Indoor cubicles are neither weatherproof nor drip-proof; therefore, store them indoors. If they must be stored outdoors, provide an adequate covering, and place a heat source inside the cubicles to reduce condensation.

Remove all flammable materials from near the heaters before turning the heaters on.

Foundation

Whether installing the switch cubicle on an existing floor or on a new floor, follow the sill channel and anchor bolt dimensions shown on the "General Arrangement and Floor Plan" drawing. Typical floor plans for indoor and outdoor equipment as shown in **Figure 4** and **5**.

Conduit

Install conduit for power and control connections in the area indicated on the "General Arrangement and Floor Plan." Keep conduit ends a maximum of 2" (51 mm) above the finished floor to prevent wash water from soaking the cables. Cap and tape ends to keep out moisture and vermin. In indoor installations, conduit ends should be a maximum of 2 in. (51 mm) above the unit's floor line.

Erection

Switch cubicles are usually shipped as single groups. If the shipment includes several groups, the "General Arrangement and Floor Plan" drawing will indicate the size and relative location of each group. Before installing, make sure that the floor is level within 1/16" (1.5 mm).

NOTE
When connecting the switch to the system, avoid placing any stress on the insulators or bushings.

Bus Bar Joints

When it is necessary to make bus bar joints in the field, all required hardware is furnished. Connections are made with 1/2 in. (12.7 mm) bolts, tightened with a torque wrench to 50-75-foot-pounds (70 N.m). Tightening the bolts as specified will prevent connections from becoming loose as bus bars alternately heat and cool during changes in load.

Bolts provided for these connections are specially designed to withstand the stresses imposed by the torque specified and by the subsequent expansion of the bus bars. Do not replace them with standard bolts. If replacements are needed, use SAE Grade 5 heat-treated bolts.

Transformer Connections

Ventilated Dry Transformers

In line-ups with ventilated dry transformers, the switch is placed against the transformer and bolted together. This results in a more rigid line-up than an unbolted assembly and can also correct for minor variations in the plumbness of these adjacent pieces of equipment.

Figure 6 shows location of bolt holes to be used for this purpose. Two holes are provided on load interrupter switch units; the two holes are in-line with captive nuts provided on the vent dry transformer frame and are "plugged" with .38-16 hardware prior to shipment. To connect the transformer to the switchgear the procedure is:

Bolting Procedure

1. Remove .38-16 in. hardware from bolt holes shown in **Figure 5**; Note that this hardware is hex head and all other hardware holding side plates in place is flat head type. Save all hardware except for hex nut.
2. Move switch into its final position to the dry type transformer.
3. Inspect front and rear joints between switch and transformer. If units are perfectly plumb and the floor is perfectly level, there should be no gap evident between equipment at these joints. If there is a gap larger than .13" (3.30 mm) at top and bottom, proceed to Step 4; if no crack exists, proceed to Step 5.
4. If a gap larger than .13" (3.30 mm) appears at joints, it will be necessary to level and plumb all equipment, and not try to draw equipment together by bolting since this is apt to disturb cubicles which, in turn, may cause malfunctions. Check plumb on all equipment to determine which is causing the problem. Once this has been determined use suitable shims under the equipment base to reduce the gap to a maximum of .13" (3.30 mm).
5. Using the .38-16 bolts, flat and lockwashers removed in Step 1, bolt the switch to the transformer case.

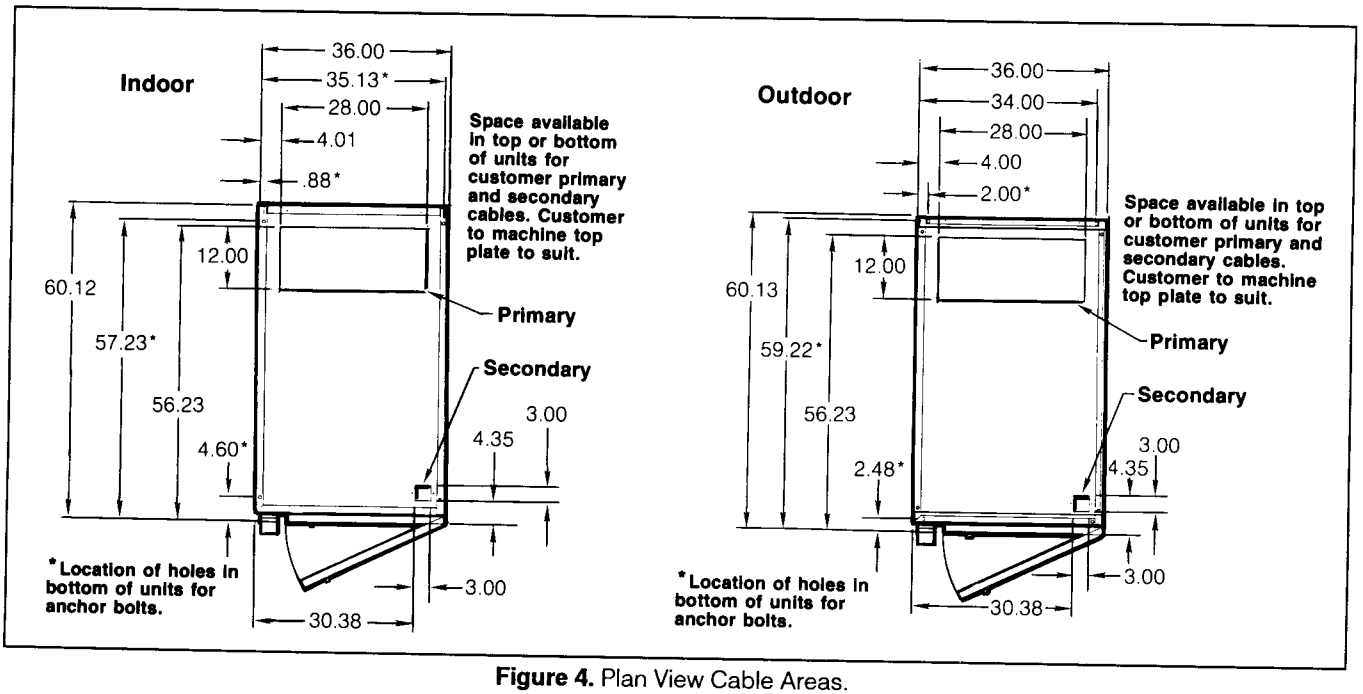
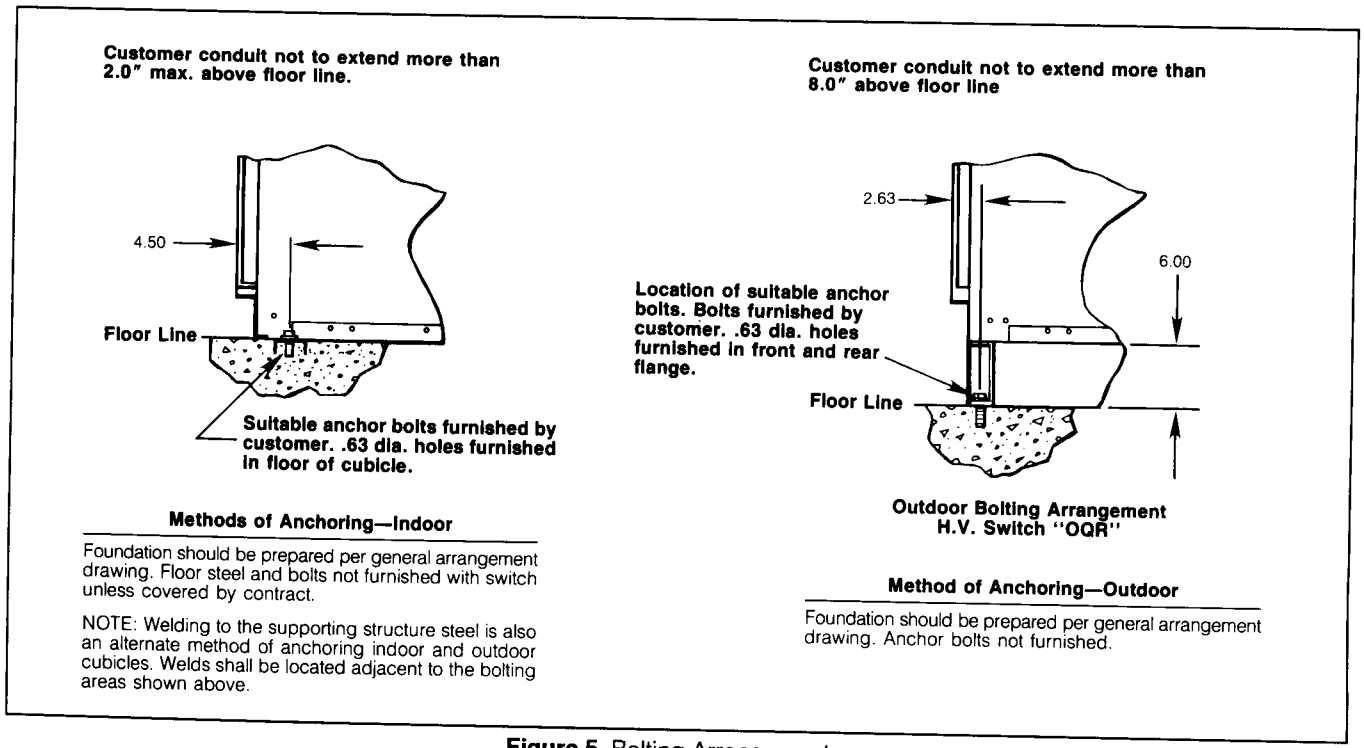


