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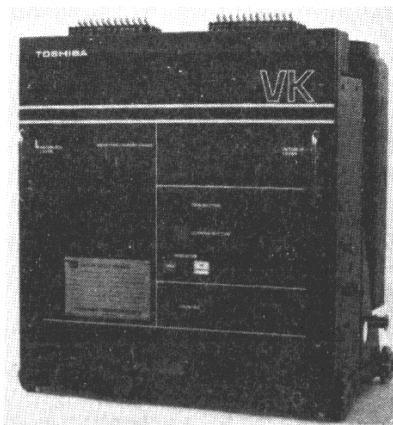


TOSHIBA

INSTRUCTIONS FOR

INSTALLATION, OPERATION AND MAINTENANCE
OF VACUUM CIRCUIT BREAKER

TYPE: VK-6M32 VK-10M25
VK-6P32 VK-10P25



TOSHIBA CORPORATION
TOKYO JAPAN

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1. Introduction

This instruction manual describes the method and procedures for unpacking, storage, maintenance and inspection and part replacement for VK vacuum circuit breaker of spring operation type.

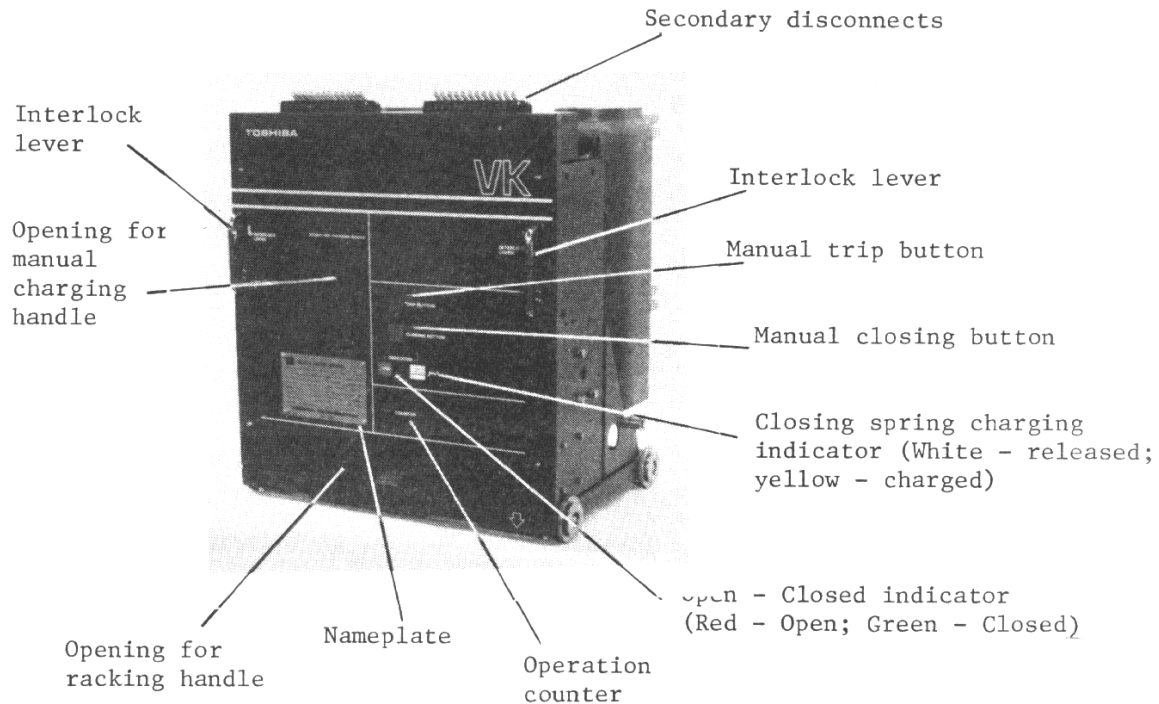


Fig. 1 External view of the type VK vacuum circuit breaker

2. Receiving and Storage

2-1 Receiving and Unpacking

- (1) The circuit breakers are each subjected to complete factory production tests before being wrapped in polyethylene sheet and packed.

- (2) To protect the breakers against any damage, do not lay it on its side or upside down. Upon receiving, please check for visible damage.
- (3) After unpacking, check the following points:
 - a) Check the accessories and spares, and also check that no parts are missing nor any damage sustained.
 - b) If there should be any part missing or damaged, immediately inform the nearest Toshiba representative.

2-2 Moving

When carrying the circuit breaker, suspend it as shown in Fig. 2.

NOTE: Use caution when lifting the breaker. The breaker, when lifted, will incline slightly backward as the center of gravity is located on the rear side (the main circuit terminal side).

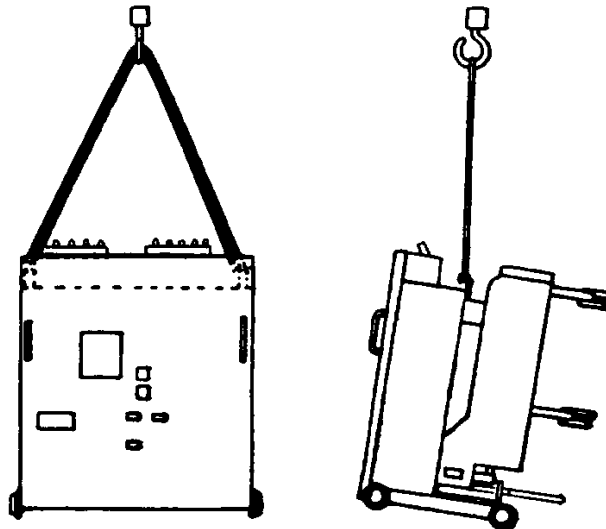


Fig. 2

2-3 Storage

If the circuit breaker will not be operated for a long period after being installed or if it will be stored for a long period before starting installation work, the following precautions should be taken.

- (1) Do not subject it to high moisture or sun rays.
- (2) Store it in a place free from corrosive gases and dust.
- (3) Be sure to put the dust cover over the breaker when storing it.

3. Outside View of Circuit Breaker and Items to be Checked

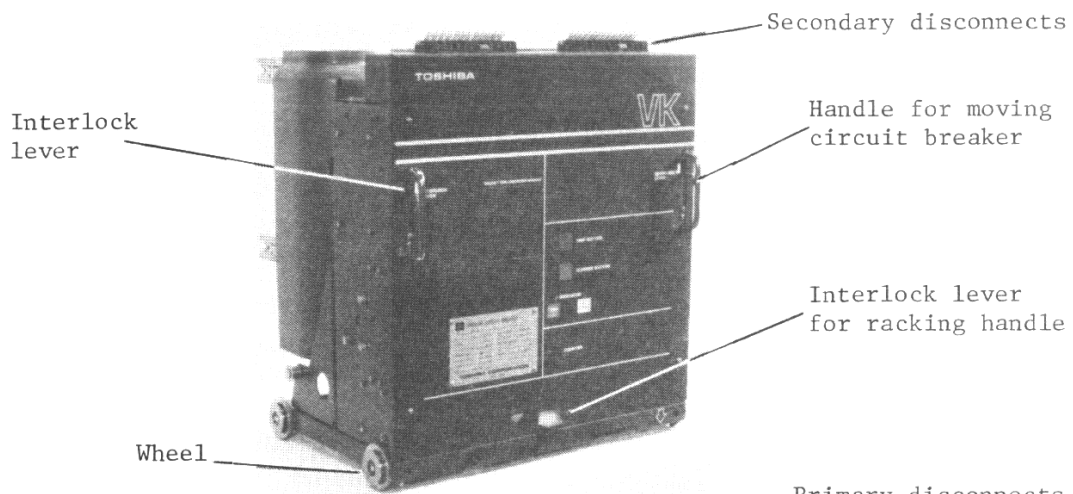


Fig. 3

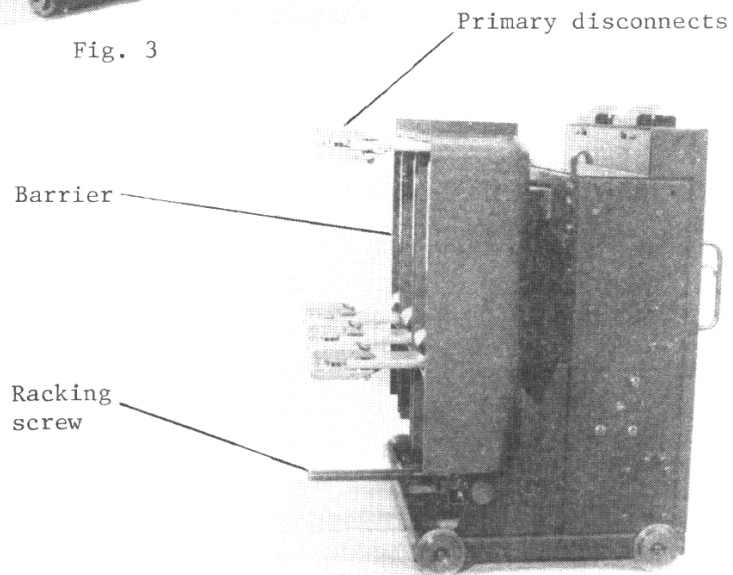


Fig. 4

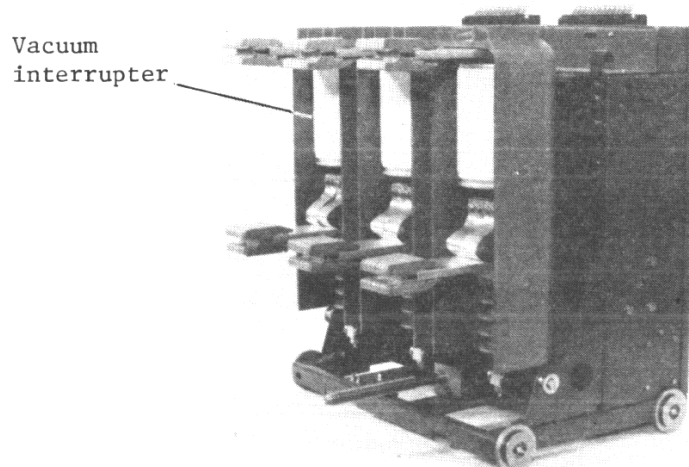


Fig. 5

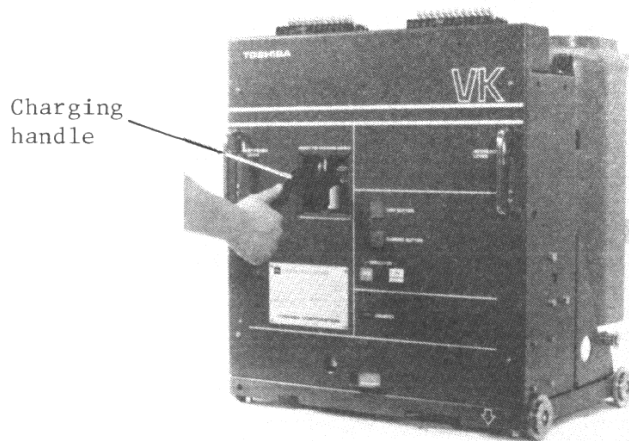
4. Operation

4-1 Manual Operation

4-1-1 Charging of Closing Spring

Insert the charging handle into the opening and move it up and down several times (usually 7 times) until a clicking sound is heard when the charge-discharged indicator will change its color from white to yellow. This is the position where the closing spring is charged.

