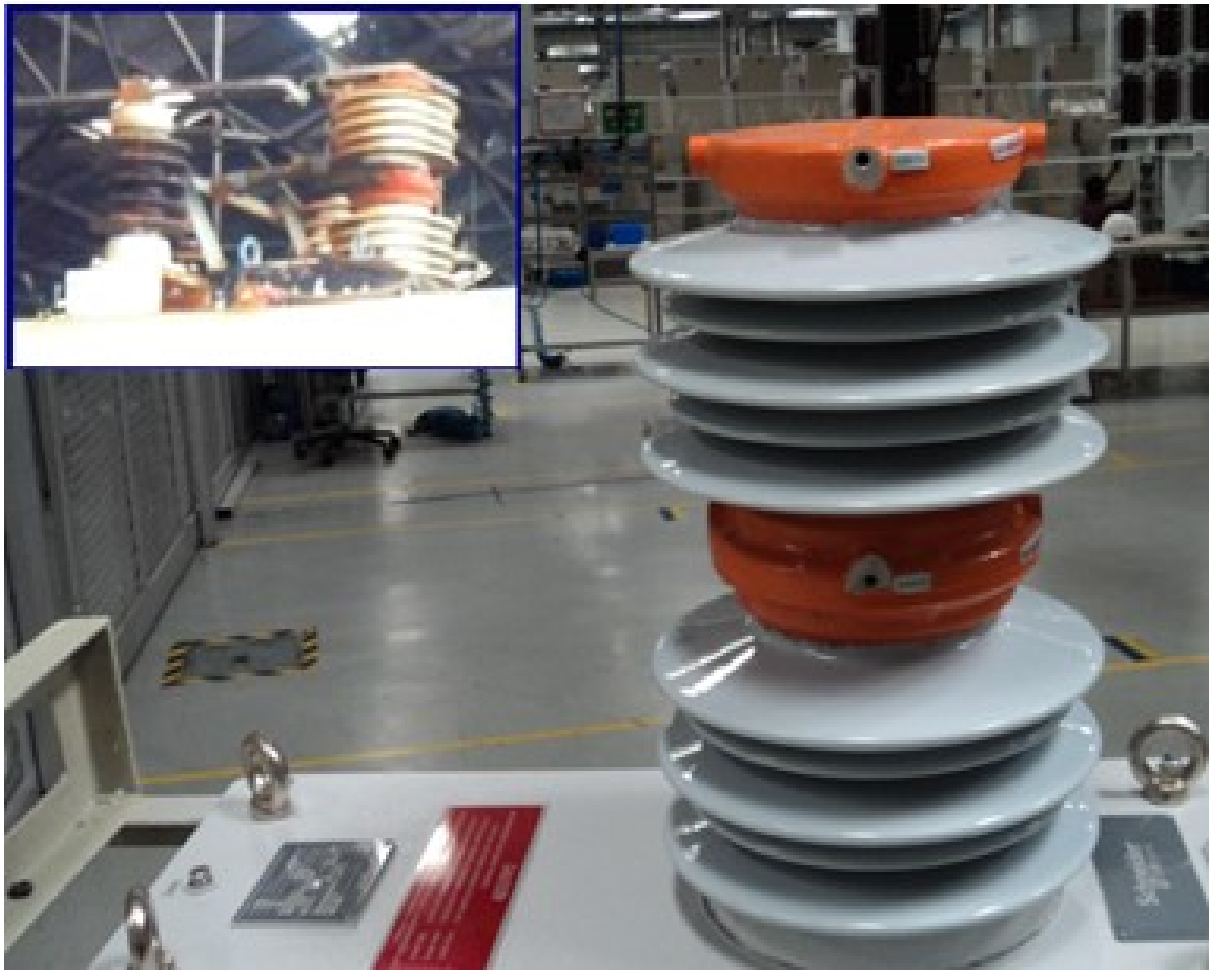
Single Interrupter
Vacuum Circuit Breaker type 22CB
for A.C. Traction Application
in Indian Railways



Installation, Operation and Maintenance Manual

(For VI V807VG, Rotex Magnet valve & Parker Pressure Regulator)

Schneider Electric Infrastructure Limited

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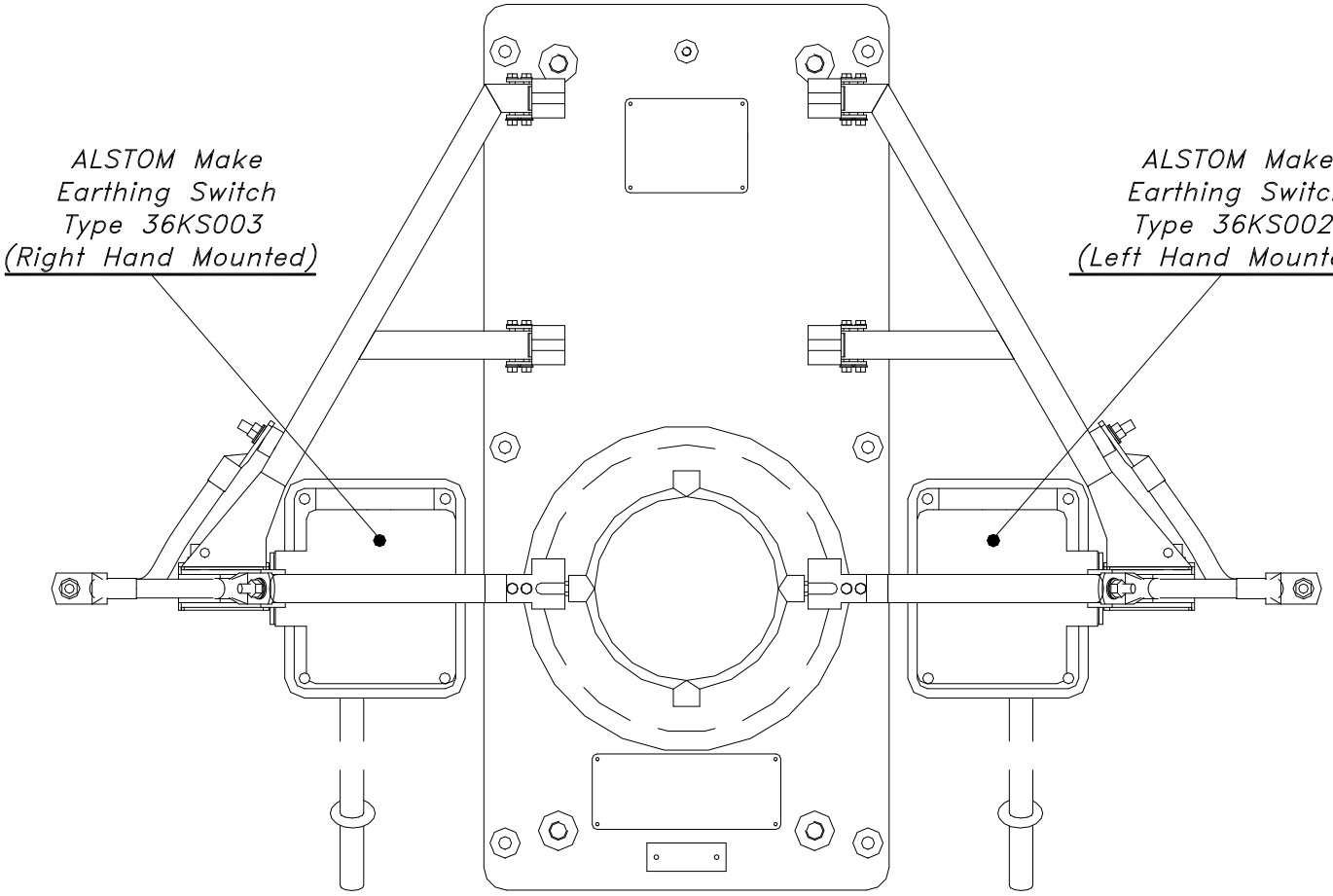
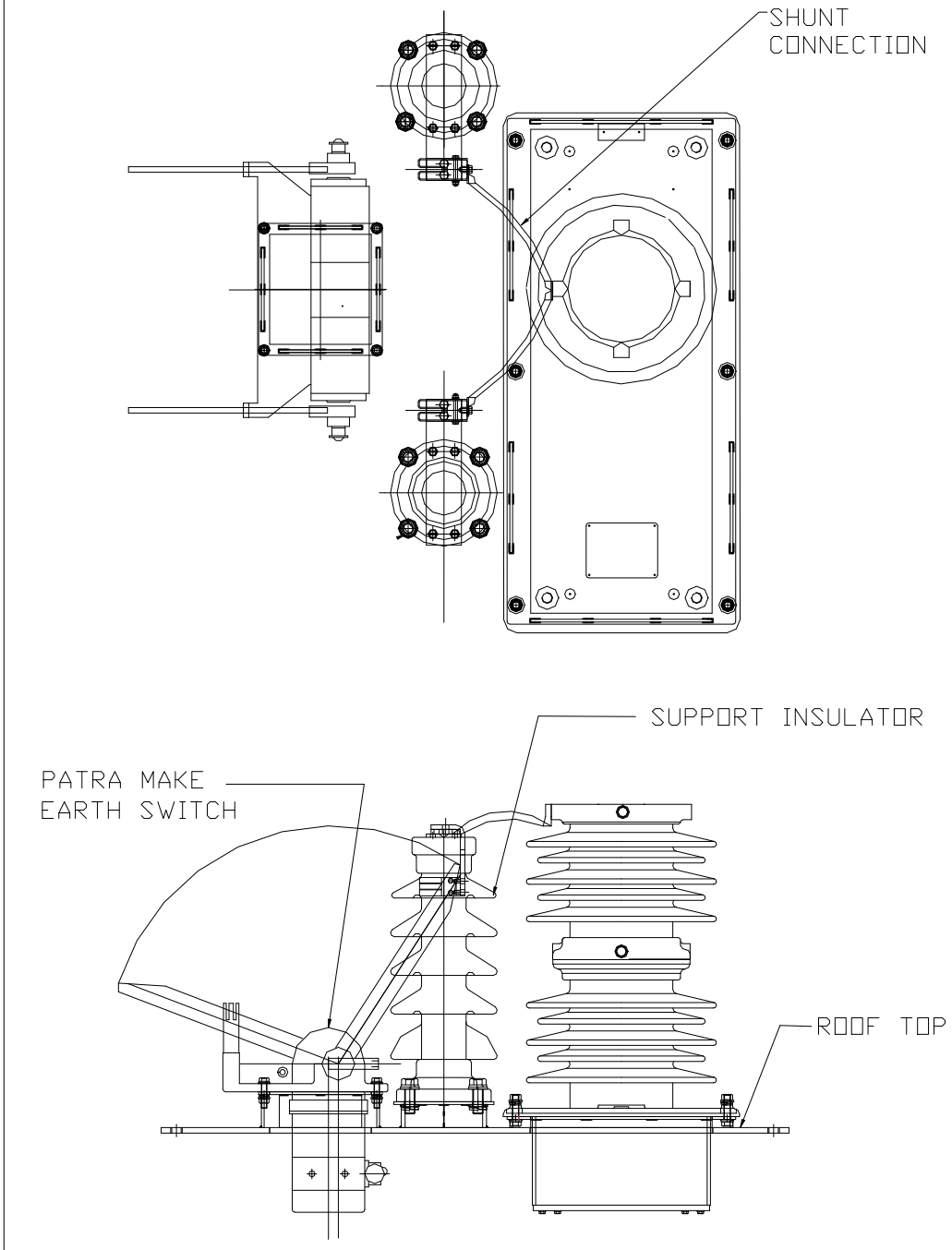


Figure–1a: Outline arrangement showing Schneider make VCB type 22CB and Earthing Switch type 36KS mounted in 'Left–Hand' and 'Right–Hand' configurations



Figure–1b: Outline arrangement showing Schneider make VCB type 22CB and Earthing Switch (Patra make) – For 3 – Phase Locomotives

1.0 INTRODUCTION

This vacuum circuit breaker (VCB) is designed to operate on traction systems with the following ratings:

- 25 kV, 1∅, 50/60 Hz

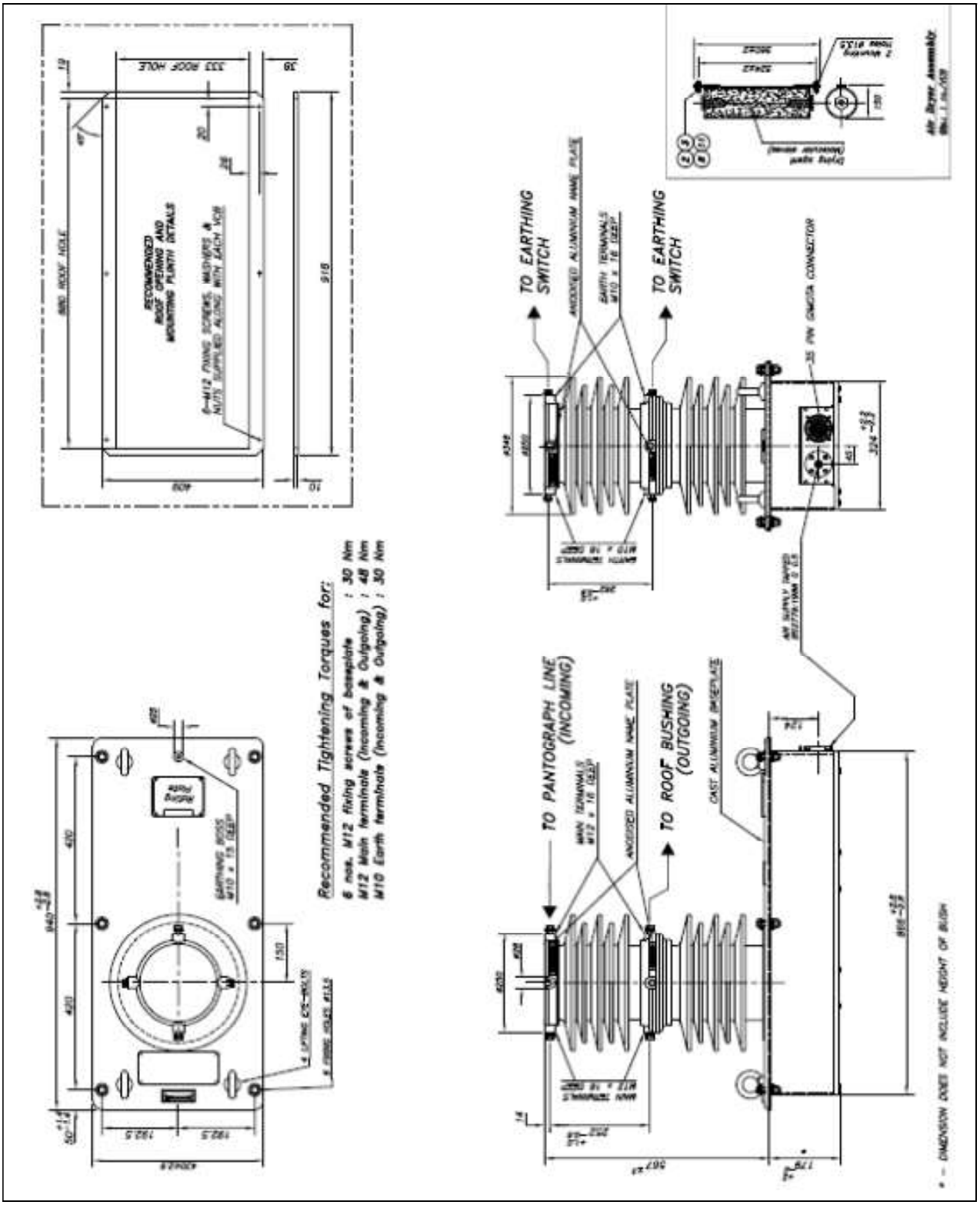
It has a continuous current rating of 1000 Amps with a rupturing capacity of 16kA at 25kV. This VCB is suitable both for new vehicles and as a convenient replacement for following circuit breakers:

- AEI air-blast circuit breaker type TG1H
- Brown Boveri air-blast circuit breaker series DBTF
- Schneider Electric vacuum circuit breaker type 20CB
- Secheron vacuum circuit breaker type BVAC 25.10

Although air connection is same as circuit breakers listed above, standard design of 22CB has control wires terminated at moulded type terminal strips on end of baseplate, opposite to air connector, so as to ensure interchangeability with our double interrupter VCB type 20CB. Also, the main roof-busbars are not interchangeable.

The VCB is designed to be used in conjunction with ALSTOM make earthing switch type 36KS & Patra & Chandra make Earth Switch, which when closed, earths both terminals of the circuit-breaker contacts for safety purposes mounted in either a *"left-hand"* or a *"right-hand"* configuration (Refer Figure-1a & refer figure 1b for mounting of VCB with patra & Chandra make earth switch). The earthing switch mates with earthing studs provided on the VCB. When some other make earthing switch is to be used, these earthing studs are replaced with M10 screws and earth busbars connected to the earth terminals of the VCB.

Unlike VCB type 20CB wherein two vacuum interrupters are used in series, this VCB makes use of only one interrupter which houses a pair of main contacts. Suspended from the body is a tubular metal shield which protects the insulating surfaces from the metal vapour in arc. A beneficial characteristic of switching in vacuum is that contact wear is minimal. Also, a small contact gap (around 8mm) is able to withstand all test voltages associated with the rated voltage. The resulting simple operating mechanism aids reliable high speed interruption, as well as contributes to minimal maintenance requirements.


TO EARTHING SWITCH
TO EARTHING SWITCH
TO PANTOGRAPH LINE (INCOMING)
TO ROOF BUSHING (OUTGOING)
Recommended Tightening Torques for:
6 nos. M12 fixing screws of baseplate : 30 Nm
M12 Main terminals (Incoming & Outgoing) : 48 Nm
M10 Earth terminals (Incoming & Outgoing) : 30 Nm

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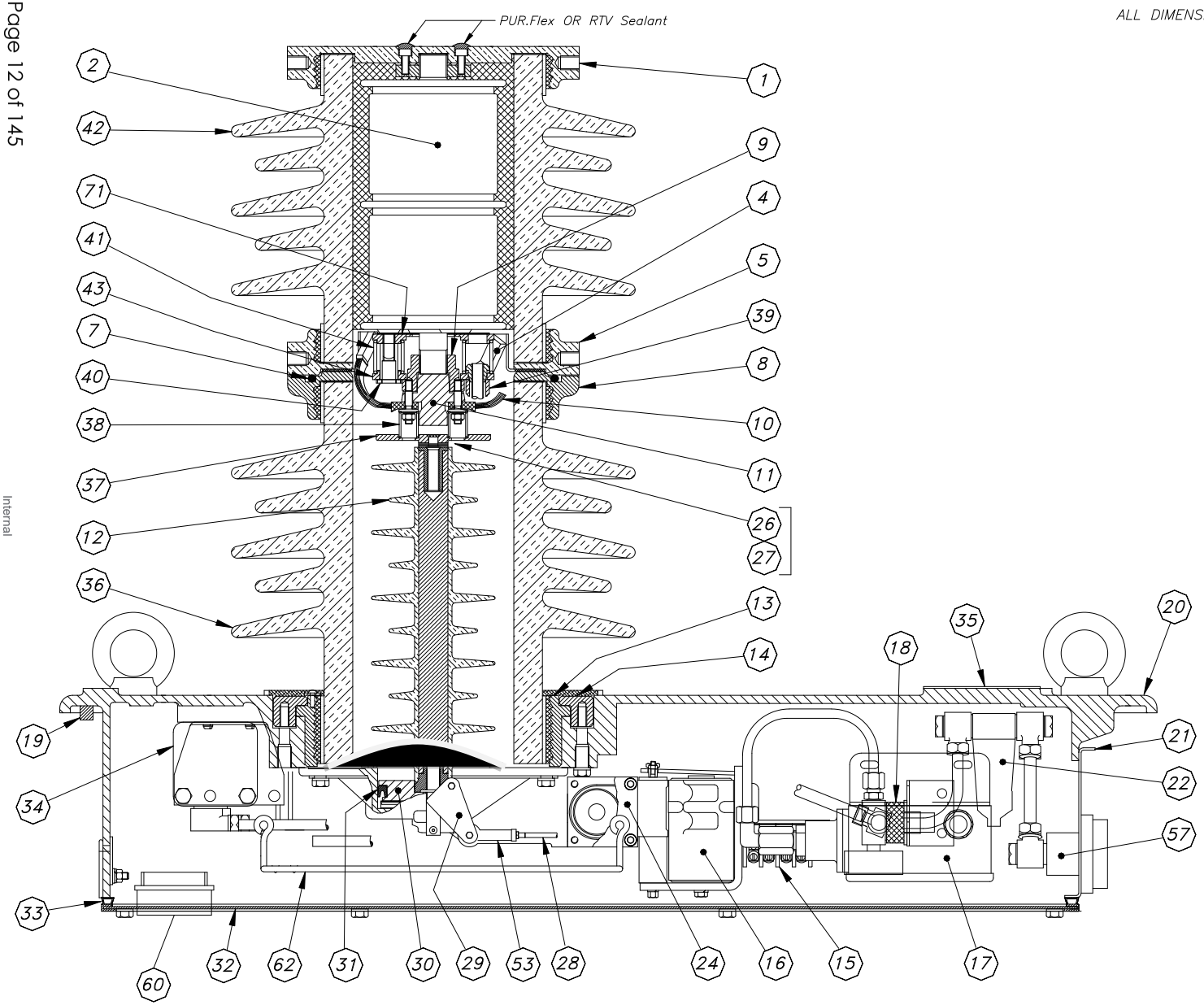
ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE



Item		Description
1	–	Upper terminal (Incoming)
2	–	Vacuum interrupter (V807 VG)
4	–	Shunt collector ring
5	–	Lower terminal (Outgoing)
7	–	'O' ring
8	–	Top casting for 36
9	–	Compression ring
10	–	Flexible shunt
11	–	Connector block for 10
12	–	Actuator rod
13	–	Lower casting for 36
14	–	Clamping ring
15	–	Auxiliary–contacts unit
16	–	Magnet–valve assembly (Rotex)
17	–	Pressure switch
18	–	Pressure regulator (Parker)
19	–	Gasket
20	–	Baseplate
21	–	Connector mounting plate
22	–	Air filter
24	–	Relay–valve assembly
26	–	Shim (steel)
27	–	Packing washer
28	–	Drive rod for 15
29	–	Link for 15
30	–	Piston
31	–	Piston seal ring
32	–	Bottom access cover
33	–	Sealing section
34	–	Air reservoir
35	–	Rating plate
36	–	Bottom insulator
37	–	Drive–plate assembly
38	–	Spring
39	–	Spacer
40	–	Mechanism stop
41	–	Spring
42	–	Top insulator
43	–	Lower spring plate
53	–	Rod end spherical bearing
57	–	Air connector (supply)
60	–	Electrical connector (optional)
62	–	Cable tie–bar
71	–	Upper spring plate
77	–	Terminal strip

Figure–3: Cross–section Through the VCB

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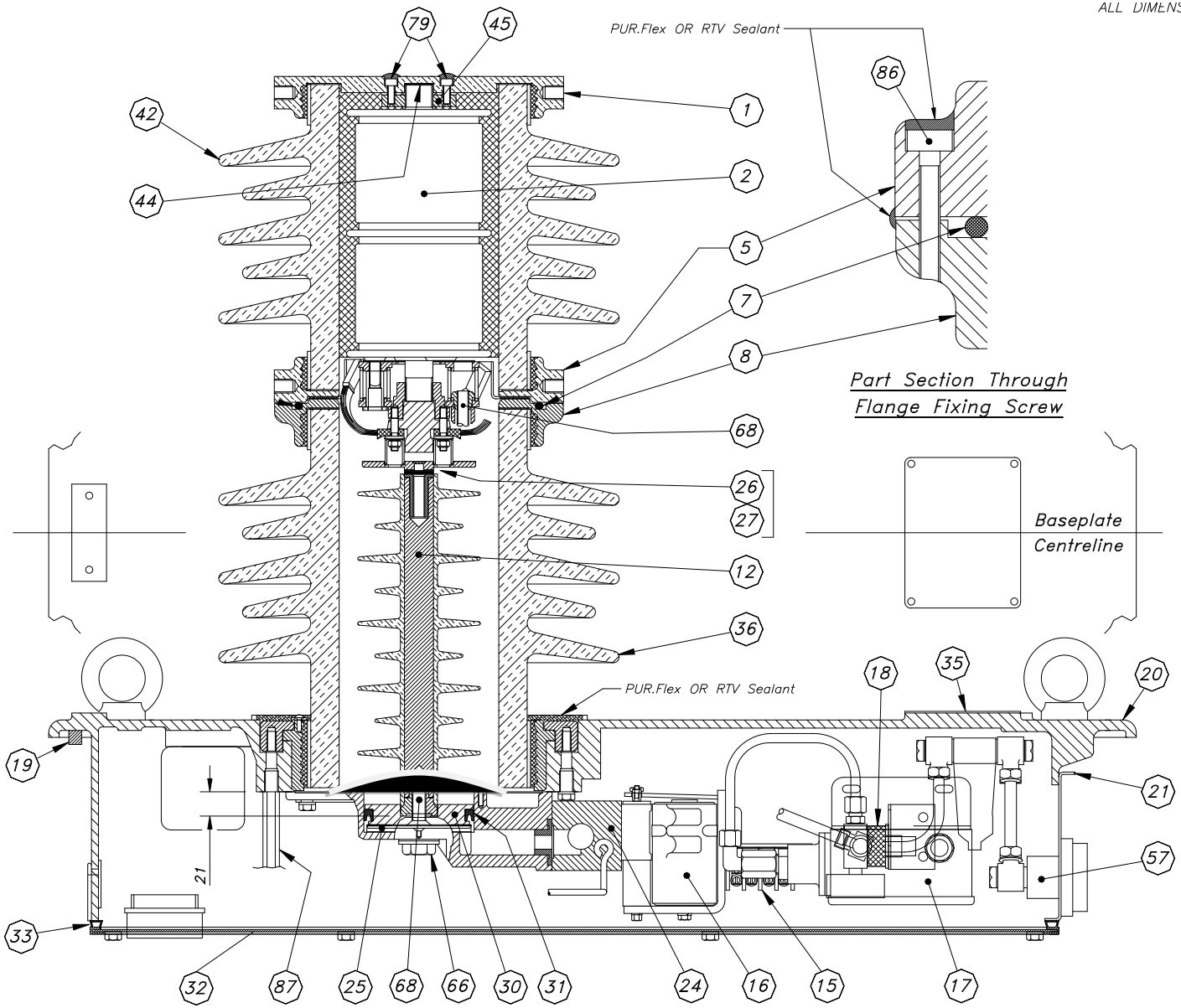
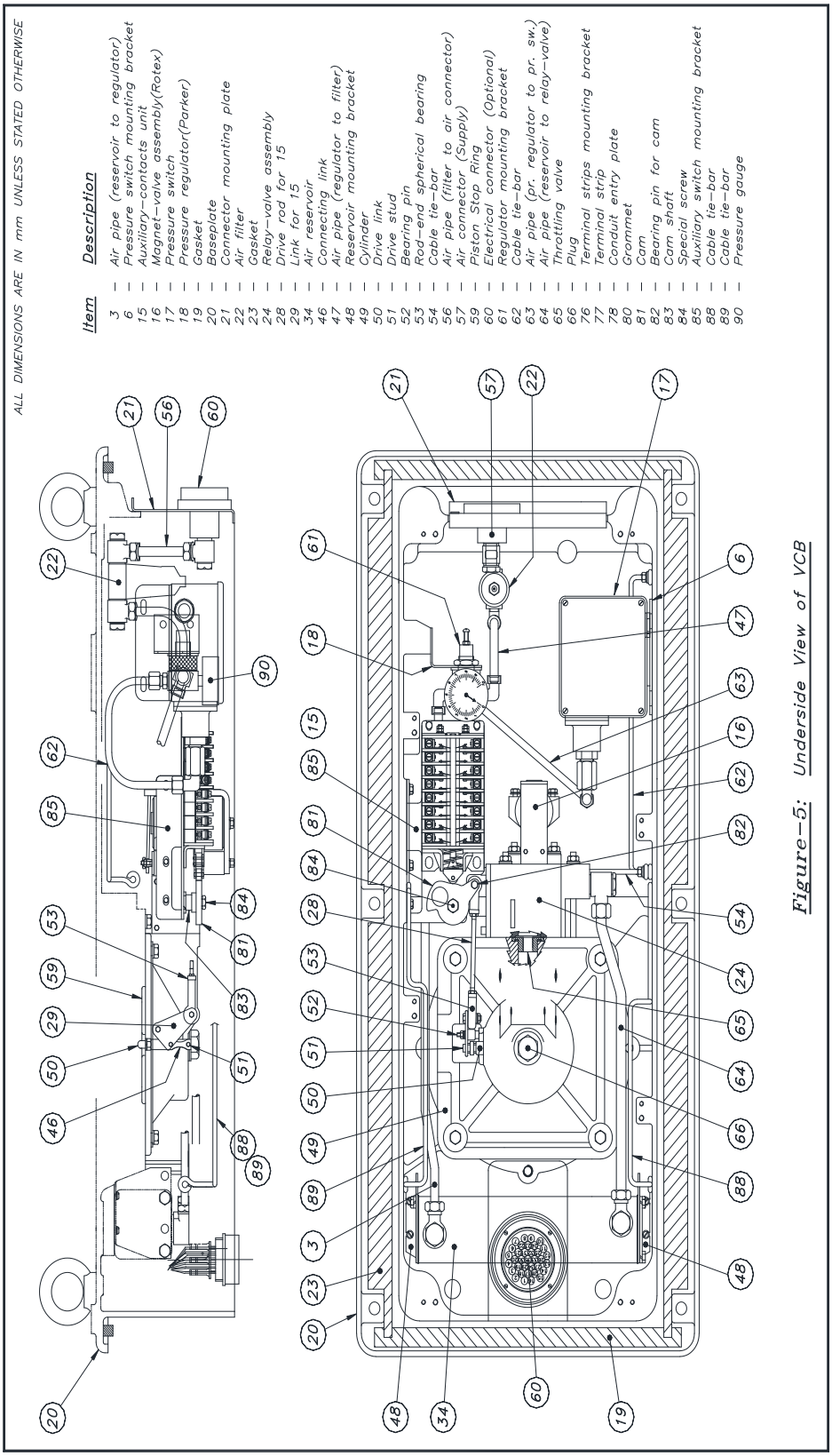


Item		Description
1	–	Upper terminal (Incoming)
2	–	Vacuum interrupter(V807 VG)
5	–	Lower terminal (Outgoing)
7	–	'O' ring
8	–	Top casting for 36
12	–	Actuator rod
15	–	Auxiliary–contacts unit
16	–	Magnet–valve assembly
17	–	Pressure switch
18	–	Pressure regulator
19	–	Gasket
20	–	Baseplate
21	–	Connector mounting plate
24	–	Relay–valve assembly
25	–	Damper assembly
26	–	Shim (steel)
27	–	Packing washer
30	–	Piston
31	–	Piston seal ring
32	–	Bottom access cover
33	–	Sealing section
35	–	Rating plate
36	–	Bottom insulator
42	–	Top insulator
44	–	Tin washer
45	–	Top compression ring
57	–	Air connector (supply)
66	–	Plug
68	–	Hex. socket C'SK head screw
79	–	Hex. socket head cap screw
86	–	Hex. socket head cap screw
87	–	Pillar

Figure–4: Cross–section Through the VCB



Figure–5: Underside View of VCB

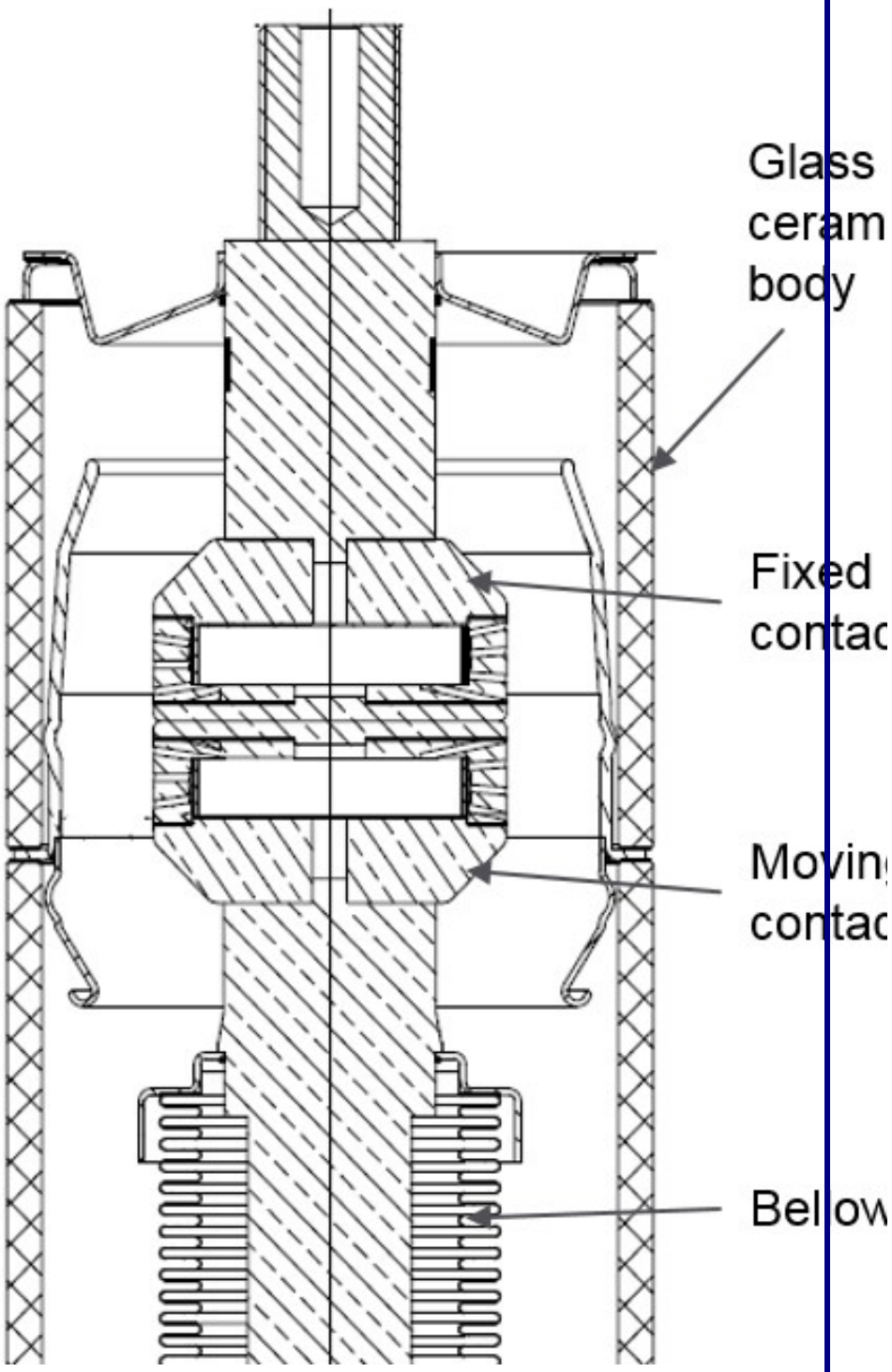


Figure – 6: Cross Section through the vacuum Interrupter

2.0 CONSTRUCTION (Refer Figures - 3, 4 & 5)

Two porcelain weather-proof insulators (36 & 42) are mounted vertically, one above the other, on a cast aluminium baseplate (20) which is fitted on the roof of vehicle.