Figure 4. Plan View Cable Areas.



Methods of Anchoring—Indoor

Foundation should be prepared per general arrangement drawing. Floor steel and bolts not furnished with switch unless covered by contract.

NOTE: Welding to the supporting structure steel is also an alternate method of anchoring indoor and outdoor cubicles. Welds shall be located adjacent to the bolting areas shown above.

Method of Anchoring—Outdoor

Foundation should be prepared per general arrangement drawing. Anchor bolts not furnished.

Figure 5. Bolting Arrangements

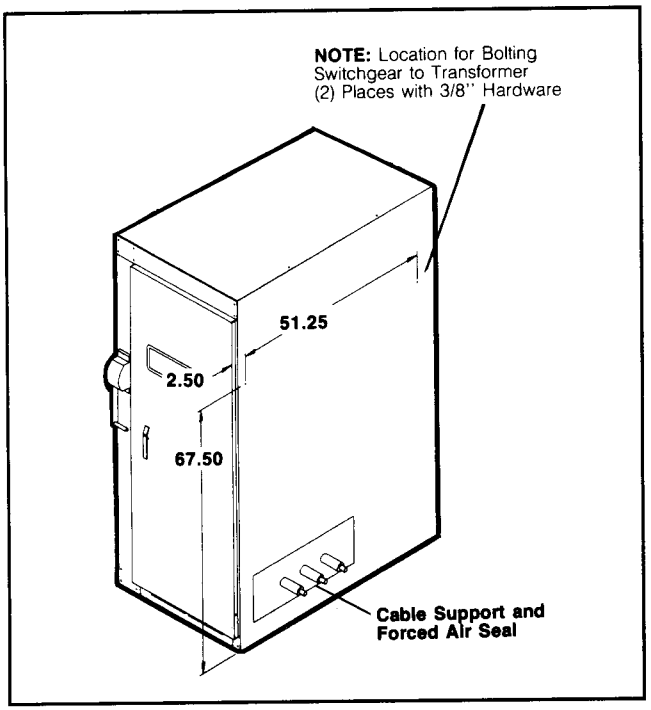


Figure 6. Bolting Procedure for Ventilated Dry Transformers

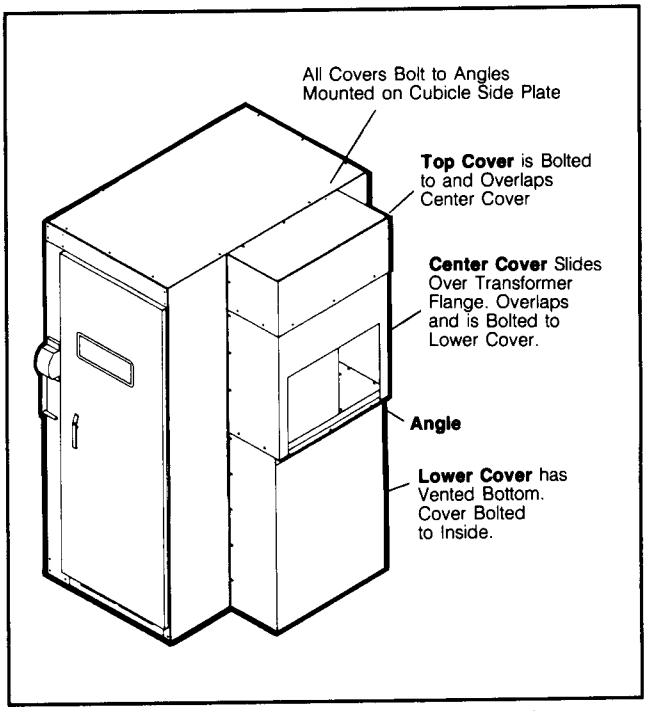


Figure 7. Flexible Cable Connections to the Transformer, Protected by a Hood Assembly

Liquid Immersed Transformers

Connections to liquid immersed transformers are protected by a hood assembly, consisting of a hood, cover, and an angle for sealing the 1 in. (25 mm) space between the switch and the transformer lower throat flange shown in **Figure 7.**

1. Remove the top cover.
2. Remove the center cover.
3. Loosen the angle and adjust to the lowest position.
4. Position the transformer and/or the switchgear according to the dimensions shown on the general arrangement.
5. Connect cable to the transformer. **Figure 8**.
6. Slide angle up to contact the bottom edge of the throat flange.
7. Slide the center cover over the transformer throat and reassemble.
8. Replace the top cover.
9. For Outdoor applications, caulk the vertical seams between the covers and the switchgear.

Precut factory installed cables with suitable cable lugs are provided for making connections to a liquid-filled transformer, as shown in **Figure 8.** To insure ease of assembly and proper fit of mating parts, position the switch and transformer according to dimensions indicated on the "General Arrangement" drawing.

Cable Connections

See typical terminal locations, **Figure 9 A-E**. before making cable connections, consider phase rotation. When the switch is feeding a transformer, phasing is traced from the transformer throat. For typical customer's cable connections, see **Figure 10**. Refer to cable manufacturer's recommendations for detailed information.

the bus insulation by a minimum of 1.5 in. (38.1 mm). Three layers of 1/2 lapped tape are required for 5 kV and 4 layers for 15 kV. Stretching of the tape in problem areas may help in eliminating voids and wrinkles.

