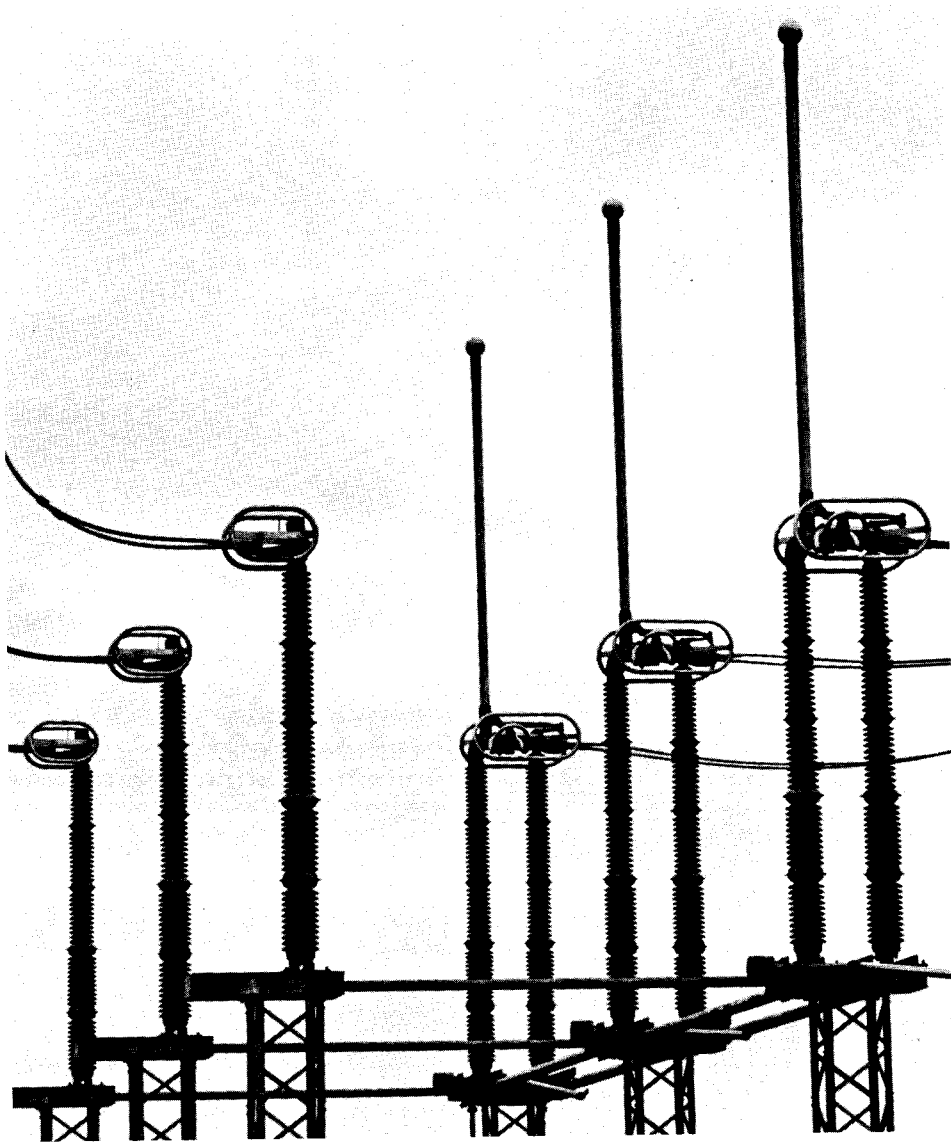


AIR SWITCHES – OUTDOOR

INSTRUCTIONS

**TTR6 VERTICAL-BREAK
500-AND 765-KV**

200 DEGREE INSULATOR DRIVE



IFE Imperial
CORPORATION



INSTRUCTIONS FOR 500-AND 765-KV

TTR6 VERTICAL-BREAK SWITCHES

200 DEGREE INSULATOR DRIVE

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 and a number) identifies the numbered crate or carton in which the various item numbered parts of the bill of material are to be found.

