Instructions For Type ADM Medium-Voltage Disconnect Switch Rated 7.2 kV

DANGER

HAZARDOUS VOLTAGE.

READ AND UNDERSTAND THIS INSTRUCTION LEAFLET IN ITS ENTIRETY BEFORE INSTALLING OR OPERATING THE SWITCH. INSTALLATION, ADJUSTMENT, REPAIR AND MAINTENANCE OF THIS EQUIPMENT MUST BE PERFORMED BY QUALIFIED PERSONNEL. A QUALIFIED PERSON IS ONE WHO IS FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED.

THE SWITCH

The Type ADM switch is a three-pole, manually operated, quick-make, quick-break switch available in both 600 ampere and 1200 ampere continuous ratings. This device is used primarily as a disconnect switch in AC power systems up to 7200 volts and may be supplied with or without fuses.

A Type ADM switch without fuses is capable of closing under fault conditions and interrupting magnetizing and load currents as indicated in Table I, but is not intended to interrupt fault currents.

When supplied with fuses, a Type ADM switch may be used to provide fault protection up to the interrupting rating of the fuses.

Each Type ADM switch is designed for operation in an enclosure and should not be operated under load with the enclosure door open.

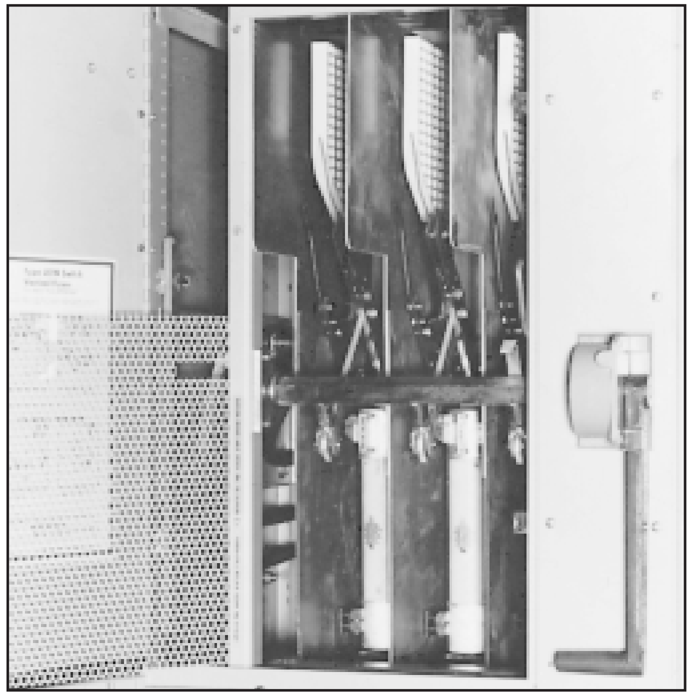


Fig. 1 ADM Switch with Safety Screen Removed

CONSTRUCTION

The main stationary contacts and main moving contact blades are made from high conductivity copper with copper-tungsten inserts mounted at the points where the contacts first touch during closing. As the main switch blades move to the fully closed position, the copper-tungsten inserts disengage and final contact is made at contact points on the main body of the stationary and moving contacts.

TABLE I. ADM SWITCH RATINGS (UNFUSED)

Maximum Voltage (Kilovolts)	BIL Rating (kV)	Continuous Current (Amperes)	Interrupting Capacity (Amperes)		Momentary Current Withstand		Fault Current Closing Asymmetrical (Amperes)
			at 80% PF	at 10% PF	10 Cycles Asymmetrical (Amperes)	4 Seconds Symmetrical (Amperes)	
7.2	60	600	600	80	40,000	25,000	40,000
7.2	60	1200	1,200	160	61,000	38,000	61,000

CONSTRUCTION (Cont.)

Spring washers are used at both the hinge and main contact points to assure contact force, and graphite grease is used to provide lubrication without jeopardizing conductivity.

Each pole has a second moving contact called a “flicker blade” which carries the current to be interrupted only for a brief period as it moves within the arc chute. The arc chute sides are made from a material which gives off a de-ionizing gas when exposed to a high current arc. Silver-tungsten arcing contacts, mounted within the arc chutes, momentarily delay the flicker blades on opening. Arc-resistant and flame-retardant insulating barriers are mounted between poles and also between the two outside poles and the switch framework.

SWITCH OPERATION

When the operating handle is moving upward toward the CLOSED position, the operating gear segment will push the spring rod casting in a clockwise direction to compress the powerful operating spring shown in Figures 2, 3, and 4. The operating gear segment and spring rod casting are free to rotate on the round portion of the operating shaft, so the operating shaft will remain stationary, held by the restraining force of the switch units.

After the spring rod bolt passes center position, the spring rod casting will continue to travel in the clockwise direction under energy supplied by the operating spring and will ultimately strike the operating shaft drive casting. The operating shaft drive casting is pinned to the operating shaft, so the energy stored in the operating spring during the earlier portion of the closing cycle is not applied to the operating shaft to rotate it in a clockwise direction until later when the casting closes the switch units.

The spring rod casting is free to pull away from the gear segment after it passes dead center so that it is not restrained by the operating handle. In this way the operating speed of the switch is determined by the characteristics of the operating spring alone, and is independent of the speed at which the operator manipulates the operating handle.

To open the switch, move the handle downward and the mechanical sequence for closing is repeated to provide positive opening of the contacts. Figures 2 and 4 show the mechanism in the CLOSED position.

