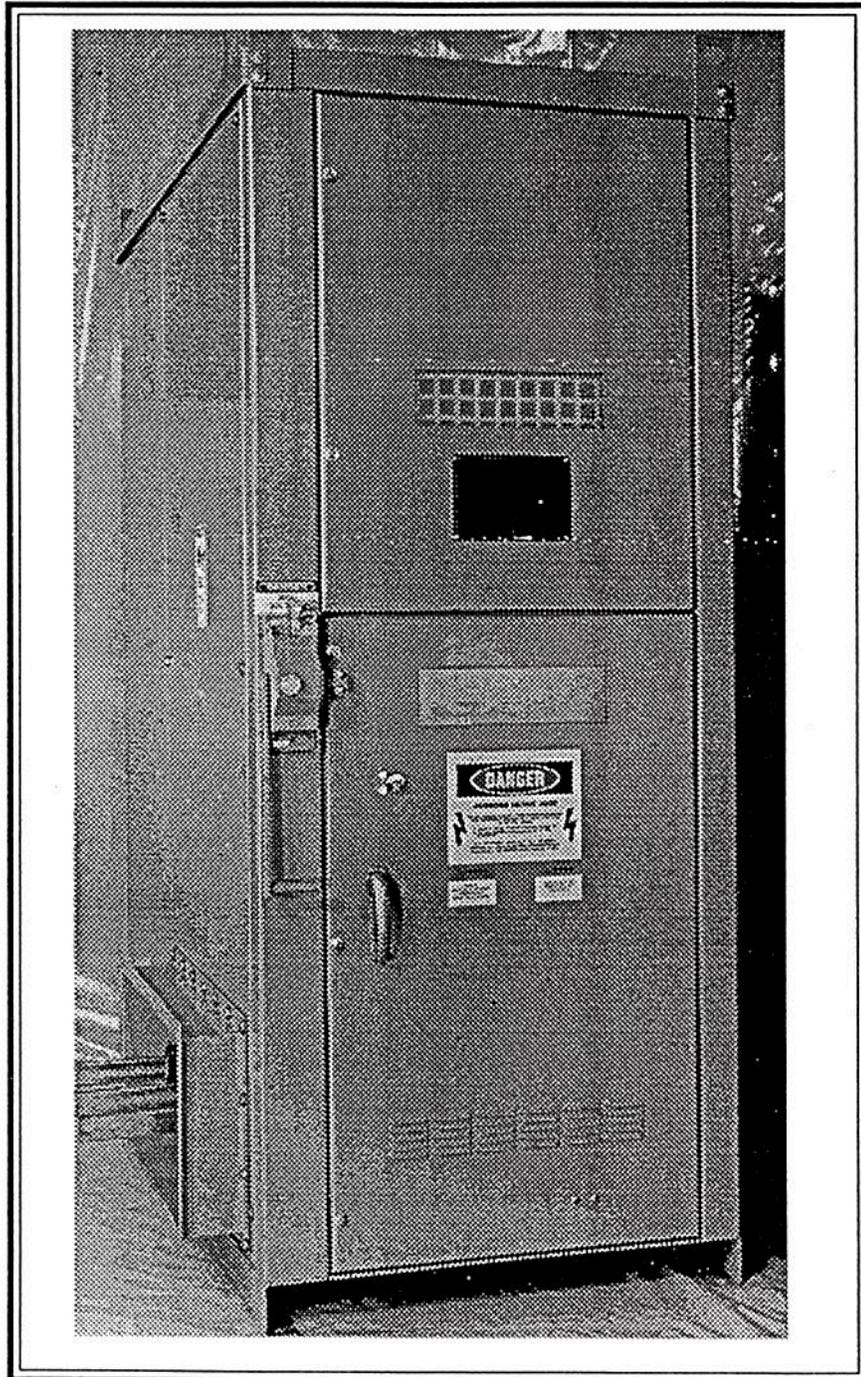


Instruction Manual  
Metal Enclosed Interrupter Switch  
Indoor/Outdoor Applications