NOTE: The number of times the handle must be operated depends on the angle of handle operation.



4-1-2 Closing Operation

Push the closing button and the circuit breaker will close. At this time the indicator reads "CLOSED" and the charging indicator turns white.

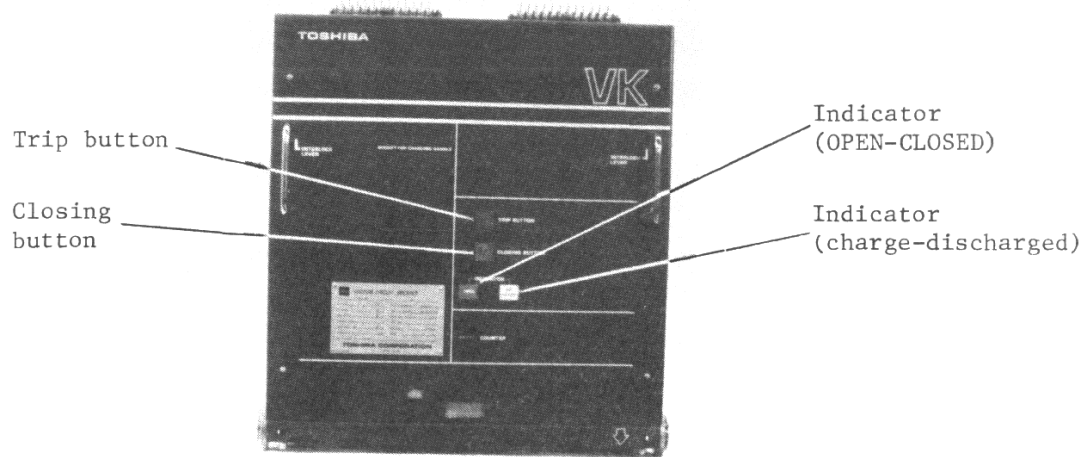


Fig. 7

4-1-3 Opening Operation

Push the trip button and the circuit breaker will open and the indicator will read "OPEN".

4-2 Electric Operation

Electric operation can be carried out at the test or connected position. When the circuit breaker is outside of cubicle, it can be operated electrically by jumper cable or test cabinet.

4-2-1 Charging of Closing Spring

Connect the control circuit of the circuit breaker and turn on the power switch and the motor will immediately start. When the spring is charged, the indicator turns from white to yellow and the motor.

4-2-2 Closing Operation

Turn on the closing switch and the closing coil will immediately be energized closing the circuit breaker. After the closure of the breaker, the motor runs until the spring is charged when the indicator will read "CLOSED" and the charge-discharged indicator will turn yellow.

4-2-3 Opening Operation

When the trip switch is turned to "OPEN" position, the trip coil will immediately be energized and the circuit breaker opened, with the indicator reading "OPEN".

5. Sequence of Operation of Circuit Breaker

5-1 Control Circuit (see Fig. 8)

- (1) Closing... Fig. 8 shows the condition in which the charging is completed. When in this condition the external operation switch CS (1) is turned to the "CLOSE" position, the circuit (IL)-b-LCS-Yb-Xb-CC energizes the closing coil instantly closing the circuit breaker (within about 60 msec).

As the circuit breaker closes, an auxiliary switch (b) deenergizes the closing coil and auxiliary relay Y is energized completing the anti-pumping circuit.

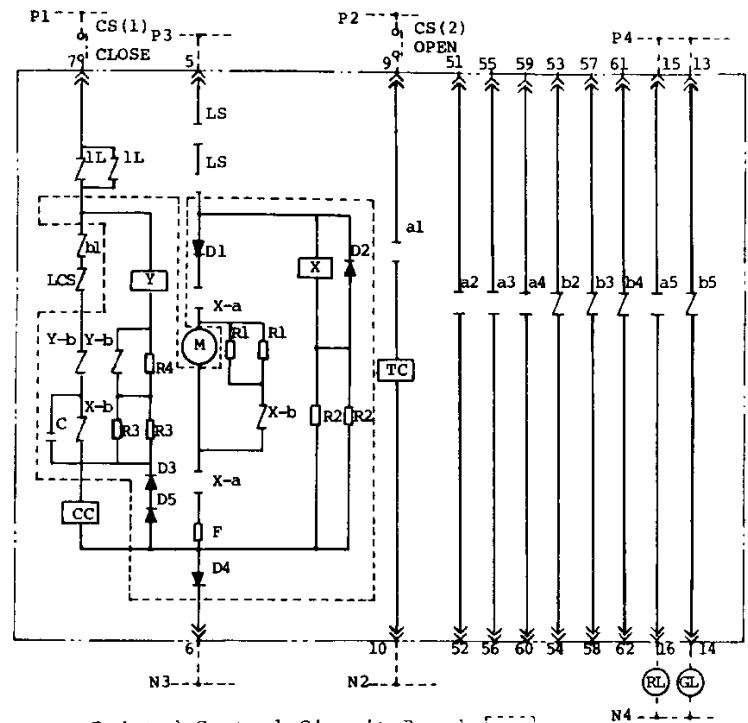
- (2) Charging.. At the same time that the circuit breaker is closed the microswitch LS closes, energizing the control relay X, which in turn charges the closing spring. With the control relay energized the circuit LS-LS-Xa-M-Xa-F causes the motor to run (for about 3.5 sec) until the closing spring is charged. The limit switch LS then opens, deenergizing the control relay X.

- (3) Tripping... The tripping of the breaker involves only the a-TC circuit. When the external operation switch CS (2) is turned to the "CLOSE" position, the trip coil is energized tripping the breaker in about 30 msec. With the breaker tripped, the auxiliary switch deenergizes the trip coil.

NOTE: When the control circuit is energized, the spring will be charged immediately.

5-2 Operation of Mechanism (see Fig. 8, 9 and 10)

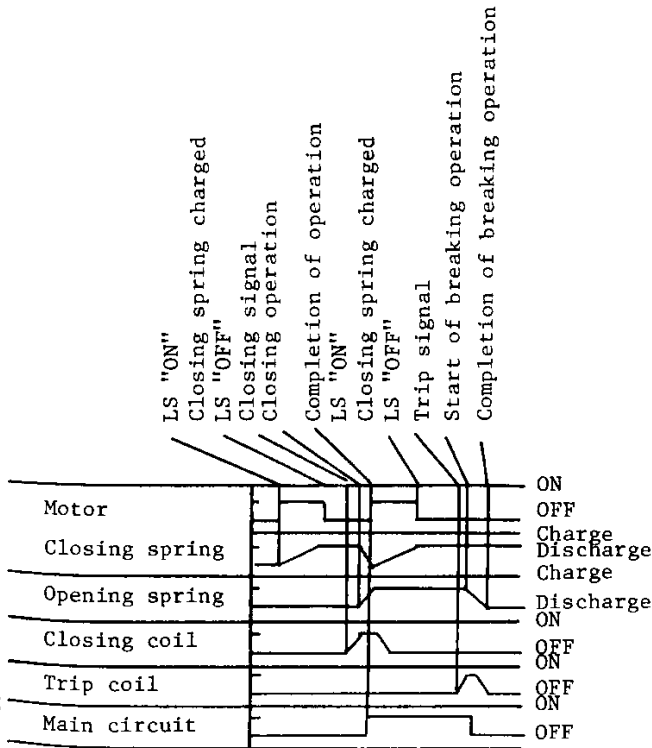
- (1) Closing.... The condition shown in Fig. 10(A) represents the condition where the breaker is open and the closing spring is charged (ready for closing). When in this condition the closing catch is driven by the closing button or the closing coil, the closing spring causes the cam to rotate at fast speed into the condition shown in Fig. 10(B) in which the breaker is closed.
- (2) Charging... From the CLOSED condition of Fig. 10(B) only the closing cam is rotated by the motor, with the breaker kept closed, until the roller on the cam engages with the catch.
- (3) Tripping... When the trip shaft is driven by a trip button or a trip coil, all the links return to the original OPEN condition shown in Fig. 10(A).
- (4) Trip free.. When the trip catch is driven the link will come to the trip free condition shown in Fig. 10(C). When the charging operation is completed the link will assume the OPEN condition.