FLICKER BLADES

The flicker blades are mounted parallel to the main contact blades and are disengaged from their stationary contacts (mounted within the arc chutes) when the main contact blades are fully closed. The flicker blades are made from a spring-type copper alloy and the leading edges are fitted with weld-resisting silver-tungsten inlays. In the opening sequence, the main blades separate from the stationary contacts first and the current is transferred to the flicker blades, which are momentarily restrained by the stationary contacts within the arc chutes. Once the maximum angular movement between the flicker blades and main blades has been reached, the flicker blades start to move out of the arc chute contacts. At this point, the flicker blade springs snap the flicker blades open and the heat of the arcs releases a blast of de-ionizing gas from the arc chute walls to extinguish the arcs.

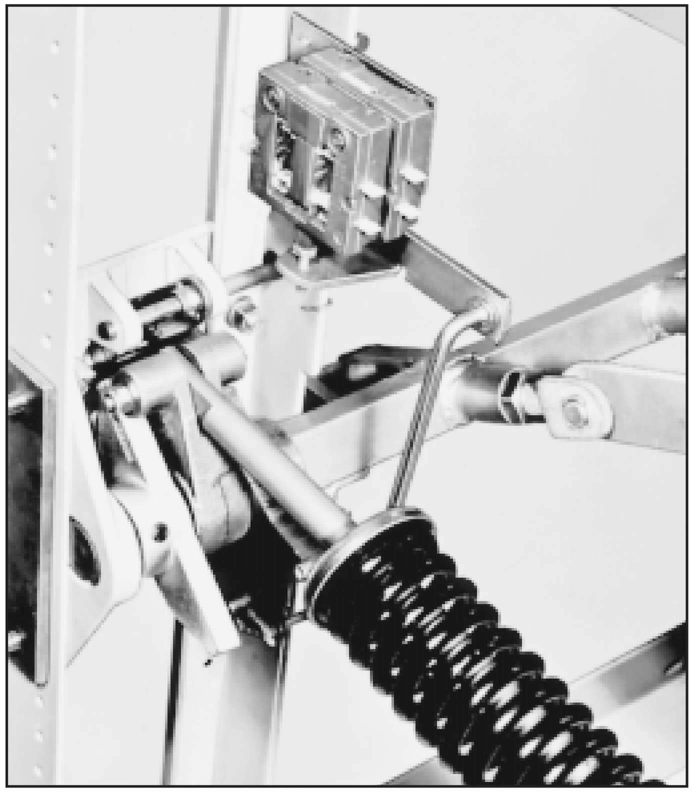


Fig. 2 Operating Mechanism in the CLOSED Position

DANGER

DO NOT ENERGIZE THE ADM SWITCH AT LINE VOLTAGE WITHOUT HAVING ARC CHUTES AND PHASE BARRIERS IN PLACE. SWITCH MAY FAIL TO INTERRUPT ON OPENING.

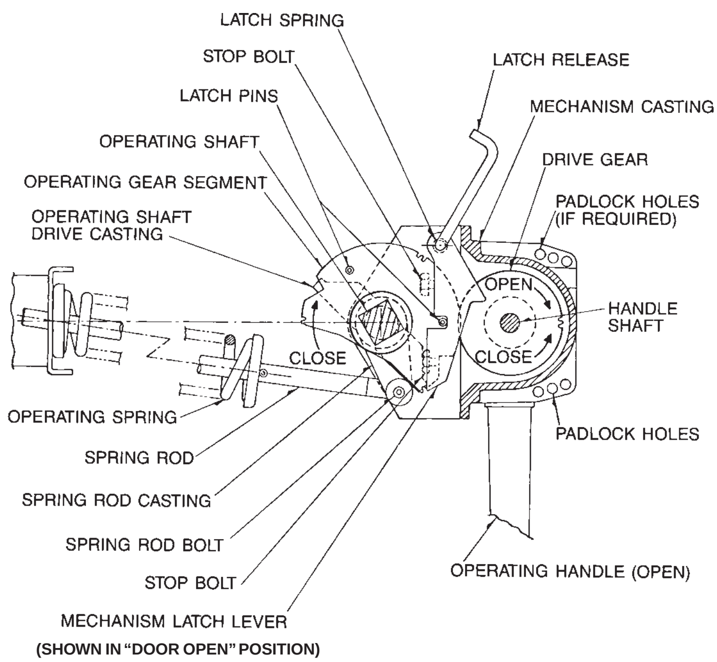


Fig. 3 Operating Mechanism in the OPEN position.