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5kV - 15kV  
600 - 1200 Amp



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## **SAFETY PRACTICES**

**Only qualified electrical workers with training and experience on high voltage circuits should be permitted to work on this equipment. They should be familiar with work to be performed, the safety equipment required and the hazards involved.**

- 1. Read and understand these instructions before attempting any assembly, operation or maintenance of the switch.**
- 2. These load interrupter switches are designed to operate within the current and voltage limitations on the switch nameplate. Do not apply these switches to systems with current and/or voltages exceeding these limits.**
- 3. Disconnect all power sources before making adjustments or performing maintenance.**
- 4. After opening switch and before closing door, use viewing window to insure that all three switches blades are open. If necessary, use a flashlight to verify all three contacts are open.**
- 5. There are several interlocks on the switches. They are for personnel and/or equipment protection. Under no circumstances should they be made inoperative when the switch is in service. To do so could cause bodily injury or property damage.**
- 6. Never energize the switch without the arc chutes and barriers installed in place.**
- 7. Always be sure that all switch hardware is in place and properly tightened. Refer to Maintenance Note.**
- 8. Before replacing covers, carefully inspect buswork and phase barriers to insure that no tools or other objects are accidentally left inside the unit.**

## FOREWARD

The information, recommendations, descriptions, and safety notations in this document are based on experience and judgement in respect to all of the subject matter contained herein. This information must not be considered to be all inclusive or covering all contingencies.

### WARNING QUALIFIED PERSONNEL ONLY

The equipment covered by this Instruction Book must be selected for a specific application and it must be installed, operated and maintained by qualified persons who are thoroughly trained and who understand all of the hazards involved. As with any electrical apparatus the thorough knowledge of the engineering safety, inspection, maintenance and repair techniques and familiarity with particular features of the apparatus involved is mandatory. This book does not provide sufficient instructions for inexperienced electricians or unqualified persons to do any work required including the handling, installation, testing, operation, inspection, maintenance, and repair.

### WARNING SAFETY GROUNDING TO BE DONE ON DE-ENERGIZED EQUIPMENT ONLY

Before energizing the equipment and prior to any testing it is recommended that the equipment be safely grounded. Prior to any grounding whether it be for any testing, inspection, or maintenance procedures, assure that all safety precautions are taken. It is further recommended that an appropriate glow tube instrument that lights up and warns the worker when held in any alternating current field, indicating the presence of voltage, be used prior to grounding.

Personnel doing such work should wear lineman's protective equipment in accordance with such equipment manufacturer's recommendations including but not limited to protective gloves, insulated sleeves, lineman's blankets, insulated helmets, face and eye protection that will assist in preventing injury if for any reason the equipment is grounded to an energized circuit. Every precaution should be taken to prevent electrical grounding on an energized circuit. Suitable grounding clamp leads should be used and safety grounding techniques employed. All such grounds must be removed after testing, inspection, or maintenance prior to energizing the equipment.

