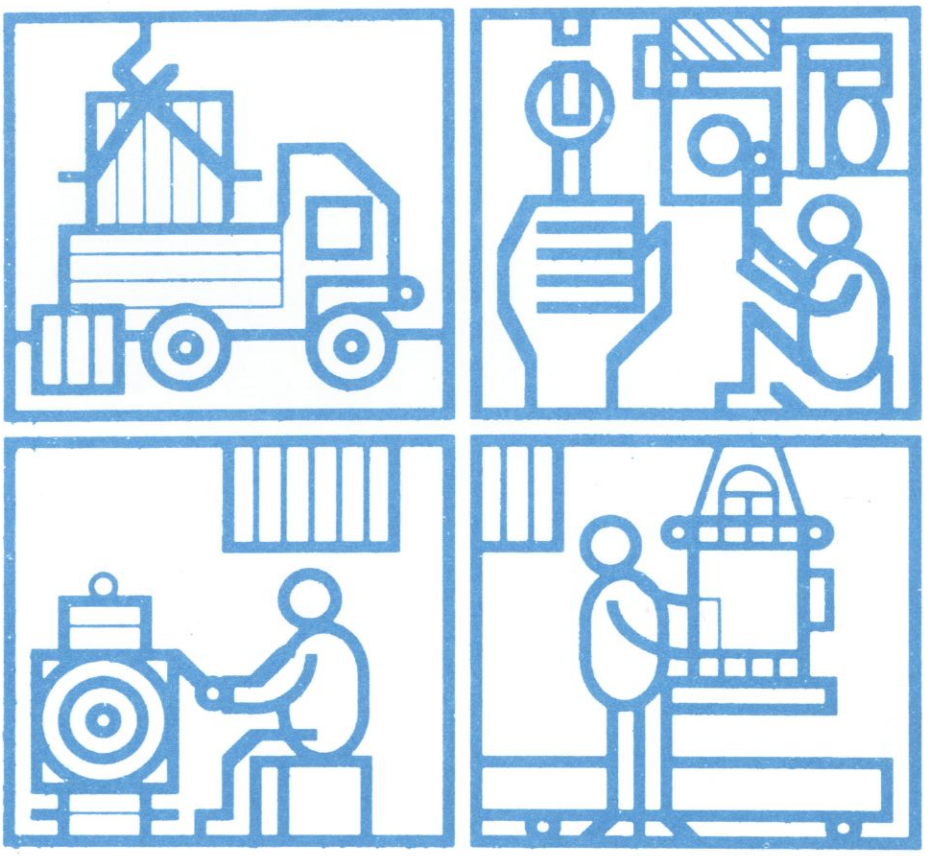
Jyoti Ltd.

'Jyoti'
36 kV, 26.4 kA,
1250/1600/2000 A
Outdoor Vacuum Circuit Breaker
(Type : VY-30M25D)

Installation, Operation
and Maintenance
Manual



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GLOSSARY OF TERMS

VCB	'Jyoti' Vacuum Circuit Breaker
CHARGED	Closing springs of the breaker charged
DISCHARGED	Closing spring of the breaker discharged
OPEN	Breaker in OFF condition
CLOSED	Breaker in ON condition
NO-Contacts	Normally Open contacts
NC-Contacts	Normally Closed contacts
WIPE	The compression of the wipe springs which provides sufficient contact pressure.

IMPORTANT INSTRUCTION

1. ALWAYS KEEP THE PACKED CASE WITH ITS RIGHT SIDE UP SO AS TO PROTECT THE CIRCUIT BREAKER AGAINST DAMAGE DURING TRANSPORTATION AND HANDLING.

2. DO NO LIFT OR LOWER THE VCB WITH A JERK, THIS CAN DAMAGE THE VACUUM INTERRUPTERS.

3. DO NOT DISTURB ANY SETTINGS OF LATCHES AND LINKAGES, OR THEIR POSITIONS IN THE OPERATING MECHANISM.

4. WHILE CHARGING THE VCB MANUALLY, STOP THE HANDLE MOVEMENTS AS SOON AS DISTINCT CLICK SOUND IS HEARD AND INDICATOR CHANGES OVER TO 'CHARGED' POSITION.

5. CONDUCT HIGH VOLTAGE TEST ON THE VACUUM INTERRUPTERS BEFORE COMMISSIONING.

6. REPLACEMET OF VACUUM INTERRUPTER OR ANY OTHER COMPONENT ON THE POLE PART SIDE OF THE VCB SHOULD BE DONE UNDER THE SUPERVISION OF OUR EXPERT ONLY.

7. INCOMING & OUTGOING TERMINALS OF THE BREAKER SHOULD BE TIGHTENDED PROPERLY.

CONTENTS

1. INTRODUCTION

This instruction manual describes the methods and procedures for unpacking, storage, maintenance and inspection of 'JYOTI' outdoor vacuum circuit breaker type VY-30M25D, which is a compact unit that can be used for various outdoor applications with excellent reliability.