Printed Control Circuit Board []

Fig. 8

(Ex. 125V DC Operation)



SYMBOLS	DESCRIPTION
Y	Auxiliary Relay
Yb	"b"Contact of Auxiliary Relay
X	Control Relay
Xa	"a"Contact of Control Relay
Xb	"b"Contact of Control Relay
CC	Closing Coil
TC	Trip Coil
a	Auxiliary Contact "a"
b	Auxiliary Contact "b"
M	Motor
LS	Limit Switch
D	Diode
R	Resistor
IL	Interlock Switch
C	Capacitor
F	Fuse
LCS	Latch Checking Switch

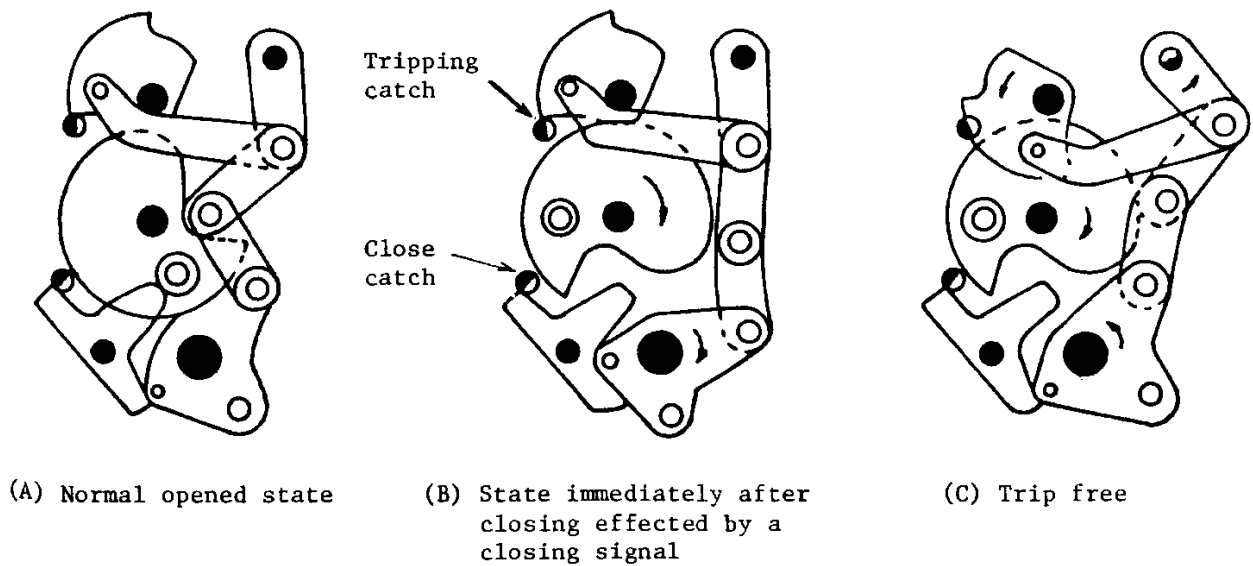
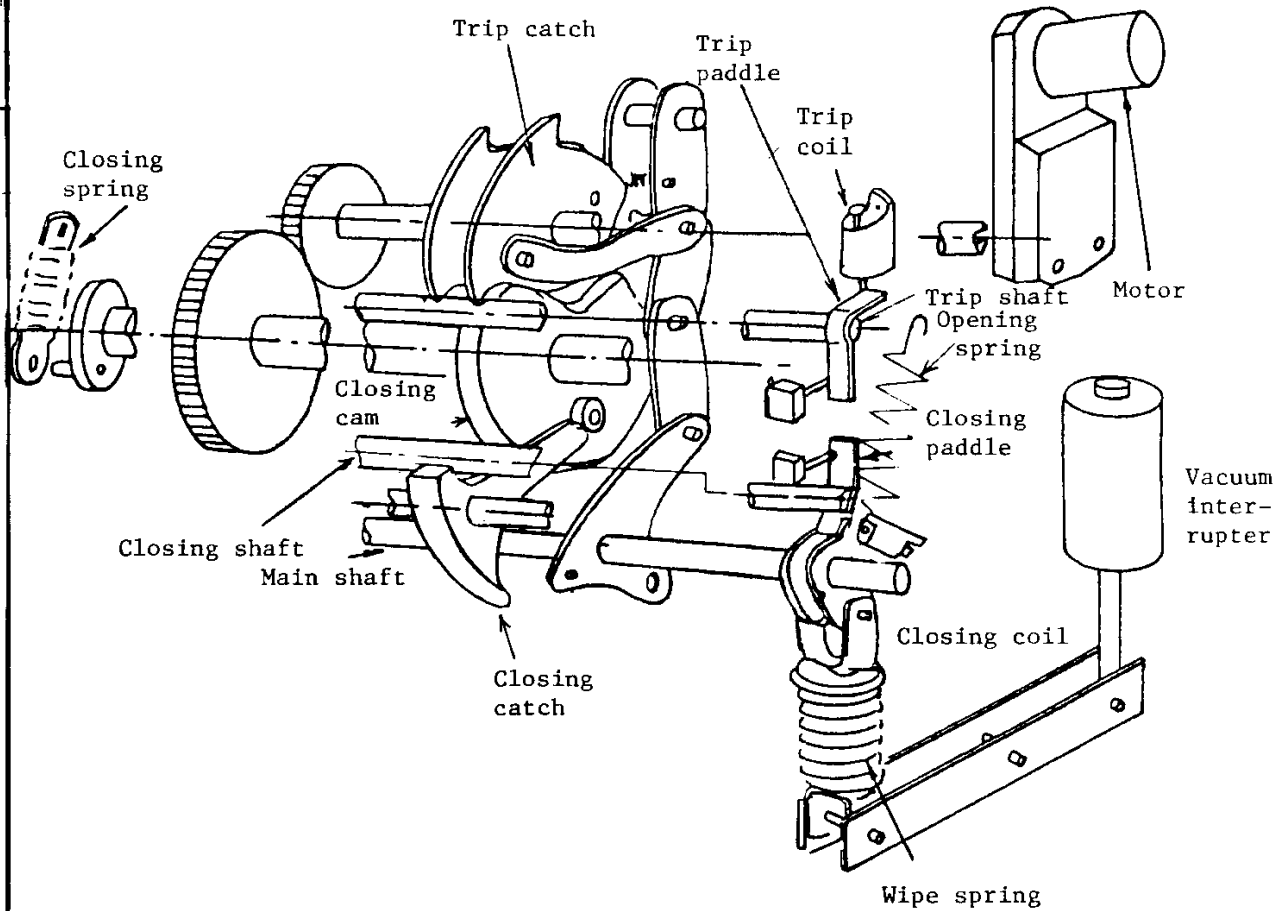


Fig. 10 Operation of Mechanism

6. Procedure for Moving Circuit Breaker in Cubicle

This circuit breaker has the following interlocks.

- (1) With the closing spring charged, the circuit breaker cannot be moved into or out of the cubicle.
- (2) With the breaker closed, it cannot be moved between the connected and disconnected positions and neither can be moved into or out of the cubicle.

Between the disconnected position and the test position, move the circuit breaker by hands. And between the test position and the connected position, move it by using the racking handle.

The interlock lever for racking handle is linked with the interlock levers at the upper left and right. When a racking handle is used to move the circuit breaker, lift the interlock lever for racking handle as shown in Fig. 11 and the opening for the racking handle will be opened and the upper interlock levers on both sides will be moved up. In moving the breaker in the cubicle, follow the procedure shown below.



Fig. 11

6-1 Procedure 1 : Moving between disconnected position and test position

In moving the circuit breaker between the disconnected position and the test position, lift the interlock levers on each side as shown in Fig. 12 and hold the grips to move the breaker. When you release the interlock levers at the predetermined position, make sure that the interlock levers drop completely.

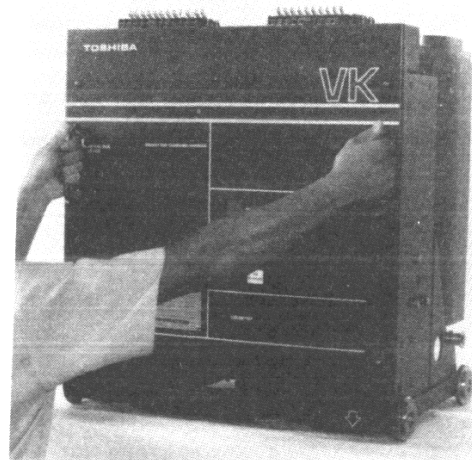


Fig. 12

6-2 Procedure 2 : Moving between test position and connected position

In moving the circuit breaker from the test position to the connected position, lift the interlock lever for racking handle and insert the racking handle, as shown in Fig. 13. Turn the handle clockwise and the breaker will move forward (see Fig. 14).

Stop rotating the racking handle when the arrow at the lower part of the breaker comes in line with the red line of the connected position indicating plate on the cubicle floor. Then remove the racking handle. At this time check that the side interlock levers have dropped completely.

Next when drawing out the breaker from the connected position, turn the racking handle counterclockwise to move it to the test position. Stop rotating the racking handle when the arrow at the lower part of the breaker is aligned with the red line of the disconnected position indicating line. Make sure that the interlock levers on both sides have dropped completely.

NOTE: When the circuit breaker is withdrawn from the cell, push the closing button first and then push the trip button to release the closing/opening springs at disconnected position.

