Medium Voltage Switchgears

VCB

Vacuum Circuit-Breaker (11kV, 630A to 1250A, 26.3kA)

Installation

Operation & Maintenance

MANUAL

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CONTENTS

1.0 INTRODUCTION

1.1 GENERAL

This manual contains detailed information required for Installation operation and maintenance of VOLTECH main door VCB panel. The panel is metal clad type having compartmented design.

Vacuum circuit breaker is fully assembled on a draw-out trolley. I.e. Outdoor shell along with its closing and tripping mechanism, current transformer, potential transformer, control panel and other auxiliary circuit so as to ensure smooth and continuous consistent operation of the breaker.

The panel being dust proof, provides complete protection to the inside components from dust as per IS/IEC 62271-1. The breaker, the panel and all its constituent components are capable of withstanding various weather condition like humidity, cold temperature (-5°C) and high temperature (50°C). The indoor VCB panel undergoes all the stringent quality checks and tests as per IEC 62271-100, IEC 60694 & IS: 13118 are the manufacturing unit before dispatch, in order to ensure its proper functioning at customer's end.

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The vacuum circuit breaker consists of mechanism housing complete with stored energy spring mechanism and control elements and three encapsulated vacuum interrupter polls.

1.2 SAFETY

1.2.1 PRECAUTIONS

User Personnel must adhere to the following precautions:

1. Always work on de-energized equipment. Always de-energize a circuit breaker, and remove it from the switchgear before performing any tests, maintenance or repair.
2. Always perform maintenance on the circuit breaker after the spring-charged mechanisms are discharged.
3. Always let an interlock device or safety mechanism perform its function without forcing or defeating the device.

1.2.2 SIGNAL WORDS

The following signal words "Danger", "Warning" and "Caution" used in this manual indicate the degree of hazard that may be encountered by the user.

DANGER: Failure to follow this instruction will lead in death, serious injury or equipment damage

Warning: Failure to follow this instruction can result in death, serious injury or equipment damage

Caution: Failure to follow this instruction can result in equipment damage

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1.2.3 QUALIFIED PERSON

For the purpose of this manual a Qualified Person is one who is familiar with the installation, construction or operation of the equipment and the hazards involved.

In addition, this person has the following qualifications:

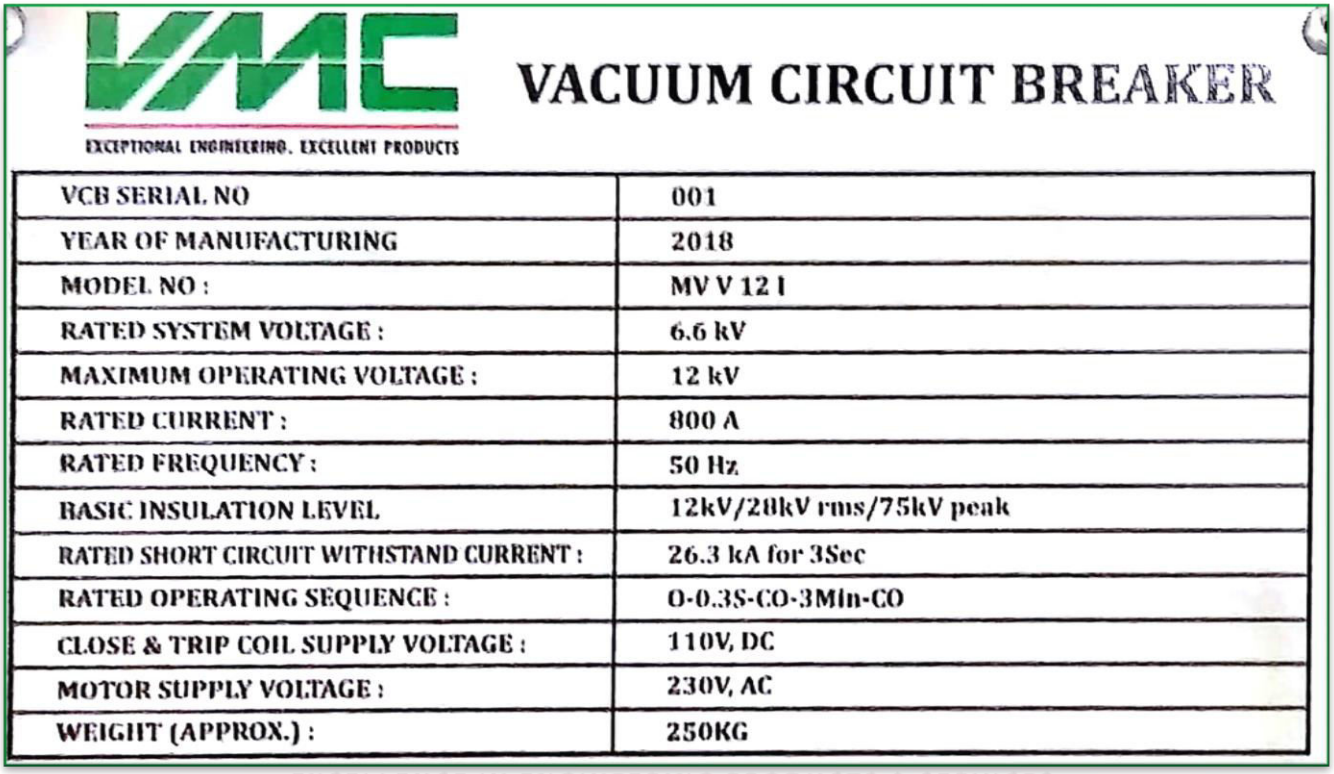
• Training and authorization to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.

• Training in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses, face shields, flash clothing, etc., in accordance with established safety procedures.

• Training in rendering first aid.

2.0 TECHNICAL SPECIFICATION

The following image contains the technical specification of a typical Vacuum Circuit Breaker.



VMC
EXCEPTIONAL ENGINEERING, EXCELLENT PRODUCTS

VACUUM CIRCUIT BREAKER

VCB SERIAL NO	001
YEAR OF MANUFACTURING	2018
MODEL NO :	MV V 12 I
RATED SYSTEM VOLTAGE :	6.6 kV
MAXIMUM OPERATING VOLTAGE :	12 kV
RATED CURRENT :	800 A
RATED FREQUENCY :	50 Hz
BASIC INSULATION LEVEL	12kV/28kV rms/75kV peak
RATED SHORT CIRCUIT WITHSTAND CURRENT :	26.3 kA for 3Sec
RATED OPERATING SEQUENCE :	O-0.3S-CO-3Min-CO
CLOSE & TRIP COIL SUPPLY VOLTAGE :	110V, DC
MOTOR SUPPLY VOLTAGE :	230V, AC
WEIGHT (APPROX.) :	250KG

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Figure 2.0. Technical specification

2.2 SWITCHGEAR LAYOUT

Metal partitions subdivide each panel into

- Circuit Breaker Compartment
- Busbar Compartment
- CT Compartment
- Metering Compartment

2.3 CIRCUIT BREAKER COMPARTMENT

The circuit breaker compartment contains a draw-out withdrawable truck with vacuum circuit breaker. It consists of a rack using which breaker can either be connected to the live supply i.e., service or the test position. The breakers are enclosed with a door in order to ensure protection of the breakers from the surroundings.

2.4 BUSBAR COMPARTMENT

This part of the HT panel consists of the bus bars which connect the incoming feeders, outgoing feeders and bus coupler. Incoming panels receive the supply from the transformers and the supply is given to the outgoing panels. The bars are coated with the standard colour representation to distinguish different phases i.e., R, Y, B and Ground (green colour).

Figure 2.1. Busbar Compartment

2.5 CT COMPARTMENT

It is the compartment where the measurement of current from the power feeders is done. It consists of current transformers which performs both measuring of current and the protection of the devices. Core balanced current transformers are commonly used for transformer and motor feeders to protect the devices from the sensitive earth faults. This compartment also has epoxy insulator to isolate the live contact and other part. Current transformers are present in all the panels be it indoor or outdoor panel.

