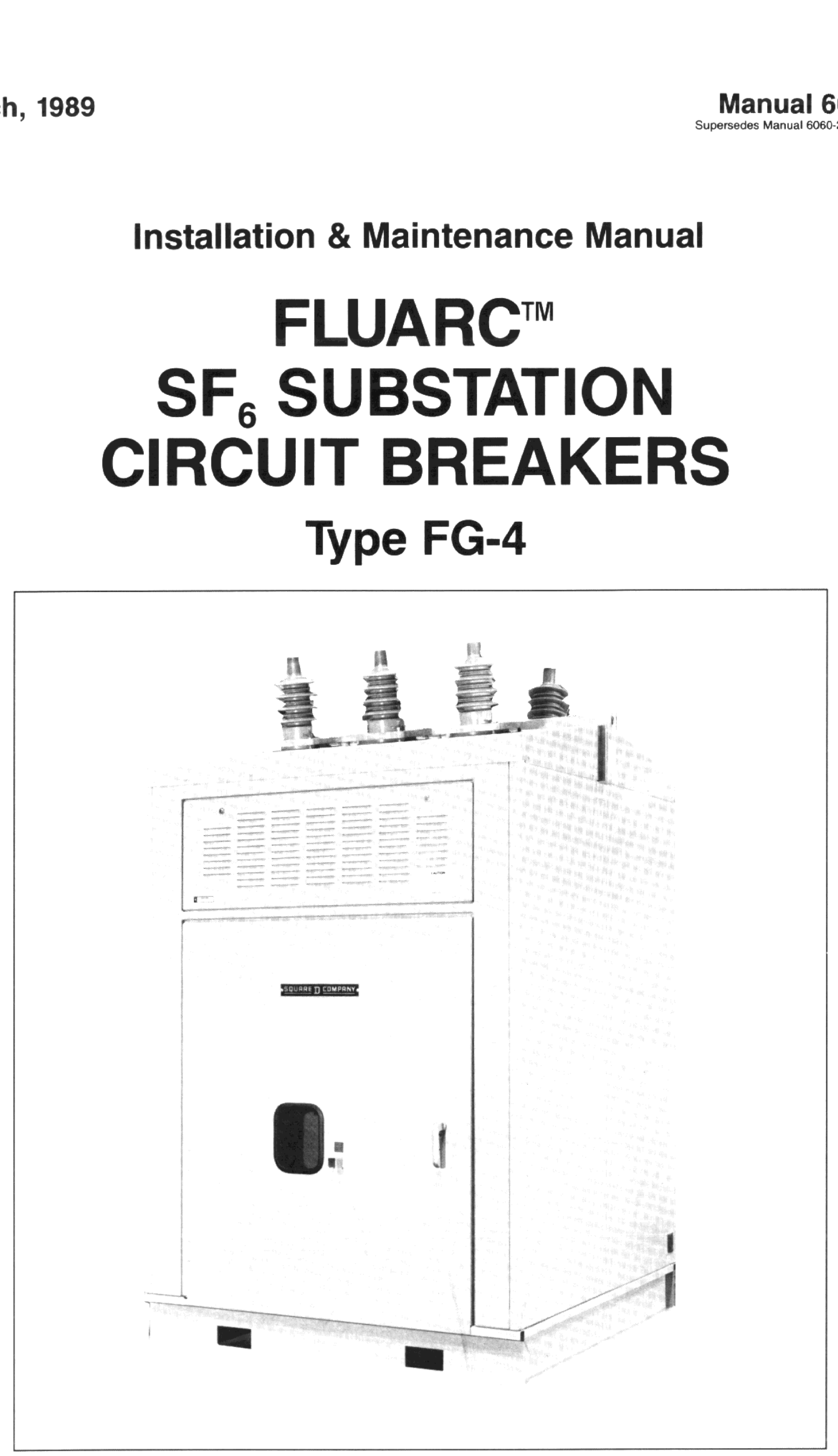
March, 1989

Manual 6060-4
Supersedes Manual 6060-2 dated 10/84

Installation & Maintenance Manual

FLUARC™ SF_6 SUBSTATION CIRCUIT BREAKERS

Type FG-4



SQUARE D COMPANY

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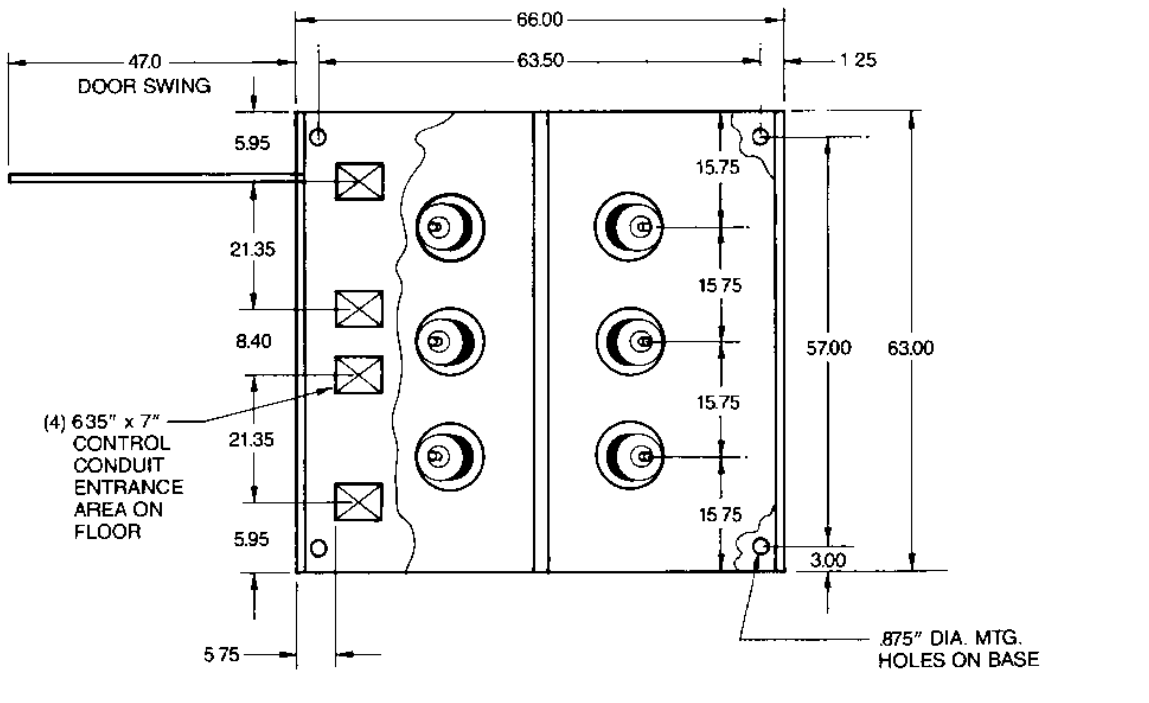
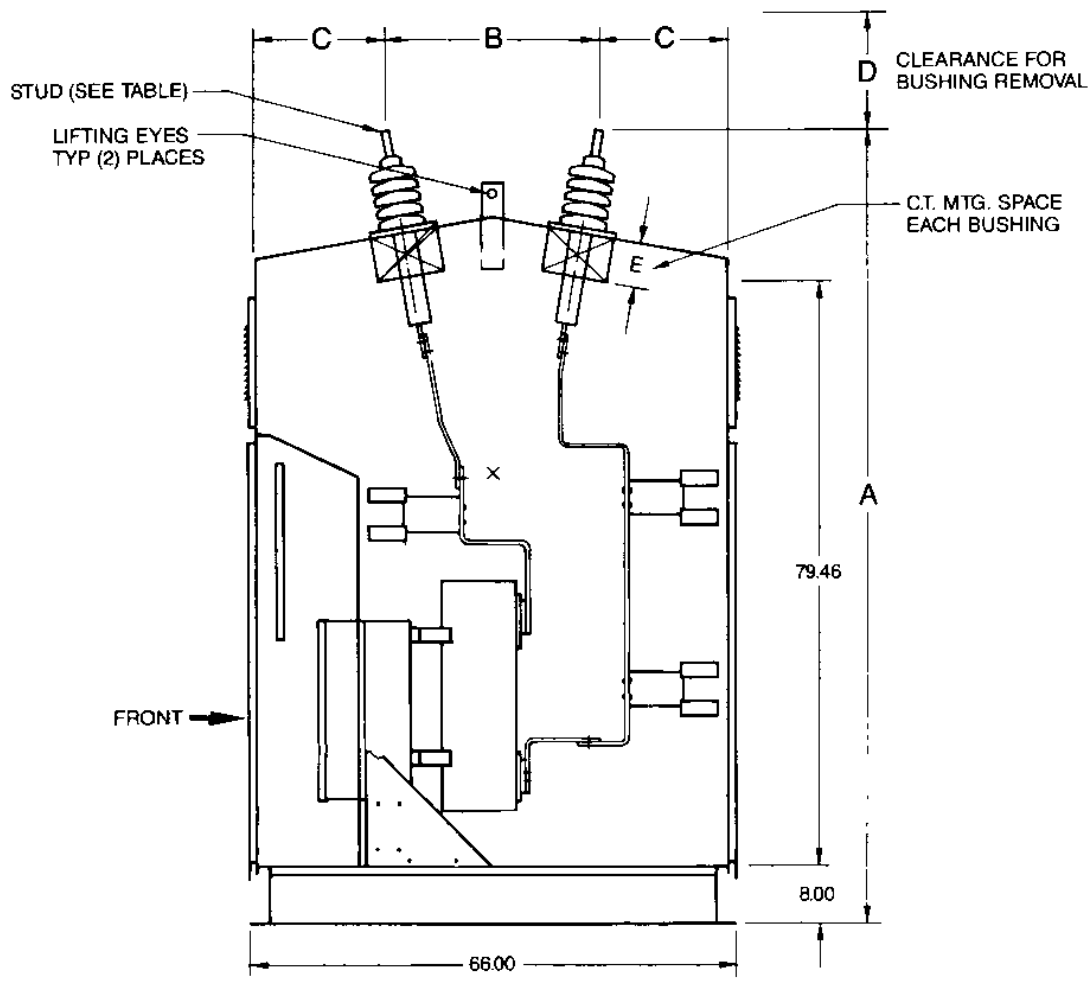
SF_6 SUBSTATION CIRCUIT BREAKERS
TYPE FG-4





VOLTAGE	CURRENT	BUS (CU.)	STUD SIZE	WEIGHT	A	B	C	D	E
15.5 KV	1200 A	(1) .38 X 4.00	1 1/8-12 X 3.5	2500	107.50	33.50	15.50	21.00	5.00
15.5 KV	2000 A	(2) .38 X 4.00	2-12 x 3	3000	108.00	33.50	15.50	21.00	7.00
15.5 KV	3000 A	(2) .38 X 6.00	2 7/8-12 X 4	3500	109.00	34.00	15.25	21.00	7.00
25.8 KV	1200 A	(1) .38 X 4.00	1 1/8-12 X 2.8	3000	115.75	31.75	16.38	25.00	7.00
25.8 KV	2000 A	(2) .38 X 4.00	2-12 X 3	4000	116.50	32.00	16.25	25.00	7.00
38 KV	1200 A	(1) .38 X 4.00	1 1/8-12 X 2.8	3000	115.75	31.75	16.38	25.00	7.00
38 KV	2000 A	(2) .38 X 4.00	2-12 X 3	4000	116.50	32.00	16.25	25.00	7.00

