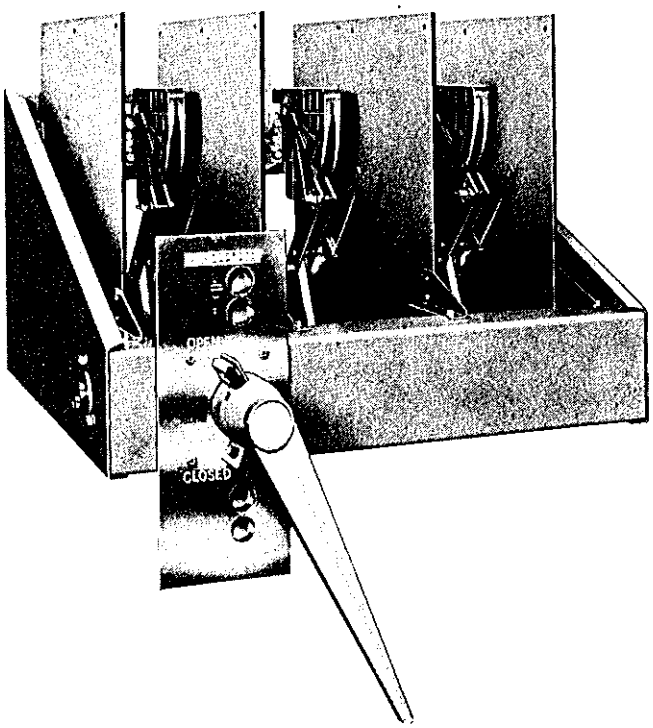
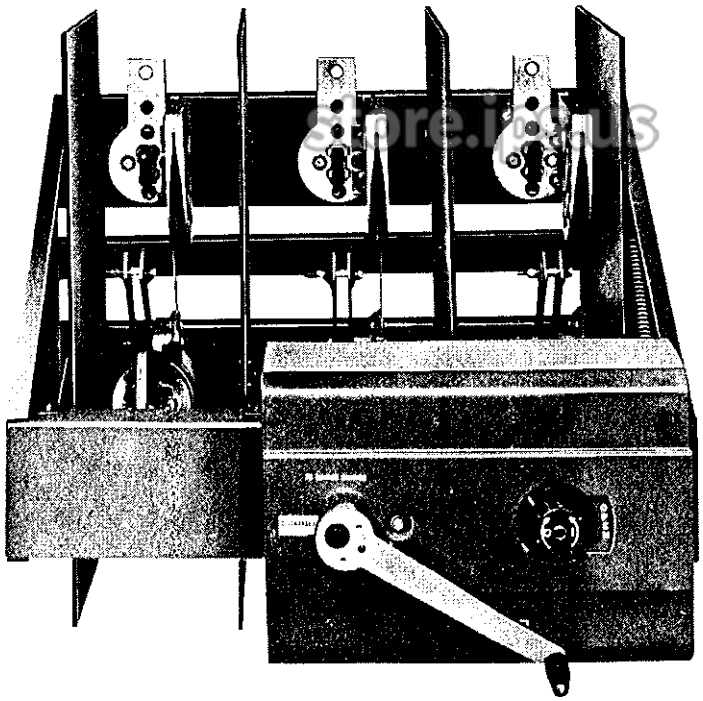
INSTRUCTION and RENEWAL PARTS MANUAL

TYPE LI AND LIFE 5 AND 15KV LOAD INTERRUPTER AND DISCONNECT SWITCHES MANUALLY AND ELECTRICALLY OPERATED





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IN-825.1 JULY, 1972

FEDERAL PACIFIC ELECTRIC COMPANY
SWITCHGEAR DEPARTMENT – POWER EQUIPMENT SYSTEMS DIVISION
150 AVENUE L, NEWARK, NEW JERSEY 07101

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Refer to Class 6065 Descriptive Sheet for General Information and Outline Dimensions.

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1 INTRODUCTION

Federal Pacific Electric Company apparatus is built to the highest standard of quality to insure continuous reliable service with a minimum of maintenance. Some routine preventative maintenance is, however, required on semi-annual or annual basis in accordance with the various uses of the product. It is suggested that, due to the precision craftsmanship involved in the construction of this apparatus, no attempts (with the exception of few minor adjustments) should be made by the customer to fix or adjust clearances.

Should the need occur, the Field Service Department of the Power Equipment Systems Division of Federal Pacific Electric Company is equipped to assist you with any maintenance or repair which may be required throughout the anticipated long life of this equipment.

FPE "On-Site Test Facilities" are available to you. This service includes engineering inspection and testing of electrical equipment planned to supplement your regular maintenance program, to improve equipment reliability and to protect your investment. Such services, for Metal Enclosed, Metal Clad Switchgear, and other type Electrical Apparatus are as follows:

(a) Cleaning of cells with low pressure air or vacuum.
(b) Inspection of cell bushings, cable connections and bus joint connections.
(c) General Inspection of control wiring and components.
(d) 2500 Volt DC Megger Test for Insulation Resistance Values.
(e) Protective Relay Calibration Tests for Response and Time Delay.
(f) 5KV and 15KV circuit breaker electrical and mechanical operating checks coordinated with relay response.
(g) Transformer oil or askarel dielectric Hi-pot Tests (also on minimum oil breakers and tank type oil breakers).

For further information regarding service, please contact the Manager of Field Service Department at Newark, New Jersey.

2 DESCRIPTION

Type LI, 5 or 15KV Load Interrupter or Disconnect Switch is a fixed mounted, three-pole gang-operated device with insulated interphase barriers, for use in indoor or outdoor metal enclosed switchgear. This switch is available with either a manually, or electrically operated spring mechanism. It has an interlock on the switch front which prevents opening of the door when the switch is closed, and provisions for padlocks which prevent operating the switch. The handle is removable by pulling at the hub to permit opening of the door when the switch is open.

