

**IB-13.2.5-1**

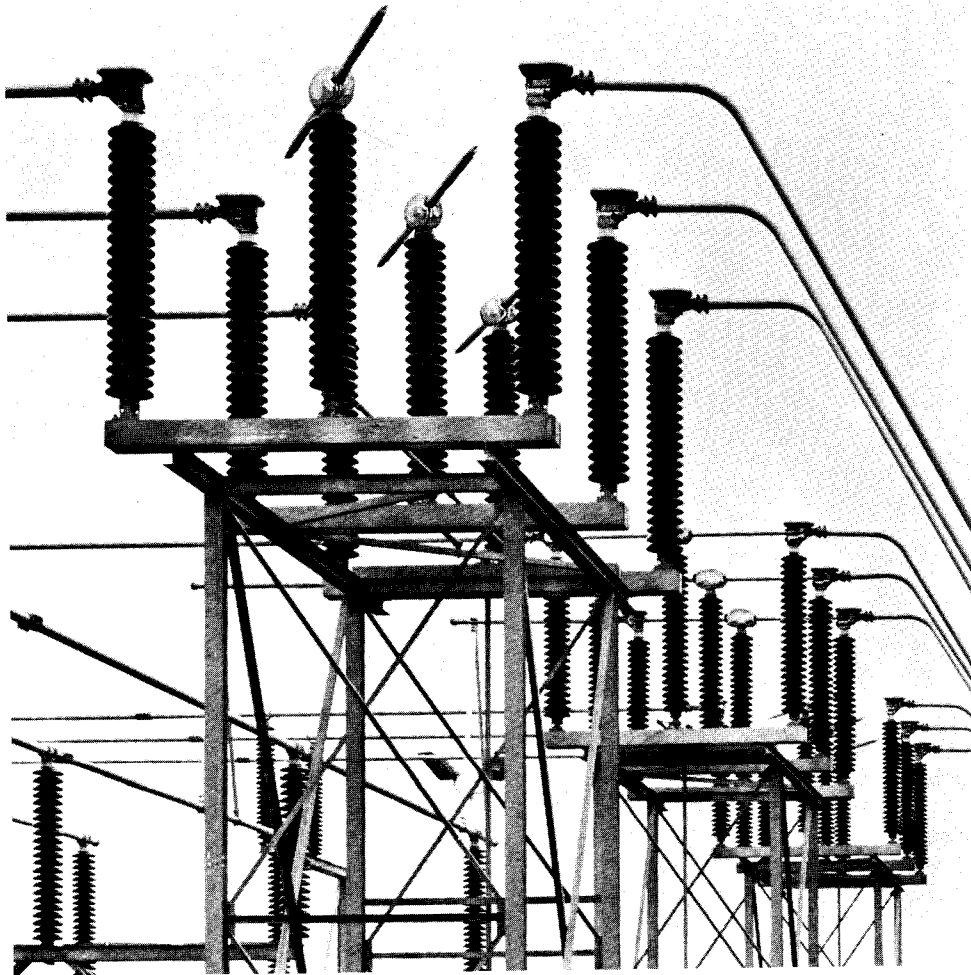
ISSUE A

**AIR SWITCHES – OUTDOOR**

**INSTRUCTIONS**

---

**69 THRU 500 KV  
TTT7 DOUBLE-BREAK SWITCHES**



**IMPORTANT**

**Make absolutely sure applicable equipment is de-energized and properly grounded before proceeding with any installation or maintenance.**



**ITE Imperial**  
CORPORATION



## INSTRUCTIONS FOR 69-THRU 500-KV TTT7 DOUBLE-BREAK SWITCHES

### RECEIPT

Check the total shipment of switch-pole units and operating mechanism components against the shipping notice, bill of material and installation drawings.