SF_6 SUBSTATION CIRCUIT BREAKERS
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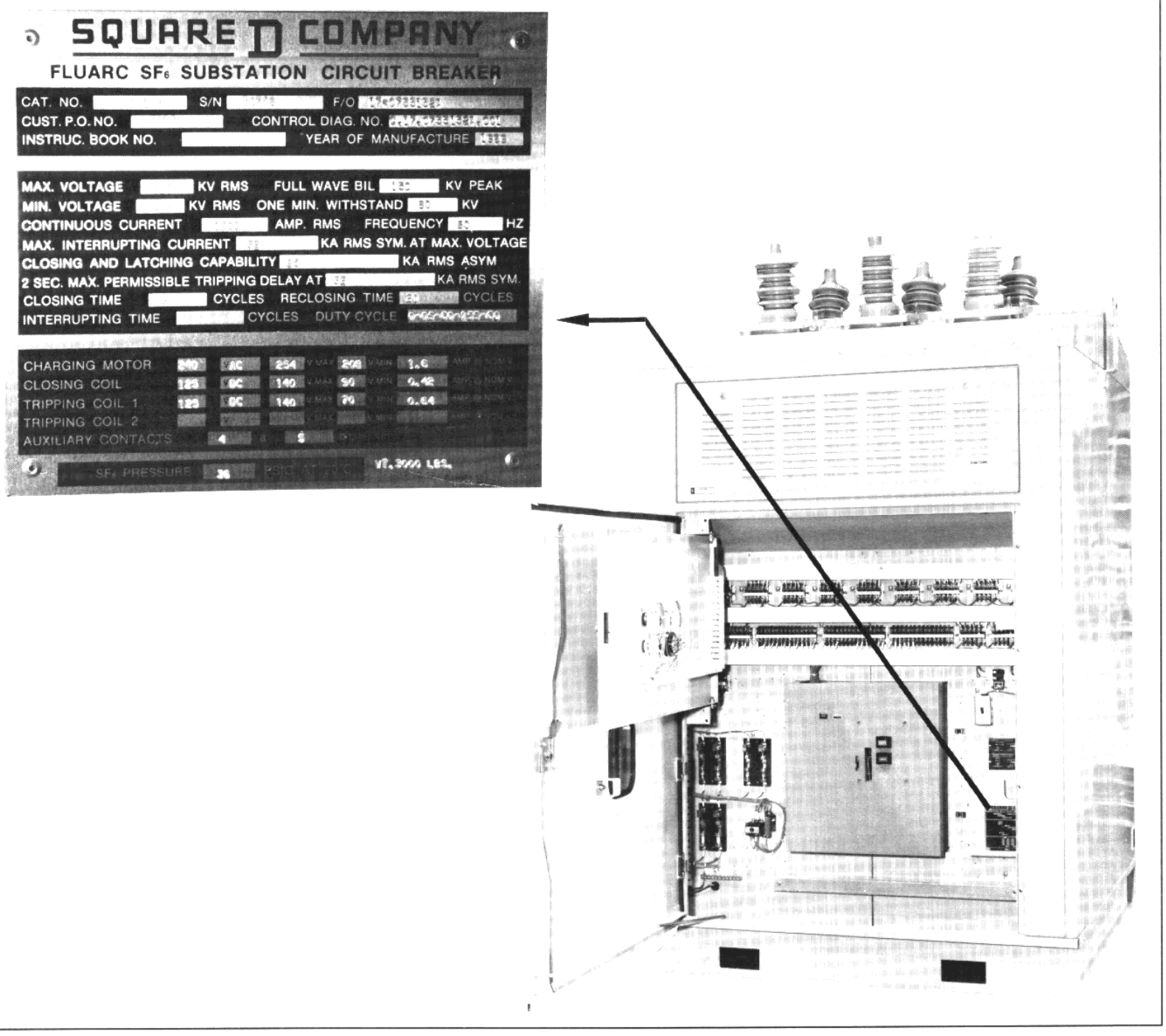


I. INTRODUCTION

This manual provides handling, installation, operation, and maintenance instructions for FG-4 substation breakers. The FG-4 substation breaker features the latest advances in SF6 (Sulfur Hexafluoride) technology, combining superior performance with low maintenance.

The FG-4 Circuit Breaker uses three sealed interrupter units. These interrupters are filled with SF6 gas to 37 psig at the factory and field charging of these interrupters is *not* required. A pressure switch is supplied for the purpose of providing a warning of a low pressure situation. The pressure switch contact closes when the pressure goes below 22 psig. The pressure switches are part of the permanent sealing system of the interrupters and can *not* be replaced in the field. Breaking the seal on the interrupter will void the warranty.

The design ratings for the breakers are shown in Table 1. If further questions exist, contact your local Square D Company representative for comprehensive factory and/or field support.

II. RECEIVING

Upon receipt by the customer, remove the shipping material from the breaker to carefully inspect for any damages that may occur during shipping. From the rating nameplate on the book pocket inside the low voltage compartment, verify that the breaker specifications match the order specifications.

A claim for damages should be filed at once with the transportation company if there is any visual evidence of damage. Notify Square D Company of the damages and/or discrepancies noted.

SF_6 SUBSTATION CIRCUIT BREAKERS
TYPE FG-4

STANDARD FG-4 BREAKER RATINGS

FG-4 BREAKER		15.5 kV	25.8kV	38.0kV
Rated Frequency		60 Hz	60 Hz	60 Hz
Maximum Design Voltage		15.5kV	25.8kV	38kV
Voltage Range Factor		1	1	1
Basic Insulation Level		110kV	125kV	150kV
60 Hz Withstand Capability	Dry - 1 minute	50kV	60kV	80kV
	Wet - 10 seconds	45kV	50kV	75kV
Minimum External Creep Distance		17.38 in (1200A)	47 in. (1200A)	47 in. (1200A)
		20.5 in. (2000A)	44 in. (2000A)	44 in. (2000A)
		20.5 in. (3000A)		
Minimum External Strike Distance Phase to Ground		10.0 in. (1200A)	19.88 in. (1200A)	19.88 in. (1200A)
		11.12 in. (2000A)	21.56 in. (2000A)	21.56 in. (2000A)
		11.12 in. (3000A)		
Minimum External Strike Distance Between Bushing Terminals Phase to Phase		12.75 in.	12.75 in.	12.75 in.
Interrupting Time		5 cycles	5 cycles	5 cycles
Time Between Coil Energization and Contact Parting		45-65 msec.	45-65 msec.	45-65 msec.
Spring Charging Time		10-13 sec.	10-13 sec.	10-13 sec.
Time Between Coil Energization and Contact Closing		60-90 msec.	60-90 msec.	60-90 msec.
Minimum Reclosing Time		0.2 sec.	0.2 sec.	0.2 sec.
Continuous Current		1200A- 3000A	1200A- 2000A	1200A- 2000A
Interrupting Capacity at Maximum Voltage		40 kA rms sym	40 kA rms sym	31.5 kA rms sym
Close and Latch Capacity		108 kA peak	108 kA peak	85 kA peak
3-second Short Time Capacity		40 kA rms sym	40 kA rms sym	31.5 kA rms sym

TABLE 1

III. HANDLING

Handle the breaker with care and avoid impacts. The interrupter poles are under pressure (37 psig) and meters may be damaged by rough handling. Two lifting eyes have been welded to the top of the housing for lifting by crane or hoist. The recommended method of handling the breaker is by using a crane arm as shown below. Carefully position the crane arm between bushings and hook to lifting eyes by using a cable or chain.

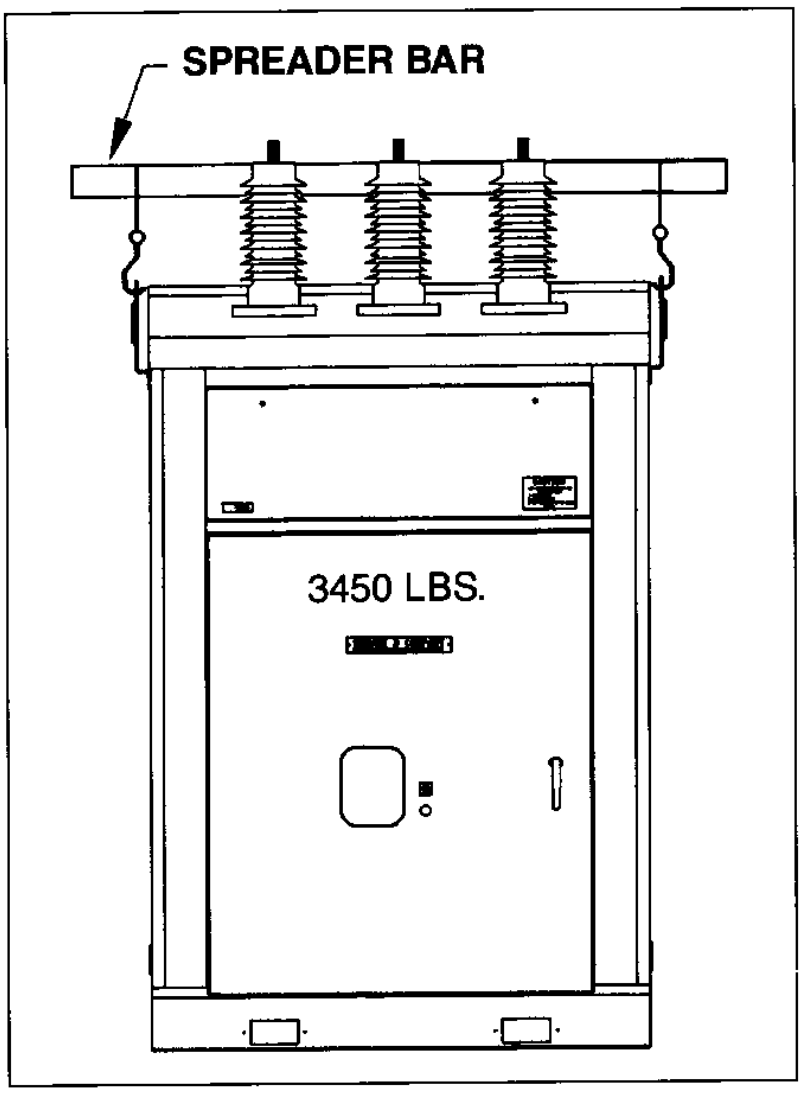


Figure 1

IV. STORAGE

All breakers are shipped, and should be stored, in open position with operating mechanism in the discharged position. If the breaker is stored prior to installation, provisions must be made for energizing the space heaters to prevent condensation inside the enclosure. These units must be kept in a place that is clean, dry, and free of corrosive elements.

If the breaker is stored for an extended period of time prior to placing in service, regular inspection is required and, if necessary, spray the unplated parts lightly with oil. Periodic exercising of the breaker is recommended. The time between exercise periods should be no greater than one year.