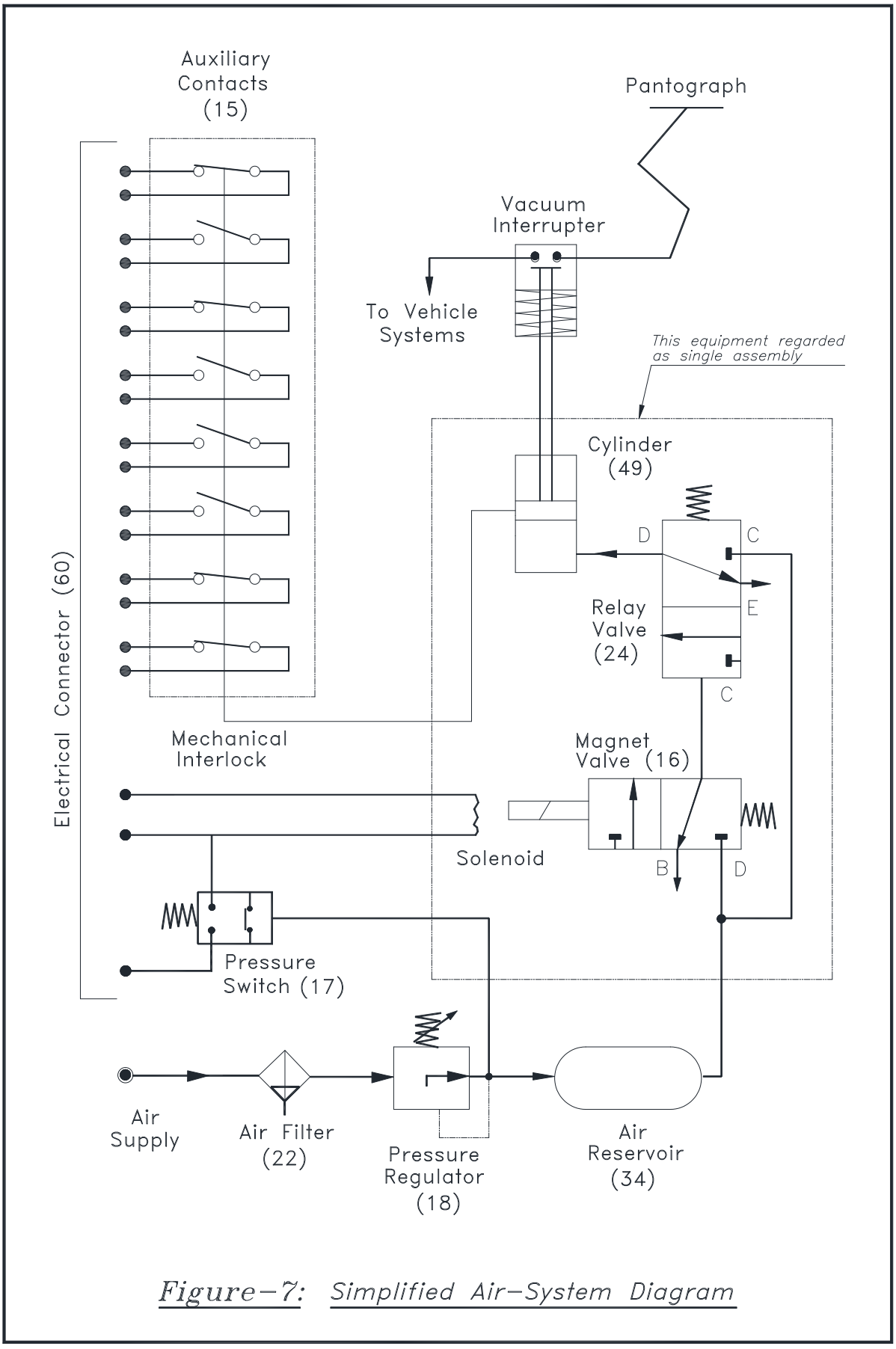
Upper terminal (1) of the VCB is normally used as incoming connection from the pantograph and lower terminal (5) is used as outgoing connection to the roof-bushing / cable for transformer connections on the roof of locomotive.

The vacuum interrupter (2) which houses the main switching contacts alongwith its operating mechanism, is housed in the top insulator (42) and is electrically between the busbars.

Chromium-copper castings (1 & 5), which are cemented to the top insulator (42), carry the current between the interrupter and the busbars. Not only are they used as the main terminals of the VCB, but they also support the earthing studs for the earthing switch (ALSTOM type 36KS). If some other make earthing switch is in use, these earthing studs are replaced with M10 screws and the earth busbar is connected directly to the bosses provided on terminals.

Bottom insulator assembly is separately bolted to the baseplate using clamping ring (14). This facilitates replacement at site, in the event of any damage to the insulator.

Cylinder (49), piston (30) and relay valve assembly (24) are mounted inside the baseplate. An actuator rod (12), located inside the hollow bottom insulator (36) is connected on one end to main piston (30) and on the other end to operating mechanism. This actuator rod closes the contacts of VCB when magnet valve (16) is energised. The opening mechanism, which is mounted on vacuum interrupter itself, ensures that the VCB remains open when magnet valve is de-energised. Auxiliary switch and all control equipment used to monitor electrical and pneumatic supplies are mounted within the baseplate (20).



Figure–7: Simplified Air–System Diagram

3.0 OPERATION (Refer Figures - 3, 4, 5 & 7)

Compressed air reaches the air reservoir (34), via air filter (22) and pressure regulator (18). A spur is connected to the control governor (pressure switch, 17). Air supply is then fed to relay-valve assembly (24). Pressure of compressed air inside VCB is regulated at 5.7 - 5.8 kg/cm^2, by the pressure regulator (18).

Pressure switch (17) is connected electrically in series with the magnet valve (16); therefore the VCB opens automatically if air pressure falls below 3.85 - 4.0 kg/cm^2. To close the VCB, pressure of compressed air supply must exceed 4.60 - 4.75 kg/cm^2.

To close the main contacts of VCB, magnet valve (16) is energised; this operates the relay valve (24). A parallel air-supply is then fed directly through the relay valve into the cylinder (49).

Relay valve assembly (24), which is mounted in the baseplate (refer Figures - 3 & 11), comprises a poppet valve (24/8), a piston (24/4) and a valve stem (24/10); the piston is fitted with a piston seal (24/5). Two O-rings (24/9 & 24/17) seal the faces between valve body (24/1) and end plates (24/2 & 24/3) respectively. Valve discs (24/6) are located in poppet valve (24/8) and the piston (24/4).

As the main VCB piston (30) moves, so does the auxiliary-contacts drive mechanism (28 & 29) (refer Figures - 3 & 5). This operates the auxiliary contacts which comprise four normally-closed contacts and four normally-open contacts, that are interchangeable. These are connected as shown in the wiring diagram (Figure-37).

Actuator rod (12) pushes against the mechanism below the vacuum interrupter (2). As the actuator rod moves upwards, so does the drive plate (37) and spacers (39). This in turn moves the spring plate (43) and compresses the springs (41). The moving contact closes under the influence of atmospheric pressure acting on the bellows. As soon as the contacts touch, springs (38) are compressed, giving an immediate increase in contact force through the connector block (11), thereby minimising contact bounce. Mechanism

movement continues until drive plate (37) bears against the connector block (11) with the piston force acting against the contacts.

The mechanism is now charged, so that when air is discharged from cylinder at the start of opening cycle, the springs (41) force the spring plate (43) to hit the connector block (11). This ***"Snatch Effect"*** breaks any contact weld.

Flexible shunts (10) carry the current out from the moving stem of vacuum interrupter to chromium-copper lower terminal casting (5).

Principle of operation of major sub-assemblies / pneumatic equipment is explained in ***OVERHAUL*** section.

Principle of switching in vacuum

Vacuum principle

A vacuum, which has excellent insulating properties, allows the distance between the energised contacts to be considerably reduced. Rupturing of the arc occurs very rapidly at the next current zero crossing. Insulation between the contacts is re-established after a few fractions of a milli-second and hence the arc cannot form again. Particular shape of contact surfaces, as well as the combined magnetic forces, cause rotation of the arc about the axis of contacts. This effect allows hot spots to be reduced thus minimising contact wear and ensuring high electrical life of circuit breaker.

Vacuum interrupter (Refer Figure-6)

The vacuum interrupter comprises two copper alloy contacts, one fixed and the other moving. The fixed contact is mounted on a metal flange which carries the ceramic envelope of the chamber. The ceramic envelope is generally in two parts with a metal shield fixed between them. This shield protects the ceramic parts against deposition of metallic vapour produced by the arc when the contacts open. The moving contact travels in a guide which assures its axial positioning and the correct angle of movement. Sealing of the moving contact is assured by metal bellows which are welded both to it and to the end flange which is integral to the ceramic cover.

4.0 INSTALLATION AND REMOVAL (Refer Figure - 2)

WARNINGS

+ ***Before carrying out removal / installation / maintenance, ensure that the pantograph is lowered (and/or the shoegear isolated), and that the VCB is earthed by closing the earthing switch.***
+ ***If the vehicle is standing beneath an overhead conductor, ensure that the overhead is not energised and cannot be energised whilst maintenance work is being carried out.***
+ ***Isolate and earth the overhead (and/or the conductor rail), then lock the isolator in "Earthed position".***
+ ***It is imperative that local safety regulations be observed.***
+ ***Following operation requires the use of a compressed-air supply. Appropriate precautions must be ensured.***

4.1 INSTALLATION

To mount the VCB on to a vehicle, proceed as follows:

1. Lift the VCB using the lifting frame (refer Figures – 25 & 35) by an overhead crane and locate it the correct way round, in roof aperture. Plinth surrounding the roof aperture should either be drilled to accept six numbers M12 bolts to secure the baseplate, or it should have located in it, six numbers M12 studs. These studs are located through six numbers ∅13.5 mm holes in baseplate. No special alignment is necessary. The position of VCB is fixed by the size of aperture and these six securing holes. ***Ensure tightening torque of these screws is as specified below.***

2. Connect the copper busbars / flexible connectors to main terminals of the VCB. ***Note that the incoming supply from the pantograph is connected to the top terminal (1). The outgoing busbars / flexible connectors to the roof bushing is connected to the lower terminal (5).*** These busbars should be connected to M12x16 Deep tapped holes available on the terminals, ***ensuring the tightening torque specified below.*** Two numbers M12x16 deep tapped holes, diametrically opposite, are provided on each terminal. Depending on vehicle roof configuration, any one can be used for busbar connection.

   NOTE ***If the normal line current is greater than 800 A_{rms}, it is advisable to connect in parallel, both of the incoming terminals on the top casting of the VCB and both of the outgoing terminals at the centre of the VCB.***

3. i. If ALSTOM make earthing switch type 36KS is being used on the vehicle, fit it now, checking that jaws are in alignment with the earthing studs on VCB. (Fitting instructions and adjustments are given in the instruction describing the switch type 36KS).

   ii. If some other make earthing switch is fitted on the vehicle, remove the earthing studs provided on VCB. Connect the copper busbars / flexible connectors from earthing switch to the main terminals of VCB. These busbars should be connected to M10x16 Deep tapped holes available on the incoming and outgoing terminals (1 & 5 respectively), ***ensuring the tightening torque as specified below.*** Two numbers M10x16 deep tapped holes, diametrically opposite, are provided on each terminal. Depending on vehicle roof configuration, any one can be used for busbar connection.

Recommended Tightening Torques

For 6 nos. M12 fixing screws of baseplate	:	30 Nm
For M12 Main terminals (Incoming & Outgoing)	:	48 Nm
For M10 Earth terminals (Incoming & Outgoing)	:	30 Nm

CAUTION ***Excessive tightening will damage the CAST Aluminium baseplate and M10/M12 tapped holes in terminals castings.***

4. Fit the air dryer supplied alongwith each VCB, inside the locomotive compartment. ***Ensure that the air dryer is fitted vertically and that it is filled with unsaturated molecular sieves.*** At the time of initial fitment, weight of the air dryer should be taken and record maintained, for future reference.

5. Connect the longer flexible hose pipe from air dryer to G0.5 (1/2" BSP) tapped hole in air connector (57) fitted to the baseplate (20) of VCB. Connect the shorter hose pipe between air dryer and vehicle air supply. ***To avoid damage to these hose pipes, ensure their minimum bending radius as per manufacturer's recommendation and also avoid over hangs by rigidly supporting them at intermediate points.***

6. i. Remove bottom access cover (32), conduit entry plate (78) and connect control circuits of vehicle to the terminal strips (77) of VCB.

   ii. In case the VCB is fitted with multi-pin electrical connector (60), crimp the female pins to control wires of vehicle and push-fit all these pins into the coupler ensuring that ferrule numbers match with numbers

engraved on OK the holes of coupler. Coupler and female pins are supplied loose alongwith the breaker. Connect this assembled coupler to the other half of coupler fitted on baseplate of circuit breaker.

CAUTION ***Terminal 3 on the terminal strip / connector by-passes the VCB pressure switch; this is intended for VCB off-vehicle testing only. SCHNEIDER ELECTRIC does not recommend that the magnet valve be energised by using this terminal instead of terminal 5. When the magnet valve is correctly energised from terminal 5, terminal 3 is alive.***

If the VCB does not operate, check that the following are as specified:

+ *control voltage*
+ *compressed air-supply (check that the supply is present and that it is at correct pressure)*

The pressure switch inhibits VCB closure at air pressure below 3.85 - 4.0 kg/cm^2. If the compressed-air supply is present and is at correct pressure, fit a calibrated pressure gauge to the pressure regulator and re-adjust it until it reads 5.0 - 5.2 kg/cm^2. Re-seal pressure regulator and mark the setting with paint / permanent marker. Further details on setting the pressure regulator are given in Section - 5.3.1.

4.2 REMOVAL

1. Ensure that the VCB is in open condition and that the battery-isolating switch is open. Also ensure that the compressed-air system to the VCB is either isolated or discharged.
2. Disconnect the electrical supplies by removing the wires from terminal strips (77) or by removing the multi-pin electrical connector (60) (if provided). Disconnect the air-supply pipeline. On the roof, disconnect main bus-bars and earthing switch bus-bars from the VCB.
3. Unscrew and remove the six numbers M12 screws securing the VCB to vehicle roof. Connect sling hooks of lifting frame to four numbers M20 lifting hooks fitted on baseplate of VCB (refer Figures - 25 & 35). Using an overhead crane, remove the VCB from vehicle roof, ensuring that the porcelain insulators are not damaged. Transfer the VCB onto a handling trolley (refer Figure - 38) and secure it using six numbers M12 bolts, plain washers and nuts.

5.0 GENERAL MAINTENANCE (on-vehicle)

WARNING ***Follow all safety measures as stipulated under Clause - 4.0.***

5.1 GENERAL

This type of VCB is generally maintenance-free until a major overhaul, apart from cleaning the insulators.

The top insulator and interrupter are a potted assembly. If new parts are required, the interrupter will be supplied ready-potted in its insulator.

Also enclosed in Section - 9.8 of this manual is the maintenance schedule for this VCB. If records are kept for each VCB in service, a pattern will emerge and it may be possible, at the discretion of the Maintenance Engineer, to extend the maintenance period.

5.1.1 Thread Sealing of Compressed air joints

Since most of the threaded joints of compressed air path of VCB are of parallel thread type, PTFE thread sealing tape should be used on male threads before re-fitting the item such as pressure switch, pressure regulator, air filter, air reservoir, relay valve etc. in order to avoid air leakage from threaded joints.

5.1.2 Monitoring the Vacuum Interrupter

The interrupter has a life of approximately 3,00,000 switching operations. It must be replaced by another one before this figure is reached. SCHNEIDER ELECTRIC recommends that replacement be carried out at the first suitable time after 2,50,000 operations have occurred.

This figure can be determined using either one of the two methods outlined below:

- Monitor a vehicle for a specific period, say one month, then calculate or count the number of VCB operations during that period. The sum

deduced may be extrapolated to ascertain when the 2,50,000 operations will have been reached.

- θ Fit a counter to one vehicle of the fleet and have it switched by a spare contact on the auxiliary-contacts unit. However, to have confidence on this option, it is imperative that the zeroing facility of the counter is inoperative.
- θ Also, refer clause 5.3.3 below for the same.

5.2 EXAMINATION / REPAIR / SERVICING

Remove bottom cover (32) and check that the components fitted inside baseplate are clean, that there are no signs of damage and that all electrical and air connections are tight and are in good condition. It is not necessary to remove any part unless a fault is suspected.

5.2.1 Porcelain Insulators

Check the porcelain insulators for cracks and for chips. Minor damage (chips, small cracks & scratches) to the porcelain insulators can be repaired with epoxy resin. If the damage is more severe, fit a new insulator.

Service the porcelain insulators as below:

WARNING ***When using solvents to clean parts, take care not to inhale fumes. Also ensure that smoking is not permitted, since some solvents are flammable and others produce poisonous gases.***

+ Hand-wash the porcelain insulators using a detergent and water solution. Then rinse with clean water. Do not use pressure or steam cleaning tools on porcelain insulators.
+ Wipe clean all insulation surface with dry lint-free cloth. If necessary, first use a cloth moistened with white spirit, then finish off with dry lint-free cloth.
+ Smear the porcelain insulators with silicone grease and polish with clean, soft lint-free cloth.

5.2.2 Air Filter (refer Figure – 17)

Remove the air–filter bowl and check that it is clean; if not, remove it and clean. A visible coating of dirt or condensate inside the bowl or on surface of filter element indicates that cleaning is necessary. Wash the filter element with denatured alcohol; blow out the body with clean compressed air and wash the bowl, inside and outside, using a household soap and water solution.

5.3 CHECKING / ADJUSTMENT

WARNING ***The following operation requires the use of a compressed-air supply. Appropriate precautions must be ensured.***

A commercial grade (with low accuracy) pressure gauge is fitted to pressure regulator for Indication purpose only. During checking / setting of pressure regulator and pressure switch, it is highly recommended to use a calibrated pressure gauge with a range of 0 to 10 kg/cm^2 and accuracy of ±0.5%.

5.3.1 Pressure Regulator (refer Figures – 15 & 16)

Perform the following activities to set the pressure regulator. There are two test points on the pressure regulator. One test point is used for air supply to pressure switch while pressure gauge is fitted on the other test point.

+ Remove the bottom cover (32) to gain access to pressure regulator.
+ Remove the commercial grade pressure gauge fitted to pressure regulator.
+ Check air pressure, using a calibrated pressure gauge (range: 0 – 10 kg/cm^2; accuracy: ±0.5%) with a flexible air connection having a G0.125 (1/8" BSP) termination to fit into corresponding thread in test point of pressure regulator. Set the inlet air pressure as 9.5 kg/cm^2.
+ Pull yellow knob and adjust by rotating it so as to read 5.8 kg/cm^2, in the calibrated pressure gauge.
+ Operate VCB five times to ensure that the reading given on pressure gauge is consistent.

+ Check yellow knob properly released & locked, check / adjust the setting of pressure switch as given in following section and then lock regulator .

+ Remove the test pressure gauge and flexible pipe.

+ Apply liquid threadseal (Loctite 542 / Fevicol ANR-171 OR PTFE tape) to the thread of commercial grade pressure gauge and fit it to regulator. Allow the sealant to set for 10 to 15 minutes. ***Do not apply any other sealant as it might cause leakage at a later stage.***

5.3.2 Pressure Switch (refer Figure – 14)

After having set the pressure regulator as mentioned above, perform the following activities to adjust pressure switch settings.

+ Connect a continuity tester across terminals 3 & 5 at the terminal strips (77) OR multi-pin terminal connector (60), as the case may be, to verify the micro-switch contact operation.

+ Terminals 2-3 of pressure switch are across normally-open contact which is in series of magnet coil circuit. This contact "makes" on rise of pressure above 4.6 – 4.75 kg/cm^2 while they "break" when pressure falls below 3.85 – 4.0 kg/cm^2.

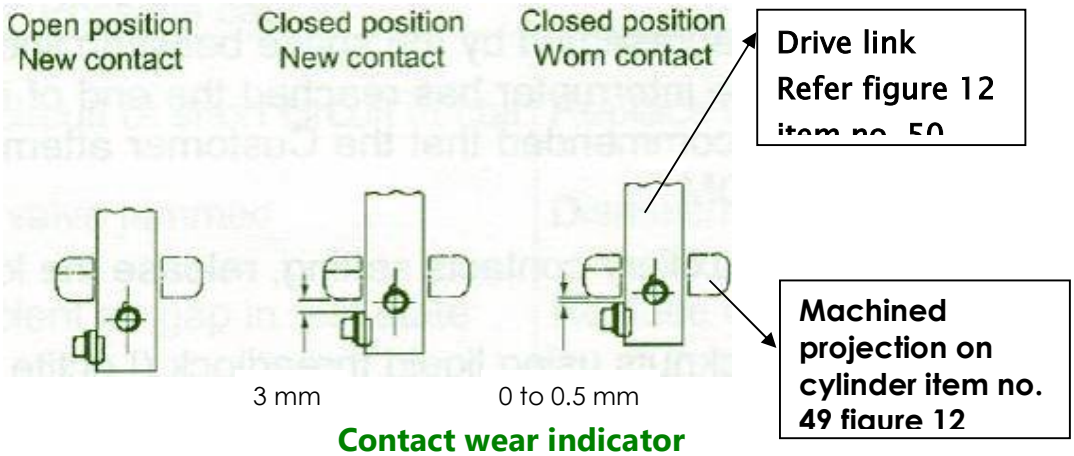
+ Raise air-pressure gradually and check that micro-switch contact closes between 4.6 – 4.75 kg/cm^2. Then disconnect air supply and gradually bleed air inside pneumatic circuit of VCB and check that contact opens between 3.85 – 4.0 kg/cm^2.

+ In case adjustment is required, rotate setting knob of pressure switch to achieve the above mentioned cut-in and cut-off values.

+ Repeat the above operations 4-5 times and ensure that the settings have not changed.

5.3.3 Main contact wear indication

The contact wear indicator is set in factory during the routine test. Between the face of cylinder and the contact wear indicator bracket, the gap is 3 mm. when the gap is between 0 and 0.5mm, the wear of the main contact is reached.



Contact wear indicator

5.3.4 *In – situ Inspection of Auxiliary Switch*

1. Check the condition of moving N/C contacts visually in breaker off condition. Now close the breaker & the contacts which were N/O before have become N/C. Check the condition of N/C contacts. Sag of moving contacts during N/C condition should not be more than 3 mm.
2. Keep the breaker in open condition. Check the gap between cam & roller of Aux switch by putting plain paper. Gap should not be more than 0.5 mm (paper should pass through the gap).
3. Clean the contacts with CRC626 spray in case of excessive deposition of carbon on contacts.

6.0 OVERHAUL (off-vehicle)

Overhaul the VCB and its associated components in workshop as described in this section.

NOTE ***While dismantling the VCB and its mechanism, replace any component that shows signs of wear.***

6.1 Dismantling Insulators from baseplate assembly

(Refer Figures - 3, 4 & 5)

1. Mount VCB onto handling trolley (refer Figure – 38) and turn it over so that baseplate is uppermost. Remove the bottom access cover (32).
2. Remove link (29) and connecting link (46) from the drive rod (28). Fold drive rod backwards (towards auxiliary switch).
3. Remove plug (66) from the base of cylinder (49); then unscrew and remove the M12 securing screw from piston (30).
4. Disconnect all cables terminated at the terminal strips. Remove the terminal strips mounting bracket (76) by opening two M6 hexagonal nuts and one M8 screw.
5. Remove the control wires from magnet valve (16). Relaese coupling screws at relay valve (24), air reservoir (34) and remove air pipe (64).
6. Remove four numbers M8 screws securing the cylinder (49) to baseplate (20). Now remove cylinder assembly complete with the piston (30), relay valve (24) and magnet valve (16). ***Note that a jerking action may be required in order to release the piston (30) from actuator rod (12).***

   NOTE ***If it is necessary to repair individually-failed components, including the relay valve, these may be removed from baseplate without disturbing the cylinder assembly.***

7. Rotate the VCB so that top insulator assembly is uppermost. It will be necessary to remove sealant that encapsulates screw heads and break the sealant bond between top and bottom insulator assemblies. Remove the eight numbers M8 socket-head screws (86) that secure top insulator assembly to lower insulator assembly.

8. Secure lifting frame (refer Figure – 36) to upper terminal of top insulator assembly. Taking great care, since the actuator rod (12) is still connected, lift and remove the top insulator assembly. ***Place the assembly in inverted condition on a soft rubber mat.***

9. ***Following operation is to be done only if bottom insulator is to be replaced with a new one, due to physical damage to insulator.***

   CAUTION ***Bottom insulator assembly should ONLY be removed with VCB in its normal operating position i.e. not inverted.***

   Remove the sealant from surface of baseplate that covers the lower casting (13) and clamping ring (14) that forms a water-proof sealing. Having finally unscrewed the three numbers M8 securing screws & one pillar (87), it should now be possible, by a combined action of twisting and pulling, to remove bottom insulator assembly (36) from baseplate. (If multi-pin connector is used, pillar, 87 is replaced with M8 screw). It will be necessary to break the sealant bond on both circular ring interfaces of clamping ring (14).

   After many years in service, the insulator may have become seized. For this reason, two of the four holes from which one number M8 securing screws and one pillar (87) have just been removed, are tapped M12. These two numbers M12 tapped holes facilitate fitment of a plate or bar having two jacking screws, across the bottom of insulator assembly. The insulator can also be forced out using an M12 bolt which has been modified as shown in Figure – 29. An additional spacer (5.8 mm diameter) may be required to push the insulator clear.

   These screws can be tightened to apply a force against the end-face of insulator retaining ring so that the assembly can now be pushed out.

6.2 Dismantling the baseplate assembly (Refer Figure - 5)

Having removed cylinder assembly (49), auxiliary-contacts drive-link (29) and connecting link (46), baseplate assembly is now free from remainder of VCB assembly.

It may not be necessary to carry out any further dismantling, but if it is required to remove the remaining components, proceed as follows:

1. Disconnect and remove air-pipe (3) between air reservoir (34) and pressure regulator (18), by unscrewing the banjo bolts on each component.
2. Disconnect and remove air-pipe (64) between air reservoir (34) and relay valve (24) by unscrewing the banjo bolts on each component.
3. Remove air reservoir (34), by removing at each end, two screws securing the reservoir mounting brackets (48).
4. Disconnect all control cables from auxiliary-contacts unit (15) and pressure switch (17) making a note of the positions of all wires to facilitate reassembly (Refer Figure-37). Since the wires have already been disconnected from magnet valve and terminal strips, the cabling can now be released from cable tie-bars (54, 62) and removed along with the electrical connector (60), if fitted. Unless they have sustained damage, the tie-bars can be left in position.

