Type TTT7

72.5 THRU 550 kV
1200-5000A
61-120 KA MOMENTARY

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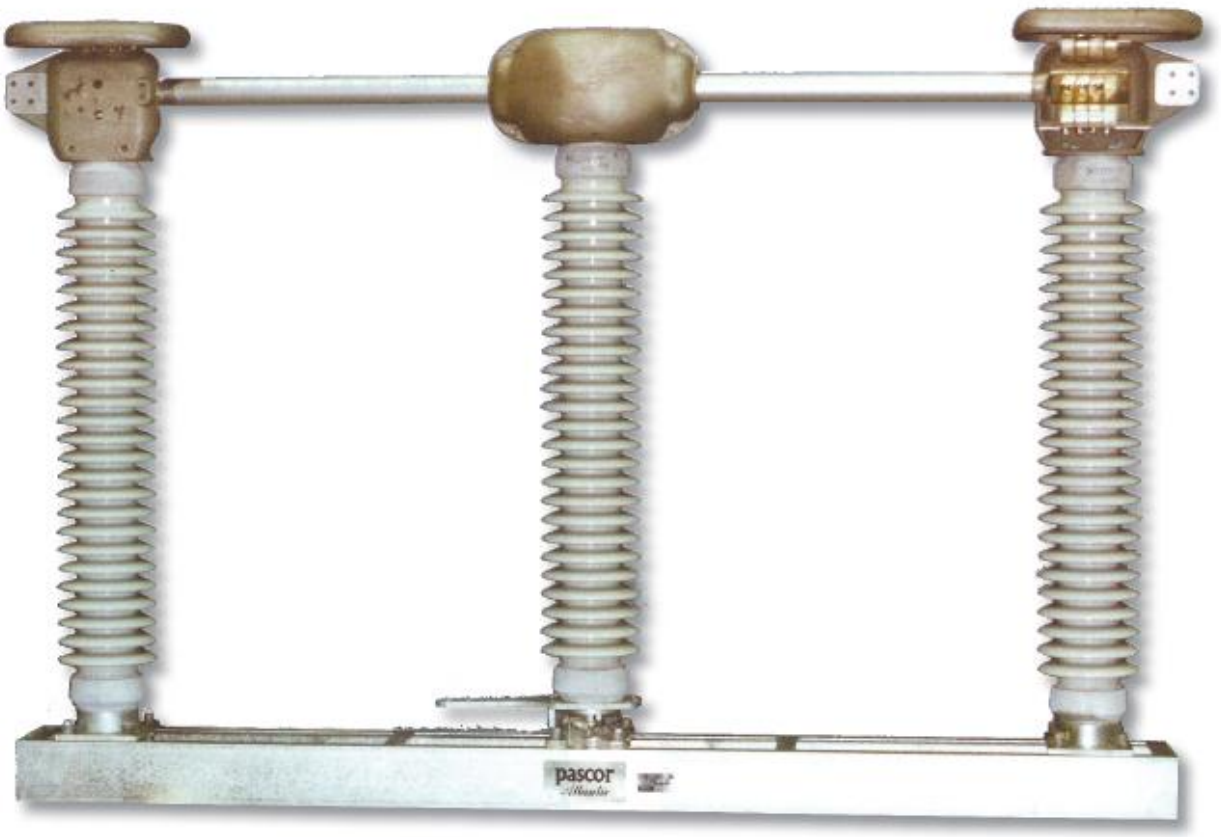

Double End-Break Outdoor Air Disconnect Switch

Contents

Suggested Tools

- 15/16” Open-End Wrench
- 15/16” Socket
- 3/4” Open-End Wrench (2)
- 3/4” Socket
- 1 1/2” Open-End Wrench or Adjustable
- Lineman Pliers
- Tape Measure
- Angle Finder
- Metal Cutting Saw
- Level

IMPORTANT: Read manual before installing or maintaining equipment! Make absolutely sure that equipment is de-energized and properly grounded.