The breaker has been especially designed for tropical, humid and vermin infested climate as normally obtained in INDIA.

2. RECEIPT AND STORAGE

2.1 ACCEPTANCE

Each circuit breaker is subjected to extensive testing and thorough inspection at factory before being wrapped and packed in two cases, one containing complete breaker unit itself and another one containing support structure made up of steel.

TO PROTECT THE CIRCUIT BREAKER AGAINST TRANSPORT DAMAGE, ALWAYS KEEP THE BOX WITH ITS RIGHT SIDE UP.

Before unpacking, check if there is any damage or breakage of the packing.

2.2 STORAGE

If VCB is not going to be installed immediately, the following precautions should be taken during storage.

a. Store it in a place free from corrosive gases.

b. Keep the loose spares and accessories properly wrapped in polyethylene bags so that they are free from moisture, dust and do not get lost.

2.3 UNPACKING

After unpacking, check for the following :

a. Check the accessories and spares, if ordered.

b. Check that no parts are missing.

c. Visually inspect the VCB for any damage, cracks or breakage.

d. If any part is missing or found damaged, immediately inform our nearest branch office or at :

Jyoti Ltd.
Marketing Division
Switchgear Plant,
J/44-59, BIDC, Gorwa,
Vadodara - 390 016.
Gujarat (INDIA)

Please take care of insurance formalities simultaneously.

2.4 LIFTING (Refer fig. 1)

When lifting the circuit breaker, always hook the rope / chain at the lifting hook provided on pole box unit for this purpose. Do not use any other portion of the breaker for lifting purpose.

DO NOT LIFT OR LOWER THE VCB WITH A JERK, THIS CAN DAMAGE THE VACUUM INTERRUPTERS.

3. DESCRIPTION OF VACUUM CIRCUIT BREAKER

VCB incorporates a specially designed and completely sealed vacuum interrupters to perform its basic function of opening as well as closing when called upon to do so under both normal operating conditions and fault conditinos such as short circuit.

The three columns of porcelain bushings contain interrupter in the upper bushing. These columns are hermetically sealed and mounted on a common frame. The common frame houses the linkage drive for each pole. The cabinet below the common frame houses the spring operating mechanism and control wiring. A spring operating mechanism mounted inside a sheet steel cabinet,

provides the energy required for breaker operation. The closing springs, charged manually or through a motor provide the energy for closing the VCB, charging the opening springs and for applying sufficient contact pressure on the moving contacts of vacuum interrupters through the wipe springs. The opening springs get charged during closing of the VCB & provide the energy for opening the VCB.

The mechanism energy is transmitted to the vacuum interrupters through linkage drive from mechanism to linkage drive of common frame and from common frame to individual poles.

The operating mechanism of VCB is provided with OPEN/CLOSED and CHARGED/DISCHARGED indicators on its front side. A green push button is provied for manual closing and red push button for manual opening of the VCB. VCB is supplied in OFF condition which closing springs DISCHARGED. A built in charging handle is provided for manual spring charging. A chassis assembly is provided on right side of mechanism. This hinged type chassis assembly houses all type of electrical inserts such as fuse, changeover switch, relay etc.

All internal wiring is brought out on to the terminal station TB2. The connections for incoming supply is to be made to TB2. The cable for this connections are to be bought through gland plate provided at the bottom of cabinet.

4. WORKING OF OPERATING MECHANISM (refer Fig 3 & 4)

4.1 CHARGING OPERATION

VCB is supplied in OPEN condition with closing springs DISCHARGED. Charging operation of closing spring is performed either manually or electrically through a motor. The CHARGED/DISCHARGED indicator shows the status of the closing springs.

4.1.1 Manual Charging Operation

Hold the CHARGING HANDLE (1) and move it down by APPROXIMATELY 30° TILL IT STOPS. This will rotate gear (2) which in turn will rotate gear (3). Gear (3) will rotate cam shaft (4). The closing springs (5) which are hinged at one end, will start getting charged due to rotation of cam shaft as the other end of the spring is connected to crank (6) fitted on the cam shaft (4).

Now return the charging handle back to its original position and move it down again. Repeat this till springs are fully charged. A distinct clicking sound will be heard as soon as springs are fully charged and the CHARGED/DISCHARGED indicator changes over the CHARGED position. The VCB is now ready for closing.

In order to prevent overcharging, STOP the handle movement as soon as a distinct 'click' sound is heard and indicator changes over to 'CHARGED' position. Overcharging can damage the mechanism.

The number of times charging handle is to be moved up and down for full charging of closing springs depends on the angle of handle movement. If the movement of manual spring charging handle is kept to about 30° every time, approximately 14 strokes will be required for full charging.