Report any shortages or damages immediately to the carrier and file proper claim. The shipping notice (designated S/N) identifies the numbered crate or carton in which the various items of the bill of material are to be found. Typical example: The bill of material drawing covering complete switch and control parts might list Item 15 as a ground clamp. The shipping notice should then list Item 15 and its drawing number as being included in some carton number such as 1252-54. Similarly, all other parts of the switch and controls will be identified and designated as being in certain numbered cartons or crates.

### INSTALLATION AND ADJUSTMENT

#### Step 1 - Checking Bases

Make sure the insulator supports (spacers and rotor bearings) on the switch bases are square and level. If necessary, make adjustments or shim to achieve this. Shims are normally used through 230 kV and leveling screws for 345 kV and above, see Figs. 1 and 2.

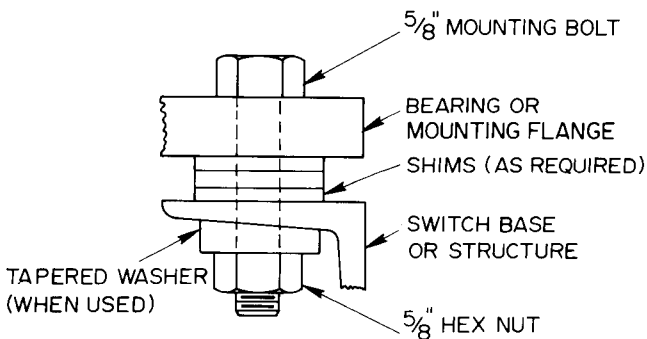


Fig. 1 Shims used for leveling 69-thru 230-kV switches

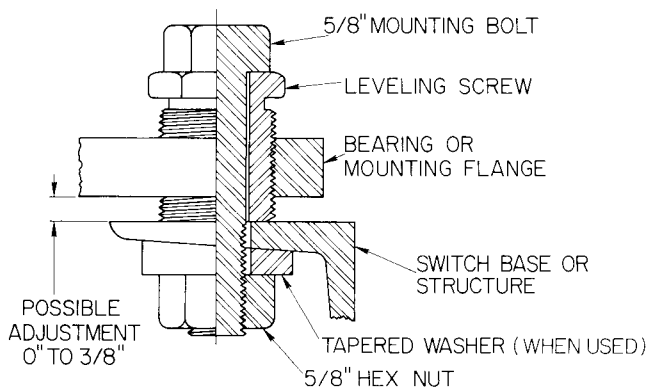


Fig. 2 Leveling screws used on 345-and 500-kV switches

#### Step 2 - Mounting Switch Bases

Mount the switch bases on the supporting structure. They should be level and parallel to each other, in the position shown on the control drawing. One switch base usually has additional cranks for attaching either the main switch or the ground switch to the operating bearing at the top of the vertical-operating pipe. Make sure that this base is placed in a position as called for on the control drawing.

#### Step 3 - Mounting Operating Bearing

Mount the operating bearing and its supporting base on the supporting structure as shown on the control drawing. Check the operating crank for the proper radius and angle. Also, make sure the stop crank is mounted correctly and that the stops are positioned correctly.

If the operating bearing has an adjustable crank, it is sometimes necessary to add 1/4" to 1/2" to the trial radius given on the control drawing to get the required travel of the switch blades. This additional length in the crank radius allows for lost motion and clearances in pin holes and will provide a definite audible sound accompanied by a reasonable amount of deflection in the structural members when the crank crosses the dead center position. This serves as a signal to the operator that the switch is fully open or closed.

#### Step 4 - Mounting Insulators

Using the bolts provided, assemble the insulators to their supports on switch bases. Make sure that operating cranks under the rotating column are positioned properly (refer to the control and single-pole switch drawings). If necessary to adjust the insulator columns for variation in heights or proper angle, use the shims or leveling screws as provided, see Figs. 1 and 2.

#### Step 5 - Mounting Current Carrying Parts and Corona Rings

Rotate the center insulator column to the open position as shown on the drawings. The stop at the bottom of the column limits the travel. At this time, the crank at the bottom of the insulator column will be at an angle of 60° to the switch base. (On 345- and 500-kV switches, first mount corona rings on top of insulators and under the current carrying parts.)