V. PRE-SERVICE CHECK-OUT

All personnel responsible for supervision and operation should be familiar with the breaker and its functions. Prior to placing the breaker in service, perform the following checks:

1. Open all panels and inspect the entire breaker for any shipping damages such as broken parts or loose hardware.
2. Verify the tightness of the following hardware:

POSITION	TORQUE
Flex connector to interrupter pole connections	55 ft.lbs.
Flex connector to bushing connections	70 ft.lbs for 1200A 40 ft.lbs for 2000A, 3000A
Bushing to roof connections	30-35 ft.lbs for 15 kV 1200A 40-45 ft.lbs. for 38 kV 1200A 15 ft.lbs. for 2000A, 3000A

These checks are part of the normal quality procedures, it is however, suggested that these items be re-checked prior to actual energization.

3. Clean the bushings, interrupters, and all insulating parts by wiping with a soft dry cloth. For more extensive cleaning, a nonflammable solvent is recommended.
4. Manually charge the closing springs, close and trip the breaker.
5. If relays are supplied, remove blocking on relay armatures.
6. Apply control power and operate the breaker electrically.
7. Make resistance measurements on each pole with breaker in closed position. When new, each pole should measure 150 micro ohms or less, from bushing external terminal to bushing external terminal, using a low resistance ohmmeter.
8. To ensure that damage has not occurred during shipment, perform a hi-pot test across the open contacts of each SF6 interrupter. Then with the breaker in the closed position, perform a phase to phase and a phase to ground hi-pot test for each pole. Gradually raise the test voltage to the level shown and hold for one minute.

Rated Maximum Voltage	Test Voltage	
	AC	DC
15.5 kV	27 kV	38 kV
25.8 kV	45 kV	63 kV
38.0 kV	60 kV	84 kV

The above AC test voltages are 75% of those applied at the factory in accordance with ANSI recommendations.

Observe the following precautions when performing the hi-pot test.

1. Do not exceed the above voltages.
2. All persons should stay at least three feet away from "live" parts during testing.
3. Perform tests only when all insulating parts are installed. The operator should be positioned so that one of the metal sides of the enclosure is between the operator and the interrupter being tested.
4. Discharge to ground all "live" parts before handling. These parts can retain a static charge after a hi-pot test.

VI. ENCLOSURE

The FG-4 substation circuit breaker consists of an isolated high voltage compartment and low voltage compartment.

The high voltage compartment includes cycloaliphatic cast epoxy bushings which protrude through the stainless steel roof. A maximum of two current transformers can be mounted on each bushing. The high voltage compartment can be accessed through the rear panel as well as through two access panels located at the top-front and top-rear of the enclosure.

CAUTION: DO NOT ATTEMPT TO OPEN HIGH VOLTAGE PANELS WHILE BREAKER IS ENERGIZED.

The low voltage compartment is isolated from the high voltage compartment by a steel barrier. A hinged panel for relays, terminal strips and other instrumentation is accessible through the hinged gasketed front door. The breaker mechanism is also accessed from the low voltage compartment. A padlockable vault-type handle with a three-point latch is provided on the front door. A wind stop is also provided.

A viewing window allows easy viewing of the circuit breaker operations counter, mechanical open/close indicator and closing spring charge indicator. An emergency trip button, that can be padlocked in the trip position, is provided. Each time the breaker is tripped manually, mechanical and electrical interlocks are actuated and must be manually reset before the breaker can be reclosed, either electrically or manually. A single reset lever resets both inerlocks and is accessible only in the low voltage compartment.

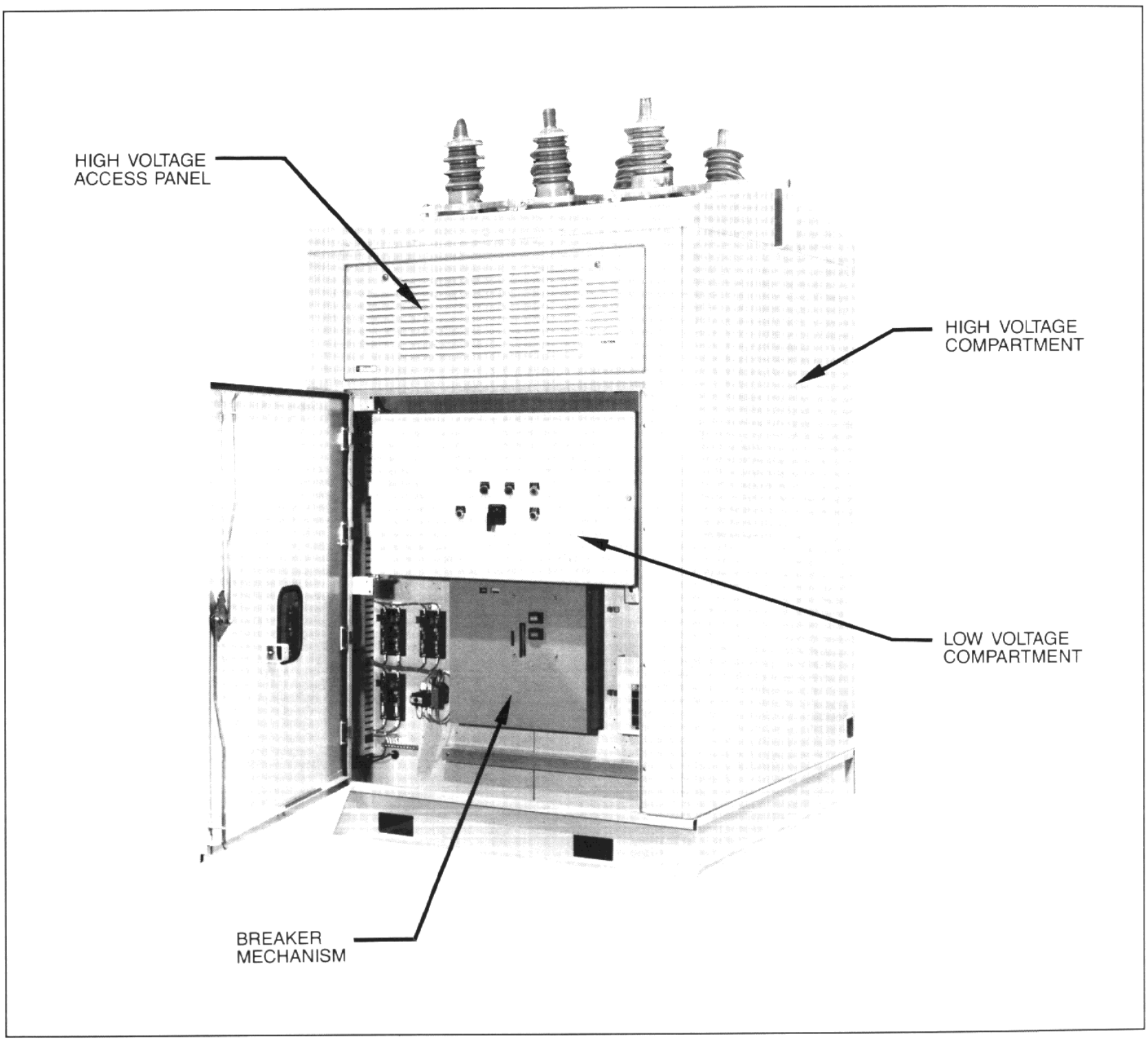


Figure 2

VII. OPERATING MECHANISM DESCRIPTION

The stored energy mechanism on the front of the breaker contains high energy closing springs and a ratcheting system for charging these springs. The breaker may be charged electrically by the gear motor or manually with the manual charging handle (located in the low voltage compartment) until the "Springs Charged" indicator snaps to the charged position. The opening and closing speeds are independent of the method by which the springs are charged. The breaker is prevented from being closed until the springs are fully charged. After the springs are fully charged, the breaker may be operated either electrically or manually by pushing the open and close buttons located in the operating mechanism compartment. The closing springs recharge automatically immediately after breaker closes.

The position of the breaker contacts is given by a position indicator on the mechanism. The position indicator consists of a white flag with the word "closed" indicating that the breaker is in the close position. A green flag with the word "open" indicates that the breaker is in the open position. This indicator is not intended to be used as a final authority to indicate safety of the power circuit.

The "Springs Charged" indicator is located to the left of the manual charging handle slot. This indicator shows whether the closing springs are fully charged or discharged. If the springs are partially charged, the indicator will be in the discharge position. An operations counter counts the number of close/open cycles. The counter advances by one on the closing stroke. The breaker is rated for 10,000 operations at rated current, however, the life of the interrupters can be considerably less depending upon the current switched with each operation. The need for inspections and possible interrupter replacement should be based upon the frequency of operation, types and levels of interruptions, and environmental conditions. (See contact wear measurement section.)