4.1.2 Motor Charging Operation

As soon as electrical supply is given to the charging motor (7), it will rotate the shaft (8) which in turn will rotate the gear (3). Th remaining charging operation is similar to manual charging.

When the springs are about to get charged fully, the cam (9) mounted on cam shaft (4) will operate the micro switch (10) through lever (11)

and supply to the motor will be cut off. The motor takes less than 15 seconds to charge the springs.

The closing springs will get automatically recharged electrically as soon as they get discharged on closing of the breaker.

4.2 CLOSING OPERATION

When the springs are fully CHARGED, the linkages attain position A (Fig. 4). Now the VCB is ready for closing opertion.

4.2.1 Manual Closing

Push the closing push button (12). This will turn closing shaft (13), this will release the closing catch (14). now energy of the closing springs will cause the cam (15) to rotate at fast speed and bring linkages to position B (Fig 4). The rotation of cam will rotate the main shaft (16). The opening springs (17) mounted on main shaft (16) will get charged during closing operation. The breaker position indicator changes over to CLOSED and the charging indicator changes over to DISCHARGED. The connecting link (29) connected with main shaft transmits the movements to vacuum interrupter (32) via pole box shaft (30) & breaker will get closed. The movement of pole box shaft (30) will also charge the wipe springs (25), which provides contact pressure to the contacts of Vacuum interrupters to keep them closed.

The linkages will attain position B, if motor supply is off. It is not possible to recharged the closing springs again in charged position. The closing springs will get charged automatically electrically after closing. If motor supply is on, & the linkages will attain position D.

4.2.2 Electrical Closing

When supply is given to the closing coil (18), the plunger (19) of closing coil will push the closing paddle (20). This will cause the closing shaft (13) to turn & the remaining closing operation is similar to manual closing operation. The supply to the motor is reconnected automatically on closing of the breaker due to rotation of cam (9). Lever (11) and Micro switch (10) and the closing springs will get recharged and linkages will attain the position D.

The breaker position indicator will change over to CLOSED, and after immediate recharging, the charging indicator will show CHARGED.

4.3 OPENING OPERATION

When the VCB is CLOSED, the linkages attain the position D or B, and the breaker is ready for opening.

4.3.1 Push the trip push button (21). This will turn the trip shaft (22) through tripping padle (23), which in turn will release the tripping catch (24). The energy of opening springs (17) and wipe stprings (25) will cause the linkages to attain the position A or C.

This movement of linkages from position D or B to position A or C, will turn the main shaft (16) and the circuit breaker will get OPEN. During opening operation. Initially, energy of wipe springs (25) will be released to attain the required initial speed. The same will be further maintained by the release of opening spring energy.

The breaker position will change over to OPEN, while CHARGED/ DISCHARGED indicator will not be affected.

4.3.2 Electrical Opening

When supply is given to the tripping coil (27), the plunger of tripping coil will push the paddle (26) of half shaft (35) of latch which causes it to turn, this will release the latch (36). The latch (36) is linked with a lever pain (37) which impacts on the tripping haft shaft paddle (38) which causes it to turn the tripping shaft (22). The remaining opertion is similar to manual opening operation. As soon as breaker is open the latch gets reset.

4.4 AUTO RECLOSING FEATURE

The VCB is provided with a facility for Autoreclosing. The feature is achieved since it is possible to charge the closing springs as soon as they get discharged during closing opertion. The mechanism is thus kept ready to re-close the VCB as soon as it is opened.

4.5 AUXILIARY SWITCHES

All switches have their normally open NO contacts and normally closed NC-contacts when the VCB is OPEN and mechanism is DISCHARGED.

Auxiliary switch	AS	Cam Switch (Rotary Switch)
Auxiliary switch	LS1	Micro Switch
Auxiliary switch	LS2	Micro Switch
Ausiliary switch	SW1	Toggle Switch
	SW2	Toggle Switch
	SW3	Toggle Switch
	V	Local Remote Switch

The auxiliary switch AS is breaker operated and is driven by a link attached with the main shaft. This switch has 14 contacts (7 NO + 7 NC). Within the VCB two pair of these contacts are used to cut off the control supply of the closing coil or opening coil as soon as breaker is closed or opened. If required, open pair is used for ON/OFF indication & one pair for trip circuit healthy indication purpose. The remaining contacts are spare contacts.

When circuit breaker is closed, NO contacts become closed and NC contacts open. When the VCB is opened the auxiliary contacts regain their original status.

Auxiliary switch LS1 is micro switch. It is controlled by the rotation of cam shaft (4). When the closing springs are in DISCHARGED condition. Its NC contacts energizes the control Relay X which in turn connects supply to the spring charging motor. When the springs are fully CHARGED, micro switch LS1 changes its position and cuts off the supply to control relay X thus disconnecting the motor supply.