Figure 2.2 CT Compartment

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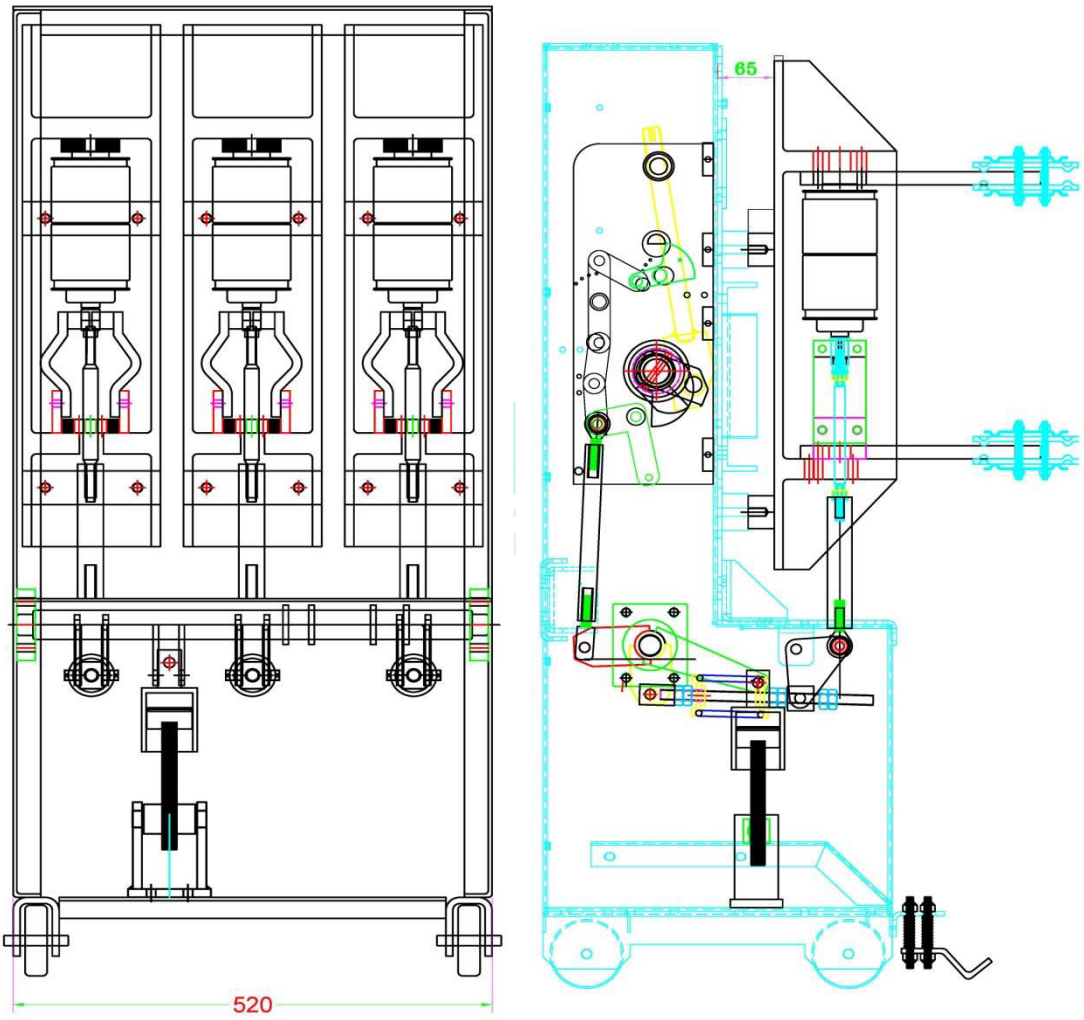
2.6 METERING COMPARTMENT

This compartment houses all the low voltage devices. Indicating lamps/metres, push buttons, relays and control switches are mounted flush with metering compartment door.

Figure 2.3 Metering Compartment

2.7 DESIGN

These new circuit breakers exemplify Voltech's proven vacuum interrupter engineering and manufacturing technology, as well as the superior design standards employed in the production of circuit breakers. The Following images are the typical 2D wire drawing of a Vacuum Circuit Breaker which is designed detail on AutoCAD software.



REAR VIEW SIDE VIEW

Figure 2.4 VCB Drawings

3.0 DELIVERY

- Handle shipping units carefully when unloading and unpacking them.
- Shipping units must be unpacked immediately after receipt.
- Any damage occurred in transit must be recorded and reported immediately to the manufacturer.
- On delivery, the consignment must be checked for completeness.
- The supplier must be notified in writing about any discrepancies.

3.1 UNPACKING

During unpacking, take the following precautions:

- Never allow the circuit breaker / panel to be laid on its side or turned upside down before, during or after unpacking.
- Ensure that the circuit breaker / panel are free from nails, piece of wood etc.
- Check the damage or deformations caused during transit or unpacking the crate.
- Check the accessories / spare and all items as per packing note.
- The circuit breaker should be removed from Panel for inspection of circuit breakers / panel.
- Open the panel door
- Withdraw the breaker from the panel using the driving handle as per withdraw / insert instruction given on the breaker.

Remove all cartons, containers and any other miscellaneous packaging and packing material from inside the Switchgear sections before energizing if any internal heaters. If to prevent from fire, remove any plastic polyethylene shrouding from the Switchgear sections before energizing any internal heaters.

3.2 TRANSPORTATION

Transport using a forklift truck: Only transport the circuit-breaker within its shipping unit on a pallet. The transport unit consists of assembled Switchgear cubicle with VCB trolley, CTs, PTs, busbars, roof bushings, electrical equipments etc and wired as per specification. On receipt, equipment should be checked according to the instruction in relative order specification. In any damage or irregularity is observed in the supply, the supplier should be notified at the earliest.

Make sure the rope or strap is strong enough to bear the weight of the circuit breaker and do not touch the circuit-breaker.

3.3 STORAGE

The transport packaging is not intended for storage. The risk of storing the parts in packed condition shall be the consignee's responsibility! Once the wooden packaging and the polythene sheet cover or corrosion proof packaging used inside are removed, respect for any damage to instruments, relays, etc. Check and verify the items as per the relevant dispatch note. Show the switchgear in an upright position on a levelled platform under permanent cover free from moisture and dust.

4.0 INSTALLATION

4.1 FOUNDATION PREPARATION

It is important that the finished floor area is flat, and not sloping. If the floor is not level, the switchgear may be deformed during installation, resulting in eventual malfunction of the equipment.

Pay particular attention to the following requirements for correct erection:

- The panel must be placed on a flat and level foundation without any foreign materials over the openings. Foundation channels or uni-struts may be used to ensure this condition. However, ensure that the space in between is cement filled. The level of the floor should be within +/- 0.5mm/m and +/- 2mm across the entire width of the switchboard.

- Mark the allocated positions of the panels on the cement surface for easy positioning. Ensure that minimum working space is available on Front, rear, Top and on side of first and last panel once the panels are coupled.

- The area of the sub-station floor in front of the switchgears must be flat and level so that the VCB can be easily racked in and out of the panel. Special cement with hardener should be used in these areas to prevent the cement from cracking under the weight of the VCB.

Note - CARE SHOULD BE TAKEN WHEN TIGHTENING THE FOUNDATION BOLTS AS EXCESSIVE TIGHTENING WILL DISTORT THE BOTTOM PLATE.

4.2 ERECTION OF VCB

After withdrawal from the cubicle the VCB can be shifted by means of four transport wheels fix at the lower end. The vacuum circuit breakers are supplied in the open (OFF) state with closing spring discharged.

The levelling is to be checked with a spirit levelling in perpendicular direction also. Foundation pocket for bolts shall be marked and made using a template. Typical G.A.Drawing:

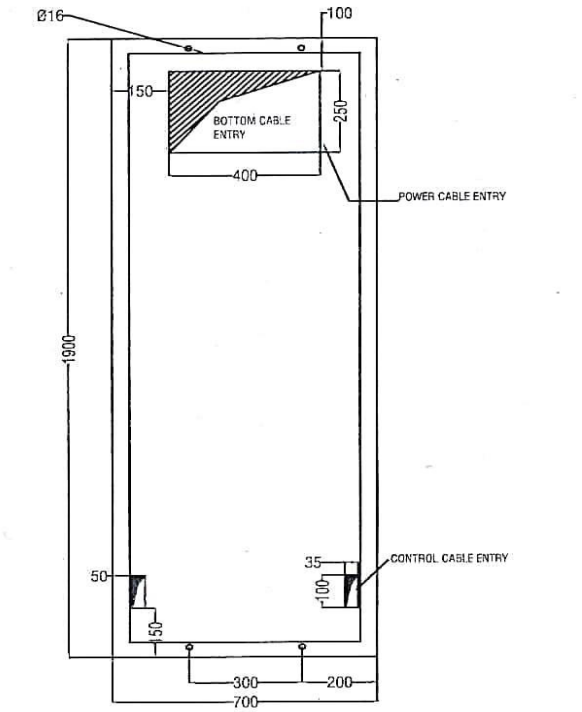


Figure 4.1 Foundation Diagram

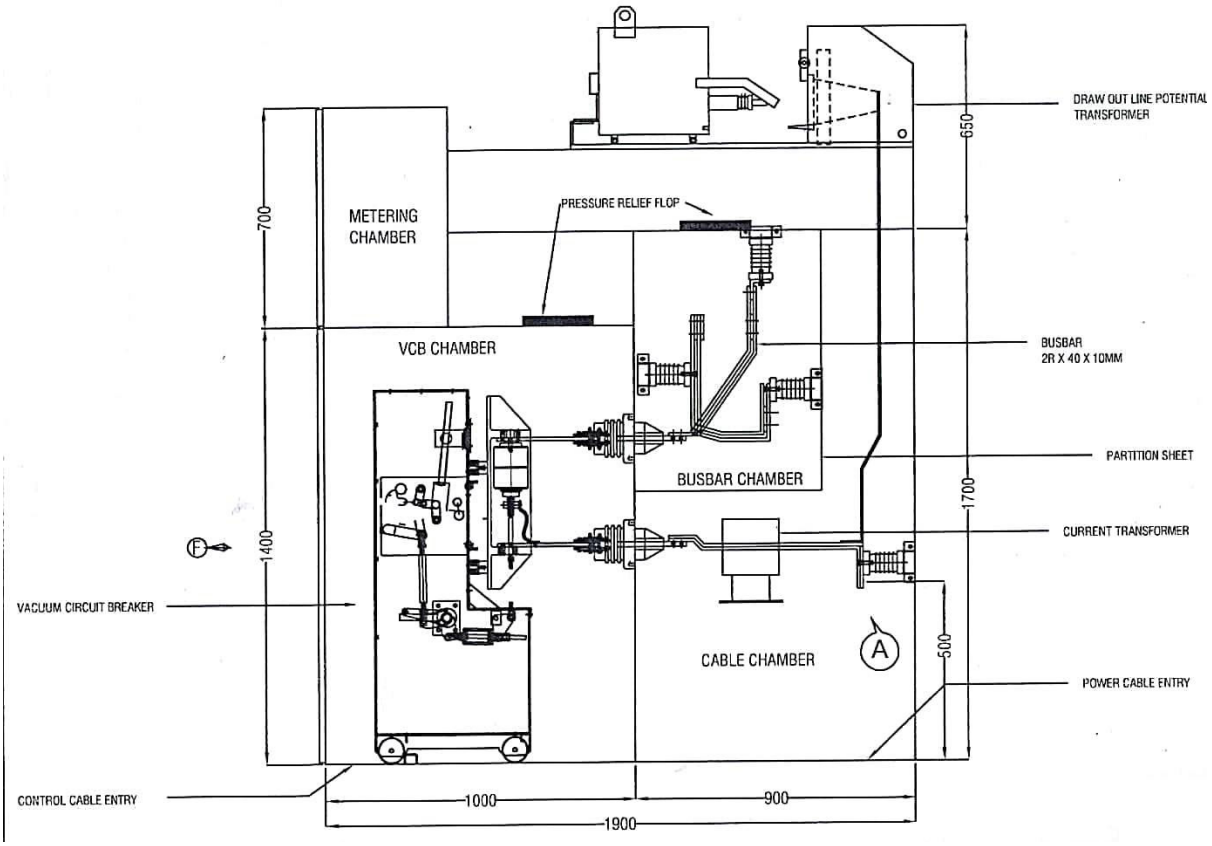


Figure 4.2 Side view of Panel

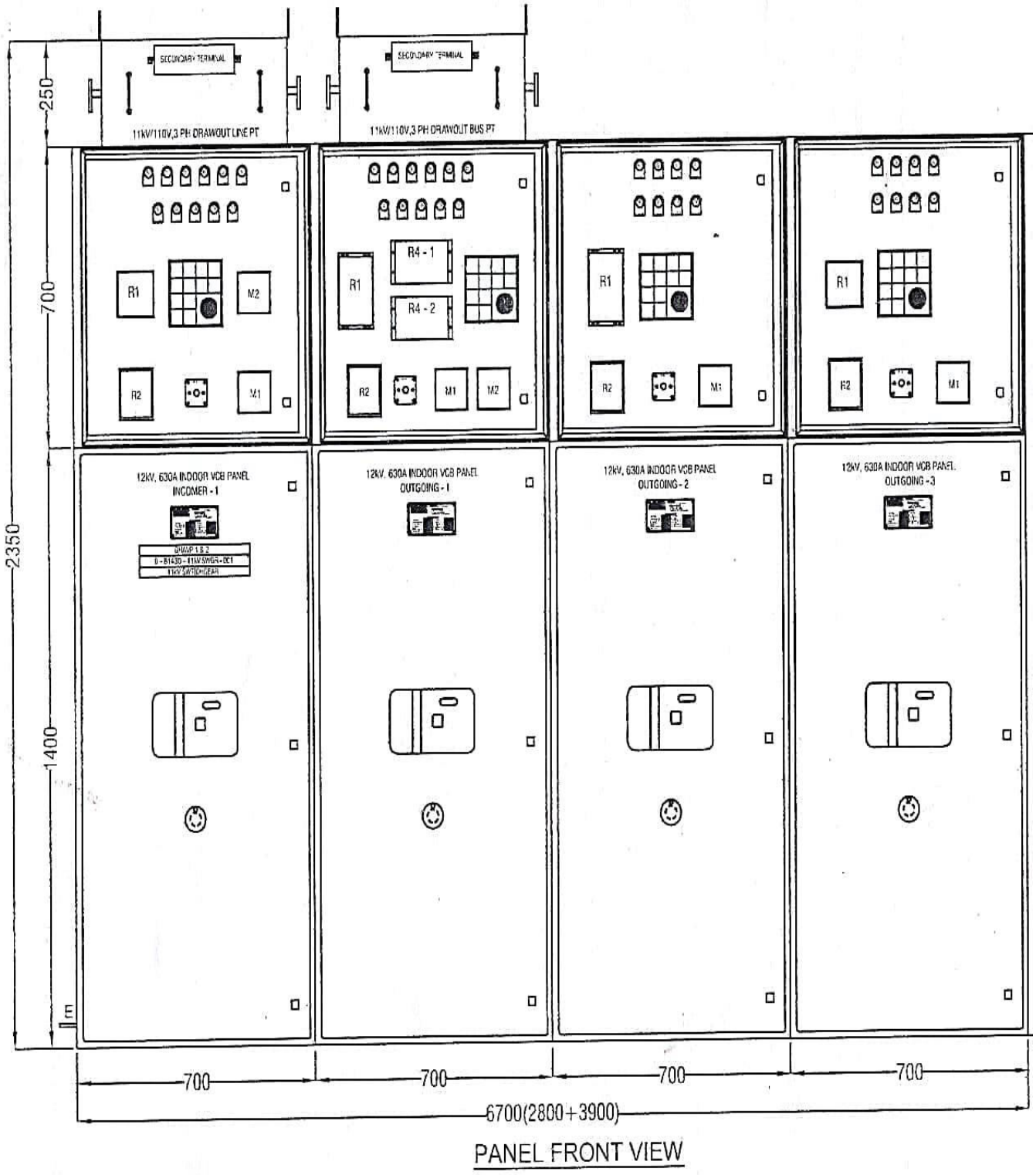


Figure 4.3 Front view of panel

4.3 ERECTION OF INDIVIDUAL PANELS

- Before direction of the panel transfers the transport unit including their wooden pallets to the point of using fork lift, mobile crane or trolleys only.
- Withdraw the truck from the cubicle before shifting.
- Position the panel unit cover the prepared area using the lifting Bolt provided on either side of panel aligning the fixed housing to the foundation Bolts.
- Locate the holes on the panel over that of grouted Bolt and tighten the balls ensuring that no excessive force is applied.
- Ensure that the panel is erected vertical with spirit level as described earlier with bolts, nuts, washer if necessary.
- Verify that the opening for cable entry is provided at the correct location.
- In case of bus ducts verify the position of income a cubicle with reference to the transformer a cubicle on the other end of the bus duct.