Mount the blade assembly on the center insulator column at an angle of 70° to the centerline of the switch base which is 10° further in a clockwise direction than the switch crank, see Fig. 3, Page 3.

Mount the switch jaw assembly on the end insulators leaving the mounting bolts finger tight in order to allow for any adjustment later for proper alignment.

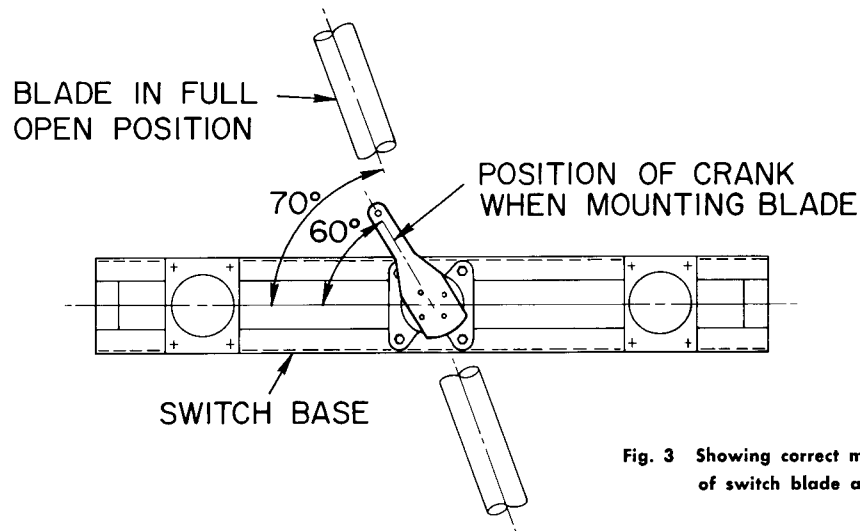


Fig. 3 Showing correct mounting positions of switch blade and crank

### Step 6 - Switch Adjustment (One pole at a time)

On an upright mounted switch, the direction of rotation of the center insulator column (looking at the switch from above) is clockwise to open and counter clockwise to close.

#### 6.1 Blade Entry

Using a piece of pipe over the crank at the bottom of the rotating insulator stack, move the switch blade slowly toward the closed position. The contacts on the ends of the blade should approach the jaw fingers at the same time and the blade should hit both stops at about the same time. Also the blade contacts, as they enter the jaw contacts, should not rub the jaw fingers. If the blade rubs the top fingers on one jaw and the bottom fingers on the other, then a little adjustment at the bottom of the center insulator stack with the shims or leveling screws provided will usually result in proper entry. If the blade rubs the top fingers on both jaws or the bottom fingers on both jaws, then a change in elevation is required and can be achieved at the center stack or jaw stacks by using the same shims or leveling screws. At this point, recheck the blade penetration to see that the blade hits both stops at the same time. If it doesn't, the shims and leveling screws will provide for the necessary adjustment.

When blade entry is satisfactorily achieved then check to see if all jaw fingers are contacting the blade end contact. If necessary, adjust with either shims or leveling screws at the base of the jaw insulator stacks. If it is expected that the conductors to be attached to the terminal pads will impose an appreciable force, it is recommended that the jaw insulator columns be adjusted so that the jaw fingers end up slightly off center on the blade contact in a direction opposite to the expected force. The jaw mounting bolts may now be tightened.

#### 6.2 Blade Contact Angle

The blade contacts can be at a slight angle in the closed position, see Fig. 4. An allowable contact angle of 4 degrees permits an (X) dimension of  $1/16''$  for each 1" of contact width. Example: If the contact width (A) is 3", then dimension (X) can be as much as  $3/16''$  and still be within the plus or minus 4 degree tolerance.