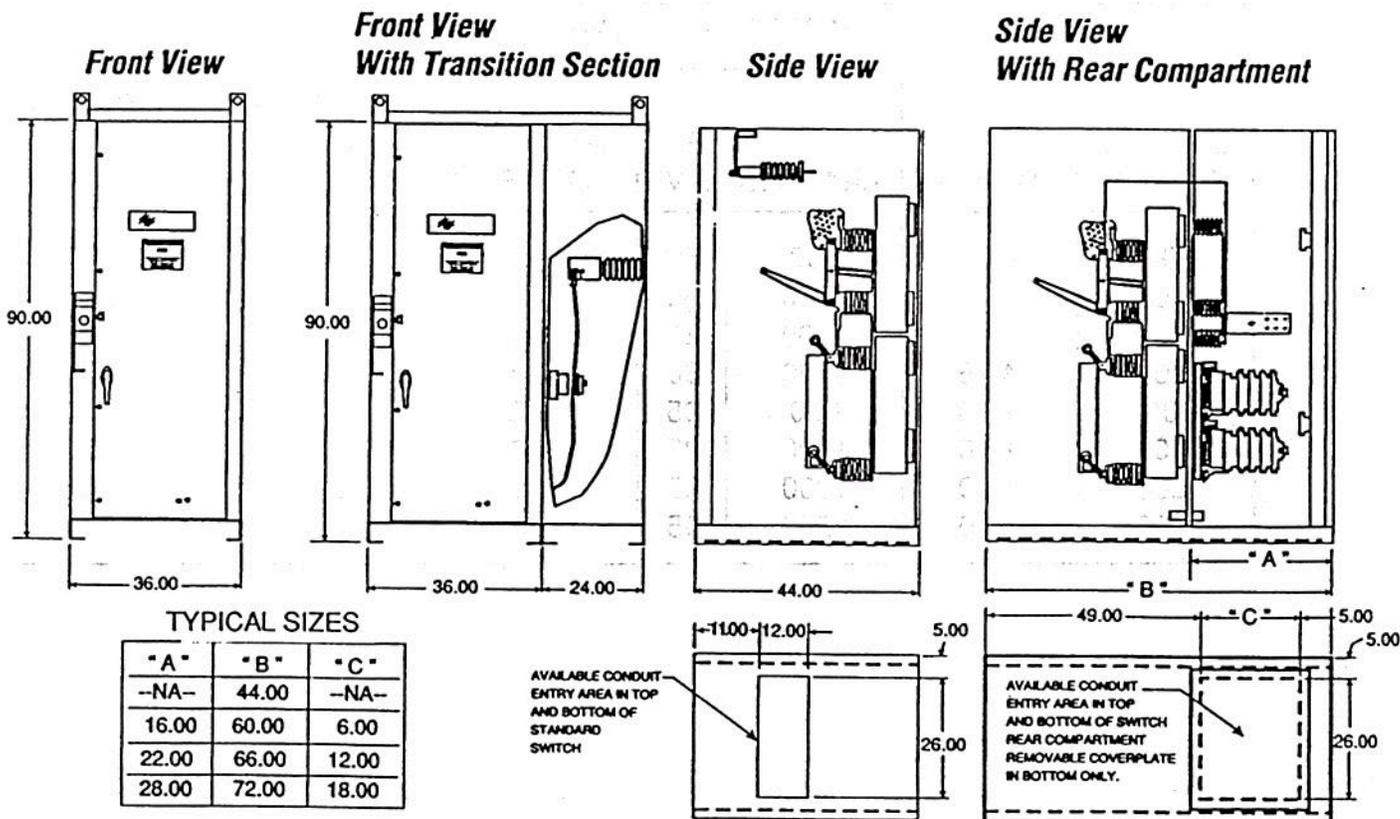
The above in no way replaces the user's safety techniques or applicable safety codes, rules, or regulations.

## INTRODUCTION

Metal enclosed interrupter switches provide dependable, reliable, and safe load break disconnects for primary circuits rated thru 15kV and 1200 Amps. The interrupter Disconnect Switch is a totally integrated assembly consisting of switches, fuses, lightning arresters and bus which is coordinated for maximum reliability. Switches are available for both indoor and outdoor applications.

**INTERRUPTER SWITCHES:**  
Front and Side View Detailed in Below Sketch

### TYPICAL VIEWS



## APPLICATION

Metal enclosed interrupter switches provide reliable operation, optimum safety, and minimum maintenance for dependable switching operations on primary circuits rated 2.4 kV through 14.4 kV in 600 or 1200 amp ratings. The equipment incorporates inherent design features which have been thoroughly tested to insure a comprehensive product with unparalleled security, versatility and durability.

The metal enclosed interrupter switches are manufactured under a meticulously controlled quality assurance system which conforms to NRC Regulation 10CFR50, ANSI Std. N45.2, MIL-I-45208, and CSA Z 299.3. The switches have undergone conformance testing per ANSI C37.58 and design, manufacturing, and routine testing per ANSI C37.20.4.

