S&S POWER SWITCHGEAR LIMITED

UNLOADING, STORAGE, ERECTION, INSTALLATION & MAINTENANCE MANUAL

36 kV Outdoor Fixed Porcelain Clad Vacuum Circuit Breaker Type OFVp36

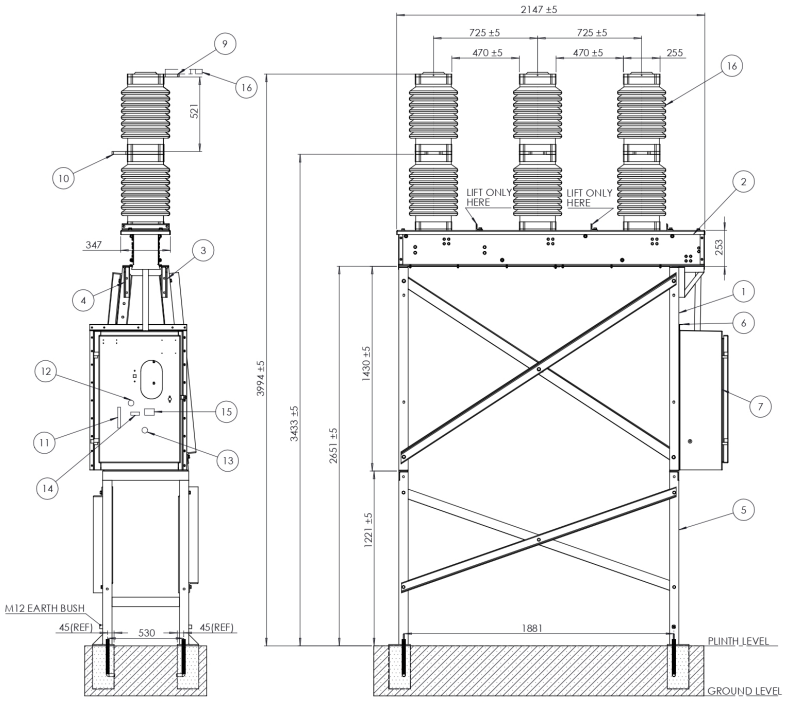
INDEX

1. GENERAL

- This manual describes the recommended procedures and practices for providing a satisfactory service.
- In case of any doubt please contact our Maraimalai Nagar factory – Near Chennai
- The equipment supplied may differ in details from that described in this manual due to our goal of continuous improvements.

1.1. INTRODUCTION

The Outdoor version Fixed Porcelain Clad Vacuum Circuit Breaker type OFVp is a non-extensible type and is for use on earthed systems. The Circuit Breaker is supported on a steel frame and designed for plinth mounting. Refer G.A.drawing. - Fig.1.



ITEM NO.	DESCRIPTION	QTY.
1	ASSY.OF PRIMARY STRUCTURE	1
2	ASSY.OF LINKAGE OFVP36kV	1
3	W.A OF SUPPORT ANGLE LH	1
4	W.A OF SUPPORT ANGLE RH	1
5	ASSY. OF SECONDARY STRUCURE	1
6	MECH.MOUNTING PLATE	1
7	WA OF MECHANISM BOX	1
8	OFVP 36kV POLE ASSY	1
9	TOP FLANGE (TERMINAL PAD)	1
10	BOTTOM FLANGE (TERMINAL PAD)	1
11	MANUAL CHARGING HANDLE (INSERT)	4
12	MANUAL TRIP PUSH BUTTON	4
13	MANUAL CLOSE PUSH BUTTON	4
14	SPRING CHARGED/RELEASE INDICATION	4
15	VCB ON/OFF INDICATOR	4
16	TERMINAL CONNECTOR	3

(FIG-1)

G.A of Outdoor Vacuum Circuit Breaker (OFVp36kV)

i) The Circuit Breaker conforms to Indian Standard IS:13118 and International Standard IEC 62271-100.

ii) The circuit breaker consists of a drive linkage assembly between two steel side channel and above these side plates Pole Assy. containing drive link and Vacuum interrupter are mounted.

iii) Vertical movement applied to the drive rod by the operating mechanism is transmitted through bell crank levers and insulation drive links (housed in the bottom BUSHING) to the flexible contact attached to the interrupter moving contact stem. Support base casting for interrupter houses contact strips for current transfer between base casting and sliding contact. Interrupter top fixed stem is connected to the top aluminium pad through a copper casting. Bottom aluminium pad is bolted to the interrupter support base casting.

iv) Contact pressure is applied in closed position by contact spring. Hold open spring assembly which is compressed while closing provides opening force during tripping.

v) Access to linkage is possible from sides and underneath through the bolted covers.

vi) The Circuit breaker operating mechanism, together with its ancillary equipment is housed within the weatherproof chamber.

vii) Current Transformers and Voltage Transformers can be mounted on the integral steel structure of the breaker when provided.

viii) Weather proof outdoor relay and instrument control panel can be mounted on the structural frame or as per the customer's requirement. Relays, meters and switches are mounted on an inner door, which is hinged to swing outwards, thereby giving access to rear terminals. Entry of pilot-cables is through the plate situated in the bottom of the chamber.

2. TRANSPORTATION / UNPACKING / STORAGE

2.1.TRANSPORTATION

The Circuit Breakers are dispatched as units duly packed as per the following standard packing list.

Case No.1

A.	Assembly of 36 kV Outdoor Triple PoleVacuum Circuit Breaker with Linkage Assembly, operating mechanism and primary structure. (Safety link bolted to the side plate of the Mechanism box)	1 No.
B.	Components for Secondary Structure	200 kg (app) Weight of Case

Case No. 2

a.	Assembly of C.T. Mounting Structure (when ordered)	
i)	LHS/RHS angles	2 Nos.
ii)	W.A. of Vertical member	2 Nos.
iii)	Support angle	2 Nos.
iv)	Horizontal support (Breadth) angle	2 Nos.
v)	Horizontal support (Length) angle	1 No.
vi)	Hardware for the above	Lot

Case No. 3

A.	Assembly of Outdoor Control Panel (when ordered)	1 No.
	Weight of case	400 kg approx
B.	Loose Items:	
a)	Foundation Bolts, Nuts & Washers	4Nos. each
b)*	Foundation Bolts, Nuts & Washers for CT Structure	2Nos. each
c)	Slow Close Handle	1No.
d)	Manual Spring Charging Handle	1No.
e)	Setting Gauge	1 No.
f)	Assembly of Terminal Connectors	6 Nos.
g)*	Interconnections between CT & Breaker	3 sets
h)	Hardware for the same	Lot
I)*	CT Mounting Plate	3 Nos.
	Weight of Case	200 kg.approx.

Case No.4

1*	Current Transformers	3 Nos.

-

NOTE: Item Marked (*) are related to Current Transformers and these optional items will be supplied as per the Purchase Order if called for.

2.2. UNPACKING AND INSPECTION

Carefully unpack without damaging the equipments. Carry out visual inspection of Porcelain Clad Pole Assemblies. Also ensure Electrical components in Control/Relay Boxes are received in sound condition. Count and ascertain Structure and Hardware material are in line with Bill of Materials. Report to Supplier / Insurance for damages / missing items, noticed during inspection duly by an authenticated document. Repack if the equipment is going to be stored for a long period.

2.3 STORAGE

The Circuit Breakers are sent in crates secured for safe transportation. Store it in upright position on secured ground or ramp. Free fall of the equipment due to soil erosion should be avoided as weight of the breaker is confined to its upper portion. Control Box and Control Relay Panels if supplied should be taken out of their packing's and should be stored indoors in upright position free from moisture.