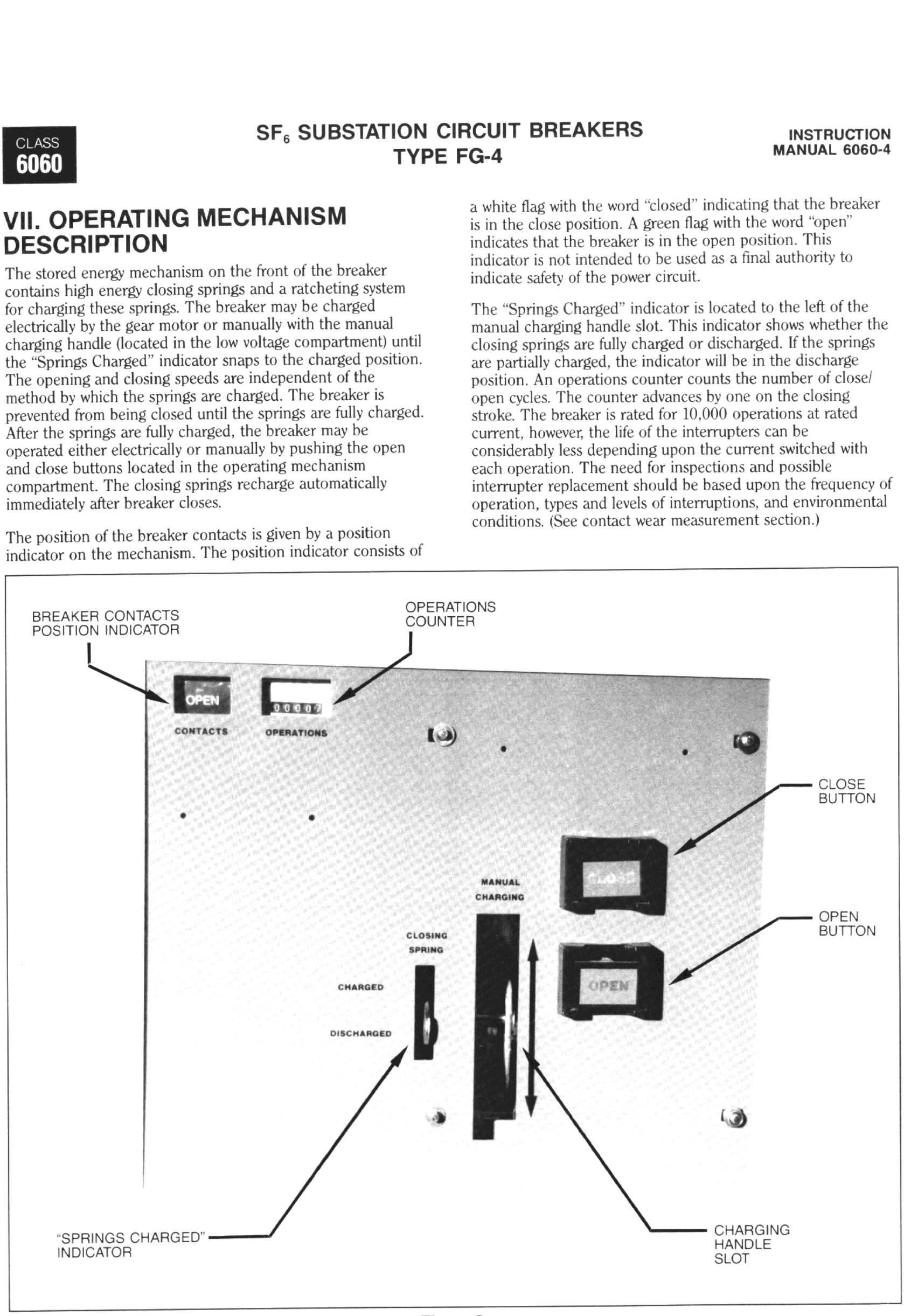
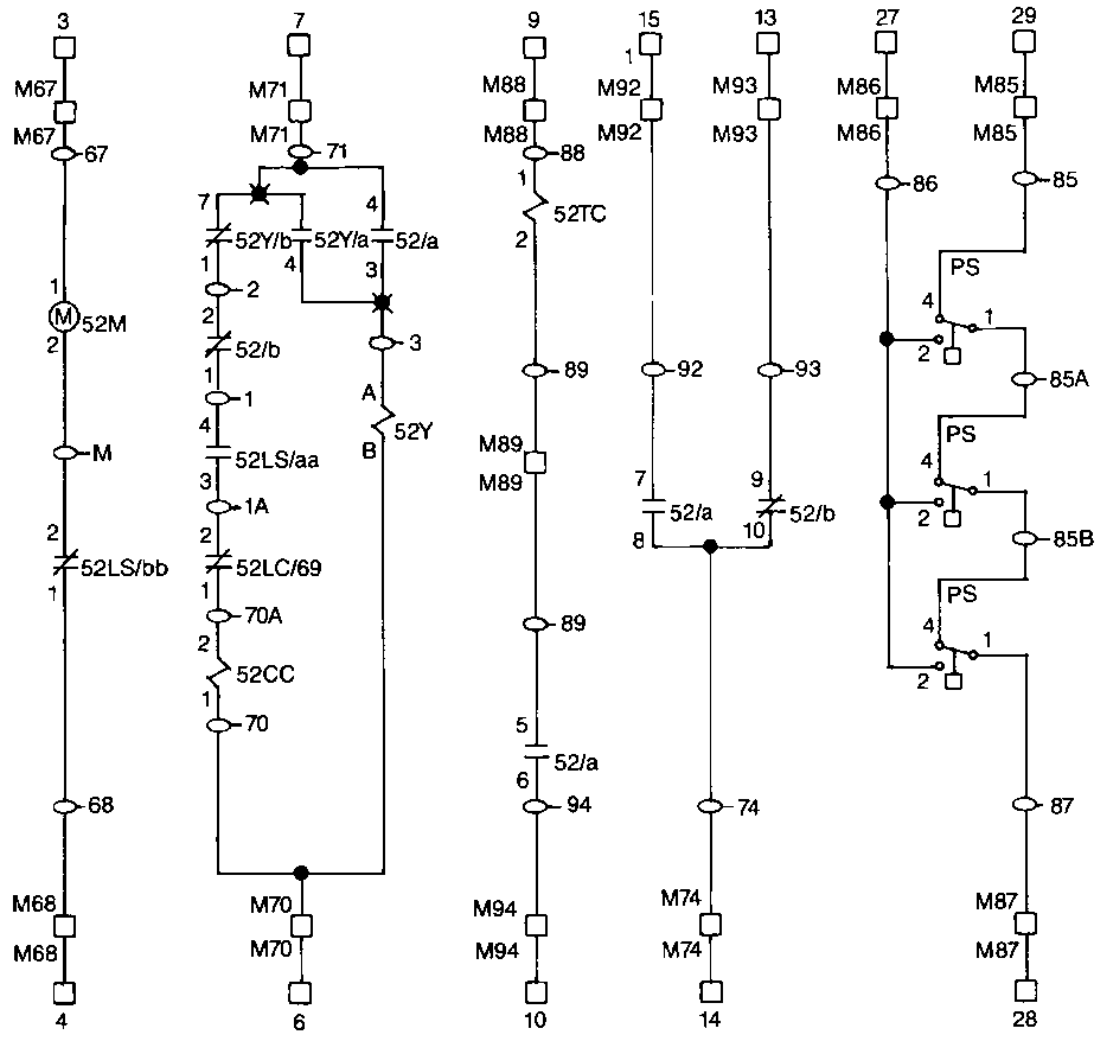


Figure 3

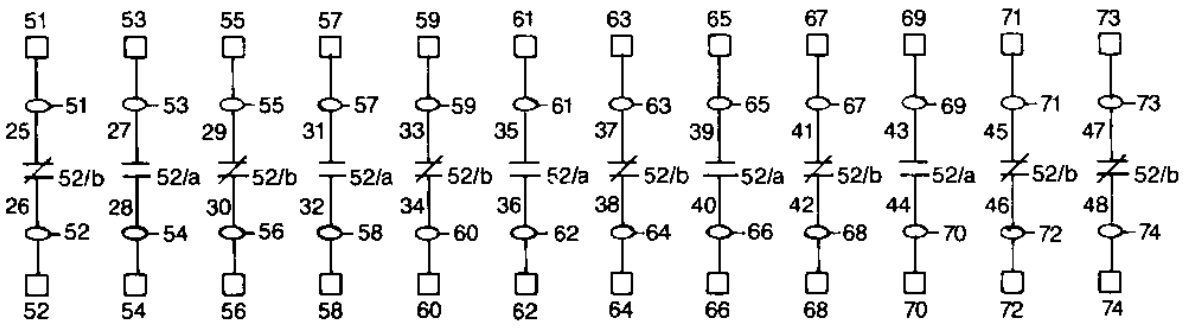
SF_6 SUBSTATION CIRCUIT BREAKERS
TYPE FG-4

BREAKER ELEMENTARY DIAGRAM



BREAKER AUXILIARY CONTACTS

INTERNAL TO THE BREAKER



LEGEND

□	TERMINAL BLOCK.
52/a	CIRCUIT BREAKER AUXILIARY CONTACT, NORMALLY OPEN.
52/b	CIRCUIT BREAKER AUXILIARY CONTACT, NORMALLY CLOSED.
52M	CLOSING SPRINGS CHARGING MOTOR.
52TC	BREAKER TRIP COIL.
52CC	BREAKER CLOSING COIL.
52LC/69	COMBINATION LATCH CHECK AND MANUAL TRIP AND LOCKOUT SWITCH.
52Y	ANTI-PUMP RELAY.
52Y/a	ANTI-PUMP RELAY CONTACT, NORMALLY OPEN.
52Y/b	ANTI-PUMP RELAY CONTACT, NORMALLY CLOSED.
52LS	CLOSING SPRINGS CHARGED LIMIT SWITCH.
52LS/aa	CLOSING SPRINGS CHARGED LIMIT SWITCH CONTACT, OPEN WHEN SPRINGS ARE NOT CHARGED AND CLOSED WHEN SPRINGS ARE CHARGED.
52LS/bb	CLOSING SPRINGS CHARGED LIMIT SWITCH CONTACT, CLOSED WHEN SPRINGS ARE NOT CHARGED AND OPEN WHEN SPRINGS ARE CHARGED.
PS	PRESSURE SWITCH, OPERATES AT 1.5 BAR (22 PSIG) RELATIVE PRESSURE.
MTB	MECHANISM TERMINAL BLOCK.

VIII. PREVENTIVE MAINTENANCE

This equipment, like all other equipment, requires two types of maintenance; scheduled preventive maintenance to avoid equipment problems and troubleshooting/corrective maintenance to repair the equipment as quickly as possible after a problem has occurred.

1. Only qualified and authorized personnel should be permitted to handle or operate the breaker.
2. Do not work around live parts.
3. Any switch or breaker that has been opened to de-energize the equipment being serviced should be effectively locked, tagged, and even blocked open if possible to prevent accidental energization of equipment.
4. Service current carrying parts only when these parts are disconnected from the system and grounded to the ground pad.

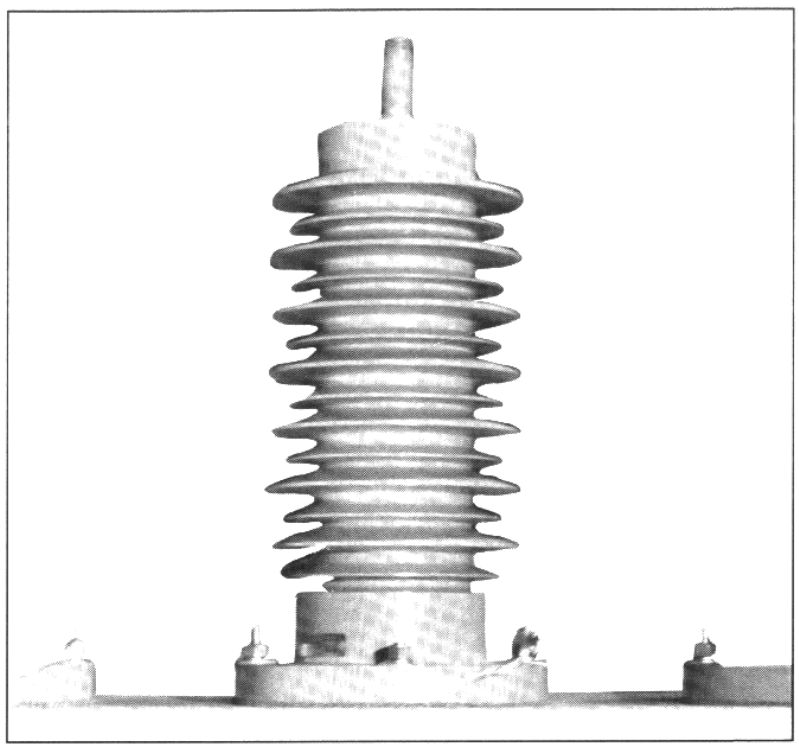
Maintenance Schedule

Preventive maintenance increases the life of the equipment and greatly reduces the possibility of equipment problems and unscheduled downtime. The schedule for preventive maintenance is dependent on the environment, number of switching cycles, currents switched, and schedules of other equipment in the system. In determining the minimum requirements, Square D Company recommends a check every 3000 operations or 36 months, whichever comes first. Consideration for more frequent maintenance should be given to applications in environments with high temperatures or contaminated atmospheres.