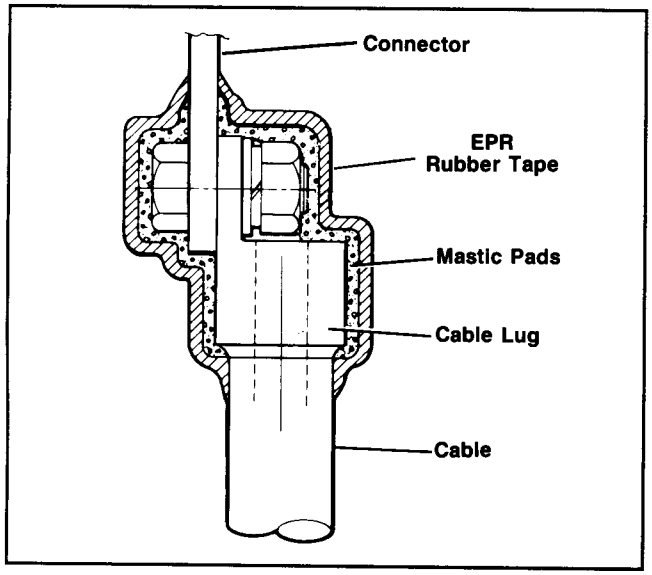


Figure 11. Example of Joint Taping for Cable Connections Required on 15kV Selector Switch

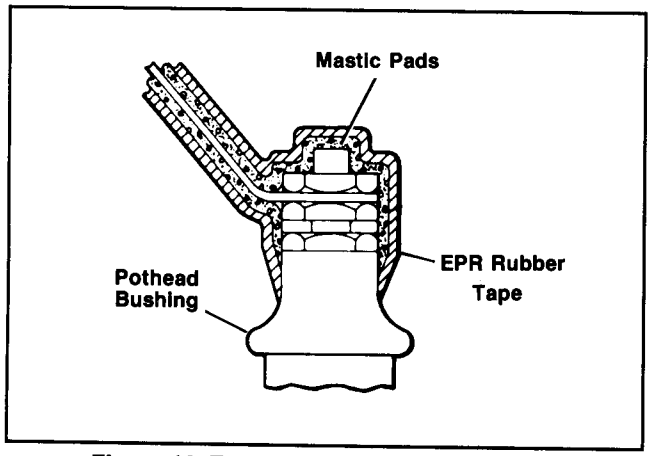


Figure 12. Typical Insulated Taped Joint on Pothead Bushing, 15kV Only

Ground Connection

A common ground bus is incorporated in all units for properly grounding the equipment after installation.

The ground bus is accessible in the primary cable area. Connections to this ground bus must be made so that a reliable ground connection is obtained. Consult latest National Electrical Code for ground connection standards.

Secondary Wiring

Secondary wiring when required, is carefully installed and tested at the factory. A terminal block is furnished for customer's connections as shown in the "Wiring Diagram" for the job.

If special connections are required, such as a source of supply for heaters, wired terminal blocks are provided for this purpose.

Inspection

A thorough inspection and test must be made before placing equipment in service.

Check the following points:

1. High voltage connections properly installed.
2. Electrical disconnecting contacts, machined parts, operating mechanism, etc., checked for lubrication and operation.
3. Blockings, supports and temporary ties removed from switches, instruments, relays, etc.
4. Proper fuses, correctly placed.
5. Temporary wiring jumpers (used on the secondaries of current transformers tied to external devices, as shown on wiring diagrams) removed.
6. Incoming primary and secondary connections properly made and checked for shorts and undesired grounds.
7. All equipment removed during assembly, replaced.
8. Operating handles working easily.
9. Interlocks performing properly.

   Slight variations in the levelness of the installed equipment can make variations between interlock components mounted on the hinged panel and components mounted on the fixed structure. Shimming of the structure or loosening and shifting of the interlock components may be required after final installation.

Final Testing

1. Perform a Megger test on the high voltage circuit to be sure all connections made in the field are properly insulated. A Megger test on the control circuit is also advisable.

   A minimum reading of 200 MEGOHMS when tested with a 1000 volt MEGGER should be obtained before energizing the equipment with primary power.

2. A dielectric test on the high voltage circuit for one minute at one of the following voltages (corresponding to the rated voltage of the equipment) should be made:

Max. Rated kV	Test kV 60 Hertz	DC
4.76	14.3	20.2
15.0	27.0	38.2

NOTE

Voltage transformers, surge arresters, surge capacitors, etc., are disconnected during this test.

A dielectric test on secondary and control circuits is made at 1130 volts. The above test voltages are in accordance with ANSI standards.

DANGER

Disconnect switch from all external power sources before performing any inspection or maintenance except fuse replacement in units whose fuses cannot be energized by backfeed.

Unauthorized personnel should not be allowed near energized equipment. Failure to observe those precautions will result in serious burns or electrical shock causing serious personal injury, death, and/or property damage.

General Information

The load interrupter switch is completely adjusted, tested and inspected at the factory before shipment. No additional adjustment is necessary; however, check to be sure shipment and storage have not resulted in damage or change of adjustment.

Description

The opening and closing springs of the off-center stored energy mechanism provides for quick make (rated fault closing) and quick break (rated load interruption). The switch mechanism shaft is driven by a chain and sprocket from the front operating handle. As the handle is rotated, it is directly connected to a sprocket which in turn, chain drives the opening spring to a "charged" position. As the operator continues to rotate the handle, the charged spring is driven off-center by the chain and releases its energy into rotating the operating shaft to open. The switch blades will not move, in either a closing or opening direction, until the closing spring causes rotation in the operating shaft. It should be noted, that once the springs are moved off-center, the operator has no further control of the opening and closing operation. Therefore the fault closing and load break operations are independent of the operating handle speed.

Sequence of Operation

Quick Make—Rated Fault Close

Quick Break—Rated Load Interruption

To Open the Switch:

1 Pull handle latch button to its extreme position.

CAUTION

Failure to clear latch button lever from the housing mechanism can cause extreme damage and jam the operating mechanism.

2. Move handle toward the lower position about 15° or until a resistive force is felt in the handle. It is now safe to release the latch button.

CAUTION

Once operating handle motion has been initiated DO NOT let go of the handle until the 180° travel has been completed.

3. With a swift positive unhesitating force complete the opening stroke. Once again "off-center" the stored energy mechanism takes over and there is no further control of opening by the operator.
4. Now complete the movement of the operating handle until you feel and/or hear the latch button seat itself.

To Close the Switch:

Closing procedures are just the reverse of the above, except of course, move the handle toward the upper position.