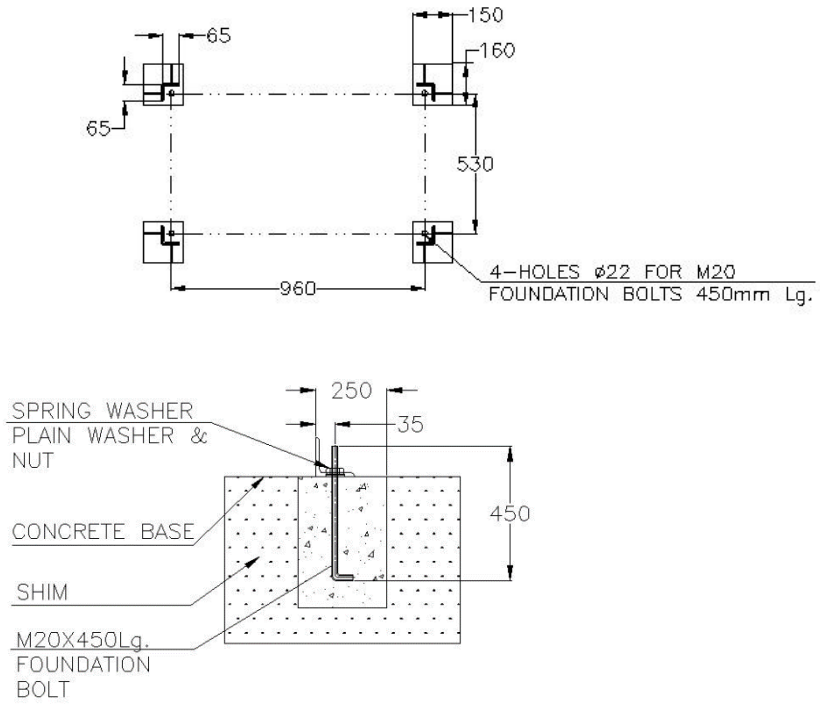
2.4 TRANSPORTATION TO SITE

Where the breakers are to be transported from one store to another or to site, it should be transported along with its packing crates. The packing crates are designed not only to cover the equipment but also to protect it from damage during transportation. While loading, unloading and transportation, due care should be taken to prevent any damage to the equipment. For loading/unloading, Crane / Fork Lift should be used and manual handling should be avoided. Safety Transportation angles should be removed only just before installation.

3. ERECTION

3.1 SITE PREPARATION

OFVp type VCBs are free standing requiring accuracy of foundation only as far as is necessary from and appearance point of view. It is recommended that the floor should be flat and level to within 3.0 mm in 1 meter.



Method of Securing Unit

(FIG-2)

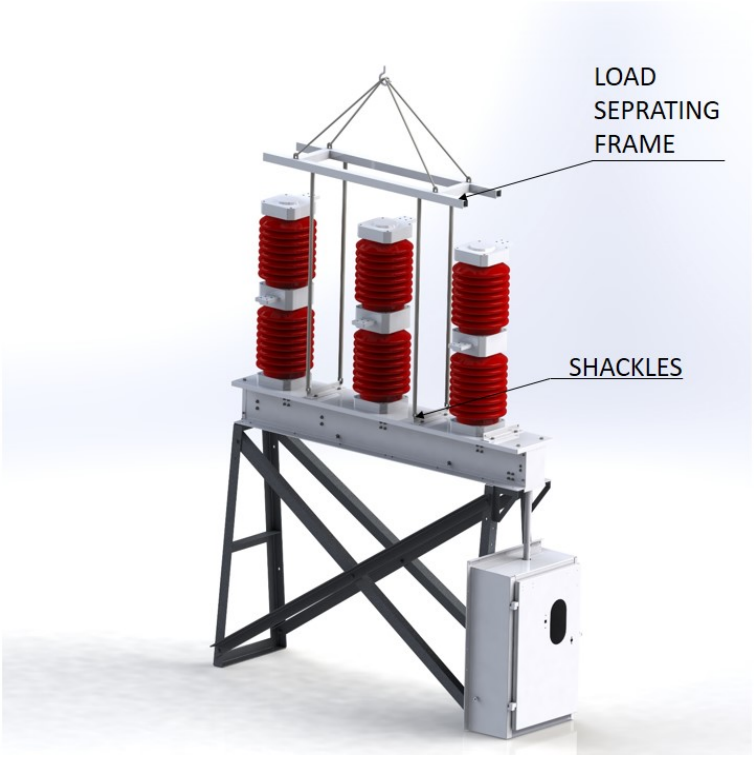
The impact loading of the vacuum interrupter is negligible and therefore no allowance need be made for this when calculating factor of Safety for general foundation arrangement refer to fig.2.

3.2 UNLOADING

The Circuit Breaker along with its packing's should be kept near to the plinth where it has to be erected. Packing crates of all sides except bottom should be removed and the securing bolts and nuts of the Breaker and base packing as well as the transportation angle should be removed.

Lifting provision by means of 4 lifting lugs has been provided carefully balancing the weight of the Circuit Breaker. Hence lifting must be done through these lifting lugs only. Spreading frame, Shackles, stings, deric / crane should be used for lifting the breaker, (refer fig.3). Care

should be taken while lifting, such that no load should come on to any part of the Porcelain Bushings or Terminal Pads of the Pole Assembly.



Method of Lifting the Unit

(FIG-3)

3.3 UNIT ASSEMBLY: Fig.1, 2 & 3

The Unit should be assembled in the following manner:

Grout all the foundation bolts as per the relevant general arrangement drawing or as per the foundation plan drawing supplied along with the equipment. (Refer fig.2 for typical foundation).

Complete the assembly of secondary structure and secure it to the ground by the foundation bolt.

Assemble the circuit breaker along with mechanism over secondary structure and secure them by the hardware supplied.

If CT Structures are in S&SPSL's scope of supply, erect the CT structures as shown in the relevant general arrangement drawing and erect CT's and Control Panel after grouting the frame by means of foundation bolt.

Make the connections between Breaker and CT's. Incoming and Outgoing jumper connections through the terminal connectors supplied for the breaker. Ensure that there is no strain on the terminal pads of the breaker and suitable allowance should be given for expansion of jumper conductors.

3.4. EARTHING

Provision has been made for terminating the Station Earthing on to the Primary Structure at 2 locations which are marked clearly. Conductor with a cross section suitable for substation fault level shall be used to connect the breaker earthing terminals and station earthing. CT's and PT's if used shall also be earthed and connected to the Station Earthing. Ensure that all the earthing terminals/joining bolts and nuts are fully tightened. Use ANTI-CORROSIVE grease/agent on joints where necessary.