Type LI electrically driven 5 or 15KV Load Interrupter Switch is similar except it has electrical key interlocks and

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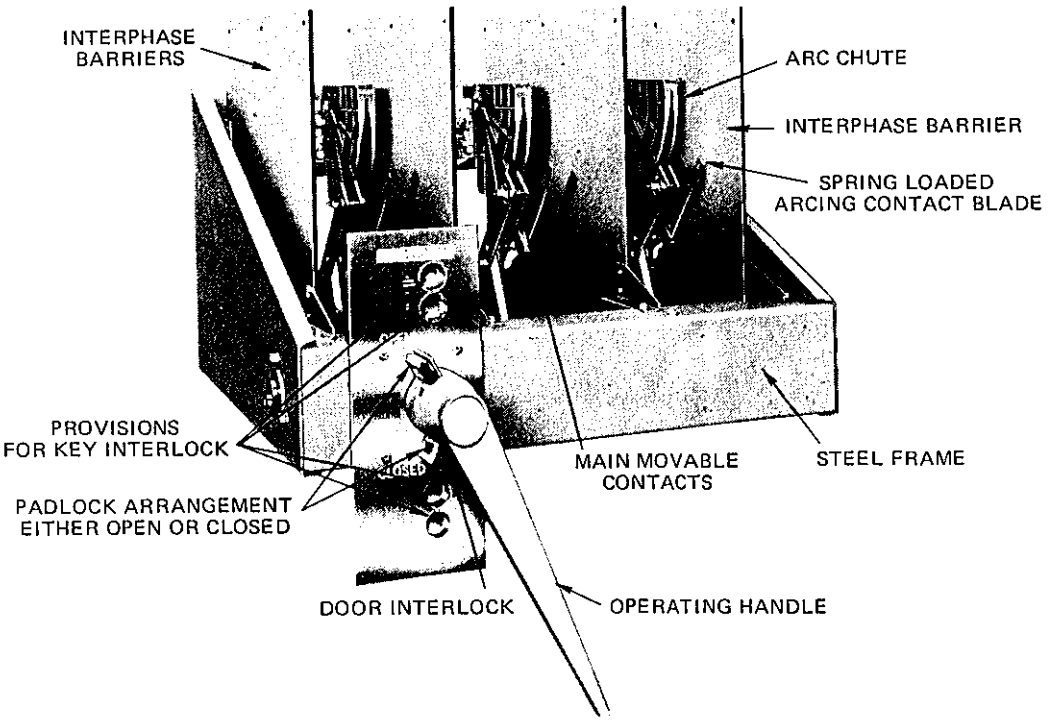


FIGURE 1 – 15KV TYPE LI INTERRUPTER SWITCH WITH MANUALLY OPERATED STORED ENERGY MECHANISM

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does not have an operating handle. A ratchet for emergency manual charging is available. Approximately 7 seconds is required to close or open.

Type LIFE 15KV Load Interrupter Switch is similar, but is powered by a circuit breaker mechanism, thereby providing instantaneous closing and opening. A handle for emergency charging is provided. Anti single phasing in event of fuse interruption as well as ground fault protection is available.

These switches are precision built devices, and are factory adjusted and tested in compliance with NEMA Standards. Each switch is assigned a catalog number, found on the front nameplate. This catalog number should be specified if it becomes necessary to contact the factory.

The following information has been prepared for use by qualified service personnel. Should additional information be necessary, consult the nearest FPE sales office for field service assistance.

3 RECEIVING AND INSPECTION

When a shipment of switches is received, each crate should be examined before it is removed from the railroad car or truck. If any damage or indication of rough handling is evident, a description of the condition should be written on the freight bill, a claim should be filed against the carrier immediately, and notice of the extent of damage sent without delay to Federal Pacific Electric Co. at the address from which shipment was made, giving serial number of the switch, the carrier's name, and the car number if shipped by rail. This information enables the company to supply needed information to assist the purchaser in support of the claim.

3.1 STORAGE

Switches arriving at the job in advance of installations should not be removed from their cartons until used, and should be stored indoors in a dry place.

4 INSTALLATION

Uncrating: Uncrate the switch and remove carefully, taking care not to damage the interphase barriers or nameplate.

4.1 MOUNTING

The switch is mounted on the bottom side of the support frame. Use four 5/16"-18 bolts. The cutout in the door installed in front of the switch should be as shown in Figure 2. Alternate mounting is with 4-1/2" screws through rear channels (See Fig. 3).

4.2 MECHANICAL CHECK

To ascertain that factory adjustments have not been altered during shipment or installation, the switch should be tested by closing and opening several times. No lubrication is required since all bearings are permanently lubricated for the life of the switch.

5 PRINCIPLE OF OPERATION

5.1 MANUALLY OPERATED

The spring operated mechanism is of the quick-make, quick-break type which is actuated by the handle. As the handle is rotated upward, the closing spring is compressed and driven over center so that it is pushed free of the handle and drives the contacts "closed." Counter-rotation for "opening" is similar mechanically (see Figure 4).

On manually closed switches, the contacts are driven directly by the handle; therefore, contacts should be closed and opened quickly.

5.2 ELECTRICALLY OPERATED MECHANISM

The electrically operated Type LI switch, for remote operation, utilizes the basic construction of the spring operated device with the addition of a motor operator,

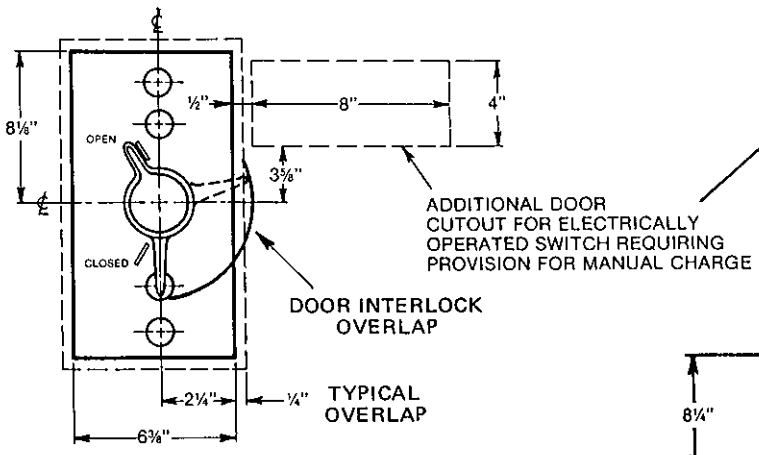
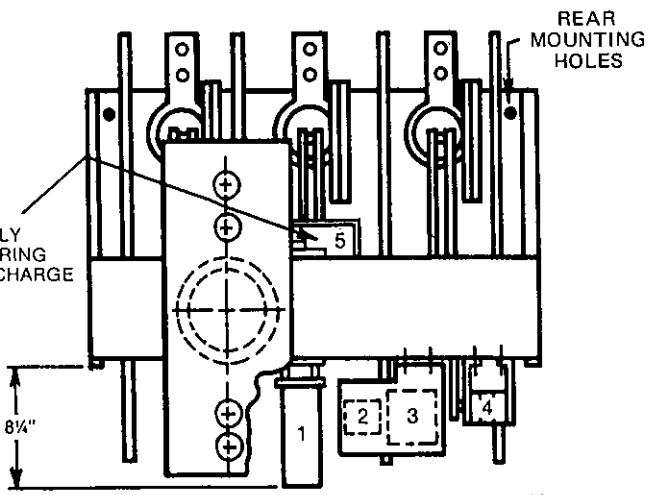