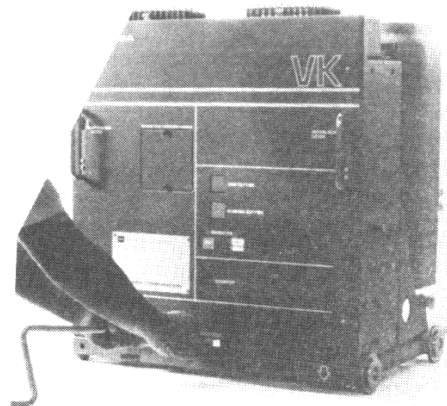


Fig. 13

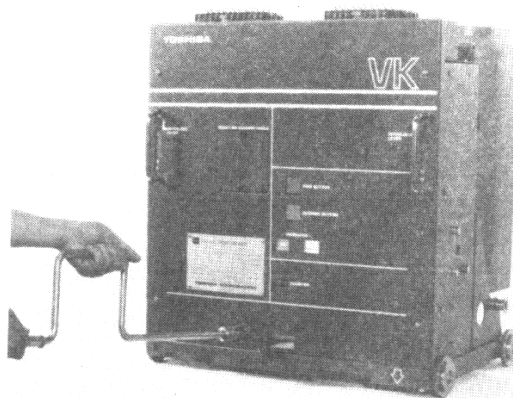
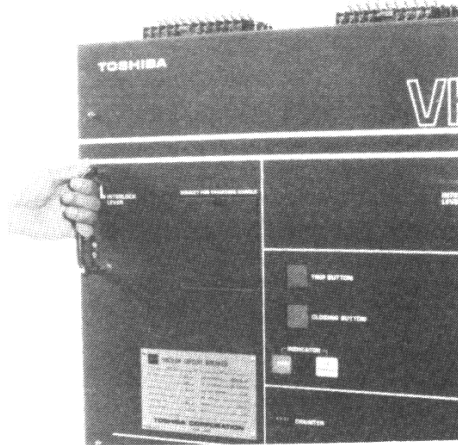


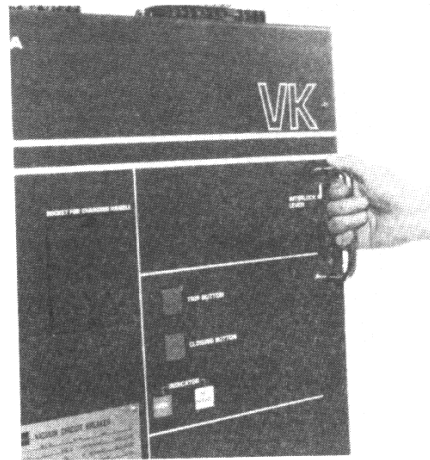
Fig. 14

7. Interlock Structure



Interlock lever on the
left side

Fig. 15



Interlock lever on the
right side

Fig. 16

Interlock lever

- (1) The interlock lever on the right side cannot be lifted when the circuit breaker is closed. Before lifting the levers, check that the indicator is green (open).
- (2) When the interlock levers are lifted, the closing action is blocked both electrically and mechanically.

NOTE: When the circuit breaker is set at the operating position, check that the interlock levers are down. As shown in Fig. 17, with the interlock levers up, the microswitch is off, thus electrically blocking the breaker from being closed.

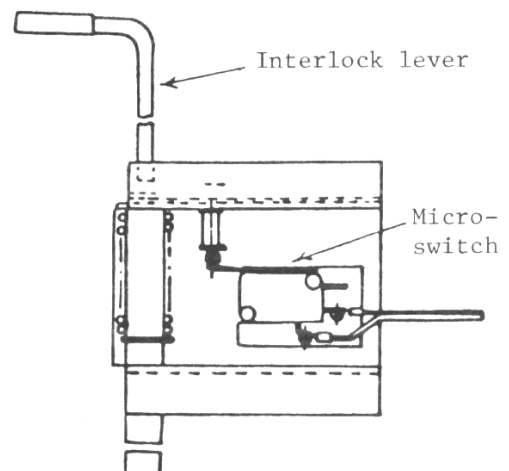


Fig. 17

8. Self Coupling Type Secondary Disconnects

Self coupling type secondary disconnects are mounted on the top of the circuit breaker. The control circuit is completely connected when the circuit breaker is in the connected or test position. To ensure smooth connection of the self coupling contacts, apply B7 grease to the contacts before inserting the circuit breaker into the cubicle.

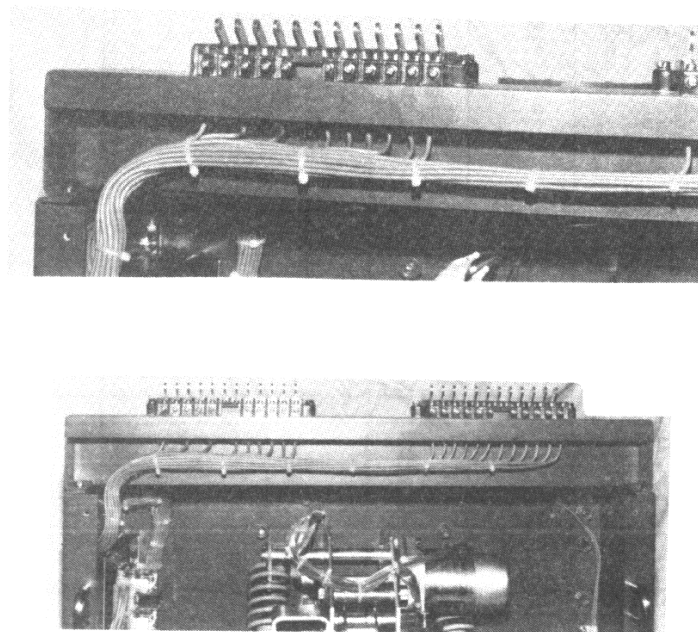


Fig. 18

9. Maintenance and Inspection

9-1 Check Points for Periodical Inspection (Check should be done one year after purchase and thereafter every 3 years)

No.	Check point	Check item	Check method	Criteria	What to do	Remarks
1	Entire circuit breaker	Tightness of hardware	By tightening them with screw driver and wrench	There should be no loose fastenings.	Retighten loose fastenings.	
		Dust and foreign matter	Visual check	The breaker shall be clean and contain no foreign matter.	Clean by pressure air. Wipe with a clean dry cloth.	
		Deformation, excessive wear and damage	Visual check	There should be no deformation, excessive wear or damage.	Remove cause and replace parts.	
		Lost or missing parts	Visual check	There should be no missing parts.	Reinstate to the normal condition.	
2	Operation mechanism	Dust and foreign matter	Visual check	There should be no dust and foreign matter.	Remove foreign matter by pressure air.	
		Smooth operation	Manual operation	Operation shall be smooth.		
		Lubrication of bearing pins	Check by sight and feel			
		Shaft of closing and tripping portion	Visual check	Must rotate smoothly	Supply a small amount of oil.	

(Continued)

No.	Check point	Check item	Check method	Criteria	What to do	Remarks
3	Vacuum interrupter	Contact wear	Visual check	Wipe length shall be more than 2mm in the breaker closed state.	If the red marking is not visible, replace the vacuum interrupter.	Fig. 36 f Fig. 49
		Vacuum pressure	See section 9-2.		Replace when vacuum pressure is not sufficient.	Fig. 36 f Fig. 49
		Number of open-close operation	Counter	When the counter reading reaches 10,000 (for the rated current interruption), check the internal pressure. The next check shall be done at the reading of 15,000. But be sure to replace the vacuum interrupter when the counter reading reaches 20,000. For the method of checking the vacuum pressure, see section 9-2.	Replace the vacuum interrupter if the internal pressure is not sufficient or when the counter reading reaches 20,000.	
4	Auxiliary switch	Terminals Case and contacts	Tighten by screw driver Visual check	There should be no loose screws. There should be no damage nor deformation.	Retighten Replace when damaged.	Fig. 22 f Fig. 26 f Fig. 28

(Continued)

No.	Check point	Check item	Check method	Criteria	What to do	Remarks
5	Main circuit disconnects	Discoloration of contact surfaces by heat	Visual check	There should be a thin film of Toshiba B7 grease on the contact surface. There must be no discoloration.	If the contact surface has no grease on it, apply a small amount of grease. Replace if the contact is discolored.	Fig. 4
6	Control circuit	Closing and tripping by electricity	Check at the test position (or the disconnected position).	The closing and tripping operations can be done smoothly.	Check circuits and the closing and tripping devices, also check the limit switches.	When the spring charging by motor cannot be completed, check if the fuse is blown. (Replace it if blown)
7	Control circuit disconnects	Insulating portion Contact surface	Visual check Visual check	There should be no damage. There should be a thin film of Toshiba B7 grease on the contact surface.	Replace if there is any damage. If the contact surface has no grease on it, apply a small amount of grease.	Fig. 18

(Continued)

No.	Check point	Check item	Check method	Criteria	What to do	Remarks													
8	Barrier (Bacuum interrupter support)		Visual check	There should be no dust and foreign matter. There should be no cracks or damages.	Clean by pressure air and then wipe with a clean cloth. Replace when cracked or damaged.	Fig. 4													
9	Measurement of insulation resistance	<table><tr><th>Measuring location</th><th>Insulation resistance</th><th>Megger</th></tr><tr><td>Main conductor-Ground</td><td>500MΩ or more</td><td>1000 V</td></tr><tr><td>Control circuit-Ground</td><td>2MΩ or more</td><td>500 V</td></tr><tr><td>Between main circuit terminals</td><td>100MΩ or more</td><td>1000 V</td></tr></table>			Measuring location	Insulation resistance	Megger	Main conductor-Ground	500M Ω or more	1000 V	Control circuit-Ground	2M Ω or more	500 V	Between main circuit terminals	100M Ω or more	1000 V	When the insulation resistance between the main circuit terminals is low, clean the surface of the vacuum interrup- ter with a dry cloth and then take measurements again.		
Measuring location	Insulation resistance	Megger																	
Main conductor-Ground	500M Ω or more	1000 V																	
Control circuit-Ground	2M Ω or more	500 V																	
Between main circuit terminals	100M Ω or more	1000 V																	

9-2 Check on Vacuum

The relationship between the dielectric breakdown voltage and the vacuum internal pressure is shown below.

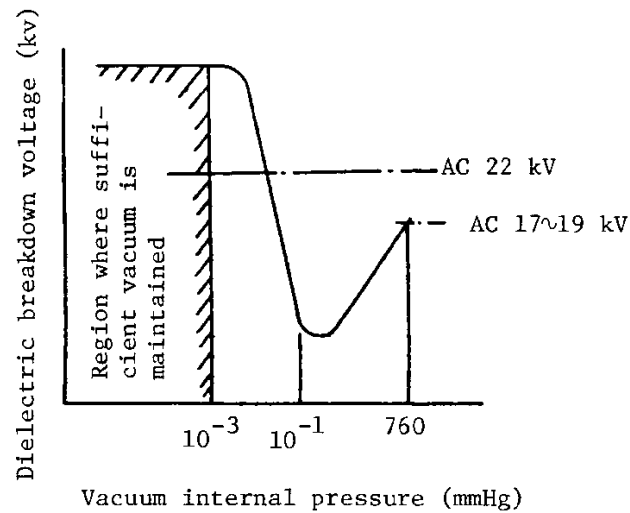


Fig. 19

Since the breakdown occurs in the vacuum interrupter when applied with a voltage of about AC 17 - 19 kV under atmospheric pressure, whether the interrupter maintains a high internal pressure can be checked by applying the voltage of AC 22 kV in this voltage withstand test.