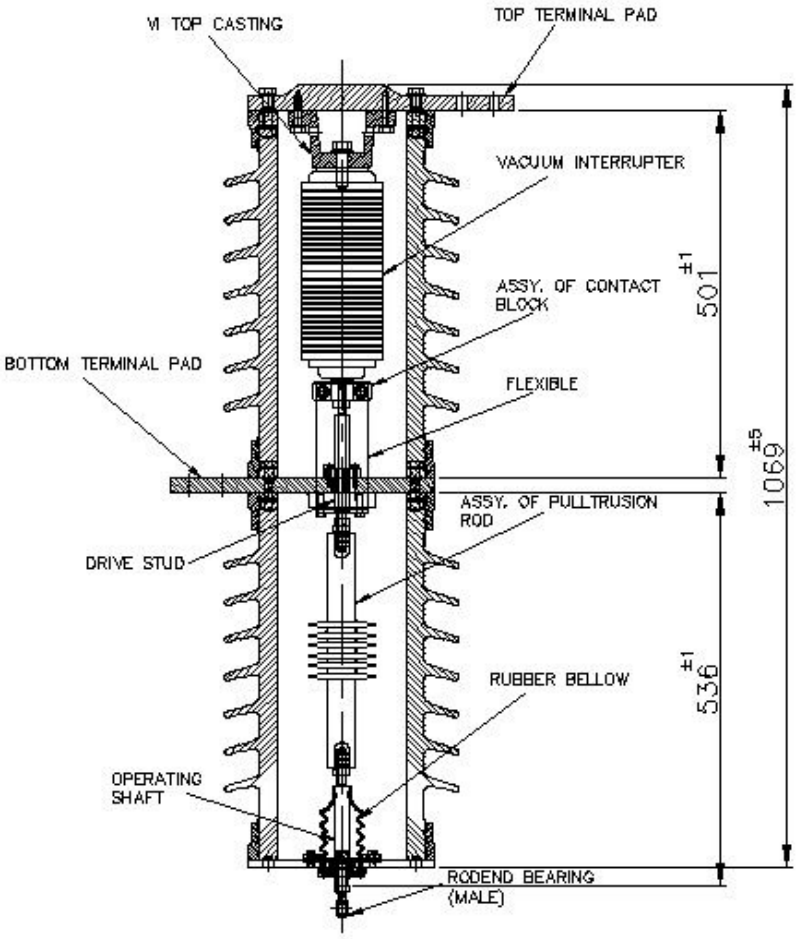
3. OPERATION AND SETTING INSTRUCTIONS

4.1 GENERAL DESCRIPTION OF CIRCUIT BREAKER (Type OFVp)

The Circuit Breaker consists of the following:

1. Pole Assembly (3 nos.) (Fig.4)
2. Common Linkage Assembly. (Fig.5)
3. Operating Mechanism type M37 with housing.
4. Primary Structure and Secondary Structure.
5. Outdoor Control Cubicle.

4.1.1 Pole Assembly (Ref.Fig.4)



Pole Assembly

(Fig-4)

The **Vacuum Interrupter** is housed in the (Top) **interrupter Bushing**.

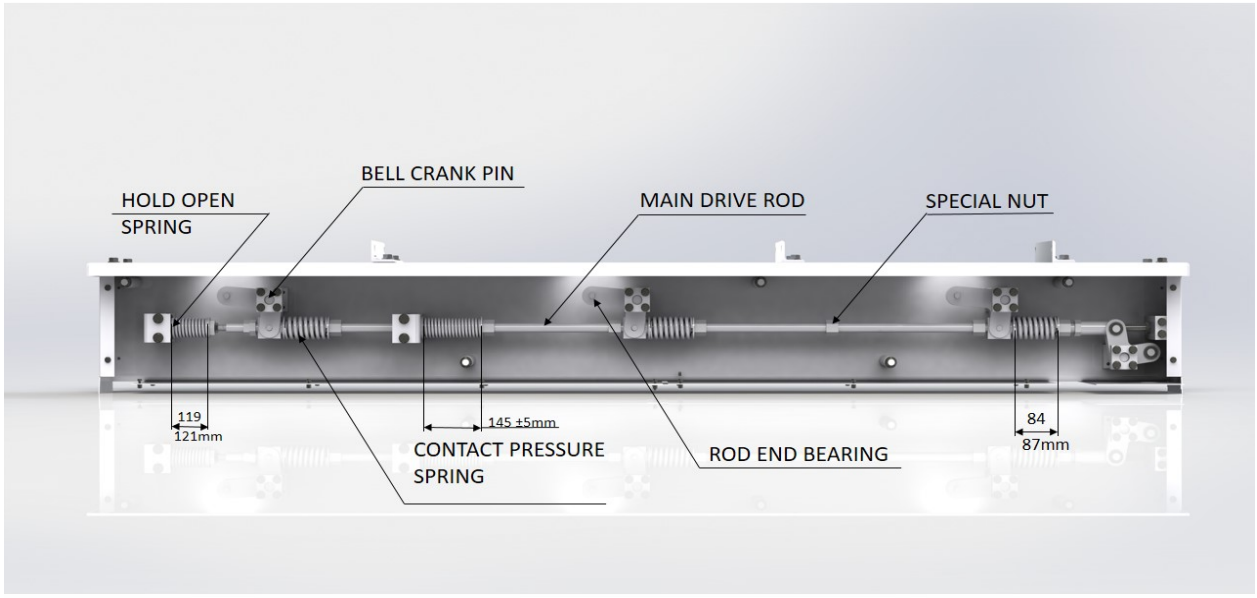
The Interrupter is mounted from Top i.e. the fixed contact stem at the top-of the interrupter is connected to the **Top Aluminium Terminal Pad** through **Top Casting** and secured. The Moving Contact Stem at the bottom of the interrupter is connected to a contact block which is free to operate through the Base Support Casting. The support casting is secured to the Bottom Terminal Pad. Flexible connected to contact block will effectively transfers current between the top terminal pad to the Bottom Terminal Pad.

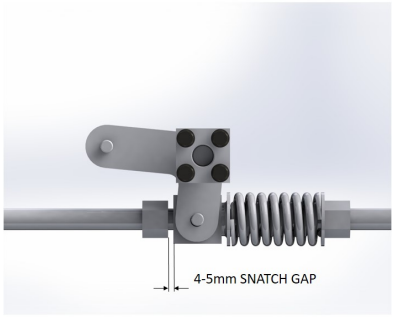
The other end of the flexible Contact is connected to the bottom terminal pad. Interrupter bottom stem connected to one end of the pulltrusion rod through a Drive Stud. The other end of the pulltrusion rod (bottom portion) is connected to the Operating Shaft. The operating

shaft passes through a Rubber bellow and is connected through a stud to the Bell crank of the common linkage assembly. The Pulltrusion rod, Operating shaft, rubber bellow etc., are housed in the Bottom support bushing.

Thus the entire pole Assembly is effectively sealed to prevent moisture entry. The Pole Assemblies are mounted over the Roof Plate under which the common linkage assembly is housed.

4.1.2 Common Linkage Assembly (Ref. Fig.5)





Linkage Assembly

(FIG-5)

The common Linkage Assembly is housed in between two steel side channels and over the side plates the Roof cover is mounted. The Linkage Assembly is accessible from bottom& side by bolted type removable covers.

The common Linkage Assembly consists of common Drive Rod, Contact Pressure spring assembly for each phase, Bell Crank Assembly of each phase and Hold Open Spring assembly at end of the linkage drive rod.