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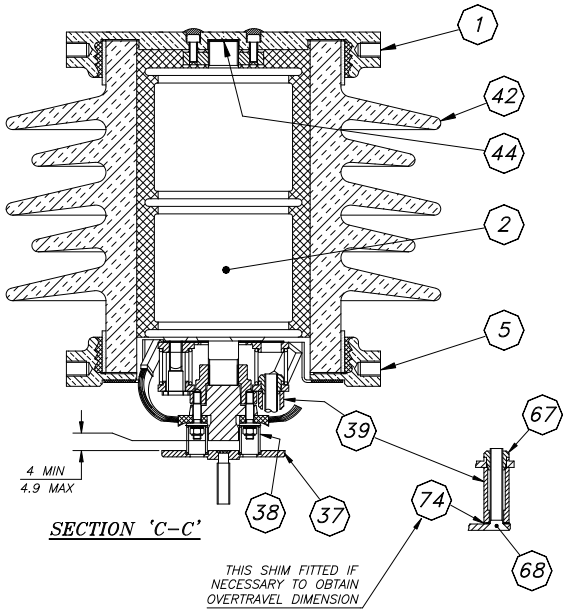

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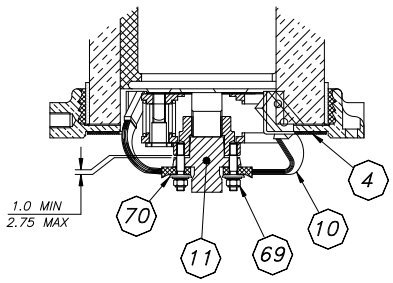

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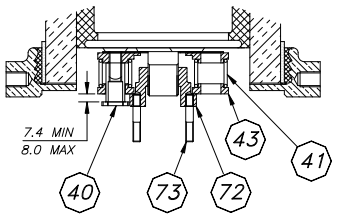

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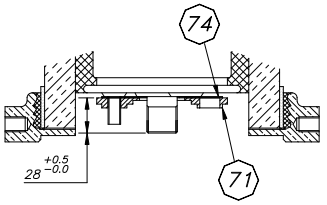
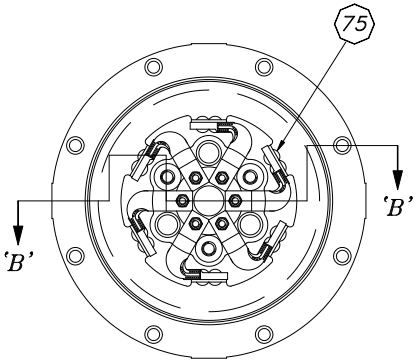
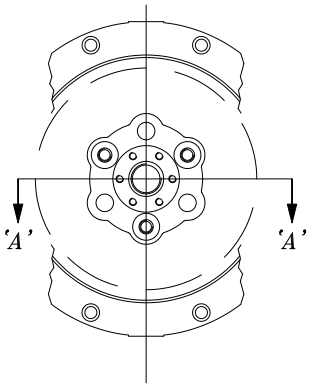
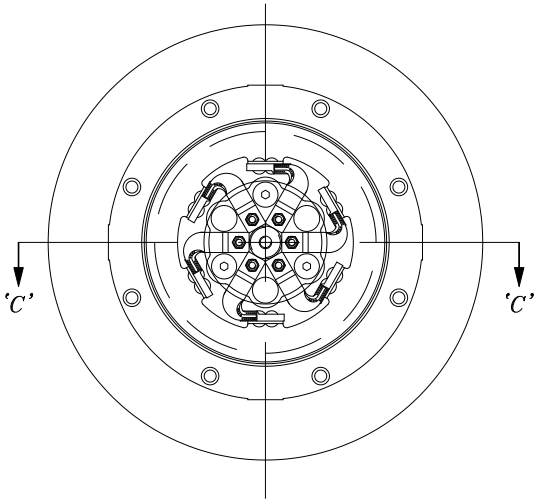


PART SECTION ON INTERRUPTER £







Item		Description
1	–	Upper Terminal (Incoming)
2	–	Vacuum Interrupter
4	–	Shunt Collector Ring #
5	–	Lower Terminal (Outgoing)
10	–	Flexible Shunt #
11	–	Connector Block #
37	–	Drive Plate Assembly
38	–	Spring
39	–	Spacer

Item		Description
40	–	Mechanism Stop *@
41	–	Spring
42	–	Top Insulator
43	–	Lower Spring Plate
44	–	Tin Washer #
67	–	Special Nut ***
68	–	Hex Skt CSK Hd Screw *@
69	–	Nyloc Nut
70	–	Special Washer

Item		Description
71	–	Upper Spring Plate
72	–	Compression Ring
73	–	Stud **
74	–	Shim Washer (0.5mm thk)
75	–	ø6 Copper Rivet

* locked with Loctite–242
** locked with Loctite–270
*** locked with Loctite–638
@ sprayed with Molykote D321R
# smear with UNIAL paste

Figure–8: Top Insulator and Mechanism Assembly

5. If auxiliary-contacts unit is being replaced by another, independent of other work, refer to Section - 6.7.
6. Auxiliary-contacts unit (15), mounting bracket (85), cam (81) fitted with bearing pin (82), cam shaft (83) & special screw (84) are considered as a single unit. To remove this unit, release the drive rod (28) from cam by opening M5 hexagonal nut and lock nut. ***Care should be taken not to damage or disturb the length of drive rod (28).*** Now unscrew three hexagonal-head M6 screws that secure mounting bracket (85) to baseplate and release the complete unit.
7. Free air-pipe (47) between pressure regulator (18) and air filter (22) by unscrewing the banjo bolts at regulator end. Remove the pressure regulator and its mounting bracket (61) by unscrewing two numbers M6 screws from the side of baseplate.
8. To remove air filter (22), release the remaining banjo bolt at air connector (57). Air filter (22), along with the air pipes (47 & 56) are now free to move. Unless air connector (57) has sustained damage, it may be left in place.
9. To remove pressure switch (17), first remove air pipe (63) between pressure switch and pressure regulator. Open the cover of pressure switch by unscrewing the four screws. With the cover removed, access can now be gained to two screws securing the switch to its mounting bracket (6). Open these screws and remove the switch from its mounting bracket. Release the mounting bracket from baseplate by opening two securing screws.

6.3 Top Insulator & Mechanism Assembly (Refer Figures-3,5&8)

6.3.1 *Dismantling*

1. Remove the top insulator and mechanism assembly by following steps 1 to 8 given under clause 6.1.
2. Take a M12 bolt and screw a nut onto it. Now fit this screw into metallic insert of actuator rod and tighten the nut against flange of insert. Unscrew the bolt, thereby releasing actuator rod from drive plate (37) (Refer Figure-3). ***Ensure that shim / packing washers placed on stud of drive plate are not misplaced.***

3. Unscrew and remove three numbers M10 countersunk-head socket screws (68) from drive plate (37). Note that the six springs (38) will tend to push the plate upwards. Remove drive plate, spacers (39) and six springs. ***Do not misplace shim washer (if present below drive plate).***
4. Unscrew the six numbers nyloc nuts (69), then remove special washer (70), shunt and collector ring assembly (4 and 10) and connector block (11). Unscrew compression ring (72) and remove it. ***Keep connector block (11) in a safe place to avoid any damage.***

5. Using peg spanner (Refer Figure-26), carefully unscrew three stops (40) against the force of six main springs (41) and remove them. Now remove lower spring plate (43), main springs (41), upper spring plate (71) and finally the shims (74) placed under the upper spring plate. ***Ensure that these shims are not misplaced.***

6.3.2 *Cleaning / Examination / Reconditioning*

CAUTION ***Follow safety measures as stipulated in Clause 5.2.1.***

1. Wash all components in non-corrosive degreasing fluid like white spirit and dry them out by blowing compressed air and wiping with dry lint-free cloth. If necessary, first use a cloth moistened with white spirit, then finish-off with dry lint-free cloth.
2. Examine all metal parts for cracks / deterioration; replace if found defective.
3. Examine all moving parts for the extent of wear; replace any which are excessively worn.

6.3.3 *Reassembling / Setting*

At this stage, it is assumed that a potted upper insulator assembly is available. If a new upper insulator is being fitted, record the serial number of interrupter (2) {(which is stamped on upper face of the upper terminal casting (1)} together with the serial number of VCB, which is to be found on rating plate (35) affixed to the baseplate (20).

1. Determine the length of M24 moving stem of vacuum interrupter from the three stud-mounting faces, using the 28mm gauge (Refer Figure-33). The

amount by which it exceeds 28mm must be made up by using 0.5mm shims (74).

Example:	Length	=	29.75 mm
	29.75 – 28	=	1.75 mm
	Use three shims	=	1.50 mm

Do not reduce the dimension below 28 mm OR use more than eight shims.

2. Fit the upper spring plate (71) and six main springs (41).
3. Spray the outer surface of three stops (40) with anti-friction coating (Molykote D321R). Fit lower spring plate (43) and secure it with three stops, applying liquid threadlock (Loctite-242) and taking care not to inadvertently wipe-off the anti-friction coating from surface of stops. Use peg spanner (Refer Figure-26) for tightening these stops.
4. Depress the lower spring plate (43) until a gap of 7.5mm (8.0 mm max^{m}) between stops and spring plate is achieved. Fit the three setting spacers (Refer Figure-28) into this gap.
5. Screw the compression ring (72) onto the interrupter moving stem, until it just touches lower spring plate (43). Adjust the ring so that two studs of compression ring (72) are set equidistant between the spacers (39) at all positions. Remove the setting spacers. Depress lower spring plate (43) until main contacts of the interrupter make contact (use a continuity tester to sense this condition) and check the gap between spring plate and stops using 7.5mm gap gauge (Refer Figure-32).
6. Smear the contact face of connector block (11) and that of shunts (10) with electrical jointing paste (Unial) and fit it and the shunts to the studs of compression ring (72), securing them with special washers (70), M6 belleville washers and M6 Nyloc nuts (69).

NOTE ***Flexible shunts (10) are riveted to shunt collector ring (4). Should it be necessary to change any shunt, always apply electrical jointing paste (Unial) between mating faces of shunt ferrules and tang of collector ring before riveting them together with copper rivets (75).***

CAUTION ***New special washers (70), should always be used. Do not, in any case, use the old belleville washers and Nyloc Nuts.***

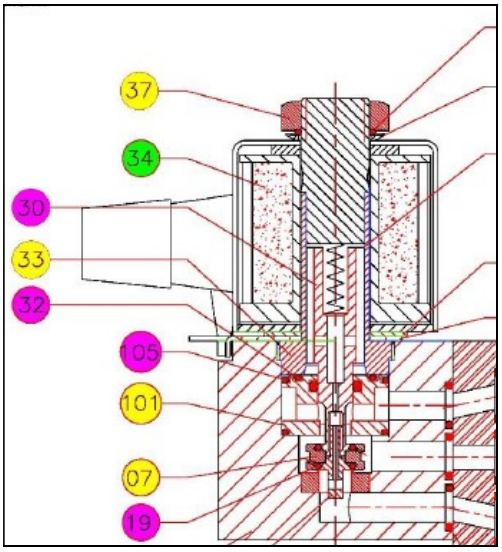
7. Using the 1 mm / 2.75 mm gap gauge (Refer Figure-31), check that the gap between compression ring (72) and connector block (11) is greater than 1 mm, but that it does not exceed 2.75 mm.

8. Place the three spacers (or pillars) (39) on lower spring plate (43) and the drive plate (37) on top of these spacers. Check that contact overtravel is between 4.0 mm and 4.9 mm, using 4.0 mm / 4.9 mm gap gauge (Refer Figure-34). If it is less than 4.0 mm, insert a 0.5mm shim (74) between drive plate and the three spacers.

9. Remove drive plate and place six springs (38) on the special washers. Apply anti-friction spray Molykote D321R under countersunk head of M10 screws (68) and liquid threadlock Loctite-242 on threads and then secure the assembly with three such screws tightened to a torque of 60Nm. ***Ensure that springs seat properly in counter-bore holes provided on drive plate.***

10. Check that the shunts (10) are clear of all other components.

As a result of above procedure, total travel of the operating mechanism should not exceed 13 mm.



Sectional view of magnet Valve

Figure 9: Magnet valve assembly

01	COPPER WASHER	19
01	NUT 'O' RING	18
01	STOPPER PLATE	17
01	COIL GASKET	16
01	STAR WASHER	15
01	M HOLDER	14
02	SLEEVE 'O' RING	13
01	SLEEVE	12
03	ADAPTOR 'O' RING	11
01	ADAPTOR PLATE	10
01	NUT	09
01	COIL ASSLY.	08
01	GUIDE ASSLY.	07
01	GUIDE 'O' RING	06
01	PLUNGER ASSLY/SEAL	05
03	BODY 'O' RING	04

Exploded view of magnet valve

6.4 Magnet Valve Assembly (Refer Figures - 9 & 10)

6.4.1 *Operating principle of 3/2 solenoid valve*

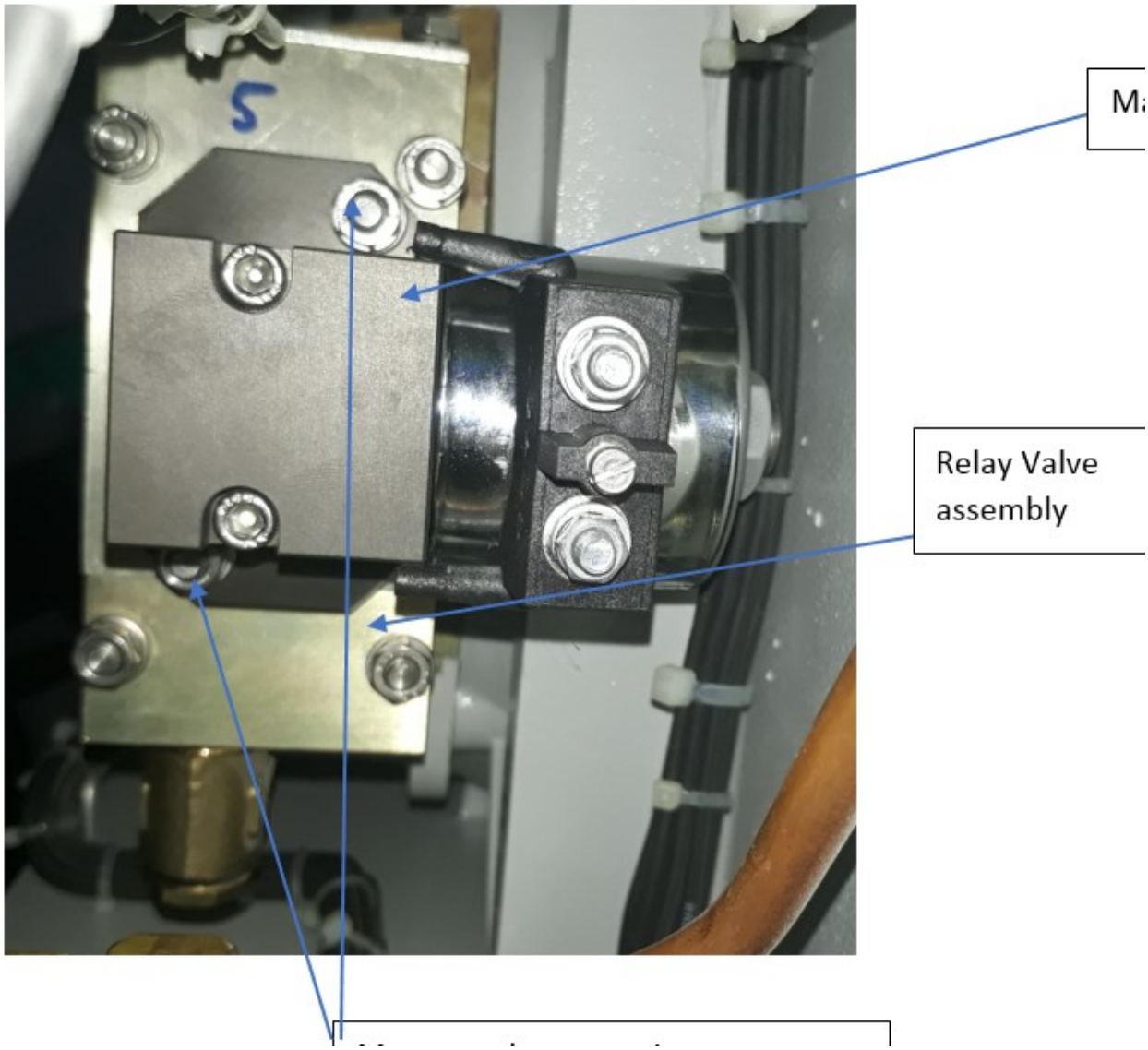
NC Operation

In De-energized condition, port 1 (Inlet) is disconnected from port 2 (Outlet). Port 2 is connected to port 3 (exhaust).On energizing the solenoid, the plunger will lift. So valve will open and port 1 (Inlet) will be connected to port 2 (outlet). Thus port 3 (Exhaust) will be closed.

When the magnet valve is mounted on relay valve, which it controls, each of the ports coincide with corresponding ports in relay valve body. One of the corresponding ports in relay valve leads to the compressed-air supply, another leads into the VCB itself and a third port leads to the atmosphere.

6.4.2 *Dismantling*

1. Disconnect control cables from magnet valve assembly by removing the two M5 hexagonal head screws. Remove magnet valve assembly from relay valve by unscrewing two M6 hexagonal nuts to the relay valve body. ***Ensure that three O-rings fitted on ports are not misplaced.***
2. Remove the retaining nylon nuts, pull coil assembly.
3. Unscrew plunger assembly.(30)



6.4.3 *Cleaning / Examination / Reconditioning / Testing*

CAUTION ***Follow safety measures as stipulated in Clause 5.2.1.***

1. Wash all metal components in non-corrosive degreasing fluid like white spirit and dry them out by blowing compressed air. Wipe clean all rubber parts/ insulation material with dry lint-free cloth. If necessary, first use a cloth moistened with white spirit, then finish-off with dry lint-free cloth.
2. Examine all metal parts / insulations for cracks; replace if found defective.
3. Examine all moving / rubber parts for the extent of wear; replace any which are excessively worn.
4. Examine the operating coil carefully; if any cracks discolored are observed in the encapsulation material, or if there is any evidence of overheating, fit a new one. Check sturdiness of lead wires coming out of surge suppressor unit. Replace if found loose.
5. Measure the resistance of the coil and if it is not as stipulated in DATA Section - 8.0; replace with a new one.

6.4.4 *Reassembling / Setting / Testing*

1. Reassemble magnet valve in the reverse order from that described under dismantling. Slightly smear all O-rings, fluted rubber valves and inside bore of valve body with Molykote-55M silicone grease.
2. When magnet valve has been reassembled, perform 2-3 operations to check its function.

CUSTOMER : SCHNEIDER ELECTRIC INFRA LTD.
P.O. NO : 1102263159
ROTEX VO. NO. : 17103236
ROTEX GA DRG. NO. : 526-S3 (REV.8)

VALVE SPECIFICATION

01)	VALVE TYPE ----------	3/2 DIRECT ACTING, HIGH ORIFICE NORM CLOSED SUBBASE MOUNTED SOLENOID V/
02)	MODEL ----------	3486
03)	MAIN FLUID ----------	AIR
04)	SEAT / SEAL ----------	Viton
05)	WORKING PRESSURE -----	0-10 bar
06)	ORIFICE ----------	5 mm
07)	FLOW FACTOR (kv) --------	5 lpm
08)	PORT CONNECTION -------	SUBBASE
09)	BODY MATERIAL ----------	ALUMINIUM
10)	SOLENOID CODE ----------	28
11)	SOLENOID VOLTAGE -------	110V-DC
12)	SOLENOID INSULATION ---	CLASS H
13)	SOLENOID POWER ----------	8 Watt
14)	SOLENOID TYPE ----------	Open Stud Type
15)	DEGREE PROTECTION -----	IP54
16)	PICK UP VOLTAGE -----	< 70 V
17)	DROP DOWN VOLTAGE -----	11V to 37V DC
18)	CURRENT ----------	73.3mA (±10%)

8

6

7

6.5 Relay Valve Assembly (Refer Figure - 11)

6.5.1 *General*

The main components of the relay valve assembly are the valve body (24/1), piston (24/4), poppet valve (24/8), valve stem (24/10), two valve discs (24/6) and the spring (24/13).

When the magnet valve, which is bolted to relay valve, is energised, air pressure displaces the piston (24/4) overcoming the spring (24/13) force, until valve disc (24/6) of piston seats against seat-A. At the same time, poppet valve (24/8) / valve disc assembly lifts-off seat-B and the main air supply, which is admitted through port-C, enters the cylinder of VCB through port-D.

When the magnet valve is de-energised, spring (24/13) pushes poppet valve assembly back onto its seat, thereby lifting the piston assembly off its seat. This allows the air inside cylinder to exhaust to atmosphere through port-E.

6.5.2 *Dismantling*

1. Remove the magnet valve assembly (16) as explained in Section 6.4.2.
2. Remove the relay valve assembly (24) from cylinder (49) by unscrewing four M6 hexagonal nuts and sliding the complete assembly over four studs (55) fitted to the cylinder flange. ***Ensure that the O-ring (24/16) fitted on port-D is not misplaced.***
3. Remove the top plate (24/2) by unscrewing two M6 (24/14) and one number M8 hexagonal socket countersunk head screws (24/15) and gain access to poppet valve (24/8) and valve disc (24/6). ***Do not misplace the O-ring (24/7) fitted on counter-bore hole of top plate (24/2).***
4. Remove the bottom plate (24/3) by unscrewing four M6 hexagonal head screws (24/12) to gain access to piston (24/4) and valve disc (24/6).

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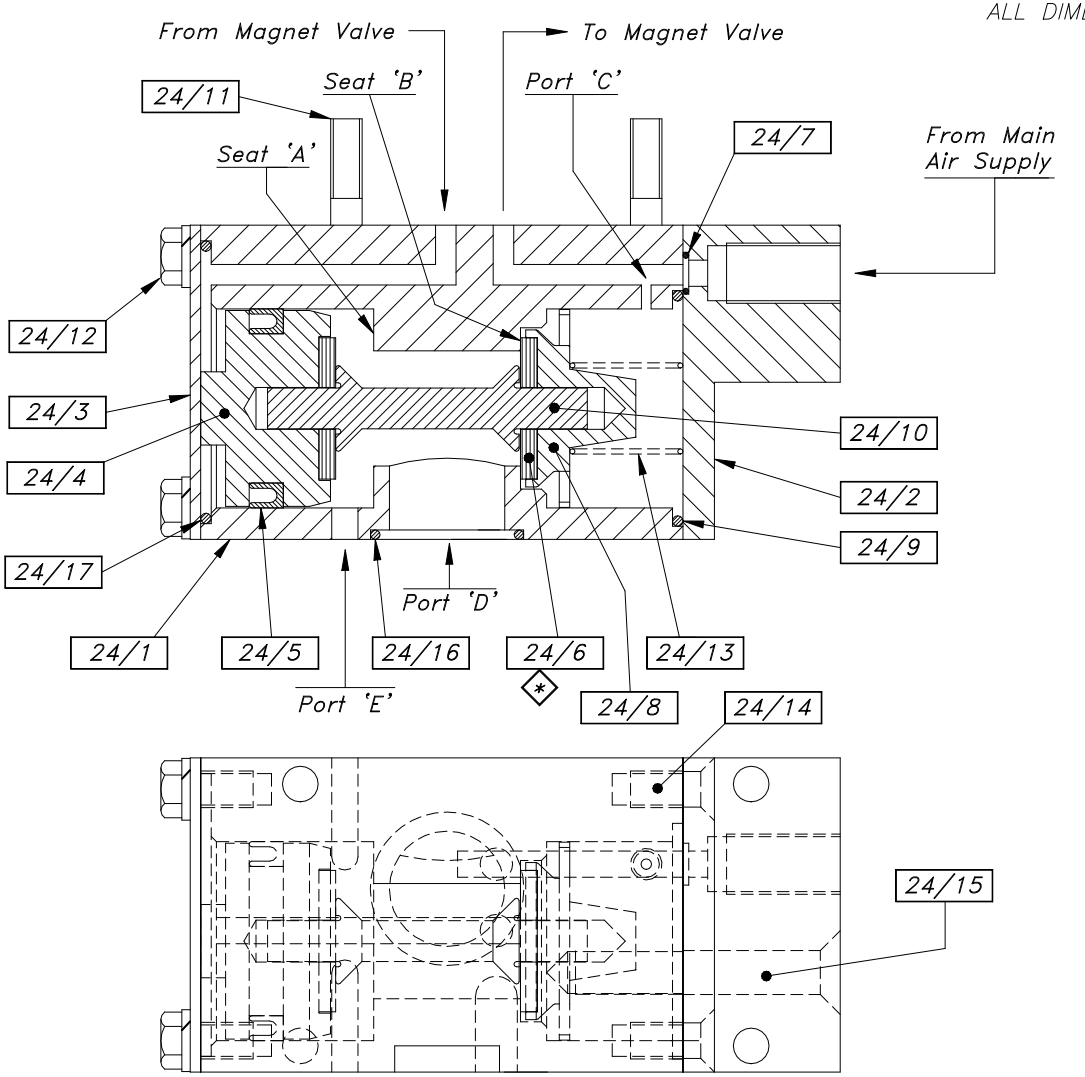

Item		Description
24/1	–	Valve Body
24/2	–	Top Plate
24/3	–	Bottom Plate
24/4	–	Piston
24/5	–	Piston Seal
24/6	–	Valve Disc
24/7	–	O–ring
24/8	–	Poppet Valve
24/9	–	O–ring
24/10	–	Stem
24/11	–	Stud
24/12	–	M6x14Lg Hex Hd Screw
24/13	–	Spring
24/14	–	M6x12Lg Hex Skt C'sk Hd Screw
24/15	–	M8x30Lg Hex Skt C'sk Hd Screw
24/16	–	O–ring
24/17	–	O–ring

(*) Bond valve discs to poppet valve and piston with RTV1080 sealant.

Figure–11: Relay Valve Assembly

5. The piston and poppet valve are not rigidly secured to the stem (24/10) and are therefore easily removed by pulling outwards.
6. Separate out piston seal (24/5) from piston (24/4), valve discs from piston and poppet valve (24/8) and all O-rings (24/7, 24/9, 24/16 & 24/17).

6.5.3 *Cleaning / Examination / Reconditioning*

CAUTION ***Follow safety measures as stipulated in Clause 5.2.1.***

1. Wipe clean all components including bore of valve body with dry lint-free cloth. If necessary, first use a cloth moistened with white spirit, then finish-off with dry lint-free cloth.
2. Examine all metal components for cracks; replace if found defective.
3. Examine all moving / rubber parts for the extent of wear including O-rings; replace any which are excessively worn.
4. Remove and discard old valve discs (24/6) and replace with new ones.
5. Scrape-off RTV sealant from counter-bores of poppet valve and piston, using a blunt tool.

6.5.4 *Reassembling*

1. To reassemble the relay valve, first smear RTV sealant in counter-bore of poppet valve and piston. Place new valve discs in these counter-bores; apply pressure on surface of valve discs against respective components and leave in position for one hour for sealant to set.
2. Grease O-rings, piston seal, bore of valve body with Molykote-55M silicone grease. Fit the greased piston seal onto piston such that open end of seal points away from the valve disc end of piston.
3. Push bonded assembly of piston and valve disc into the correct end of valve body; then with the O-ring (24/17) in place, screw down the bottom plate (24/3).
4. Through the valve body, fit stem (24/10) so that it enters hole in piston. Push bonded assembly of poppet valve and valve disc into valve body so that stem fits into the hole of poppet valve.
5. Place spring (24/13) on dome of poppet valve. Place the O-rings (24/7 & 24/9) in respective counter-bores on top plate (24/2) and valve body

(24/1). Secure top plate to valve body using two M6 and one M8 countersunk head screws (24/14 & 24/15).

6. Slide relay valve assembly onto four studs of cylinder and secure it using four M6 hexagonal nuts, while ensuring that the reducer (65) (Refer Figure-5) and its O-ring (24/16) are in place.

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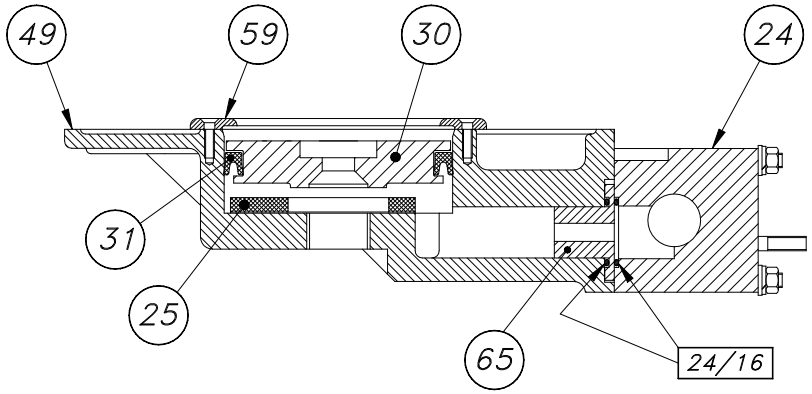
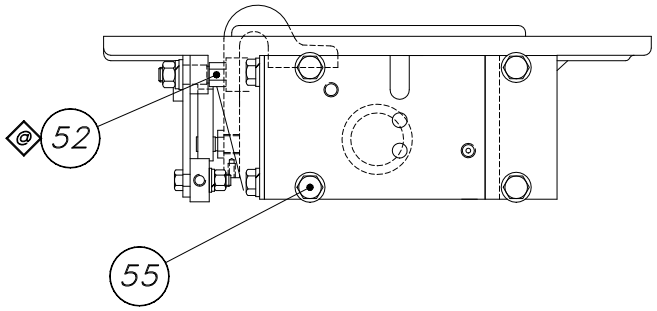
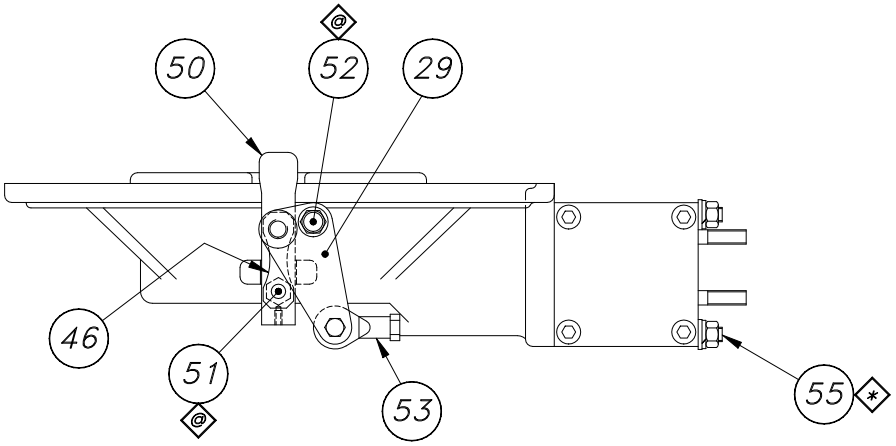






Item		Description
24	–	Relay Valve Assembly
24/16	–	O–Ring
25	–	Damper Assembly
29	–	Link
30	–	Piston
31	–	Piston Seal Ring
46	–	Connecting Link
49	–	Cylinder
50	–	Drive Link
51	–	Drive Stud @
52	–	Bearing Pin @
53	–	Rod End Spherical Bearing
55	–	Stud *
59	–	Piston Stop Ring
65	–	Reducer

@ Secured with Loctite–242

* Secured with Loctite–270

Figure–12: Cylinder–Piston Assembly

6.6 Cylinder-Piston Assembly (Refer Figure - 12)

6.6.1 *Dismantling*

1. For dismantling cylinder-piston assembly (along with relay valve and magnet valve assemblies) from the VCB, carry out operations mentioned in points 1 to 6 under Clause 6.1.
2. Remove the magnet valve assembly from relay valve by opening two M6 hexagonal nuts. Refer Section-6.4 for details on overhauling of magnet valve assembly. ***Ensure that three O-rings (16/12) located between magnet valve and relay valve are not misplaced.***
3. Remove the relay valve assembly from cylinder by opening four M6 hexagonal nuts. Refer Section-6.5 for details on overhauling of relay valve assembly. Separate the reducer (65) along with its O-ring (24/16).
4. Open one M6 hexagonal nut and release the drive link (29) and connecting link (46). Unscrew the six M4 hexagonal socket countersunk screws securing the piston stop ring (59). Remove piston (30) along with the drive link (50) and piston seal ring (31). Separate the piston seal ring from piston.
5. Unscrew bearing pin (52) and two drive studs (51) fitted to drive link (50) and link (29) respectively only if they show signs of deterioration and require replacement.