The auxiliary switch LS2 is also a micro switch and operates exactly the same way as LS1. The switch LS2 is used for charged/discharged indication lamp.

The auxiliary switch SW1 is a toggle switch and used in the charging circuit. When switch is made ON, the supply to motor circuit starts. It is to be normally kept ON unless motor circuit is to be disconnected for any maintenance purpose. The running of the motor in charging circuit is controlled by operation of motor control relay & micro switch LS1.

The SW2 is also a toggle switch and is used in heater circuit. During moist wheather, to prevent condensation in the cabinet, the Switch SW2 is to be made ON to start the heater.

The Switch SW3 is also a toggle switch and is used to switch on & off the plug socket provided for maintenance.

The auxiliary Switch V is a cam switch, it is used for change over of supply to closing and tripping circuits from local to remote and vice versa.

5. ERECTION

The erection of JYOTI Outdoor VCB is very simple. The complete unit with support structure can be placed on foundation as per foundation drawing on the Base Assembly.

Following procedure should be followed for erection.

1. Prepare the foundation as per drawing.
2. Grout the foundation bolts as per drawing and ensure proper leveling of foundation. Make sure that foundation bolt of correct size and length is used.
3. Allow sufficient time to set the foundation after grouting the foundation bolts.
4. Place the Base assembly over foundation bolts.
5. Level the Base Assembly properly using packing, if required. Use spirit level to check the level and fasten the Base Assembly with foundation bolt. Place the support structure on the Base assembly & fasten the four bolts of base assembly.
6. Place the vacuum circuit breaker unit over the support structure and bolt them together. All 10 bolts are to be used for fixing support structure and vacuum circuite breaker unit.
7. The vacuum circuit breaker is now installed and ready for mechanical operations. The unit is completely assembled and properly factory tested. It does not require any type of setting at site during/after erection.
8. The breaker is provided with a cable gland plate fitted in cabinet. Dismantle the gland plate and make hole suitable for cables. Pass the cable through the hole, seal the gland plate and assemble it to connect cable wire to terminal station (TB2) of circuit breaker.
9. Connect the cable wire to their respective terminals of the breaker as per respective wiring diagram.
10. Check the electrical operation of vccuum circuit breaker.

The circuit breaker is now ready of commissioning after usual pre-commissioning checks.

6. COMMISSIONING INSTRUCTIONS

a) Check manual spring charging, Closing and Opening operations.

b) Check operation of all indicators (i.e. CHARGED/DISCHARGED, OPEN/ CLOSED)

c) Check tightness of all wire termination.

d) Check electrical operations of the VCB.

e) Check electrical interlocks for satisfactory working.

f) Check and ensure that there are no loose connections in the power circuit.

g) Clean the insulating surface of VCB with compressed air and/or lint-free cloth.

h) Check insulation resistance between phases and also phase to earth with the help of a megger as described in Table-1.

i) Conduct High Voltage test on the vacuum interrupters, as described in 7.2 before commissioning.

j) Ensure that applicable voltage as per respective standard is available at VCB input terminals under load condition.

7. MAINTENANCE AND INSPECTION

7.1 CHECK POINTS FOR PERIODICAL INSPECTION

The stroke of Vacuum Circuit Breakers being very small, the energy required to operate the vacuum interrupter at specified speed is very less as compared to other types of circuit breakers of the same rating.

As operating energy is very less, the VCB requires minimum maintenance. The

various maintenance check points and methods to ensure consistent performance are mentioned in Table - 1.

The checking should be done for the first time after 2000 operations or one year, whichever is earlier and thereafter evey 3 years or 5000 operations, whichever is earlier.

7.2 CHECK ON VACUUM INTERRUPTERS (FIG. 6)

The relationship between dielectric breakdown voltage and internal pressure in the vacuum interrupter is shown in fig. 6.

Whether the interrupter maintains a high internal vacuum can be checked by applying a voltage of AC 56 KVrms as a voltage withstnds test for about 10 seconds. Measurement is taken with the VCB OPEN and the voltage applied between the terminals of the vacuum interrupter.

When the pressure inside a vacuum interrupter has attained atmospheric pressure, dielectric breakdown occurs at a voltage between about AC 17 kVrms to 21 kVrms.

When the vacuum level is not sufficient, there is almost no delay in the breakdown. So a duration of 10 seconds of voltage application is enough.

If test set up trips, repeat the process three times. If test set up trips all three times, the vacuum interrupter is deemed to be defective and needs to be replaced.

NOTE : Meggre test (I.R. TEST) is not a method recommended for assessing integrity of vacuum in the interrupter.