FIGURE 2–
LI SWITCH NAMEPLATE
DOOR CUTOUT



1—Motor
2—T. Block
3—Relay
4—Aux. Sw.
5—Man. Charge

FIGURE 3–
ELECTRICALLY
OPERATED SWITCH

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worm gear, reducer, control relay and auxiliary switch. An easily accessible terminal block for customer connection is provided in front of the switch.

The standard auxiliary switch provided is a 6 contact (3 N.O. and 3 N.C.) unit; for special applications a 16 circuit auxiliary switch is available.

Key interlocks, with built-in electrical contacts are available.

All accessories listed for the spring operated Type LI switch are also adaptable to the electrically operated switch.

Operating time required for "closing" or "opening" of electrically operated switch is 7 seconds.

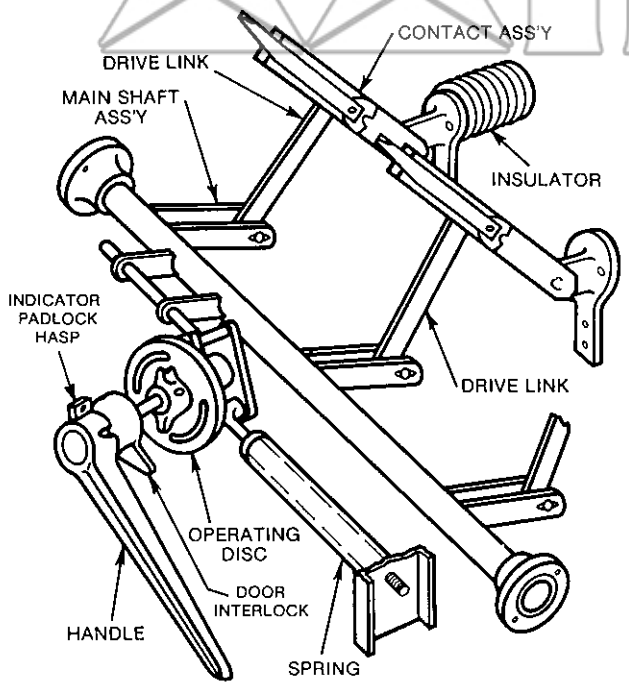


FIGURE 4 – SPRING OPERATED MECHANISM

5.2.1 Manual Operation of Electrically Operated Switch

The switch is designed with provisions for emergency manual charge by using a 1/2 square drive reversible ratchet with screwdriver socket attachment. A cutout (see Figure 2) is provided in the cell door for access.

5.3 STORED ENERGY MECHANISM OPERATED SWITCH

The type LIFE Switch is operated by a circuit breaker mechanism utilizing a charging motor, close and trip coils, Y relay, and 10 contact auxiliary switch. For special applications a 16-contact auxiliary switch is available. This switch is capable of the same operations as a circuit breaker, except it can only interrupt load currents. See Instruction Manual IN820.11, Section 7, for details on mechanism.

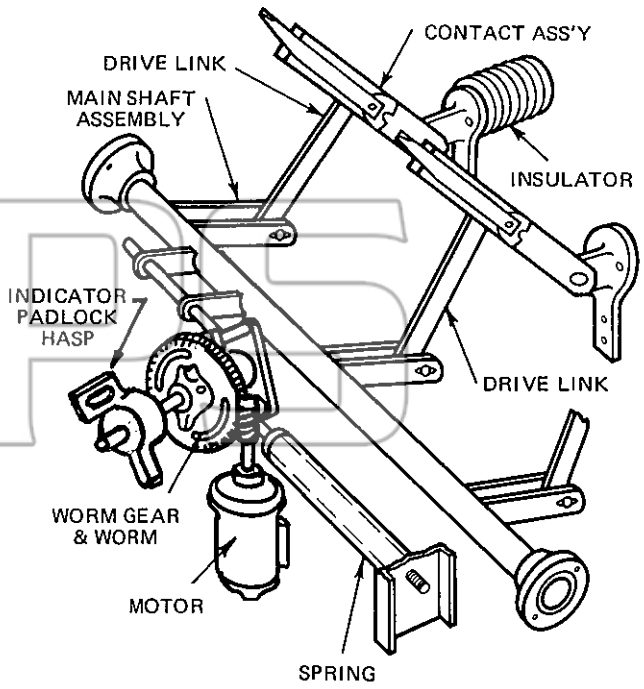


FIGURE 5 – ELECTRICALLY OPERATED SWITCH

6 SWITCH MAINTENANCE

An annual maintenance schedule should be established dependent upon frequency of operation and conditions. Easily accessible arc chutes, contacts, operating mechanism, and insulation allow a complete inspection in a minimum of time.

The following should be part of the periodic maintenance. MAKE SURE CIRCUIT IS DEAD.

(1) All insulation should be wiped free of dust with a clean dry rag.

(2) Main contact tips should be checked. These contacts should be clean and free of irregularities. The inlay on the arcing tip should also be inspected for excessive scoring or arc erosion.

(3) The arc chute should be inspected for chipped parts and misalignment.

(4) Worm wheel on electrically operated switch lubricated.