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5.0 CONTROL ELEMENTS AND OPERATOR INTERFACE

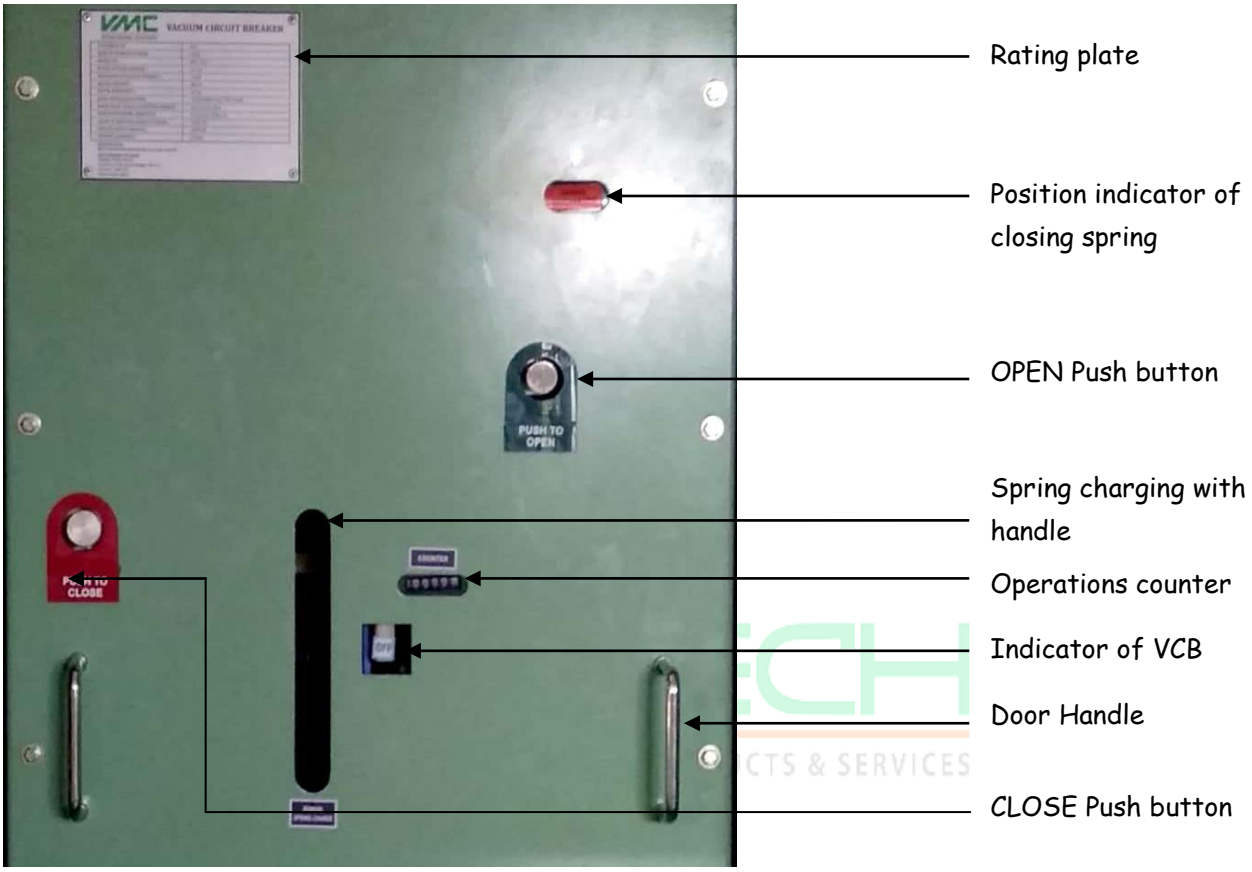


Figure 5.1 Operator Interface

5.1 ACTUATING WITHDRAWABLE UNIT

Move circuit-breaker from disconnected into service position by hand:

Initial situation:

Circuit-breaker OFF

Earthing switch OFF

LV plug / supply CONNECTED

Front door CLOSED

1. Insert crank handle (Fig. 5.1) and move it clockwise to its stop or until blocking; the circuit-breaker is racked into its service position.
2. Observe the position indicator on the switchgear panel.
3. Remove crank handle.

Move circuit-breaker from service into disconnected position by hand:

Initial situation:

Circuit-breaker OFF

1. Insert crank handle (Fig. 5.1) and move it counter-clockwise to its stop; the circuit-breaker is racked into its disconnected position. Observe the position indicator on the switchgear panel.
2. Remove crank handle.

5.2 CHARGING THE ENERGY STORING DEVICE

- **Manually**

Move circuit-breaker in"ready-for-closing" position.

1. Insert crank into opening for tensioning the energy storing device (Fig. 5.1)
2. Charge the spiral spring using the spring charging crank. As soon as the spiral spring is charged, the spring charging mechanism is decoupled and the position indicator signals"charged": If the motor starts during this process, this does not constitute a risk.
3. Remove crank. Now the circuit-breaker is ready for closing.

- **Via motor**

The energy storing device of motorized circuit-breakers is charged automatically as soon as the auxiliary voltage is applied. The remaining charging operation is similar to manual charging. When the springs are about to charged fully, the cam mounted on the cam-shaft will operate the micro switch through lever and supply to the motor will be cut off. The motor takes about 6 to 8 seconds to charge the springs.

5.3 CLOSING OPERATION

When the springs are fully charged the linkages attain position A. now the VCB is ready for closing operation.

5.3.1 MANUAL CLOSING

Push the closing push button the closing shop will turn about its axis, press releasing the closing catch. Now, energy of the closing spring will Cause cam to rotate at fast speed and bring linkages to position. The rotation of cam will turn the main shaft and the breaker will get charged during processing operation.

The breaker position indicator changes over to DISCHARGED. It is possible to recharge the spring in this position.

5.3.2 ELECTRICAL CLOSING

When supply is given to closing coil the plunger of closing coil be pushed the closing paddle. This will cause the closing shaft to turn.

The remaining closing is similar to manual closing operation. The supply to motor is reconnected immediately on closing of the breaker due to rotation of cam, lever and micro switch and the closing spring get recharged and linkages attain the position. The breaker position indicator changes over to closed, and after immediate recharging, the charging will show charged.

5.4 OPENING OPERATION

When the VCB is closed the linkages attain the position and the breaker is ready for opening.

5.4.1 MANUAL OPENING

Push the trip push button. This will turn the trip shaft through tripping paddle, which in turn will release the tripping catch. The energy of opening springs and white springs will cause telling cages to attain the position.

This movement of linkages will turn the main shaft on the circuit breaker will open. During opening operation, initially, the energy of wipe springs will be released to attain the required initial speed. The same will be further maintained by the release of opening spring energy.

5.4.2 ELECTRICAL OPENING

When supply is given to tripping coil the plunger of tripping coil will push the tripping shaft, causing it to turn. The remaining operation is similar to manual of opening operation.

5.5 AUTO RE-CLOSING FEATURE

The VCB is provided with the facility for auto re-closing. This feature is achieved since it is possible to charge the closing springs as soon as they get discharged during closing operation. The Mechanism is thus ready to re-close VCB as soon as it is opened.

6.0 VACUUM CIRCUIT BREAKER

A circuit breaker is a device that interrupts an electric circuit to prevent fault current, caused by a short circuit or overload. A vacuum circuit breaker is a kind of circuit breaker where the arc quenching takes place in a vacuum medium. It consisted of completely sealed vacuum interrupter for 3 phase AC current which performs basic functions such as opening and closing of VCB. It is used in sub-stations, industries, star hotels, factories, and high voltage requirements.

The vacuum circuit breaker consists of The mechanism housing, the 3-pole assemblies with vacuum interrupter, U-shaped barrier which ensure stable mounting of the vacuum interrupter and also provide adequate inter-face and phase to earth segregation. The barrier is mounted on the rear side of the The vacuum circuit breaker consists of The mechanism housing, the 3-pole assemblies with vacuum interrupter, U-shaped barrier which ensure stable mounting of the vacuum interrupter and also provide adequate inter-face and phase to earth segregation. The barrier is mounted on the rear side of the VCB mechanism cabinet. The mechanism housing accommodate all electrical and mechanical elements required for opening and closing the vacuum circuit breaker. The mechanism housing has a detachable cover which has cut-outs for the equipment level of the circuit breaker. mechanism cabinet. The mechanism housing accommodates all electrical and mechanical elements required for opening and closing the vacuum circuit breaker. The mechanism housing has a detachable cover which has cut-outs for the equipment level of the circuit breaker.

- Vacuum circuit breaker is attached with a dedicated switchgear panel to serve as switchgear.
- The incoming supply is connected to the switchgear panel and outgoing is given to the external product.
- The relay senses the fault occurred and transmits the signal to the vacuum circuit breaker.
- The breaker trips the circuit automatically by spring charging mechanism.
- After the fault is cleared, circuit may be closed with the help of breaker by manually pushing the closing coil button or it can be closed with the help of remote access.
- Since all processes are automated, only installation is enough to use this product.