7.3 MEASUREMENT OF WIPE (FIG. 5)

The wipe springs (25) shown in fig. 3, provide sufficient contact pressure to the Vacuum Interrupter when it is CLOSED. In case of excessive fault tripping, the main contacts may get eroded progressively. When the contacts get eroded, the wipe of the wipe springs get reduced.

Wipe can be observed for each phase by removing the front cover of the common frame of VCB. It can be seen by the red mark on the link of the wipe springs (25) with circuit breaker CLOSED as shown in fig. 6. As a routine inspection, the presence of wipe can be seen by the red mark.

When the red mark is about to disappear with the breaker CLOSED, the value of wipe reaches, its minimum permissible value. Nominal value of wipe, when circuit breaker is supplied is 3 ± 0.5 mm. When the value of wipe raches 1 mm or less, the vacuum interrputer is required to be replaced.

8. REPLACEMENT OF PARTS

Customers are advised not to replace Vacuum interrupter or any other components on the pole part side of the VCB.

For such replacement, customers are advised to contact Customer Service Dept., Jyoti Ltd., Switchgear Plant, J/44-59, BIDC, Gorwa, Vadodara - 390 016, India or our nearest branch office.

Replacement of other parts like coil, motors, micro switches etc. should also done only by those personal who are properly trained at our works which can be arranged on specific request.

9. SPARE PARTS AND ACCESSORIES

9.1 LIST OF RECOMMENDED SPARES

Sr.	Item No.	Rating	Part No.	Qty. Per Unit
1.	Closing Coil	220 V DC 110 V DC 30 V DC 24 V DC	DEG/VS/TP/237/07	1
2.	Tripping Coil	220 V DC 110 V DC 30 V DC 24 V DC	DEG/VS/TP/237/08	1
3.	Auxiliary Switch		DEG/VS/TP/237/14	1
4.	Micro Switch		DEG/VS/TP/237/09	2
5.	Control Relay	220 V DC 110 V DC 30 V DC 24 V DC	DEG/VS/TP/237/04	1
6.	Thermal Overload Relay		DEG/VS/TP/237/05	1
7.	Gaskets		4VC62-0373 4VC62-0373	6 6
8.	Packing		4VC62-0386	3

Other Voltages of 110 V Ac, 240 V AC are possible using rectifier and power pack unit.

NOTE : While ordering spares, please specify the auxiliary voltage

TABLE - 1

10. CHECK POINTS FOR PERIODICAL INSPECTION

Sr. No.	Check Point	Item	Checking Method	Criteria	Actions Required
1.	Complete Circuit Breaker	Screws, Bolts & Nuts	By screw driver & wrench	There should not be any loose screw, bolts or nut	Tighten if found loose
		Dust & foreign matter	Visual check	The breaker should be clean and should not have any foreign matter on any part	Clean with compressed air and wipe the accessible part by clean and dry lint free cloth
		Deformation, excessive wear	Visual check	There should be no deformation or excessive wear or damage to any part	Remove cause and replace part
2.	Operating	Dust & foreign matter	Visual check	There should be no dust or foreign matter	Clean with compressed Air
		Smooth operation	Manual operation	Operation shuld be smooth	
		Lubrication of bearings pins, latches etc.	Visual check	Should be well lubricated	Apply PTFE grease, Beacon Q2 greast or its equivalent on as shown in Fig. 3
		Closing and tripping shaft	Visual check	Must rotate freely	Apply PTFE grease, Beacon Q2 grease or its equivalent on as shown in Fig. 3
3.	Vacuum Interrupter	Contact Wear	Visual check	Wipe should be 3.0 ± 0.5 mm when breaker is in closed position	If it is less then 1 mm, vacuum interrupter should be replaced
		Vacuum integrity	See check on	The interrupters should withstand the test	Vacuum interrupter should be replaced if found defective. The manufacturer should be consulted for replacing the Vacuum Interrupter.

Sr. No.	Check Point	Item	Checking Method	Criteria	Actions Required
		Number of operations	Vacuum (7.2) Counter	When counter reading reaches 10,000 check vacuum. If OK, continue to use and check again when counter reading reaches 15,000, check vacuum and if OK, continue to use till 20,000 operations.	Vacuum Interrupter should be replaced, if vacuum is not OK or when counter reaches 20,000 operations
4.	Auxiliary Switch	Terminal	Tighten screw driver	There should be no loose connection	Retighten if found loose
		Case & Contacts	Visual check	There should not be any damage	Replace if found damaged
5	Main power circuit	Discoloration of contact surface by heat	Visual check	There should not be any discoloration	Check contacts and joints
		Joint	Physical with tools	Check for tightness of all joints in power circuit	Tighten if found loose
6.	Control Circuit	Operate Breaker electrically	Check at test position	Smooth Operation	Check circuit and operation of micro switches & auxiliary switch

