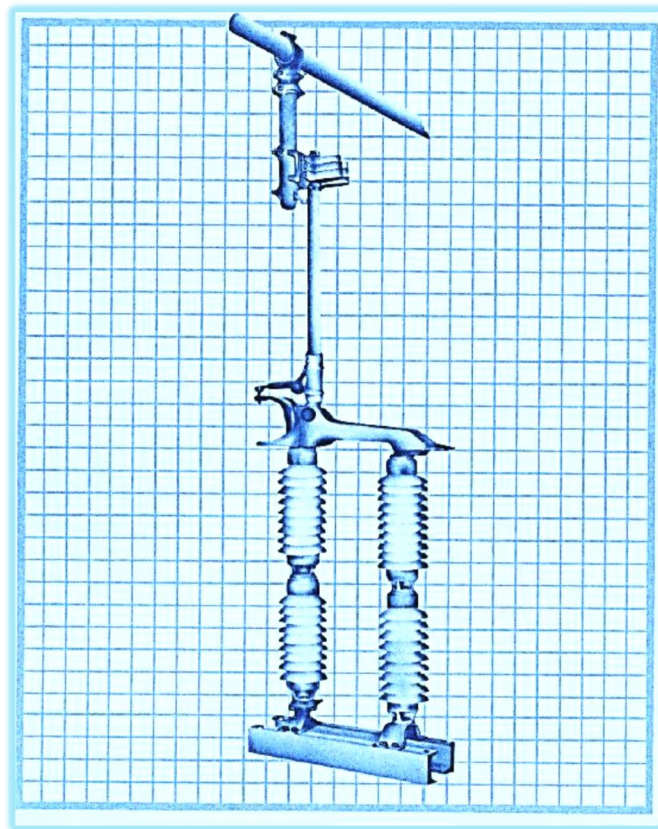


Type VT2

121 thru 800 kV Max. Design



Group Operated Vertical Reach

Contents

<u>Subject</u>	<u>Page</u>
Receiving and Handling	2
Installation and Adjustment	
Step 1. Check Bases	2
Step 2. Assemble Insulators	3
Step 3. Insulator Stack Alignment	3
Step 4. Mount Current Carrying Parts	3
Step 5. Mount Switches	3
Step 6. Mount Offset Bearing	3
Step 7. Adjust Multi-Angle Crank	3
Step 8. Install Interphase and Offset Bearing Rods	5
Step 9. Install Vertical Operating Pipe	5
Step 10. Install Pipe Splice and Guide Plate	5
Step 11. Install Operating Mechanism	6
Step 12. Switch Blade Adjustment	7
Step 13. Switch Adjustment in Areas of High Wind Loads	7
Step 14. Arcing Horn Installation	8
Step 15. Installation of Corona Rings and Balls	8
Step 16. Final Checks	9
Terminal Connections	9
Maintenance	10
Bearings	10
Cranks	10
Renewal Parts	11

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.

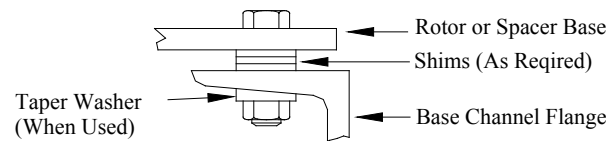
HANDLING

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

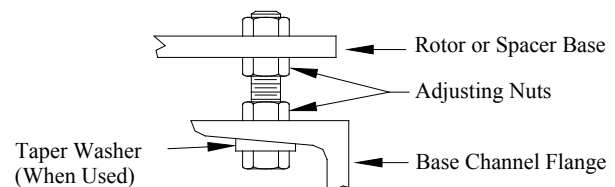
Factory drawings should be followed during installation. It is recommended that switches be fully assembled and adjusted at ground level before being placed into position. This should minimize final adjustments.

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.