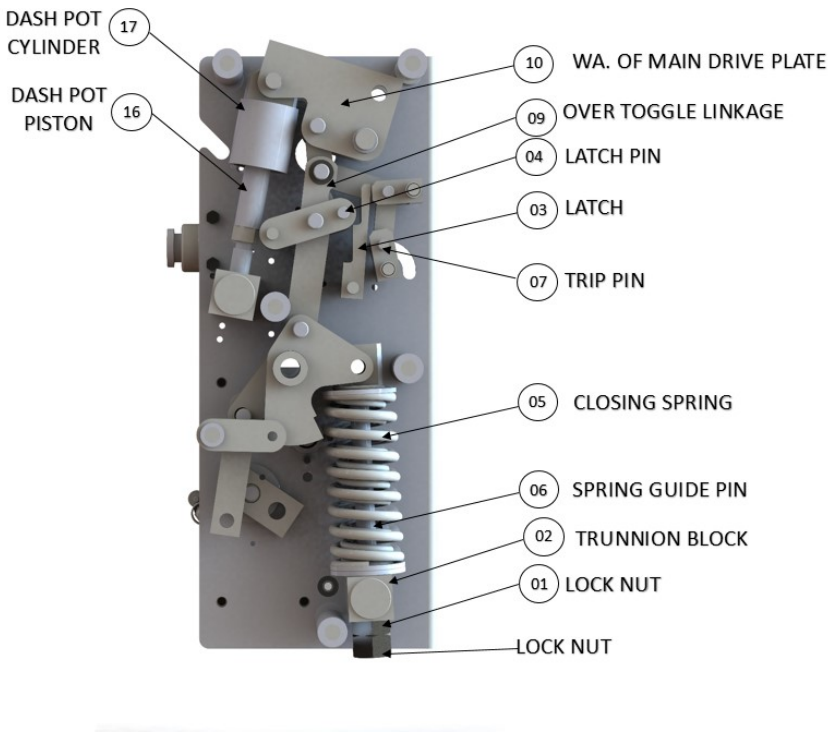
The rotary movement applied to the Drive Rod of the Common Linkage Assembly by the Operating Mechanism is transmitted vertically through Bell Crank Levers, Operating Shaft, Pulltrusion rod, Drive Stud attached to the Interrupter moving contact stem.

The Contact Pressure between the Fixed Contact and Moving Contact of the Interrupter is applied in closed position by Contact Pressure Springs. Hold Open Spring Assembly which Is getting compressed during closing operation provides opening force during tripping of the breaker.

4.1.3 OPERATING MECHANISM TYPE M37 WITH HOUSING

(Ref. Fig.6 - 10)

These mechanisms are of the Spring Operated power closing type specially designed for operating short stroke Vacuum Circuit Breakers and are TRIP FREE Mechanism.

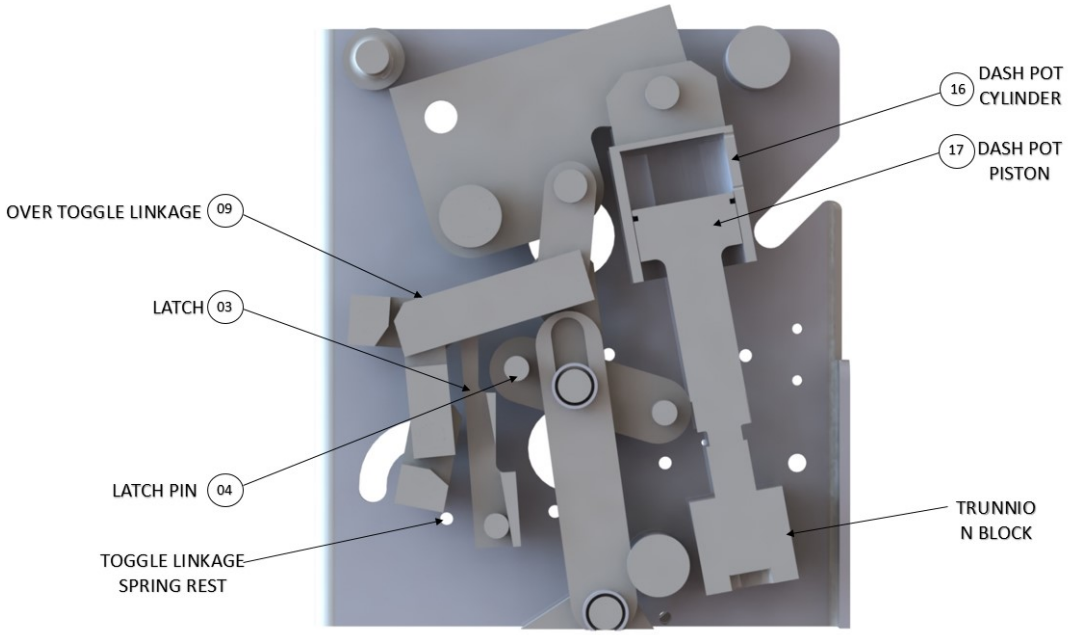


Arrangement of Mechanism and Spring Actuator

(FIG-6)

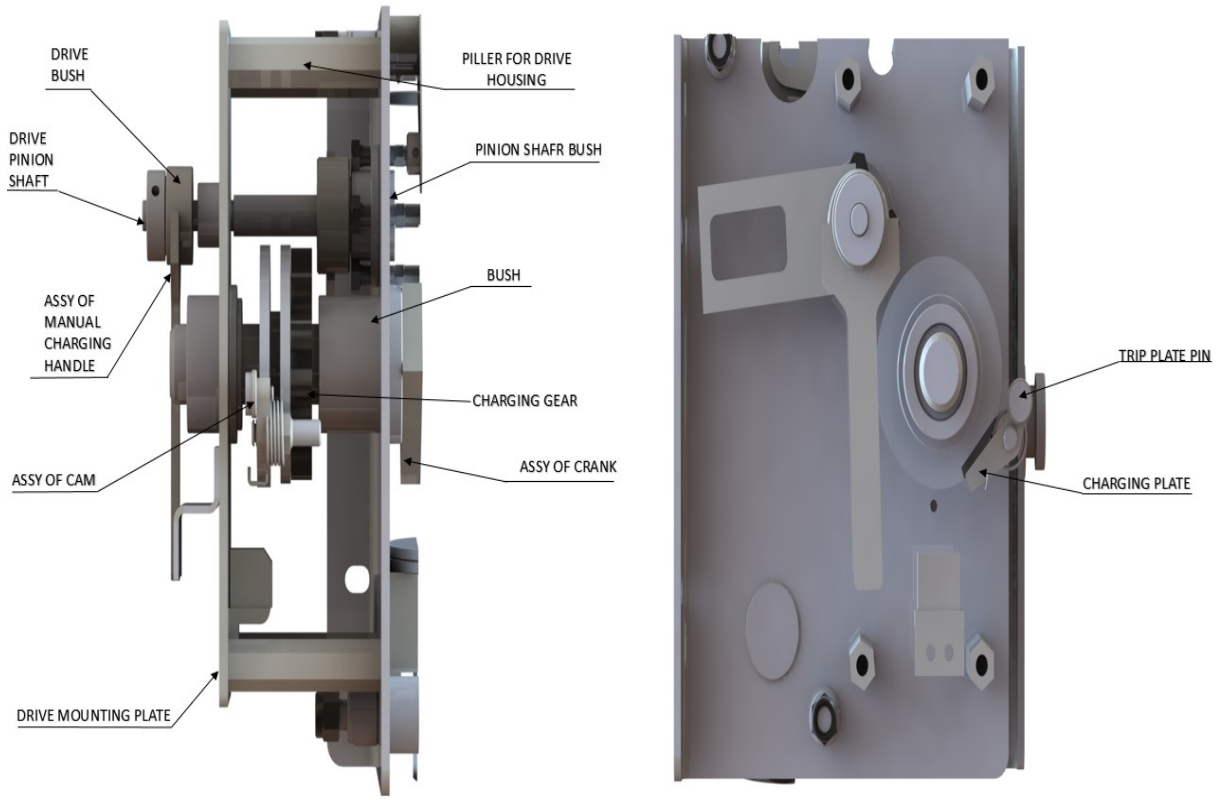
The Closing Springs are either manually charged by the Manual Spring Charging Handle or electrically charged by a Motor drive. In the motor drive, once the spring is charged fully, motor stops automatically through action of limit switch and starts again to charge the spring when the Closing Spring (05) of Fig. 6 is discharged i.e. on closing of the Breaker. Once the closing spring is fully charged, it is prevented from discharging by an eccentric and Over Toggle Linkage which is upset either by the Closing coil or by a Manual Push Button in order to close the breaker. The Push Button can be padlocked to prevent inadvertent manual closing.