6.1 CONTACTS

The contact blades of heavy copper have arc resisting tungsten alloy inlay at the points of contact to resist damage during closing. The arcing blade which breaks last also has a tungsten alloy inlay to resist damage during arcing conditions. Fixed main contacts have silver inlays. Contact assembly (see spare parts Section 7.3) should be replaced after 100 load break operations of 600 amp at an 80% P.F. lagging. (Arc chute assembly should be replaced at the same time.)

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The following three adjustments are required on contacts assembled with Belleville washers. Contact assemblies having conical springs need only adjustment (3).

(1) Contact pressure is adjusted with the drive link disconnected so that a perpendicular force of 47# to 50# is required at the drive link pin to move the blade along the contact.

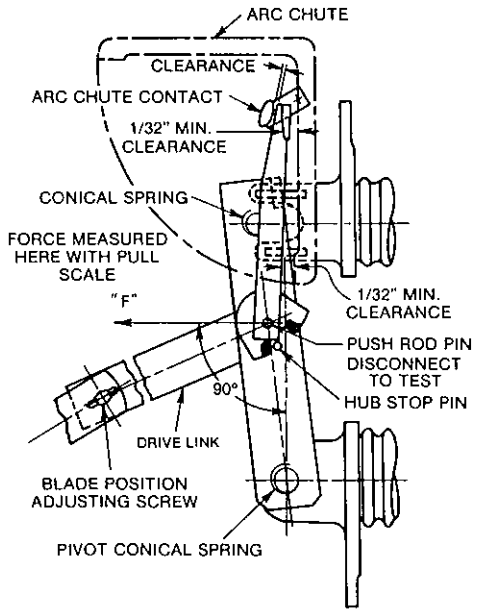
(2) Blade pivot springs are adjusted with the drive link disconnected so that a perpendicular force of 11# to 13# is required at the drive link pin to move the blade when it is in the "OPEN" position.

(3) Blade location in the "CLOSED" position is adjusted by locking the lower drive link pivot with a torque of 32 to 34 ft. lb. when the arcing contact tip is behind the arc chute contacts when in the "CLOSED" position.

6.2 ARC CHUTES

Arc chutes should be checked for alignment with the arcing contact and condition of molded sides. Arc chute assembly (see spare parts Section 7.3) should be replaced after 100 load break operations of 600 amperes at an 80% P.F. lagging.