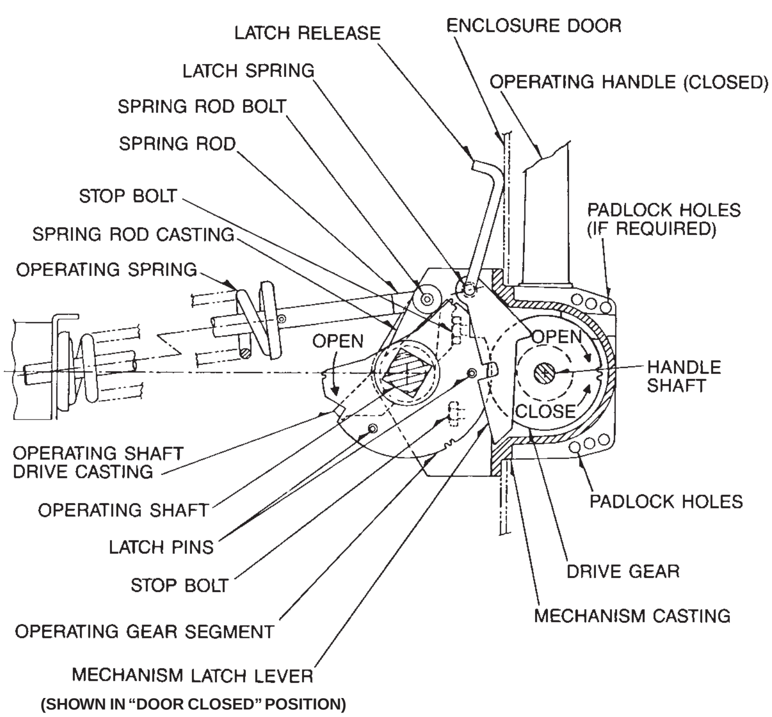


Fig. 4 Operating Mechanism in the CLOSED position.

DOOR INTERLOCKS

The Type ADM Switch includes two mechanical interlocking features between the switch operating mechanism and the enclosure door. The first interlocking feature prevents the switch mechanism from opening or closing when the enclosure door is open. The second interlocking feature prevents the enclosure door from being opened when the switch is in the closed position.

When the enclosure door is open, the latch spring rotates the mechanism latch lever into its engaged position and a notch in the mechanism latch lever engages a pin projecting from the side of the operating gear segment, as shown in Figure 3. This prevents the switch mechanism from opening or closing. When the enclosure door is closed, it pushes the latch release lever to rotate the mechanism latch lever out of engagement with the latch pin to permit the switch mechanism to operate. This interlocking feature may be deliberately defeated by qualified personnel by manually pushing the latch release lever inward to simulate the door being closed.

WARNING

Do not operate an energized switch unless the enclosure door is closed and latched.

CAUTION

DO NOT ATTEMPT TO FORCE OPERATION OF THE SWITCH MECHANISM WITH THE DOOR INTERLOCK ENGAGED. THE MECHANISM MAY BE DAMAGED.

With the enclosure door shut, a hook mounted on the operating shaft engages a loop on the inside of the enclosure door as the switch mechanism closes. This prevents the door from being opened while the switch is closed. If it is necessary to open the enclosure door without first opening the switch, this interlock may be bypassed by removing, from the outside of the door, the loop mounting screws that attach the interlock loop to the door. See Figure 6.

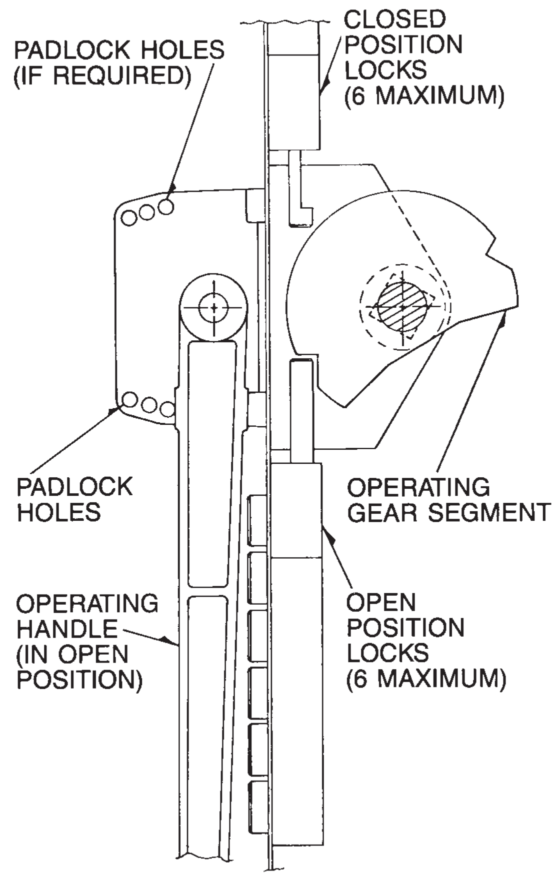


Fig. 5 Location of Key Operated Interlocks

WARNING

DE-ENERGIZE SWITCH BEFORE OPENING DOOR AND/OR WORKING ON SWITCH MECHANISM.

LOCKOUTS

The operating mechanism may be locked in the OPEN position using up to three padlocks. If it is desirable to padlock the switch in the CLOSED position, additional holes may be drilled in the mechanism casting to accommodate up to three padlocks. In addition, provisions are available for mounting up to six key-operated mechanical interlocks. See Figure 5.