Typical example: The bill of material drawing covering switch and control lists Item 15 as a ground clamp. The shipping notice lists Item 15 and its drawing number as being included in Carton 1252-54. Similarly, all component parts of the switch and control will be identified by inclusion in properly numbered cartons or crates.

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INSTALLATION AND ADJUSTMENT

Step 1 - Checking Bases

Check bases to make sure that insulator supports are square and level. The two supports on the hinge end must be exactly the same height. If necessary, adjust leveling screws to achieve this - Refer to Fig. 1.

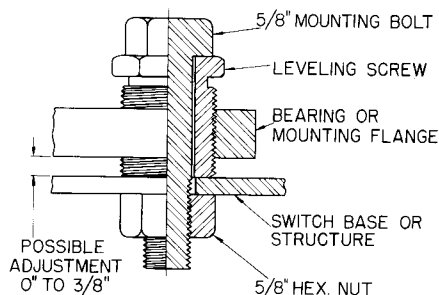


Fig. 1. Insulator leveling screws.

Step 2 - Mounting Bases

Referring to the installation drawing, assemble the bases on the supporting structures. Some switches have divided bases with or without tie members. Where tie members are used they should be installed between the hinge and jaw bases of each pole unit (See Fig. 2). The bases should be level and parallel to each other, in the positions shown on the installation drawing. Position is important for interphase and couplings.

Step 3 - Mounting Insulators

Refer to the installation and single-pole switch drawings and assemble the insulator columns. Leveling screws are provided to adjust for variations in heights or the angles of the insulator columns to the mounting surface, Fig. 1.

Step 4 - Mounting Current Carrying Parts

Complete installation of single-pole units by assembling the blade hinge and jaw assemblies on the insulator columns.

CAUTION: When uncrating the blade hinge assembly, be careful not to disturb the steel banding which holds the blade locked in the closed position during shipment. Do not cut or remove the steel banding until the blade hinge assembly has been bolted in place on the insulator columns. Otherwise, the powerful counter-balance springs may collapse the hinge end toggle and possibly cause injury to workmen.

Care should be exercised when hoisting the blade hinge and jaw assemblies into position to prevent scratches or damage to these current-carrying parts.

When assembling the jaws on the insulator columns, leave the jaw base holding-down bolts finger tight. This will permit the jaw base to be rotated and shifted slightly for subsequent contact alignment. This alignment will be discussed later.