When the internal pressure is not sufficiently high, there is almost no delay in the breakdown, so 10 seconds of voltage application duration is enough.

Measurement is taken with the vacuum circuit breaker open and the voltage applied between the terminals of the vacuum interrupter.

* As an option a compact vacuum checker (TYPE CI35-ID) is available, which enables a quick and easy check on the vacuum internal pressure.

(1) Example of voltage withstand test circuit

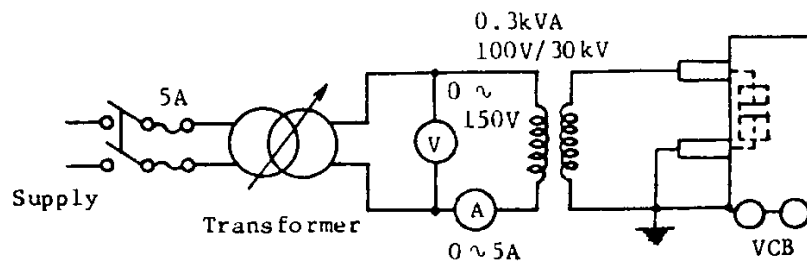


Fig. 20

(2) Method of applying voltage

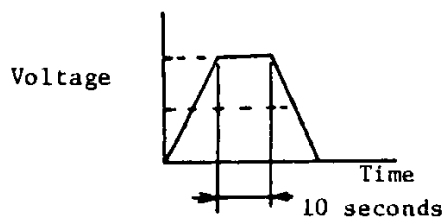
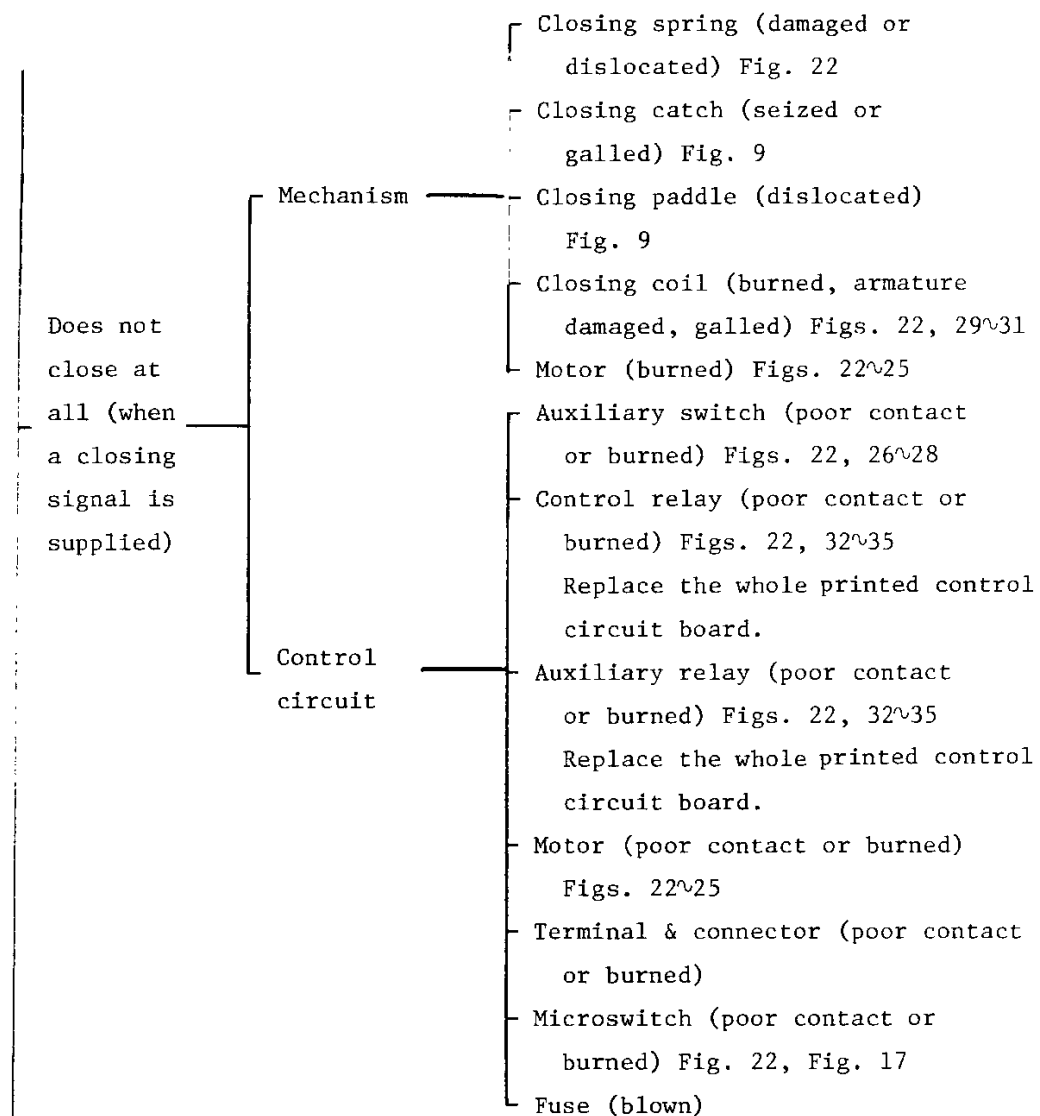


Fig. 21

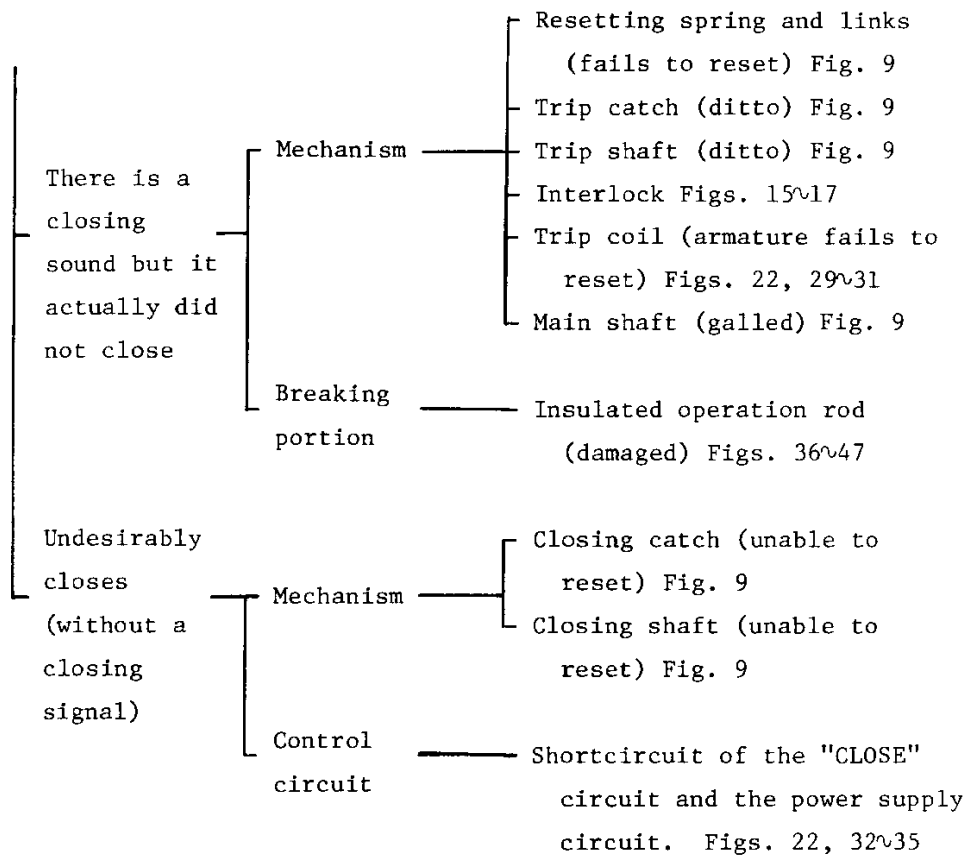
While the voltage is being increased, if the ammeter pointer shows the current flow, the voltage must be reduced to zero and then increased. Repeat this process two or three times. Those interrupters in which the current increases with the voltage are deemed defective; and those in which the current is kept almost zero are good.