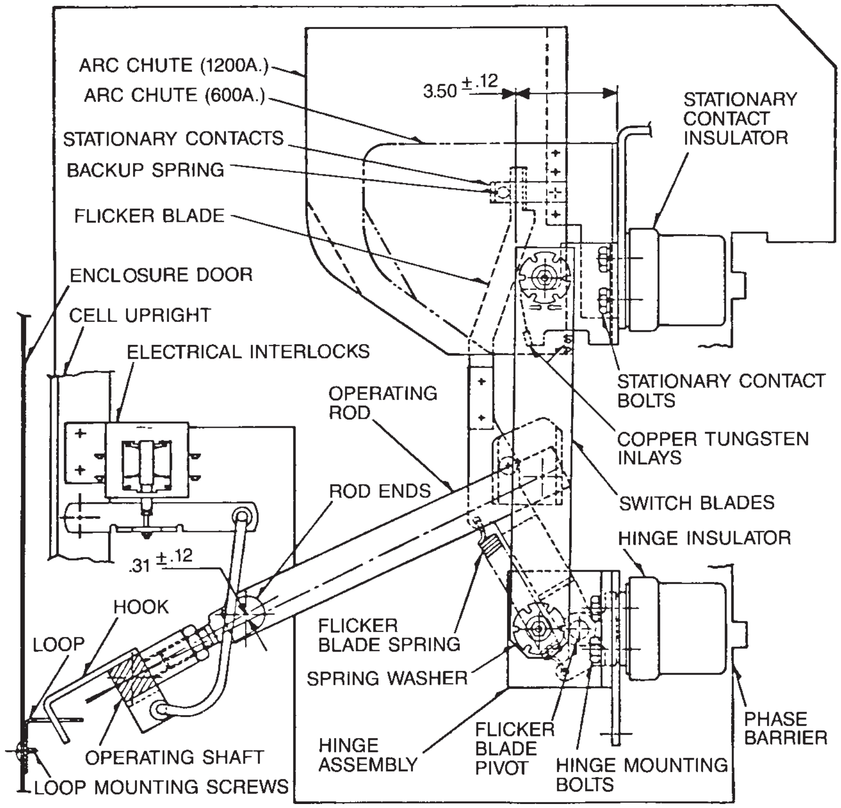


Fig. 6 General Assembly

INSTALLATION AND MAINTENANCE

This industrial type control is designed to be installed, operated, and maintained by adequately trained workers. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.

After installation, and before energizing the equipment for the first time, the insulation resistance between poles and from each pole to ground, should be measured and recorded. It is not practical to specify an absolute value for these readings since they are dependent on other connected apparatus, and conditions of service. However, any unusually low reading or abrupt reduction in a reading would indicate a possible source of trouble, and the cause should be determined and immediately corrected.

Be sure that the switch is disconnected from all power sources before servicing. After power has been disconnected from the switch, ground both sides of the switch.

Before the switch is placed in service for the first time, or following maintenance work, operate the switch slowly by hand two or three times without power to check the alignment and operation of the main and flicker blade contacts (see **Power Circuit Contacts** below for checkout procedure). After the switch adjustment is found to be satisfactory, close and open the switch two or three more times using the external operating mechanism.

INSTALLATION AND MAINTENANCE (Continued)

When the equipment is first put into service, inspect the switch after the first 50 rated current interruptions. If the switch is ever closed into a fault, inspect it at the first opportunity that it can be deenergized.

After the switch has been inspected a number of times at regular intervals, and the condition noted, the frequency of inspection can be increased or decreased to suit the conditions found, since this need will depend upon the severity of the switch duty.

General Checkout

See that bolts, nuts, washers, cotter pins, and terminal connectors are in place and in good condition. Replace items showing excessive wear or corrosion.

Note the general condition of the main contacts and bolted connections, especially any discoloration which would indicate excessive heating due to loose hardware, high current, or low contact force.

Inspect insulators for breaks, cracks, or burns. Clean the insulators where abnormal conditions such as salt deposits, cement dust, or acid fumes prevail. This is necessary to avoid insulator flashover as a result of the accumulation of foreign substances on their surfaces.

Measure insulation resistance and check readings against original readings.

Power Circuit Contacts

1. To check the operation of the main and flicker blade contacts it is necessary to close and open the deenergized switch slowly by hand as follows:
   (a) Be sure the operating handle is latched in the OPEN position by the door interlock latch as shown in Figure 3.
   (b) Place a pipe or monkey wrench, with a handle approximately 32" (81cm) long, on the square operating shaft and push down on the wrench handle to close the contacts. In this mode of operation the operating shaft strikes its stop before the operating spring moves past the center position, so the contacts will not slam closed. Also, they will re-open automatically when force is removed from the wrench handle.

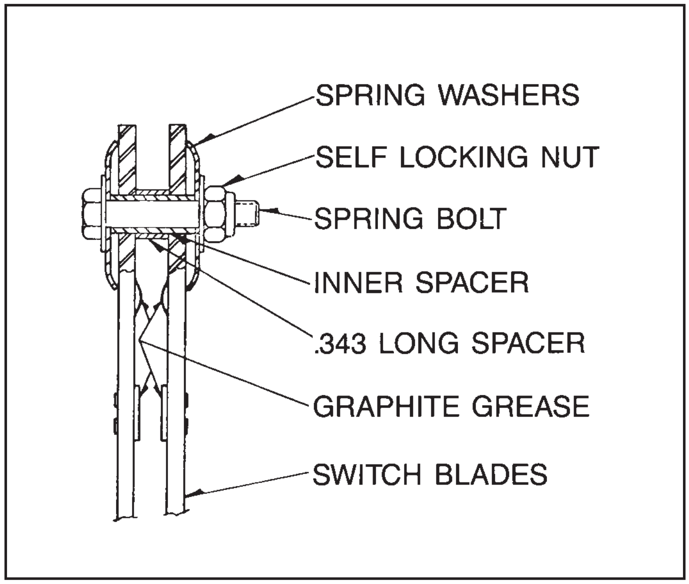


Fig. 7 Main Contact Assembly

2. With the switch open, check the contact inlays on the stationary contacts and on the inside edges of both moving contact blades for excessive erosion or wear, and for tightness. Also check copper and plated contact points for excessive wear or pitting. Replace badly pitted, burned, or worn contacts. If the contact inlays look satisfactory except for sharp edges or rough spots, which might hinder proper closing, they should be dressed with a fine file. Make no attempt to file out the pit marks. Do not file the copper and plated contact points. Opening and closing the switch will clean these contact points. Abrasive materials that produce dust should not be used on the contacts.