TABLE 1

INTERRUPTER SWITCH RATINGS						
Continuous Current	(Maximum)	Amps Load Break	BIL (kV)	Momentary Amps RMS (kA) ASYM.	Fault Close Current RMS (kA) ASYM.	2 Second Short-Time Current RMS (kA) SYM.
600	4.76	600	60	40	40	25
1200	4.76	1200	60	40	40	25
1200	4.76	1200	60	61	61	38
1200	4.76	1200	60	80*	61	38
600	15.0	600	95	40	40	25
1200	15.0	1200	95	40	40	25
1200	15.0	1200	95	61	61	38
1200	15.0	1200	95	80*	61	38

## RECEIVING, STORAGE AND HANDLING

### RECEIVING

Upon receipt of the load break interrupter switchgear, immediately make an examination for any damage or loss sustained in shipment. This pertains to the housing as well as the load break switch and mechanism. If injury, loss or rough handling is evident, a written damage claim should be filed at once with the transportation company. Be sure that no loose parts are left in the packaging material. Blow out any dirt or loose particles of packing material on or around the load break switch and mechanism. Study the erection drawing carefully and check the bill of material to be sure that all parts are on hand.

### STORAGE

When the unit is not to be placed in service immediately, it should be stored in a clean, dry location and covered with a suitable cover. Moisture absorbing material should not be used to cover the equipment as that could cause corrosion of the parts. During the construction period the equipment should be properly protected against construction environment conditions such as moisture, dirt, cement, rough handling, abrasion or damage, etc..

When dampness or condensation exists, the equipment must be covered with a suitable vented cover to allow moisture to escape. Heaters of 250 watts rating should be placed in each unit to prevent moisture damage. IF EQUIPMENT HAS BEEN SUBJECTED TO MOISTURE IT SHOULD BE TESTED WITH A 1000V MEGGER. A READING OF 200 MEGOHMS SHOULD BE OBTAINED.

### CAUTION

**REMOVE ALL FLAMMABLE MATERIALS AWAY FROM HEATERS PRIOR TO ENERGIZING.**

### HANDLING

The metal enclosed interrupter switchgear may be moved using a crane or forklift. Overhead lifting provisions are provided on the top of the unit. The base frame is suitable for rolling and skidding.

## INSTALLATION

### ANSI C37.20.3 8.2.4 Installation

**"Installation of Metal Enclosed Interrupter Switchgear must only be done with de-energized switchgear. When installing the switchgear: (a) Protect workers adequately from live parts with barriers, screens, etc., (b) Observe National Electrical Safety Code ANSI C2, Rule 124 for guarding live parts."**

### ANSI C37.20.3 8.2.5 Removal of Shipping Members

**"Before any installation of Metal Enclosed Interrupter Switchgear a careful check should be made to insure that all members included for shipping purposes, have been removed."**

**Switches are shipped closed to avoid shipping damage. Open switches in accordance with outlined instructions.**

Before any installation work is done, consult and study all drawings furnished. These drawings include arrangement drawings, wiring and elementary diagrams and a summary of material.

Frequently, additional shipping members are installed in the bus and primary area to insure against shipping damage. These members are clearly marked as shipping members. It is imperative that all shipping members are removed and joints properly tightened before energizing the equipment.

Mats, screens, railings, etc., which are external to the switchgear, but which may be required to meet any local codes, must be furnished by the purchaser.

### PREPARATION OF FLOOR-ANCHORING

The station floor must be strong enough to prevent sagging due to weight of the switchgear structure. The impact loading is approximately 1.1 times the static load.

Suitable means must be provided by the purchaser for anchoring the equipment to the floor. It is essential that the floor be level to avoid distortion of the switchgear structure and the equipment be completely aligned prior to final anchoring. The floor channels must be level and straight with respect to each other. Steel shims should be used for final leveling of the switchgear if necessary. If the floor is not level and flush with the base channels, it will be difficult to align the equipment and open doors.

Provisions should be made in the floor for conduits for incoming and outgoing cables as required. Refer to load interrupter switch outline or plan view for recommended conduit areas. If desired, the conduits may be installed before the switchgear.