Switch Operator

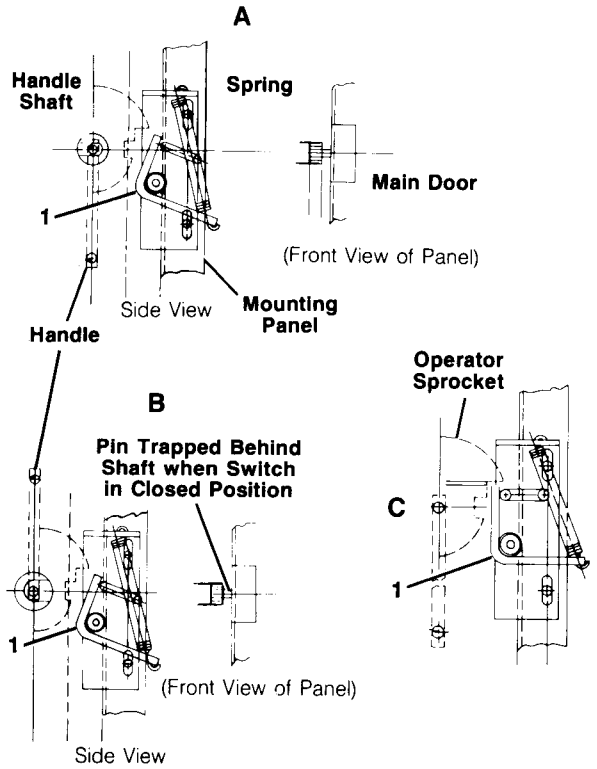
Mechanical Interlocks (**Figure 13**), supplied as standard, hold the main door closed when the switch is closed. To gain access to the switch compartment when the switch is open rotate door handle counter clockwise on the main door. The door is new free to be opened.

Key interlocks (**Figure 14**) can be supplied when specified. The lower key interlock engages the operating handle and prevents rotation in the open and/or closed position. The upper key interlock also prevents motion of the operating handle and can only be used to lock the switch in the open position.

⚠WARNING

Do not attempt to defeat any interlocks. Failure to observe these precautions may result in serious burns or electrical shock causing serious personal injury, death, and/or property damage.

Figure A interlock position: Switch open, handle down, door closed and locked
Figure B interlock position: Switch closed, handle up and door closed and locked
Figure C interlock assy. mtg. switch open, handle down and door open



When the main door is closed the interlock (1) assembly is rotated to unblock the operator handle sprocket allowing the switch to be closed. When the main door is open, the interlock assembly (1) blocks the rotation of the operator handle sprocket preventing switch from being closed.

Figure 13. Mechanical Interlocks (Switch Operator)

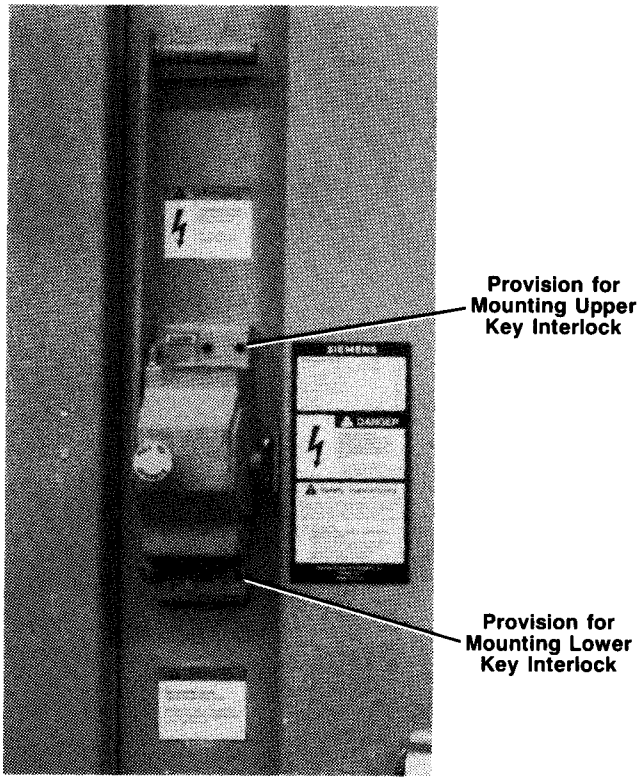


Figure 14. Load Interrupter Switch Operator

⚠ WARNING

Failure to properly maintain the equipment can result in severe personal injury and product failure. The instructions contained herein should be carefully reviewed, understood and followed.

These instructions do not represent an exhaustive survey of maintenance steps necessary to ensure safe operation of the equipment. Particular applications may require further procedures. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office.

Dangerous voltages are present in the equipment which can cause severe personal injury and product failure. Always de-energize and ground the equipment before maintenance. Maintenance should be performed only by qualified personnel.

The use of unauthorized parts in the repair of the equipment, tampering by unqualified personnel, will result in dangerous conditions which can cause severe personal injury or equipment damage. Follow all safety instructions contained herein.

⚠ DANGER

Before any maintenance work is performed within primary compartments, make certain that the equipment is completely deenergized, tested, grounded, tagged or properly identified and released for work in an authorized manner.

Failure to observe these precautions will result in serious burns or electrical shock causing serious personal injury, death, and/or property damage.

Periodic Inspection

Thorough inspection at periodic intervals is important to satisfactory operation. Conditions affecting maintenance are weather and atmosphere, experience of operating personnel, and special operation requirements. The frequency of inspection and maintenance will, therefore, depend on installation conditions and can be determined only by experience and practice. It is recommended, however, that the following inspections be performed at least once a year or after 100 operations of a 600-amp switch or 20 operations of a 1200-amp switch whichever occurs first. More frequent inspection may be necessary if local conditions require.

Disconnect and remove this switch from all sources of electric power, so that it is COMPLETELY de-energized prior to working on it. This includes BUT is NOT LIMITED TO:

1. The switch supply source of electricity.
2. Back feed of electricity from:
    a. Motors
    b. Generators
    c. Power Transformers
    d. Potential Transformers
    e. Control Power Transformers
    f. Other sources of electric power
    g. The outgoing and/or incoming distribution system

Consider this equipment alive until all sources of voltage are removed and safely grounded.

Cleaning

All switches, including insulators and operating arms, should be thoroughly cleaned periodically by wiping with a clean cloth to prevent accumulations of dust. After cleaning, a light coat of Siemens Contact Lubricant should be applied to the contact surfaces. Do not use "cup" or other grease which may harden upon exposure to air. Do not lubricate arcing contacts.

Contacts (Replace any worn or damage parts)

Check to determine that the blades make good contact—**IMPORTANT**—this is a sliding joint and over tightening can cause the switch not to open and cause severe damage to the mechanism. Tighten to approximately 22-inch pounds. A

contact resistance reading should be taken and should be between 35 to 80 micro ohms. If values of resistance are greater than 100 micro ohms, check the blade wipe to insure proper contact. If resistance readings are less, refer to step 1 & 2 (under Switch Alignment), to insure blades can be "opened" from jaw casting with pulling pressure of approximately 25 pounds.

Switches are provided with silver to silver contacts. These contacts do not tarnish like copper, but they should be "wiped" clean occasionally, especially if the switch has not been operated for some time. This can be done by opening and closing the switch several times in succession. Do not attempt to grind the blades with powdered emery or other abrasives. Such practice inevitably results in poor contact and overheating. See Switch Alignment (page 15) for aligning and making proper contacts.

Insulators

It is necessary that the insulators surfaces be kept clean. This is absolutely essential, particularly when the switches are located where cement dust, metallic dust, salt spray, acid fumes and other unfavorable environmental conditions exist. Isopropyl Alcohol cleaner is recommended for cleaning the porcelain insulators. Make absolutely sure that proper ventilation and other precautions are provided when using any chemical cleaner. Discard and replace any insulators showing signs of treeing or tracking.

Insulation Check

When making a periodic check, all insulation should be carefully examined for tracking. Special attention must be given to areas where the conductor passes through an insulator or lays near a barrier. Examine the surface for cracks or streaked discoloration. When tracking is found, the insulation involved must be replaced.