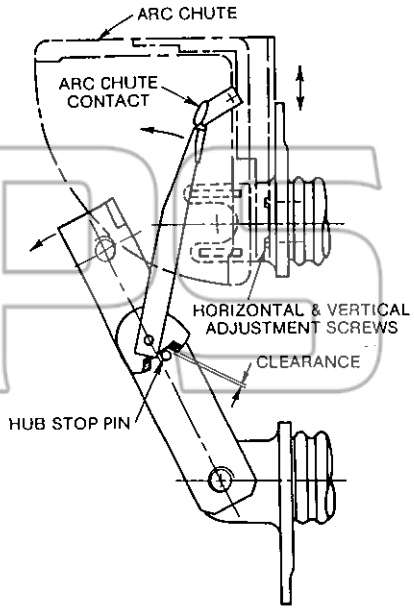
6.2.1 Adjustments



ADJUSTMENT NO. 1
ARC CHUTE LOCATION

A. Lateral: Arc chute slot must be in line with blade within 1/32 inch.

B. Vertical: Whipper blade must slide freely under arc chute contacts before pivot hub is restrained by stop pin.



ADJUSTMENT NO. 2
CONTACT PENETRATION

A. Whipper blade must pass fully thru arc chute contacts.

B. Whipper blade clearance to back of arc chute is 1/32 inch absolute minimum.

C. When whipper blade is properly adjusted, main blade should engage upper contact for a minimum of 50% of its width.

6.3 OPERATING MECHANISM

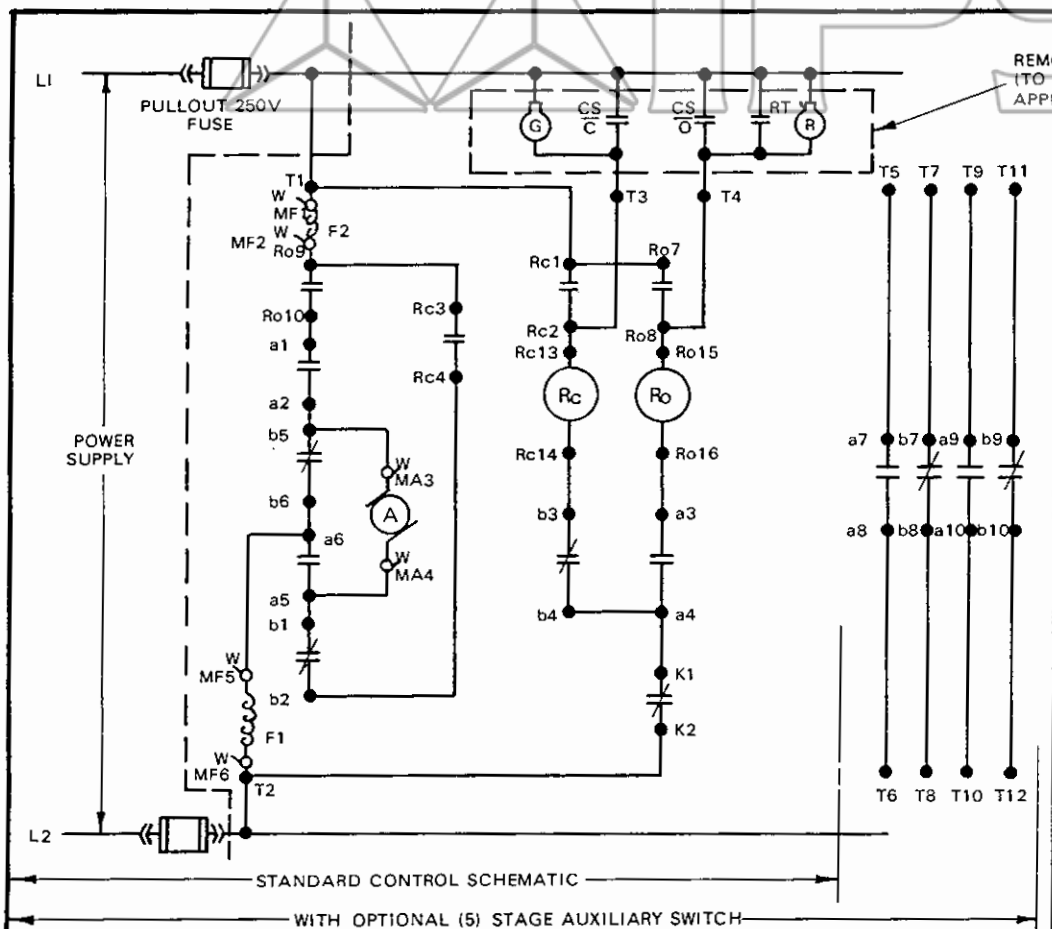
6.3.1 Type LI Switch

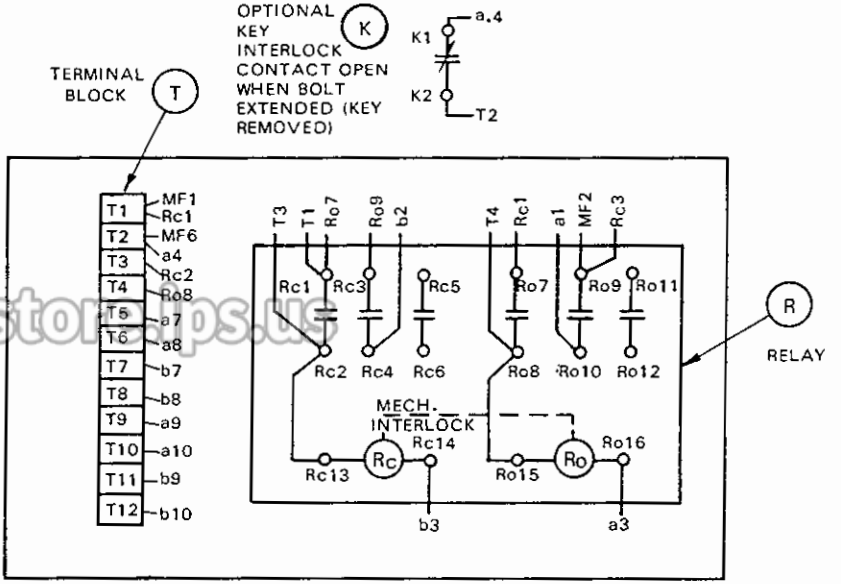
Both manually operated and electrically operated switch mechanisms are simple and require only periodic cleaning.

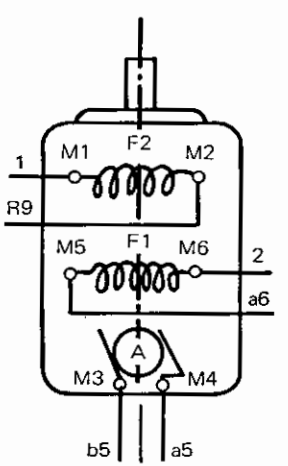
6.3.2 Type LIFE Switch

The Type "AEM" mechanism on LIFE switches should be inspected periodically. For maintenance procedure and spare parts, refer to Instruction Manual Type DST-2-5 and 15KV Magnetic Air Circuit Breaker, IN-820.11.

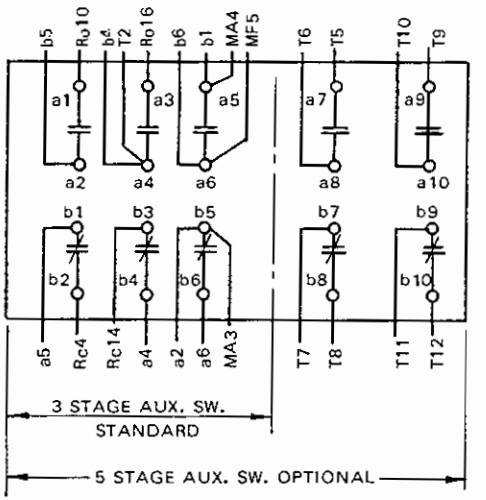
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MOTOR INTERNAL WIRING



MOTOR & RELAY CONTROL VOLTAGE

CONTROL VOLTAGE	FUSE	VOLTAGE RANGE
125 V.D.C.	5 A	70-140
115 V.A.C.	5 A	95-125

MOTOR CHARGING TIME – 7 SECONDS (CLOSE OR TRIP)

LEGEND:

F1 or F2 – FIELDS (MOTOR)
A – ARMATURE
a – AUX. SWITCH (CLOSED WHEN LI SW. CLOSED)
b – AUX. SWITCH (CLOSED WHEN LI SW. OPEN)
(R) or (G) – INDICATING LAMPS (RED OR GREEN)
Ro – OPEN RELAY } STRUTHERS–DUNN
Rc – CLOSE RELAY } TYPE A175KXX
CS – CONTROL SWITCH OR PUSHBUTTON
PT – PROTECTIVE DEVICE
T – TERMINAL BLOCK POINTS
~ – WIRE LEAD
DOTTED LINES INDICATE CUSTOMER SUPPLIED DEVICES