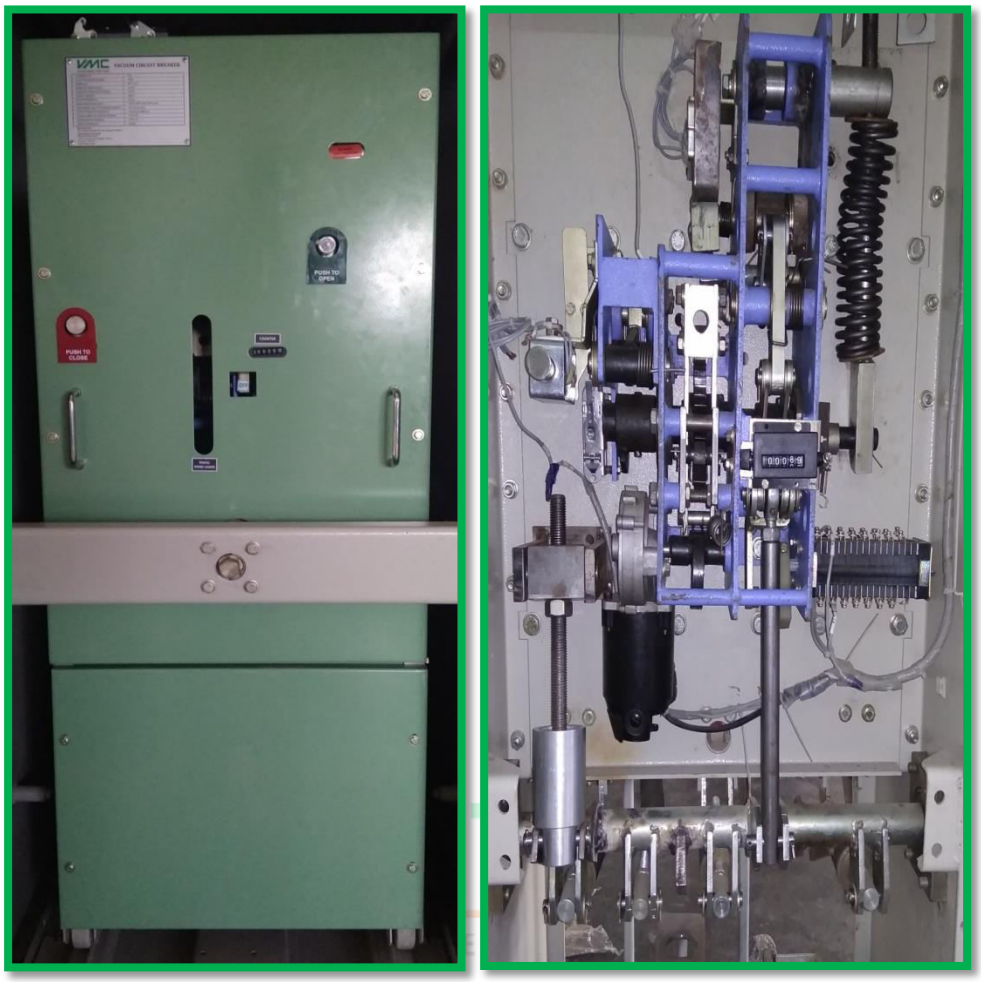


Figure 6.1 VCB with and without panel (FRONT)

Figure 6.2 VCB (REAR)

6.1 CHARGING

- Spring charging motor mechanism incorporates a cam attached with rotor to change the closing spring.
- The charging is done by a ratchet (with curved tooth) mounted on the main shaft.
- The motor will run until reaches the limit switch thereby positioning the cam in the correct position.

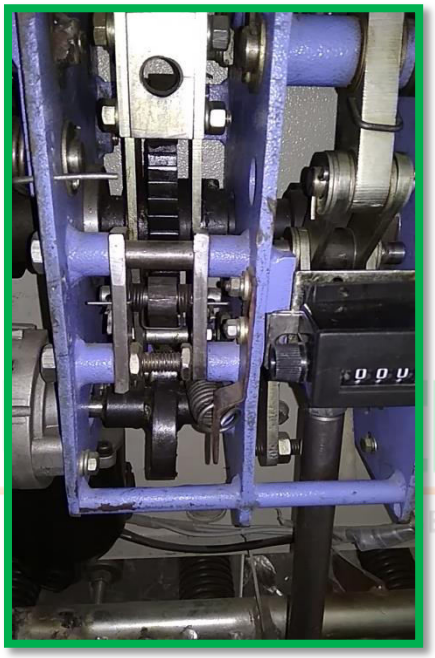


Figure 6.3 Charging Mechanism

6.2 COMPRESSION

- The closing spring (open coil helical spring) is charged or compressed by spring charge motor mechanism or by manual cranking.
- The fully compressed position also makes the cam to be in the vertical position (being ready to close the breaker i.e. to hit the linkage roller)
- This closing coil will always be in the compressed/closed position to make sure that it is always ready for the next closing operation.

Figure 6.4 Closing Spring

6.3 CLOSING

- The closing coil (Fig 6.5) with its latch assembly holds the closing spring force, which is waiting for the signal to close the circuit breaker or by manually.
- The latch holds the curved arm with is connected to the main shaft.

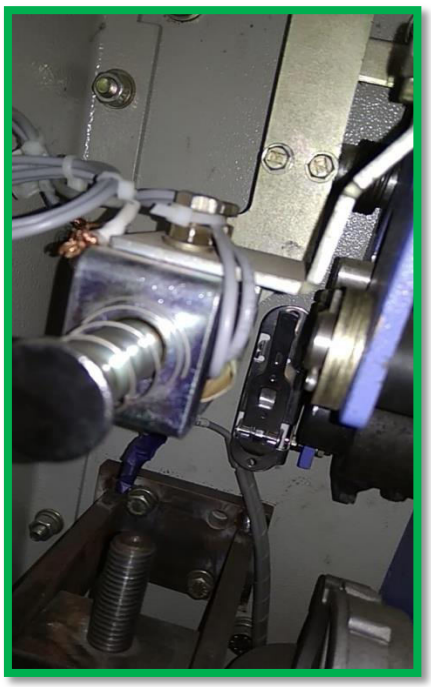


Figure 6.5 Closing coil

- On pushing the closing coil the latch releases the arm to rotate with the main shaft thereby the closing cam (Fig 6.6) hits the linkage associate with a roller.
- Now the main drive rod rotates the main drive shaft.