1. At the time of normal relay maintenance it is recommended that the breaker be totally exercised by closing and opening through all available means while checking the control functions.
2. Square D recommends the user not check the gas pressure. Each interrupter has a pressure switch which operates should the pressure fall below 22 psig. The breaker is capable of interrupting a fault of 12,000 Amp rms sym once under this condition. However, if the maintenance policy of the user requires gas pressure checks, special instructions may be obtained from the factory.

Field Testing of Bushings

The Square D Company Cast Epoxy Apparatus Bushing is a solid dielectric construction made of filled cycloaliphatic epoxy. These bushings have been designed, tested, and exceed the requirements of ANSI/IEEE standards 21 and 24 for apparatus bushings. Performance and field experience have indicated no need for regularly scheduled field testing. It is expected that this bushing will provide service free performance for the life of the FG-4 Substation breaker.



If for any reason field testing of bushing is required, an effective bushing test is the one minute, power frequency dielectric test. The ground insert for this bushing's internal ground screen is connected to ground during normal service and should remain connected during this test. Isolate bushing and apply test voltage (line to ground) as follows:

Rated Maximum System Voltage	Field Test Voltage	
	AC	DC
15.5 kV	27 kV	38 kV
25.8 kV	45 kV	63 kV
38.0 kV	60 kV	84 kV

Power factor measurements have proven to be valuable for some insulation medium, but are far less effective for cast epoxy and other similar solid dielectric materials. Power factor measurements above 1% for Square D epoxy bushings do *not* indicate pending failure. Readings up to 25% have been recorded with no adverse effect.

Cleaning: Square D bushings may be cleaned with most commercial detergent and water as is used in high pressure cleaning equipment. Bushings should be allowed to air dry before energization.

Occasionally, a foreign object or a branch from a tree may cause an electrical arc to be established over the surface of the bushing. This event may leave a track of burnt debris which remains embedded into the surface of the epoxy. Normal cleaning may be insufficient to remove debris embedded into the surface. Such areas may be ground out using a small engraving router or grinder. The area may also be sandblasted using clean silica sand. The treated area is then polished using wet 400 grit silica-carbide sandpaper. The cleaned area should be blended into adjoining surface contours.

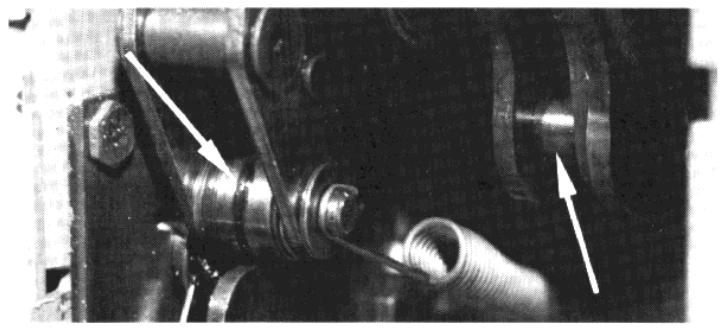
Field Lubrication

Proper lubrication of bearing surfaces and cleanliness is of prime importance. Dirt on the exterior surface of parts does not necessarily indicate the condition of the bearing surfaces. In many instances it is better to lubricate without cleaning, as long as dirt is not forced into the bearing surface areas. Should cleaning be necessary, consideration needs to be given to the part and bearing surface being cleaned so that dirt is not introduced into the bearing areas. Parts to be cleaned should be disassembled and cleaned thoroughly before new lubricants are applied. It is recommended that cleaning be limited to portions of the mechanism that can be disassembled, cleaned, inspected, lubricated, and reassembled.

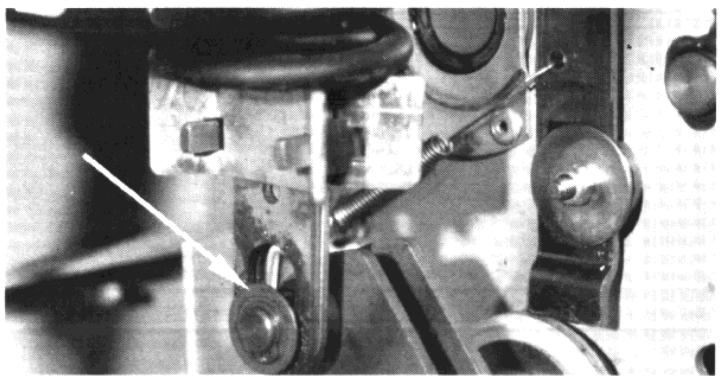
Avoid any cleaning process which consists of projecting an insulating solvent under high pressure. These type processes could destroy the lubrication at inaccessible pivot points that cannot be relubricated. Therefore, Square D Company cannot guarantee any equipment which has undergone this kind of cleaning; even if followed by lubrication.

Field lubrication consists of adding lubricants without cleaning in most instances. Below is a list of cleaning agents and lubricants required for preventive maintenance.

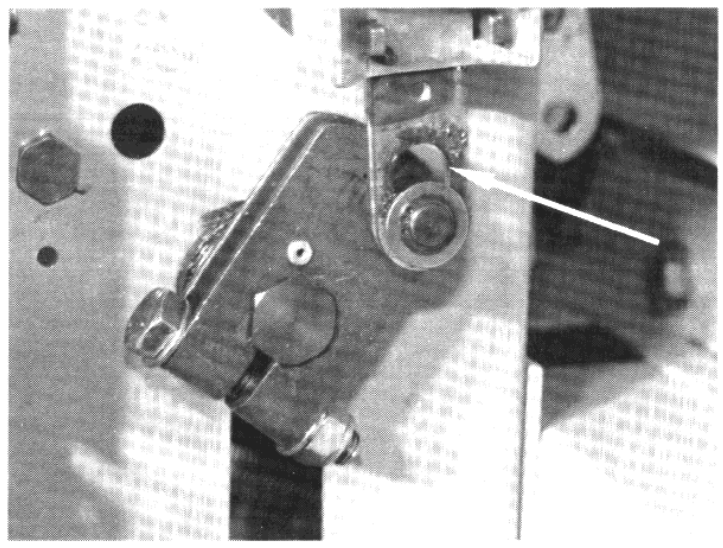
APPLICATIONS	ITEM
Cleaning	Non-flammable solvent
Lubricating pivot points & bearings	SAE 10W40 Oil
Lubricating spring guides & gears	Ball joint grease - Molybdenum Disulfide type



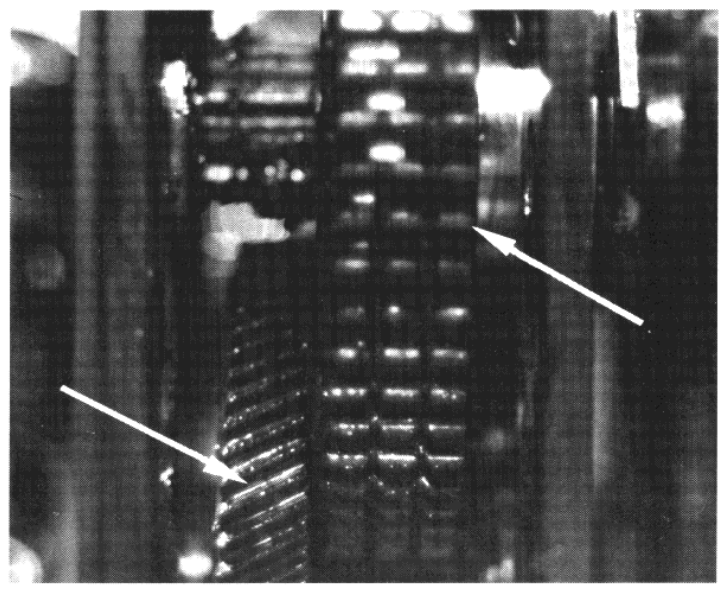
Step 1. Locate all mechanical bearing surfaces such as rotary shafts in bearings, or parts sliding in relation to each other. Apply sufficient amount of multi-grade oil in the most direct fashion available to assure that the oil gets applied to the surface to be lubricated. Operate the mechanism a few times and relubricate to improve the flow of lubricant. Wipe away excess lubricant making sure not to force dirt into lubricated areas.

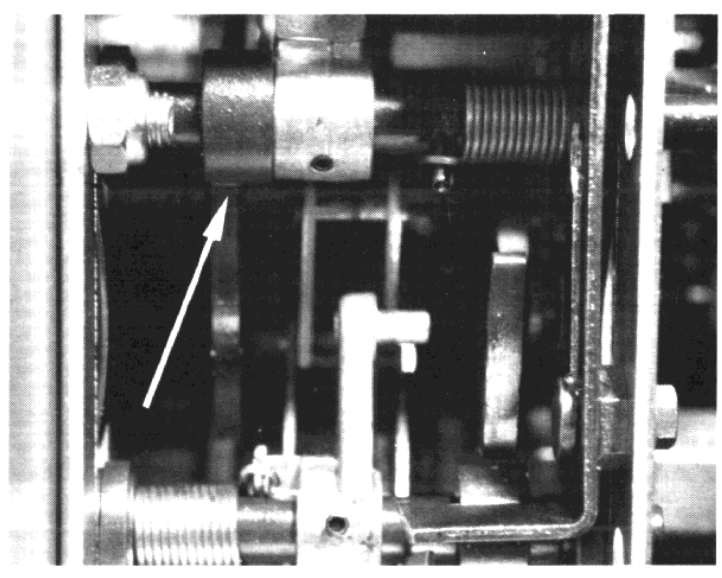


Step 2. Lubricate the opening and closing spring guides with molybdenum disulfide grease.



Step 3. Lubricate trip latch surfaces and gears using molybdenum disulfide grease.





VIII. PREVENTIVE MAINTENANCE (Cont.)

Contact Wear Measurement:

Required Tools: two 3/16″ dia. pin or bolt (approx. 3/4″ - 1″ long), test light or ohmmeter for testing continuity, needle nose pliers, 9/16″ wrench or 9/16″ socket & ratchet.

The total life of an interrupter is determined by a combination of interrupting current and number of operations, and is measured through contact erosion. The degree of contact erosion can be measured without dismantling the circuit breaker. SF6 gas keeps all of its dielectric characteristics after interrupting, thus the life of the interrupter is limited only by the amount of wear on the arcing contacts. The life of the interrupters can be predicted by use of the graph below showing the relationship between interrupter current and number of operations.