6.6.2 *Cleaning / Examination / Reconditioning*

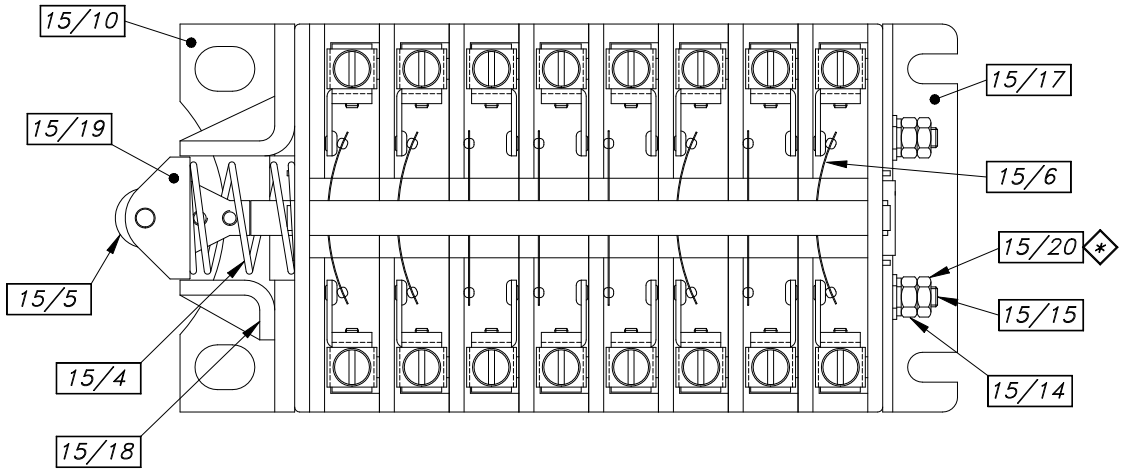
CAUTION ***Follow safety measures as stipulated in Clause 5.2.1.***

1. Wash all components in non-corrosive degreasing fluid like white spirit and dry them out by blowing compressed air and wiping with dry lint-free cloth. If necessary, first use a cloth moistened with white spirit, then finish-off with dry lint-free cloth.
2. Examine all metal parts for cracks; replace if found defective.
3. Examine all moving / rubber parts for the extent of wear; replace any that are excessively worn.

6.6.3 *Reassembling*

1. Smear Molykote 55M silicone grease on piston seal ring (31) and fit it onto piston (30) such that the open face of seal points towards the damper assembly (25). Ensure the drive link (50) fitted to piston is not loose; otherwise open the M6 hexagonal socket countersunk head screw and check that ∅2 spiral pin is not damaged. If it is broken, replace with new one and secure drive link to piston with above M6 screw, using liquid threadlock Loctite-242.
2. Refer SLW_LOCO_Bellow fitment

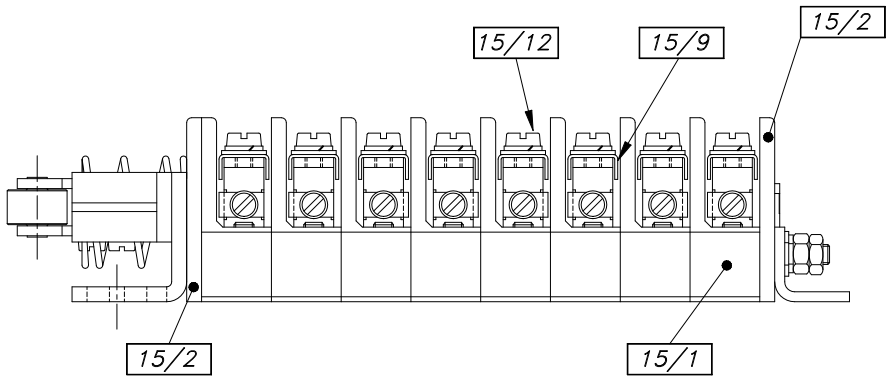
ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE

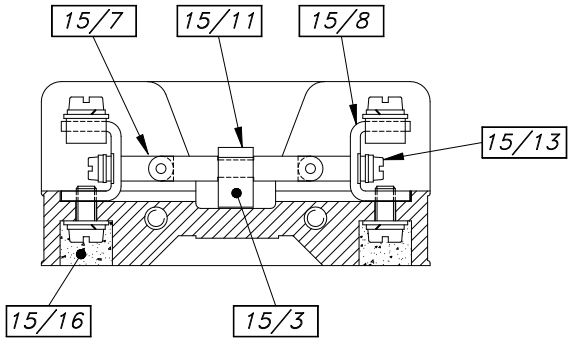


Item		Description
15/1	–	Fixed contact carrier moulding
15/2	–	End plate
15/3	–	Moving contact carrier
15/4	–	Compression spring
15/5	–	Roller
15/6	–	Moving contact with tip
15/7	–	Fixed contact with tip
15/8	–	Fixed contact carrier
15/9	–	Retaining clip
15/10	–	Mounting bracket (Front)
15/11	–	Moving contact carrier cover
15/12	–	M4x8Lg Slotted Ch. Hd. screw
15/13	–	6BAx1/4"Lg Slotted Ch. Hd. screw
15/14	–	M4 Hex Nut
15/15	–	M4 Stud
15/16	–	Silicone sealant type RTV1080
15/17	–	Mounting bracket (Rear)
15/18	–	Guide bracket
15/19	–	Roller bracket
15/20	–	M4 Lock Nut *

Note: Contact configuration may change as per customer requirement.

* Secured with Loctite–242





Figure–13: Auxiliary–Contacts Unit Assembly

2.Examine permanent set of damper assembly (25); replace with new one if permanent set is appreciable; using two M4 slotted countersunk head brass screws, treated with Loctite-222.

3. Smear Molykote 55M grease on bore of cylinder (49) and between two bosses on cylinder. Now offer piston assembly to cylinder such that drive link (50) is guided between the above mentioned bosses.
4. Secure piston stop ring (59), in place, using six M4 hexagonal socket countersunk head screws, treated with Loctite-242. The slot in ring coincides with the slot in cylinder wall and allows freedom of movement of drive link (50) for auxiliary drive mechanism.
5. If the bearing pin (52) and drive studs (51) were removed earlier, fit then now. Secure bearing pin (52) to cylinder; one drive stud (51) to link (29) and other to drive link (50) using liquid threadlock (Loctite-242).
6. Smear drive studs (51) and bearing pin (52) with Molykote 55M grease and secure connecting link (46) and link (29) to the bearing pin (52) with one M6 hexagonal nut.
7. Ensure that piston (30), drive link (50), connecting link (46) and link (29), operate smoothly.
8. Smear O-ring (24/16) with Molykote 55M, fit to reducer (65) and offer it to counter-bore in cylinder (49).

6.7 Auxiliary-Contacts Unit (Refer Figures - 5 & 13)

6.7.1 *General*

The linear movement of main piston (30) is transferred by drive rod (28) to cam (81) which converts this linear motion into rotary motion. The cam is mounted on a cam shaft (83) fitted to the auxiliary switch mounting bracket (85). When the VCB is closed, the cam rotates and pushes the roller (15/5) of auxiliary switch (15), thus changing the contact configuration. When VCB opens, auxiliary switch returns to its normal position by means of its own spring (15/4).

6.7.2 *Dismantling*

1. Release drive rod (28) from the cam by opening M5 hexagonal nut and lock nut. ***Care should be taken not to damage or disturb the length of drive rod (28).***
2. Unscrew three hexagonal head M6 screws that secure the auxiliary switch mounting bracket (85) to baseplate (20) and remove the complete unit.
3. Unscrew special screw (84) fitted to cam shaft (83). Remove the cam (81). ***Ensure that brass shim washers between cam and cam shaft are not misplaced.***
4. Release the auxiliary switch from its mounting bracket by unscrewing two M8 screws in the front and two M5 screws in the rear.

6.7.3 *Cleaning / Examination*

Cleaning

1. Clean the moving and fixed contacts using CRC626 spray or equivalent contact cleaner.
2. Check condition of contacts for pitting or burning marks. If pitting / burning marks observed, replace the auxiliary switch with new one.
3. Wipe-off excess grease applied on the cam surface, roller, guide bracket etc.
4. Do the operation of aux switch by applying force manually. The sag of moving contacts – when closed – should not be more than 3 mm.

Caution Points

1. Do not clean the contacts by emery paper.
2. Do not bend the moving contacts.

6.7.4 *Reassembling*

1. Apply Molykote 55M grease on surface of camshaft (83) and place cam (81) onto it. Cover-up extended portion of cam shaft above cam by providing 0.5mm brass shim washers. Apply Loctite-242 on thread of special screw (84) and secure it to the cam shaft (83).
2. Fit the auxiliary switch (15) onto its mounting bracket (85) using two M8 screws in roller end side and two M5 screws on the rear end. ***Do not tighten these screws fully.***

3. Fit this partially completed assembly to baseplate (20) with three M6 hexagonal head screws.
4. Apply Molykote 55M grease on bearing pin (82) fitted on cam (81) and refit drive rod (28) with M5 hexagonal nut and lock nut.
5. Operate VCB a few times and check that adequate paper gap is achieved between cam & roller of Aux Switch. While holding the switch in this condition, fully tighten M8 & M5 screws securing the auxiliary switch to its mounting bracket.
6. Apply grease on the surface of guide brackets (15/18) to reduce friction between guide brackets and roller brackets (15/19).

6.8 Pressure Switch (Refer Figures - 5 & 14)

6.8.1 *General*

This automatic pressure switch is designed to be operated by changes in fluid pressure and thus the name "Differential Pressure Switch". This pressure switch utilises seamless bellows and the sensing element which are made of phosphor bronze and brass wetted parts. The enclosure made of DMC is weatherproof and is sealed with a painted steel cover. This enclosure houses the full mechanism and a micro-switch with two sets of contacts - one normally closed and one normally open.

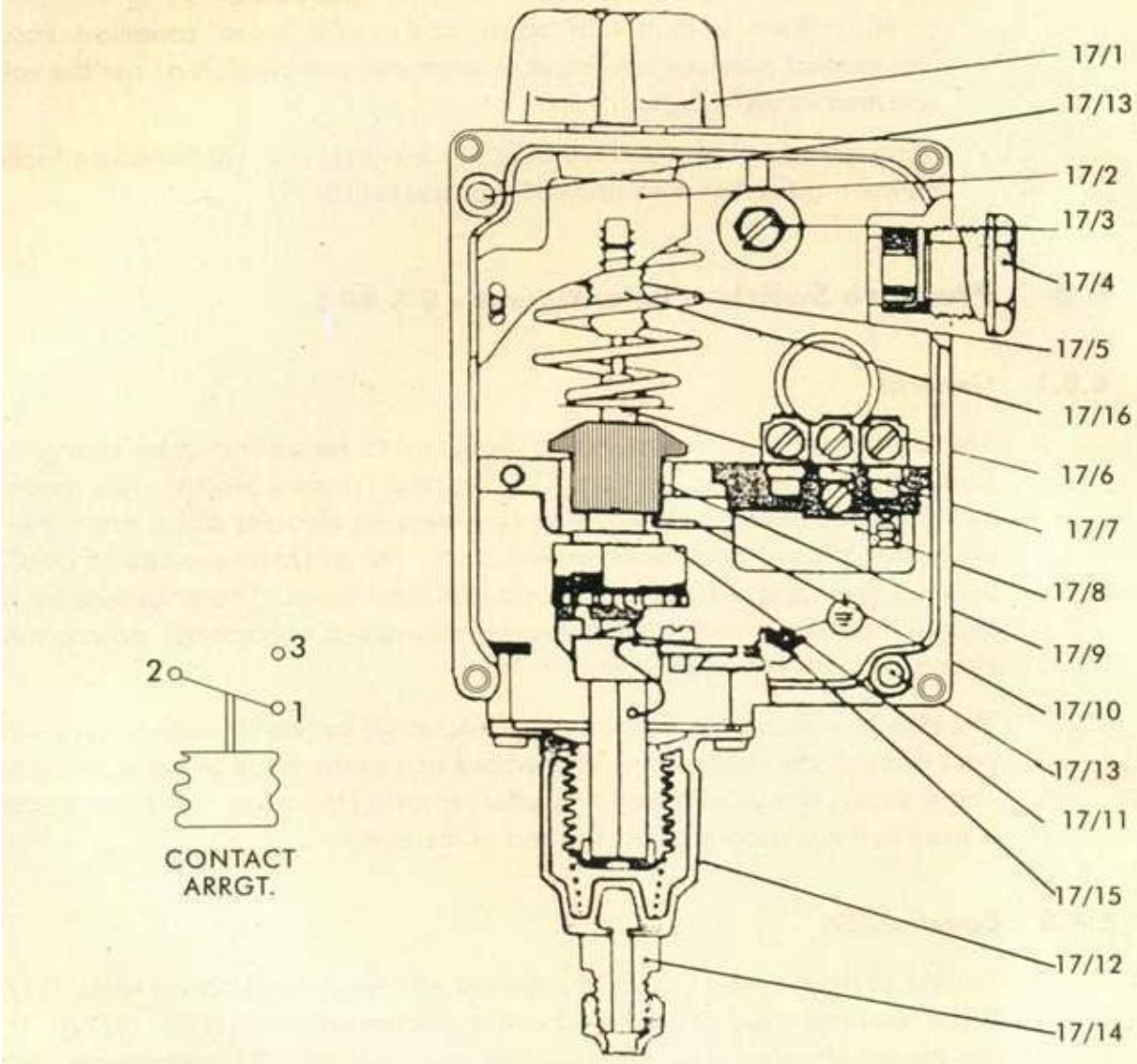
The switch is fitted onto its mounting bracket (6) by two mounting screws that pass through the holes (17/13) provided across the body of pressure switch. These screws can be accessed only after removing the cover. The air connection is fixed to the coupler fitted at the end of the switch.

6.8.2 *Construction*

Tension of main spring (17/5) is adjusted with the help of setting knob (17/1) to the required value as displayed by the pointer on range scale (17/2). This sets the cut-off value of air pressure. The main spring (17/5) compresses upper guiding bush (17/9) via the main spindle (17/7). One end of main spindle is connected to the bellows (17/12) (sensing element). The cut-in pressure is adjusted by differential setting roll (17/11). Upper guiding bush (17/9) has a step in which rests the contact arm (17/10) of micro-switch (17/8). Connections to magnet valve coil are taken from the connection terminals (17/6).

6.8.3 *Operation*

When compressed air exerts force on bellows (17/12), the main spindle (17/7) moves forward against the action of main spring (17/5). This moves upper guiding bush (17/9) which provides the clearance required by contact arm (17/10) to move under the action of contact return springs and the switch thus becomes “open”.



Item		Description	Item		Description
17/1	-	Setting knob	17/9	-	Upper guiding bush
17/2	-	Range scale	17/10	-	Contact arm
17/3	-	Coil clamp	17/11	-	Differential setting roll
17/4	-	Cable entry	17/12	-	Bellows element
17/5	-	Main spring	17/13	-	Mounting holes
17/6	-	Connection terminals	17/14	-	Connection
17/7	-	Main spindle	17/15	-	Earth screw
17/8	-	Microswitch	17/16	-	Setting spindle

Figure-14 : Pressure switch

6.8.4 *Cleaning / Setting*

Maintenance work is carried out with the switch in normal location. ***Take necessary precautions to ensure safety of persons during the work.***

This pressure switch requires very little routine maintenance. Essential requirement is that the switch interior must be kept clean. To ensure this, open the painted steel cover by unscrewing the four screws securing it, with a screwdriver and clean all internal parts with a small brush. Refit cover with the four screws.

Pressure switch is set by rotating knob (17/1) and at the same time by reading the main scale (17/2). This sets the cut-off value of pressure. The difference in cut-in and cut-off value of pressure is set by rotating the differential setting roll (17/11) which is calibrated into 10 equal divisions. Cut-in pressure is the sum of cut-off pressure and the differential.

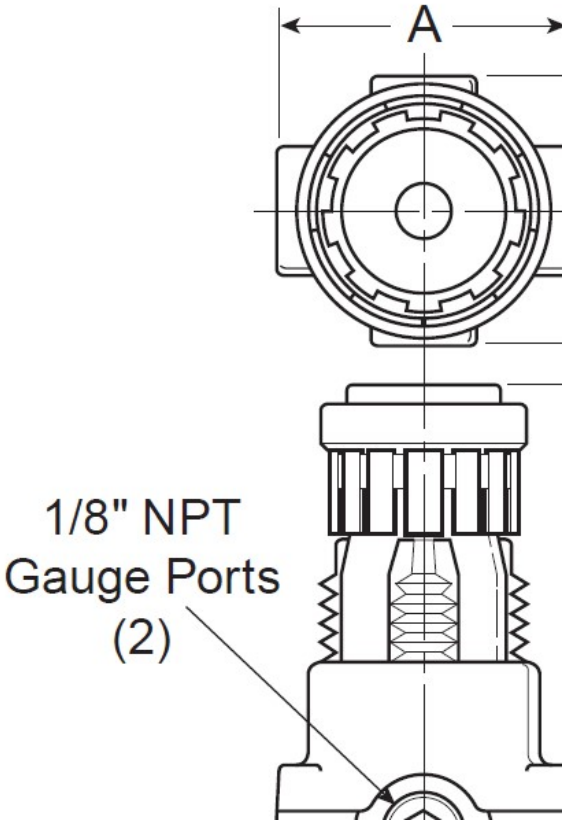
Magnet valve coil is to be connected through the terminals 2-3 of micro-switch (17/8). These are the normally open contacts of switch. These contacts **"make"** on rise of pressure to cut-in value and above while they **"break"** when the pressure falls to cut-off pressure and below.

Ensure that settings done are correct by fitting a calibrated pressure gauge to the pressure regulator. Raise and lower the pressure applied on switch and see that it operates efficiently at the cut-in and cut-off values as stipulated in DATA Section-8.0. Refer Section-5.3.2 for more details on checking the settings.

6.9 Pressure Regulator (Refer Figures - 5, 15 & 16)

6.9.1 *General*

Parker makes 14R113FC has been used on VCB type 22CB. The pressure regulator is shown in Figure-15.



14R Regulator Dimensions				
	A	B	C	D
14R	1.65	1.56	2.50	0.38

Figure 15

Figure 16,
Exploded view of Pressure Regulator

The regulator shown is of “Relieving type” and should a secondary over-pressure condition occur, the diaphragm moves upwards, allowing secondary air to flow through the tube , into the bonnet from where it escapes to atmosphere. This feature prevents any possible damage to down-stream equipment in such a situation.

The unit has two gauge ports, one on each side of body to enable fitment of pressure gauge. One gauge port is used as air supply take-off point for pressure switch. On the other G0.125 (1/8” BSP) port, a back connected commercial grade pressure gauge is fitted.

6.9.2 *Dismantling*

1. Unscrew coupling nuts of air-pipes (3, 47 & 63) connecting pressure regulator (18) to air reservoir (34), air filter (22) and pressure switch (17). Remove the pressure regulator and its mounting bracket (61) by unscrewing the screws from the side of the baseplate (20).
2. Unscrew the metallic nut that secures pressure regulator to its mounting bracket.

6.9.3 *Cleaning / Examination*

1. Thoroughly wipe clean all components with dry lint-free cloth. If necessary, first use a cloth moistened with denatured alcohol, then finish-off with dry lint-free cloth.
2. Clean the regulator body by blowing with clean compressed air.
3. Inspect diaphragm assembly for any cracks, its tube for blockage; slip ring ,valve seat, gasket , valve assembly for cracks or accumulation of dirt. Replace any worn-off or damaged parts.
4. If Outlet pressure below 5.6 pull yellow colour setting knob and turn clockwise for make it higher. If found above 6.0 pull yellow color setting knob and turn anti clockwise for make it correct . After that make black mark on yellow knob for fixed pneumatic setting. Now keep it for 1 Minuit. As per manufacturer recommendation
5. In order to get optimum performance of regulator it is suggested to cycle the regulator from the off to the highest pressure setting for couple of times. This will move and lubricate the piston entirely.

6.9.4 *Reassembling / Testing / Resetting*

1. Refit valve spring, valve assembly, gasket and valve seat into brass body.
2. Lightly grease the tube of diaphragm assembly with silicone grease Molykote 55M, then place it into valve seat, ensuring good sliding fit.

3. Now test the regulator assembly as given below:
   + Block the test port and outlet port with grub screws. With the adjusting screw fully retracted, connect compressed air supply to inlet port. No air should be present at the outlet port. If there is an air leak, this is probably caused by a faulty valve seat.
   + Turn the adjusting knob clockwise and adjust the regulator to the mains pressure. Check that there is no escape of air through the small exhaust hole. If there is an air leak, it is probably caused by diaphragm seat damage.
4. Reconnect air pipes (3, 47 & 63) to regulator. Tighten all banjo bolts / olive nuts loosened earlier to ensure leak-proof joints.
5. After fitting the regulator to VCB, reset the same by following instructions as given in Clause 5.3.1.

6.10 Air Filter (Refer Figures - 5 & 17)

6.10.1 *General*

Air filter is installed in the pneumatic circuit of VCB, upstream of pressure regulator and inlet air is connected to the port marked "IN". ***Bowl of air filter must be vertical when in the final operating position.***

Air entering the filter is guided into a swirling pattern by louvers (22/3). Coarse solid particles are forced to the wall of bowl (22/12) by centrifugal force and settle at the bottom of bowl. Air leaving the bowl passes through a filter element (22/5) where finer solid particles are removed. It is important to drain the manual-drain type filter on a regular basis. The condensate level should never be permitted to rise above the stud (22/7), in which case liquid will carry over downstream.

6.10.2 *Dismantling*

1. Unscrew the banjo bolts of air pipes (47 & 56) at inlet port of regulator (18) and at air connector (57). Remove the air filter which is now free to move alongwith its air-pipes. ***Do not open or loosen these pipes during maintenance as it may lead to leakage.***

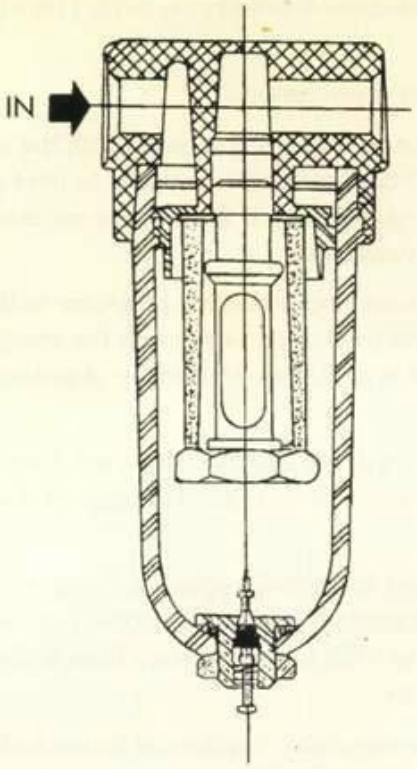
2. Unscrew the threaded bowl (22/11) by rotating it in anti-clockwise direction. The O-ring (22/2) will normally remain in the body.
3. Remove stud (22/7) by unscrewing it and remove filter element (22/5), louver (22/3) and gaskets (22/4 and 22/6).
4. To clean manual-drain arrangement, unscrew nut (22/16) and remove insert (22/14), O-ring (22/10) and valve (22/13).

6.10.3 *Cleaning / Examination*

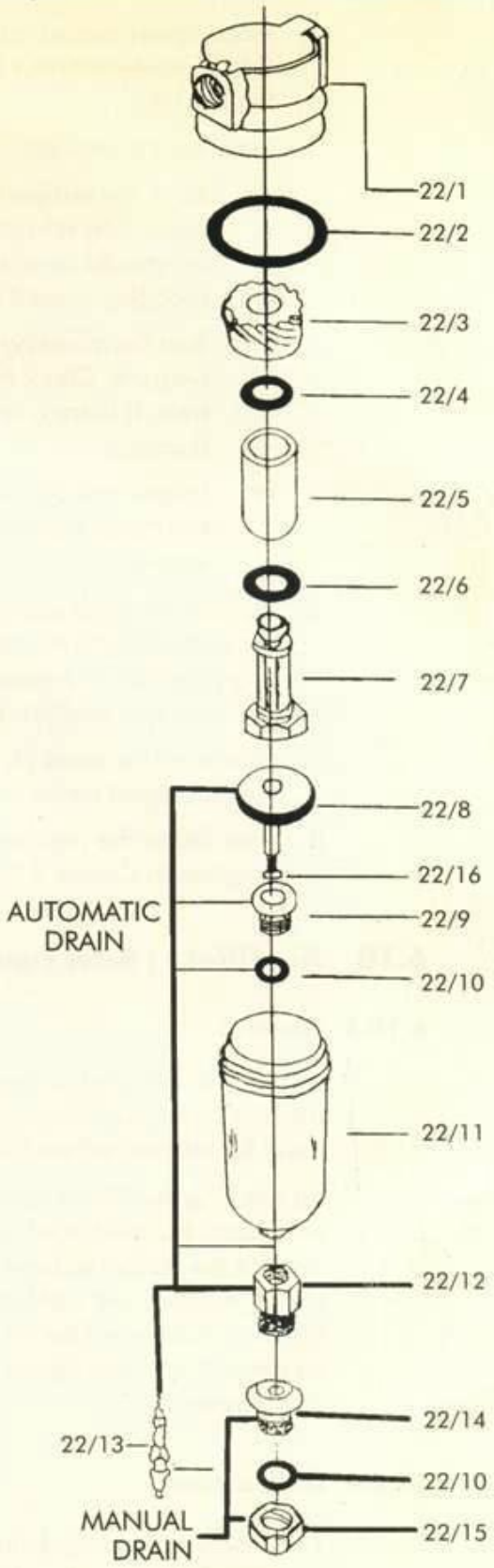
A visible coating of dirt or condensate inside the bowl or on surface of filter element indicates that cleaning is necessary. Clean the parts as explained below:

+ Wash the filter element with denatured alcohol or kerosene and dry it by blowing with clean compressed air in direction opposite to that of normal air flow to dislodge contaminants sticking to surface.
+ Clean the body by blowing it with clean compressed air.
+ Wash the bowl using a household soap and water solution and dry it by blowing with clean compressed air.
+ Thoroughly wipe clean all components with dry lint-free cloth. If necessary, first use a cloth moistened with white spirit, then finish-off with dry lint-free cloth.

Examine all components carefully for signs of deterioration. Replace all such components and those provided in the repair kit for air filter.



Cross-section View of Air Filter



Item		Description
22/1	-	Body
22/2	-	'O' ring
22/3	-	Louvre deflector
22/4	-	Upper gasket element
22/5	-	Filter element
22/6	-	Lower gasket element
22/7	-	Stud
22/8	-	Valve assembly
22/9	-	Insert
22/10	-	'O' ring
22/11	-	Transparent bowl or Metal Bowl
22/12	-	Retainer insert
22/13	-	Valve
22/14	-	Insert
22/15	-	Hexagonal nut
22/16	-	'O' ring

Figure-17: Cross-section and Exploded Views of Air Filter

6.10.4 *Reassembling / Testing*

1. Reassemble the air filter by carrying out operations in reverse order as given in given in "Dismantling" Section -6.10.2. ***Hand tighten bowl into body. Excessive tightening might damage body.***
2. Position air filter on baseplate in inverted position so as to ensure that the bowl is vertically downward in final operating position.
3. Wrap the thread of banjo bolts with two-three layers of PTFE tape and screw them onto the incoming port of regulator (18) and at air connector (57).
4. Ensure that no leakage of compressed air takes place either from bowl to body joint or from the manual-drain arrangement.