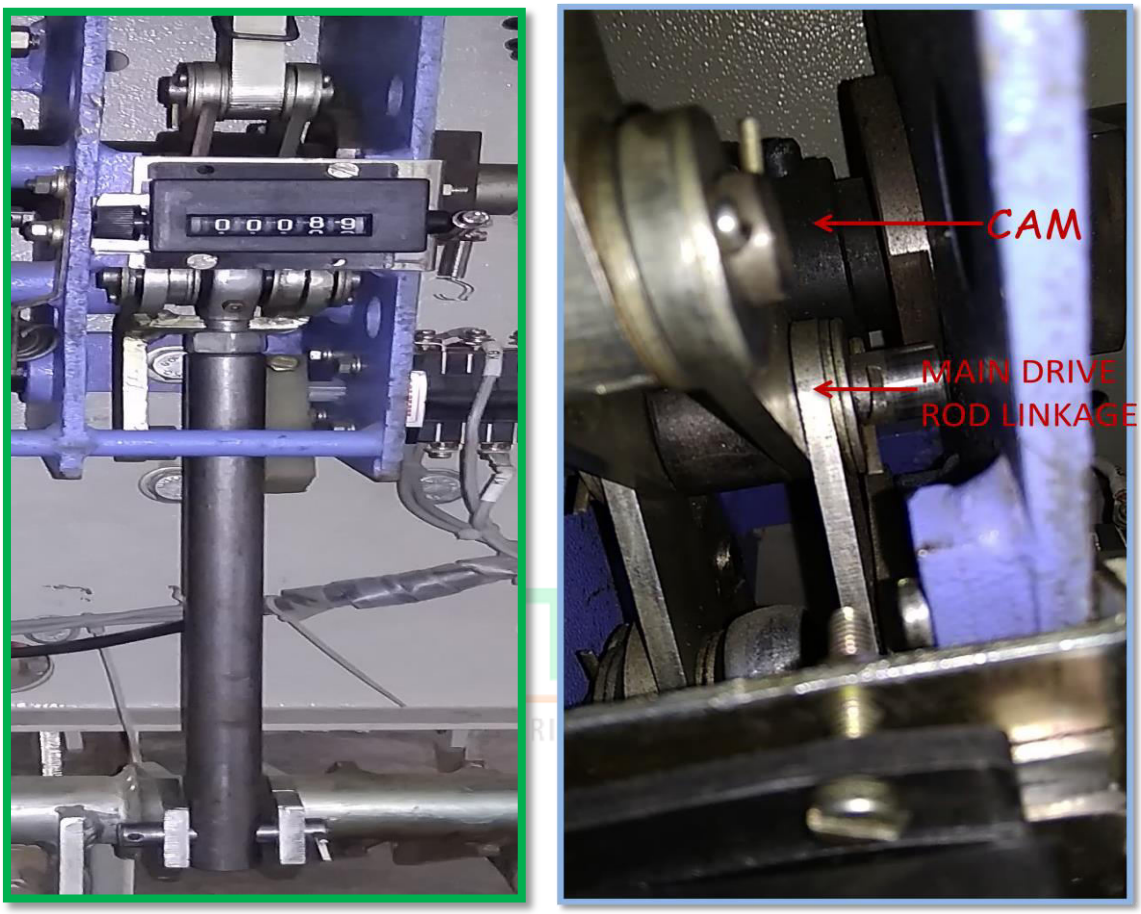


Figure 6.6 Closing cam

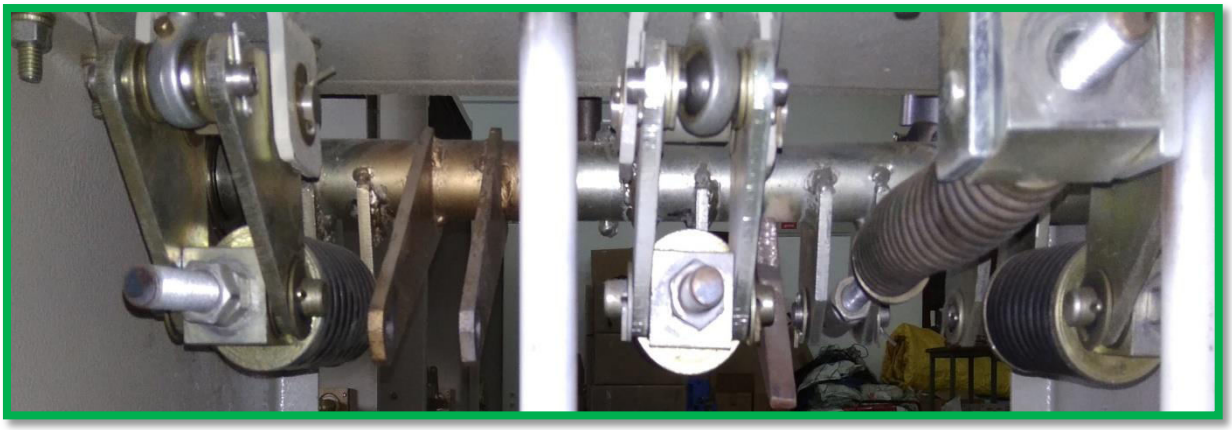


Figure 6.6 Contact spring assembly with hold open spring

- The contact spring is now compressed and forces the bell crank to lift the pole drive rod.
- The purpose of contact spring is provided to overcome the repulsive force due to short circuit & to maintain strong contact of the buds of vacuum interrupter.

Hold open spring is provided to return additional forces on tripping. The pole drive rod attached with the vacuum interrupter now closes the circuit. The bud like structure is made to contact with each other. Now the current flows between the top & the bottom terminals.

6.4 OPENING

- The pole drive rod attached with the vacuum interrupter now closes the circuit.
- The bud like structure is made to contact with each other.
- Now the current flows between the top & the bottom terminals.

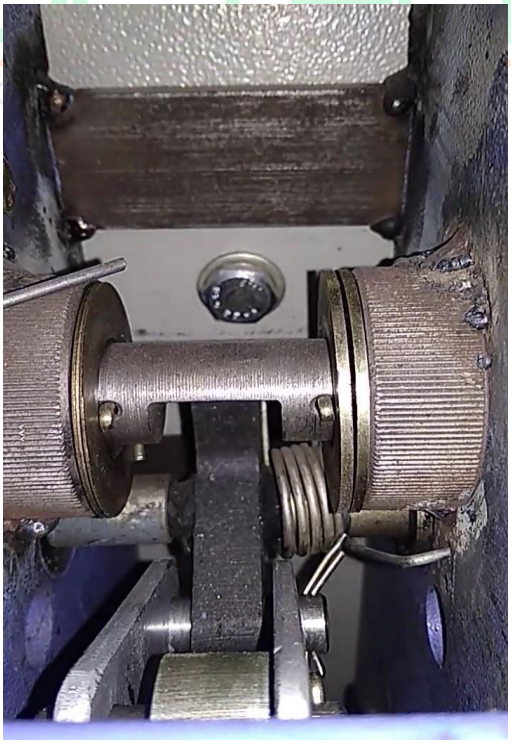
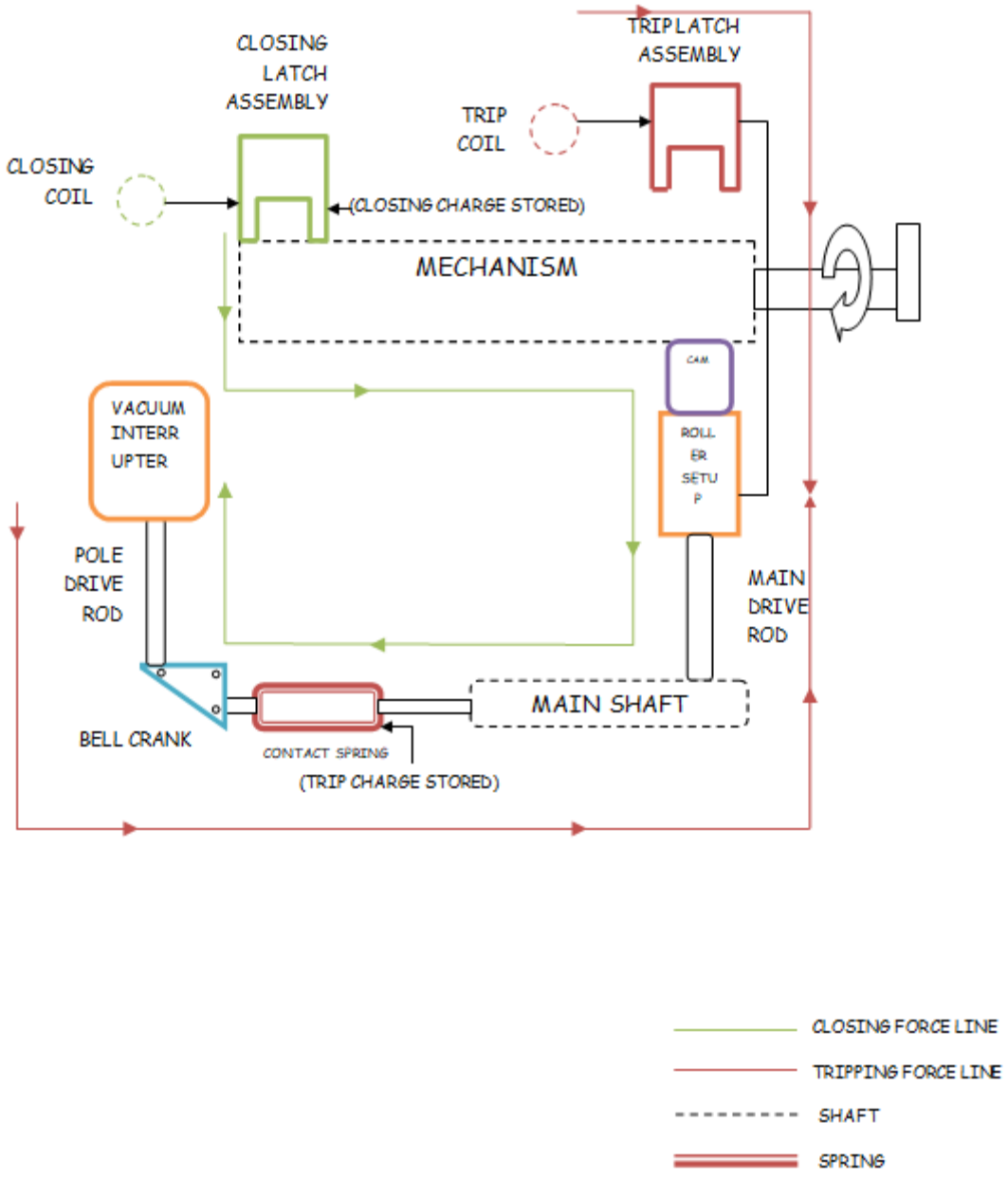


Figure 6.7 Closing latch assembly

7.0 FORCE CHART

The Force Chart of a Vacuum Circuit Breaker represents, how the mechanical force is being transfer from one component to another component & also exhibits how finally the motion of a breaker is achieved in an efficient manner.