COVER—

500-kV TTR6 Vertical-Break Switch
with divided bases and tie members

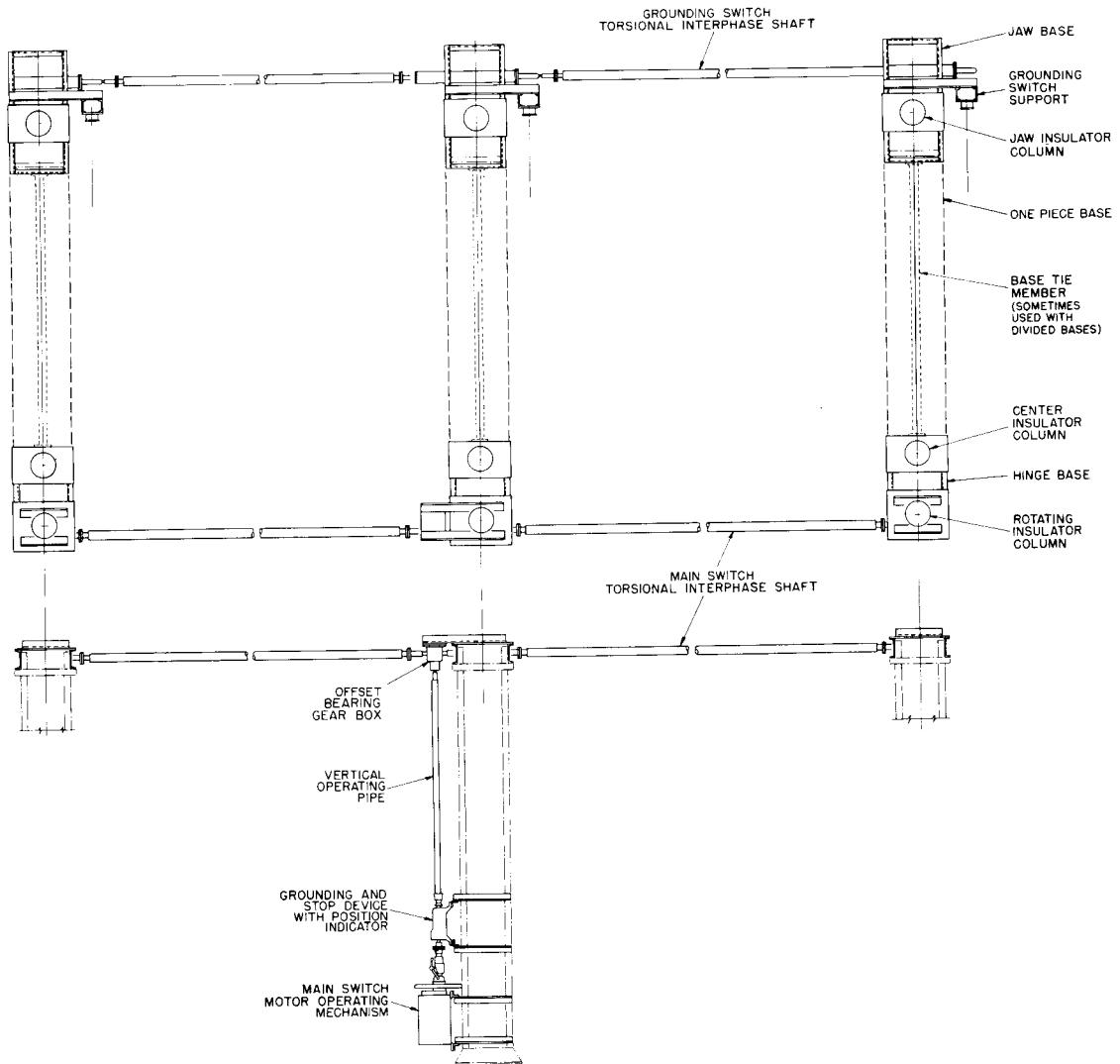


Fig. 2. Plan and elevation views of a 3-pole, 500-kV vertical-break switch installation

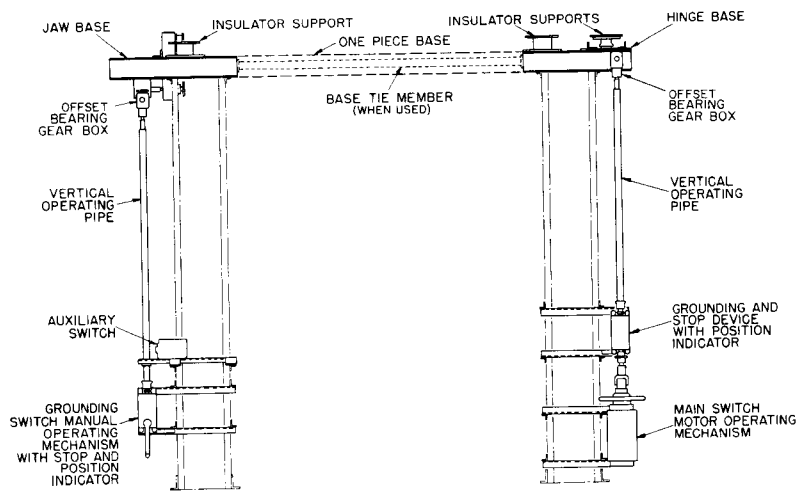


Fig. 3 Sectional view of a 500-kV vertical-break switch installation



Step 5 - Mounting Offset Bearing Gear Box

The offset bearing gear box, located at the top of the vertical-operating pipe, should be mounted as indicated on the control drawing. On certain control arrangements, this may be factory assembled.