Bus and Conductor (Switch Blade) Check

Inspect the buses and connections carefully every year for evidence of overheating. It is desirable to measure the resistance to ground with a meter (or use a megger of proper voltage) and between phases of the insulation of buses and connections. A record should be kept of this reading. Weakening of the insulation from one maintenance period to the next period can be recognized from the recorded readings. At recording time, the record should include the temperature, the humidity and the date.

Chain Drive

The chain drive assembly connects the stored energy mechanism to the operating handle on the front of the housing (**Figure 15**). It consists of a length of roller type chain fastened in a loop by two turnbuckles with lock nuts. If for some reason the chain is to be replaced, follow the instructions below.

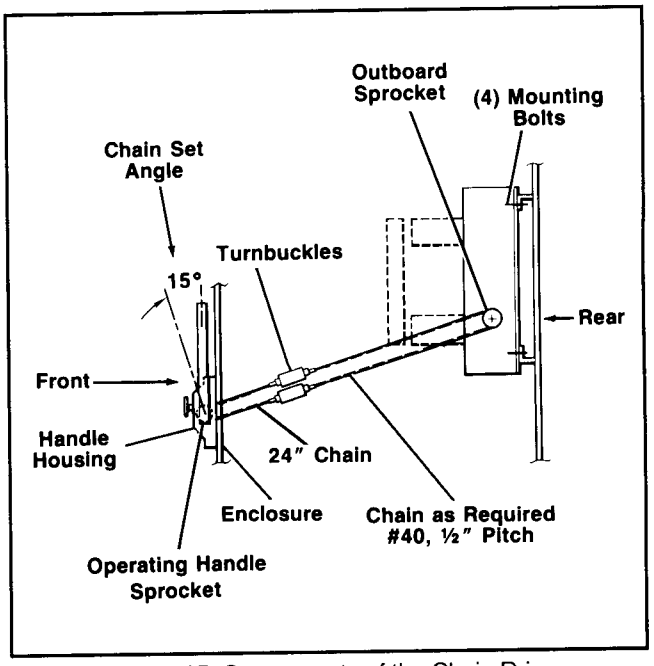


Figure 15. Components of the Chain Drive

For the operating-handle sprocket location, select the shorter length of chain sections furnished. Pass the chain around the handle sprocket such that, with the handle in mid-position, the free ends of the chain are about the same length when extended. See **Figure 16**. Place the handle in the latched-closed position. Handle "Up"—Switch must be closed.

Couple turnbuckles to each end of the above chain. Extend each turnbuckle to its maximum length. Then using the longer length of chain provided, connect it to extend from one turnbuckle, around the switch drive sprocket and back to the other turnbuckle. Remove chain links to make the chain about two links longer than required to go from one turnbuckle to the other.

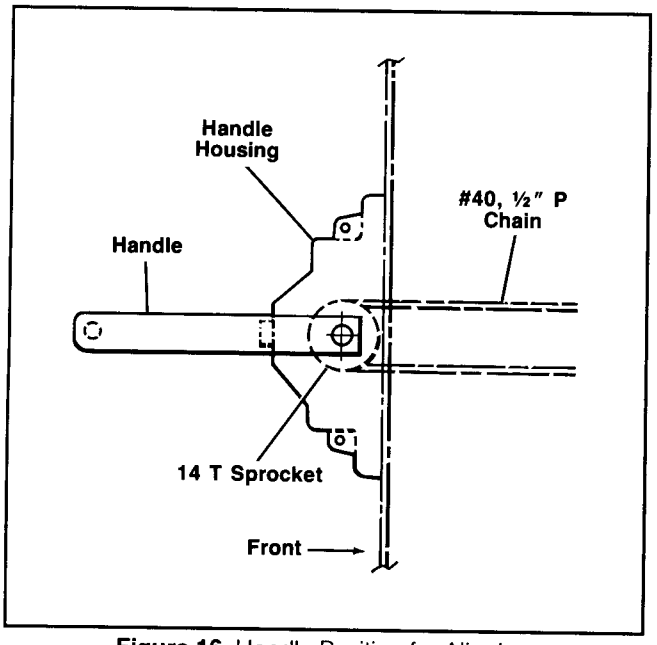


Figure 16. Handle Position for Aligning Short Chain Ends

Move operating handle approximately 15° from its vertical ("Up") position and hold it in this position. See **Figure 15**. Connect chains and turn buckles until chain tension is even and fairly tight. (1/2" deflection). Move handle back "up" into its locked-closed position.

⚠CAUTION

Be sure to tighten the nut on the turnbuckle after adjusting.

Switch Alignment

If the switch is being overhauled, or major components are being replaced, follow these steps for proper switch alignment.

Step #1

Remove cotter pins and clevis pins that connect pushrods to operating arms of each pole of switch. See **Figure 17**.

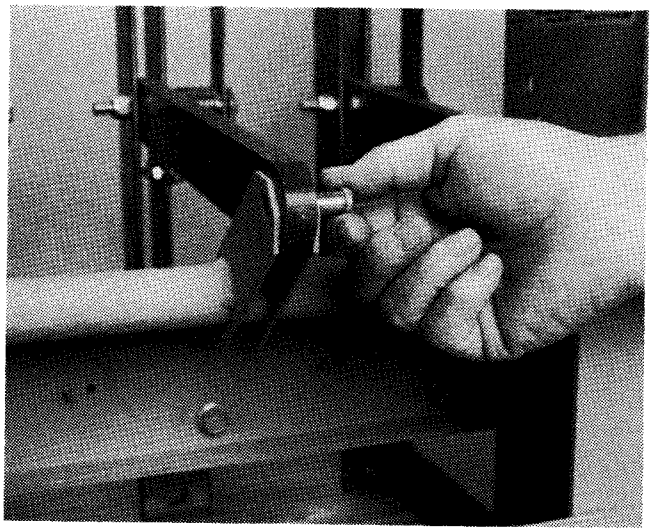


Figure 17. Disconnecting Link

Step #2

By pulling outward on switch blade, disengage switch blade from jaw casting. Continue to pull outward on switch until arcing blade disengages with arc chute. (CAUTION should be exercised in this step, due to the fact that the arcing blade is under spring pressure.) See **Figure 18**.

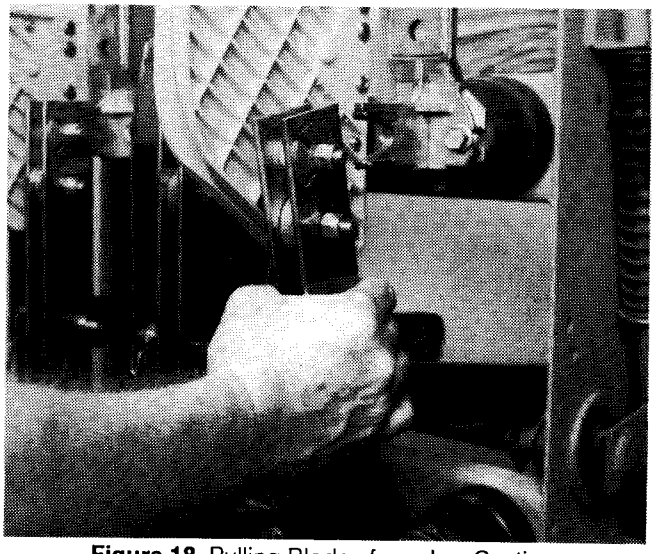


Figure 18. Pulling Blades from Jaw Casting

Step #3

Slowly move blade in and out to check for proper alignment of arcing blade to arc chute. See **Figure 19.**