The typical flow chart of a Vacuum Circuit Breaker is given below:



8.0 VACUUM INTERRUPTER

The basic construction of the vacuum interrupter for the vacuum circuit breaker is shown in the sectional view in figure 8.1

The fixed contact piece is connected directly to the housing. The moving contact is fixed to the terminal Bolt and is located centrally in the guide. The metal bellows together with insulators made of high Alumina ceramic and the end flanges from the vacuum-proof interrupter housing.

Spring operating mechanism mounted inside sheet Steel cabinet is used to provide the energy required for breaker operation. The closing springs, which are charged manually or through a motor, provide the energy for the closing the VCB and for applying sufficient contact pressure on the moving contacts vacuum interrupter through the wipe springs. The wipe springs provide the initial energy during the operation of the VCB. The opening springs, which get charged on closing the VCB, provide energy for opening of the VCB.

The mechanism energy (Fig 8.2) is transmitted to the vacuum interrupter via insulating links during closing as well as opening. There is a dashboard in which provide sufficient damping during the opening operation of the VCB.

The VCB is provided with open/closed and charged/discharge indicator on its front side. A green colour push button is provided for manual opening/tripping and red colour push button is provided for manual closing /ON of the VCB. When VCB is received at site it is in open condition and the springs are discharged. A charging handle is provided in the front for manual spring charging.

Inbuilt handles are provided on the sites for charging the VCB. At the upper centre of the VCB cabinet front cover, an opening is provided for movement of charging handle for charging of closing springs of VCB. Separate handle is provided for VCB rack in rack out. On the top of the trolley left corner, a provision has been made for inserting the multi pin plug socket.

The closing coil, tripping coil and breaker operated auxiliary switch is provided in mechanism cabinet.

The VCB is provided with an anti-pumping feature to prevent the reclosing of the breaker after opening in case of continuous electrical closing command. The anti pumping relay and auxiliary relay for spring charging motor are mounted in the mechanism cabinet.

The moving contacts of the vacuum interrupter is connected to the bottom disconnecting on through flexible jumpers, the fixed contact of the vacuum interrupter is assembled with that top disconnecting arm.

The Jaw contacts, fixed at the end of the disconnecting arms, are made of specially designed copper strip which are assembled together and are spring loaded. This includes sufficient contact pressure when the job contact gets engaged with the contacts blades in the panel while the VCB is in SERVICE position.