This manual should be used in conjunction with the factory drawings. The drawings contain critical information, which if not followed could affect the operation of the switch.

Instructions can not cover all possible variations in equipment nor provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be required or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the concern should be referred to the factory.

For Technical Assistance Call 276-688-3328

RECEIVING INSPECTION

Check the shipment for completeness against the bill of material and installation drawings. If damage is found, file a claim immediately with the transportation company and notify your Pascor Atlantic representative.

HANDLING

Handling of disconnect switches should be done with care. Porcelain is fragile and may be damaged due to improper handling.

Factory drawings should be followed during installation. It is recommended that switches be fully assembled and adjusted at ground level before being placed into position. This should minimize final adjustments.

Lifting of switches by insulators, contacts, or live parts should be avoided, because of possible damage to these parts. Attachments for hoisting should be made to the switch bases unless otherwise instructed.

INSTALLATION AND ADJUSTMENT

If the switches have already been assembled with insulators at the factory, proceed to step 5. However, it is recommended that each switch pole be checked for alignment and proper adjustment after being mounted on the structure.

Step 1—Check Bases

Check bases to make sure that the spacers and rotor bearing tops are square and level. If necessary, make adjustments or shim. Shims are normally used through 230kV and leveling screws for 345 kV and above, see Fig. 1.

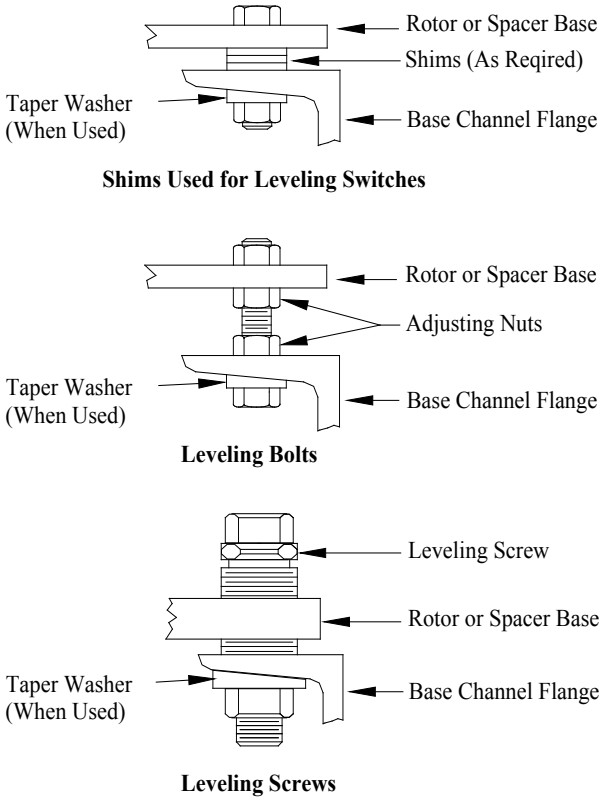

Fig. 1 Types of Leveling Devices

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.