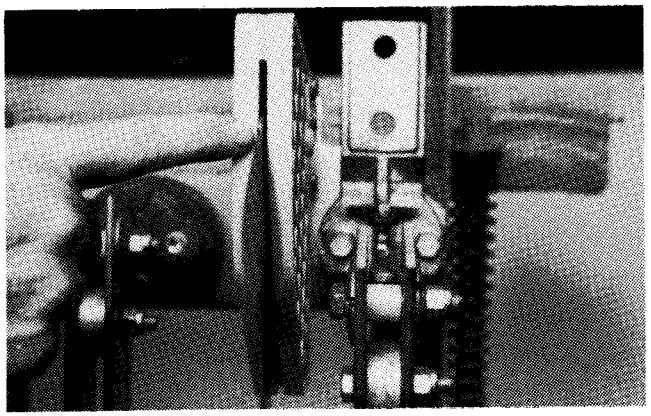


Figure 19. Checking Blade Alignment

Step #4

Alignment of arcing blade and switch blade to arc chute and jaw casting respectively is obtained by loosening jaw casting mounting bolts and lightly tapping arc chute mounting bracket. Re-tighten bolts. See **Figure 20.**

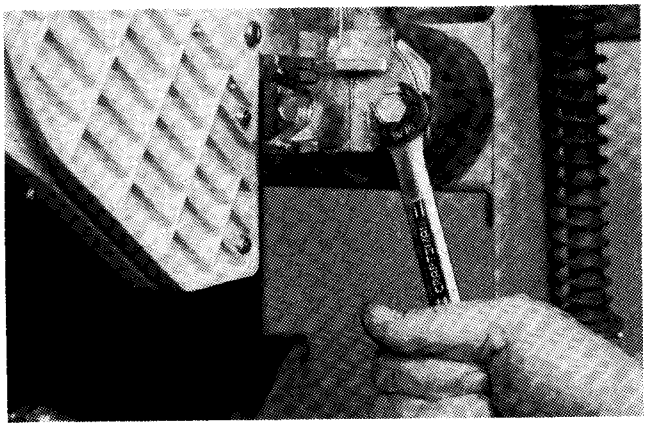


Figure 20. Loosening Jaw Casting for Alignment Change

Main Blade to Jaw Casting Clearance

After Steps 2 thru 4 above have been completed for each pole, proceed to adjust for clearance of main blade to jaw casting. This is done as follows:

Push inward on main blade until contact is made between main blade through-bolt and jaw casting. See **Figure 21**.

After repeating the first step, the proper main blade through bolt to jaw casting clearance should exist. This clearance is adequate to insure that the main blade thru bolt does not bottom on jaw casting, creating unnecessary stress on insulators, castings and connection points. This clearance is also necessary for proper positioning of arcing blade in arc chute as illustrated in the following cutaway views (**Figure 22**).

By applying pressure as illustrated in **Figure 23**, check for proper clearance. The arcing blade should rest freely in stationary arcing contact with switch "closed" and with slight pressure, it should move to the rear, approximately 1/8". Any correction in the arcing blade positioning necessary (after all of the previous steps have been completed) may be done by loosening the locknut on the arcing blade adjusting screw (see **Figure 24**) and turning screw either in or out to obtain positioning of arcing blade. Re-tighten locknut.

With the completion of all steps of alignment and a final torque check of all mounting hardware, to include jaw casting mounting bracket bolts, the switch is ready to be "opened."

Examine and test all safety interlocks.

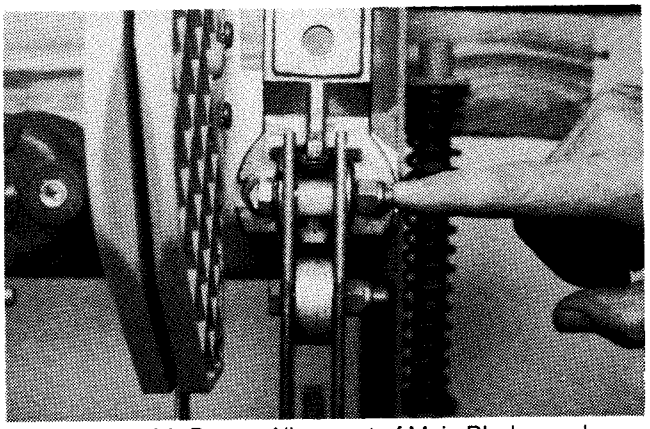


Figure 21. Proper Alignment of Main Blades and Jaw Casting

Corrosive Atmospheres

This equipment is designed to give top performance when installed in normal indoor or outdoor locations. Where abnormal conditions such as corrosive atmospheres are encountered, special precautions must be taken to minimize these effects. Exposed metal surfaces of non-insulated bus bars, disconnect switches, wire ends, instrument terminals, etc., must be protected.

Lubricate contact surfaces with a generous coat of Siemens Contact Lubricant or other equally non-hydroscopic grease. If this type of grease is not available, petroleum jelly may be used. Protect other exposed members with a coat of Glyptol lacquer or any other corrosion-resisting paint.

When old grease becomes dirty, wipe the parts clean and apply new grease immediately. Do not apply lubricants to surfaces of insulating materials.