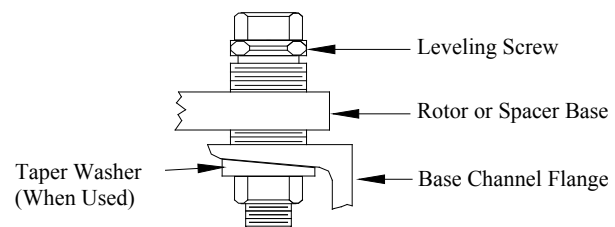
CAUTION: When uncrating switches having blade counterbalances open the switch blade to relieve the pressure of the counter balance before removing the live parts from the base.



Shims Used for Leveling Switches



Leveling Bolts



Leveling Screws

Fig. 1 Types of Leveling Devices

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. The tops of the two supports on the hinge end must be exactly the same height. If necessary, make adjustments or shim. Shims, leveling screws, and adjusting nuts are shown in Fig. 1 and are explained in step 3.

Step 2—Assemble Insulators

Assemble the insulator stacks to switch base. Do not disturb the position of the switch crank when mounting the insulator stack to the rotor bearing, as the crank has been properly located at the factory. In some cases, involving higher voltage switches, the installer may choose to mount the switch bases on the structure before assembling the insulators. In such cases the switch bases should be mounted on the supporting structure in the positions shown on the installation drawing. The bases should be level and parallel to each other. Make sure that the base for the drive phase is in the correct location and operating cranks are at their proper angles. Remove the “slack” from the rotating insulator by rotating the insulator clockwise for all three phases.

Step 3—Insulator Stack Alignment

Lower voltage switches 8.25 thru 72.5kV generally do not require insulator stack alignment. Where required, the insulator stacks of switches thru 242kV can be aligned using open-end shims or leveling screws and/or adjusting nuts (Fig. 1) if supplied (optional).

- If using shims, place the shims under the insulator supports (rotor bearing or spacer mounting flange) where the bolts secure the rotor bearing or spacer mounting flange to the switch bases.
- If optional leveling screws and/or adjusting nuts have been supplied, as shown in Fig. 1, adjust the leveling screw and/or adjusting nut to align the insulator stacks. Loosen all hardware before jacking to prevent binding.

Step 4—Mount Current Carrying Parts

Make certain that the base crank is in the proper position when mounting current carrying parts, i.e. base crank rotated to the maximum counterclockwise position with the blade open. Care should be exercised when hoisting the blade hinge and jaw assemblies into position to prevent scratches or damage to these current carrying parts.

Jaw assemblies are mounted in many ways. Two of the more common are as follows

- a. By a vertical bus drop from a horizontal bus run. (No insulators.)
- b. By a vertical bus drop off the end of an inverted insulator stack.

By referring to the drawings you can see which of these apply and then mount the parts accordingly.

The jaw assembly should first be held securely in place with the bolted clamp or cone point set screw (EHV jaws). After it is properly adjusted (per steps 12 & 13), it should be welded in place being sure to get proper weld penetration since current must flow through the weld.

Step 5—Mount Switches

Assemble the switches on the supporting structure in accordance with the positions shown on the installation drawing. The switches should be mounted level and parallel with each other. In case of a warped structure, shimming under the switch bases may be required.

Step 6—Mount Offset Bearing

For those installations requiring an offset bearing, mount the offset bearing and its supporting base on the structure in the position shown on the installation drawing. Check operating crank for proper length radius and angle, and stop crank for correct position.

If the offset bearing has an adjustable crank, it is sometime necessary to add $\frac{1}{4}$ " to $\frac{1}{2}$ " 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 center position. This serves as a signal to the operator that the switch is either fully open or closed.

Step 7—Adjust the Multi-Angle Crank

This crank is supplied on the operating pole unit connected to the offset bearing.

3" Bolt Circle Insulators have a multi-angle crank that permits 333 degrees of angular adjustment with a crank location every 9 degrees, which results in adjustments to within 4-1/2 degrees of desired position.

5" Bolt Circle Insulators have a multi-angle crank that permits 336 degrees of angular adjustment with a crank location every 12 degrees which results in adjustments to within 6 degrees of the desired position.