## **INCOMING CABLES**

Before any primary cable connections are made, the cables should be identified to indicate their phase relationship with the switchgear connections. Primary cable bracing is the responsibility of the customer. The cable manufacturer's instructions should be followed when forming cable terminations and during the installation of the cable. It is essential that the connections be clean and securely bolted, since the conductivity of the joints is proportional to the applied pressure. The terminating devices (where required) should be installed pursuant to the terminator manufacturer's instructions.

## **LOAD INTERRUPTER SWITCH**

The load interrupter switch has been factory mounted and tested prior to shipping. Refer to the switch instruction manual if any adjustments need to be made.

## **FUSING**

Fusing when supplied will be installed at the factory, if possible. The installer should remove any shipping bracing and verify the fuses are securely mounted. If for some reason the fuses are shipped separately, it is the responsibility of the customer to insure the fuses are properly installed.

## **GROUND BUS**

The ground bus is bolted to the frame near the bottom in the rear compartment. It is arranged so the connections to the station ground can be made in any unit. Where the equipment is shipped in more than one section, the sections of ground bus must be connected using splice plates or cable provided with the equipment.

It is important that the equipment be adequately grounded to protect the operator from injury when short circuits or other abnormal occurrences take place and to insure all parts of the equipment, other than live parts, are at ground potential.

## **LIGHTNING PROTECTION**

When surge arresters are provided, they will be factory installed and connected ready for service. If not provided, it is the customer's responsibility to provide suitable arresters to protect the switchgear from damage due to lightning.

## **HEATERS (Standard in Outdoor Equipment Only)**

By maintaining a slight temperature differential, the heaters help facilitate drying and prevent condensation and the resulting corrosion and insulation deterioration which might occur.

When heaters are supplied in the switchgear, either external or internal, sources of power must be supplied. With either source care must be taken to make sure of energizing prior to the equipment being subjected to moisture. In all cases, the supply must be adequate to feed the entire heater load.

## TESTING AND INSPECTION

### CAUTION

**INSTRUCTIONS LISTED UNDER MAINTENANCE SECTION OF THIS PUBLICATION MUST BE STRICTLY OBSERVED.**

After the equipment has been installed and all connections made, it should be tested and inspected before putting in service. Check area for foreign materials, tools, etc. which may have been placed on or near the high voltage parts. Vacuum floors free of debris, wipe down and clean all barriers, bus insulators, switches, etc. with denatured or isopropyl alcohol. Wipe with a clean, dry cloth. Although the equipment and devices have been completely tested at the factory, a final field test should be made to be sure the equipment has been properly installed and all connections correct and have not become loose in transportation. The primary equipment should be completely de-energized while the tests are in progress. High potential tests to check the integrity of the insulation are not necessary if the installation instructions in this book are carefully followed. If the purchaser wishes to make high potential tests, the voltage should not exceed 75% of the IEEE factory test voltages.

Potential, current and control power transformers must be disconnected during high voltage testing.

## SAFETY FEATURES

### WARNING

**Do not exceed nameplate ratings of switchgear. To do so could cause property damage, severe injury or death.**

Metal enclosed interrupter switches have several built-in features to reduce hazards and to provide proper operating sequences.

1. A door interlock prevents opening the enclosure front door while the switch is in the closed position.
2. A switch interlock prevents manual operation of the handle mechanism with the door open.
3. A viewing window is provided to verify each switch contact position.
4. Facility for padlocking the switch in the open or closed position is provided.

5. Facilities for padlocking the door handles closed are provided.
6. Mechanical indicators show whether the switch mechanism is open or closed.
7. Key interlocks, when provided, force a sequence of operation.

#### **WARNING**

**Never attempt to operate the metal enclosed interrupter switch with key interlock bolt in the extended position. Damage to the operating mechanism and/or severe injury could result.**

#### **WARNING**

##### **INTERLOCKS ARE PROVIDED ON THIS EQUIPMENT**

**When key interlocks are furnished, often duplicate keys are available. These are for installation only. Duplicate keys must be destroyed or retained in a place accessible to authorized personnel only, before any part of the equipment is energized. Failure to do so or defeating any part of the key interlock scheme, can provide access to the equipment or permit operating errors, which can result in property damage, injury or death.**

#### **DESCRIPTION OF OPERATION**

The powerful opening and closing spring 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 thereby rotating the operator shaft to the open position. The switch blades will not move, in either 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. He therefore has a fault closing and rated load break independent of his performance.