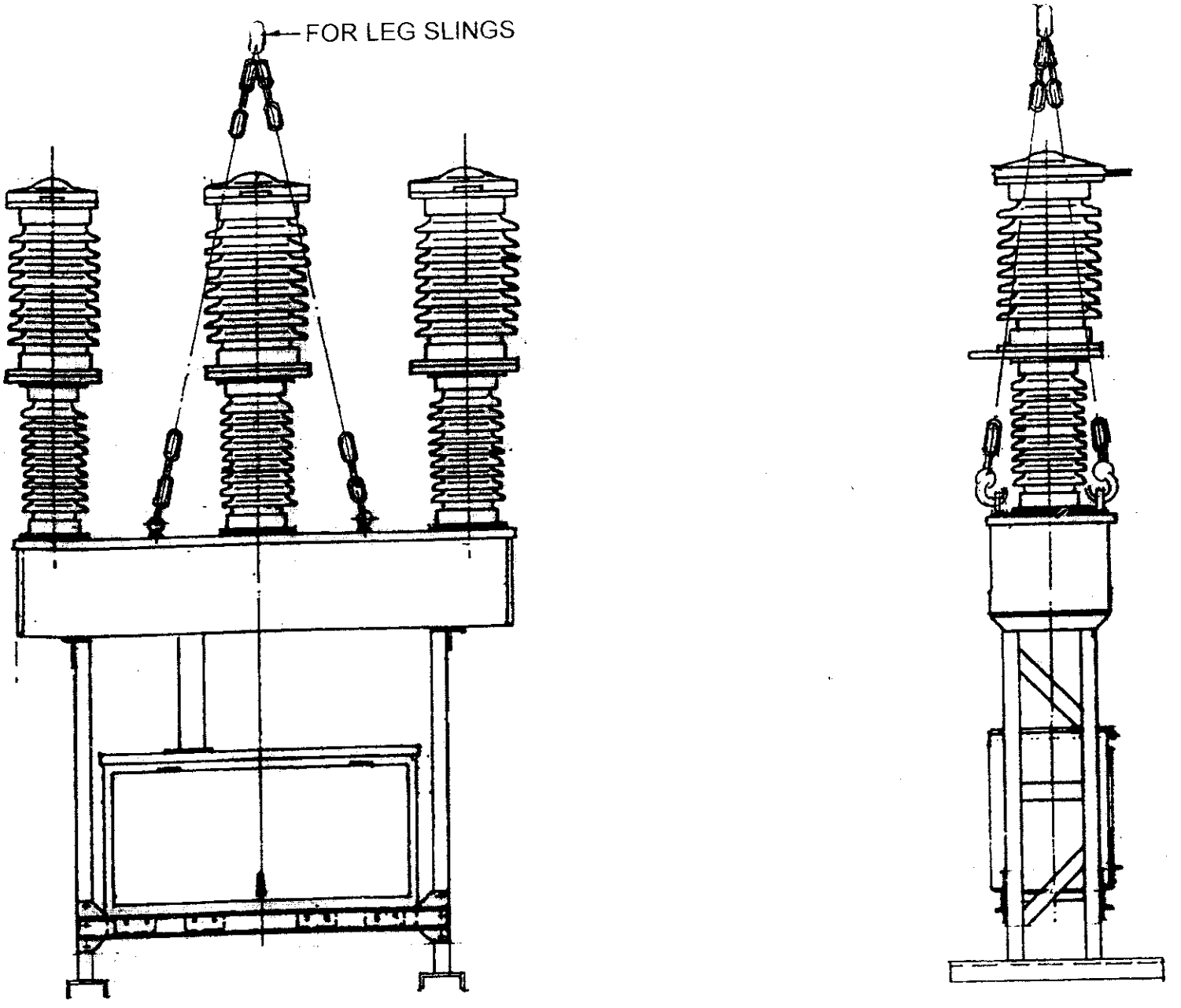


FIGURE.1 LIFTING OF CIRCUIT BREAKER

LEGEND FOR ITEM NUMBERS IN FIGURE 3

1. Charging Handle
2. Gear
3. Gear
4. Cam Shaft
5. Closing Spring
6. Crank
7. Motor
8. Shaft
9. Cam
10. Micro-switch
11. Lever
12. Push Button 'ON'
13. Closing Shaft
14. Closing catch
15. Cam
16. Main Shaft
17. Opening Spring
18. Closing Coil
19. Plunger of Closing Coil
20. Paddle
21. Push Button 'OFF'
22. Opening Shaft
23. Paddle
24. Trip Catch
25. Wipe Spring
26. Paddle
27. Tripping Coil
28. Paddle
29. Connecting Link
30. Pole Box Shft
31. Insulating Stud
32. Vacuum Interrupter
33. Porcelain Bushing
34. Terminals for External Conne
35. Half Shaft
36. Latch
37. Lever Pin