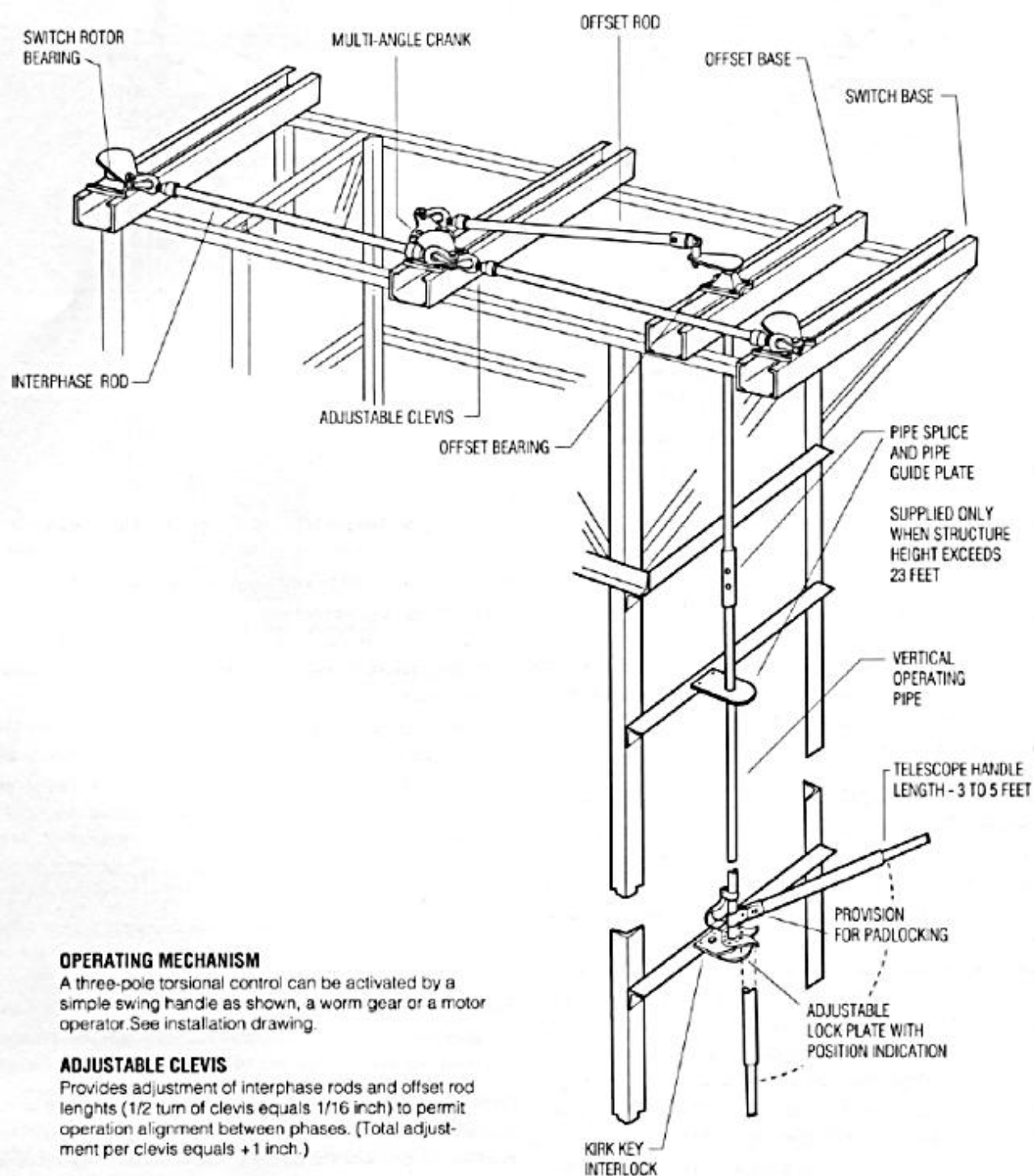


Fig. 3 Offset Torsional Operating Mechanism

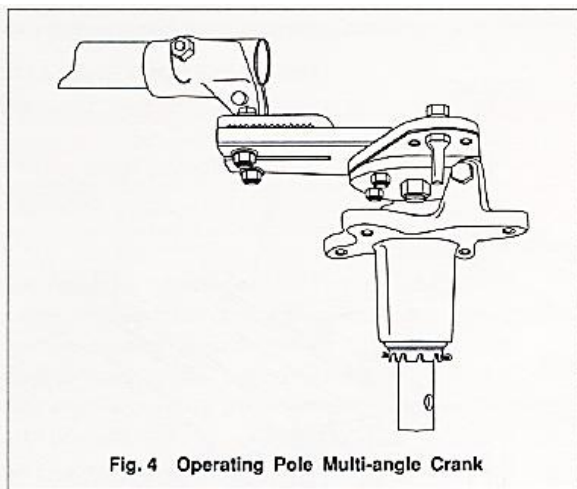


Fig. 4 Operating Pole Multi-angle Crank

In some adjustments, the multi-angle crank may be in such a position as to interfere with the stop projection on the switch crank. If this is the case, then remove this projection. The other two poles will regulate the blade travel on this unit.

Note: The multi-angle crank should be set so that it forms an angle of approximately 45 degrees with the offset link in either switch position, open or closed.

Step 8—Install Interphase and Offset Crank Rods

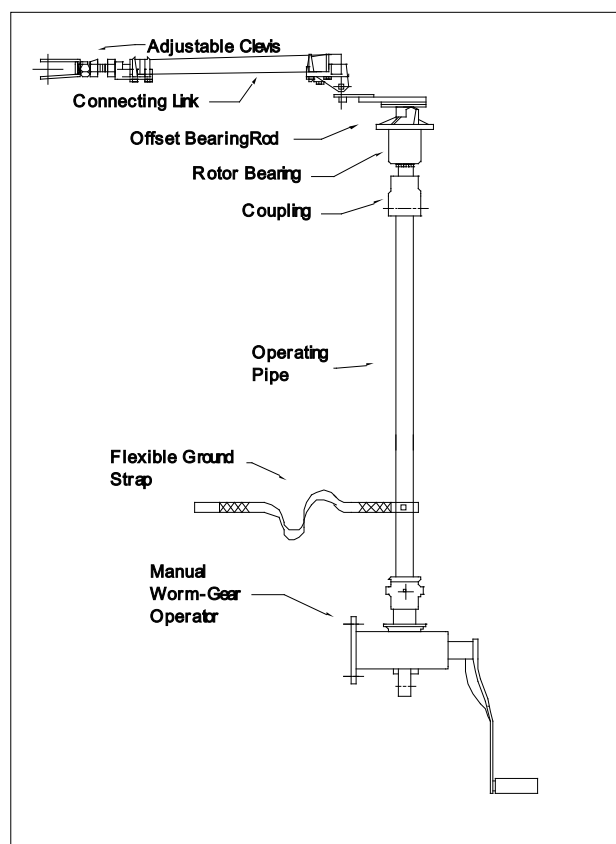
With all blades in the full open position, install the interphase rods and offset crank rod as follows:

- Lengthen the interphase rods that are in compression during opening, as much as possible, yet allowing for the pins to be inserted.
- On the rods that are in tension during opening, shorten them as much as possible, yet allowing for the pins to be inserted.
- The offset crank rod between the outboard bearing and the driven switch should be handled the same way
- For lubrication of pins and bearing areas, see Table 2

On some applications of extra high voltage switches a torsional interphase shaft system is used. In other applications double interphase rods are used or each pole is operated individually with its own operator. Refer to the drawings that are supplied.

Step 9—Install Vertical Operating Pipe

The vertical operating pipe (Fig. 5) is pre-drilled at one end for a 5/8-inch diameter bolt.



To install the vertical operating pipe (VOP):

- Install the coupling on the VOP, then fasten the VOP to the offset rotor bearing shaft (or on the pole unit rotor bearing shaft for direct-connected switches) using the 5/8" coupling bolt supplied with the unit.
- Install accessory items. Refer to the drawings shipped with the unit for instructions on installing accessory items (auxiliary switches, mechanical interlocks, position indicators, ground straps, etc.) which mount on the vertical operating pipe.

Step 10—Install Pipe Splice and Guide Plate

A pipe splice and guide plate are furnished for structures taller than 23 feet.