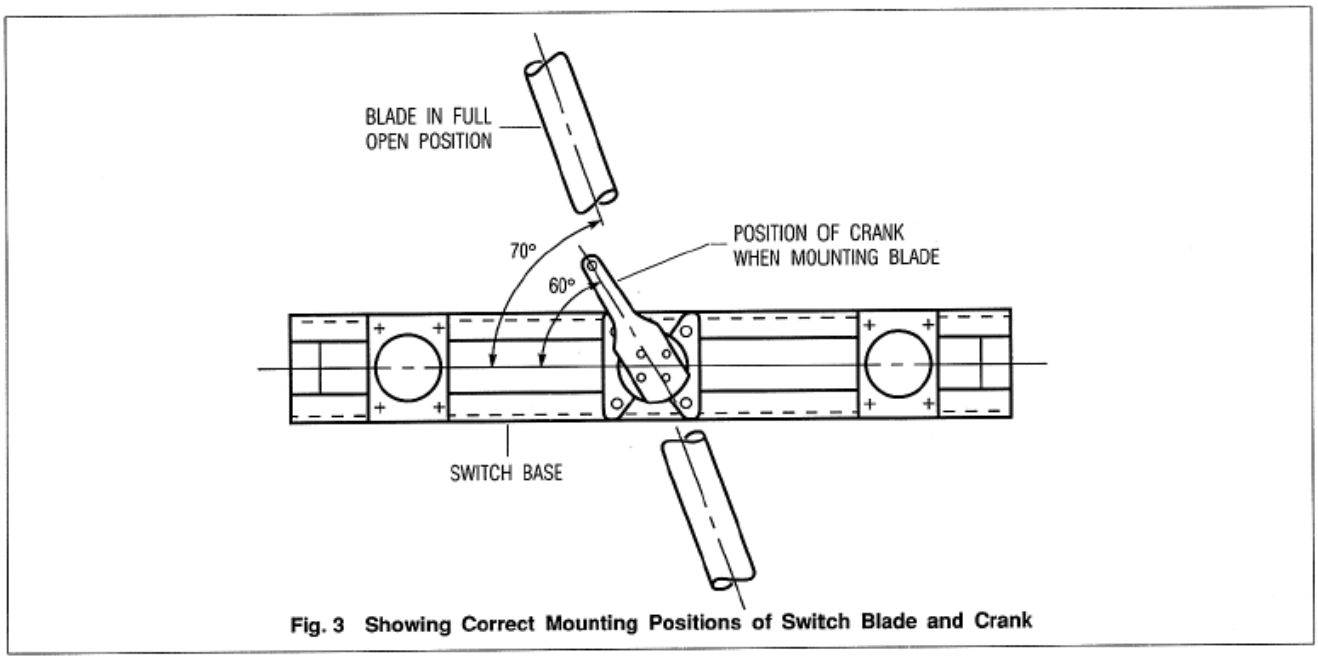

Fig. 3 Showing Correct Mounting Positions of Switch Blade and Crank

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 required travel to switch blades. This additional length allows for lost motion and clearances in pin holes and will also provide a definite audible sound accompanied by a reasonable amount of deflection in the structural members when the crank crosses the dead canter position. This serves as a signal to the operator that the switch is either 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, leveling bolts or leveling screws as provided, see Fig. 1.

Step 5 — Mounting Current Carrying Parts

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 degrees to the centerline of the switch base which is 10 degrees further in a clockwise direction than the switch crank, see Fig. 3. Mount the switch jaw assembly on the end insulators leaving the mounting bolts finger tight in order to allow for any adjustments later for proper alignment.

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 form 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 of 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 of jaw stacks by using the same shims of 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 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 shim 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, (Fig. 4). An allowable contact angle of 4 degrees permits an (dimension X) is 1/16" for each 1" of contact width. Example: If contact width (A) is 4 1/2", then dimension (X) can be as much as 9/32" 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, you may find that 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.

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 of 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—Install Interphase and Offset Crank Rods

With all blades in the closed position, install the interphase rods and offset crank rod as follows:

a. Lengthen the interphase rods that are in compression during opening, as much as possible, yet allowing for the pins to be inserted.

b. On the rods that are in tension during opening, shorten them as much as possible, yet allowing for the pins to be inserted.

c. The offset crank rod between the outboard bearing and the driven switch should be handled the same way

Step 8—Install Vertical Operating Pipe

Attach vertical operating pipe to rotor bearing shaft, of to offset rotor bearing shaft, with coupling pins supplied. At this point, check drawings for accessory equipment (auxiliary switches, mechanical interlocks, position indicators, ground straps, etc.) which mounts on vertical operating pipe and install before continuing installation. The vertical pipe is predrilled at one end for a 5/8" diameter pin, two of which are shipped, together with a coupling, in a bad, for connection to the offset bearing shaft (or on the pole unit rotor bearing in the case of direct connection switches)