Step 6 - Installing Vertical-Operating Pipe and Operating Mechanisms

The next step is to install the vertical-operating pipe immediately under the offset bearing gear box. For manually-operated switches, install the manual mechanism on the bottom of the pipe. On motor-operated switches, a stop mechanism similar to the manual mechanism but without a handle, is installed on the bottom of the vertical-operating pipe and then the motor mechanism directly under it.

The open and closed positions of the stop mechanism, or the manual operating mechanism should be set in the following manner: (Refer to Figs. 4 and 5).

- a. With the 3-pole switch in the fully closed position, remove Bolts (3) and Cover (4) from front of mechanism.
- b. Turn operating handle toward the closed position until Stop Bolt (10) or (16) hits Stop (11) or (14), which is part of the Traveling Indicator (21). Check to see that the stop bolt interferes with the Stop by 3/32". Turn operating handle toward the open position to be sure that the stop bolt clears the stop after one (1) revolution, then return handle to the closed position.
- c. Drill a 5/8" diameter hole in operating pipe using holes in Coupling (1) as a template and install Pin (2).
- d. Turn operating handle until open position Stop Bolt hits Stop. Check to see that 3-pole switch is in fully open position.
- e. If more or less travel is necessary to fully open (or close) switch, Stop Bolts may be repositioned to any of the three (3) other holes in the Stop Discs. Adjust open position stop bolt to just clear stop after one revolution towards closed, similar to adjustment in Step b.
- f. If Key Interlocks (7) are used, they may be mounted at this time by removing the small rectangular Cover Plates (5). When Interlock Bolts are extended into Slot (17) (locked position), there should be a minimum clearance between the bolt and the edge of the Blinder Plate (15). To adjust blinder plates, remove Bolts (12) and take blinder plate assembly from mechanism. Each blinder plate may be moved up or down by loosening Bolts (13). After making adjustments, return blinder plate assembly to operating mechanism and recheck clearance.
- g. After operating mechanism is fully adjusted, replace Cover and Bolts (3 & 4).
- h. If direction of rotation does not agree with words on Cover Plate (6) and Direction Indicator (9), they should be turned over.
- i. Station Ground may be attached to any of the Mounting Pads (18).

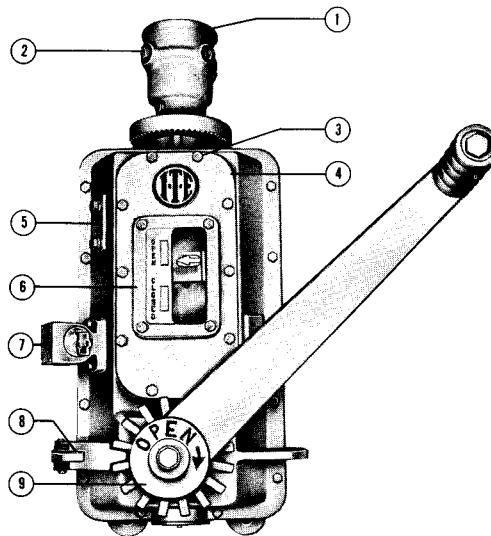


Fig. 4 Manual operating mechanism with stops

IDENTIFICATION OF PARTS - FIGS. 4 & 5

- 1, 2 - Coupling and Pin
- 3, 4, 5, 6 - Cover Plates and Bolts
- 7 - Key Interlock
- 8 - Provision for Padlocking
- 9 - Direction Indicator
- 10, 16 - Stop Bolts
- 11, 14 - Stops
- 12, 13 - Bolts
- 15 - Blinder Plate
- 17 - Interlock Bolt Slot
- 18 - Mounting Pad
- 19 - Grounding Device Contact Fingers
- 20, 23 - Stop Discs
- 21 - Traveling Indicator
- 22 - Threaded Operating Shaft