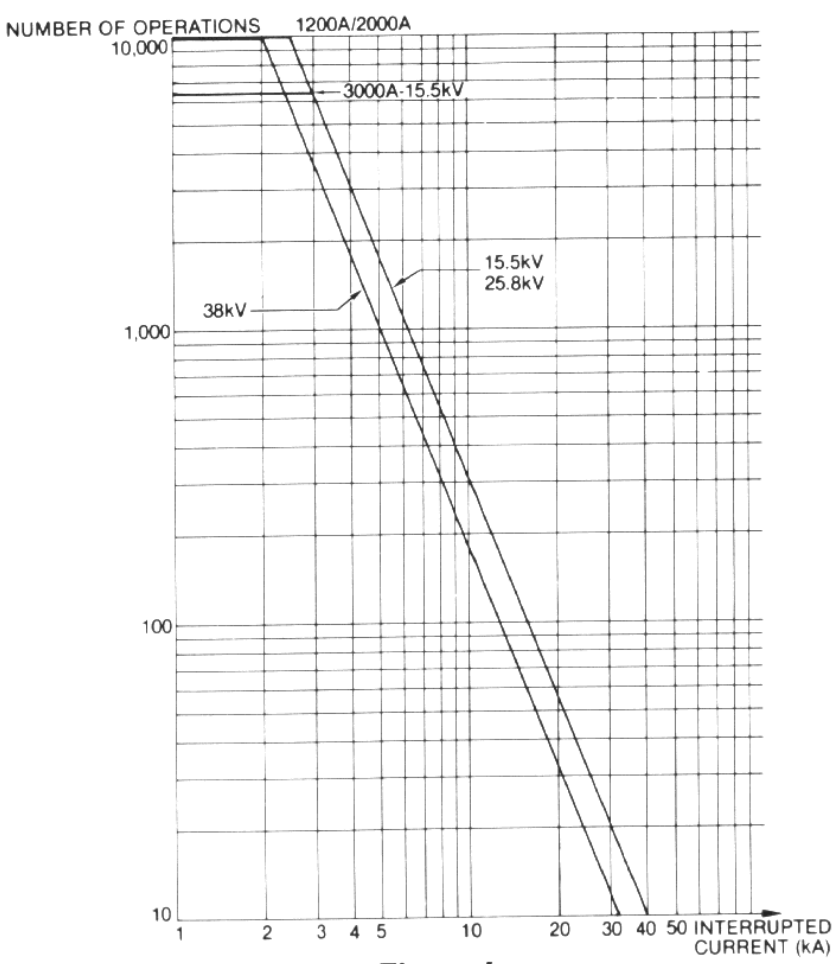
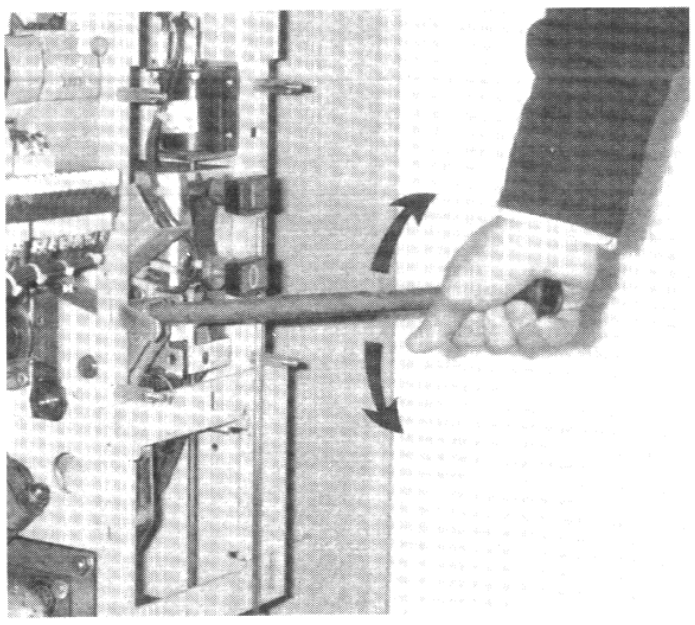


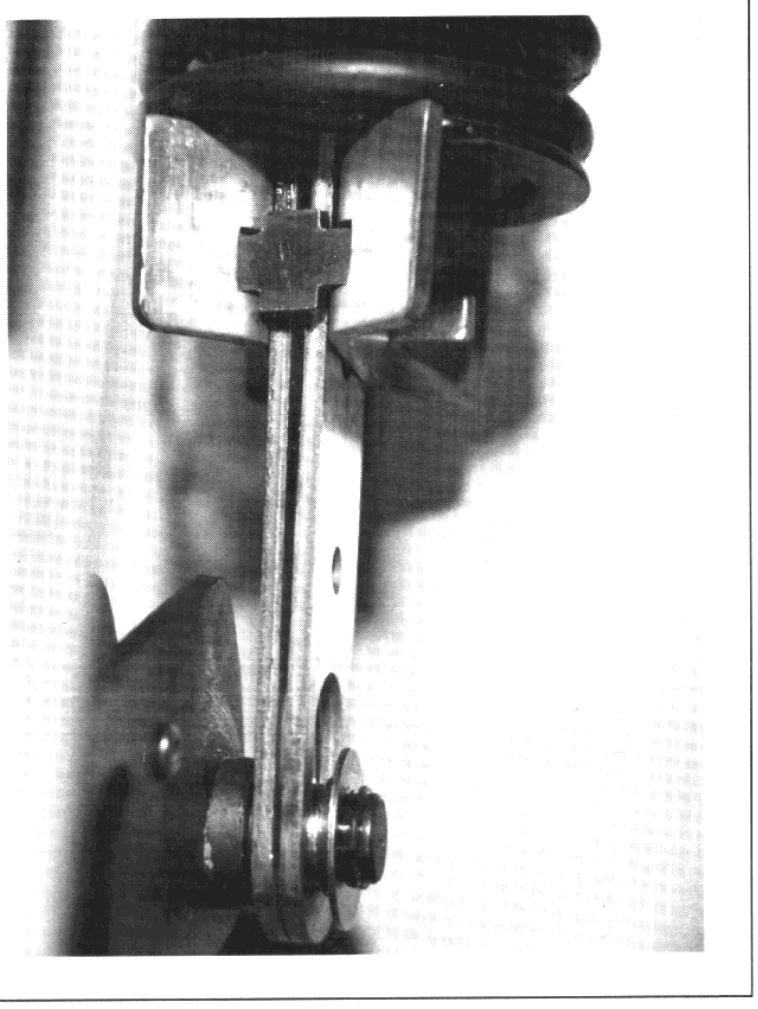
Figure 4
LIFE EXPECTANCY CURVE

Use the following procedure to measure contact wear.

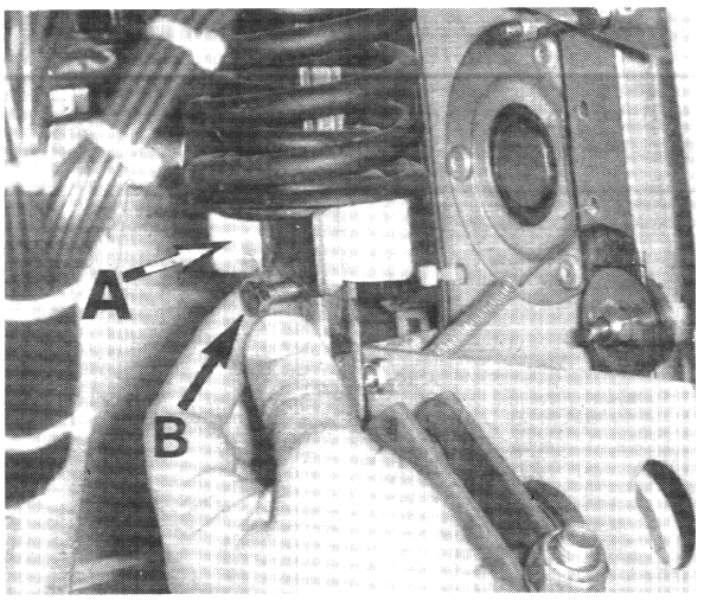
1. Remove the high voltage from the roof bushings and ground them. Disconnect all control power from the breaker. Make sure the breaker is open and the springs, both closing and opening, are discharged. If the springs are charged push the close button and then push the open button to be certain the mechanism springs are discharged and the breaker is open.
2. The closing springs on the front of the mechanism must be removed in order to perform the slow closing operation required to check the contacts of the interrupters.



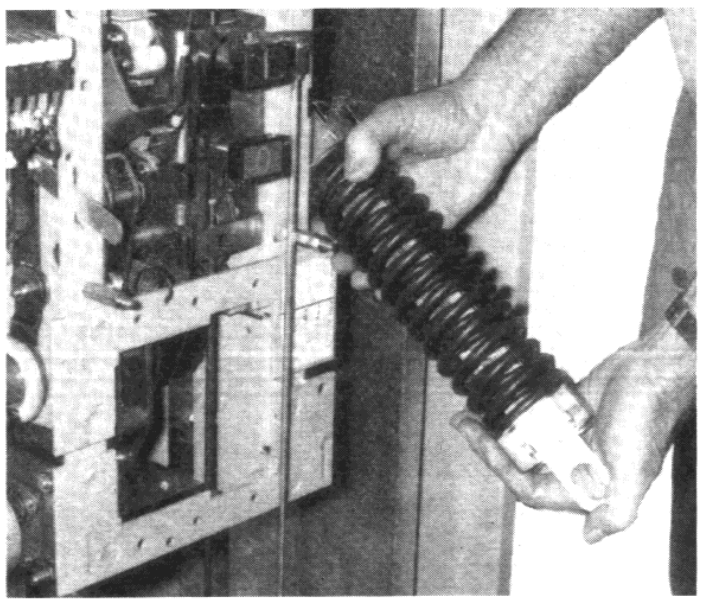
3. Insert the manual charging lever into the ratcheting mechanism slot and begin charging the closing springs, advance the ratchet mechanism one notch at a time. Notice how the spring assembly bars slide inside the springs as the ratchet is advanced.
4. Stop the charging motion at the point just before the edge of the bar is visible in the hole.



5. Carefully pull the charging lever just enough so the hole barely allows insertion of a 3/16″ dia. pin or bolt.

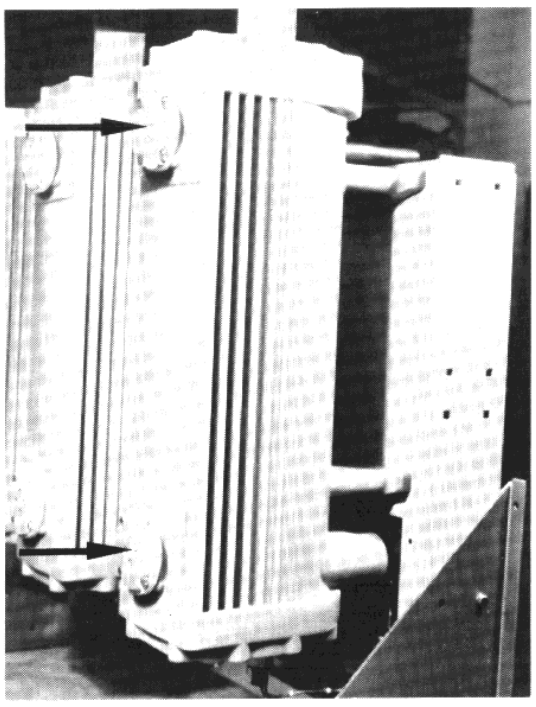


6. Continue to put a slight pressure on the charging handle, insert a 3/16″ dia. pin or bolt in the hole through the bars.
7. Do not advance the manual charging lever, allow it to return slowly. This should release the force of the springs to act against the inserted pin or bolt. If the spring force does not act against the pin when the charging lever is returned, remove the pin and completely recharge the springs, perform a close/open operation (as in step 1) and repeat steps 3-6. When performed correctly, the springs should be inoperative.
8. Detach and remove the springs by removing the snap ring from the crank end of the spring, and then slide the entire spring assembly toward the fixed end and slip the assembly over the pin. This must be performed on both the left and right closing springs. Note the position of washers and main pins so they can be placed in the same manner when reassembling.