#### **SEQUENCE OF OPERATION (SEE FIGURE 4)**

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 EXTENSIVE DAMAGE AND JAM THE OPERATING MECHANISM.)**

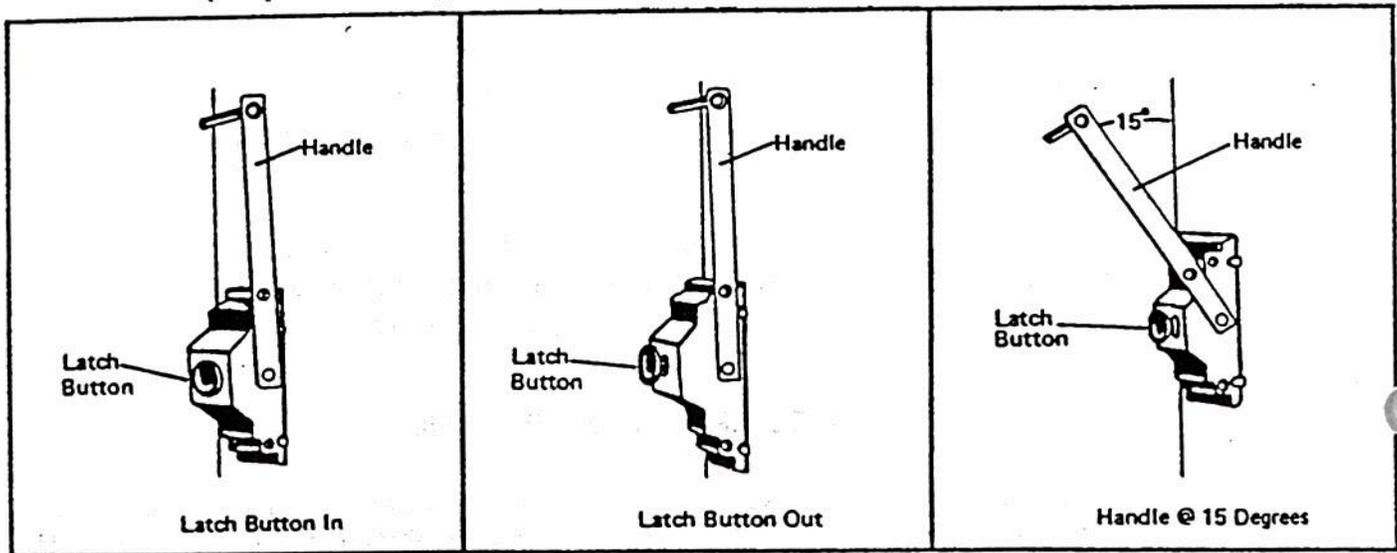
2. Move handle toward the lower position about 15 degrees or until a resistive force is felt in the handle. It is now safe to release the latch button.

3. With a swift positive unhesitating force, complete the opening stroke. Once "Off-Center", the store 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.

**FIGURE 4 (Sequence of Operation)**



**FOLLOW SEQUENCE OF OPERATION  
BEFORE DOING ANY OF THE FOLLOWING:**

Periodic Checking

Load break switches should be examined and checked once a year or sooner when conditions require it (such as numerous operations, polluted atmosphere or overloading of the switch). All switches should occasionally be opened and closed several times in succession, not exceeding their rated duty.

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 lubricant (non-corrosive, high-temperature grease) should be applied to the contact surfaces. Do not use "cup" or other grease which may harden upon exposure to air.