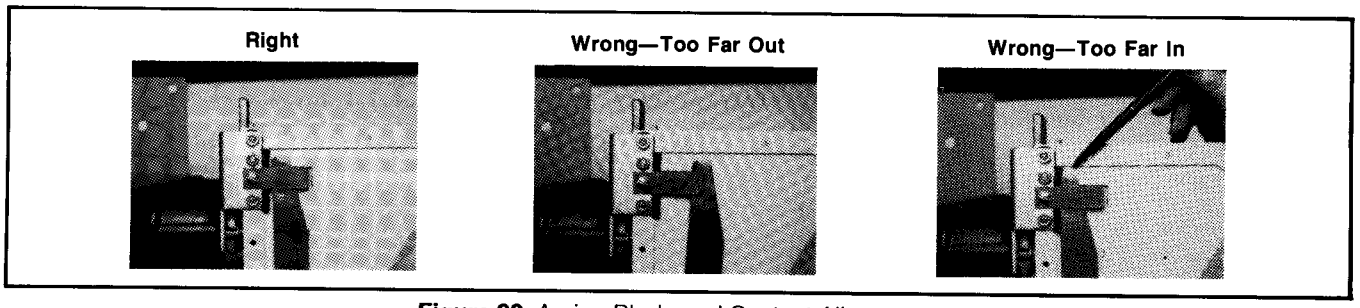


Figure 22. Arcing Blade and Contact Alignment

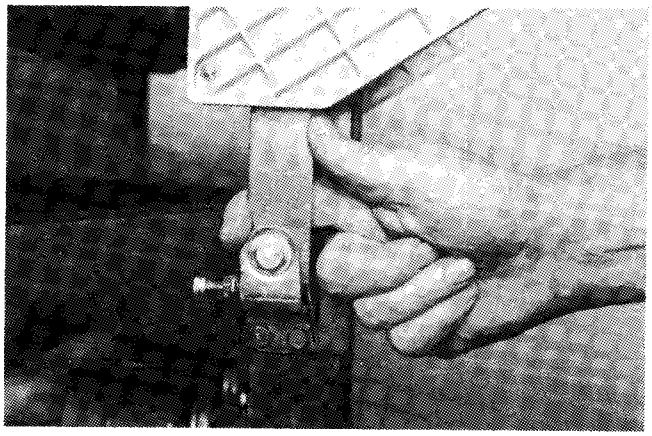


Figure 23. Checking for Arcing Blade Clearance

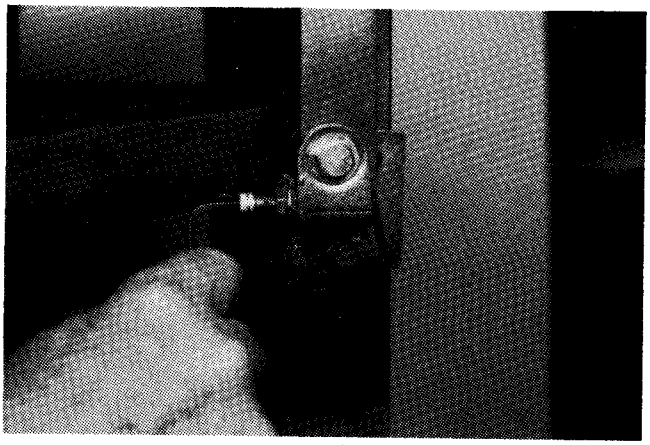


Figure 24. Arcing Blade Adjusting Screw

Space Heaters and Vent Filters

Outdoor equipment is furnished with a space heater as standard. Where humid conditions exist, start heaters well in advance of energizing the equipment to insure that the insulation is dry.

Access to the heaters for test or maintenance is available without opening the main access door. This means that the primary power does not need to be interrupted, however, be sure to turn off the secondary power supplying the heaters. **Figure 25** shows the heater access panel.

Filters are mounted in door vent protective covers and can be changed without opening the main access door. Filters can be cleaned or replaced by squeezing them into or out of the bottom opening in the cover. See **Figure 26**.

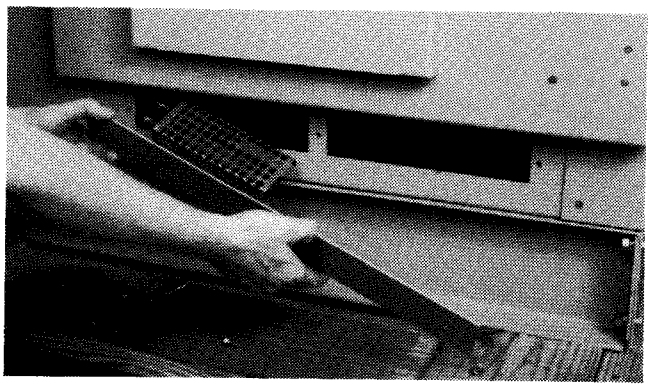


Figure 25. Space Heater Location

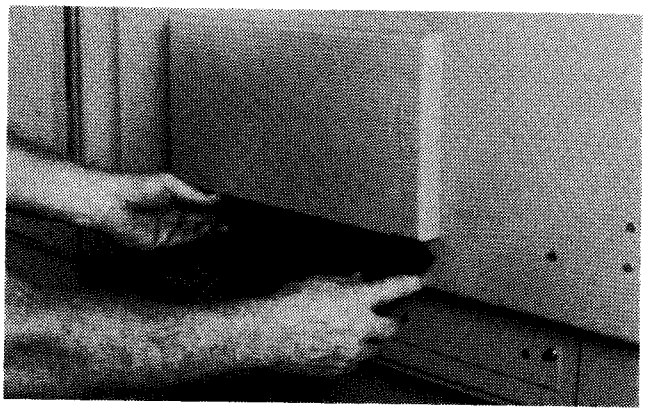


Figure 26. Door Vent Protective Filter

The following table provides a remedy for correcting an overheating problem.

Troubleshooting Chart
High Voltage Fuses and Disconnecting Switches

Trouble	Cause	Remedy
Overheating	Overload	If the switch is overheating because of excess current, one of two remedies can be adopted: Replace with a switch of rating adequate for the present or future load; or rearrange circuits to remove the excess load.
	Poor contact (contact out of adjustment)	Adjust contacts.
	Connections to switch not of adequate current-carrying capacity.	Increase the capacity of the connections by adding conductors or by replacing with heavier conductors.
	Contacts burned or pitted.	Contacts should be dressed and fitted properly.
	Bolts and nuts of connections not tight.	Tighten all bolts and nuts. (Too much pressure must not be used in tightening nuts on bolts. The use of too large a wrench may cause such excessive pressure that the expansion of the bolts exceeds their elastic limit, leading to more loosening of the connections.)
	Located in too hot an ambient (such as too close to a boiler or furnace or the like)	Relocate in a cooler place or arrange some means of cooling.

Recommended Spare Parts

Item	Style Number	Qty.
Arc Chute Assembly	15-172-700-001	3
Quick-Break Auxiliary Blade	002	3
Main Blades (600A) R&L and Hardware	007**	3
Main Blades (1200A) R&L and Hardware	008**	3
Pole ASM (600A) Arc Chute, QB Blade, Jaw CasHinge Cast Pushrod, Hardware	010**	1
(1200A) Arc Chute, QB Blade, Main B, Jaw Cast, Hinge Cast, Pushrod, Hardware	011**	1
Insulating Link Assembly	009	3
Siemens Contact Lubricant	15-171-370-002	1

Fuses (Expulsion)

Item	Style Number	Qty*
Fuse Holder	Note 1	1
Fuse Refills	Note 1	3

Fuses (C.L.)

Fuse Units	Note 1	3

NOTE 1:

If unit contains fuses, spare parts should be ordered by specifying manufacturer of fuse, type of fuse and voltage/current rating required. For example,

"3-4.8 kV, 80E, G.E. Type EJO-1 Fuse Units."

Siemens part numbers can be determined by reference to drawings applied with the unit.

Touch-Up Spray Paint

Item	Style Number	Qty.*
Light Gray, No. 61	18-168-000-001	12 oz. (355 ml)
Dark Gray, No. 24	18-168-000-002	12 oz. (355 ml)
Sky Gray, No. 70	18-168-000-003	12 oz. (355 ml)

*Recommended quantities apply to 1-5 units.
**Interchangeable only in sets.