9-3 Diagnosis of Troubles

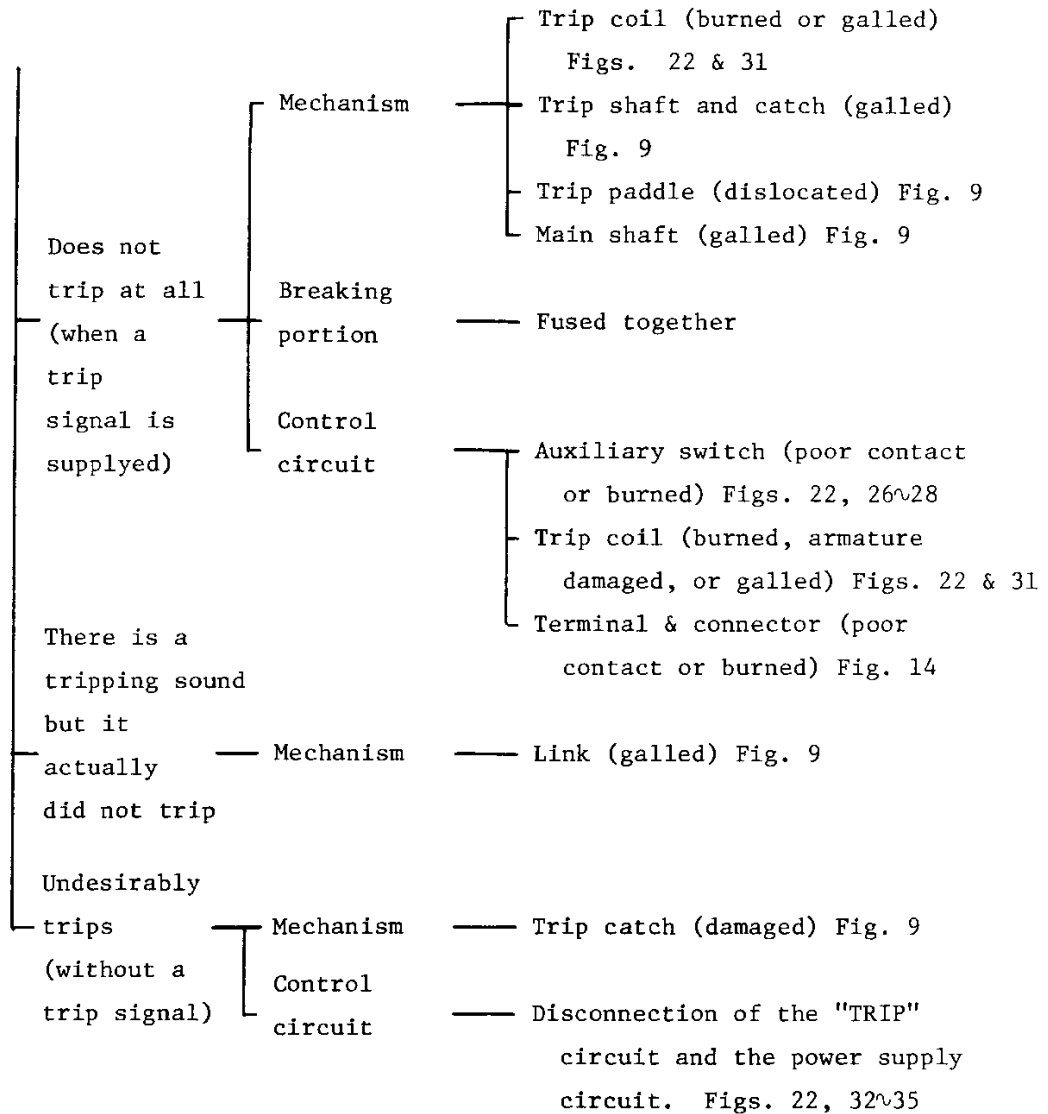
(1) Failure to close:



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next page



(2) Failure to trip:



10. Replacement of Parts

10-1 Location of Each Component Part

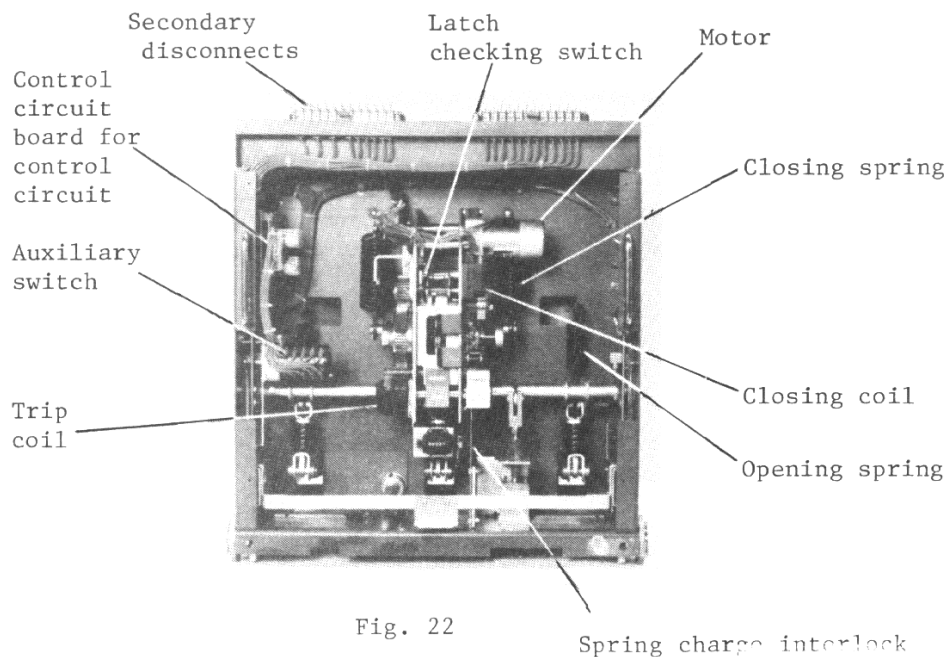
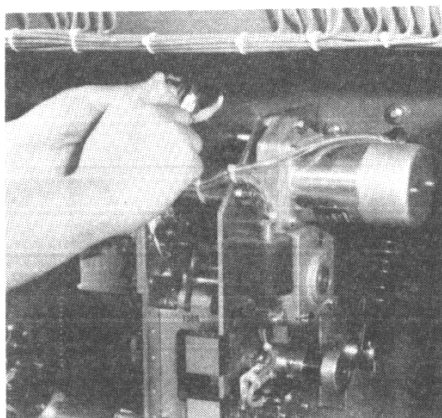


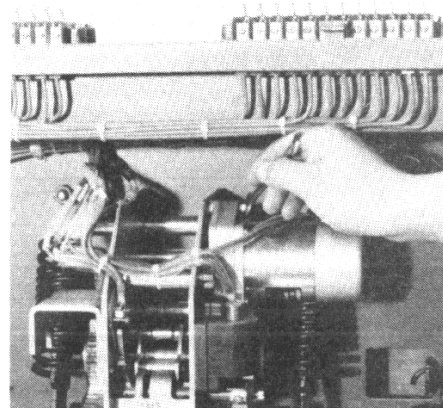
Fig. 22

10-2 Replacement of Motor

Tool: Wrench (M6)



Remove connector Fig. 23



Remove three mounting bolts (M6)

Fig. 24

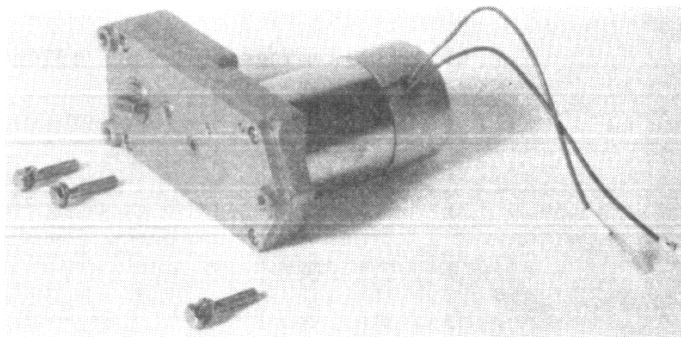
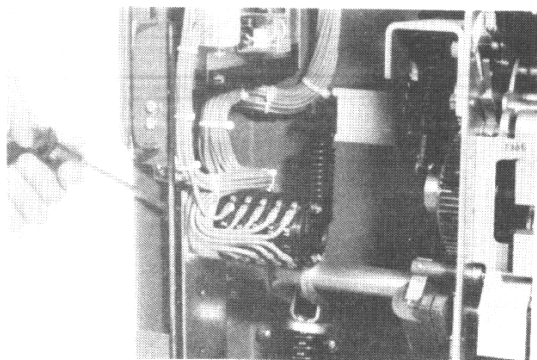


Fig. 25

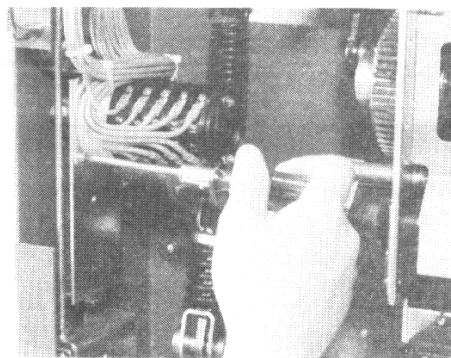
10-3 Replacement of Auxiliary Switch

Tool: Screwdriver and Wrench (M4)



Remove the screw (M4)

Fig. 26



Remove four screws (M4)

Fig. 27

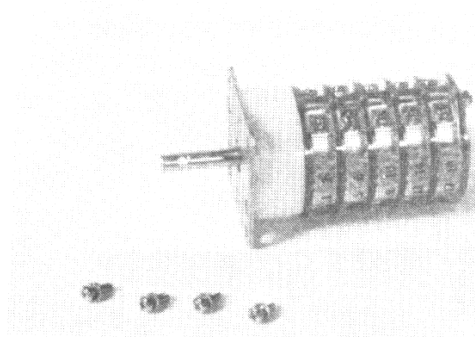
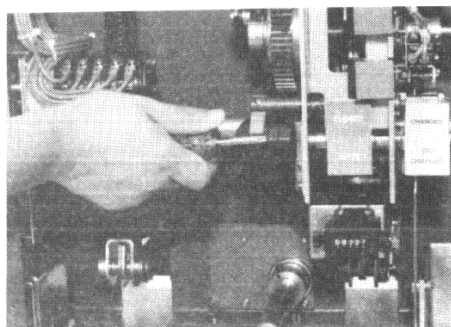


Fig. 28

10-4 Replacement of Closing Coil and Trip Coil



Remove two screws (M4)

Fig. 29

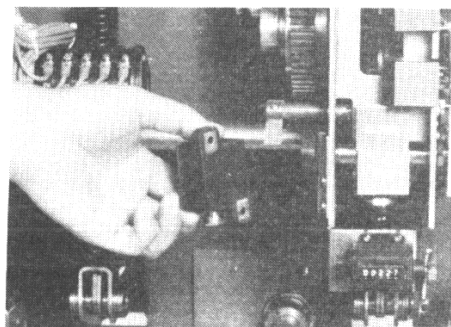


Fig. 30

NOTE: The closing coil and trip coil are identical in shape.