## Contacts

Check to determine that the blades make good contact. **IMPORTANT - THIS IS A SLIDING JOINT. Over tightening can cause the switch not to open and also cause severe damage to the mechanism.** A contact resistance reading line and load terminal pads should be taken and should be between 35 to 80 micro ohms. If values are less than 35 micro ohms, insure that the blades can be "opened" from jaw casting with a pulling force of approximately 30-35 pounds measured at a point between the main blades just below the jaw contact.

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 "INSTALLATION" for aligning and making proper contact.

## Insulators and Barriers

It is necessary that insulator 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. Alcohol cleaner or a light detergent 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 an annual 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 bus 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 bus 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. It consists of a length of roller type chain fastened in a loop by two turnbuckles with locking nuts. All chain assemblies are factory adjusted.

## Operating Shaft

The operating shaft connects the stored energy mechanism to the switch operating arms. The shaft is integral with the switch assembly and is bearing mounted. Light lubricant applied to bearing surfaces will insure trouble free operation. No adjustments are necessary.

## Pushrods

Each main blade of the switch is connected to the throw arms or the main operating shaft by an insulating pushrod. These rods should be examined during each normal maintenance procedure for signs of damage to either end of the pushrods. If a damaged pushrod is encountered, it should be replaced immediately.

## Stored Energy Mechanism

The stored energy mechanism consists of a housing with a one piece crank sprocket assembly supported by bearings and a spring assembly.

The sprocket assembly is chain driven by means of a handle on the front of the housing. As the handle is moved upward, the spring assembly is charged. As the crank sprocket assembly passes over dead center, the spring takes over and instantaneously moves the switch to the closed position. The unit is factory adjusted and should need no adjustment in the field. The only moving parts which should be checked after approximately 100 operations are the front and rear latches, which are spring operated, and the (2) shaft bearings. Check to make sure the latches rotate freely up and down by using finger pressure on the rollers.

## Lubrication

The load break interrupter switch requires infrequent lubrication. Bearing points and sliding surfaces should be lubricated at the regular inspection periods with a thin film of lubricant. Before lubrication, remove any hardened grease and dirt from latch and bearing surfaces with kerosene.

## High Potential Tests

High potential tests to check the integrity of the insulation are not necessary if the insulation maintenance in this book are carefully followed. Should the purchaser desire to make high potential tests, the test voltage should not exceed 14 KV a.c. for 4.16 KV, 27 KV a.c. for 13.8 KV and 60 KV for 34.5 KV equipments. These voltages are 75% of factory test voltages and are in accordance with ANSI standards.

## RE-FUSING

Re-Fusing of high-voltage switchgear should be performed only by qualified persons, observing the following precautions. These recommendations may differ from standard operating procedures and safety practices of certain electric utility companies. Where such discrepancy exists, the electric utilities should follow their operating procedures.

1. Adhere to prescribed safety rules at all times.
2. Wear approved and periodically tested rubber gloves, hard hat, safety glasses and flash clothing.
3. Perform operations only in the presence of other qualified persons.
4. Always assume both sets of terminals are energized unless proved otherwise by both visual evidence of open circuit and by grounding.

## MAINTENANCE

### CAUTION

Before any checking or maintenance of switchgear after it has been installed, the following must be observed: only qualified persons may operate, inspect or maintain power switchgear. In addition to personnel you may have that are qualified, others may be available from an experienced high voltage contractor or the utility servicing the installation. It is the responsibility of the purchaser, installer or ultimate user to insure that the warning voltage signs are not removed, make sure all access doors and operating handles are securely locked when the gear is left unattended by qualified people even momentarily.

## DANGER

### HAZARDOUS VOLTAGE

**DO NOT REMOVE COVERS OR OPEN DOORS OR WORK ON EQUIPMENT UNLESS POWER HAS BEEN TURNED OFF AND ALL CIRCUITS DE-ENERGIZED AND DISCONNECTED.**

**DISCONNECT, DE-ENERGIZE, LOCK-OUT AND PROPERLY GROUND CIRCUIT(S) BEFORE WORKING ON EQUIPMENT.**

**USE PROPER SAFETY PRECAUTIONS WHEN WORKING ON THE EQUIPMENT.**