The mechanism is held in the ON POSITION (i.e. circuit breaker is in closed position) by a Latch (08) Fig.7 and over toggle Linkage (09) Fig.7. Tripping is achieved by upsetting the over toggle linkage. The energy required for opening the Circuit Breaker is provided by "Opening Spring" which form part of the common linkage assembly. The opening spring gets compressed during closing operation. The Circuit Breaker can be opened with closing springs either in the charged or free condition. The latch lever is automatically disengaged during the opening stroke and tension springs automatically resets the toggle linkage ready for re-closing.



Mechanism Linkage open - Dashpot Setting

(FIG-7)



Charging Assembly

FIG - 8

Manual tripping via Trip Push Button (18) of Fig.10 and Electrical tripping via a Shunt Trip Coil 08 of Fig.10 is provided. Manual trip push button can be padlocked to prevent inadvertent tripping.

4.1.4 PRIMARY STRUCTURE AND SECONDARY STRUCTURE

Primary Structure fabricated out of Rolled Angle Iron Section is meant for supporting basic breaker along with linkage assembly and mechanism. Secondary structure which is also made out of Rolled Angle Iron Section provides necessary line to ground clearances.

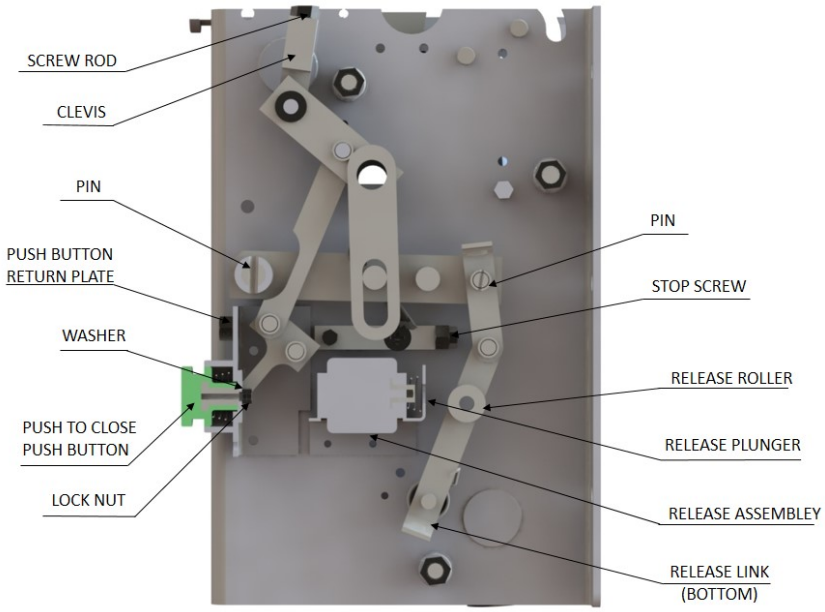
4.1.5 OUTDOOR CONTROL PANEL

The outdoor control panel is fabricated sheet steel housing. It has (a) A front swing door with suitable outdoor rubber gasket, (b) A inner swing door with hinges and locking bolts for

accommodating control accessories like Relays, Meters, Switches and a Fuse Mounting Plate "bolted to rear sheet. This cubicle is epoxy painted to shade as per order.

4. 2 OPERATION OF CIRCIUT BREAKER

4.2.1 To close the Circuit Breaker (Ref. Fig.9)



Closing Spring Release Solenoid Assembly

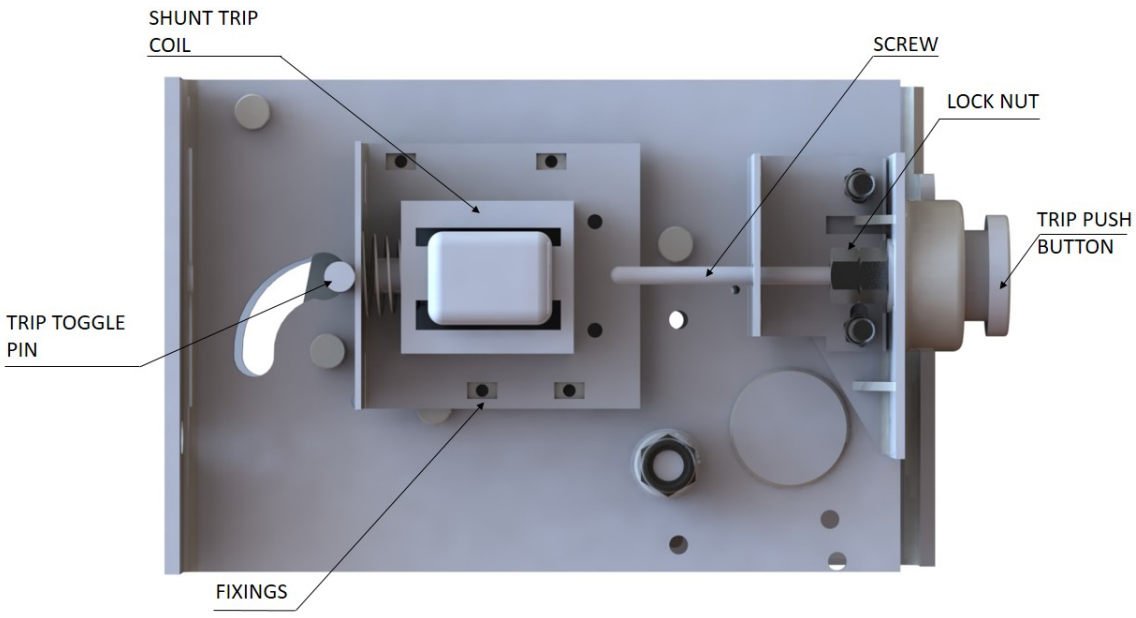
FIG - 9

To close the circuit breaker, the closing springs must be first charged fully and this fully charged position will be indicated by the "Spring Charged" indicator (Fig 6). This is achieved either electrically by the Motor drive or manually by inserting the charging handle into the lever in the left hand bottom side. Charging stroke is given when the handle is moved up and down. Once the spring is fully charged, a disengaging device removes the drive automatically and spring condition indicator will read "SPRING CHARGED" and after this the charging handle is free to move up and down without any effort. The charging handle should be removed now.

The Circuit Breaker can be closed by operating closing control switch or by pressing the manual close push bottom located at the right hand bottom side marked "PUSH TO

CLOSE". Castel Interlocks is provided as optional item to prevent inadvertent Electrical / Manual Closing.

4.2 2 To Open the Circuit Breaker (Ref.Fig.10)



Opening trip solenoid assembly

(FIG-10)

Either by pressing the manual Trip Push Button at the left hand top side marked PUSH TO TRIP or electrically by the tripping control switch, the Circuit Breaker can be opened.

4.2.3 Slow Operation for Maintenance Purpose

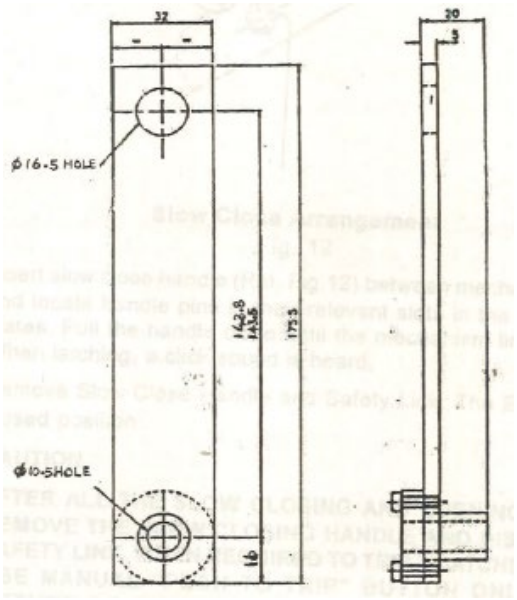
Warning

Before closing or opening the circuit breaker ensure that the circuit breaker is isolated from the primary supplies, the closing and tripping fuses and links removed. These precautions will minimize the risk of any personal injury due to inadvertent operation of the circuit breaker.