3. Check the hinge and sliding contact points to see that they are lubricated with a thin layer of graphite grease.

4. Close the switch slowly by hand and check for proper alignment of the moving contact blades with the stationary contacts. Poor alignment may be corrected by loosening the four hinge mounting bolts on top of the insulators and shifting the blade assemblies as required to provide correct alignment. See Figure 6. In the event the sides of the stationary contacts are not parallel with the moving contact blades, adjust the stationary contacts by loosening their mounting bolts and shifting the position of the stationary contacts on the insulators. See figure 6.

5. Operate the switch slowly by hand and check for any tendency of the switch blades to hang up on closing or opening due to sharp edges or rough spots on the contact inlays.

6. On closing, the main contacts must make contact first on the weld resisting inlays and then transfer their point of contact to the main body of the stationary contact and switch blades. If the contact inlays are worn to the point that initial contact is not made on the contact inlays, replace both the stationary and moving contacts.

7. Contact force at the hinges and main contacts is provided by spring washers which are held in compression by spring bolt assemblies. See Figure 7. The spring bolts are fitted with self-locking nuts which do not require jamming solid to remain in place on the bolts. Tighten these nuts with just sufficient torque to provide proper contact force. Be sure the spring bolts are not overtightened, since this may damage the contacts in addition to causing sluggish operation of the switch.

   The outside diameter of the spring bolt spacers are approximately .005" (.13 mm) less than the inside diameter of the mating holes in the switch blades to permit free movement of the switch blades on opening and closing.

   (a) When the switch is open, tighten the spring bolts just enough to take up the play in the spring bolt assemblies and draw the switch blades down until they touch the .343" (8.7 mm) long spacers mounted on the spring bolt assemblies between the switch blades. The spring washers should not be compressed beyond this point when the switch is open. See Figure 7 for this assembly.

   (b) When the switch is closed, the stationary contacts should pry the contact blades apart, in which event there will be a gap between one or both ends of the .343" long spacer and the adjacent switch blades. The presence of this gap indicates there is spring force at the main contact points. In the event both switch blades are still tight against the .343" long spacer with the switch closed, there is insufficient contact force (usually due to worn out contacts), and corrective action must be taken.

   (c) Tighten the spring bolts at the switch blade hinges one full turn after the play is taken up in the spring bolt assemblies.

8. Adjust the rod ends mounted on the square operating shaft so that all three main contacts touch within .12" (3.05mm) of each other and the front edges of the switch blades come to rest 3.50" $\pm$ .12" (88.9 $\pm$ 3.05 mm) from the stationary contact mounting surfaces as shown in Figure 6. In the CLOSED position, both contact projections on the main switch blades must engage the stationary contacts and the flicker blades must also have passed between their stationary contacts. When the switch is closed, however, the contact spring bolt assemblies should not come to rest tight against the shoulders on the stationary contacts and the flicker blades should not be tight against their stops.

9. When new main contacts are installed, apply a light coating of graphite grease to the hinge and contact points. Before the spring bolts are tightened, operate the switch blade units by hand several times to work the grease into the sliding contact points.

10. With the switch open, check the condition of the flicker blade contacts and the stationary contacts mounted within the arc chute. Check to see if they are intact, centered in the arc chute, and spring together when the switch is opened. This can be done by shining a light into the flicker blade slots. In the event the moving flicker blade contacts show considerable erosion, the arc chutes should be dismantled so that a more thorough inspection of the stationary contacts and their contact springs can be made.

    The flicker blade stationary and moving contact inlays do not require dressing unless rough spots or sharp edges, which interfere with proper opening and closing of the contacts are found. The front and back edges of the flicker blades should have a radius or bevel of .016" (4 mm) or more in the area where the blades engage the stationary contacts, to aid contact engagement. Large beads of copper which may collect on the main body of the flicker blades should be removed with a fine file to maintain proper clearance to the arc chute walls. Do not lubricate the flicker blade contacts or use abrasive materials in dressing the contacts. Replace flicker blade contacts when necessary. Also replace the flicker blade contact springs whenever new contacts are installed. See Figure 6.

11. Check the flicker blade assemblies to be sure they are free of friction and that the springs snap the flicker blades back against their stops when the flicker blades are released. The bearing holes in the flicker blade supports are approximately .005" (.13 mm) larger than the pivot shafts and the flicker blade shafts have .03" to .09" (.76 to 2.29 mm) end play.

Operating Mechanism (Continued)

12. Close the switch slowly by hand to check the flicker blade operating sequence and alignment. On closing, the flicker blades must not make contact until after the main contacts have started to engage. When the main contacts reach their fully closed position the flicker blades should have passed between their stationary contacts and come to rest on the far side of the stationary contacts. The flicker blades will now be held firmly in place by the stationary contacts until the main contacts open to a gap of 0.50" (13 mm) or more, at which time the flicker blades will encounter their forward stops and be pulled open suddenly by the main contacts. When the flicker blades become disengaged from their stationary contacts, the flicker blades will spring open to their normal position.

13. The flicker blades should move into and out of the arc chutes with minimum friction between the flicker blades and the arc chute walls. Correct any slight misalignment by bending the flicker blades. To correct for greater misalignment, the arc chute mounting bolts must be loosened and the arc chutes shifted as necessary to provide proper alignment.