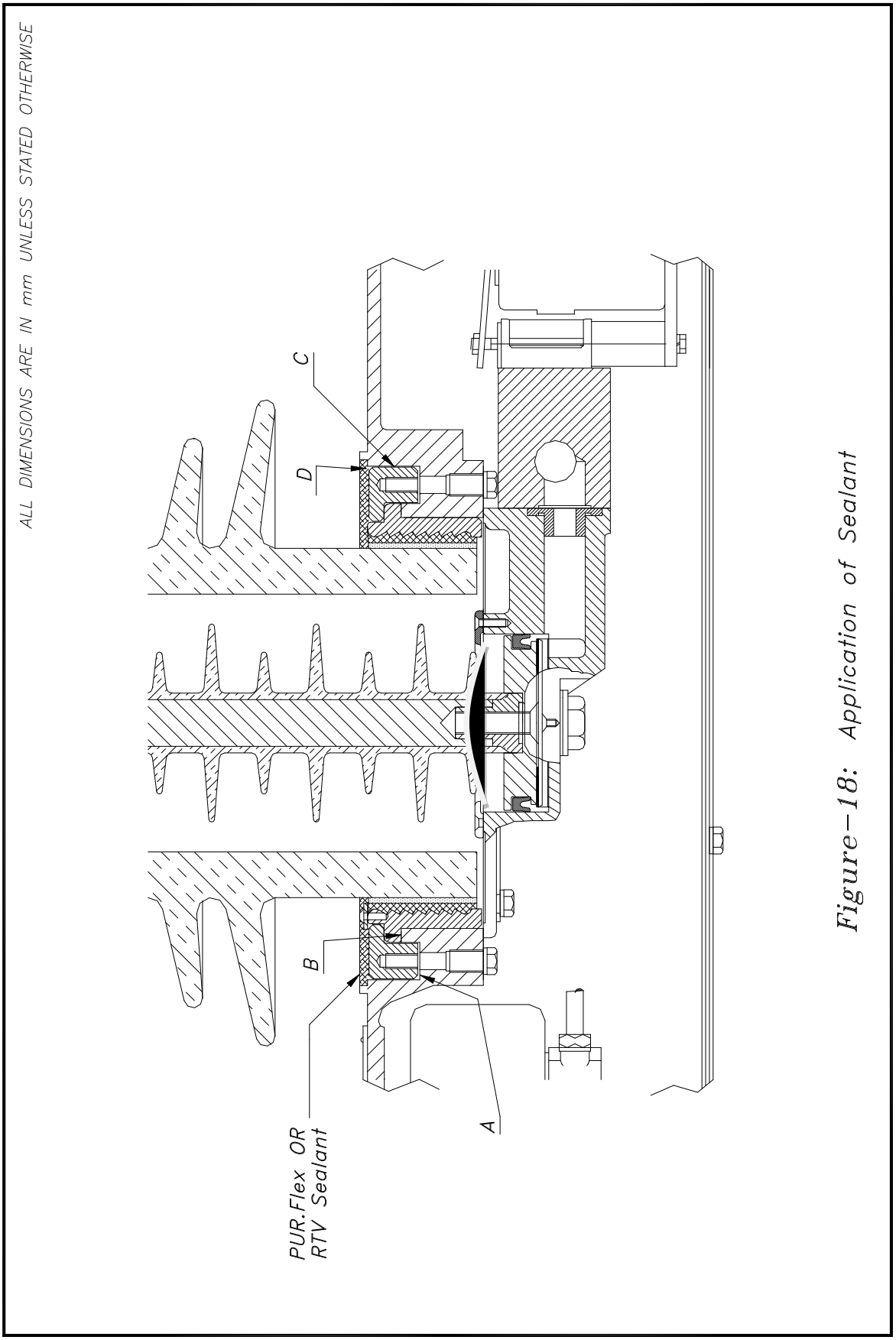
6.11 Reassembling the baseplate; Final assembly (Figures- 3&5)

Before fitting the baseplate to VCB handling trolley (Figure-38), partial assembly of baseplate can be undertaken, as described below:

1. Fit air reservoir (34) with brackets (48) to baseplate using M6 slotted cheese head screws. If removed earlier, refit and secure two grub screws to air reservoir, using liquid thread seal (Loctite-542).
2. Fit pressure regulator (18) by securing its mounting bracket (61) to the baseplate using two M6 hexagonal head screws. ***Ensure that inlet port is facing towards air filter.***
3. Fit air connector (57) onto connector mounting plate (21) with four M5 socket head cap screws.
4. Fit air filter (22) by securing the banjo bolts at inlet port of regulator (18) and at air connector (57). ***Ensure that inlet air is connected to filter at the port marked "IN" and that bowl of filter is vertical in the final operating position.***
5. Fit pressure switch (17) onto its mounting bracket (6).
6. Mount this partially-assembled baseplate to handling trolley (Refer Figure-38) in the horizontal position and secure it with six M12 screws.
7. Smear anti-scuff assembly lubricant (ASAL) type "OILDAG" (colloidal graphite in oil) on baseplate casting bore, only before fitting bottom insulator assembly to baseplate.
8. Apply Loctite different products to following areas respectively (Refer Figure-18)

a) Loctite 518 to channel “A” (continuous beading all over surface) in the baseplate casting.
b) Loctite 518 to shoulder “B” (continuous beading all over surface).
c) Loctite – 641 beads to the outer diameter of retaining ring “C” (before the bottom insulator is assembled).
d) Loctite – 290 – Filling to joints “D”.

9. Align clamping ring (14) holes and fit, but do not fully tighten, three M8 screws and one pillar (87). (Four longer M8 screws which will also secure



Figure–18: Application of Sealant

the cylinder are fitted at a later stage). In case VCB is fitted with circular electrical connector, pillar (87) is replaced with M8 screw.

10. Apply Loctite – 518 sealant to O-ring groove on top flange of bottom insulator assembly (8). Locate O-ring (7) in this groove. Place upper-insulator assembly on bottom insulator assembly and secure them with eight M8 hexagonal socket head cap screws, using liquid threadlock Loctite-242 with torque of 16 Nm.

11. Using the insulator-alignment gauge (Refer Figure-30), fit it to lower terminal (5) with one M12 and two M10 screws. Rotate the insulator assemblies inside baseplate until the hole in alignment gauge aligns with the M10 earthing boss on baseplate; fit the M10 screw.

CAUTION ***Do not remove alignment gauge, until instructed.***

12. Fully tighten the three M8 screws and pillar (87), left loose in point # 9 above, thus securing clamping ring with the baseplate.

13. Now secure actuator rod (12) onto drive-plate (37) and check the setting dimension, 21 mm (refer Figure – 4 for 21mm dimension), using the 21 mm gauge (Refer Figure-27). Bolt the tool across two opposite holes of baseplate and check for any clearance between actuator-rod end (12) and 50 mm slot in the tool. Obtain the correct dimension by removing actuator rod and fitting shim washers (26) and packing washers (27) between it and drive plate (37). On final assembly of the packing washers / shims and actuator rod, secure the rod to drive plate using liquid threadlock (Loctite-242) on the thread.

14. Take cylinder-piston, assembled in accordance to Section-6.6; liberally smear both sides of **new** special paper/cork washer and countersunk hole (for the M12 screw) on piston (30), with jointing compound. Fit the **new** special washer into counter-bore on top surface of piston (30). Now offer-up the cylinder (49) with piston inside, to the baseplate. At the same time, as the cylinder is being located with its four M8 screws, so must the actuator rod (12) be located in the counter-bore of piston. Feed the M12 hexagonal socket countersunk head screw, smeared with liquid threadseal (Loctite-542) through G0.75 (3/4" BSP) hole in the base of cylinder and through the piston, into actuator rod; then fully tighten the M12 and four M8 screws.

Remove the alignment gauge (Figure-30).

15. Assemble magnet valve (16) and relay valve (24) in accordance with Sections – 6.4 & 6.5. Then fit the relay valve, reducer (65) with its O-ring (24/16) and magnet valve to cylinder (49). Fit the plug (66) and

sealing washer to cylinder base. Ensure that the O-rings between throttle valve - cylinder (24/16); relay valve - throttle valve (24/16) and relay valve - magnet valve (16/12) are properly seated in the counter-bores and lubricated with silicone grease Molykote 55M.

16. Fit air-pipe (3) between air reservoir (34) to pressure regulator (18); air-pipe (63) between pressure regulator (18) to pressure switch (17) and air-pipe (64) between air reservoir (34) to relay valve (24).
17. Fit auxiliary switch assembly (15) to the baseplate using three M6 hexagonal head screws. Route and clip the cable harness. Connect the cable harness to terminals of auxiliary-contacts unit (15) as per the wiring diagram (Refer Figure-37). ***N/O & N/C combinations of auxiliary switch are as per customer-specific requirement.***
18. Fit terminal strips (77) to the baseplate using two M6 hexagonal nuts and one M8 screw. Connect cable harness to terminal strips as per the wiring diagram. In case, multi-way electrical connector (60) is provided, this forms a part of the cable harness, Connect it to the connector mounting plate (21) using four M4 screws.
19. Connect drive rod (28) to link (29) on one end and to bearing pin of cam (82) on the other end.
20. Connect cable harness to magnet valve (16) and pressure switch (17).
21. Seal the joint faces between upper and lower insulator castings (5 & 8), and on surface of lower flange for bottom insulator (13), clamping ring (14) with polyurethane sealant (Pur.Flex) or RTV1080 sealant, as shown in Figure - 18, so as to ensure water-proof joints. Also cover the heads of eight M8 screws that secure top and bottom insulator assemblies, with PUR.Flex or RTV sealant.
22. Stick sealing section (33) with adhesive and fit fixing screws to bottom cover (32) as shown in Figure-3. Seal the joint in sealing section with RTV sealant.

6.12 Air Dryer (Refer Figure - 19)

6.12.1 *General*

In order to ensure that compressed-air supply being fed from vehicle to the vacuum circuit breaker is **DRY**, an air dryer is provided with each VCB to be installed (inside the H.T. compartment of vehicle) in pneumatic circuit of vehicle just before the VCB. This air dryer is filled with molecular sieves that serve as the drying agent. Technical specifications of these sieves are given in DATA Section – 8.0.

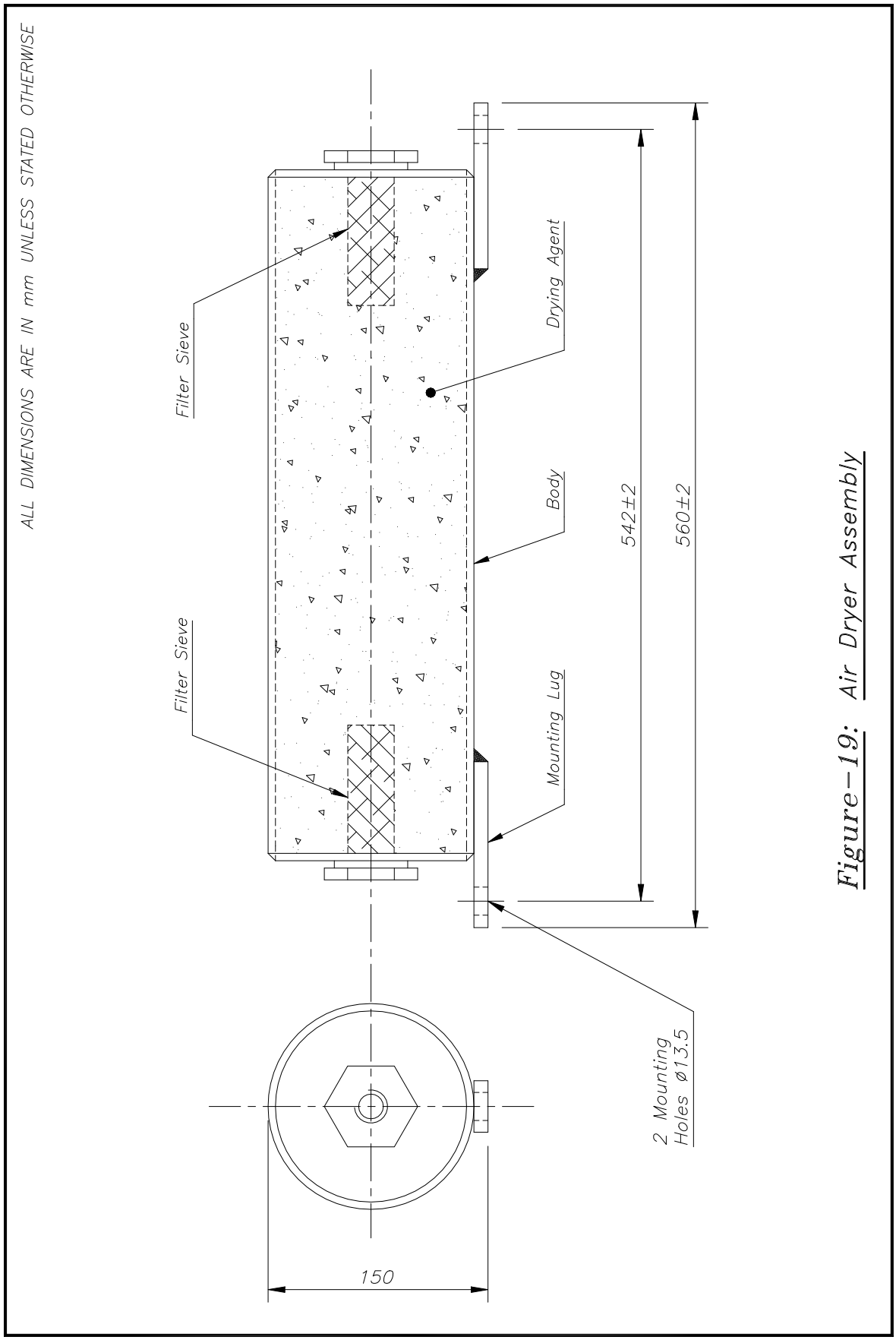
CAUTION ***This Air Dryer should be used for VCB ONLY. It should not be used to handle large quantities of air for other pneumatic equipment of locomotive / EMU.***

6.12.2 *Maintenance instructions*

1. Remove both air connections from the air dryer. Remove the two M12 mounting bolts and release air dryer assembly from vehicle.
2. Check the weight of air dryer; if it is more than 0.8 kg from the new weight, change / regenerate molecular sieves. Method of regenerating molecular sieves is given below.
3. Color change of the AIR filter during IC (as per OEM schedule) will be an indication with which decision for the replacement of molecular sieves of air dryer. Below is comparison of healthy and unhealthy air drier.

Healthy filter element

Unhealthy filt



Figure–19: Air Dryer Assembly

3. Unscrew one filter element from the body, empty sieve material and replenish with new / regenerated material, leaving sufficient room for filter only. Refit and tighten the filter assembly.
4. Dryer to be 'blown-down' by feeding compressed air from one end while keeping the other end open to remove any molecular sieve dust.
5. Check for air leaks around the filter assembly using a soap-water solution. For this purpose, blank-off one air connection and connect the other with compressed air supply.
6. Again weigh the air dryer assembly with new / regenerated molecular sieves and maintain record of this value for future reference.
7. Remount air-dryer assembly inside vehicle and reconnect the pneumatic supply connections.

Method for regenerating Saturated Molecular Sieves:

+ Measure the weight of molecular sieves to be regenerated.
+ Regenerate saturated molecular sieves by heating in an oven at 200°C for 8 hours.
+ Check the weight again and compare with the earlier weight. It should be less by 15-20%.
+ There should be no visual indication of moisture content.

CAUTION ***Refilling of sieves should be carried out as quickly as possible by scooping pellets into the air dryer body from the 145 kg drum, in case of replacement. After filling, ensure the drum is properly sealed with its lid and stored in a dry, covered area.***

6.13 R-C Network (Refer Figure - 20)

6.13.1 *General recommendations*

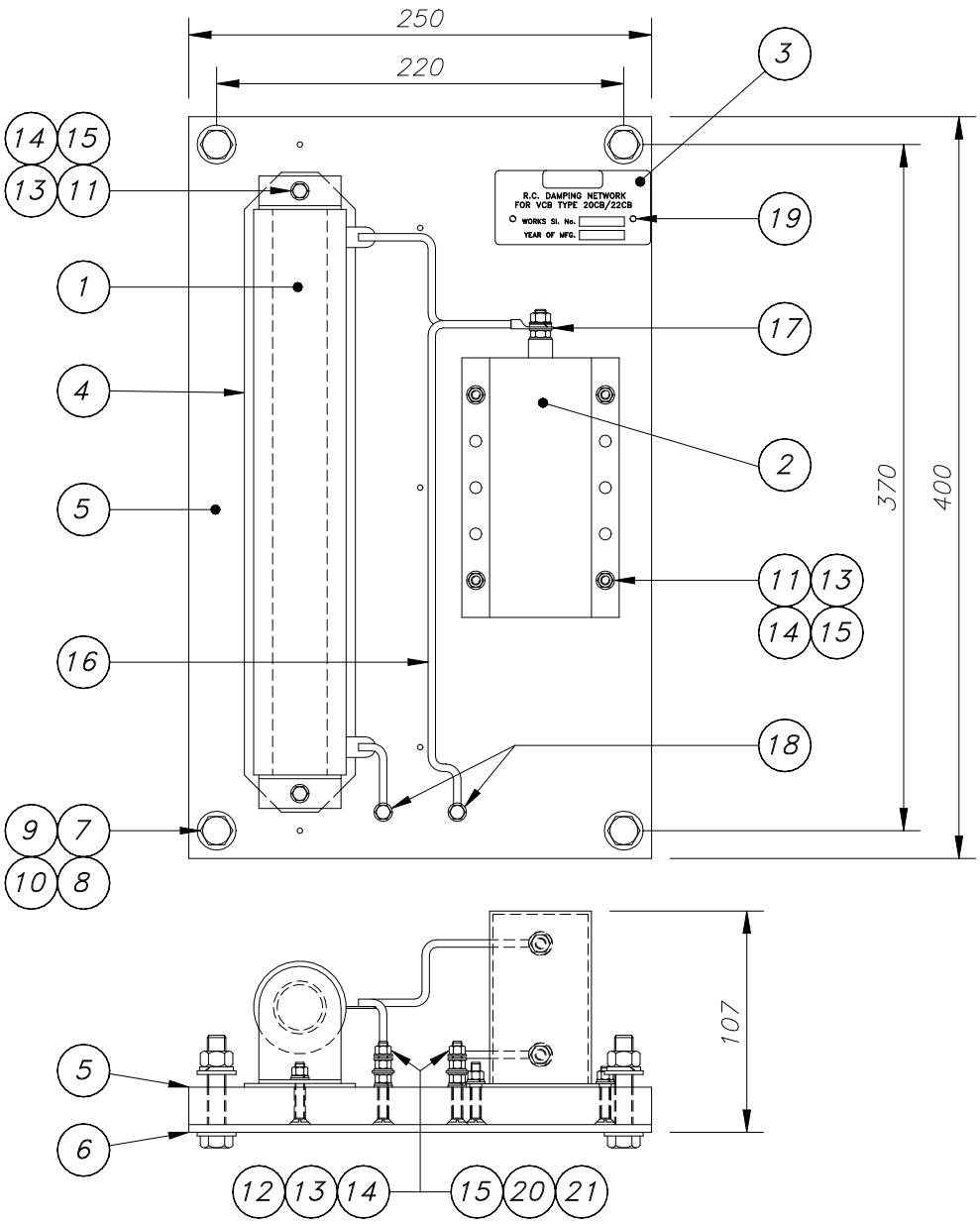
Over-voltages are generated at the time of switching the VCB On/Off due to their fast interrupting characteristics. Values of these over-voltages depend on the transformer ratings and total traction system. To limit these switching over-voltages, we recommend use of metal oxide type gapless surge arrestors on the H.T. line of locomotive. These should be as close as possible to the transformer in order to avoid propagation of over voltages in cables.

However to reduce the sharpness (to increase rise time) of such over-voltages and thus reduce their impact on transformer winding, we also recommend use of R-C Network in the auxiliary winding of transformer. We are supplying these R-C Networks as accessories along with the VCB. Technical specifications of these R-C Networks are given in DATA Section - 8.0.

6.13.2 *Maintenance instructions*

1. Disconnect the electrical connections from R-C network assemblies.
2. Remove R-C networks from their mounting boards by releasing the four M10 hexagonal head screws.
3. Connect R-C network to a variable AC supply; apply 380 V AC , 50Hz. and measure the current through this R-C network. Value of current should be as stipulated in DATA Section - 8.0.
4. If this value is incorrect, measure the resistance & capacitance values separately and match them with the specifications given in DATA Section - 8.0. Replace the defective resistance or capacitance, as the case may be.
5. Remount R-C network assemblies on the vehicle and reconnect electrical connections.

ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE



Item		Description
1	–	Resistor
2	–	Capacitor
3	–	Name Plate
4	–	Asbestos Sheet 2mm Thick
5	–	Panel Board 10mm Thick
6	–	Sealing Board 2mm Thick
7	–	M10x40Lg Hex. Hd. Screw
8	–	M10 S/C Spring Washer
9	–	M10 Plain Washer
10	–	M10 Hexagonal Nut

Item		Description
11	–	M5x25Lg Slotted C'SK Hd. Screw
12	–	M5x40Lg Slotted C'SK Hd. Screw
13	–	M5 S/C Spring Washer
14	–	M5 Plain Washer
15	–	M5 Hexagonal Nut
16	–	Control Cable 3 mm^2
17	–	Cable Socket 6.2mm I/D
18	–	Cable Socket 5.2mm I/D
19	–	No.6x1/4" Lg Self Tapping Screw
20	–	M5 Brass Hex Nut (tin plated)
21	–	M5 Brass Plain washer (tin plated)

Figure–20: R–C Network Assembly

7.0 TESTING

7.1 WARNINGS

+ ***Never apply high voltage to a naked vacuum interrupter. During H.V. withstand test on vacuum interrupters, low intensity X-rays can get generated. Take necessary precautions against emission of these X-rays.***
+ ***With vacuum interrupter mounted inside insulator assembly, the minimum safe distance for personnel to stand from equipment, with high voltage applied, is five meters, unless adequate screening is in place.***
+ ***Some operations require the use of compressed-air supply. Appropriate precautions must be observed.***
+ ***It is imperative that local safety regulations be observed.***

7.2 TEST EQUIPMENT

1. Variable pressure, compressed-air supply upto 10 kg/cm^2.
2. Variable DC voltage supply upto 125 volts.
3. 1000 volts Megger Set for Insulation resistance test.
4. High voltage test set upto 75 kV_{rms} AC supply.
5. Low voltage 500 A_{rms} DC supply source for contact resistance measurement.
6. Contact travel recording equipments detailed in Section-7.4.

7.3 TESTS TO BE CONDUCTED

A commercial grade (with low accuracy) pressure gauge is fitted to pressure regulator for Indication only. Before testing the circuit breaker, it is highly recommended to fit a calibrated pressure gauge with a range of 0 to 10 kg/cm^2 and accuracy of ±0.5%, to the pressure regulator. Non-return valve should be fitted to air connector (57) since compressed air-supply line is required to be removed for some of tests given below.

Following tests are applicable for an overhauled & reassembled VCB,

7.3.1 Visual Inspection

+ Ensure that all porcelain insulators are in undamaged and good condition.
+ Check that all faces which are used for electrical connections are clean and bright.

+ Check that all nuts and bolts are tight and are properly locked.
+ Check that all wire terminals are properly tightened and that wiring is in accordance with the wiring diagram.

7.3.2 Operations test

+ Connect 110 V DC supply to coil terminals through a N/O contact of push button.
+ Connect air supply pipe to VCB air inlet (air connector). Set pressure regulator at 5.7 – 5.8 kg/cm^2.
+ Perform fifty "Close & Open" operations.
+ Increase DC voltage to 125 Volts and perform twenty "Close-Open" operations.
+ Decrease DC voltage to 70 Volts and perform twenty "Close-Open" operations.

Check that the breaker operates freely and that the auxiliary-contacts drive-mechanism functions correctly.

7.3.3 Air-Leakage Test

VCB in "OFF" position

+ Connect the incoming air pipe to VCB.
+ Set the pressure regulator at 6.5 kg/cm^2 air pressure.
+ Remove air supply pipe after air reservoir is filled up with air and note the air pressure on dial gauge.
+ Wait for 10 minutes after removal of air pipe and again note the pressure.
+ Difference of the two readings which is the fall in pressure should not be more than 10% of set value (0.65 kg/cm^2) i.e. second pressure reading to be between 5.85 to 6.5 kg/cm^2.

VCB in "ON" position

+ Connect incoming air supply to VCB.
+ Energise magnet coil by applying 110 V DC supply across coil terminals & close the breaker.
+ Remove air supply pipe after air reservoir is filled up with air and note the air pressure on dial gauge
+ Wait for 10 minutes after removal of air pipe and again note the pressure value to give the fall in pressure.
+ Fall in pressure should not be more than 10% of set value (0.65 kg/cm^2) i.e. second pressure reading to be between 6.5 to 5.85 kg/cm^2.

NOTE ***In case pressure-drop exceeds the permissible value in any of the above two conditions, detect the point of leakage by applying soap-water solution to all joints in pneumatic circuit and tighten faulty joint.***

7.3.4 Insulation Resistance Test (Megger Test)

On Main Circuit, in following conditions, using 1kV Megger

a) VCB Closed, between power terminals & frame Res. > 200 MΩ
b) VCB Open
   i. between incoming terminal to earth Res. > 200 MΩ
   ii. between outgoing terminal to earth Res. > 200 MΩ

On Control Circuit, in following condition, using 1 kV Megger

a) Between auxiliary wiring & frame Res. > 10MΩ

7.3.5 High voltage test

On Main Circuit

Apply a test voltage of 60 kV_{rms}, 50Hz for one minute in the following conditions:

a) Breaker Closed, between power terminals to earth.
b) Breaker Open
   i. between incoming terminal to earth
   ii. between outgoing terminal to earth

The breaker should withstand the test voltage in all the above three conditions. On Auxiliary & control circuit

Short all the wiring terminals and apply a test voltage of 2 kV_{rms} for one minute between shorted terminals and earth. Breaker should withstand the voltage without any break-down.

7.3.6 Millivolt Drop Test (Contact resistance of main circuit)

CAUTION ***Whilst carrying out this test, it is imperative that the DC current of 500 Amps is not switched-off by the VCB.***

+ Connect air supply pipe to VCB, 110 V DC supply to coil terminals and close the VCB.
+ Connect current leads of DC high current set to VCB power terminals rigidly.
+ Fix the potential lead of test set near to the current lead connected.
+ Pass 500 Amps DC through VCB and record the milli-volt drop value.
+ The voltage drop across the main circuit should not exceed 50.4 milli-volts (100.8 $\mu\Omega$).

7.3.7 Checking of Pressure Switch Settings

+ Connect 110 V DC supply to magnet coil through a N/C contact of push button.
+ Now slowly raise air pressure inside VCB
+ Read air pressure value at the instant when VCB closes. This is the cut-in value.
+ Now slowly decrease the pressure, through air filter, and read the instant when VCB opens. This is the cut-off value.

The cut-in and cut-off values obtained should be in accordance with specifications stipulated in DATA Section - 8.0. If the values obtained in both the above cases (rising & falling) is less or more, then pressure switch adjustment has to be done accordingly.

7.3.8 Sequence Tests

1. Set the regulator to 3.2 kg/cm^2 and by-passing the pressure switch contacts, check that the VCB operates cleanly at 50% of the rated voltage.
2. Repeat the above test, but this time with the regulator set to 6.2 kg/cm^2.
3. On a falling pressure, check that the contacts of the pressure switch open before the mechanism of the VCB moves.

7.3.9 Pressure Regulator Setting

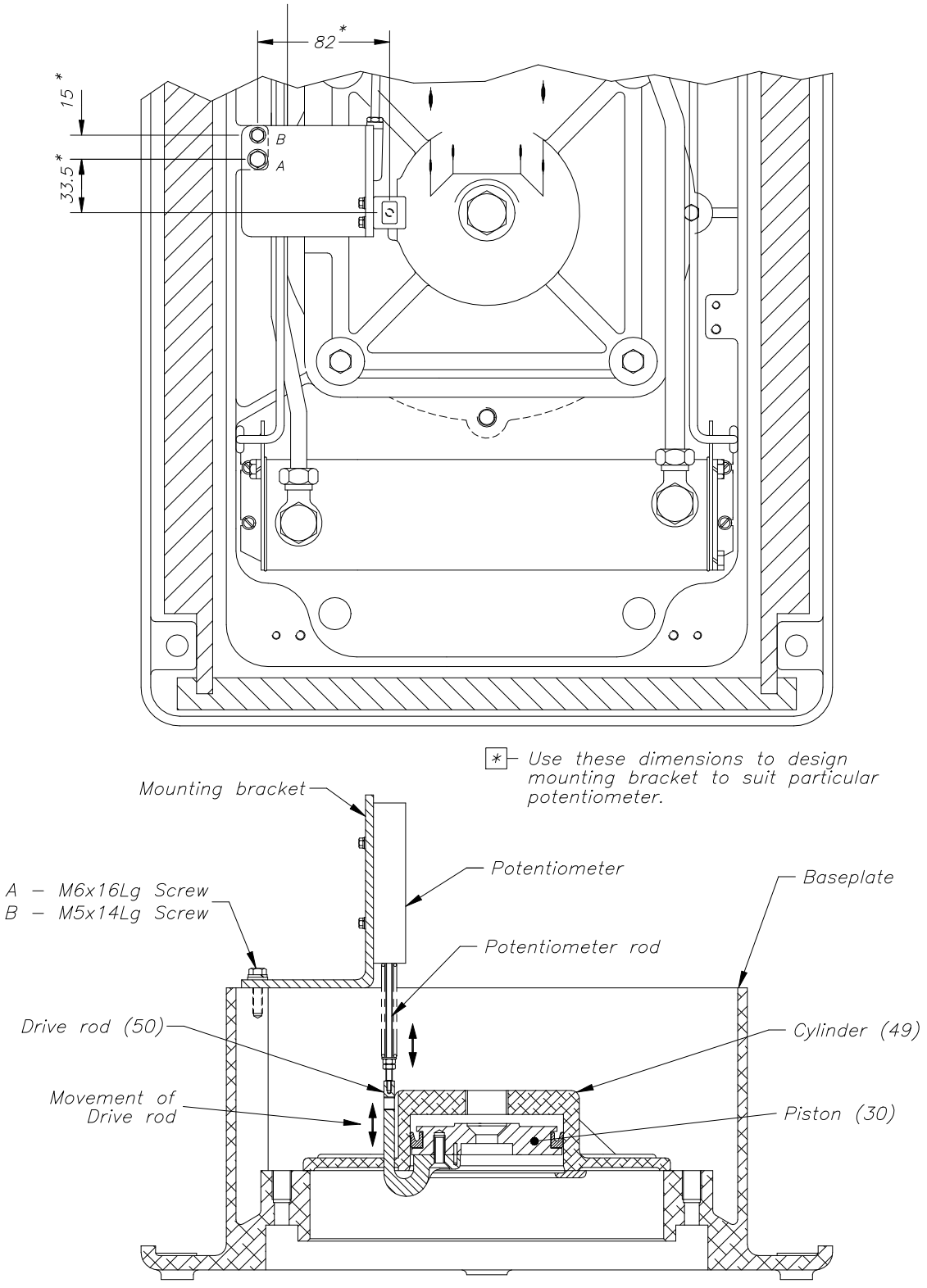
Replace the calibrated pressure gauge with commercial grade pressure gauge. Set the regulator at 5.6 – 5.8 kg/cm^2 by following instructions given in Clause-5.3.1.

7.3.10 Checking of Auxiliary Switch Configuration

Check all sets of N/O & N/C contacts of Auxiliary Switch on wiring terminals as per relevant wiring diagram and job requirements, by closing & opening the VCB through magnet coil.

7.3.11 Contact Travel Measurement

It is necessary to carry-out timing / contact-travel measurement test on a complete vacuum circuit breaker whenever any component, which is fundamental to the breaker operation, is changed or work is carried out on any major sub-assembly like magnet valve, relay valve, operating mechanism etc. Detailed procedure for conducting this test is given in Section-7.4. Ensure that all the travel parameters are within the permissible limits as stipulated in DATA Section – 8.0.