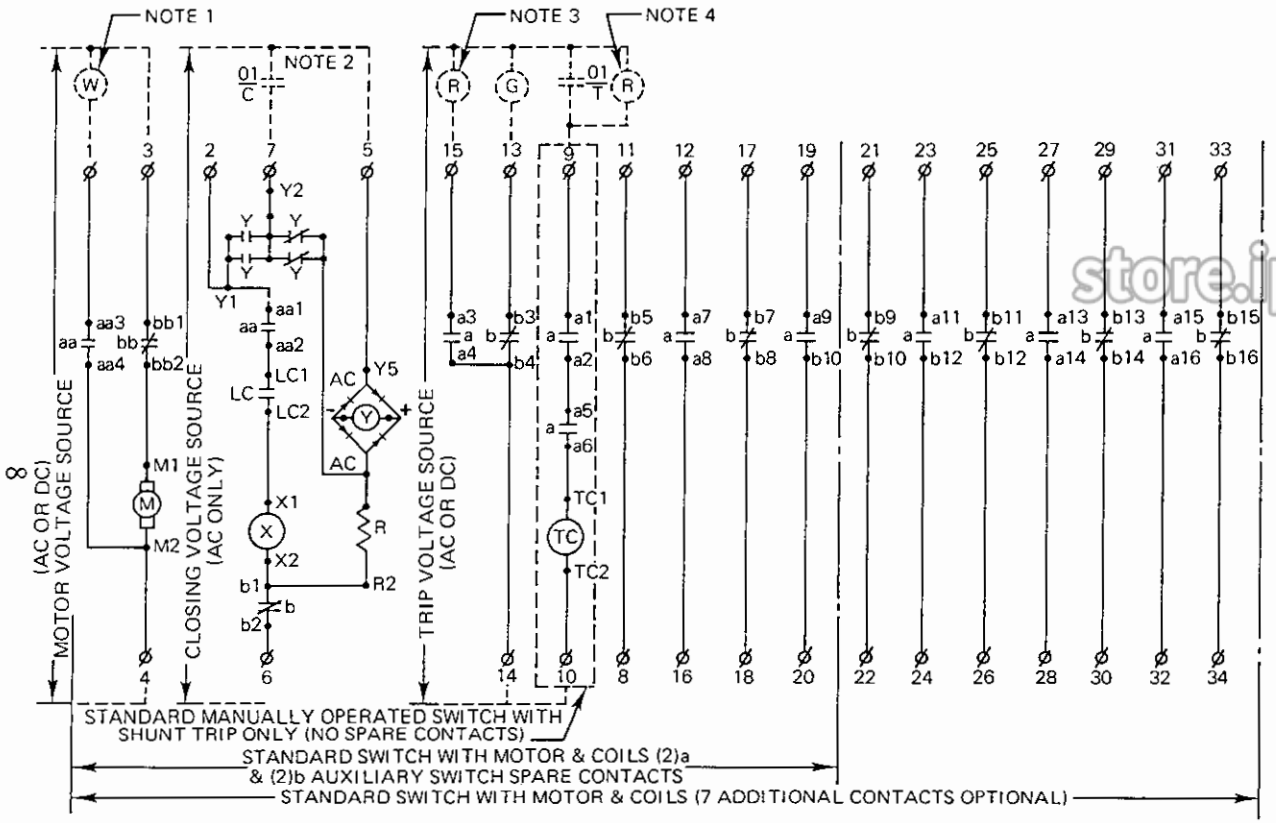
TYPE LI SWITCH – ELECTRICALLY OPERATED – CONTROL SCHEMATIC AND INTERNAL WIRING

REV.
DATE

REF. **2600 B 1800**

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NOTES.
1. WHITE LIGHT IF REQUIRED.
2. TIE TO REMOTE RELAY CLOSE CONTACT WHEN REQUIRED.
3. RED LIGHT LOCATION FOR CAPACITOR TRIP APPLICATION ONLY.
4. RED LIGHT LOCATION FOR D.C. TRIP VOLTAGES ONLY.



NOTE A:
SWITCH OPEN, SPRINGS DISCHARGED, CONTROL POWER OFF. (NORMAL POSITION OF SWITCH.)

NOTE B:
SWITCH CAN BE MECHANICALLY CLOSED AND OPENED.

LEGEND	
DEV.	DESCRIPTION
X	SHUNT CLOSE
TC	SHUNT TRIP
M	MOTOR (CHARGE OPER. SPRINGS)
a	N.O. AUX. SW. CONTACTS (See Note A)
b	N.C. AUX. SW. CONTACTS (See Note A)
aa	N.O. MECH. OPER. SWITCH (OPER WITH MECH. DISCHARGED)
bb	N.C. MECH. OPER. SWITCH (CLOSED WITH MECH. DISCHARGED)
LC	TRIP LATCH CHECK SWITCH (CLOSED WHEN LATCHED)
R	RESISTOR
ϕ	TERMINAL BLOCK POINT
Y	ANTI-PUMP RELAY

TYPE LIFE LOAD BREAK SWITCH CONTROL POWER REQUIREMENTS

Voltage Nominal	Voltage Range	Current Required	Recommended Fuse
Available Tripping Voltage			
		(Intermittent at nominal voltage)	
24 VDC	14-30	12.5	None
48 VDC	28-60	6.2	
125 VDC	70-140	2.4	
250 VDC	140-280	1.2	
115 VAC	95-125	1.	
230 VAC	170-250	1.	
Available Spring Charging Motor Voltages			
			*FPE ECN®250V Dual Element
48 VDC	35-60	14.	8.
125VDC	90-130	5.3	3.2
250 VDC	180-260	2.65	1.6
115 VAC	95-125	5.2	3.2
230 VAC	190-250	2.6	1.6
Available Closing Release Coil Voltages			
		(Intermittent at nominal voltage)	*FPE ECO®250V One-time Cartridge
48 VDC	35-60	6.2	10
125 VDC	90-130	2.4	10
250 VDC	180-260	1.2	10
115 VAC	95-125	4.4	10
230 VAC	190-250	2.2	10

*Use fuse recommended for motor circuit when closing coil and motor circuit-have common power supply.