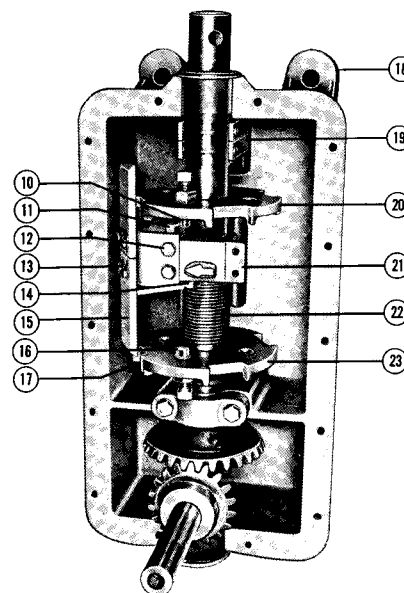


Fig. 5 Same as Fig. 4, exposing internal parts



Step 7 - Switch Adjustment

At this step it will now be possible to check the operation and adjustment of the switch by using the manual operating mechanism.

NOTE - When looking down on the switch rotating insulator column, rotation of the column is clockwise to open the switch and counter-clockwise to close.

Starting with the pole unit nearest the operating mechanism, check the following items:

- a. Blade must enter jaw contact centrally. Lower the blade slowly to the closed position, and check that the moving contact is entering the jaw in a central or nearly central position. The blade is now rotated into contact, deflecting the spring members of the jaw. The base bolts of the jaw assembly should now be tightened. The blade should be opened again and central entry of the blade into the jaw should be examined. If it does not enter centrally, the mounting bolts on the insulator stacks for the blade hinge assembly should be loosened slightly and the blade assembly shifted to bring the blade into alignment. The switch should be operated again to assure proper operation. Should the above method of alignment be insufficient, the insulator stack leveling screws may be used to obtain proper alignment.

- b. In fully closed position, blade height and angle should conform with tolerances described below:

BLADE CONTACT ANGLE

Fig. 6 shows blade in closed position. The allowable difference in elevation from one side of the blade contact to the other (dimension X) is 1/16" for each 1" of contact width. Example: If contact width (A) is 3", then dimension (X) can be as much as 3/16" and still be within the plus or minus 4° tolerance.

Also, Fig. 6 shows blade contact high on the right and low on the left. The reverse is also acceptable, high on the left and low on the right. 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, you may find one pole will be high on the right, one fairly level and one high on the left. This is due to many variables and tolerances plus the free play or clearance in pin connections of all the switches and control parts.

This variance in contact angle is nothing to be concerned about because there is no measurable reduction in contact pressure until the blade gets to an angle of more than 8 degrees.

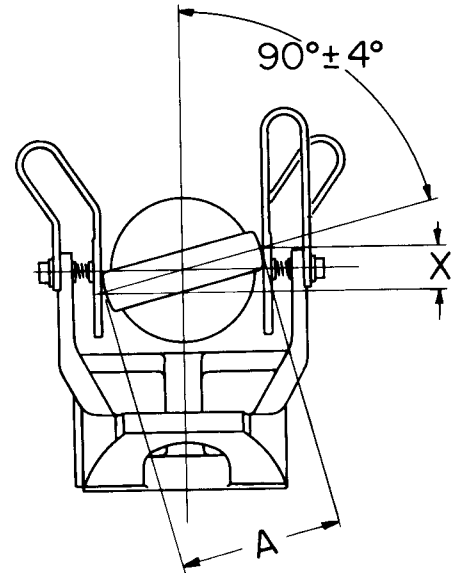


Fig. 6. End view showing blade contact angle

BLADE HEIGHT IN JAW

In Fig. 7, dimension (H) can vary from about 1/8" to 5/8" or a little more, with the switch in the closed position. It is not usually possible to get this dimension to be equal on all poles of a three-pole switch. If necessary to vary this dimension, remove connecting pin (A) and screw clevis (E) in or out 1/2 turn then reconnect and try switch. Repeat if necessary, but be very careful not to screw clevis (E) out too far so that the blade is forced down hard against the fulcrum. This can cause damage to internal parts at the hinge end. If blade is too far into jaw and not open far enough, screw clevis into forked link. If blade is too high in jaw and opening too far, then turn clevis out of forked link.