Figure–21: Mounting arrangement of Potentiometer for Travel Recording

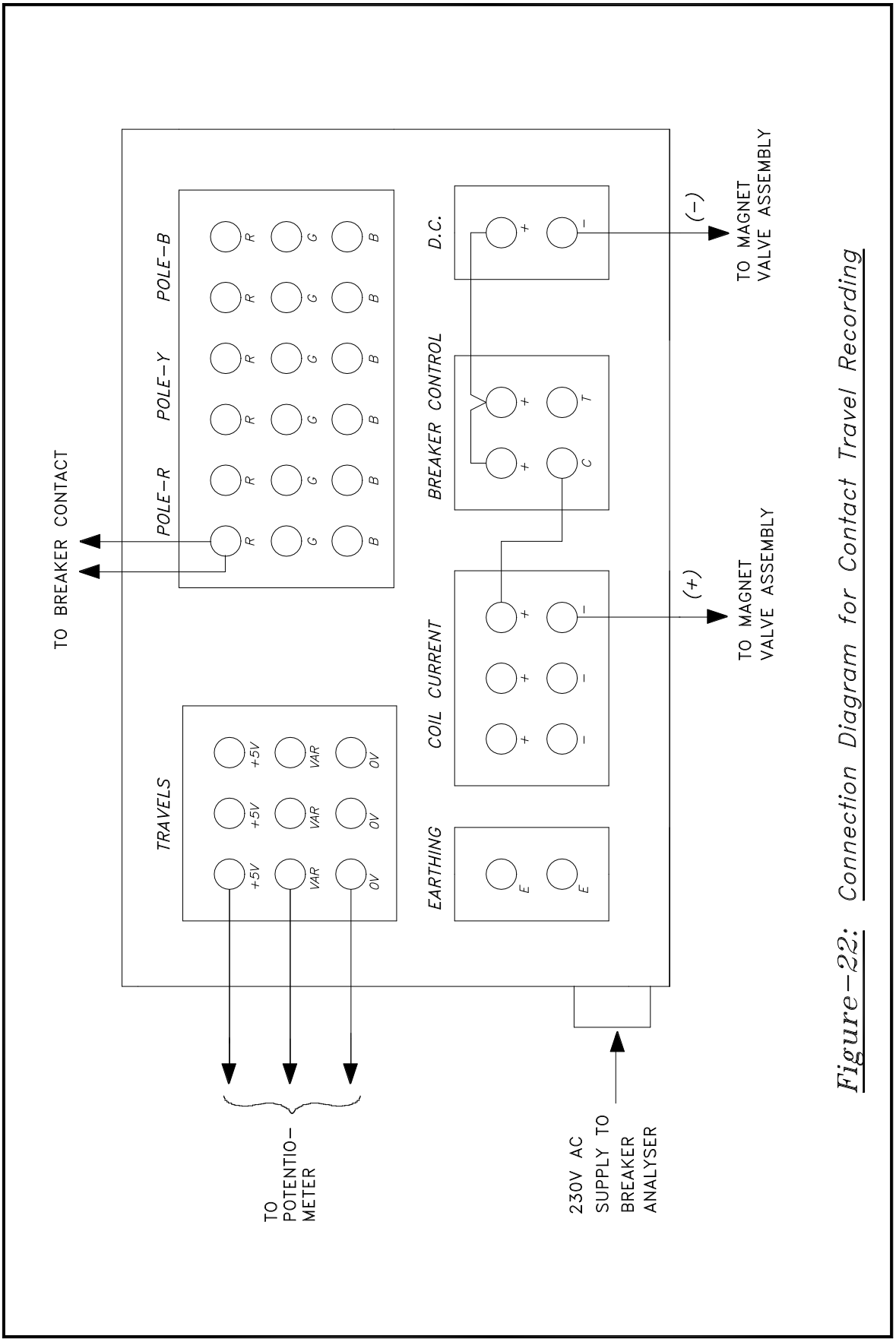
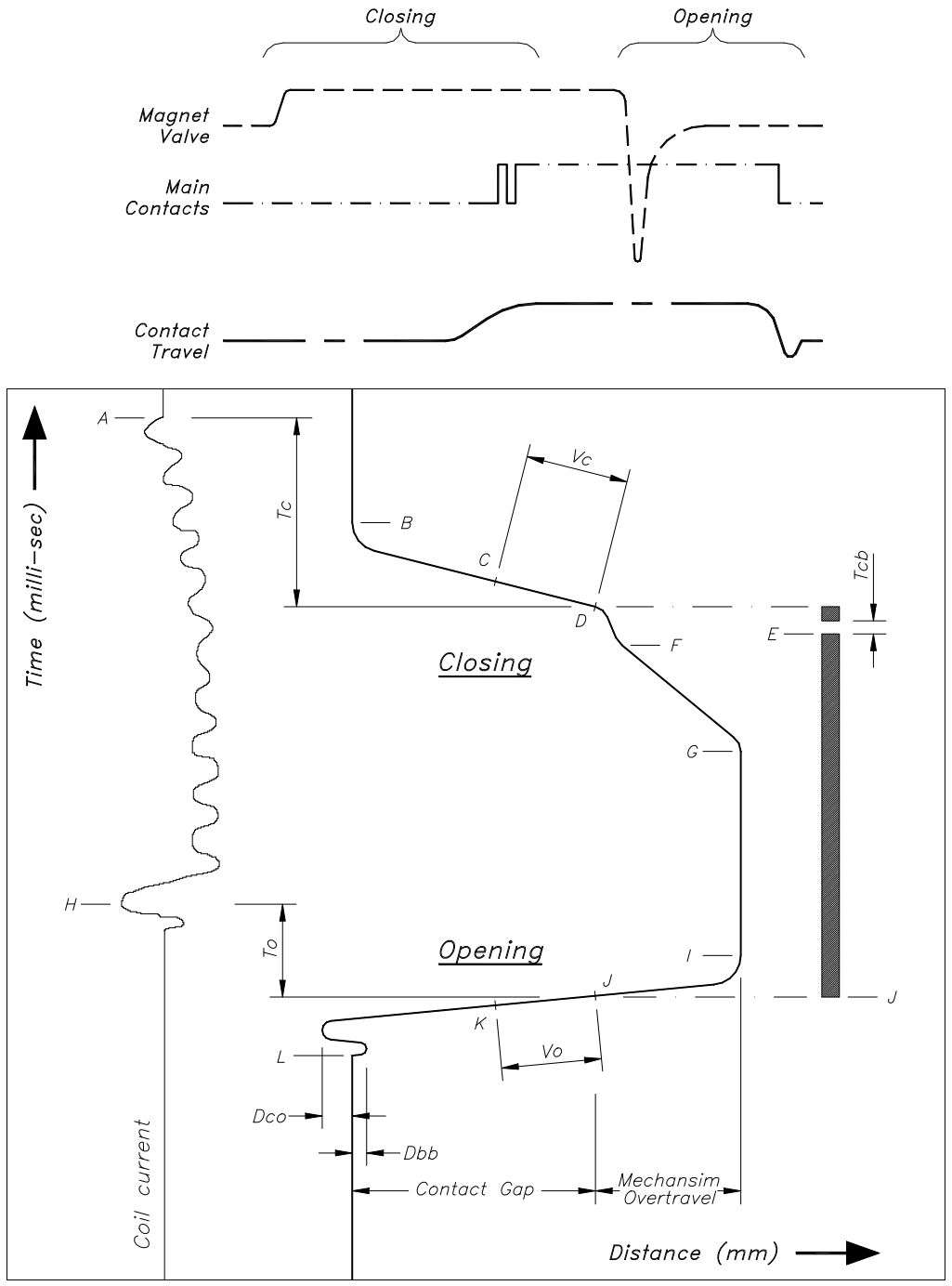


Figure-22: Connection Diagram for Contact Travel Recording



A – Instant of coil energisation
B – Instant of contact travel initiation
C – Initiation of last 3mm contact travel
D – Instant of first contact touch
E – Instant of final contact touch
F – Initiation of mechanism overtravel
G – Completion of mechanism overtravel
H – Instant of coil de-energisation
I – Initiation of mechanism travel
J – Instant of contact separation

K – Completion of first 3mm of contact travel after separation
L – Final contact open position
T_c – Closing time
T_{cb} – Contact bounce duration
D_{co} – Contact overtravel distance
D_{bb} – Contact bouce-back distance
T_o – Opening time
V_c – Closing speed (last 3mm before contact touch)
V_o – Opening speed (first 3mm after contact separation)

Figure-23: Typical Traces of Travel Parameters

7.3.12 Finishing

+ Fit the bottom cover assembly.
+ Touch-up the paintwork as required.
+ Prior to installation or transferring for storage, check that all insulator sheds have been polished with silicone grease and that all exposed joints and bolt holes have been sealed and painted. However, if the VCB is to be installed on a vehicle immediately, ensure that contact areas for busbar connections are not painted, but are clean and bright.

7.4 METHOD OF CONTACT TRAVEL MEASUREMENT / RECORDING

7.4.1 Test Equipment

1. Potentiometer (Range: 0 to 50mm)
2. Mounting bracket for potentiometer
3. Travel recording equipment (Autoscan or CB analyzer)
4. 110 V DC supply source

7.4.2 Test Procedure (Refer Figures - 21 & 22)

1. Fit potentiometer onto its mounting bracket using appropriate hardware.
2. Mount the VCB on handling trolley and rotate it so that bottom cover is uppermost.
3. Open bottom access cover and remove the M5 socket head cap screw.
4. Fit potentiometer (with its bracket) on to the baseplate using one number each M6 & M5 hexagonal head screws.
5. Connect compressed air supply to air connector (57) and 110 V DC supply to the VCB for breaker operations.
6. Connect potentiometer terminals to the travel recording instrument (refer travel recording equipment operation manual for details of connections).
7. Calibrate potentiometer with travel recording equipment by following the procedure described in recorder operation manual.
8. Operate VCB a few times through the recording device.
9. Record the time-displacement curve both for closing and opening operations of VCB, by the printing device attached to recorder.
10. Analyse the recording and evaluate all the contact travel parameters.
11. Compare these results with the permissible values as stipulated in DATA Section - 8.0.

8.0 DATA

8.1 Complete Vacuum Circuit Breaker

- Rated voltage – 25kV, Single Phase
- Rated continuous current – 1000 Amps (rms)
- Rated frequency – 50 Hz
- Rated short time current – 16 kA_{rms} / 3 seconds
- Rated short circuit breaking current (sym) – 16 kA_{rms} (400 MVA)
- Rated short circuit making current – 40 kA_{peak}
- Rated lightning impulse voltage withstand – 175 kV_{peak}
- Rated power frequency voltage (Dry & Wet) – 75 kV_{rms}
- Number of phases – One
- Total weight – 125 kg (approx.)

- ***Lifetime***

  - ***Mechanical***

    The mechanical life of VCB is 3,00,000 operations under no-load condition. Periodic maintenance must be carried out in order to guarantee the performance of VCB. Parts subject to wear are to be replaced according to Section-9.8.

  - ***Electrical***

    The electrical life of VCB is estimated to be 1,00,000 operations. It is up to user to estimate the average contact wear as a function of time.

Test voltage ***(for OLD VCB)***

- across open contacts – 60 kV_{rms}
- live to earth – 60 kV_{rms}

Contact-travel parameters

- Total travel – 11.4mm to 13mm
- Contact gap (new) – 7.4mm to 8.0mm
- Contact overtravel – 4.0mm to 4.9mm
- Contact wear – 3mm (max^{m})
- Closing time – within 115 milli-sec.
- Closing speed – 0.1m/sec to 0.4m/sec
- Opening time – within 45 milli-sec.
- Opening speed – 0.7m/sec to 1.0m/sec
- Contact bounce duration – 10 milli-sec (max^{m})

8.2 R-C Network

- Resistance – 4.7Ω, 380 Watts
- Capacitance – 25μF, 560 Volts
- Permissible current across each RC at 380V AC, 50Hz – 2.5A to 3.5A

8.3 Magnet Valve Assembly

- Type – 33MV
- Rated operating voltage – 110 V DC
- Minimum operating voltage – 70 V DC
- Maximum operating voltage – 125 V DC

Operating coil

- Coil resistance – 1600Ω ±5% at 20°C
- Power consumption – 8 Watts
- Class of insulation – H

- ***Quality checks***
  - Resistance measurement
  - Surge test at 5 kV
  - Burn-in test for 168 Hours
  - Pick-up and Drop-off voltage tests

8.4 Pressure Switch

- Type – RT116
- Make – Indfoss
- Range – 1 to 10 ATMG
- Pressure Settings
  - Cut-off – 3.85 – 4.0 kg/cm^2
  - Cut-in – 4.60 – 4.75 kg/cm^2
- Contact configuration – 1 N/O + 1 N/C

8.5 Pressure Regulator

- Type – 14R113FC
- Make – Parker
- Primary pressure range – 0 to 18 kg/cm^2
- Pressure setting – 5.7 – 5.8 kg/cm^2

8.6 Air filter

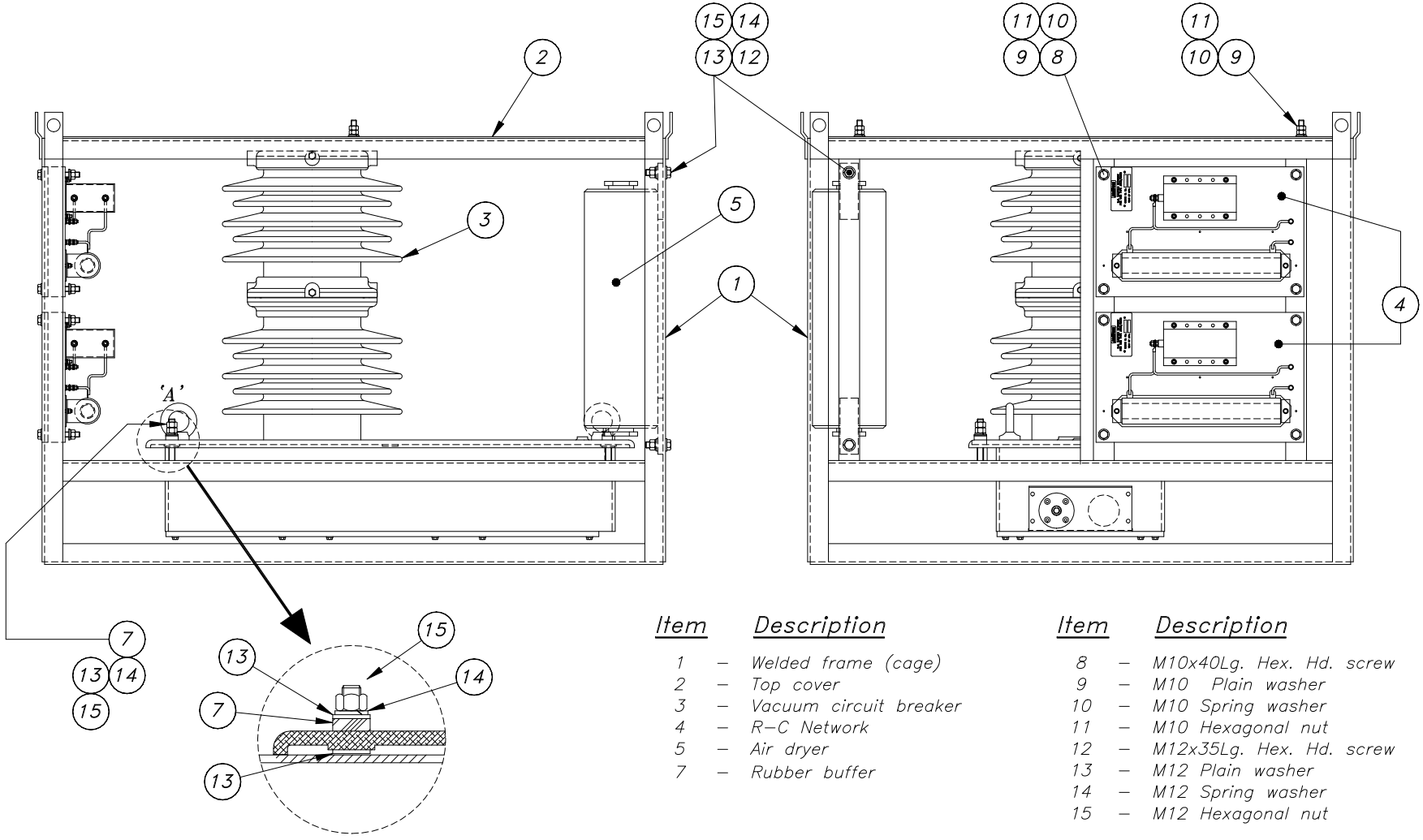
- Type – F97
- Make – Shavo-Norgren
- Primary pressure range – 0 to 18 kg/cm^2
- Bowl material – Aluminium

8.7 Auxiliary Contacts Unit

- Type – Double break, fish-bone
- Continuous current rating – 10 Amps D.C.
- Breaking capacity – 2.5 A at 125 V DC with a time constant > 15m-sec.
- Total travel of moving contact carrier – 9 mm (approx.)
- Number of contacts – Eight
- Number of contacts interchangeable – All
- Contact configuration – As per requirement

8.8 Molecular Sieves

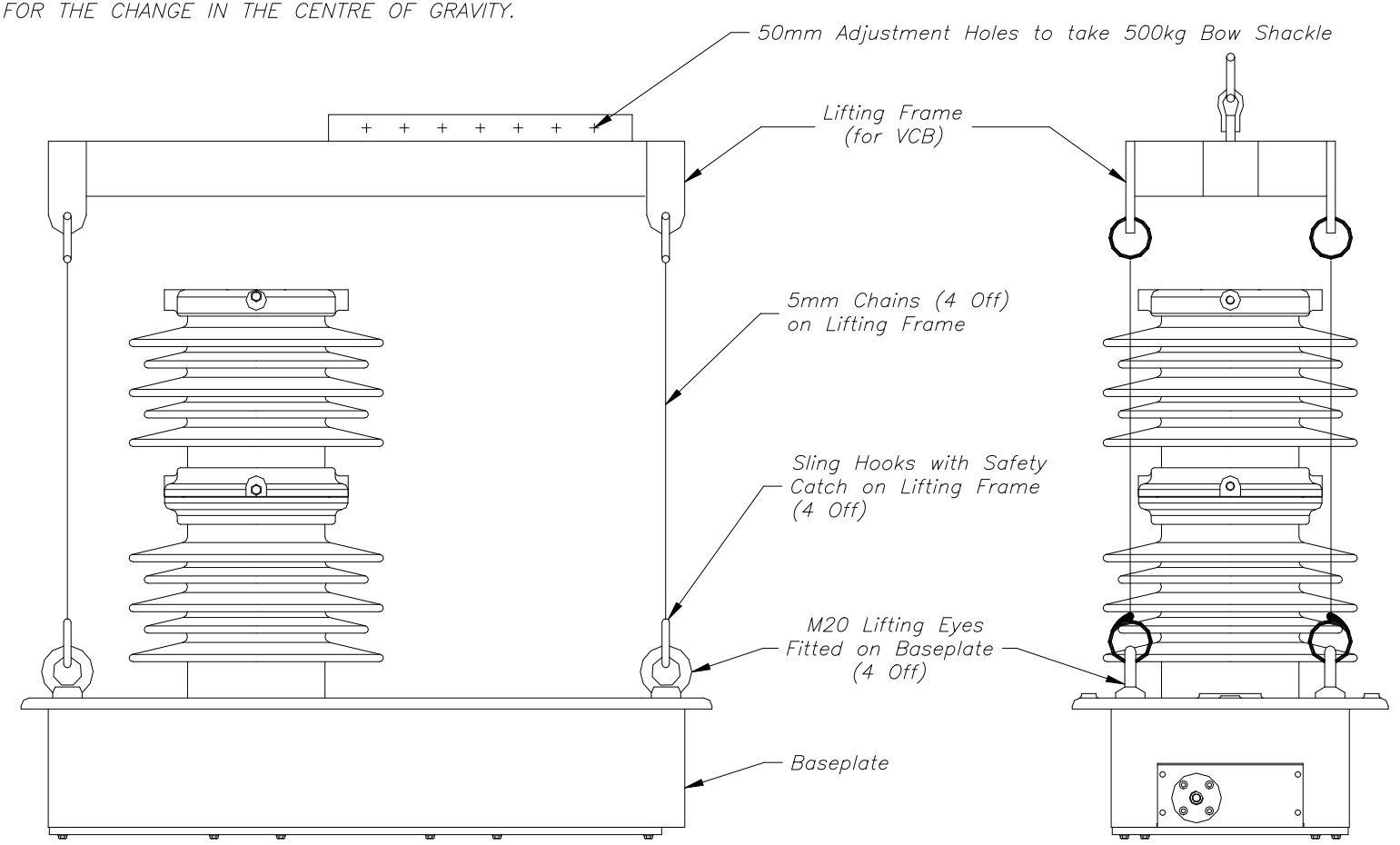
- Type – 4A
- Make – IPCL, Thane
- Size and Form – ∅3mm cylindrical pellets
- Equilibrium water absorption capacity
  - at 15% R.H. – 18.0%
  - at 60% R.H. – 22.0%
- Nominal pore diameter – 4°A



Item		Description
1	–	Welded frame (cage)
2	–	Top cover
3	–	Vacuum circuit breaker
4	–	R–C Network
5	–	Air dryer
7	–	Rubber buffer

Item		Description
8	–	M10x40Lg. Hex. Hd. screw
9	–	M10 Plain washer
10	–	M10 Spring washer
11	–	M10 Hexagonal nut
12	–	M12x35Lg. Hex. Hd. screw
13	–	M12 Plain washer
14	–	M12 Spring washer
15	–	M12 Hexagonal nut

Figure–24: Packing Detail of VCB / Air Dryer / R–C Network



Figure–25: Lifting Detail of Vacuum Circuit Breaker

9.0 ADDITIONAL INFORMATION

9.1 Do's & Don'ts

+ *Never lift VCB by tying wire rope on porcelain insulator or by using the terminal castings. Always use the 4 nos. – M20 eye-bolts fitted to baseplate for lifting the complete VCB.*
+ *Chains should be of equal length and while lifting ensure that all sling hooks are properly inserted in 4 nos. – M20 eye-bolts. Chain, in stretched condition (VCB hanged) should not interfere with insulators. To ensure this, use proper Lifting frames.*
+ *Always lift VCB vertically upward by crane. When lowering VCB, downward movement should be slow to avoid any damage due to excessive jerk / shock.*
+ *During erection of VCB, ensure recommended torques for tightening Main & Earth busbars to terminals and baseplate to vehicle roof. Excessive tightening may damage terminal castings / baseplate.*
+ *Do not push, pull or drag the VCB on shop floor.*
+ *Do not tilt the VCB for maintenance without mounting it on the handling trolley.*
+ *Do not place VCB directly on floor. When not in use, it should be either kept in cage packing or on handling trolley.*
+ *Do not place VCB in dirty area or in accumulated rain water. This may cause rusting of bottom cover.*

9.2 Despatch (Refer Figure - 24)

The complete vacuum circuit breaker, R-C Networks and Air-dryer are despatched in a metal cage. The breaker is mounted on four M12 bolts, welded to the base of the cage; with compression spring placed under the baseplate to provide cushioning effect during transit. R-C networks and air-dryer unit are bolted to the walls of cage.

9.3 Storage

When lifting, and during storage of VCB, protect the sheds of insulators using packaging material to protect against accidental impacts which could lead to damage. Do not subject the vertical insulator column to forces or to impacts during storage or lifting. It is preferable to use such metal cage (as in 9.2 above), for storage of VCBs.

9.4 Unpacking / Lifting

For unpacking and removing the equipment from cage, first remove the top cover by opening six M10 nuts. Remove R-C networks and air-dryer, by opening the securing screws.

Four numbers M20 eye bolts are fitted in M20 x 40 deep threaded bosses on baseplate (as shown in Figure-2). Attach the sling hooks of lifting frame (Refer Figure-35) to these four M20 eye-bolts fitted to baseplate. Lift the VCB out of metal cage as shown in Figure-25.

9.5 Special Tools

Special tools required for overhauling the vacuum circuit breaker are shown in Figures - 26 to 36. Special lifting apparatus required for complete breaker and for top insulator assembly only, are shown in Figures - 35 & 36 respectively. Handling trolley required for mounting breaker during maintenance is shown in Figure-38.

Figures - 26 to 36 for special tools have all the dimensional details to facilitate manufacturing locally at loco sheds / workshops. These can also be procured from us.

9.6 Consumables for Maintenance

Consumables required for maintenance of VCB are as given below:

- Silicone grease type Molykote 55M
- PTFE Tape for pneumatic joints
- Polyurethane sealant type “Pur.Flex) OR RTV1080 sealant
- Medium strength Loctite-242
- Electrical jointing paste type “UNIAL”
- Anti-friction spray type “Molykote D-321R”
- Screwlock Loctite-222
- High strength Loctite-270
- Liquid sealant Loctite-542 or Fevicol ANR-171
- Colloidal graphite in oil type “OILDAG”
- Loctite – 518
- Loctite – 290
- Loctite – 648
- CRC626 contact cleaner spray

9.7 MAINTENANCE SCHEDULE

`⊙' - indicates items to be checked; `☑' – indicates items to be replaced

Sl No	Part to be inspected	Inspection Details	IA	IB	IC	ID (AOH)	IOH	POH
1	**Vacuum Interrupter**	i. Check the contact travel. New interrupter contacts = 7.4– 8.0 mm With eroded contacts = 10.4–11.0 mm	--	--	– –	⊙	⊙	⊙
		ii. Check the mechanism overtravel. This should be between 4.0mm to 4.9mm, after contacts close.	--	--	--	⊙	⊙	⊙
		iii. Check the soundness of interrupter by applying 40 kV, 50 Hz for one minute across incoming & outgoing terminals, in breaker open condition.	--	--	--	⊙	⊙	⊙
2	**Insulators**	i. Check for cracks, chips, flash marks.	⊙	⊙	⊙	⊙	⊙	⊙
		ii. Clean with soft, clean, and dry cloth.	⊙	⊙	⊙	⊙	⊙	⊙
		iii. Perform IR test between bottom insulator and ground	⊙	⊙	⊙	⊙	⊙	⊙
3	**Pressure Regulator**	i. Check the setting of regulator using a calibrated pressure gauge. This should be set at 5.6 – 6.0 kg/cm² Refer 6.9.3 – 4	--	--	⊙	⊙	⊙	⊙
		ii. Dismantle, wipe-clean the parts using lint-free cloth moistened with white spirit and blow out the body with clean compressed air. Re-assemble the parts.	--	--	--	⊙	⊙	⊙
		iii. Change all components provided in replacement kit.	--	--	--	--	☑	☑
4	**Pressure Switch**	i. Check the setting of pressure switch using a calibrated pressure gauge fitted to pressure regulator. Ensure that the switch: Closes between 4.6 – 4.75 kg/cm² & Opens between 3.85 – 4.0 kg/cm²	--	--	--	⊙	⊙	⊙
5	**Auxiliary Switch**	i. Clean the contacts with CRC626 spray.	--	--	--	⊙	⊙	⊙
		ii. Check the tightness of all fixing bolts, nuts and connections.	--	--	--	⊙	⊙	⊙
		iii. Check proper operation of contacts.	--	--	--	⊙	⊙	⊙
		iv. Replace complete switch with new one	--	--	--	⊙	⊙	☑
6	**Magnet Valve**	i. Check tightness of all connections and fixing screws.	--	--	--	⊙	⊙	⊙
		ii. Check air leakage by operating manually	--	--	--	⊙	⊙	⊙
			--	--	--	☑	☑	☑

		iii. Replace all component recommended in kit.						

`⊙' - indicates items to be checked; `☑' – indicates items to be replaced

Sl No	Part to be inspected	Inspection Details	IA	IB	IC	ID (AOH)	IOH	POH
7	**Air Filter**	i. Drain-off condensate from filter	--	--	--	⊙	⊙	⊙
		ii. Wash porous filter element with denatured alcohol or kerosene.	--	--	--	⊙	⊙	⊙
		iii. Blow-out body with clean compressed air.	--	--	--	⊙	⊙	⊙
		iv. Wash the bowl with household soap.	--	--	--	⊙	⊙	⊙
		v. Change all components provided in replacement kit.	--	--	--	☑	☑	☑
8	**Relay Valve**	i. Replace all O-rings & PTFE valve discs.	--	--	--	☑	☑	☑
		ii. Overhaul and lubricate the relay valve.	--	--	--	⊙	⊙	⊙
		iii. Replace old piston seal ring with new one.	--	--	--	--	☑	☑
		iii. Replace old poppet valve with new one.	--	--	--	--	--	☑
9	**Cylinder-Piston Assembly**	i. Overhaul and lubricate the piston and cylinder bore.	--	--	--	⊙	⊙	⊙
		ii. Replace one no. Damper Assembly.	--	--	--	--	☑	☑
		iii. Replace old piston seal ring with new one.	--	--	--	--	☑	☑
10	**Air piping**	i. Check for air leakage, at all joints.	--	--	--	⊙	⊙	⊙
11	**Electrical Connec-tions**	i. Check for proper tightness of all electrical connections at terminal strips, magnet valve, pressure switch & auxiliary switch	--	--	--	⊙	⊙	⊙
12	**Lubrica-tion**	Lubricate the relay valve assly., cylinder piston assly. and all piston seal rings / O-rings including those of magnet valve assly., with silicone grease (Molykote 55M)	--	--	--	⊙	⊙	⊙
13	**Rubber / PVC items**	i. Change all rubber / PVC / SRBC items supplied in the replacement kits	--	--	--	☑	☑	☑
14	**Springs**	i. Change all compression springs supplied in replacement kit	--	--	--	--	--	☑
15	**Complete V.C.B. Assembly**	i. Check the closing speed / timings with the help of contact travel recorder.	--	--	--	⊙	⊙	⊙
		ii. Measure contact resistance of main circuit.	--	--	--	⊙	⊙	⊙
16	**Air Dryer**	i. Weigh the air dryer. If increase in weight is more than 0.8 kg from the new weight, regenerate by heating in oven.	--	--	⊙	⊙	⊙	⊙
		ii. Replace old molecular sieves	--	--	--	--	☑	☑

17	**R-C Network**	i. Measure current value across individual R-C Network at 380 V AC (50Hz). Value should be between 2.5A to 3.5A. Replace if not in range.	--	--	--	⊙	⊙	⊙

Notes: **DO NOT OPEN THE BOTTOM COVER DURING IA, IB & IC.**

Overhauling of VCB should be carried out as per instructions.

Consumables required for maintenance are not included in the replacement kits.