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APPENDIX

7.1 TYPE LI SWITCH RATINGS

Rated KV	KV WITHSTAND		AMPERE RATING					DESCRIPTION	CATALOG NO.	
	60 Hz	Impulse	Contin-uous	Inter-rupting	Fault Closing	Momen-tary	4 Second			
5	19	60	600	–	–	40KA	25KA	MANUAL DISCONNECT	2651 D 2429	
			1200	–	–	40KA	25KA	MANUAL DISCONNECT	2652 D 2429	
			2000	–	–	60KA	38KA	MANUAL DISCONNECT	2652 D 2429	
			600	600	–	40KA	25KA	MANUAL INTERRUPTER	2654 D 2429	
			1200	600	–	40KA	25KA	MANUAL INTERRUPTER	2655 D 2429	
			600	–	40KA	40KA	25KA	SPRING DISCONNECT	2656 D 2429	
			1200	–	40KA	40KA	25KA	SPRING DISCONNECT	2657 D 2429	
			600	600	40KA	40KA	25KA	SPRING OP. INTERRUPTER	2658 D 2429	
			1200	600	40KA	40KA	25KA	SPRING OP. INTERRUPTER	2659 D 2429	
			600	–	60KA	60KA	38KA	SPRING DISCONNECT	2660 D 2429	
			1200	–	60KA	60KA	38KA	SPRING DISCONNECT	2661 D 2429	
			600	600	60KA	60KA	38KA	SPRING OP. INTERRUPTER	2662 D 2429	
			1200	600	60KA	60KA	38KA	SPRING OP. INTERRUPTER	2663 D 2429	
			600	–	40KA	40KA	25KA	MOTOR DISCONNECT	2651 D 2445	*
			1200	–	40KA	40KA	25KA	MOTOR DISCONNECT	2652 D 2445	*
			600	600	60KA	60KA	38KA	MOTOR INTERRUPTER	2653 D 2445	*
			1200	600	60KA	60KA	38KA	MOTOR INTERRUPTER	2654 D 2445	*
15	36	95	600	–	–	40KA	25KA	MANUAL DISCONNECT	2651 D 2430	
			1200	–	–	40KA	25KA	MANUAL DISCONNECT	2652 D 2430	
			2000	–	–	60KA	38KA	MANUAL DISCONNECT	2653 D 2430	
			600	600	–	40KA	25KA	MANUAL INTERRUPTER	2654 D 2430	
			1200	600	–	40KA	25KA	MANUAL INTERRUPTER	2655 D 2430	
			600	–	40KA	40KA	25KA	SPRING DISCONNECT	2656 D 2430	
			1200	–	40KA	40KA	25KA	SPRING DISCONNECT	2657 D 2430	
			600	600	40KA	40KA	25KA	SPRING OP. INTERRUPTER	2658 D 2430	
			1200	600	40KA	40KA	25KA	SPRING OP. INTERRUPTER	2659 D 2430	
			600	–	60KA	60KA	38KA	SPRING DISCONNECT	2660 D 2430	
			1200	–	60KA	60KA	38KA	SPRING DISCONNECT	2661 D 2430	
			600	600	60KA	60KA	38KA	SPRING OP. INTERRUPTER	2662 D 2430	
			1200	600	60KA	60KA	38KA	SPRING OP. INTERRUPTER	2663 D 2430	
			600	–	40KA	40KA	25KA	MOTOR DISCONNECT	2651 D 2446	*
			1200	–	40KA	40KA	25KA	MOTOR DISCONNECT	2652 D 2446	*
			600	600	60KA	60KA	38KA	MOTOR INTERRUPTER	2653 D 2446	*
			1200	600	60KA	60KA	38KA	MOTOR INTERRUPTER	2654 D 2446	*

* Specify control voltage 115V AC or 125V DC

TYPE LIFE SWITCH RATINGS

Nominal KV	KV WITHSTAND		AMPERE RATING					DESCRIPTION	CATALOG NO.
	60 Hz	Impulse	Contin-uous	Inter-rupting	Fault Closing	Momen-tary	4 Second		
4.16	19	60	600	600	40KA 60KA	40KA 60KA	25KA 37KA	– – ------	2652 D 2360 2654 D 2360
13.8	36	95	600	600	40KA 60KA	40KA 60KA	25KA 37KA	– – ------	2652 D 2340 2654 D 2340

Catalog numbers above are for standard height switches, front connected. Control voltage for trip coil and motor must be specified.

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ORDERING INFORMATION

When ordering Load Break Switches be sure to supply the following information:

Switch Catalog Number . . . . . .

Voltage Rating . . . . . kv.

Continuous Current Rating . . . . . Amperes.

Fuse Kit Catalog Number . . . . . .

Operating Mechanism: Manual/Electrical . . . . . ;

Stored Energy . . . . . Motor . . . . . ;

If Motor Operated, Control Voltage: a.c. d.c.

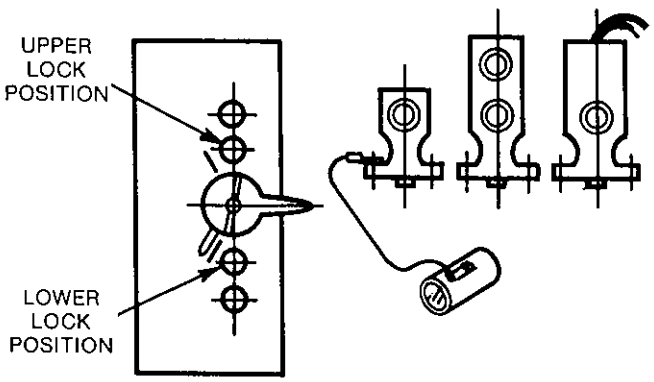
If Shunt Trip Device (Only) Voltage: a.c. d.c.

Contact Guard Catalog Number . . . . . .

7.2 ACCESSORIES

The following accessories are available for Type LI Switches.

7.2.1 INTERLOCKS

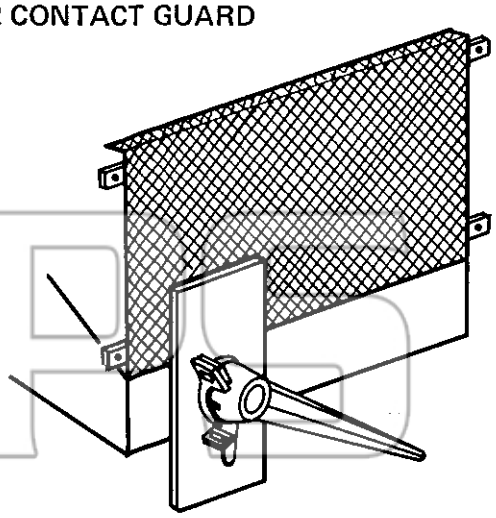


Single or double key interlocks to lock switch when open and/or closed. Electrical key interlock available for electrically operated switch will disconnect control voltage as well as interlock switch.

Provisions are made for blocking screws in the operating disc so that various interlock schemes can be arranged. Only one (1) key supplied with each cylinder. (Additional keys upon order.)