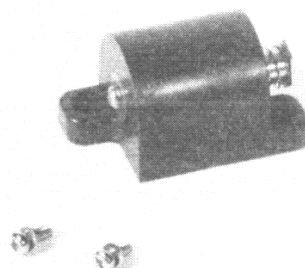
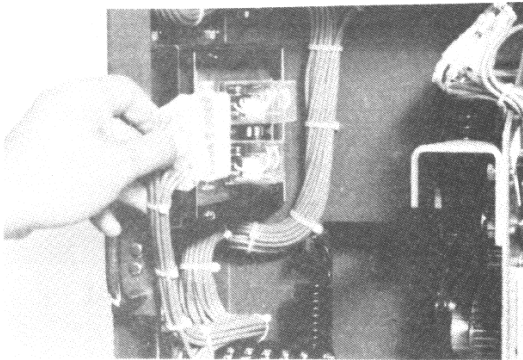


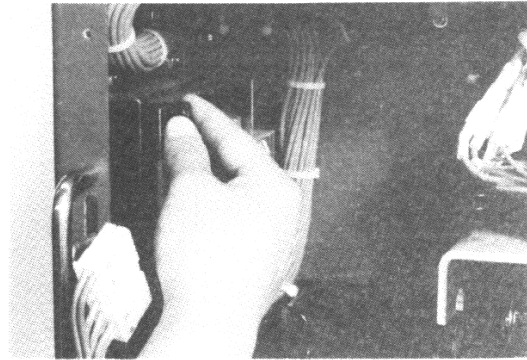
Fig. 31

10-5 Replacement of Control Circuit Board



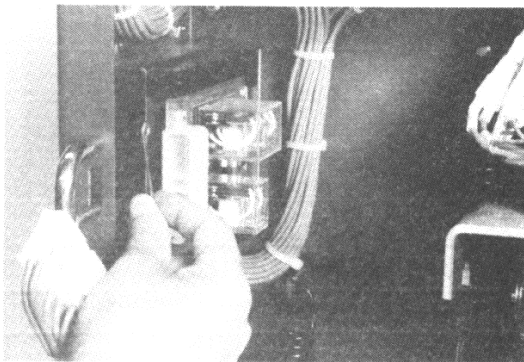
Pull out the connector

Fig. 32



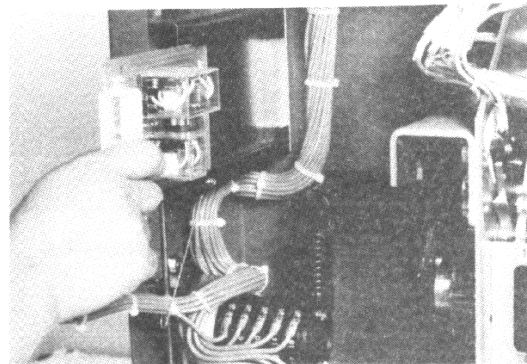
Remove the knurled screw

Fig. 33



Draw out the fixture

Fig. 34



Pull out the control circuit board

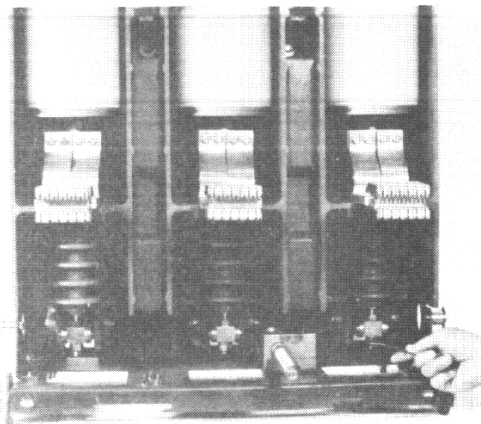
Fig. 35

10-6 Replacement of Vacuum Interrupter

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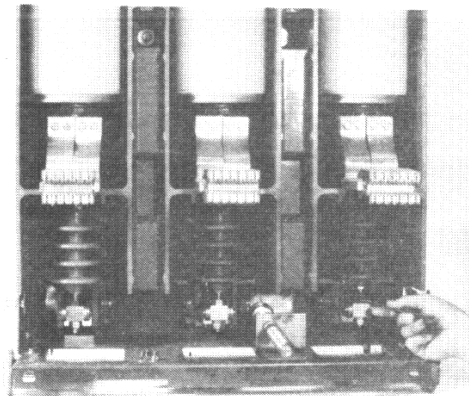
10-6-1 Type 1200A

Tool: Wrench (M6, M10, M12)



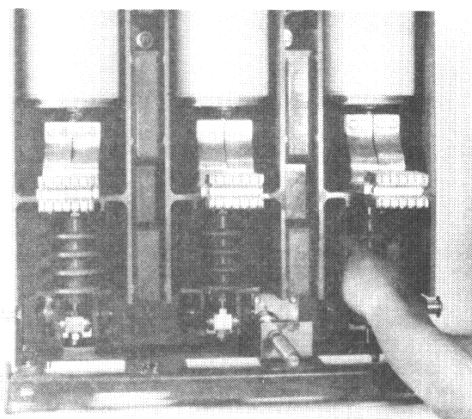
Loosen the nut (M10)

Fig. 36



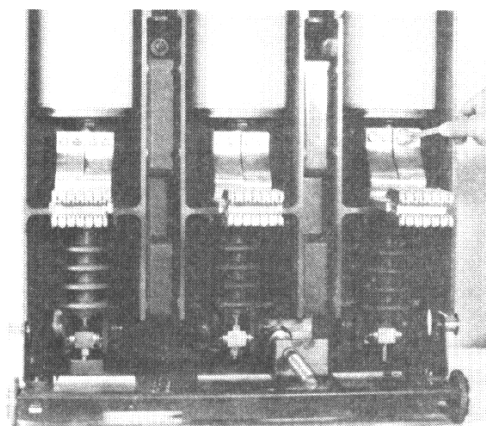
Loosen the nut (M10) fixing the operation rod.

Fig. 37



Turn the operation rod counter-clockwise until it parts from the vacuum interrupter.

Fig. 39



Remove four bolts (M6)

Fig. 39

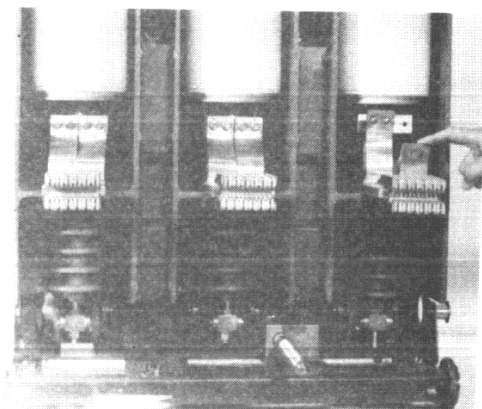
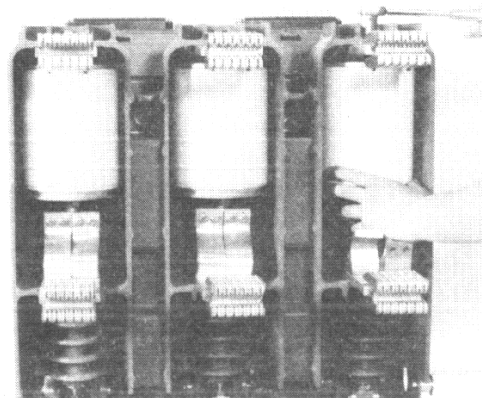


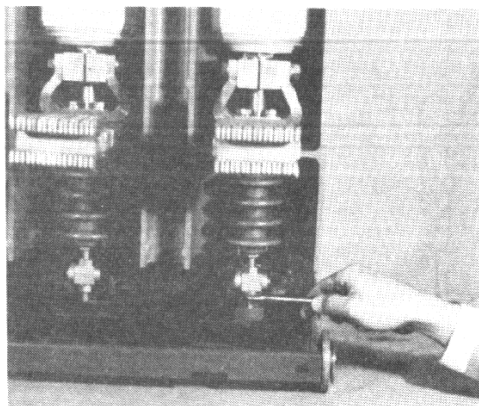
Fig. 40



Hold the vacuum interrupter and remove the bolt (M12) on the top.

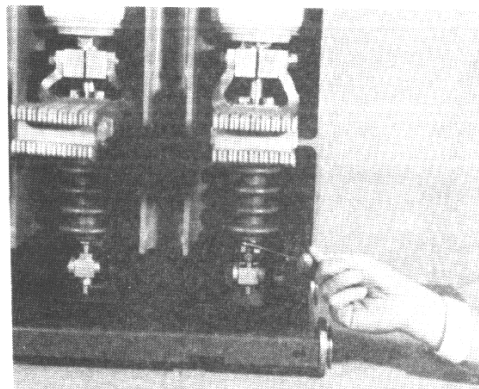
Fig. 41

10-6-2 Type 2000A



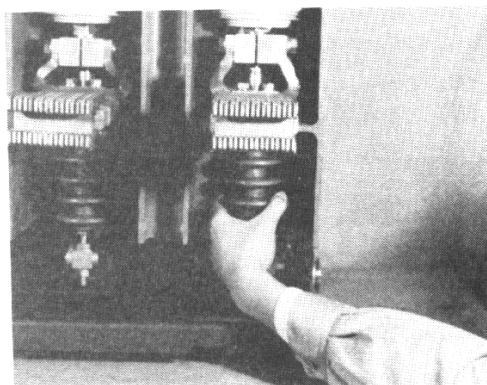
Loosen the nut (M10)

Fig. 42



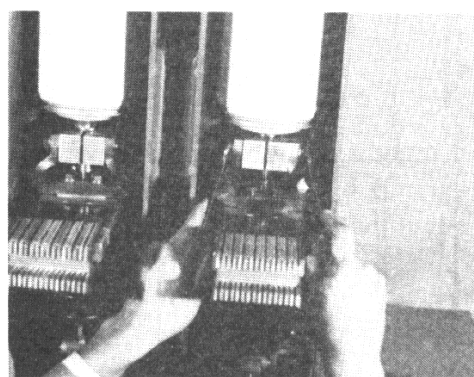
Loosen the nut (M10) fixing the operation rod.

Fig. 43



Turn the operation rod counter-clockwise until it parts from the vacuum interrupter.