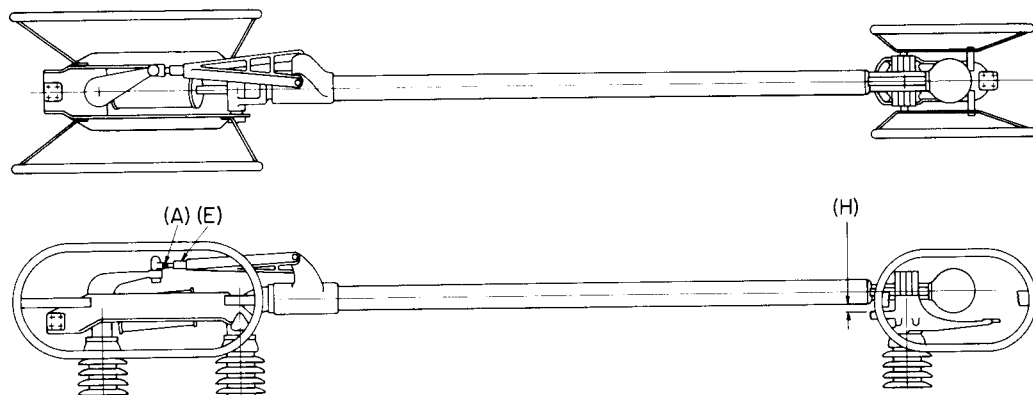


Fig. 7. Switch current-carrying parts



- c. Blade operating crank axis should be 20 degrees past blade axis in the fully closed position.
- d. Switch blade should be vertical in its open position with its operating crank turned 180 degrees from the jaw. The crank radius is set at the factory and normally should not require field adjustment. However, if the blade travels more than or less than 90 degrees, adjustment to correct this can be made at the operating crank swivel as shown in Fig. 8 below and following directions.

DIRECTIONS FOR CHANGING RADIUS (FIG. 8)

- (1) If either the open or closed position is satisfactory, then make these changes in the good position.
- (2) Move linkage slightly to relieve pressure.
- (3) Remove Pin (A).
- (4) Loosen Locknut (C)
- (5) Remove Locking Screw (B)
- (6) Turn Adjusting Screw (D) clockwise to increase radius for more crank travel or counter-clockwise to reduce radius for less crank travel. Do not adjust more than one or two turns. Replace Locking Screw (B) and tighten locknut.
- (7) Before re-connecting, adjust clevis as follows:
If adjustment was made in closed position, then clevis should be screwed into forked link approximately same amount that radius was increased; or out of forked link same amount that radius was decreased.
If adjustment was made in open position, then clevis should be screwed out of forked link approximately the same amount that radius was increased or into forked link same amount that radius was decreased.
- (8) Repeat steps (1) to (7) above until correct travel is achieved.
- (9) After final adjustment has been made, secure locknut in position by drifting some of the metal of the countersunk thread into slot in nut.
- (10) If necessary at any time, swivel assembly can be lifted out of crank by removing locknut entirely.

Step 8 - Connecting Interphase Shafts

With the switches in the full open position, and blade operating cranks centered over the hinge terminal pad (Fig. 9), install the interphase shafts. Slight rotation of the couplings or shafts may be necessary to get coupling holes to align. After interphase shafts are in place, operate the three-pole switch and observe the closed position. If any of the poles are not within the tolerances listed previously, additional adjustments may be necessary as described in Step 7.