Arc Chutes

1. Clean foreign matter from the arc chute chambers.
2. Inspect arc chute sides for cracks and excessive erosion and replace if necessary.
3. Align the arc chutes as described in subparagraph 13 above.

Operating Mechanism

1. Check the operating shaft stop locations. Readjust using the stop bolts shown in Figures 3 and 4 to achieve the following:
   (a) When the switch is in the OPEN position, a latch pin in the operating gear segment must line up with the notch in the door interlock latch lever and the operating handle should **not** come to rest tight against the handle stop on the front of the mechanism casting.
   (b) When the switch is in the CLOSED position, a second latch pin in the operating gear segment must line up with the notch in the door interlock latch lever. The operating handle should not come to rest tight against the handle stop, and the switch operating linkage must pass the center position as shown in Figure 6.
2. The operating gear segment and the spring rod casting must be free to rotate on the round portion of the operating shaft without friction, so that the operating shaft and contacts will not start to move until the operating spring passes the center position. The bores in the gear segment and spring rod casting are approximately .005" (.13 mm) larger than the shaft on which they are mounted so the fit of these parts will be loose.

When the operating handle is in either the OPEN or CLOSED position, the operating gear segment should be loose on the operating shaft and there should be some lost motion between it and the operating gear segment. The right side of the mechanism casting is bolted in place using horizontally elongated holes in the side of the right corner post of the switch frame and the left side of the mechanism casting is bolted to a front upright of the switch frame. Lost motion in the operating gear can usually be increased and friction in the operating gear segment can be reduced by properly aligning the operating mechanism. The right side of the mechanism may be moved in or out in the elongated mounting holes and the left side may be moved out by placing shims between the casting and the switch frame.

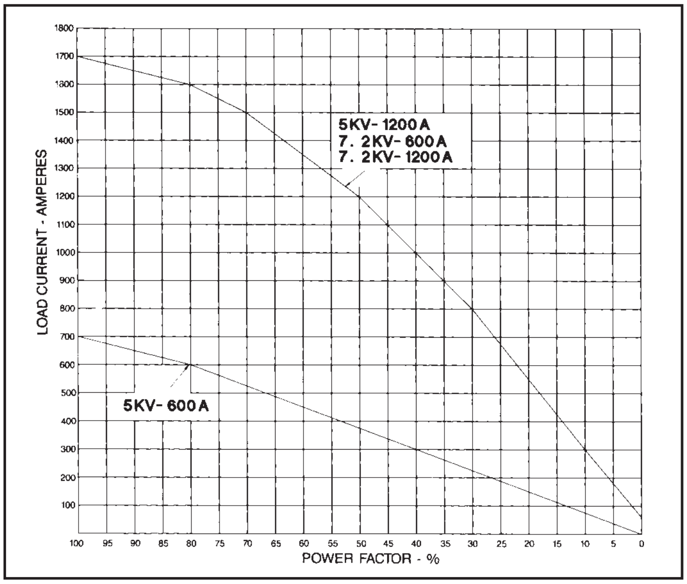


Fig. 8 ADM Switch Interrupting Ratings

TABLE II. AUXILIARY CONTACTS	
Part Number	**Circuit Combination Provided By One Auxiliary Contact Assembly**
843D943G04	One normally-open and One normally-closed
843D943G05	Two normally-open
843D943G06	Two normally-closed

3. Check the operating shaft for end play to insure that it will not become wedged between its bearings, resulting in sluggish operation of the switch.

4. The force at the end of the operating handle to open or close the switch should be 50 to 65 pounds (23 to 30 kilograms). Less force than this will indicate a defective operating spring and more force will indicate excessive friction in the operating mechanism. Either condition will reduce the operating speed of the switch and must be corrected.

Door Interlocks

1. Check that the door interlock latch mechanism is free of friction and automatically latches the handle mechanism when the enclosure door is opened.

2. Check that the interlock loop is in place on the inside of the enclosure door and is adjusted to engage the hook on the operating shaft when the switch is closed.

AUXILIARY CONTACTS

Two Type L-64 auxiliary contacts, often used as electrical interlocks, may be mounted just above the operating mechanism as shown in Figures 2 and 6. Any combination of normally-open or normally-closed circuits is available by selection of the appropriate part number from Table II.

The auxiliary contact operator is properly set when the plunger can be depressed slightly beyond the position it takes when the ADM switch is closed. Use the #10-32 hex head pushrod bolts to make the proper adjustment.

CAUTION

WARNING: ALL WORK ON THIS SWITCH SHOULD BE DONE WITH THE MAIN DISCONNECT DEVICE OPEN. AS WITH ANY SWITCH OF THIS VOLTAGE, THERE IS DANGER OF ELECTROCUTION AND/OR SEVERE BURNS. MAKE CERTAIN THAT POWER IS OFF.