Fig. 44



Remove two bolts and nuts (M10)

Fig. 45

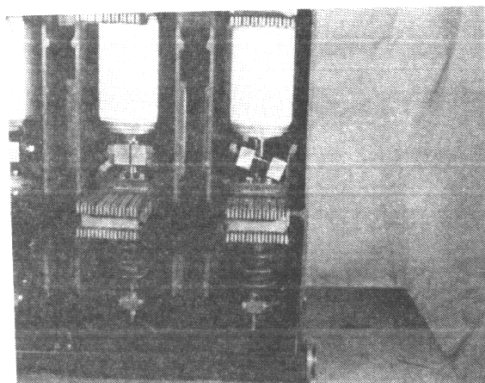
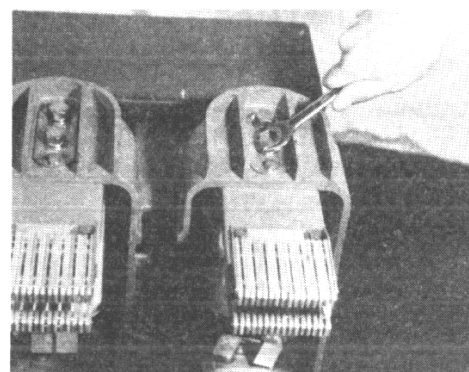


Fig. 46

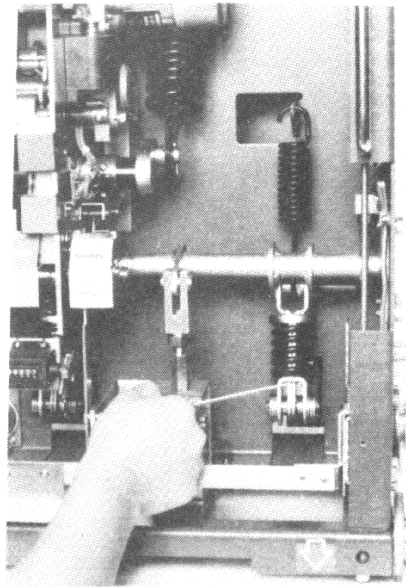


Hold the vacuum interrupter and remove the bolt (M12) on the top.

Fig. 47

10-7 Adjustment (Securely tighten the fastenings after adjustment is made)

After the vacuum interrupter is replaced, adjust the wipe dimension to that shown in Fig. 48 below with the breaker closed.



Point of measurement
for wipe length

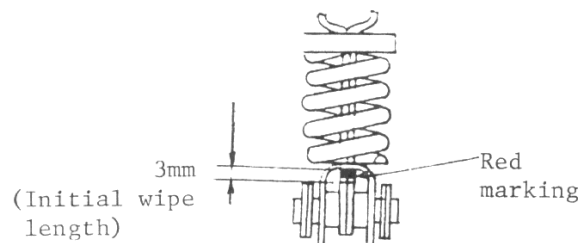


Fig. 48

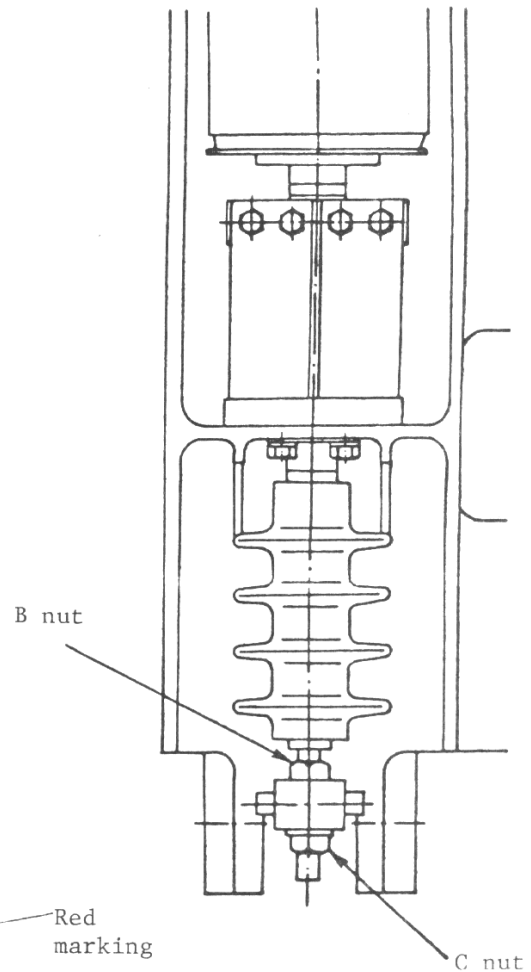


Fig. 49

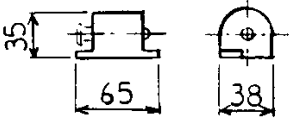
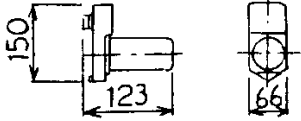

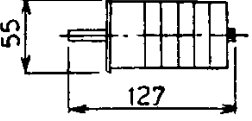
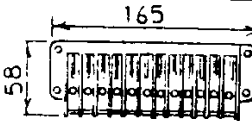
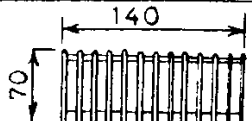
The required wipe size is 3mm. In Fig. 46 the wipe size is the length measured from the wipe base line indicated at A to the bottom surface of the wipe spring mounting fixture.

When the wipe size is other than 3mm, adjust it by loosening the C-nut at the rear of the circuit breaker and rotating the B-nut. The wipe size widens when the B-nut is turned clockwise and reduces when turned counterclockwise.

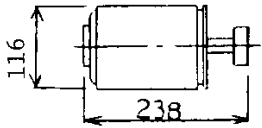
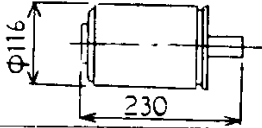

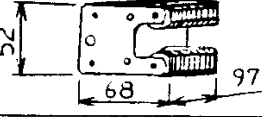


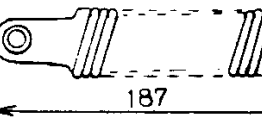


11. Replacement Parts List

6F9A2070-P32

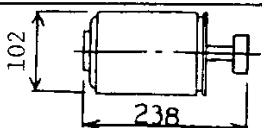
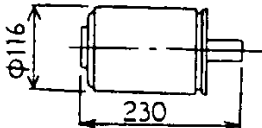
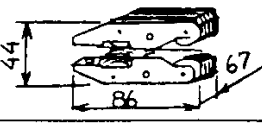
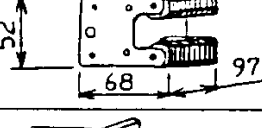


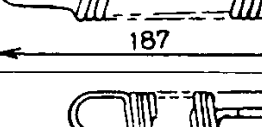
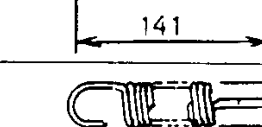
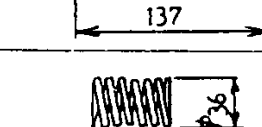
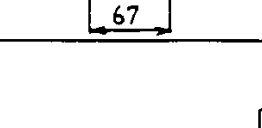
11-1 Replacement Parts List for Common Use

No.	Name of Part	Outline	Work	Ordering Code No.	
1	Closing/trip coil		2	250 VDC	4D9A2174 G001
				220/200 VDC	4D9A2174 G002
				125 VDC	4D9A2174 G003
				110/100 VDC	4D9A2174 G004
				50/48 VDC	4D9A2174 G005
				30 VDC	4D9A2174 G006
				24 VDC	4D9A2174 G007
2	Charging motor		1	250 VDC	4D9A2175 G001
				220/200 VDC	4D9A2175 G002
				125 VDC	4D9A2175 G003
				110/100 VDC	4D9A2175 G004
				50/48 VDC	4D9A2175 G005
				30 VDC	4D9A2175 G006
3	Auxiliary relay unit		1	250 VDC	4D9A2176 G001
				220/200 VDC	4D9A2176 G002
				125 VDC	4D9A2176 G003
				110/100 VDC	4D9A2176 G004
				50/48 VDC	4D9A2176 G005
				30 VDC	4D9A2176 G006
4	Auxiliary switch Limit switch (LS)		1	4D9A2177 G004	
			2		
	Interlock switch (LS1, LS2)		2	4D9A2177 G007	
	Latch checking switch (LCS)		1		
	Spring charged switch (SCS)		-		
6	Secondary disconnects (VCB side)			4D9A2179 G001	
7	Secondary disconnects (CELL side)		2	4D9A2179 G002	

11-2 Replacement Parts List for VK-6M32, VK-6P32

No.	Name of Part	Outline	Work	Ordering Code No.
1	Vacuum interrupter (For VK-6M32)		3	4D9A2173 G001 (SVB-6M32)
2	Vacuum interrupter (For VK-6P32)		3	4D9A2173 G002 (SVB-6P32)
3	Finger contacts (For VK-6M32)		6	4D9A2178 G001
4	Finger contacts (For VK-6P32)		6	4D9A2178 G002
5	Flexible conductor (For VK-6M32)		6	4D9A2178 G003
6	Flexible conductor (VK-6P32)		3	4D9A2178 G004
7	Closing spring		2	4D9A2182 G001
8	Opening spring (For VK-6M32, VK-6P32)		2	4D9A2182 G002
9	Wire spring		3	4D9A2182 G004

11-3 Replacement Parts List for VK-10M25, 10P25

No.	Name of Part	Outline	Work	Ordering Code No.
1	Vacuum interrupter (For VK-10M25)		3	4D9A2173 G003 (SVB-10P25)
2	Vacuum interrupter (For VK-10P25)		3	4D9A2173 G004 (SVB-10P25)
3	Finger contacts (For VK-10M25)		6	4D9A2178 G005
4	Finger contacts (For VK-10P25)		6	4D9A2178 G006
5	Flexible conductor (For VK-10M25)		6	4D9A2178 G003
6	Flexible conductor (For VK-10P25)		3	4D9A2178 G004
7	Closing spring		2	4D9A2182 G005 (For VK-10M25) 4D9A2182 G001 (For VK-10P25)
8	Opening spring (For VK-10M25)		2	4D9A2182 G006
9	Opening spring (For VK-10P25)		2	4D9A2182 G007
10	Wire spring		3	4D9A2182 G008

APPROVED BY	CHECKED BY	DRAWN BY
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
Pop. 30. '83	Sep. 27 '83	