Fig. 4 shows the top of the blade contact leaning to the left. It is also permissible for the top of the blade contact to lean to the right as long as the 4 degree angle is not exceeded. It is common to have both situations on one three-pole switch. In fact, after all three poles have been adjusted in the open position and then closed, it may be found that the top of the blade contact on one pole may be to the right of vertical, another to the left of vertical and the other vertical or nearly vertical. This is due to many variables and tolerances plus the free play or clearance in the pin connections of all the switches and control parts.

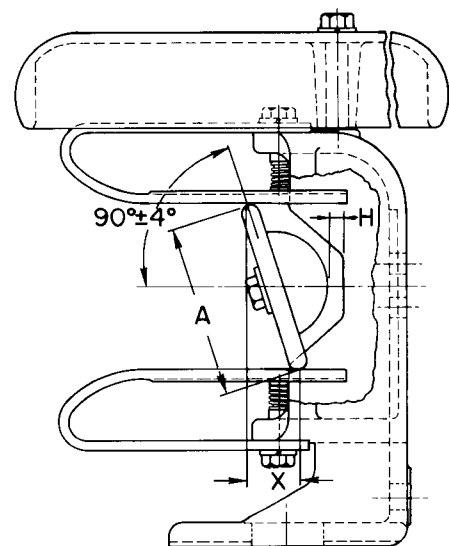


Fig. 4 End view showing blade contact angle



**MAINTENANCE**

A certain amount of care and inspection is recommended. The frequency of inspection depends on the atmospheric conditions at a given switch location and the frequency of operation. This service interval must be determined by the user. **Before servicing the switch, be sure it is disconnected from all electric power sources and is properly grounded.** Recommended maintenance is similar to that listed in the latest industry standards. First, it is important that the insulators are always clean. It is also important that the contacts be examined to see that they are aligned, clean, and bear with a firm uniform pressure. If the contacts are pitted, or burned to some extent, they should be removed and replaced.

Under normal service conditions, the jaw contacts should be examined and maintained at least once a year, depending upon the type of atmosphere to which they are exposed.

Periodic maintenance should consist of cleaning the contact surfaces thoroughly by carefully scraping off any contamination or deposit and sanding the surface to a smooth finish with clean fine emery or sand paper being careful to wipe off evidence of sand. With the contact surfaces entirely clean, a coating of lubricant should be applied. Suggested lubricants are Darina #2 grease or NO-OX-ID Grade A special. (Darina #2 grease is a Shell Oil Company product. NO-OX-ID is made by Dearborn Chemical Co., 310 South Michigan Ave., Chicago, Illinois.)

In general, operating linkages require virtually no maintenance. However, in contaminated atmospheres or where operation under sleet conditions is common, some lubrication at pivot points may be desirable. The grease used should be durable even when exposed to the elements, and should retain its viscosity over a wide temperature range.

Also refer to ANSI C37.35 (American National Standard Guide for the Application, Installation, Operation and Maintenance of High-Voltage Air Disconnecting and Interrupter Switches).

**TERMINAL CONNECTIONS**

Because of the wide acceptance and use of aluminum conductors, the terminal surfaces are aluminum to provide an easy current transfer surface. (In cases where copper conductor is used, it is recommended that a tinned terminal clamp be bolted to the aluminum switch terminal pad.) However, if a non-tinned clamp is used, a liberal amount of grease should be used at the joint and all over the pad of the fitting.

An instruction tag is attached to the terminal clamps shipped with the switches for making aluminum connections as follows: (1) Clean all contact surfaces of conductors and fittings with a stiff wire brush to remove heavy oxide coatings until they become a typical fresh aluminum color. (2) Immediately coat these contact areas with a liberal amount of corrosion inhibitor such as NO-OX-ID Grade A Special or equivalent. (3) Abrade the contact surface again, this time through the applied compound with a stiff wire brush. (4) Make connections and tighten bolts.

**CAUTION** - Do not remove the compound.

In making copper-to-aluminum connections: (1) Prepare all aluminum contact surfaces as described above. (2) Prepare any bare copper surfaces in the usual manner. (3) Do not abrade or wire brush any plated surfaces; a few light rubs with fine steel wool before greasing is sufficient. (4) Make connections and tighten bolts.