IA- Monthly overhauling
IB- Overhauling after every two months
IC- Overhauling after every three months
AOH- Overhauling after every one year,
IOH- Overhauling after every two years,
POH- Periodic overhauling after every six years

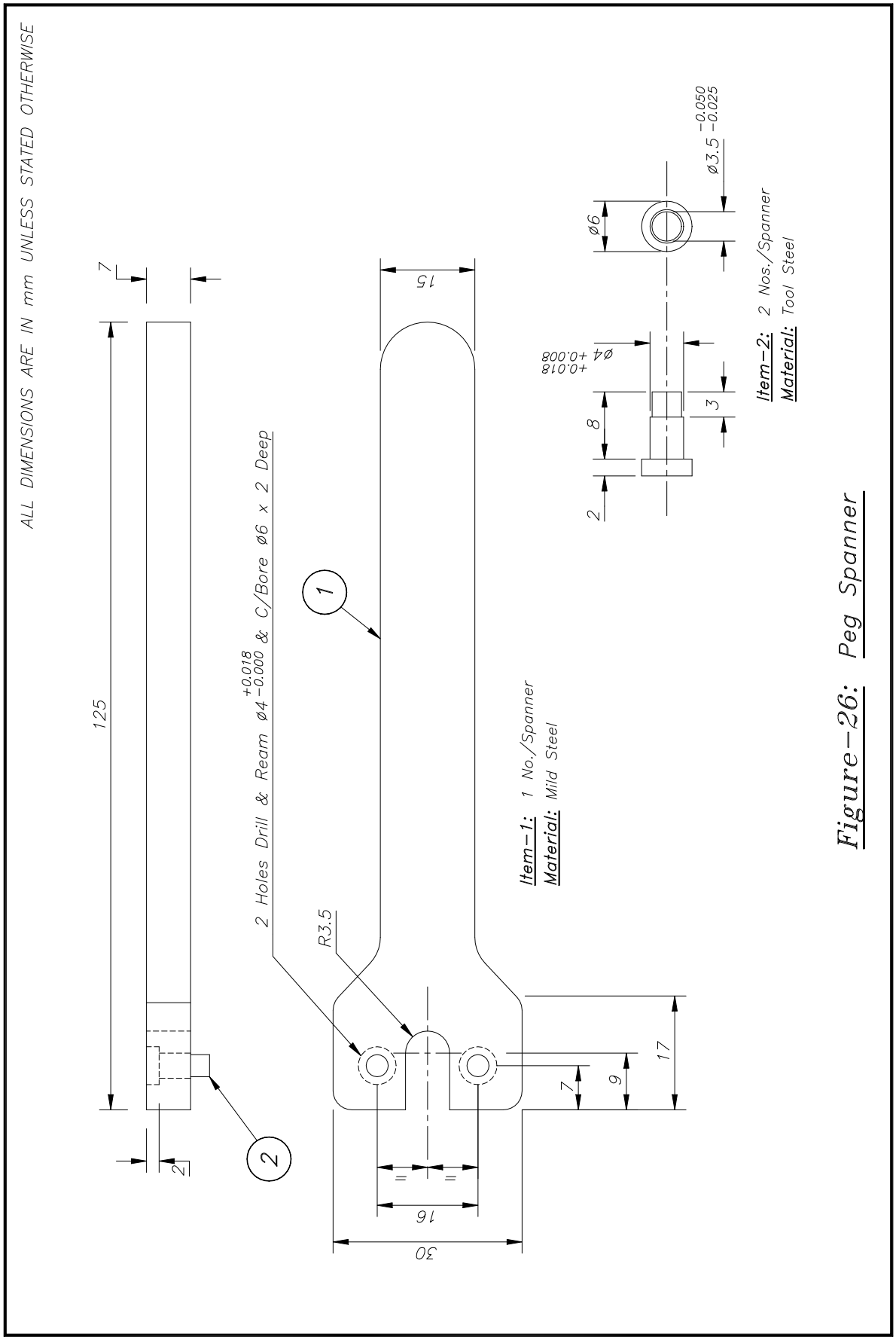
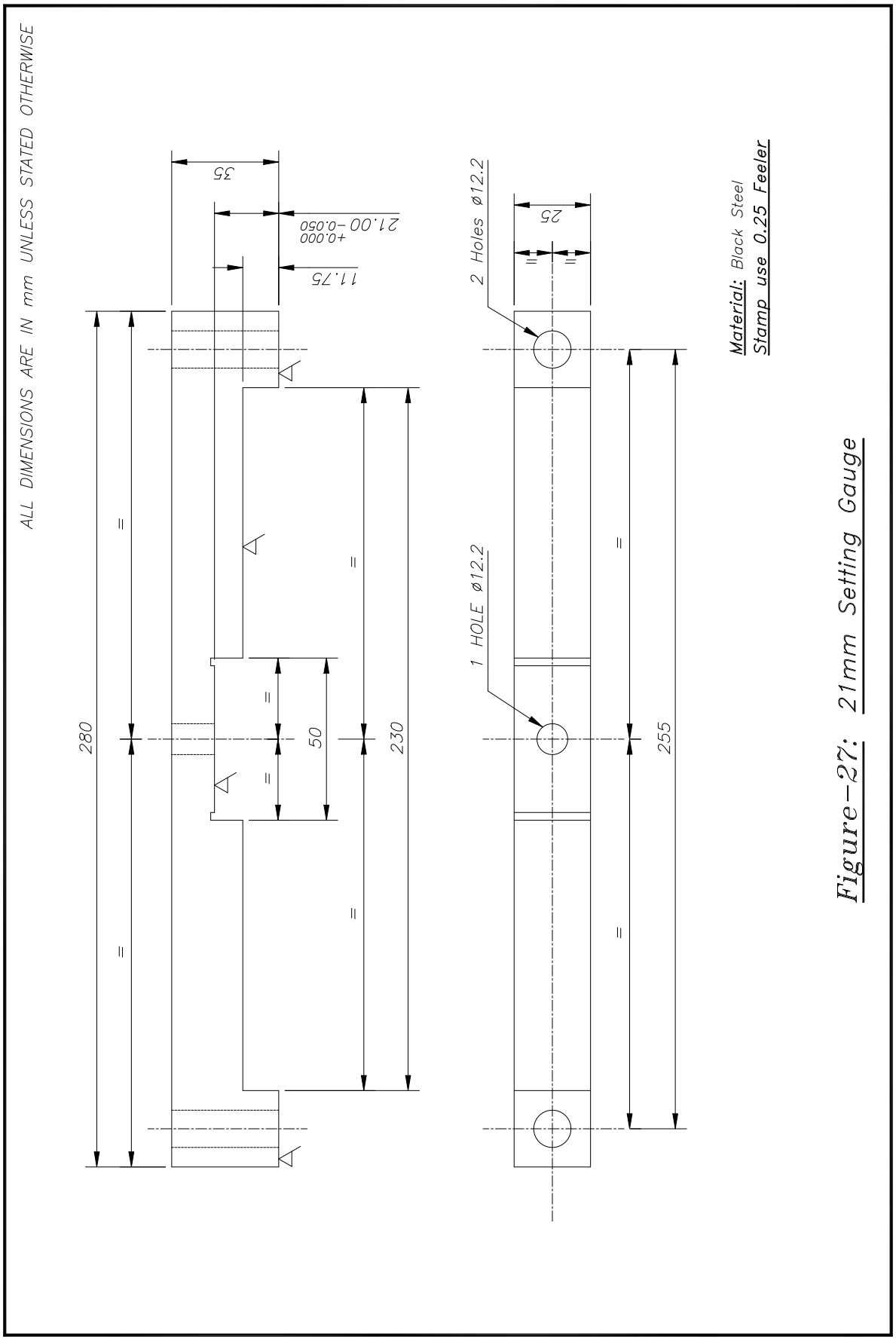
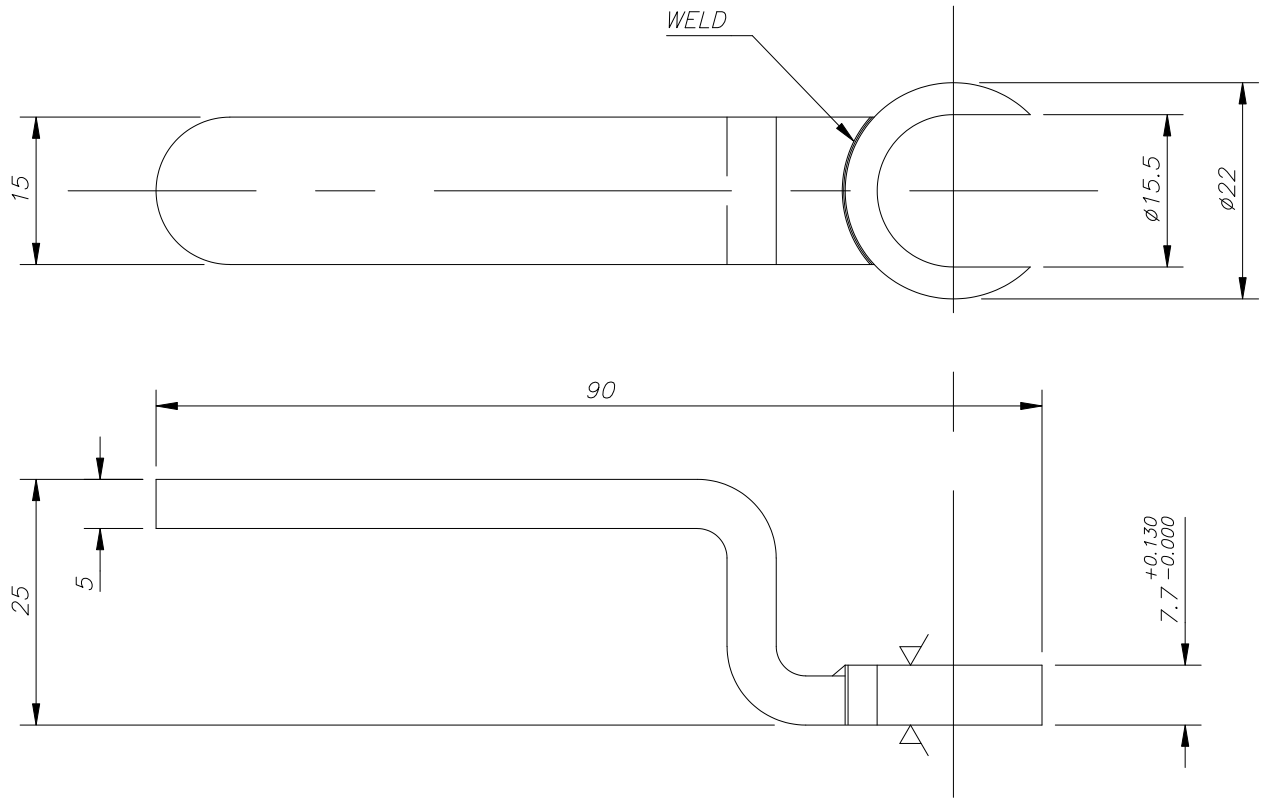


Figure-26: Peg Spanner



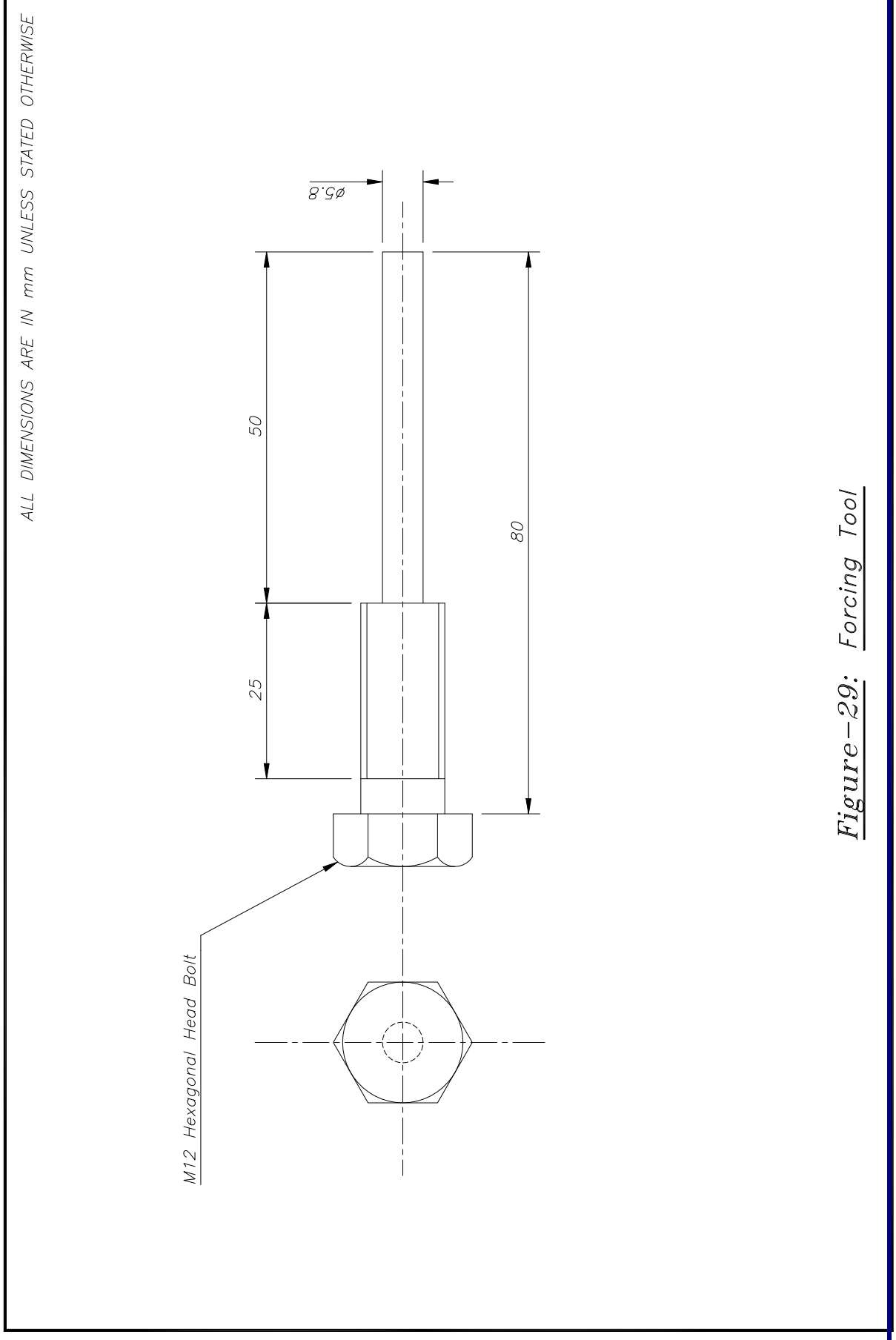
Figure–27: 21mm Setting Gauge

ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE

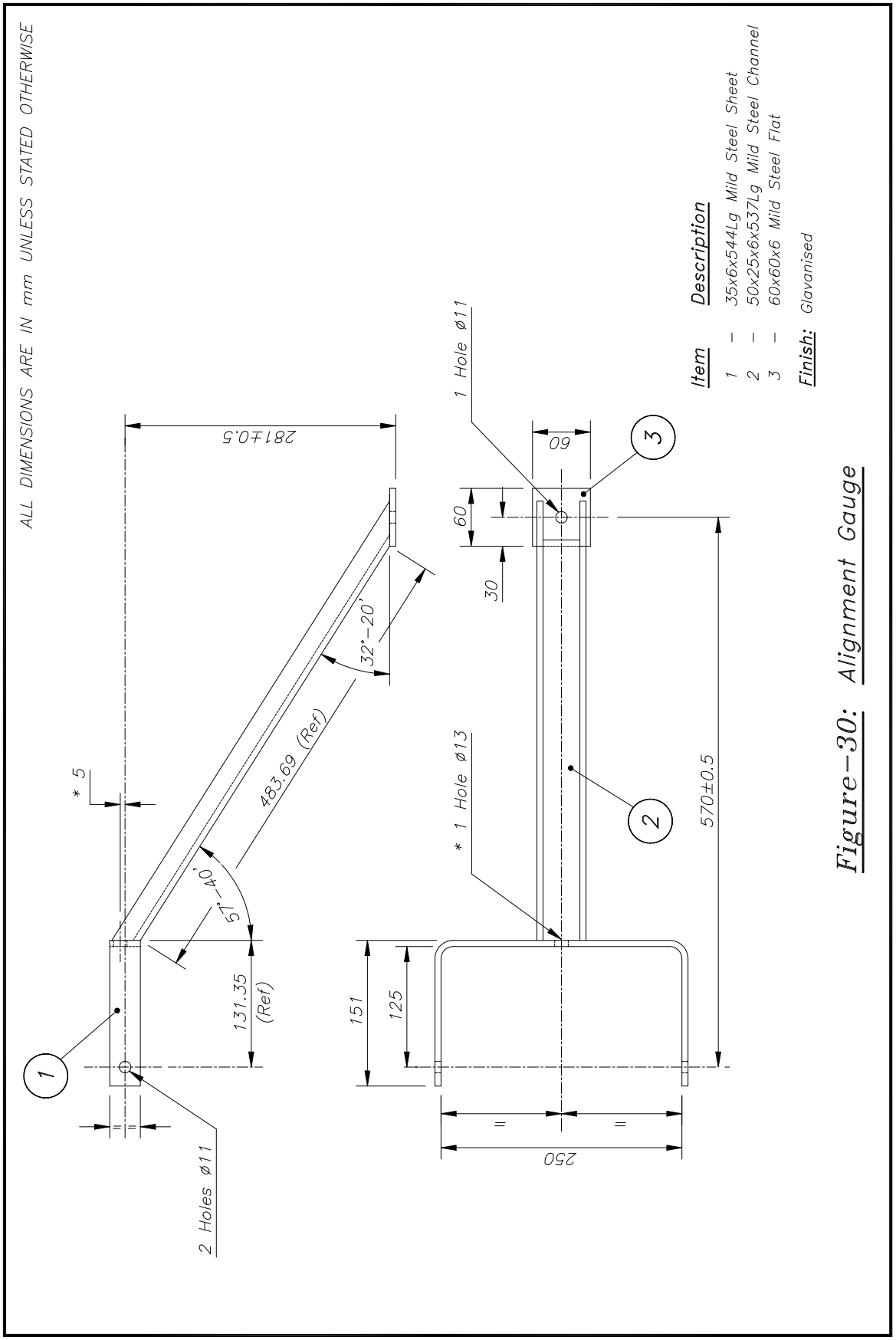


Material: Tool Steel
(Hardened & Ground)

Figure–28: Setting Spacers

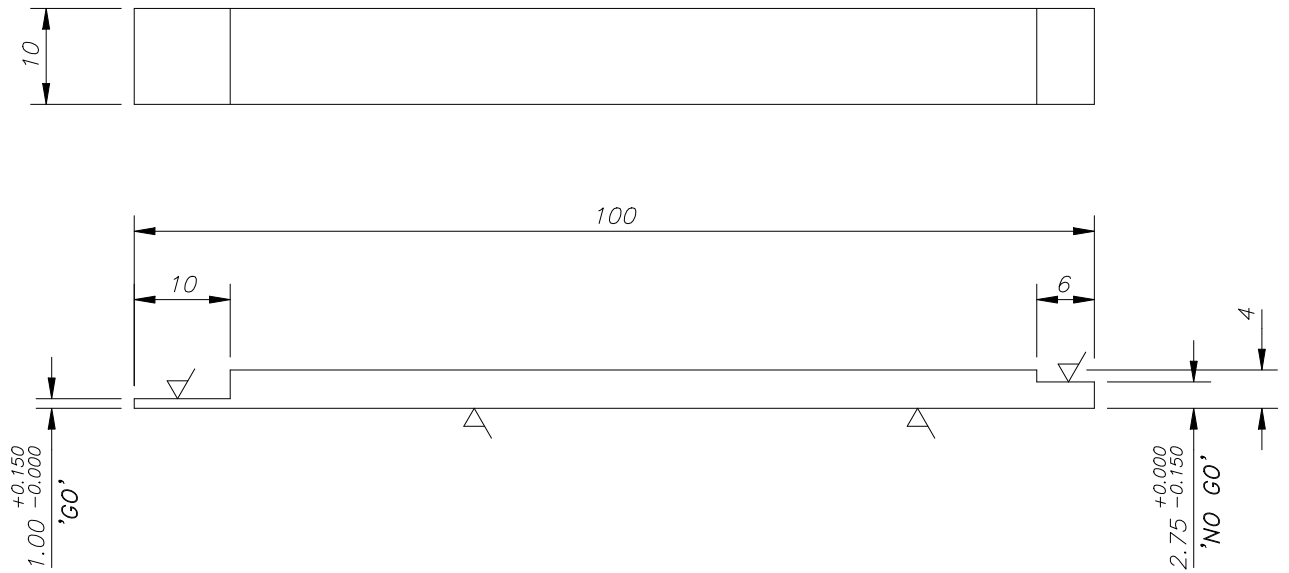


Figure–29: Forcing Tool



Figure–30: Alignment Gauge

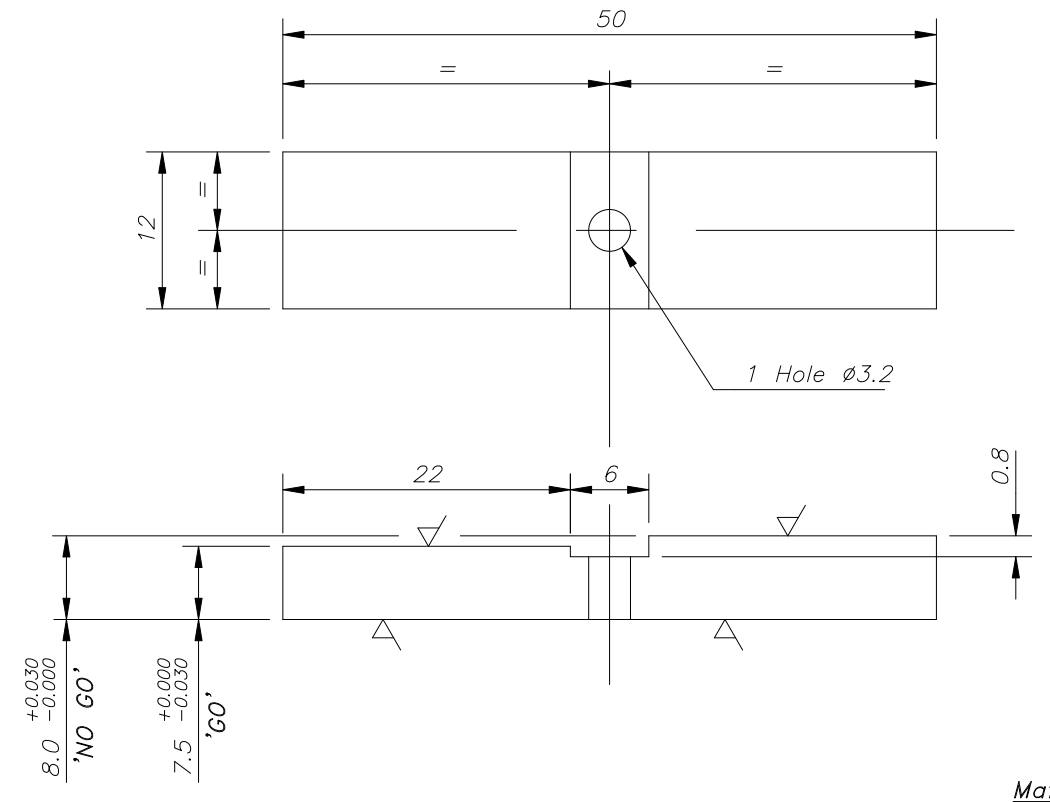
ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE



Material: Tool Steel
(Hardened & Ground)

Figure–31: 1 mm / 2.75 mm Gap Gauge

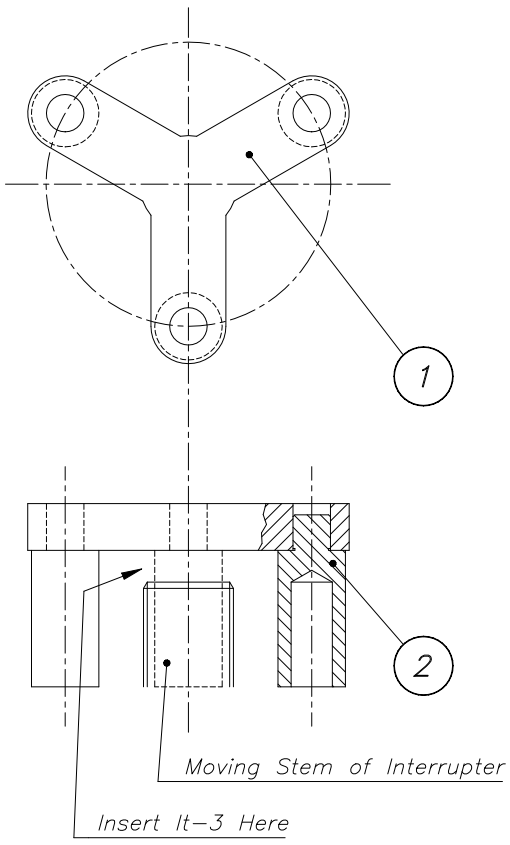
ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE

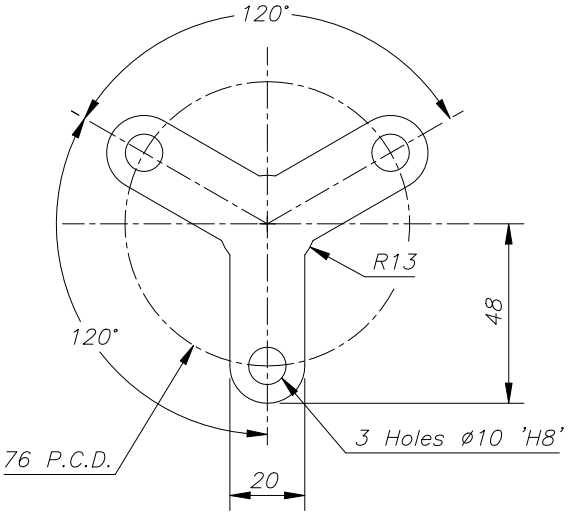


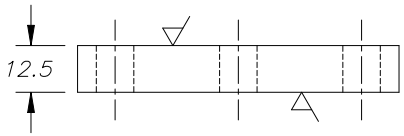
Material: Tool Steel
(Hardened & Ground)

Figure–32: 7.5 mm Gap Gauge

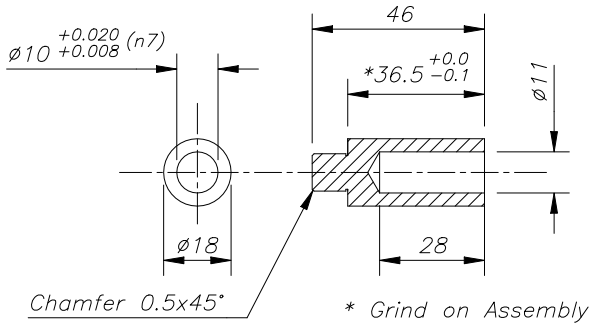
ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE



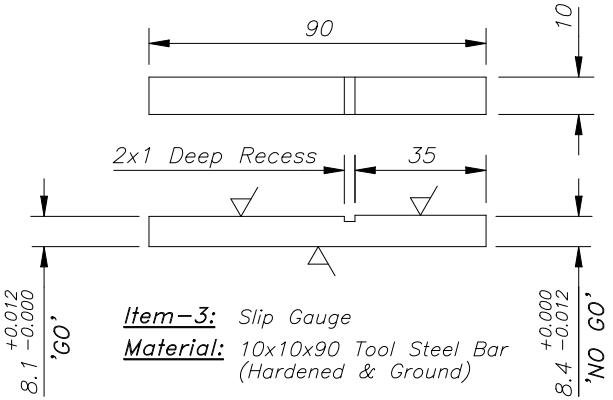




Item–1: Top Plate
Material: 12.5 Thk Tool Steel Plate (Hardened & Ground)

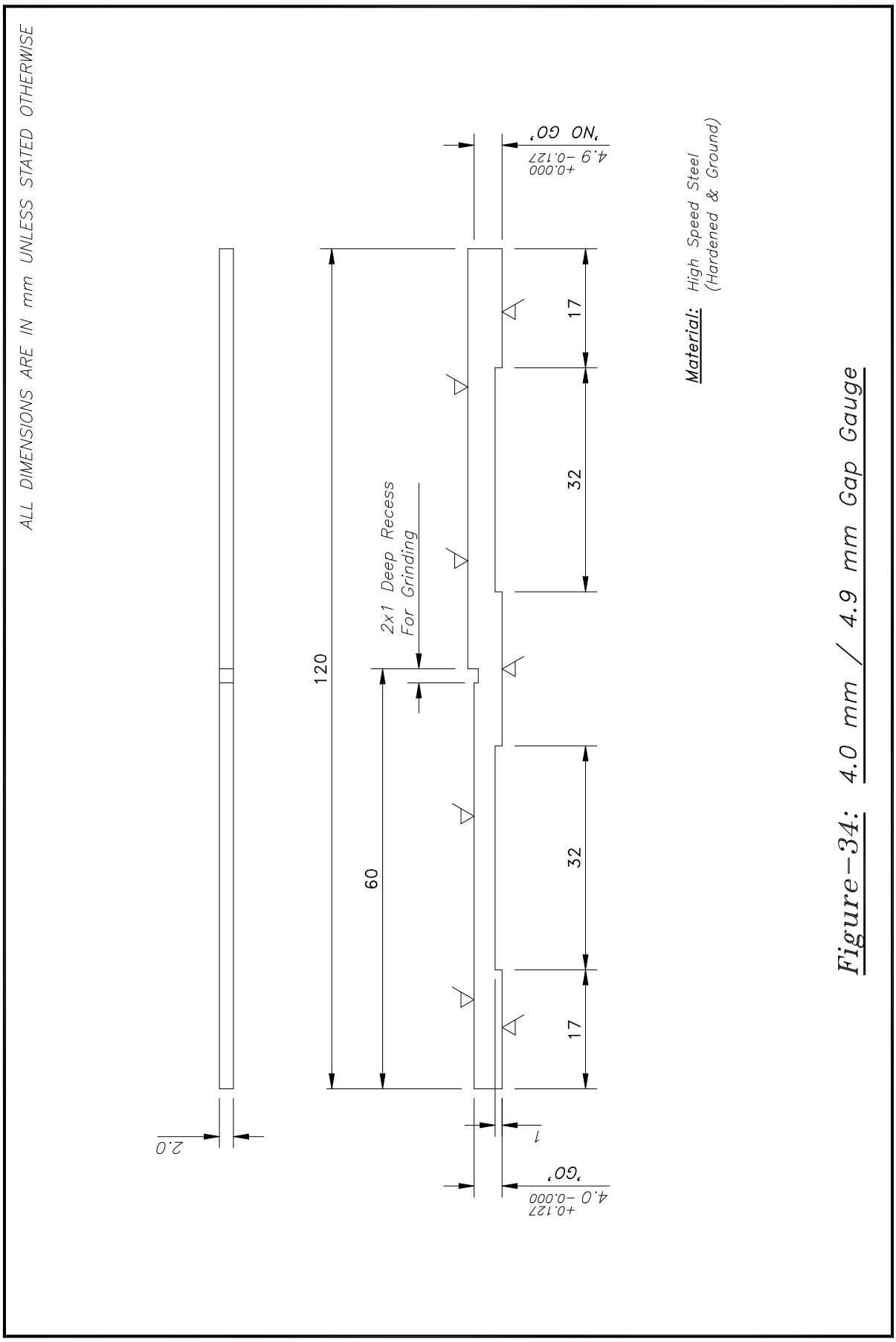


Item–2: Pillars (3 Nos./Set)
Material: ø18 Tool Steel Rod (Hardened & Ground)