4.2.4 To Slow Close the Circuit Breaker

Before attempting to slow close the mechanism, check whether the mechanism indicator is indicating OFF i.e. the Circuit Breaker open. The following procedures should then be followed to slow close:

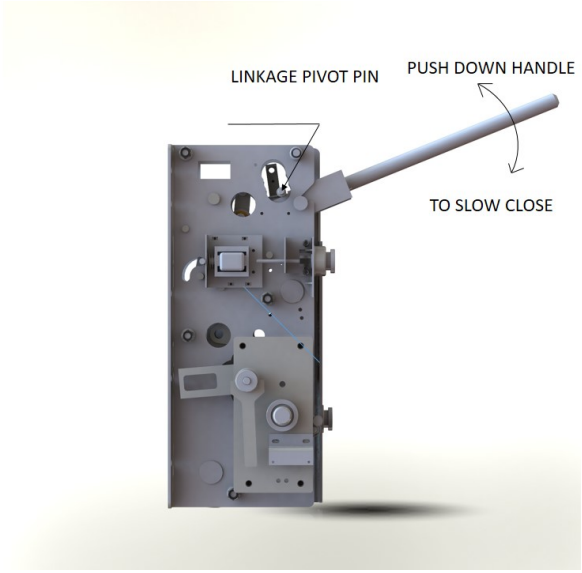
4.2.5. Remove the Mechanism Cover. Charge the Closing Spring manually and remove the manual charging handle. Fit Safety Link (Ref.fig.11) using the pin (Ref.Fig.9) on lower right hand side of the Mechanism. This ensures that the linkage is locked in safe position and prevents inadvertent release of "Closing Spring" (05) of Fig.06.



Details of Safety Link

(FIG-11)

Insert slow close handle (Ref.Fig.12) between mechanism side plates and locate handle pins in their relevant slots in the mechanism side plates. Pull the handle close until the mechanism linkage is latched. When latching, a click sound is heard.



Slow Close Arrangement

(FIG-12)

Remove Slow Close Handle and Safety Link. The Breaker is now in closed position.

4.2.6 To slow open the Breaker. Press the slow close handle down wards. Hold the Push to Trip Button and release the slow close handle.

Warning

After all slow closing and opening operations immediately remove the slow closing handle and disconnect the safety link. When required to trip a latched mechanism use manual "push to trip" button only. No other method of attempting to dislodge latch should be employed due to risk of personal injury.

4.3 **SETTING INSTRUCTION:** (Common Linkage Assy.) Ref. Fig.5

The Circuit Breakers are set for life at the Factory to the appropriate setting instructions and should not be disturbed unnecessarily. Before gaining access to the Circuit Breakers ensure that the instructions given against Maintenance under 5.0 are strictly followed. Once correctly set, it should not be necessary to alter the settings for-the life of the interrupter contacts. As the Contacts wear, the snatch gap setting of 5.9 / 6.1 decreases and length of pressure spring settings of 82.5 /81.5 increases in closed position. The contact pressure springs give sufficient pressure for the full 3 mm wear of the interrupter contacts.

Following are the procedures for setting the Breaker:

4.3.1 **VCB in Closed (ON) position**

a) Set Contact Pressure Springs to 85 mm +2 mm.

b) Adjust nuts (09) to achieve snatch gaps of 4 / 5 between Swivel Block face and Lock Nut Fig (5).

c) Check with mechanism in latched position (i.e. after spare charging of the spring) ensure that the length of Hold Open Springs is between 119/121mm (in Breaker closed position).

d) Check whether Hold Open Spring dimension is 134/136 mm in Breaker open condition (i.e. Breaker in OFF condition).

4.4 **RESETTING INSTRUCTIONS - MECHANISM**

When it becomes necessary to readjust any of the settings originally made in the Factory due to disturbance of setting or wear, the following instructions must be followed in sequence for correct resetting to be achieved.

4.4.1 **Mechanism in Over travel Setting (Ref.Fig.6)**

a) Close the Vacuum Circuit Breaker.

b) Adjust Nuts (01) at the bottom of the spring post (02) until latch (08) see fig.6, just Moves fully under Latch pin (04).

c) Unscrew nuts (01) at the bottom of spring post (02) a further 2 turns and lock off. This means that the mechanism is now in over travel position.

d) Charge the main closing springs and fit safety link (Ref.Fig.11) between pins (12) and (13) Fig.9. Adjust M6 Stop Screw (11) until it touches Pin (12) and lock off using Loctite 241.

e) Check VCB Contact Pressure Spring lengths, snatch gap and Hold Open spring Length. Re-set wherever necessary (Ref. fig-5- Resetting Instructions - Linkage Assembly under 4.4)

NOTE: It is imperative that the Main Closing Springs are charged prior to carrying out the above checks.

4.4.2**Trip/Close Coil Setting (Ref.Fig 10 &9)**

a) **Trip Coil Setting (Ref.fig.10).**

Loosen .the Trip Coil Assy. fixing screws. Adjust the gap between Trip Pin and Trip Coil plunger Link 3 to 3.5mm by sliding the Trip Coil Assy within its screws. Lock off using Loctite 241.

b) **Close Coil Setting (Ref. fig 9)**

Closing Spring Release - Electrical (Ref Fig. 9). Adjust the gap between release roller and electrical release closing coil plunger to 3.0 - 3.5 mm by adjusting
Release assembly within its mountings. Fully tighten fixings and lock off using Loctite 241.

4.4.3 **Dashpot Settings (Ref.Fig.7)**

a) Open VCB using Manual Push to Trip Button.

b) If Trip pin (07) resets automatically screw in Dashpot Piston (16) until cylinder (17) goes slack (i.e. reducing dimension "Y"). Screw Piston (16) out by hand (i.e.no tool) until stopped by Cylinder (17) (i.e. increasing dimension Y), Screw Piston (16) out by two turns (increasing dimension Y) and lock off using Loctite 241.
If tripping does not reset automatically screw out Dashpot Piston (16) until trip pin reset and repeat the settings given in (b) above.

4.4.4 **Push Button Trip - (Pre Travel Setting)**

Opening Trip Coil (Ref. Fig.10). Check trip button for contact pre-travel before engagement with trip solenoid plunger face.
If pre-travel is incorrect loosen off lock nut and adjust screw until correct setting is obtained. Retighten lock nut and lock off using Loctite 241. Depress Push Button until travel screw engages with trip solenoid, plunger face-. Push Button should then be able to be depressed for a further 7 mm before being stopped.
If 7 mm travel is not obtained advance screw towards trip solenoid plunger face the desired amount to give 7 mm travel at the trip solenoid plunger.

4.4.5 Closing Release Electrical (Ref.Fig.10)

With the Main Closing Springs discharged, (i.e. Breaker closed condition) depress the Push Button until travel screw engages, with release solenoid plunger face. Push Button should then be able to be depressed further 7 mm. If 7 mm travel is not obtained, advance screw towards the release solenoid plunger face the desired amount to give 7mm travel at the release solenoid plunger face. Retighten locknut and lock off using Loctite 241.