**ORDERING INFORMATION**

In ordering parts or in correspondence regarding this equipment, contact nearest I-T-E Sales Office and state the voltage, current rating, type and the serial number as indicated on the switch name plate.

**RECOMMENDED TORQUE FOR ALUMINUM BOLTS**

Bolt Diameter, Inches	Lubricated Threads		Dry Threads	
	In.-Lbs.	Ft.-Lbs.	In.-Lbs.	Ft.-Lbs.
1/2	240	20	420	35
5/8	480	40	720	60
3/4	720	60	1140	95



**ITE Imperial**  
CORPORATION



### 6.3 Blade Engagement When Switch is Closed

Due to varying friction and deflection, the distance between the blade and its stop (dimension H in Fig. 4), with the switch fully closed, may vary from 0" to 1". Insulator stacks can be adjusted to achieve this. It is not usually possible to get this dimension to be equal on all poles of a three-pole switch.

### 6.4 Stops on Current Carrying Parts

The stops on the blade mechanisms are set at the factory and seldom require any adjustment. However, if these stops prevent the blades from turning to an acceptable closed or open position, they should be re-adjusted.

After each pole has been adjusted, the open and close stop bolts at the base of the rotating insulator column should be set.

### Step 7 - Installing Interphase and Operating Connecting Rods

With the blades against the jaw stops, but not twisted into contact, install the interphase rods as follows:

- a. Adjust the interphase rods that are in compression during closing to be as long as possible while allowing the pins to be inserted.
- b. Adjust the interphase rods that are in tension during closing to be as short as possible while allowing the pins to be inserted.
- c. The adjustment of the connecting rod between the operating bearing and the driven switch should be made in the same manner.

### Step 8 - Installing Vertical-Operating Pipe and Operating Mechanism

Attach the vertical-operating pipe to the operating bearing shaft using the coupling and pins supplied.

At this point, check the drawings for accessory equipment (auxiliary switches, mechanical interlocks, position indicators, ground straps, etc.) which mounts on the vertical-operating pipe and install these before installing operating mechanism. A worm gear mechanism (Fig. 5) is normally supplied for manual operation. Before installing it, remove position indicators which are attached to the worm gear coupling with Allen set screws. After accessory equipment is installed on the vertical-operating pipe, mount the worm gear mechanism and tighten the square head set screws in the coupling until the operating pipe is pierced.

The three-pole switch should now be operated and checked for proper adjustment. If all stops at switch base elevation, including the operating bearing, have been set then the position indicators for the worm gear mechanism should be installed. These indicators should not quite touch the raised boss on the worm gear housing in either the open or closed position. There is a possibility of damage to the indicators or coupling if this is not observed.

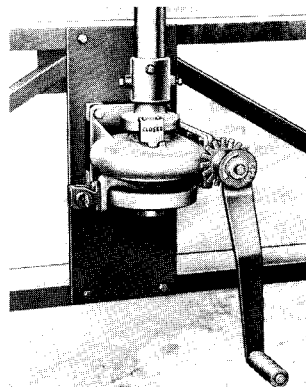


Fig. 5 Worm gear operator

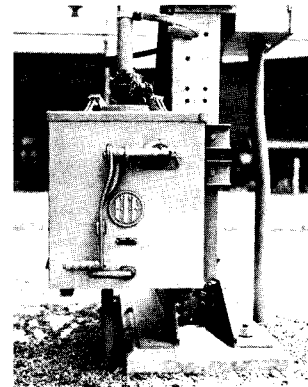


Fig. 6 MO-10 motor operator

For remote operation, a motor operator (Fig. 6) is supplied and should be installed per included instructions. When using a motor operator, it is important to make sure that its limit switches are adjusted to disconnect the drive motor circuit just slightly before the switch stops and operating bearing stops make contact.