- Install the pipe splice.
- Mount the guide plate.



Fig. 6 Geared Mechanism

3. Align the hole in the guide plate with the normal position of the vertical pipe without any binding and tighten the bolts on the guide plate.

Step 11—Install Operating Mechanism

Worm Gear Mechanism

1. With ground strap in place on vertical operating pipe, slide worm gear mechanism over the vertical operating pipe and attach it to the structure.
2. Remove the small position indicators, which are attached to the worm gear coupling with Allen set screws.
3. Tighten hex head set screws in the coupling until the vertical operating pipe is pierced.
4. 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. The switch can also operate manually using the operating handle supplied with the motor operator. The control circuit to the motor when the handle is inserted in the front of the motor operator, making it inoperable with the pushbuttons.

The manual handle should be used when adjusting switches furnished with a motor operator. After the switch is adjusted with the manual operator, the motor operator limit switches should be set as instructed in the separate instruction book supplied with the motor operator.



Fig. 7 MO-10 Motor Operator

Step 12—Switch Blade Adjustment

Observed from above the switch, the rotating insulator column turns clockwise to close the switch and counter clockwise to open it.

Blade Entry

Using the manual operating handle, operate the switch blades toward the closed position, slowly as the blades are about to enter the jaw contacts. The blades should enter their jaws on center. If a blade does not enter its jaw on center. Loosen the hinge assembly mounting bolts on stationary insulator stack and with the blade just out of the jaw, shift it into alignment and retighten the hinge mounting bolts.

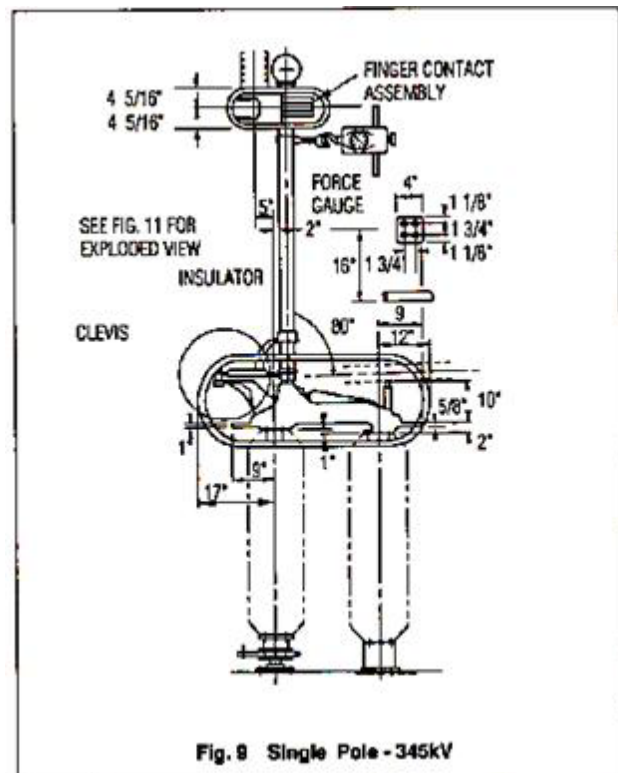
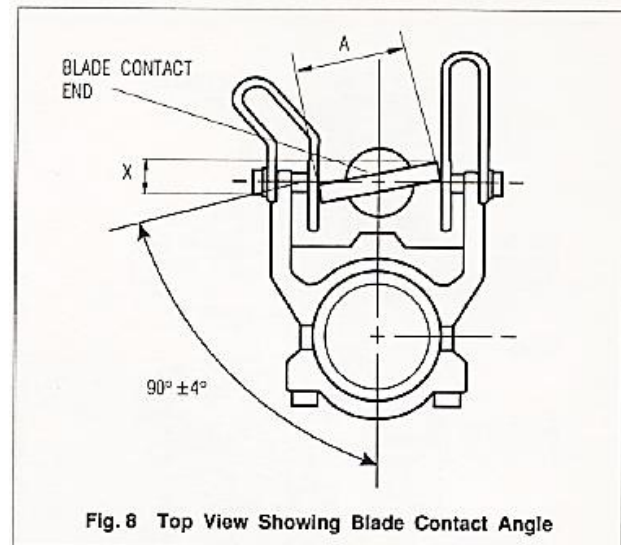
If this should fail to give central blade entry, the insulator stacks should be shimmed or adjusted with leveling screws as required.