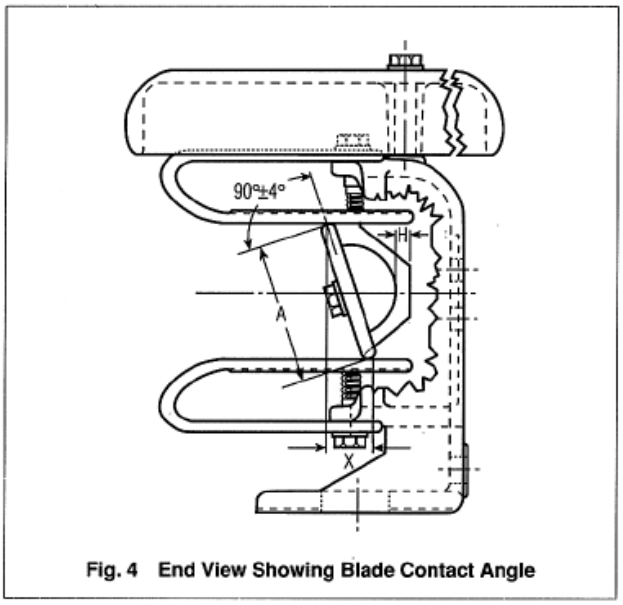

Fig. 4 End View Showing Blade Contact Angle

Step 9—Installing Operating Mechanism

Either a swing handle or a worm gear mechanism is (normally) supplied for manual switch operation.

Swing Handle Operator

To install the swing handle operator:
With ground strap in place on vertical operating pipe, slide handle and handle lock plate over the end of the vertical operating pipe. Fasten the lock plate at the proper location. Recommended height for the lock plate is 3 ft. 6 in. above ground.

Note: The lower end of the vertical operating pipe should extend through the lock plate at least 3 inches. It may extend as much as 3 feet or more, just so it doesn't touch the ground or column footing.

The lock plate assembly (Fig. 8) consists of two castings, mounted on the pipe guide plate, which can be easily adjusted in an arc to provide the required rotation. These act as locks for the manual operating handle when it is dropped from the operating position. The handle must be raised to a horizontal position for operation. With the switch in the fully closed position, set the handle clamp so its set screws are 4 inches above the lock plate and its vertical centerline is at or near as possible to the closed position, see Fig. 8.
Temporarily fasten the handle to the pipe with the set screws. Operate the switch and move the adjustable lock castings until they exert pressure against the handle in both the open and closed


Fig. 5 Worm Gear Operator


Fig. 6 MO-10 Motor Operator

positions of the switch. This provides a slight torsional wind-up in the operating pipe. Tighten the two piercing set screws on the handle clamp until holes are punched into the pipe and continue until the screws are firmly seated.