4.4.6 Interlock Settings (Ref.Fig.10)

a)With the springs discharged (i.e. the mechanism in the over travel position breaker in closed condition without spring spare charged) adjust the Screw Rod in the Clevis Block to give a gap of 0.5 to 1.0 mm between the Push Button return plate and the Washer.

b) Recharge the closing springs and check that with the Push Button release fully depressed, the closing spring will not discharge with the breaker closed already. Lock off the clevis blocks and the Screw Rod using Loctite.

4.5 CONTACT EROSION AND INTERRUPTER REPLACEMENT

Interrupter needs replacement when its contacts are eroded by 3mm. This can be detected by measuring the snatch gap if it gets reduced by 3mm (Ref.Fig.5) from the original settings of 4 / 5mm then the interrupter of that particular pole needs replacement. Till reduction of 3mm in the Snatch gap setting of 4 / 5mm, the interrupter can be kept in service subject to its healthiness for vacuum.

4.6 PRE COMMISSIONING CHECK

The Circuit Breaker has undergone all routine tests at the factory before despatch and settings are carried out and secured with Loctite and marked in red line. Hence it should be ensured that these are not disturbed inadvertently.

4.6.1 Wiring

Interconnection wiring between Breaker and Control Panel/Control and Relay Panel is to be finalized in accordance with the wiring diagram (wires are identified by the numbered ferrules). Cabling and Termination for AC and DC supply to the Control Panel should be done. Cabling and Termination of CT Secondary should also be done.

4.6.2 **Protection and Metering Instruments**

Remove movement arresters placed on to the induction discs of meters and relays. Check zero settings of Ammeter and Voltmeter.

4.6.3 **Insulation Test for Control Wiring**

Free the Circuit Breaker from Main Power supply (HT) as well as AC and DC control Supplies. Test the secondary wiring with 500 V or 1000 V megger after looping all terminals at a convenient point. Make sure that all relays and CT earthing connections are isolated before carrying out this test. The value of this insulation test should be above 2 Megohms. Then remove all the looping provided for this test. Check for proper wiring in line with schematic diagram and also check for the correct rating and healthiness of HRC Fuses provided. When in need for replacement of HRC fuses, replace with the same rating fuses.\

4.6.4 **HV Megger Test and High Voltage Test**

All insulated parts (Porcelain Bushings) must be 'clean and dry. (For cleaning use always lint free cloth). The Circuit Breaker must be isolated from all other external equipments such as CTs and PTs; Lightning Arresters as well as incoming and outgoing connections. Only the Circuit Breaker shall be subjected to this test. Using a 1000V/2500 Volts Megger, measure the Insulation Resistance as follows: -

a) Breaker in closing position (i.e. in 'ON' condition)

i) Incoming to ground of each phase of the breaker.

ii) Incoming to outgoing of each phase of the breaker.

(The value should be 'zero' megohms)

iii) Between each phase of the breaker.

b) Breaker in Open position (i.e. in 'OFF' condition) across the Incoming and Outgoing terminals of each phase of the breaker. The value should be above 100 megohms for proceeding to HV test, if the value is less than 100 megohms an Inspection for low insulation value should be made before proceeding with HV test. For High Voltage Test, voltage up to 28kV r.m.s, for one minute should be applied between the

incoming and outgoing terminals of each pole of the Circuit Breaker in Breaker open condition i.e. the HV test is to be carried out across the contacts of the interrupter.

The vacuum integrity of the interrupter is considered to be satisfactory if it is successfully withstanding the HV test. Repeat this test for each pole of the breaker.The loss of vacuum of the interrupter is indicated by its failure on HV test. Then the interrupter should be replaced.

Caution

Small amount of x-ray may be emitted during the HV test. Operating personnel must keep away at least a minimum distance of 2 meters from the breaker under test.

4.6.5 Conduct secondary injection test on the Protective Relays and primary injection tests on the connected CTs to check proper relay operation and also to ensure correct ratio and polarity of the CTs. In and also VT if connected, ratio test should be done. All the CTs (VTs if connected) should' be tested for Insulation Resistance with 1000 Volts or 2500 Volts megger. The value should be above to 0meg.ohms.

4.7 FINAL OPERATION CHECK

Without extending HT supply to the Breaker, check Electrical operation of closing and tripping after extending DC and AC supply to the Breaker Control Panel, Also check for proper Electrical spring charging of mechanism. In case sequential interlocks are provided to the Trip/ Neutral /Close control witch (TNC Switch), always ensure that the switch is turned to Trip position before going to close position. Also check for breaker tripping by operating the protective Relays.

Extend H.T. supply and close the breaker to put into commercial use.

5. MAINTENANCE

It is recommended that periodical maintenance need to be carried out once in two years or after 2000 operations whichever is earlier for Mechanism, Linkage Assembly, Incoming/Outgoing terminations and Control Wiring. The interrupters need to be tested once in 4 years or after 4000 operations whichever is earlier with the help of HV test as discussed in 4.6.4.

5.1 ROUTINE CHECKS

Before opening bottom access door isolate the Circuit Breaker from Main HT supply and AC and DC control supplies. Ensure that the breaker is earthed at both Incoming and Outgoing

terminals on* all the phases of the breaker by means of External Earth Rods. Check for tightness of the fixing hardware at terminal pads, Linkage Assembly Mechanism and Operating mechanism.

Check for proper positioning of spring dowel pins, split pins etc. Check for tightness of all Control Circuit leads and Terminal lugs.

Clean all porcelain bushings. Use Genclean /Aerosol liquid for cleaning and wipe out with lint-free cloth. Lubricate sliding surfaces/moving parts with SAE80 or 90 oil.

Ensure for proper insulation resistance values by conducting Insulation Resistance test by1000/2500V megger.

Ensure that the source of control supply i.e. the batteries are healthy and are fully charged.

5.2 TROUBLE SHOOTING

S.No.	Problem	Action	Reference
1 .	Closing Spring getting released immediately after charging It.	Adjust stop screw check closing Coil gap. (Ref.fig.9)	See coil gap setting Ref. Cl.4.4.2
2.	Dummy stroke obtained. toggle pin. Ref.fig.7.	Check resetting of over toggle trip Adjust dashpot.	See dashpot setting. Ref.CI.4.4.3
4.	Could not keep spare Charge	Check over toggle linkage. Fig. 6	See over travel setting Ref. Cl. 4.4.1
4.	Not able to "Close" Electrically.	Check wiring-fuse. Adjust (Ref. fig.9) Check battery voltage.	See closing release electrical Ref.4.4.5.
5.	Not able to "Trip"	Check wiring-fuse.	See trip Coil

	Electrically.	Adjust trip coil gap.(Ref.fig.10) Check battery Voltage.	setting. Ref. CL.4.4.2
6.	Motor running continuously.	Check Crankshaft for possible breakage of dowel etc., Check limit switch. Check DC Contactor.	
7.	Main contact closed even in Breaker open position.	Check for discontinuity in operating link from linkage assy. Reset.	

5.3 **DO's**

1. Check Castell Interlock, if provided for closing coil is properly operated in sequence.

2. While performing the HV Test the Operating Personnel should be at a distance of2 meters away from the equipment.

3. Use slow closing handle in de-energized+ condition only for testing and setting purpose.

5. Spare spring charge should be kept in the mechanism for proper latching and also to switch off the DC supply to the Contactor, thereby enhancing the life of the Contactor coil.

DON'T's

1. Do not unduly strain the Pole Assemblies during stringing of Conductors/Lifting of Breaker.

2. Do not attempt mechanism setting with spring in charged condition unless and until the safety link is put in position.

6. **SPARES**

In the event of replacement parts being required the following information must be furnished in order to supply the correct spare parts required.