Blade Contact Angle

(Fig. 8) 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 $4\frac{1}{2}''$, then dimension (X) can be as much as $9/32''$ and still be within the plus or minus 4 degree tolerance. Also 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 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.

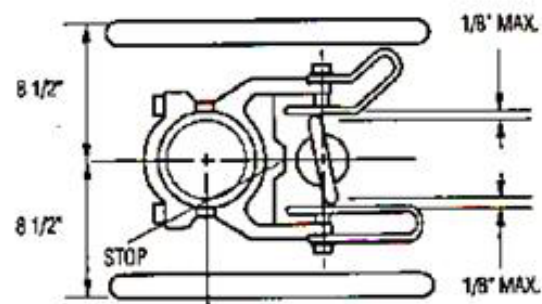
Variance in contact angle is not significant because no reduction in contact pressure occurs until the blade exceeds $\pm 8^\circ$ above the horizontal



Step 13—Switch Blade Force Adjustment

This adjustment is made on the clevis at the hinge end of the switch, see Fig. 9 and 11. It is made such that the switch blade on a closing operation exerts a certain force on the jaw stop. The adjustment should be made after the switch installation is complete, except for the hinge corona rings. The adjustment is easier with them off. The blade force adjustment is made as follows:

Start with the 3-pole switch in a position such that the blade contacts are at least 1 foot from



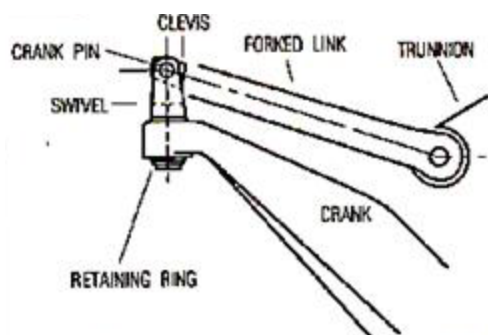


Fig. 11 Exploded View - Clevis Adjustment

the stationary contact fingers. Using the manual operator, and observing one switch pole, raise the blade into the finger contact assembly and continue to close the switch to the point where it rests on the stop and there is approximately 1/8" clearance between the blade end contact and the stationary contact fingers on each side, see Fig. 10. This is the point at which the blade force is to be measured. It is important that the 1/8" clearance be obtained as the switch is being operated toward the closed position as described and never as the switch is opened. This would cause improper adjustment.

Using a force gauge, set blade closing force at 30 to 40 pounds. Measure the exerted by the blade in the jaw stop by either pushing the blade outward from behind and noting the lbs.

required Using a force gauge, measure the force exerted by the blade on the jaw stop by either pushing the blade up from below and noting the lbs. at which the blade is lifted off the jaw stop, or by putting a wire loop around the blade and lifting it with the gauge and noting the lbs.

required. The place on the blade at which the force is measured should be just outside the finger contact assembly. If the force required is not proper, an adjustment must be made at the hinge end of the switch. To make the necessary adjustment, move the switch blade to a convenient point near the full open position and remove crank pin then move and twist blade or forked link to disengage clevis from crank, see Figs. 9 and 11 for these items.

If the force measured was too high, turn the clevis 1/2 turn into the forked link. But if the force measured was too low, turn the clevis 1/2 turn out of the forked link and re-connect the clevis. Check the threads on the clevis, some switches have right hand threads and others have left hand threads. Close the switch to the point previously described and again measure properly, another adjustment must be made. Repeat the procedure previously described. After one switch pole is satisfactorily adjusted, the other two poles should then be adjusted in the same manner.