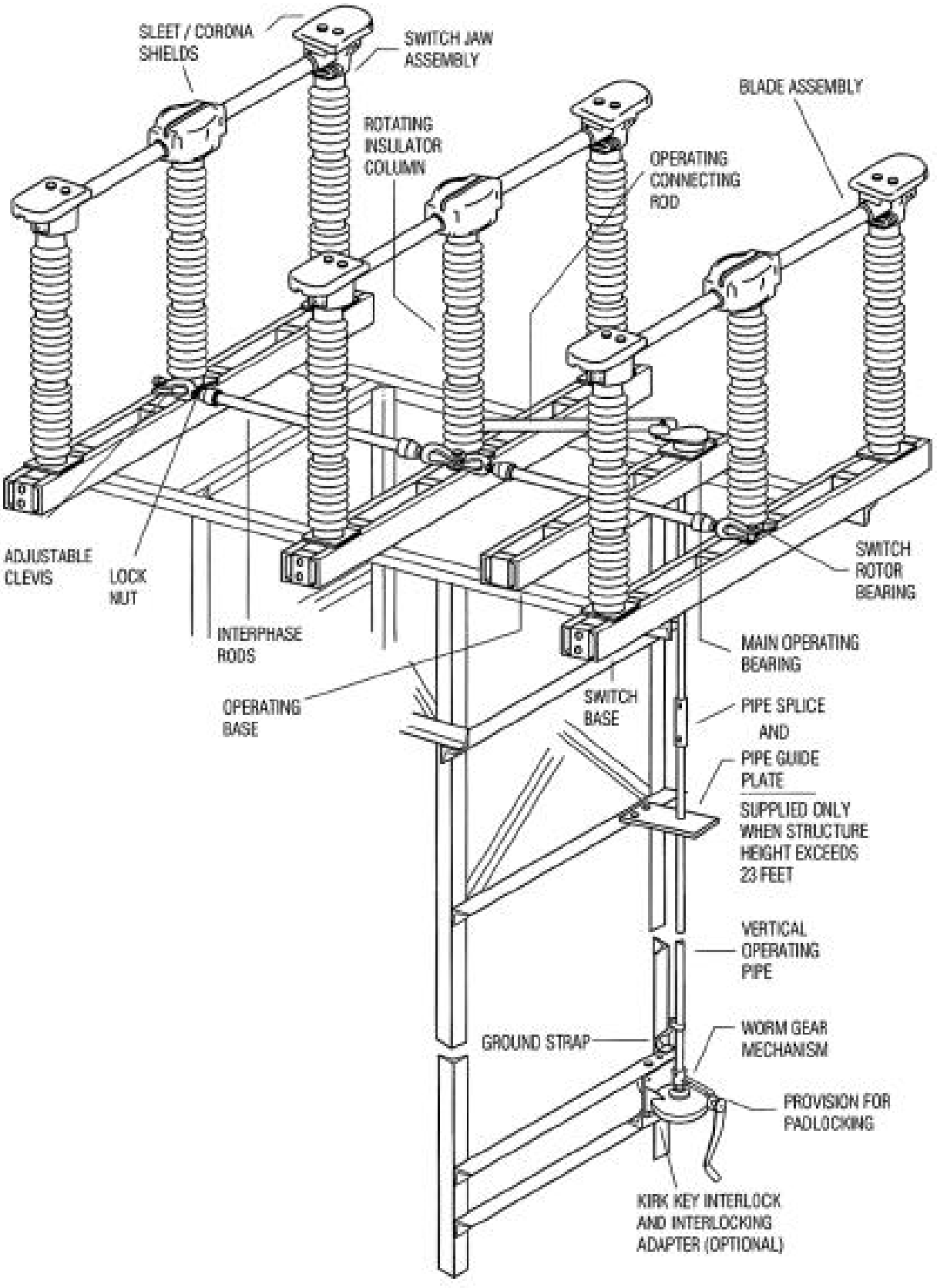

Fig. 7 Typical TTT Switch Installation.
The TTTV type switch is essentially the same as the TTT except for the "V" shape formed by the two outside insulators. The "V" shape allows for a smaller base structure; making the TTV switch more space efficient.

Worm Gear Mechanism

With ground strap in place on vertical operating pipe, slide worm gear mechanism (Fig. 5) over the vertical operating pipe and attach it to the structure. Remove the small position indicators, which are attached to the worm gear coupling with Allen set screws. Tighten hex head set screws in the coupling until the vertical operating pipe is pierced. The three-pole switch should now be operated manually to check for proper adjustment. If all stops at switch elevation have been set, including the offset bearing, then it is safe to reinstall the position indicators on the worm gear mechanism. 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 the coupling if this is not observed

Motor Operator

For remote operation, a motor operator is supplied and it should be installed per the instructions supplied with it.

Step 10—Arcing Horns or Arc Restrictors

When arcing horns of 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 11—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.

Step12—Final Checks

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

1. In the open position, the blades should be at an angle of 70° to the centerline of the switch base, and 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.
2. In closing, blades should make central entry into their jaws at approximately the same time.
3. In the closed position, all blades must 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 to the worm gear operating mechanism should indicate the switch is closed.