Fuse Selection Guide

System Voltage	Fuse Type (1)	Symmetrical Interrupting Ratings (50-60 Hz)		All fuses are "E" rated and meet all NEMA standards. Fuse Size for Various Substation Sizes, Continuous Current Rating in Amperes (4)																
		Total RMS kA (2)	Max. 3-Phase MVA (3)	500 kVA			750 kVA			1000 kVA			1500 kVA			2000 kVA			2500 kVA		
				Min.	133%	Max.	Min.	133%	Max.	Min.	133%	Max.	Min.	133%	Max.	Min.	133%	Max.	Min.	133%	Max.
2,400	CS-3	60.0	250	125	200	200	200	250	250	250	350	350	400	—	450	—	—	—	—	—	—
	CL-14	60.0	250	125	200	200	200	250	250	250	400	400	400	500	500	600	—	600	—	—	—
	EJO-1	50.0	207	150	175	175	200	250	300	250	350	350	400	—	450	—	—	—	—	—	—
	CLE-750	40.0	166	—	—	—	—	—	—	—	—	—	—	—	—	600	—	600	750	—	750
	SM-4Z	17.2	70	125	175	200	200	—	200	—	—	—	—	—	—	—	—	—	—	—	—
	SM-5S	37.5	155	125	175	300	200	250	400	250	400	400	400	—	400	—	—	—	—	—	—
	RBA-200	19.0	79	125	200	200	200	—	200	—	—	—	—	—	—	—	—	—	—	—	—
	RBA-400	37.5	155	125	200	250	200	250	300	250	400	400	400	—	400	—	—	—	—	—	—
	RBA-800	37.5	155	—	—	—	—	—	—	—	—	—	450	540	720	540	720	720	720	—	720
4,160	CS-3	60.0	430	80	100	125	125	150	150	150	200	200	250	300	300	300	400	400	400	—	450
	CL-14	60.0	430	80	100	100	125	150	150	150	200	200	250	300	300	300	400	400	400	500	500
	EJO-1	50.0	360	80	100	125	125	150	150	150	200	200	250	300	300	300	400	400	400	—	450
	SM-4Z	17.2	123	80	100	200	125	150	200	150	200	200	—	—	—	—	—	—	—	—	—
	SM-5S	37.5	270	80	100	200	125	150	250	150	200	300	250	300	400	300	400	400	400	—	400
	RBA-200	19.0	136	80	100	150	125	150	200	150	200	200	—	—	—	—	—	—	—	—	—
	RBA-400	37.5	270	80	100	150	125	150	200	150	200	250	250	300	400	300	400	400	400	—	400
	RBA-800	37.5	270	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	450	540	540
4,800	CS-3	60.0	498	65	80	100	100	125	125	125	200	200	200	250	250	250	350	350	350	400	450
	CL-14	60.0	498	65	80	100	100	125	125	125	200	200	200	250	250	250	400	400	400	400	450
	EJO-1	50.0	415	80	80	100	100	125	125	125	175	175	200	250	300	250	350	350	350	450	450
	SM-4Z	17.2	142	65	80	175	100	125	200	125	200	200	200	—	200	—	—	—	—	—	—
	SM-5S	27.0	224	65	80	175	100	125	200	125	200	300	200	250	400	250	400	400	300	400	400
	RBA-200	19.0	157	65	80	125	100	125	150	125	200	200	200	—	200	—	—	—	—	—	—
	RBA-400	37.5	311	65	80	125	100	125	150	125	200	250	200	250	300	250	400	400	300	400	400
7,200	CS-3	48.0	598	50	65	80	65	80	100	100	125	125	125	200	200	200	—	200	—	—	—
	CL-14	39.0	486	50	65	80	65	80	100	100	125	125	125	200	200	200	—	200	—	—	—
	EJO-1	50.0	623	50	65	65	65	80	80	100	125	125	125	175	200	175	250	250	250	300	300
	SM-4Z	17.2	214	40	65	100	65	80	150	80	125	200	125	200	200	175	—	200	200	—	200
	SM-5S	27.0	336	40	65	100	65	80	150	80	125	200	125	200	300	175	250	400	250	300	400
	SM-5SS	34.6	431	40	65	100	65	80	150	80	125	200	125	200	300	175	250	400	250	300	400
	RBA-200	16.6	207	40	65	100	65	80	125	80	125	150	125	200	200	200	—	200	200	—	200
	RBA-400	29.4	366	40	65	100	65	80	125	80	125	150	125	200	250	200	250	300	250	300	400
12,470	CS-3	39.0	842	25	40	50	40	50	50	50	65	80	80	100	100	100	125	125	125	175	175
	CL-14	39.0	842	25	40	50	40	50	65	50	65	80	80	100	100	100	125	125	125	200	200
	EJO-1	50.0	1079	25	50	50	50	50	50	50	65	65	80	100	100	100	125	125	125	175	175
	SM-4Z	12.5	269	25	40	65	40	50	80	50	65	100	80	100	175	100	125	200	125	200	200
	SM-5S	25.0	539	25	40	65	40	50	80	50	65	100	80	100	175	100	125	200	125	200	250
	SM-5SS	34.6	747	25	40	65	40	50	80	50	65	100	80	100	175	100	125	200	125	200	250
	RBA-200	14.4	311	25	40	65	40	50	80	50	65	100	80	100	125	100	125	150	125	200	200
	RBA-400	29.4	635	25	40	65	40	50	80	50	65	100	80	100	125	100	125	150	125	200	200
13,200	CS-3	39.0	891	25	30	40	40	50	50	50	65	80	80	100	100	100	125	125	125	150	175
	CL-14	39.0	891	25	30	40	40	50	50	50	65	80	80	100	100	100	125	125	125	150	150
	EJO-1	50.0	1143	25	30	30	50	50	50	50	65	65	80	100	100	100	125	125	125	150	175
	SM-4Z	12.5	285	25	40	65	40	50	80	50	65	100	80	100	150	100	125	200	125	150	200
	SM-5S	25.0	571	25	40	65	40	50	80	50	65	100	80	100	150	100	125	200	125	150	250
	SM-5SS	34.0	777	25	40	65	40	50	80	50	65	100	80	100	150	100	125	200	125	150	250
	RBA-200	14.4	329	25	40	65	40	50	80	50	65	100	80	100	125	100	125	150	125	150	200
	RBA-400	29.4	672	25	40	65	40	50	80	50	65	100	80	100	125	100	125	150	125	150	200
13,800	CS-3	39.0	932	25	30	40	40	50	50	50	65	80	80	100	100	100	125	125	125	150	150
	CL-14	39.0	932	25	30	40	40	50	50	50	65	65	80	100	100	100	125	125	125	150	150
	EJO-1	50.0	1195	25	30	30	50	50	50	50	65	65	65	100	100	100	125	125	150	150	150
	SM-4Z	12.5	298	25	40	50	40	50	80	50	65	100	65	100	150	100	125	200	125	150	200
	SM-5S	25.0	597	25	40	50	40	50	80	50	65	100	65	100	150	100	125	200	125	150	250
	SM-5SS	34.0	812	25	40	50	40	50	80	50	65	100	65	100	150	100	125	200	125	150	250
	RBA-200	14.4	344	25	40	65	40	50	80	50	65	80	65	100	125	100	125	150	125	150	200
	RBA-400	29.4	702	25	40	65	40	50	80	50	65	80	65	100	125	100	125	150	125	150	200

① Type CL-14 and CS-3 is GOULD current limiting type. Type EJO-1 is General Electric current limiting type. Type CLE-750 is WGH current limiting type. Type SM-4 and SM-5 are S & C expulsion type. Type RBA-200, 400 & 800 are WGH expulsion type. (Use RBA fuses for *liquid* transformer substation application only, except with switches having 3 insulators per pole.)

② These values for fuses correspond to momentary ratings for breakers. ③ The 3-phase MVA = 1.73 (kV) (fuse interrupting kA).

④ The minimum fuse size indicated will not operate on transformer inrush. (Fuse min. melt curve falls to right of inrush @ 0.1 sec. and is based on inrush of 8x FLC.) The 133% fuse size indicated will permit operation of transformer at up to 133% of rating. The maximum fuse size indicated will provide transformer fault protection for phase to phase, 3-phase and phase to ground faults on secondary windings of transformer. It is selected so that fuse curve falls to left of 58% ANSI point (applicable point for Δ-Δ, Y-Y, or Y-Δ connected units, larger fuses might possibly be used without sacrifice of thru-fault protection.)

The kVA value listed is the self-cooled rating. To select fuse for forced-cooled units, the 133% rating is applicable. TX impedance is 5.75% except 500 kVA at 5.0%.

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