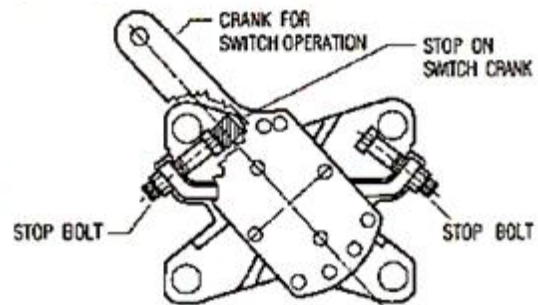


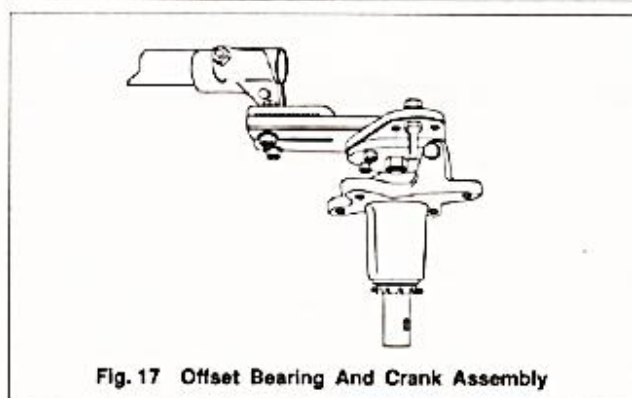
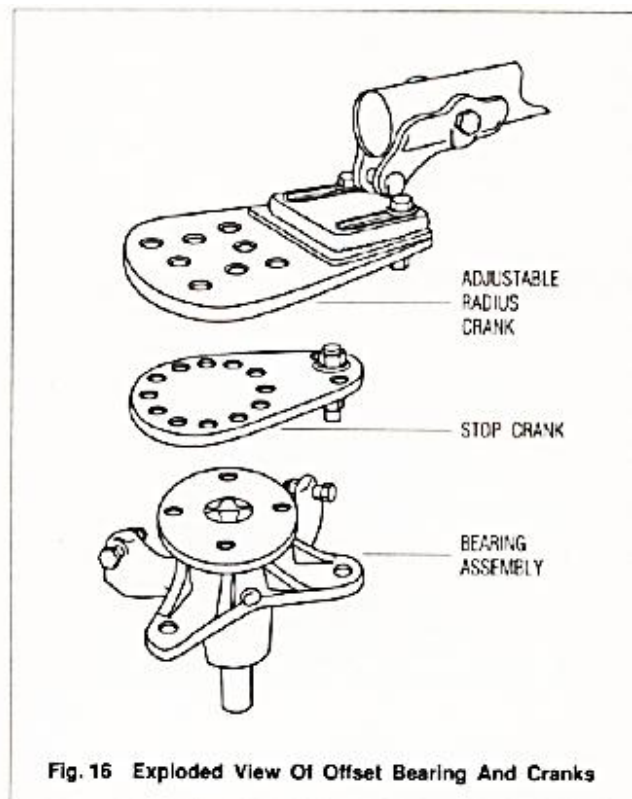
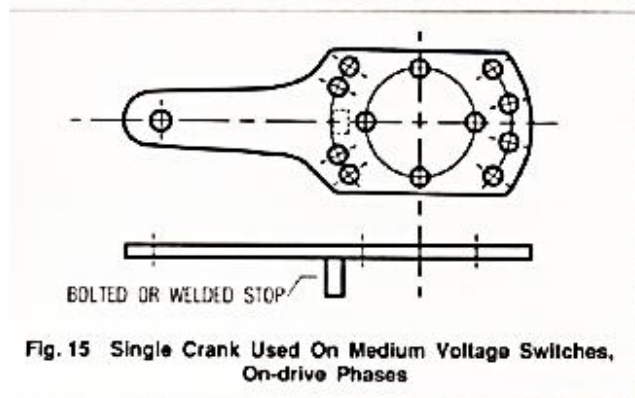
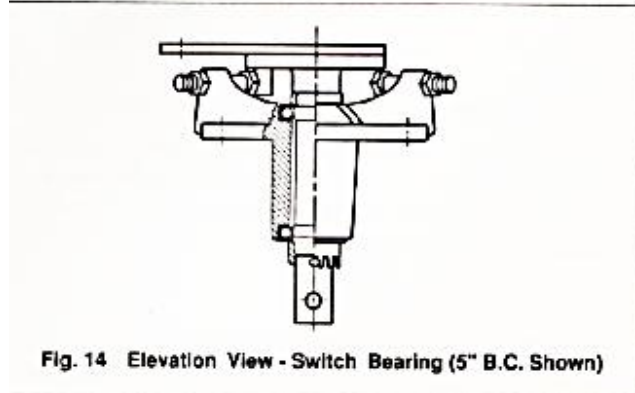
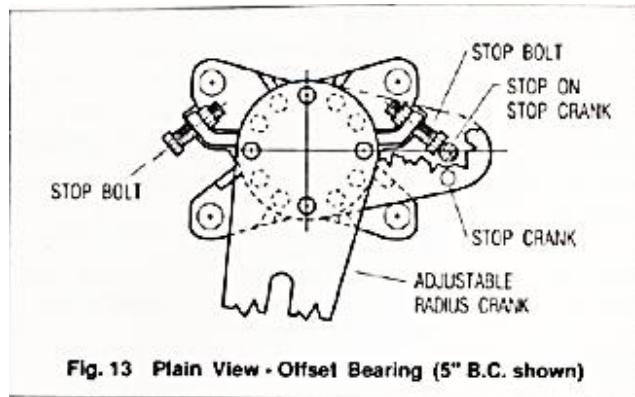
Fig. 12 Plain View - Bearing Used On Switch Poles