### Step 9 - Arcing Horns or Arc Restrictors

When arcing horns or Arc Restrictors are supplied, they should now be installed and adjusted in accordance with the drawings. The stationary horn is attached to the jaw and should be adjusted, or even bent slightly, to give a light contact pressure between the horn and the switch blade.

### Step 10 - Installation of Sleet/Corona Shields

The combination sleet/corona shields should now be installed over the blade mechanism at the top of the center insulator stack and on top of the two jaws as shown on single pole drawings.

### Step 11 - Final Checks

The completed three-pole installation should be checked for the following:

- a. In the open position, the blades should be at an angle of 70° to the centerline of the switch base, and the stop at each base and the stop for the operating bearing should be touching, or nearly so. The indicator at the worm gear operating mechanism should indicate the switch is open.
- b. In closing, the blades should make central entry into their jaws and at approximately the same time.
- c. In the closed position, the blade end contacts should be in full contact with jaw contacts and also vertical within the tolerances described previously. The stop at each switch base and the stop for the operating bearing should be touching, or nearly so. The indicator at the worm gear operating mechanism should indicate the switch is closed.

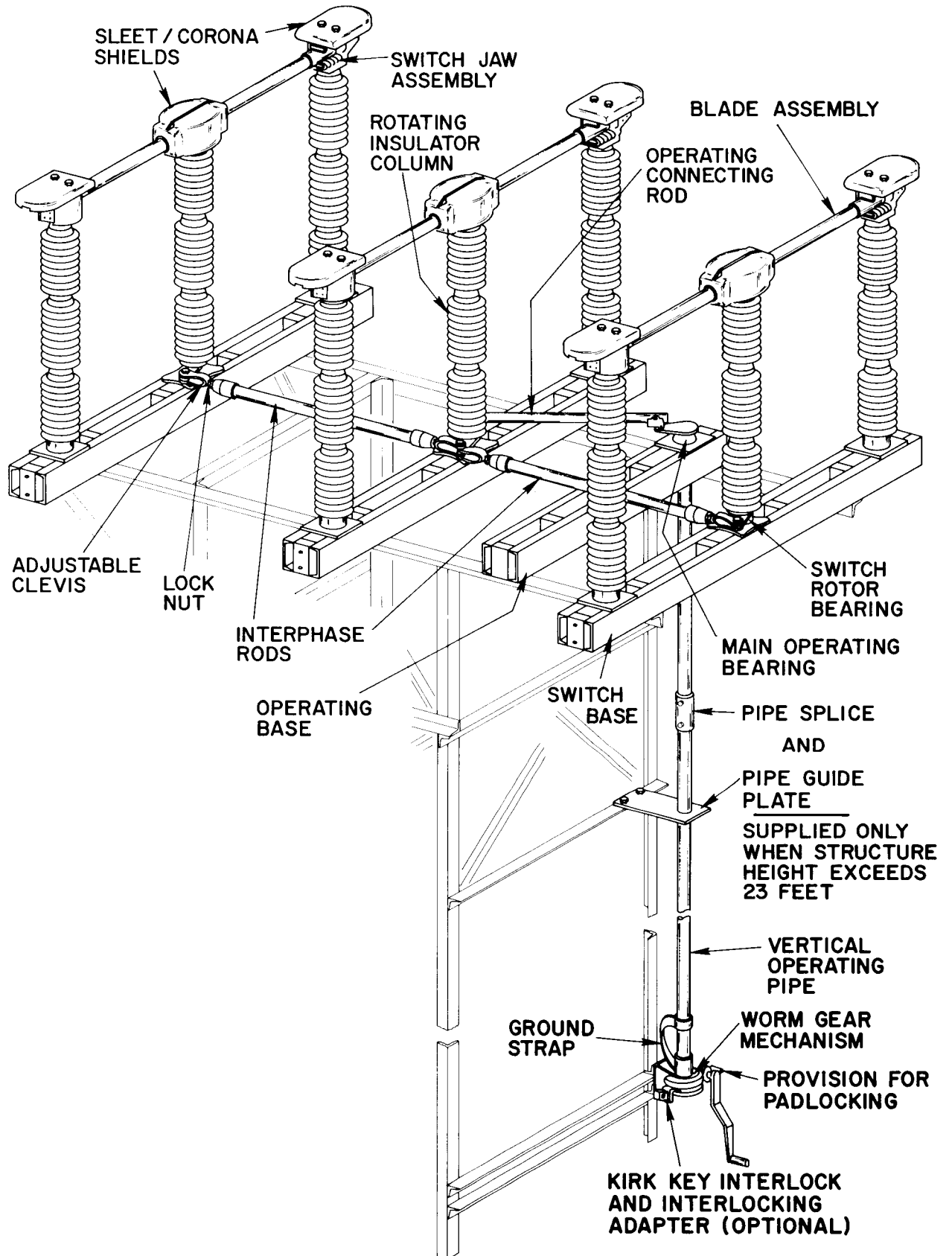
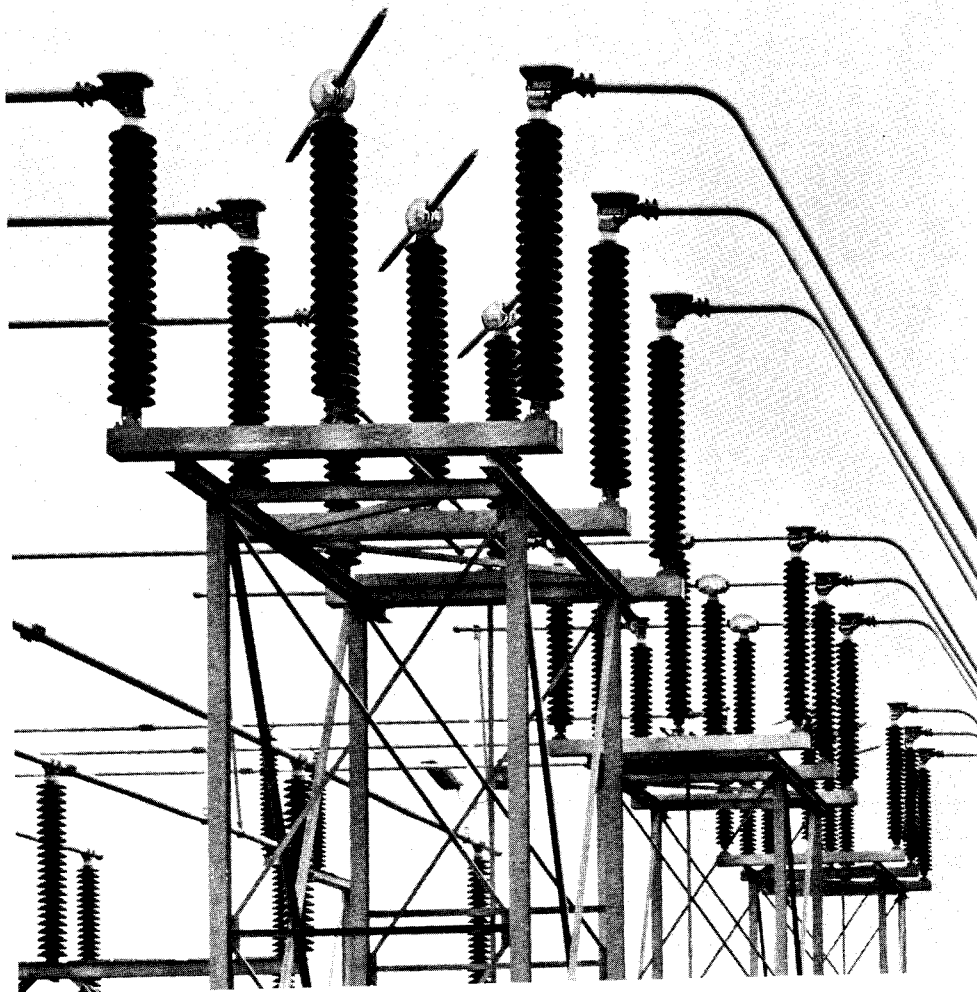