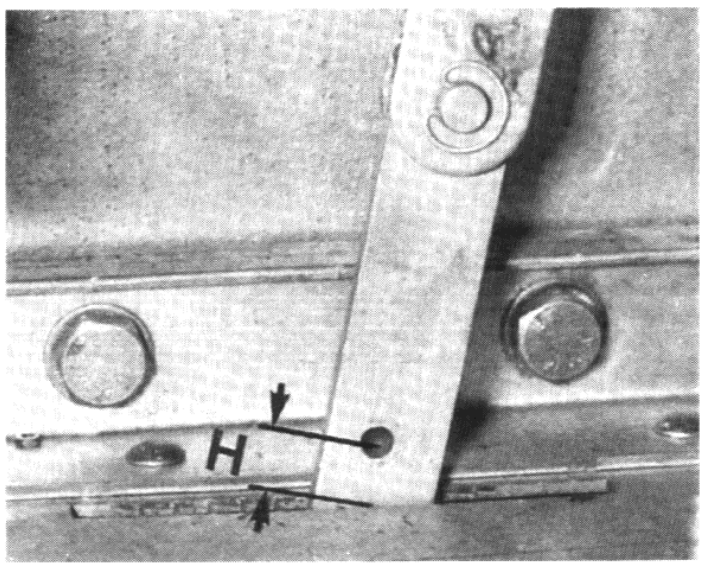


9. **CAUTION:** Once the two spring assemblies have been removed, do not drop or jar the blocking pins loose; springs will fly off.

10. Crank the mechanism manually until a click is heard and the manual charging handle becomes inoperative.



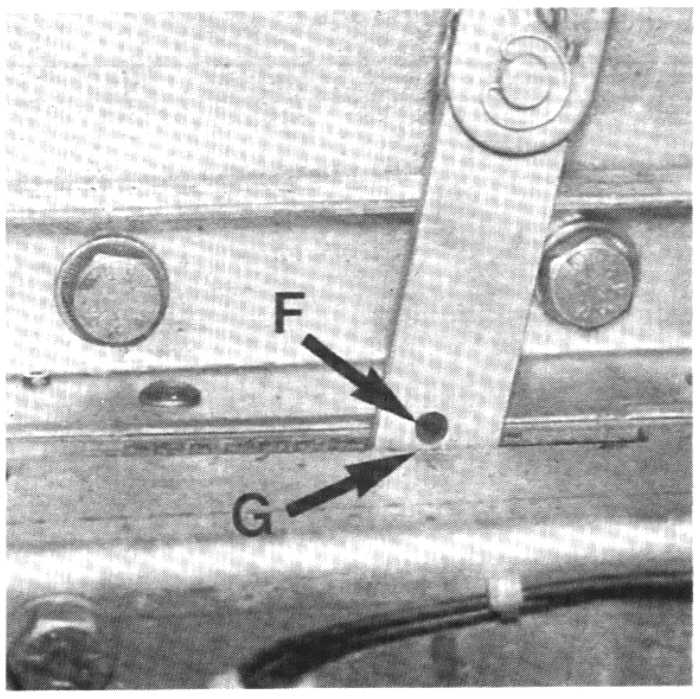
11. Attach a test light or ohmmeter between the two terminals of each interrupter to check the contact "make" point of each interrupter.
12. Push and hold the close button in and begin slow closing the breaker by operating the charging handle.
13. Slowly continue cranking the mechanism, check for the contact "make" point of the interrupter.
14. This operation may be repeated to insure that the "make" position has been reached without overclosing. Uneven arcing contact wear may require additional measurements made at each of two or three positions where arcing contact "make" is determined.



15. For new interrupters "H" measures .41 inches (10.5mm). (See above photo).

CONTINUED

VIII. PREVENTIVE MAINTENANCE (Cont.)



16. If the bottom edge of the red dot (marked "F") is at or below the top of the frame (marked "G"), the arcing contacts are worn out, all three interrupters must be replaced (no adjustment exists).

    Note: If interrupter replacements are required, it will be necessary to remove the breaker from the cubicle. Contact Square D Co. for further instructions if this becomes necessary.

Replace Closing Springs

1. After the contacts have been checked for each bottle and all are performing acceptably, crank the mechanism to slow close the breaker until a click is heard.
2. Push the open pushbutton to open the breaker.
3. Replace the closing springs on the mechanism. Be sure that all washers and bushings are located in the same position.
4. After reinstalling the springs, manually charge the mechanism slightly until the pins (inserted in step #6) can be removed.
5. Fully charge the mechanism manually, close and trip the breaker to ensure proper mechanical operation. The breaker should now be ready for reenergization.

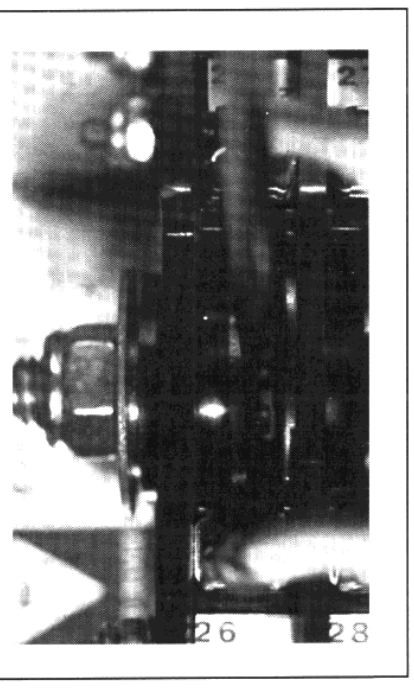
IX. CORRECTIVE MAINTENANCE

Auxiliary Contact Adjustment

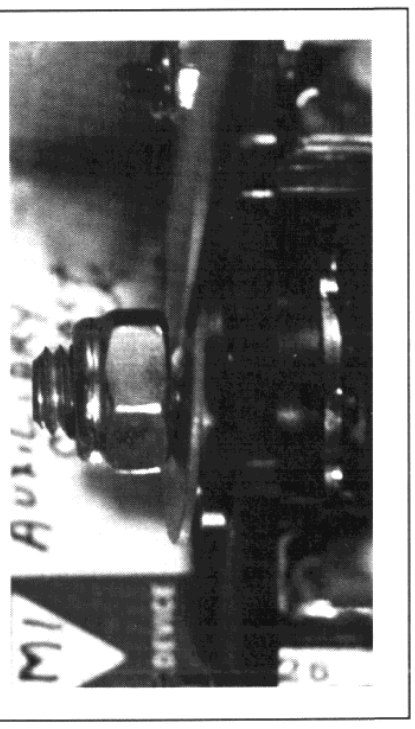
New parts required: none
Required tools: 8mm open end wrench, 13mm wrench, thin bladed screwdriver

As standard, FG-4 breakers are equipped with twelve auxiliary switches. Unless specified otherwise, the twelve auxiliary switches are arranged as five normally open "a" contact and seven normally closed "b" contacts. The contacts are field convertible as follows:

1. Note the position of each cam with the breaker closed and opened. A pencil sketch is recommended.
2. Open or close the breaker to position the cam, to be adjusted, in the open position.
3. Hold the square end of the shaft using an 8mm open end wrench.
4. Using a 13mm wrench, loosen the locknut on the opposite end of the shaft one or two turns.
5. Insert a thin bladed screwdriver between the metal cam and the notched ring of the contact to be adjusted to separate and release the indentation in the metal cam from the notched ring.



6. The cam is now free to turn. Rotate the cam to the new position.
7. Insert the screwdriver between the nut and washer at the end of the block to reclose the gap between the metal cam and the notched ring. The cam may need to be moved slightly to align the indentation and the notch.



8. Retighten the 13mm locknut taking care that all of the other cams are in their original position and all the cam indentations are properly seated in their respective notches.
9. Operate the breaker to assure that the adjustment accomplished the purpose intended, and that all other cams operate as before.

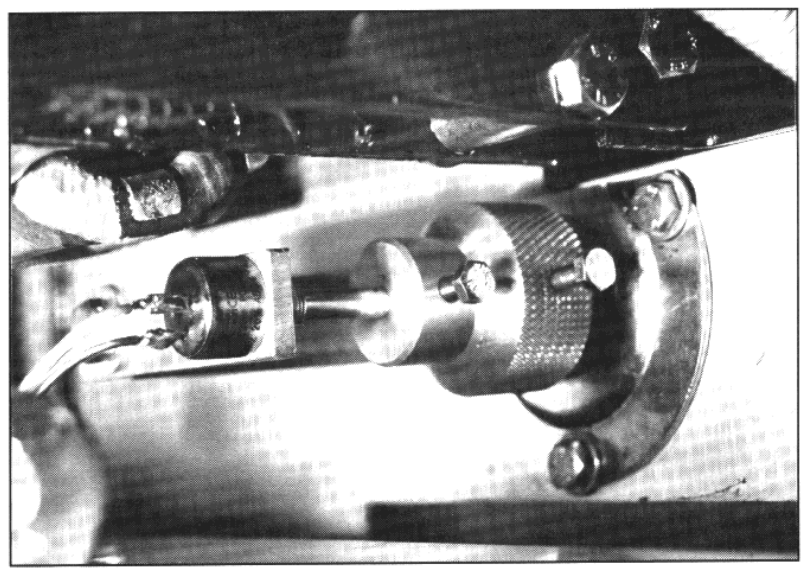
Motion Analysis

A potentiometer assembly (as shown at right) is available from Square D Co. for measuring opening and closing speeds. This assembly is used in conjunction with a Doble motion analyzer. Contact Square D for full instructions if needed.

Operating parameters as measured by motion analysis equipment should be as follows:

Closing	60-90 msec.
Opening	45-65 msec.
Closing Speed	7.25-8.5 ft/sec.
Opening Speed	8.5-9.5 ft/sec.

The velocities are measured at the point of contact make or break. The operating times and velocities should remain within the above range for the life of the breaker. No adjustments should be necessary. Any deviations should be checked by qualified personnel.



TROUBLESHOOTING GUIDE

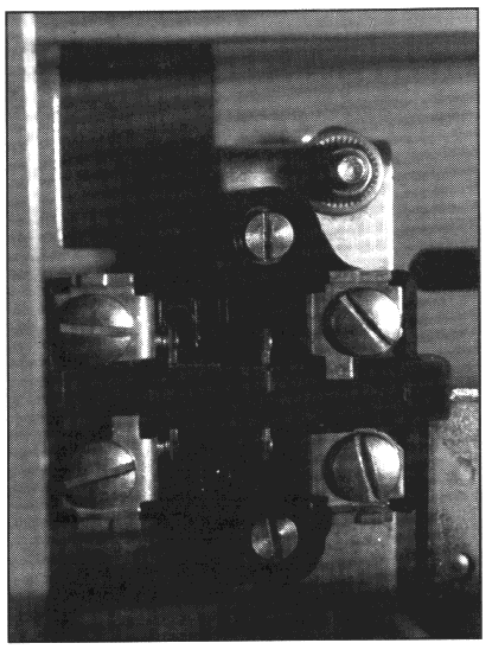
These instructions allow shutdown periods to be kept to a minimum. If the suggested remedies fail to solve the problem, refer to the factory.