Step 14—Arcing Horn Installation

When arcing horns are used on switches, they should be installed after mounting the switches on the structure. Arcing horns are furnished only when horn gap switches are ordered. The stationary horn is positioned on the jaw and bolted. It should be adjusted or even bent slightly to give light contact pressure with the movable horn. Switches 345 kV and higher use the blade corona ball for the movable arcing horn.

Step 15—Installation of Corona Rings and Balls

Corona rings and balls, when supplied, should be installed as shown on the single-pole drawings. Prepare areas where ring supports contact switch parts per instructions for aluminum connections at right.



1. 169 kV switches and below do not require corona rings or ball.
- 2.
3. 242 kV switches use corona rings at the jaw end and a small ball on each end of the blade.
4. 362 kV switches and above use rings at both ends and a large ball on the end of the blade.

After these are installed, the switches should now be ready for service

Step16—Final Checks

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

1. In closing, blades should make central entry into their jaws.

2. In the closed position, all blades must be in full contact and within tolerances.
3. In the open position, the blades should rest on their stops.

Terminal Connections

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

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.

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

MAINTENANCE

WARNING

Before servicing the switch, be sure it is disconnected from all electric power sources and properly grounded.

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

Complete the maintenance checklist items listed in the table to assure that all proper maintenance is carried out.

Notice: Contaminated environments or operation in sleet conditions also may require applying the lubricants at pivot points. The grease should be durable and able to retain its viscosity over a wide temperature range.

BEARINGS

The bearing of each switch and offset bearing is a greaseless type. Fig. 12 shows the location of stop bolts and switch cranks on all switch bearings. Fig. 13 shows the required location of stop bolts and stop cranks with a typical location of the adjustable radius crank on the offset bearing. Fig. 14 is an elevation view of a switch bearing.

CRANKS

The two switch poles that are not connected to the offset bearing normally use a single crank, similar to Fig. 15. The switch pole that is connected to the offset bearing (drive phase) uses either a solid double crank, or a two piece adjustable crank, as shown in Fig. 4. The offset bearing used a two piece adjustable radius crank plus a separate stop crank with multiple mounting holes for angular adjustment. Figs. 16 and 17.

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

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 fo renewa

Table 2 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

Pascor Atlantic
Air Switch Division • State Route 42
254 Industry Dr. • Bland, Virginia 24315-9709
Phone: 276-688-3328 • Fax: 276-688-2228 or 2229
www.pascoratlantic.com



This bulletin describes our standard product and does not show variations in design which may be available. If additional details are required, contact your local Pascor Atlantic representative. Pascor Atlantic reserves the right to make changes or improvements to the product shown in this bulletin without notice or obligation.