Fig. 7 Typical three-pole TTT 7 switch installation

**AIR SWITCHES – OUTDOOR**  
**INSTRUCTIONS**

---

**69 THRU 500 KV**  
**TTT 7 DOUBLE-BREAK SWITCHES**



**IMPORTANT**

**Make absolutely sure applicable equipment is de-energized and properly grounded before proceeding with any installation or maintenance.**



**IFE Imperial**  
CORPORATION



**MAINTENANCE**

A certain amount of care and inspection is recommended. The frequency of inspection depends on the atmospheric conditions at a given switch location and the frequency of operation. This service interval must be determined by the user. **Before servicing the switch, be sure it is disconnected from all electric power sources and is properly grounded.** Recommended maintenance is similar to that listed in the latest industry standards. First, it is important that the insulators are always clean. It is also important that the contacts be examined to see that they are aligned, clean, and bear with a firm uniform pressure. If the contacts are pitted, or burned to some extent, they should be removed and replaced.

Under normal service conditions, the jaw contacts should be examined and maintained at least once a year, depending upon the type of atmosphere to which they are exposed.

Periodic maintenance should consist of cleaning the contact surfaces thoroughly by carefully scraping off any contamination or deposit and sanding the surface to a smooth finish with clean fine emery or sand paper being careful to wipe off evidence of sand. With the contact surfaces entirely clean, a coating of lubricant should be applied. Suggested lubricants are Darina #2 grease or NO-OX-ID Grade A special. (Darina #2 grease is a Shell Oil Company product. NO-OX-ID is made by Dearborn Chemical Co., 310 South Michigan Ave., Chicago, Illinois.)

In general, operating linkages require virtually no maintenance. However, in contaminated atmospheres or where operation under sleet conditions is common, some lubrication at pivot points may be desirable. The grease used should be durable even when exposed to the elements, and should retain its viscosity over a wide temperature range.

Also refer to ANSI C37.35 (American National Standard Guide for the Application, Installation, Operation and Maintenance of High-Voltage Air Disconnecting and Interrupter Switches).

**TERMINAL CONNECTIONS**

Because of the wide acceptance and use of aluminum conductors, the terminal surfaces are aluminum to provide an easy current transfer surface. (In cases where copper conductor is used, it is recommended that a tinned terminal clamp be bolted to the aluminum switch terminal pad.) However, if a non-tinned clamp is used, a liberal amount of grease should be used at the joint and all over the pad of the fitting.

An instruction tag is attached to the terminal clamps shipped with the switches for making aluminum connections as follows: (1) Clean all contact surfaces of conductors and fittings with a stiff wire brush to remove heavy oxide coatings until they become a typical fresh aluminum color. (2) Immediately coat these contact areas with a liberal amount of corrosion inhibitor such as NO-OX-ID Grade A Special or equivalent. (3) Abrade the contact surface again, this time through the applied compound with a stiff wire brush. (4) Make connections and tighten bolts.

**CAUTION** - Do not remove the compound.

In making copper-to-aluminum connections: (1) Prepare all aluminum contact surfaces as described above. (2) Prepare any bare copper surfaces in the usual manner. (3) Do not abrade or wire brush any plated surfaces; a few light rubs with fine steel wool before greasing is sufficient. (4) Make connections and tighten bolts.

**ORDERING INFORMATION**

In ordering parts or in correspondence regarding this equipment, contact nearest I-T-E Sales Office and state the voltage, current rating, type and the serial number as indicated on the switch name plate.

**RECOMMENDED TORQUE FOR ALUMINUM BOLTS**

Bolt Diameter, Inches	Lubricated Threads		Dry Threads	
	In.-Lbs.	Ft.-Lbs.	In.-Lbs.	Ft.-Lbs.
1/2	240	20	420	35
5/8	480	40	720	60
3/4	720	60	1140	95



**ITE Imperial**  
CORPORATION