PROBLEM	POSSIBLE CAUSE	PROBABLE REASON & REMEDY
Mechanism does not charge automatically	Electrical charging motor	Voltage across motor terminals too low • Correct the voltage • Replace the motor if necessary
	End of charging switch	• Check condition of switch • Replace switch if necessary
	Wiring	• Check connections of auxiliary circuits
Breaker will not close (indicator remains green)	Closing solenoid	Bad Connection • Check circuit Defective solenoid • Replace the solenoid
	End of charging switch	• Check condition of switch • Replace the switch if necessary
	Latch sub-assembly mechanism	Close Interlock out of position • Clean and oil Interlock Hinge Shaft
	Charging rachet system	Mechanism isn't getting charged • Change the mechanism
Breaker closes and opens immediately and remains open on subsequent attempt to close.	Continuous trip signal applied	Fault in the HV main circuit or protective relays adjusted incorrectly • Eliminate the fault • Adjust protective relay
Breaker opens and closes alternately	Anti-pump relay	• Replace the relay
Breaker cannot be opened electrically	Auxiliary switch	• Check circuit
	Trip solenoid	Trip control power connections • Check the circuit Defective solenoid • Replace the solenoid • Check protective circuit

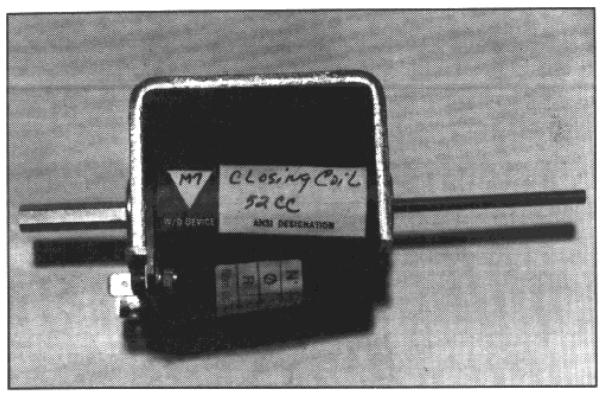
REPLACEMENT PARTS

Device	Voltage	Part No.
Spring Charging Motor	24 VDC	886657
	48 VDC	886658
	125 VDC	886661
	250 VDC	886662
	120 VAC	886661
	240 VAC	886662
Closing Solenoid	24 VDC	887 191AM
	48 VDC	887 191AJ
	125 VDC	887 191AE
	250 VDC	887 191AB
	120 VAC	887 191AF
	240 VAC	887 191AB
Trip Solenoid	24 VDC	887 191BN
	48 VDC	887 191BL
	125 VDC	887 191BF
	250 VDC	887 191BC
	120 VAC	887 191BF
	240 VAC	887 191BB
	125 VDC 3AMP	887 191BJ
Anti-Pump Relay	24 VDC	8501KFD12 24 VDC
	48 VDC	KUP11D55 48 VDC
	125 VDC	8501KFD12 110V
	250 VDC	8501KFD12 110V + 26160-21660
	120 VAC	8501KF12 120/60
	240 VAC	KUMP11A58 240 VAC
Bushing	15 kV 1200A	44081-311-01
	2000A	44080-099-06
	3000A	44080-099-04
	38 kV 1200A	44081-312-01
	2000A	44080-099-05
Interrupter		730992B
End of Charging Switch		44080-588-01
Latch Mechanism Sub-Assembly		9011045F1
Auxiliary Switches		5 contacts 44065-038-50 12 contacts 44065-038-52
Bushing Gasket	15 kV 1200A	44081-313-01
	2000A	44081-313-01
	3000A	44081-313-02
	38 kV 1200A	44081-313-02
	2000A	46010-049-01
Motion Analyzer Adaptor Ass'y.		46010-078-50

REPLACEMENT PARTS

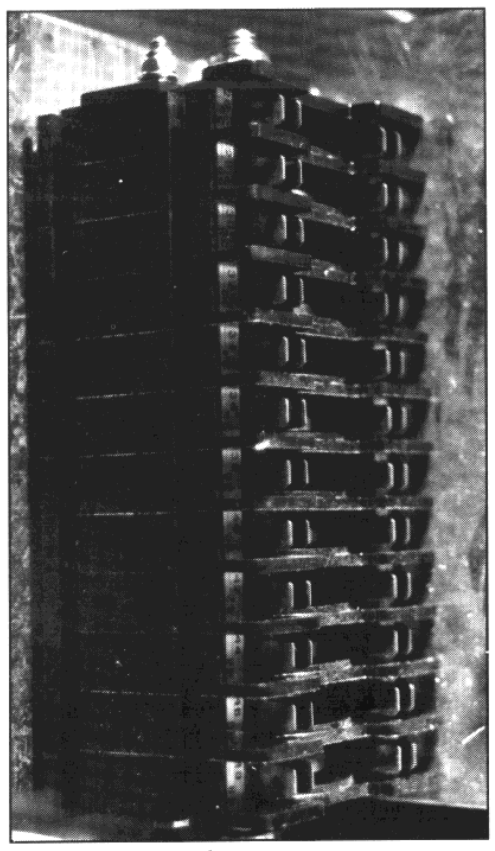


End of Charging Switch

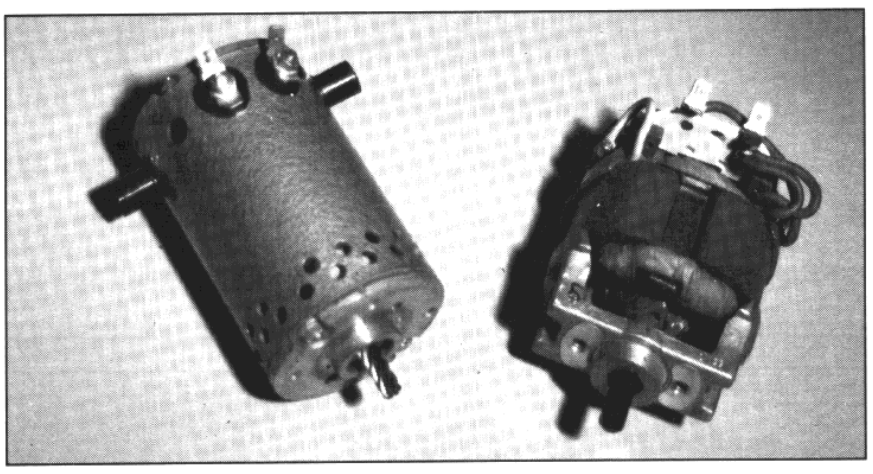


Closing Solenoid

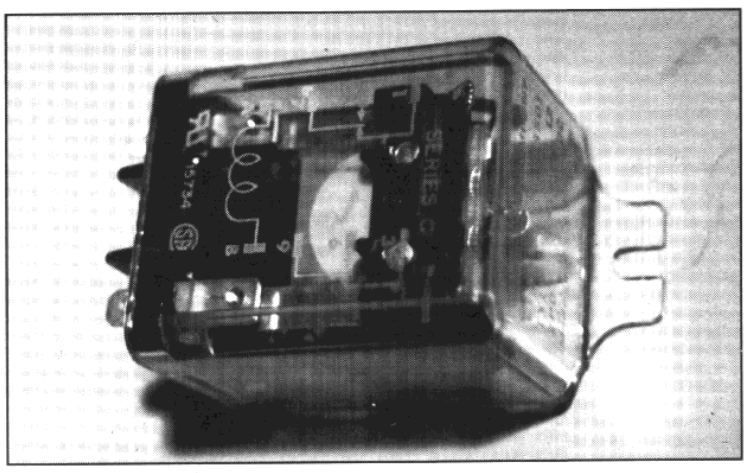
Trip Solenoid



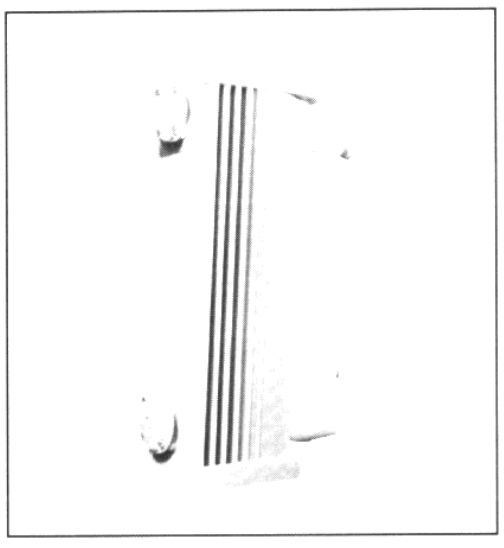
Auxiliary Switch



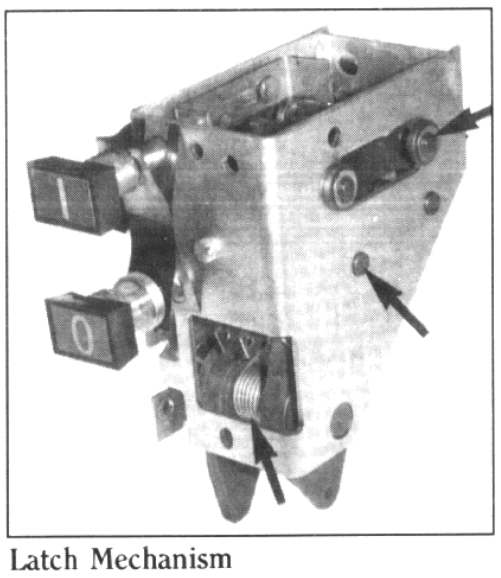
Charging Motor



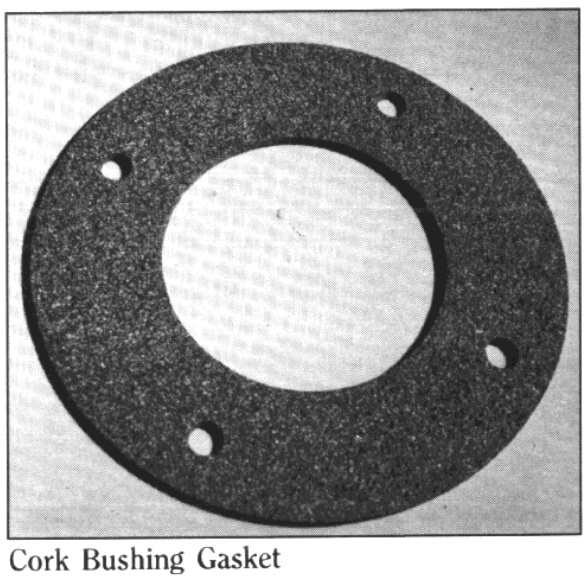
Anti-Pump Relay



Interrupters



Latch Mechanism



Cork Bushing Gasket

SQUARE D COMPANY
330 Weakley Road • Smyrna, TN 37167

Manual 6060-4

2M Litho 9/89

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