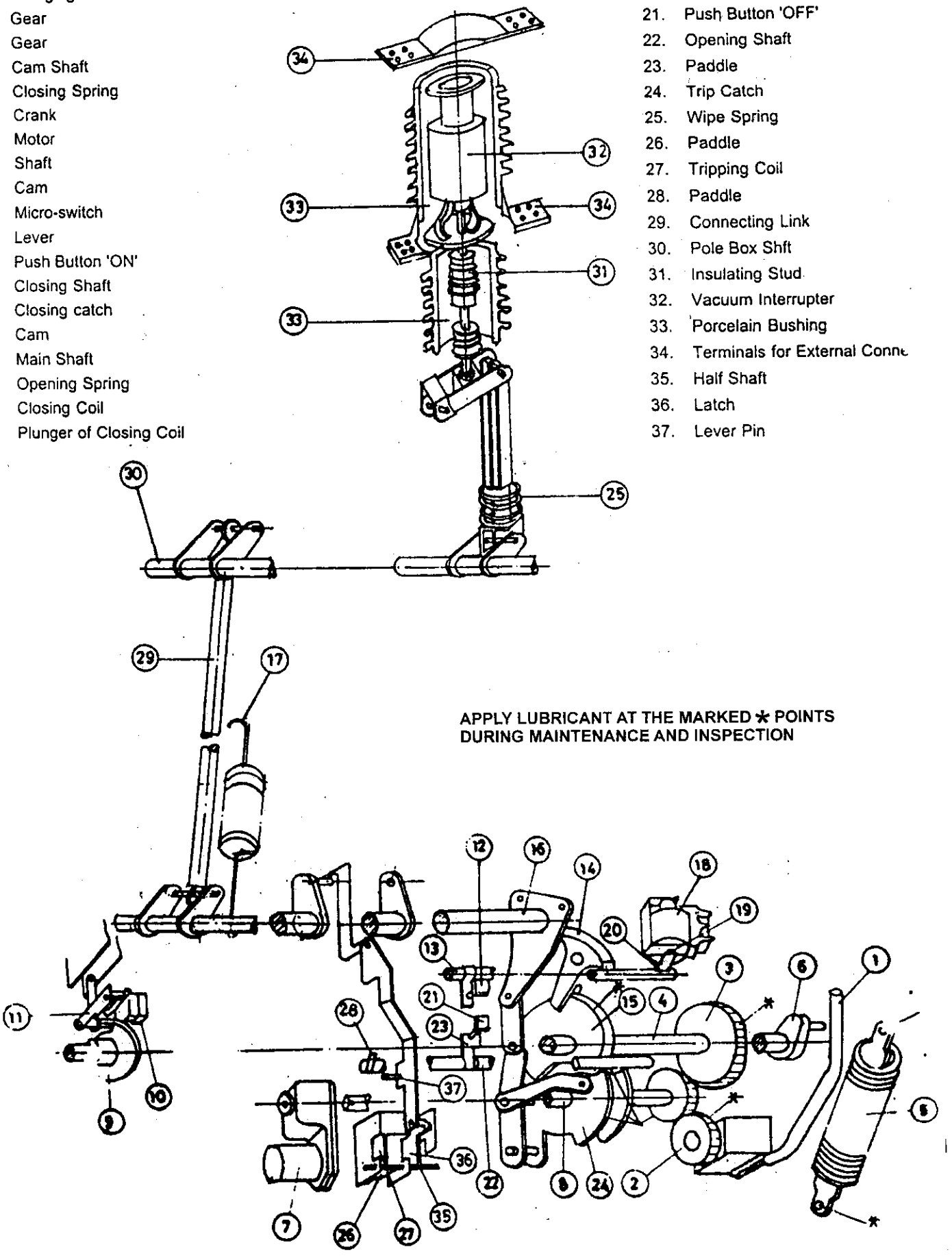
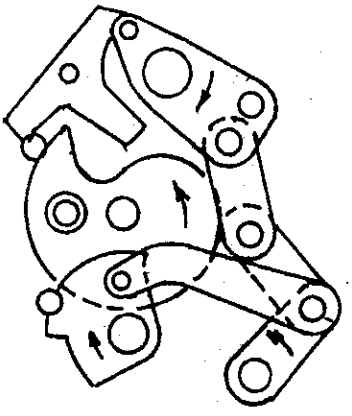
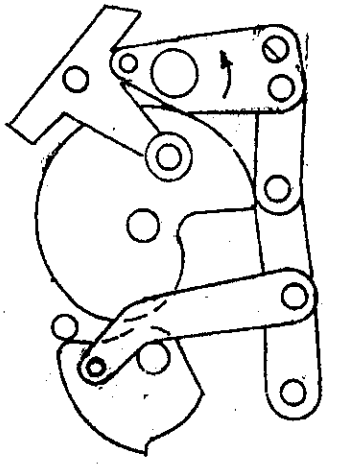