MAINTENANCE

A certain amount of care and inspection is recommended. The frequency of inspection depends upon atmospheric conditions and frequency of operation. The service interval is largely determined by the user. Recommended maintenance is similar to that listed in the latest industry standards.[1] 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 have 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 entirely clean, a coating of lubricant should be applied. Suggested lubricants are MOBIL 28 grease of NO-OX-ID “A Special”. MOBIL 28 is an Exxon Mobil Company product. NO-OX-ID is made by SANDCHEM INC.

In general, operating linkages require virtually no maintenance. However, in contaminated atmospheres of 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.

Terminal Connections

The aluminum surface of the terminal connection provides for easy current transfer.

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

Notice: In cases where a copper conductor is used, bolt a tinned terminal clamp (if available) to the aluminum switch terminal pad. If a non-tinned terminal clamp is used, apply a liberal amount of electrical joint grease at the joint and all over the pad of the fitting.

To connect aluminum-to-aluminum terminals:

1. Clean all contact surfaces of conductors and fittings using a stiff wire brush to remove heavy oxide coatings until the aluminum finish is visible and restored.
2. Coat these now clean contact areas with a liberal amount of corrosion inhibitor such as NO-OX-ID"A Special" or No. 2 EJC.
3. Abrade the contact surface through the corrosion inhibitor again using the stiff wire brush.

Notice: Do not remove the compound.

4. Connect the terminals and torque the bolts as per Table 1.

To connect copper-to-aluminum terminals:

1. Except for plated surfaces, clean all contact surfaces of conductors and fittings using a stiff wire brush to remove heavy oxide coatings until the aluminum finish is visible and restored.
2. Prepare any bare copper surfaces in the usual manner.
3. Coat these now clean contact areas with a liberal amount of corrosion inhibitor such as NO-OX-ID "A Special" or no. 2 EJC.
4. Abrade the contact surface through the corrosion inhibitor using a stiff wire brush.

Notice: Do not remove the electrical joint grease.

5. Connect the terminals and torque the bolts as per Table 1.

Table 1
Lubrication Guide for Outdoor Switch Components

Part Name	Type Lubricants Recommended	Amount Applied	Qty. Req'd. for (6) Three-pole Switches
Jaw Fingers	NO-OX-ID Grade "A" Special or Mobil 28 Grease	Medium Coat	
Blade Ends	NO-OX-ID Grade "A" Special or Mobil 28 Grease	Medium Coat	(1) Quart
Pins On current carrying parts	Mobil 28 Grease or DC-4	*	
Pins On control parts	Mobil 28 Grease or DC-4	Light Coat	(1) Quart
Bearing Areas On control parts	Mobil 28 Grease or DC-4	Medium Coat	
Terminal Connections	NO-OX-ID Grade "A" Special or NO 2 EJC	Heavy Coat	(1) Quart

BOLT SIZE	condition of Threads	Recommended torque in Ft. Lbs.			
		Silicon Bronze	Aluminum 2024-t4 anodized	Staniless Steel Type 304	Bright Zinc, Black & Galv. Steel
3/8"-16	Dry Lubricated	20 15	15 12	16 13	12 10
1/2"-13	Dry Lubricated	40 30	35 20	40 30	30 20
5/8"-11	Dry Lubricated	70 50	60 40	70 50	50 40
3/4"-10	Dry Lubricated	100 85	95 60	100 80	90 70
7/8"-9	Dry Lubricated	150 120	130 75	140 110	130 100
1"-8	Dry Lubricated	200 160	160 95	170 140	170 130

RENEWAL PARTS

Refer to the switch nameplate when ordering renewal parts. The nameplate is attached to the base assembly of each switch pole. The same data is shown on the record engineering drawings. The master file at the factory is linked to the serial number on the nameplate.

Renewal Parts Ordering Information

Serial Number
Switch Type
Part Name
Quantity Required
Max. kV
B.I.L. kV
Cont. Amps
Mom. Amps

Refer your requests for renewal parts to the Factory.

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