Catalog No.	
2651B2185	Single Key Interlock (incl. hdwr.)
2652B2185	Double Key Interlock (incl. hdwr.)
2605B2185	Dust Cover
2653B2185	Single Key Electrical Interlock (hdwr.) (upper position only)

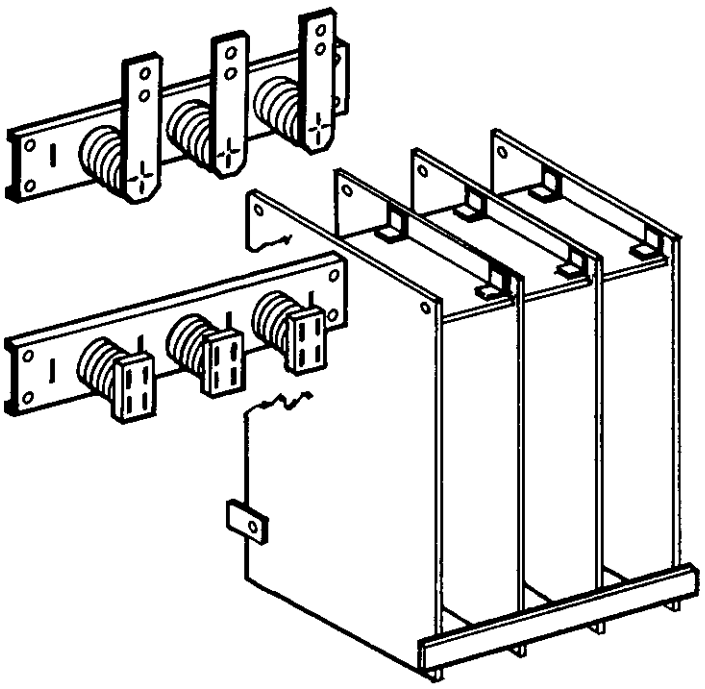
7.2.2 CONTACT GUARD



Contact guard manufactured from steel mesh to guard upper terminals and moving contacts.

Nominal KV	Contact Guard Catalog Number
4.16	2651 C 1665
13.8	2652 C 1665

7.2.3 FUSE KIT



Kit consists of universal mounting supports for various type power fuses and current limiting fuses, and interphase barriers.

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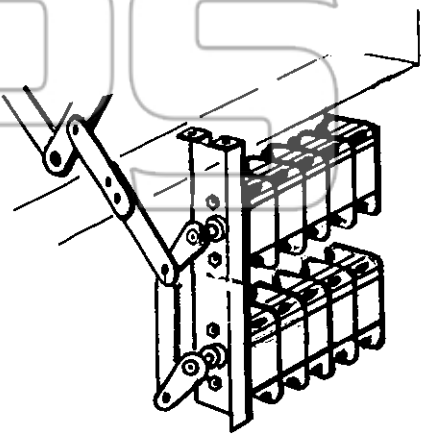
7.2.3 FUSE KIT (continued)

Nominal kv	Fuse Type			FPE Fuse Kit Catalog No.
	G.E.	S & C	West.	
4.16	EJO-1-D EJO-1-DD	SM-4 SM-5	CLE-1 CLE-2	2651A1686
13.8	EJQ-1-D EJO-1-DD EJO-1-EE	SM-4 SM-5	CLE-1 CLE-2 BA-200, Vented BA-200, with condenser or discharge filter	2652A1686

*Live fuse parts not included.

7.2.4 Auxiliary Switch

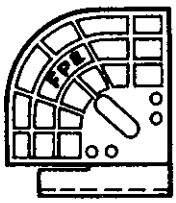
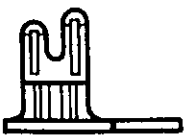
No. of Contacts	Drawing No.
20	2651 B 2330
16	2652 B 2330
10	2653 B 2330
6	2654 B 2330



AUXILIARY SWITCH ASSEMBLY

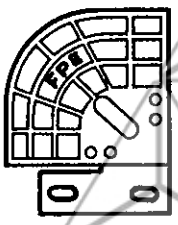
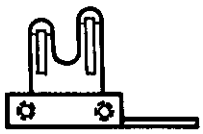
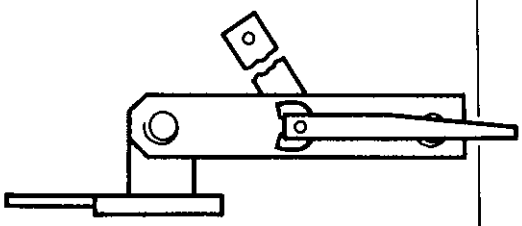
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7.3 SPARE PARTS

ARC CHUTE (Front mount type) 	5 and 15KV Switches (Obsolete Design)	Arc-Chute
	ALL EXCEPT DISCONNECT SWITCHES	2652 C 1597
CONTACT JAW (For front mounted arc chute and disconnect assemblies) 	5 and 15KV Switches (Obsolete Design)	Contact Jaw
	40KA Switches used with Arc-chute 2652 C 1597	2651 D 0387-600A 2653 D 0387-1200A
	60KA Switches used with Arc-chute 2652 C 1597	2651 A 2192

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7.3 SPARE PARTS (CONTINUED)

ARC CHUTE (Side mounted) 	**5 and 15KV Switches (Present Design)**	**Arc-Chute**
	ALL EXCEPT DISCONNECT SWITCHES	2653 C 1597
CONTACT JAW (For side mounted arc chute and disconnect assemblies) 	**5 and 15KV Switches (Present Design)**	**Contact Jaw**
	40KV Switches used with Arc-chute 2653 C 1597	2651 B 2238-600A 2652 B 2238-1200A
	60KA Switches used with Arc-chute 2653 C 1597	2652 A 2192
MOVING CONTACT ASSEMBLY (For either front mounted or side mounted arc chutes) 	**5 and 15KV Switches**	**Moving Contact Assembly**
	15KV-40KA-600 Amp 5KV-40KA-600 Amp	2653 C 1596 2654 C 1596
	15KV-40KA-1200 Amp 5KV-40KA-1200 Amp	2656 C 1596 2657 C 1596
	15KV-60KA-600 Amp 5KV-60KA-600 Amp	2659 C 1596 2660 C 1596

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