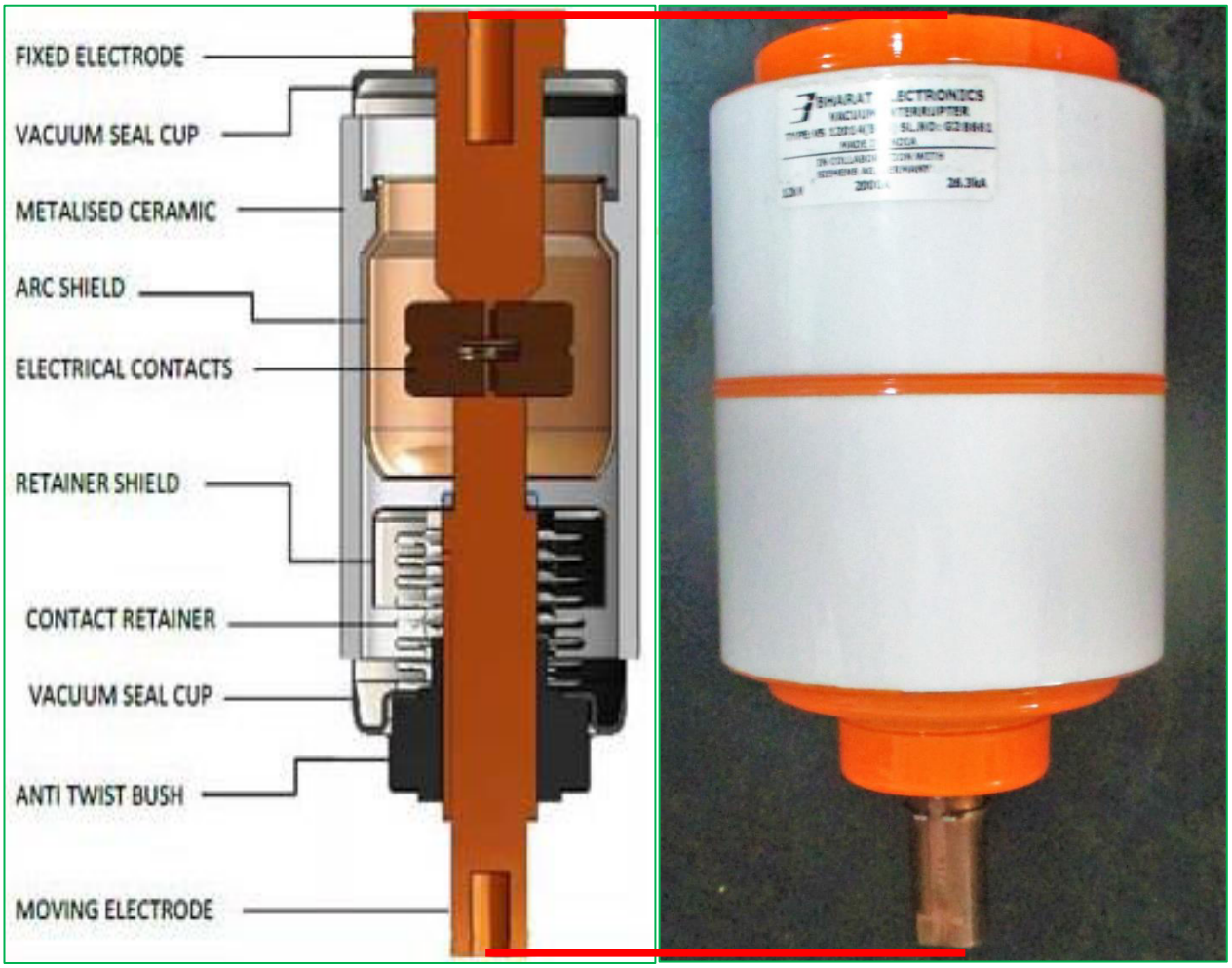


Figure 8.1 Vacuum Interrupter

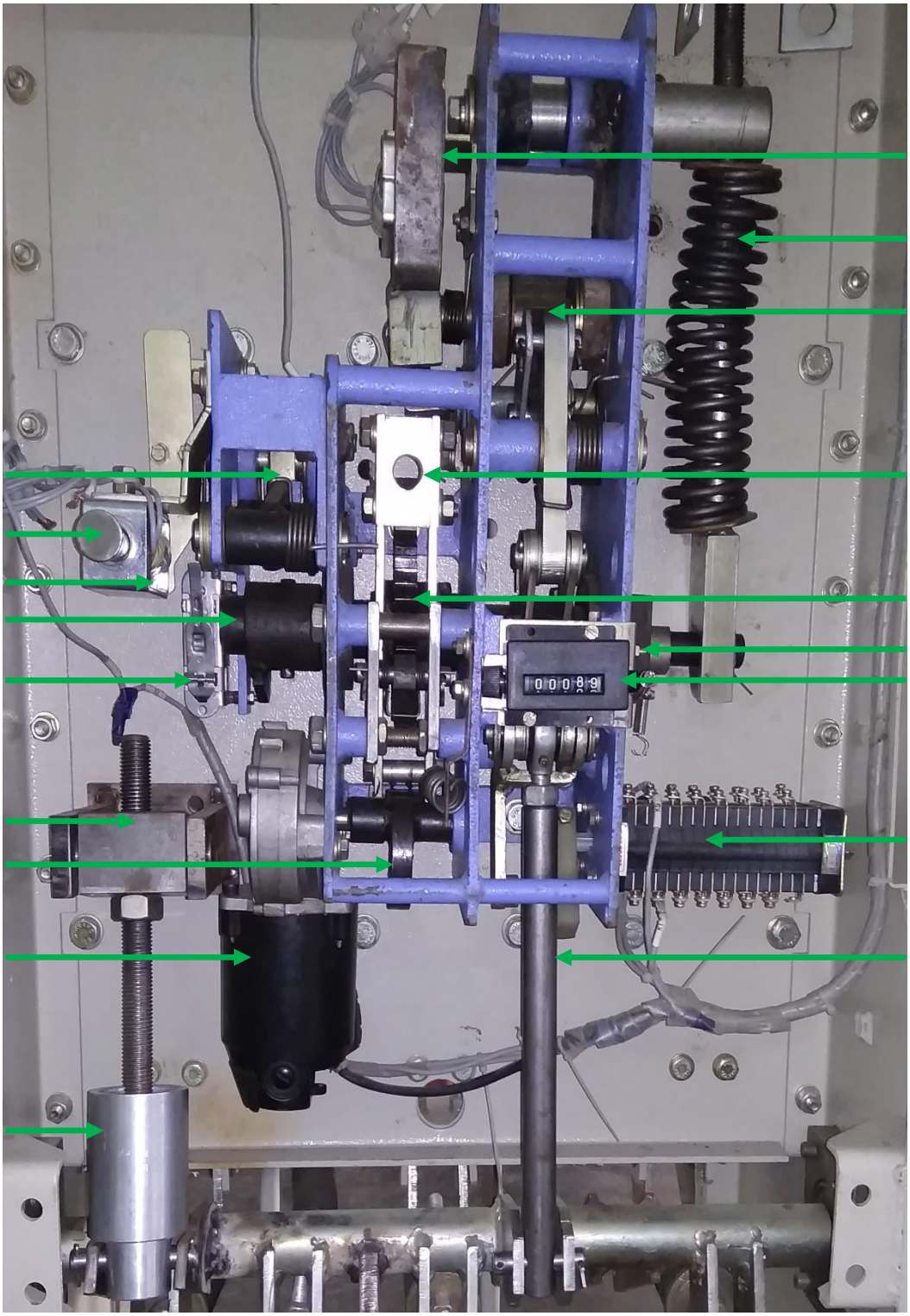


Figure 8.1 VCB Mechanism

9.0 GENERAL PROCEDURES

Before putting the circuit breaker into service carry out the following checks:

- Check the tightness of the power connections on the circuit breaker terminals.
- Check that the value of the supply voltage for the auxiliary circuit is within 85% and 110%, of the rated voltage, of the electrical devices.
- Check that no foreign material has got into the moving parts.
- To gain access to the operating mechanism safely, discharge the closing springs (by closing & opening the circuit breaker), then remove the cover of the operating mechanism.
- Check that air circulation in the circuit breaker installation site is adequate so that there is no danger of overheating.
- Remove the transport caps from the poles, Ensure that the instruction manual is available to the operator at all the times.

When the front door is open check following test operation

- The motor operating mechanism must start immediately and charges are breaking closing spring.
- Open and close the breaker 5 times
- Full of the LV cable plug. Charge the breaker closing Spring by handle.
- Operate the circuit breaker.
- Refit the LV cable plug.

When the front door closed check the following test operation

- Transfer the withdrawable truck to the disconnected position.
- Switch on the auxiliary and control supply.
- Transfer the withdrawable part to the connected position.
- Open and close the breaker as long as no high voltage is applied.
- Without using post check all mechanical and electromechanical interlocks for satisfactory functioning. Check to see whether the switching states are indicated correctly in the control room. Check insulation resistance between phases and also Phase to earth with the help of megger and also conduct High Voltage test on vacuum interrupter to check the healthiness.

10.0 MAINTENANCE SCHEDULE

During normal service the circuit breakers require only limited maintenance. The frequency and the sort of inspections and maintenance basically depend on the service conditions. Various factors must be taken into account.

Table 10.1 Maintenance schedule

Maintenance operations	Installation in normal ambient	Installation in dusty (or polluted) ambient
Carry out the general inspection	One year	Six months
Carry out visual inspection from outside and inspect the medium voltage parts	One year	Six months
Measure the insulation resistance	Three years	Six months
Lubricate the sliding points	One year	Six months
Carry out the operating mechanism maintenance	Five years or every 10000 operations	Three years or every 5000 operations
Complete overhaul	Ten years or every 20000 operations	Five years or every 10000 operations

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Before carrying out any maintenance work it is essential to follow the procedures given below:

Open the circuit breaker and check that the closing springs are discharged.

Work must only be carried out when the circuit breaker is withdrawn from the enclosure.

10.1 POLE MAINTENANCE

The breaker pole with vacuum interrupter is maintenance free upto reaching the permissible number of vacuum interrupter operating cycles. Checking of the vacuum is only necessary when there is a good cause to suspect that force applied externally to a pole tube has caused damage to the vacuum interrupter inside.

Before commencing the maintenance work, ensure that the circuit breaker :

- Is disconnected from the high voltage and auxiliary voltage terminals.
- Is in the open position and the closing spring of the operating mechanism is fully discharged.
- Is fully withdrawn from the cubicle.

10.2 VACUUM INTEGRITY CHECK

(Using Mechanical Test)

- Before putting the circuit breaker into service, or if a vacuum interrupter is suspected of leaking as a result of mechanical damage, check the vacuum either mechanically as described in this section or alternatively electrically using a high potential test set as described in the next section.
- Open and isolate the circuit breaker and detach the insulating coupler from lever

The atmospheric pressure will force the moving contact of a hermetically sealed vacuum interrupter into the "Closed" position, causing lever to move into the position. A vacuum interrupter may be assumed to be intact if it shows the following characteristics:

An appreciable closing force has to be overcome when lever is moved to the "Open" position by hand. When the lever is released, it must automatically return to the "Closed" position with an audible sound as the contacts touch. After checking the vacuum, reconnect the lever to the insulating coupler.

10.3 HIGH-POTENTIAL TESTS

The next series of tests (Vacuum Integrity Test and Insulation Tests) involve use of high voltage test equipment. The circuit breaker under test should be inside a suitable test barrier equipped with warning lights.

Vacuum Integrity Check (using Dielectric Test)

- A high potential test is used to verify the vacuum integrity of the circuit breaker. The test is conducted on the circuit breaker with its primary contacts in the Open position.

11.0 IEC & IS STANDARDS

The International Electrotechnical Commission is an international standards organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

IEC 62271 – HIGH VOLTAGE SWITCHGEAR & CONTROLGEARS

- **IEC 62271** applies to AC Switchgear & Controlgear for indoor/outdoor installation and operation up to 60 Hz & above 1000V.
- This standard defines common requirement about general conditions like indoor/outdoor temperature, humidity etc.
- This also standardize :
    1. Terms & definitions
    2. Ratings
    3. Design & Construction
    4. Type tests & Routine tests
    5. Information to be given with Enquiries, Tenders & Orders.
- **Type test** is conducted on first prototype of product to confirm the design specifications. This test is not repeated on other products of same type.
- **Routine tests** conducted on each product manufactured to confirm proper manufacturing of each and every unit. This test is essential to be performed on each unit before dispatching the product to site.

11.1 TYPES OF TYPE TESTS

The various types of type tests are given below:

1. Dielectric Test
2. Radio Interference Voltage Test (RIV)
3. Measurements of resistance of circuits
4. Temperature Rise Test
5. Short-time Withstand current & Peak Withstand current
6. Verification of Protection

7. Tightness Test
8. Electromagnetic Compatibility Test (EMC)
9. Additional Test on Auxiliary and control circuit
10. X-radiation test procedure for vacuum interrupters

- **Tripping Interlock:**

  Tripping interlock is a safety tripping rod. When the breaker is brought to test or service position it must trip for safety concern.

- **Trapped key Interlocking:**

  It uses locks & keys to control equipment & machinery to ensure safe operation. This key is used to isolate a power source.

- **Automatic safety shutters**

  It is to fully cover the female primary disconnects when the breaker is withdrawn

- **EARTHING TRUCK**
- Emergency manual trip
- Compartment door of the breaker shall not open unless the associated breaker is in open position.

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12.0 DOs:

- Perform all the operations in CLOSE door condition only. (Rack in, Rack out, Open and Close)
- Ensure following before racking the VCB from TEST to SERVICE position.
- VCB is in TEST position.
- VCB is in OPEN condition.
- Earth switch is in OFF condition if provided.
- Control circuit plug is fully engaged. Red lever on control plug mechanism should come upward direction when CONTROL PLUG is fully engaged.
- Ensure VCB compartment door is fully closed and all the bolts on VCB compartment door are fully tightened.
- Earth switch should be operated when VCB is in DISCONNECTED position.
- Always cross check rating of the VCB before insertion inside the panel.
- Ensure complete switchboard is free from dust and any other foreign particles.
- Ensure all openings including hole provided for earthing connection are properly closed with seal to avoid any vermin/ reptile entry.
- Ensure that the shutter assembly is unlatched before inserting the VCB into the panel.

12.1 DON'Ts:

- Do not apply any flammable lubrication on the bus bar joints or VCB contacts.
- Do not perform any operations in OPEN door condition. (Rack in, Rack out, Open and Close).
- Do not operate the interlocking lever on VCB.
- Do not try to rack in VCB when control plug is not engaged. By operating the VCB forcefully it may damage the control plug mechanism.
- Do not try to rack in VCB when VCB is in CLOSED condition.
- Do not try to operate Earth switch when VCB is in CONNECTED position if provided.
- Do not operate the VCB when castle lock is in LOCKED condition.

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