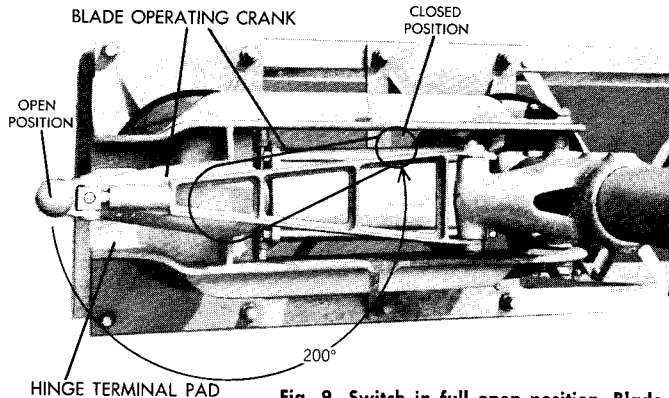


Fig. 9. Switch in full open position. Blade operating crank and rotating insulator turn through 200 degrees.

Step 9 - Final Checks

The completed 3-pole installation should be checked for the following:

- a. In the open position, the blades should stand essentially vertical.
- b. In closing, blades should make central entry into their jaws at approximately the same time.
- c. In the closed position, all blades must be in full contact and horizontal within tolerances described previously.

Step 10 - Installation of Corona Balls and Rings

Corona rings should now be installed on the jaw and hinge ends of the switch as shown on the single-pole drawings. After these are in place, the corona balls should now be attached to the ends of the switch blades. The switches should now be ready for service.

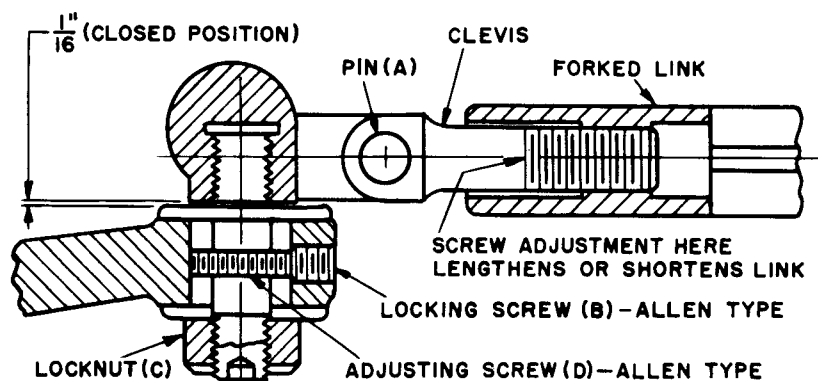


Fig. 8. Section of blade operating crank and connecting link screw adjustment



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.)

If the contacts become pitted, or burned to an extent that the periodic maintenance procedure will not remedy, they should be removed and replaced. The jaw contact fingers are bolted in place so that they can be easily removed if required.

In general, operating linkages require no maintenance. The bearings and the vital points are greaseless, requiring no lubrication. Exposed bearings, such as the pin connection of the rotor crank to the interphase connecting rods and guide plates should receive special attention particularly in areas where atmosphere contamination is abnormally great or where

operation under sleet conditions is common. Any number of lubricants may be suitable for application at these points. Dow Corning DC-44 silicone compound is recommended, for it is particularly durable even when exposed to the elements, and retains its viscosity over a wide temperature range.

All the bolts, nuts, cotter pins, etc. should be checked for tightness and that the operation of the switch is the same as it was when initially installed.

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.

CAUTION - Do not remove the compound.

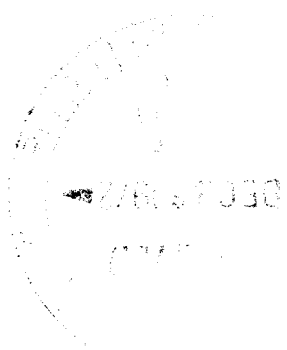
In making copper-to-aluminum connections: (1) Prepare all aluminum contact surfaces as described above. (2) Prepare any bare copper surfaces in the usual manner. (3) Do not abrade or wire brush any plated surfaces; a few light rubs with fine steel wool before greasing is sufficient. (4) Make connections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



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