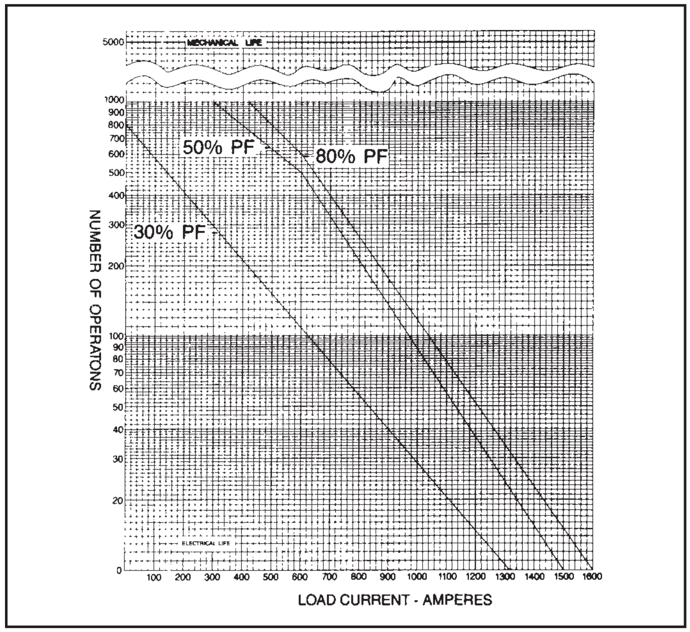


Fig. 9 ADM Switch Electrical Life

RENEWAL PARTS

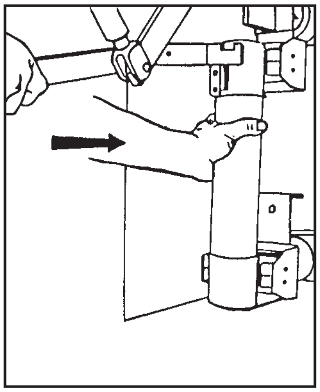
Figure 9 may be used to estimate the electrical life of current-make and current-break parts where the load current, power factor (p.f.) and number of operations are known. The renewal parts available for type ADM disconnect switches are shown in Renewal Parts Data 8855C. For optimum performance replace moving and stationary contacts as a set along with their related contact springs.

FUSES

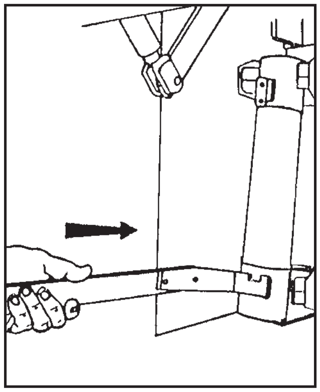
When required, the Type ADM Switch is supplied with Type CLE or HLE current limiting feeder circuit fuses. These fuses may be mounted vertically as shown in Figure 10 or horizontally as shown in Figure 11.

Fuse puller part number 6391D55G01 is supplied when the vertical fuse assembly is used and fuse puller part number 6391D55G02 is supplied when the horizontal fuse assembly is used. Instructions for using these fuse pullers are given in Figures 10 and 11 and are also mounted on the inside of the switch enclosure door.

FUSE INSERTION - SINGLE BARREL

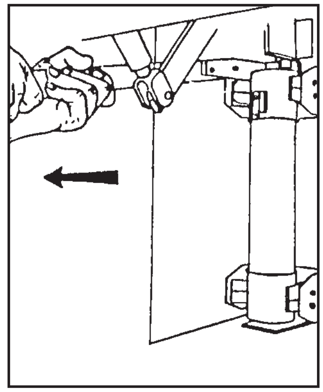


Set fuse on lower support with blown fuse indicator at top and tang on front. Place puller on top ferrule and push in sharply.

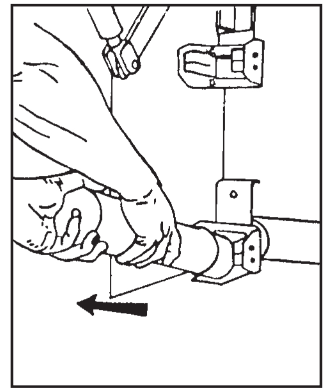


Place puller on outside of lower ferrule and push fuse into lower clip.

FUSE REMOVAL - SINGLE BARREL

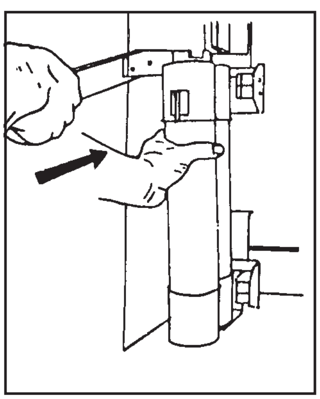


Hook puller behind top ferrule and pull sharply.

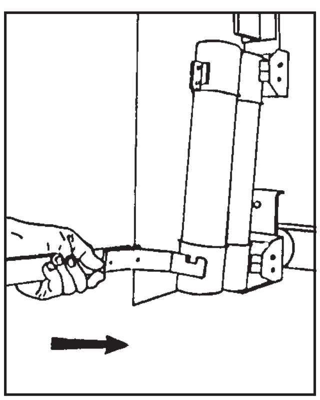


Pivot fuse forward approximately 90° and pull out of lower clip.

FUSE INSERTION - DOUBLE BARREL

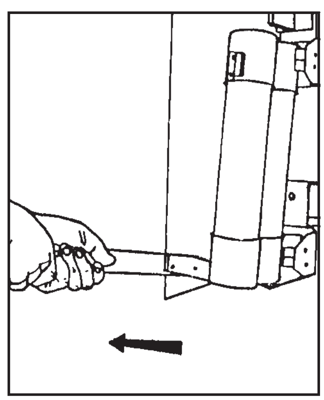


Set fuse on lower support with blown fuse indicator at top and tang on front. Place puller BETWEEN top ferrules and push in sharply.