1. Circuit Breaker Serial Number (as inscribed on the Name Plate).
2. Current and kA rating of the breaker.
3. Purchase Order reference against which the breaker was supplied.
4. Name of the site where the breaker is erected for which the spares are required.
5. Name of the Part/Part Reference and its quantity.

The type and serial number of vacuum interrupters are marked by Number Punch on the top terminal pad of each pole of the Breaker. When spare interrupters are required please indicate serial number of the Breaker for supply of correct interrupter.

Different length of Drive Links (operating Links) are used for different types of interrupters. Hence when spare drive Link is required please indicate serial number of the Breaker and Interrupter type for the supply of correct Link.

6.1 LIST OF SPARES (If required)

A. Spares for pole Assembly (Ref.4)

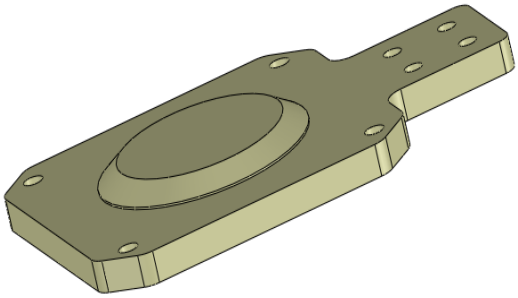
S. No.	Description of Item	Drg. No.
1.	33kV Bushing (Top& Bottom)	PR80609400
2.	Terminal Pad (Top) with 4 Nos. M10 Helicoils	PR80600100
3.	Terminal Pad (Bottom)	PR80600200
4.	Vacuum Interrupter Type	D31
5.	VI Fixing block	PR80600800
6.	Drive Stud	PR80601100
7.	Assy. Of Pulltrusion Rod	PR80600600
8.	Operating Shaft	PR80601000
9.	Neoprene 'O' Ring (4 Nos. /Poles)	PR80600900
10.	Rubber bellow	PR80606900
11.	End cap	E 5231653/0

B. Spares for M37 Mechanism:

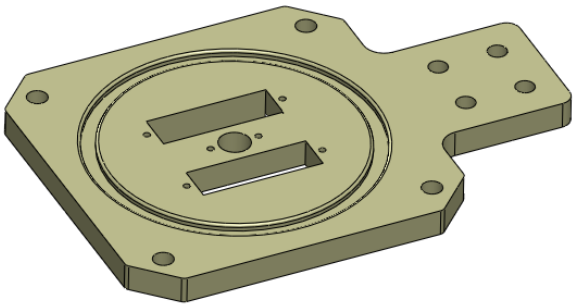
S.No.	Description of Item	Drg. No.
1.	W.A of Crank Shaft	E 5241342 00
2.	Charging Cam	E 5232027 00
3.	M6x55 Spring Dowel	-
4.	Torsion Spring for charging Pawl	E 5231626
5.	Charging Pawl (Drive Pawl)	E 5231614
6.	Clutch Bearing (HFL2026) (for Pinion Shaft)	-
7.	Drive Link with Clutch Bearing. (HFL2530)	E 5241343/00
8.	Needle Bearing (HK12x10)	-
9.	Clutch Bearing (HFL2016) (for Manual, charging Lever)	-
10.	Circlip 5mm Dia. for charging Pawl	-
11.	Circlip 7inrn Dia. for Eccentric	-
12.	Integral Drive Pinion Shaft	D 5231729/00
13.	Main Gear	E 5231621
14.	Trip Block	E 5231627
15.	Charge Link	E 5891847
16.	Tension spring (for 'U' Link Assy. Top & Link Manual Charging Handle Block)	E 5861671
17.	Release Link (Top U Link & short)	E 5891841
18.	Release Link (Bottom U Link Long)	E 5891840
19.	Manual Trip Push Button Assy.	E 5241484
20.	Manual Close Push Button Assy.	E 5241484
21.	Trip Toggle Pin	E 1810118/00
22.	Drive Pin for Auxiliary Switch	E 5231531

C.	**Electrical Items**	
1.	Spring Charging Motor	
2.	Trip/ Closing coil 24V/30V DC (OR)	E 5313205/00
3.	Trip/Closing coil 110V DC (OR)	E 5313205/01
4.	Trip/Closing coil 220V DC	E 5313205/02
5.	2 NO + 2 NC Limit Switch	-
6.	6 NO + 6 NC Aux. Switch with Drive Lever	E 5891210/02
7.	HRC Fuses 2 Amps 2F06	-
8.	HRC Fuses 4 Amps 4FO6	-
9.	HRC Fuses 6 Amps 6FO6	-
10.	HRC Fuses 10 Amps 2FO6	-
11.	HRC Fuses 16 Amps 2FO6	-

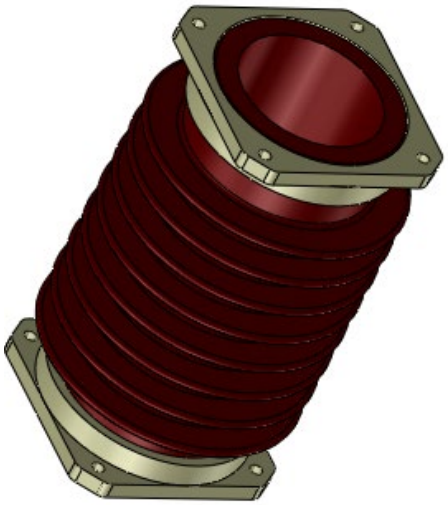
NOTE: While ordering for spares please indicate the purchase order reference against which the equipment was supplied originally.



Terminal Pad (Bottom) – PR80600200



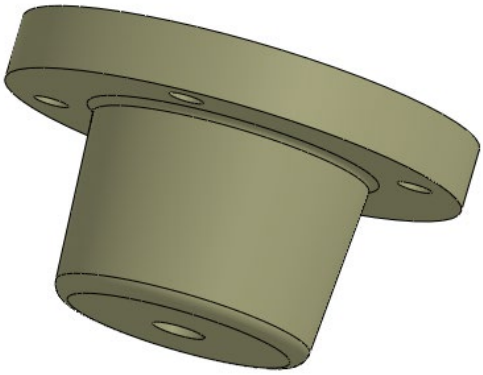
Terminal Pad (Top) - PR80600100



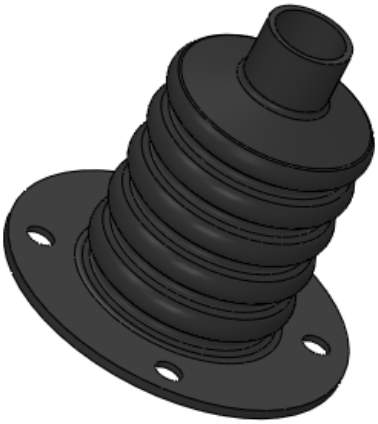
Bushing (Top & Bottom) - PR80609400

33kV

Assy.Of Pulltrusion Rod - PR80600600

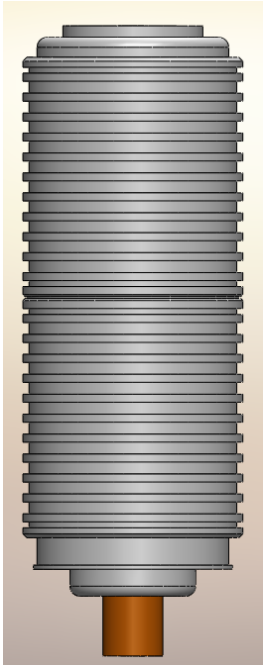


VI Fixing block - PR80600800



Rubber bellow - PR80606900

Rod end Bearing



VI Type – D31