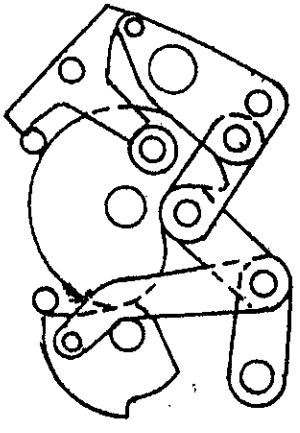
FIG: 3 **SPRING OPERATING MECHANISM**



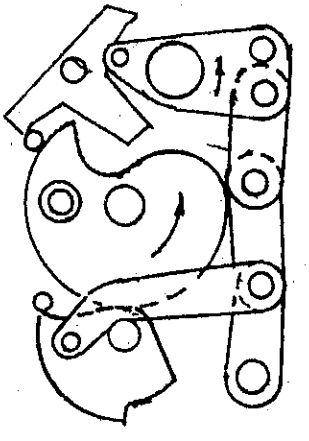
POSITION-A
OPEN & DISCHARGED



POSITION-B
CLOSED & CHARGED



POSITION-C
OPEN & CHARGED



POSITION-D
CLOSED & CHARGED

FIG.4

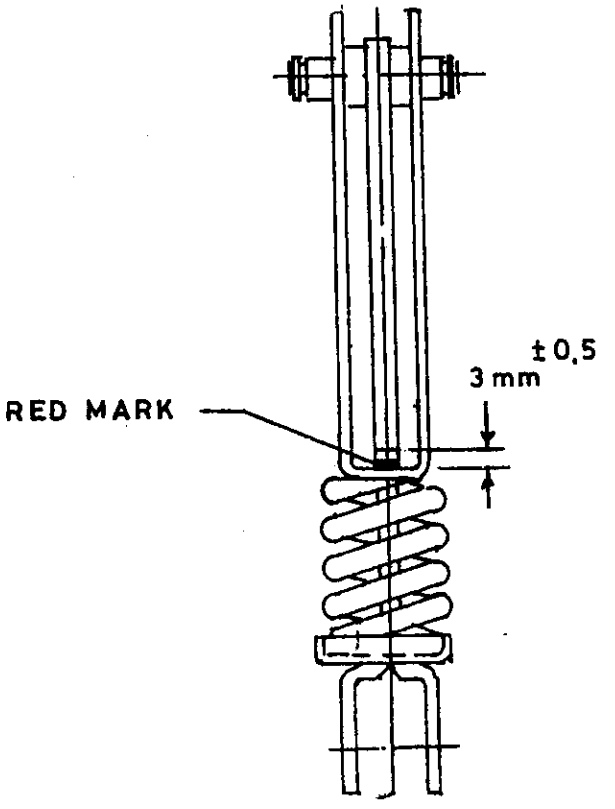


FIG.5 MEASUREMENT OF WIPE

~~MENT OF WIPE~~

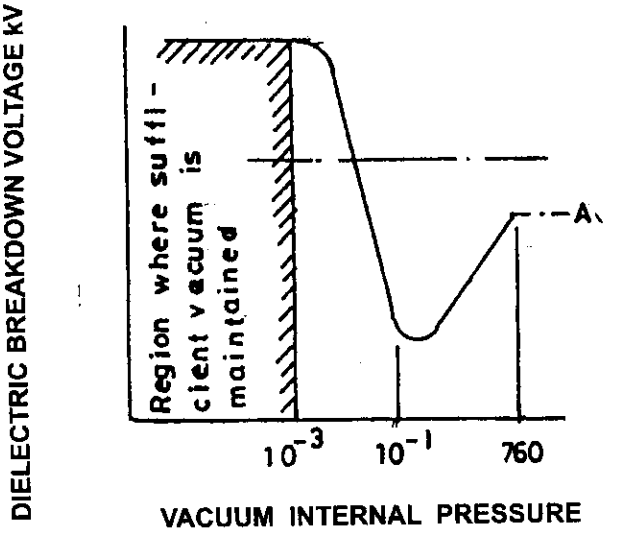


FIG.6 CHECK ON VACUUM

Jyoti Ltd. VADODARA (INDIA)

® 60 Years of Engineering Excellence

FOR FURTHER ENQUIRIES PLEASE CONTACT

SWITCHGEAR DIVISION
J/44-59, B.I.D.C., Gorwa,
Vadodara-390 016 (India)
Phone : 2280770 (5 lines)
Fax : +91-265-2280153
+90-265-2280208
E.Mail : switchgear@jyoti.com

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In keeping with the technological strides the world is making in the engineering field, we introduce changes in the design of our products. Hence, the products as actually supplied might have features varying herefrom.