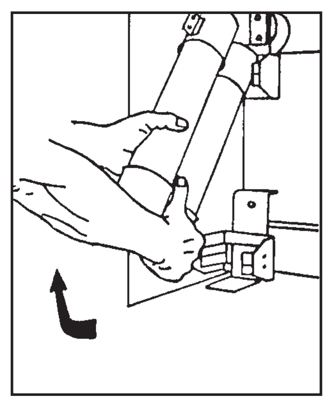


Place puller on lower ferrule and push fuse into lower clip.

FUSE REMOVAL - DOUBLE BARREL



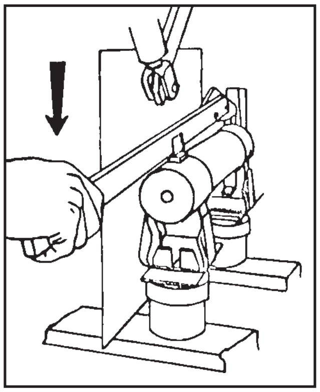
Hook puller BETWEEN lower ferrules and pull sharply.



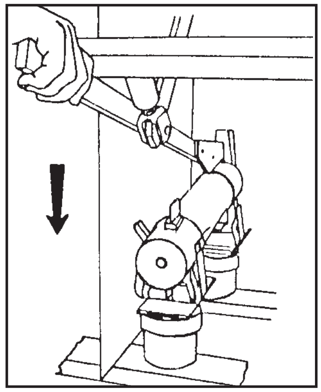
Grip fuse at bottom. Pivot fuse up and out of top clip.

Fig. 10. Vertical Fuse Puller Operation

FUSE INSERTION - SINGLE BARREL

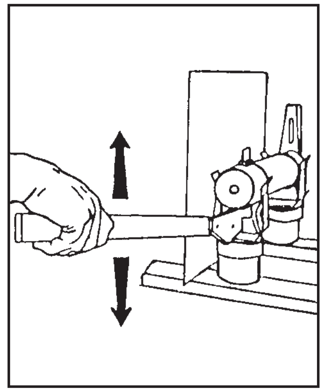


Position fuse on clips with blown fuse indicator at front and tang on top. Place tip of puller in slot at rear. Push down on puller handle until fuse snaps into front clip.

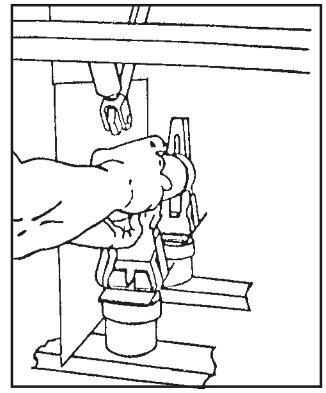


Remove puller from slot and ROTATE 180°. Again place tip in slot. Cam fuse into rear clip using a jacking motion while pushing in on puller.

FUSE REMOVAL - SINGLE BARREL

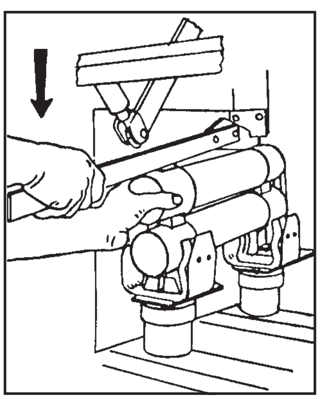


Place tip of roller in slot under front ferrule. Cam fuse out of front clip using a jacking motion while pushing in on puller.

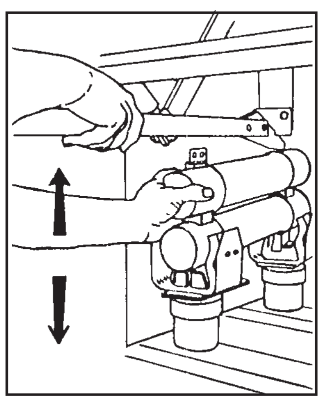


Lift up on front ferrule until fuse hits main blade. Lower fuse approximately horizontal and pull outward to free from rear clip.

FUSE INSERTION - DOUBLE BARREL

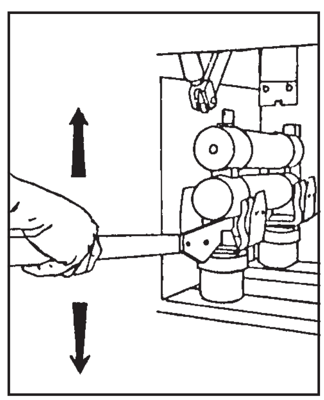


Position fuse on clips with blown fuse indicator at front and tang on top. Place tip of puller in slot above top rear ferrule. Push down on puller handle until fuse snaps into front clip.

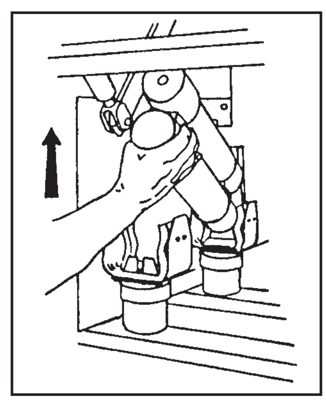


Cam fuse into rear clip using a jacking motion while pushing in on puller.

FUSE REMOVAL - DOUBLE BARREL



Place tip of puller in slot under front ferrule. Cam fuse out of front clip using a jacking motion while pushing in on puller.



Lift up on front ferrule and push to either side to clear drive link. Fuse will cam itself out of rear clip.

Fig. 11. Horizontal Fuse Puller Operation

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