Item–3: Slip Gauge
Material: 10x10x90 Tool Steel Bar (Hardened & Ground)

Figure–33: 28 mm Dimension Gauge

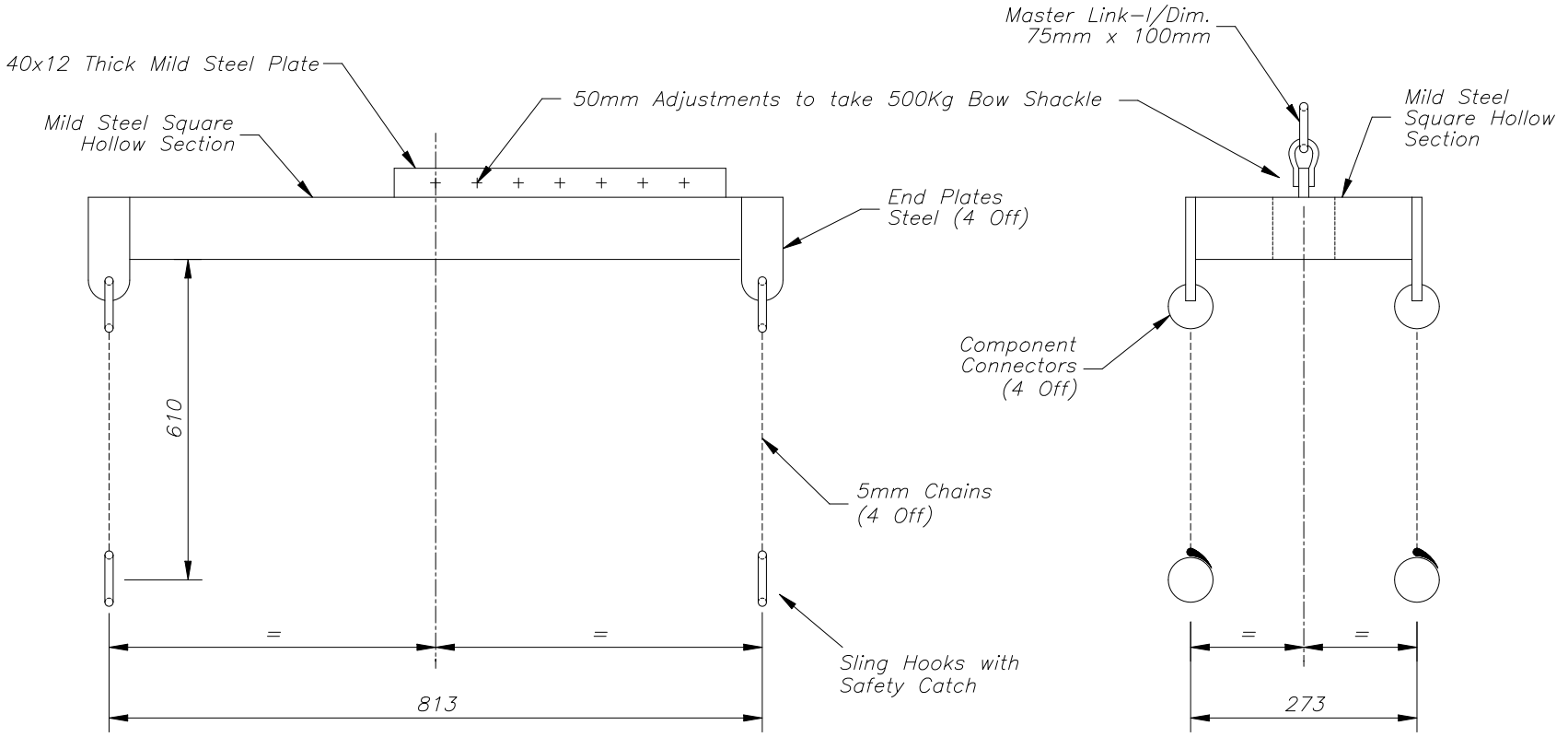


Figure–34: 4.0 mm / 4.9 mm Gap Gauge

ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE

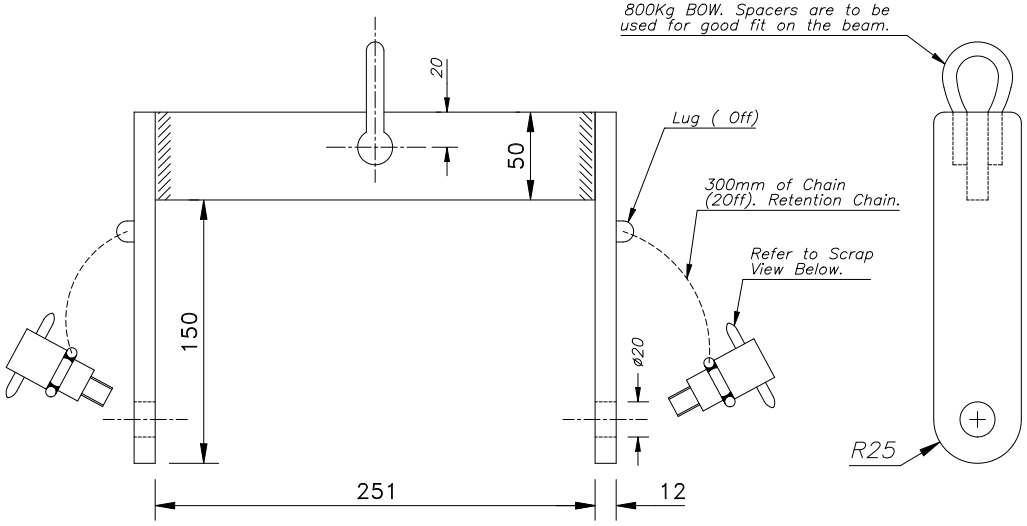
Dimensional Tolerance ±3mm

* ADJUSTMENT HOLES ENABLE THE FRAME TO BE USED TO LIFT THE BASE WITHOUT THE BOTTLE, SINCE ONE CAN COMPENSATE FOR THE CHANGE IN THE CENTRE OF GRAVITY.

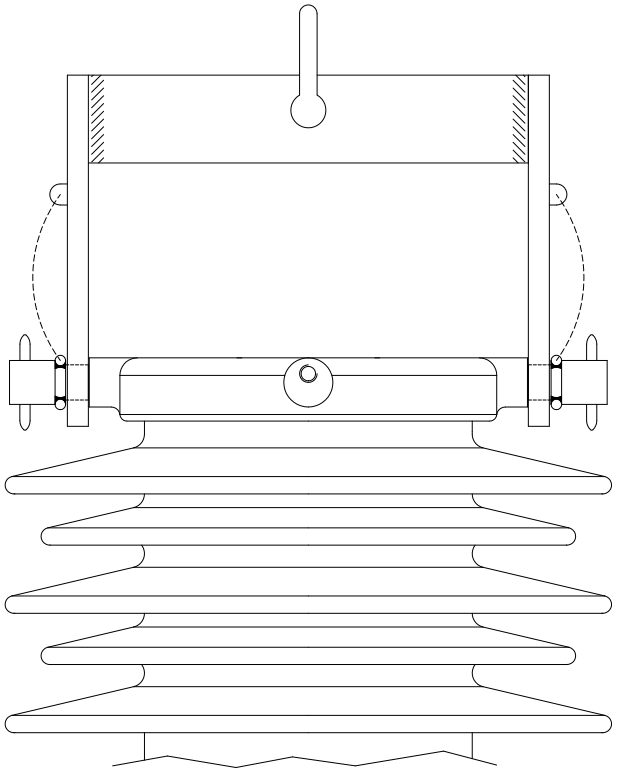


Figure–35: Lifting Frame (for complete VCB)

ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE



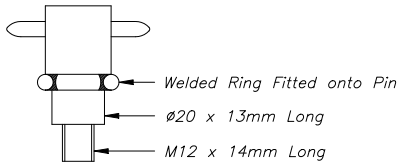
Material: 50x12 Thick Mild Steel Plate



Lifting Frame with Top Insulator Assembly

Retaining Pins (2 Off)

(Fastens to VCB Casting Bosses)

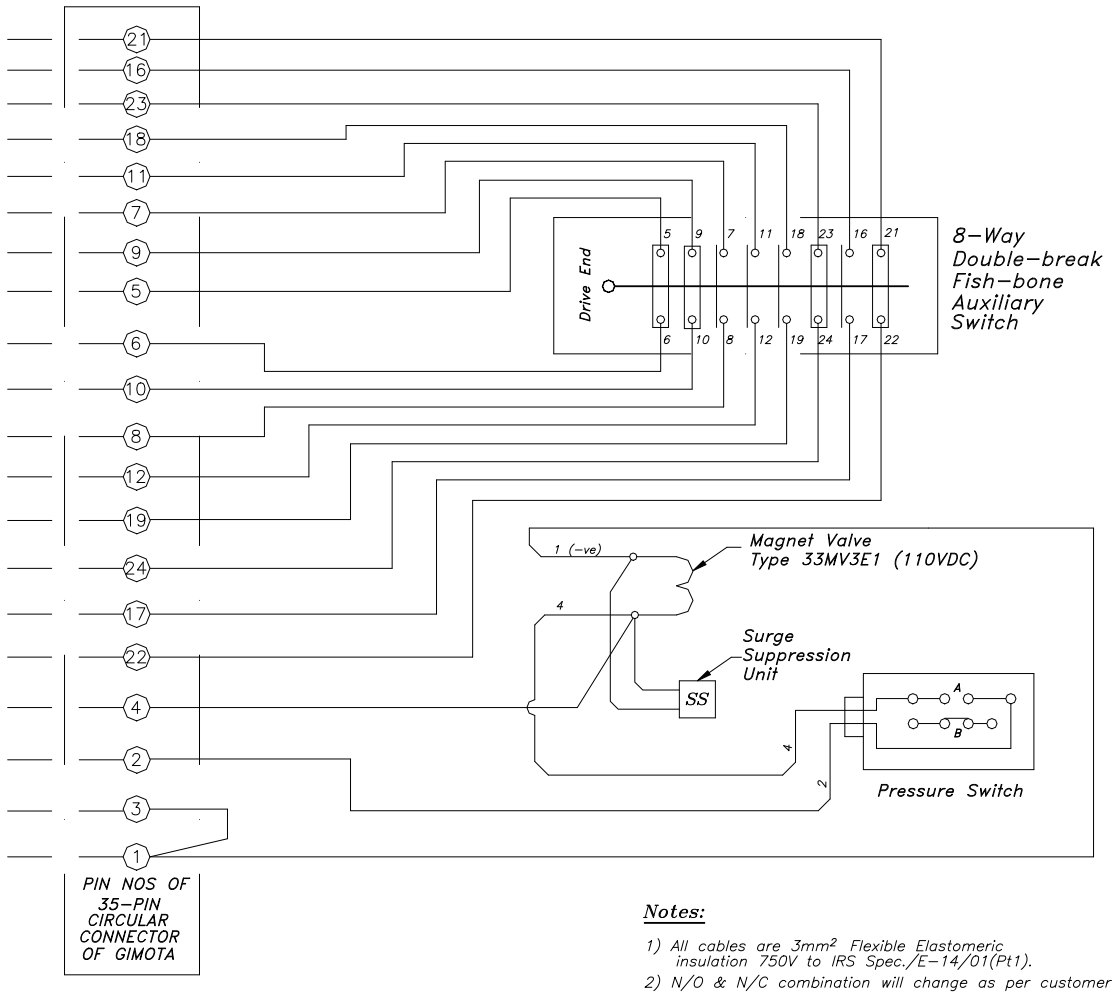


Figure–36: Lifting Frame (for top insulator assembly)

Contact Configuration

4-N/O + 4-N/C

1.	5,6	N/C
2.	7,8	N/O
3.	9,10	N/C
4.	11,12	N/O
5.	16,17	N/O
6.	18,19	N/O
7.	21,22	N/C
8.	23,24	N/C



Notes:

1) All cables are 3mm² Flexible Elastomeric insulation 750V to IRS Spec./E-14/01(Pt1).
2) N/O & N/C combination will change as per customer requirement.
3) Wiring shows terminations on terminal strips as standard practice. On specific customer demand multi-pin circular connector is used.
4) Wiring shown above is for Locomotives and will change for EMUs.

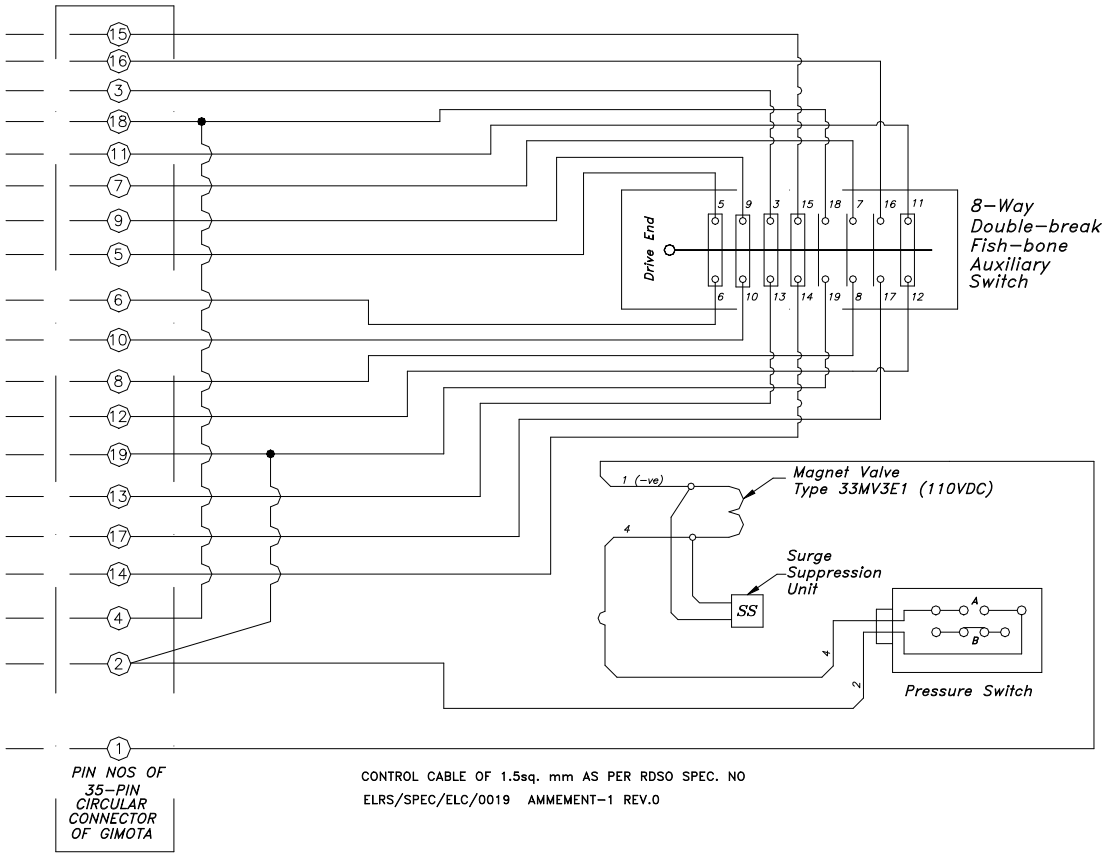
Figure-37a: Wiring Diagram for VCB – CLW type (Ref Drg no – XWC:2103 Rev – D)

Contact Configuration

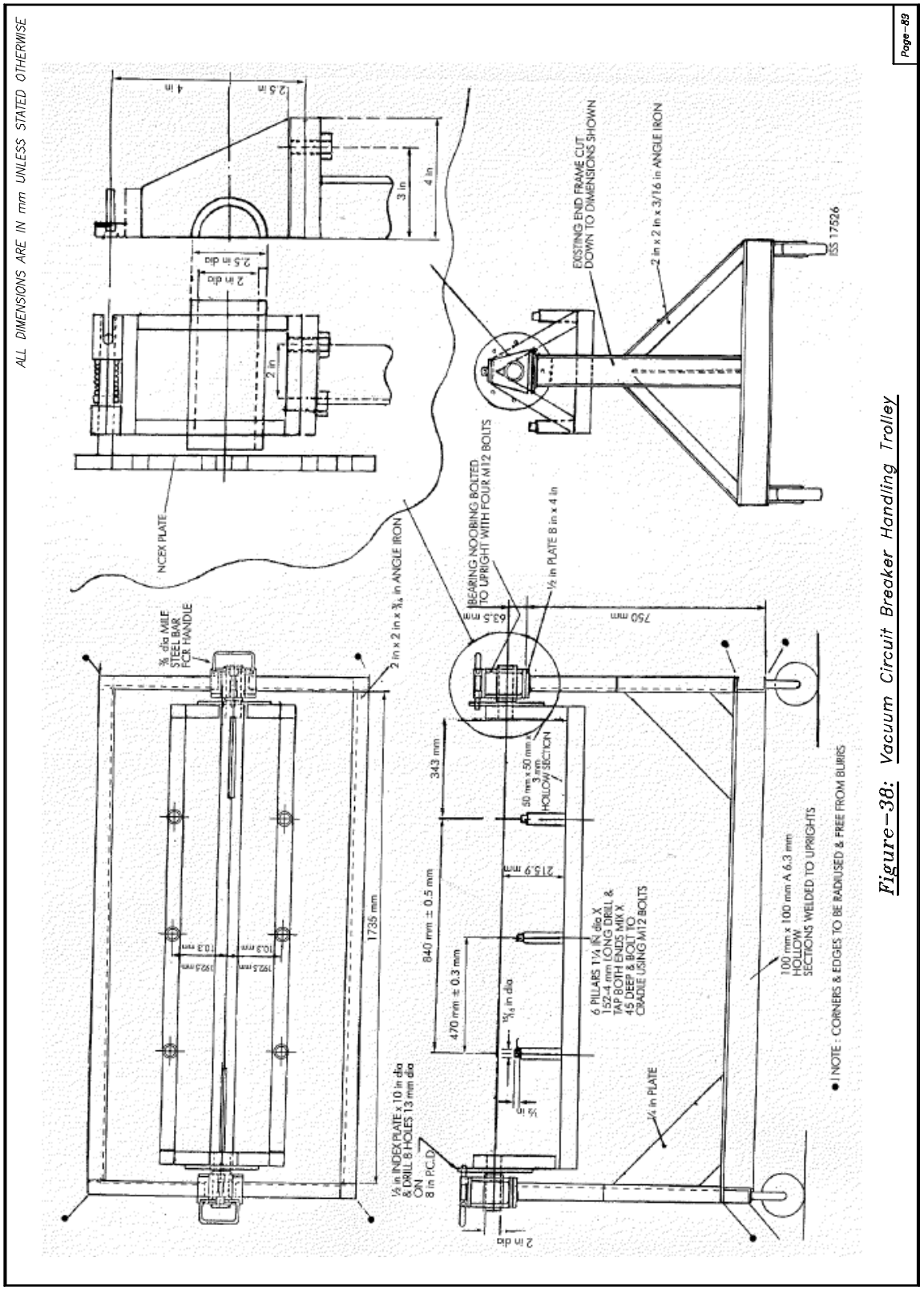
3–N/O + 5–N/C

1.	5,6	N/C
2.	9,10	N/C
3.	3,13	N/C
4.	14,15	N/C
5.	18,19	N/O*
6.	7,8	N/O
7.	16,17	N/O
8.	11,12	N/C

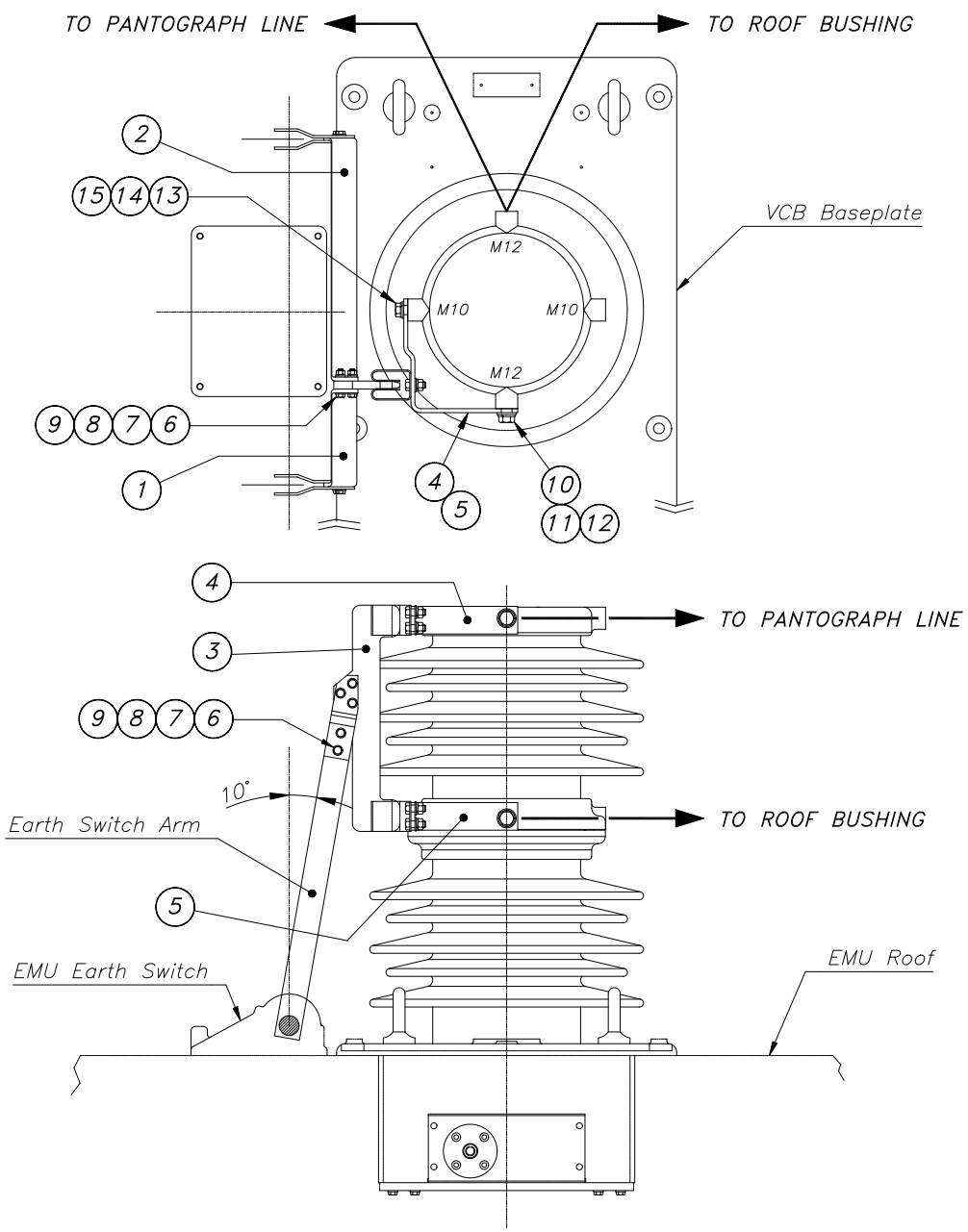
*Early closing of N/O contact



Figure–37b: Wiring Diagram for VCB – ICF / EMU type (Ref Drg – XWC:4601 Rev D)



Figure–38: Vacuum Circuit Breaker Handling Trolley



Item		Description
1	–	Earth Arm
2	–	Support Arm
3	–	Contact Blade
4	–	Earth contact clip assly. (Top)
5	–	Earth contact clip assly. (Lower)
6	–	M6x30Lg Hex. head screw (S.S.)
7	–	M6 Spring washer (S.S.)
8	–	M6 Plain washer (S.S.)

Item		Description
9	–	M6 Hexagonal Nut (S.S.)
10	–	M12x25Lg Hex. head screw (S.S.)
11	–	M12 Plain washer (S.S.)
12	–	M12 Spring washer (S.S.)
13	–	M10x25Lg Hex. head screw (S.S.)
14	–	M10 Plain washer (S.S.)
15	–	M10 Spring washer (S.S.)

Figure–39: VCB type 22CB with EMU Earthing Switch

9.8 Procedure for adapting EMU Earthing Switch with SCHNEIDER ELECTRIC make VCB type 22CB (Refer Figure – 39)

9.9.1 Fit VCB type 22CB into roof cut-out of EMU such that centreline of insulators match with that of earthing switch. Tighten the six numbers M12 foundation screws to **30 Nm** torque (maximum).

9.9.2 Fit Earth contact clip assemblies 4 & 5 on top casting (incoming) and bottom casting (outgoing) respectively, using M10 & M12 screws, plain and spring washers. Discard the M10 & M12 nuts supplied alongwith items-4&5 as these were fitted to prevent screws getting misplaced during transit. ***Ensure that Items-4&5 are fitted to the correct castings,*** otherwise centre distance of earthing clips will change. Tightening torques for M12 & M10 screws are **48 Nm** and **30 Nm** respectively.

9.9.3 Remove the two numbers existing contact blades from the earthing switch.

9.9.4 Fit the sub-assembly of items-1,2&3 to the arms of earthing switch as shown in Figure-39. Fully tighten 4 nos. M6 screws on both ends of Items-1 & 2. ***Use the double nuts provided*** to eliminate any chance of loosening due to operations.

9.9.5 Loosen 3-M6 screws (Item-6) and 2-M8 screws each, used for fitting earth clips on items-4&5.

9.9.6 Close the earthing switch slowly. Adjust the position of earthing clips (fitted on items-4 & 5) and that of contact blade (Item-3) so as to obtain the correct matching. For accomplishing this, horizontal slots are provided in Items-4&5 and vertical slots in Item-3.

9.9.7 Fully close the earthing switch so that contact blade enters the earth clips.

9.9.8 In this position, fully tighten 2-M8 screws on each earth clip and 3-M6 screws (Item-6). ***Lock these 3-M6 screws with double nuts provided*** to eliminate any chance of loosening due to operations.

9.9.9 Now open the earth switch and ensure that air clearance between lower earth clip and contact blade is greater than 188 mm.

9.9.10 Apply some conductive grease on mating surfaces of contact blade and earth clips. Press the earth clips and set its open gap to $9.0^{+0.5}$ mm.

9.9.11 Operate the earth switch few times and ensure that matching of contact blade with earth clips is correct and that movement is smooth.

9.9.12 Connect the busbar from pantograph line to remaining M12x16 deep tapped hole in top terminal (Incoming). Connect the busbar from roof bushing of transformer to remaining M12x16 deep tapped hole in lower terminal (Outgoing). ***Ensure tightening torque of M12 screws as 48 Nm.***

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10.0

Spare Parts List

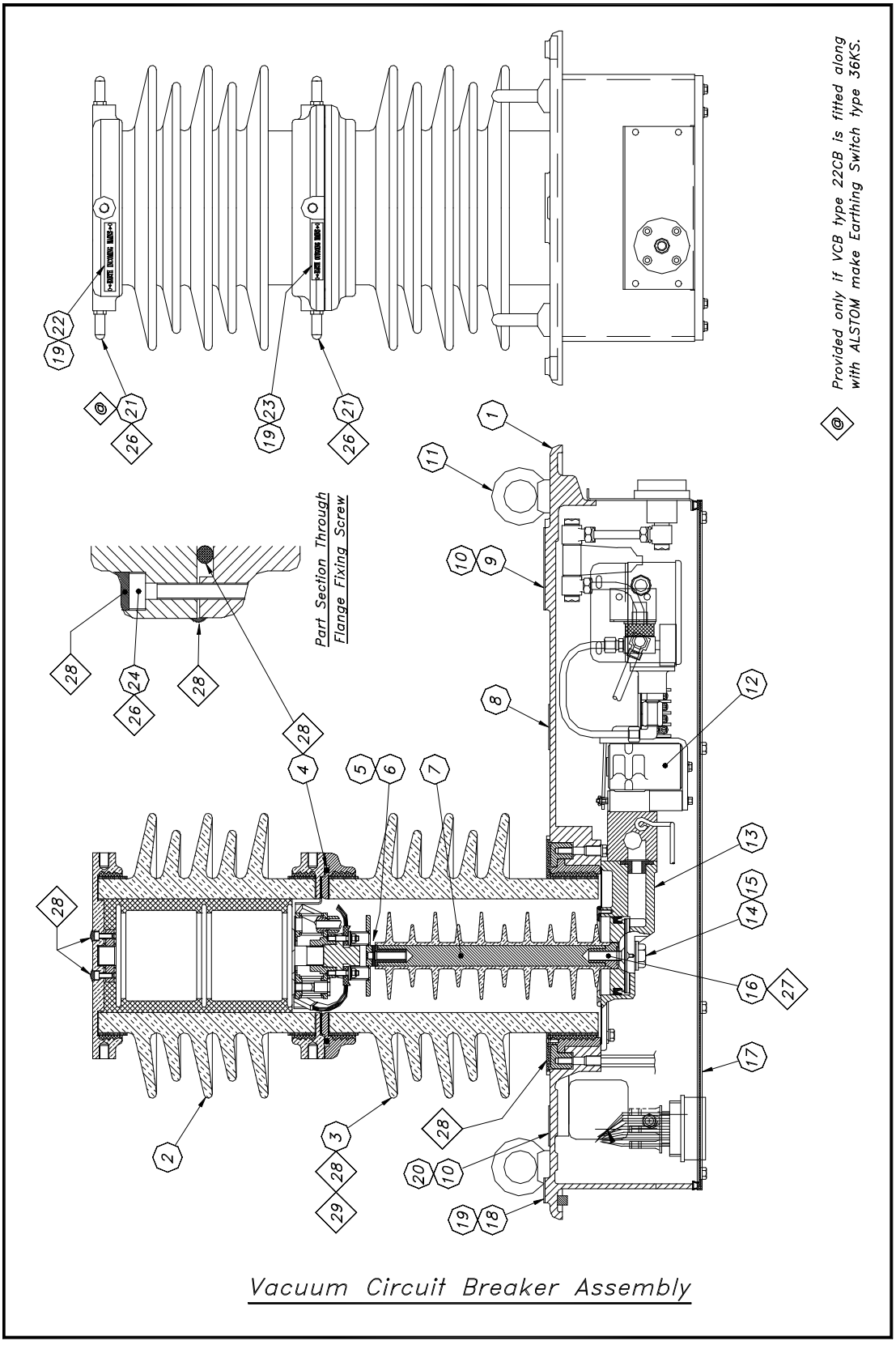
for

Single Interrupter
Vacuum Circuit Breaker
Type 22CB

The following section gives a comprehensive list of items used in VCB type 22CB.

For effective maintenance of the breaker, it is recommended to procure AOH/IOH/POH replacement kits from OEM and use them periodically.

In case any specific item, not covered in replacement kits, is required to be replaced, the same can be procured with correct reference to code number and drawing number.

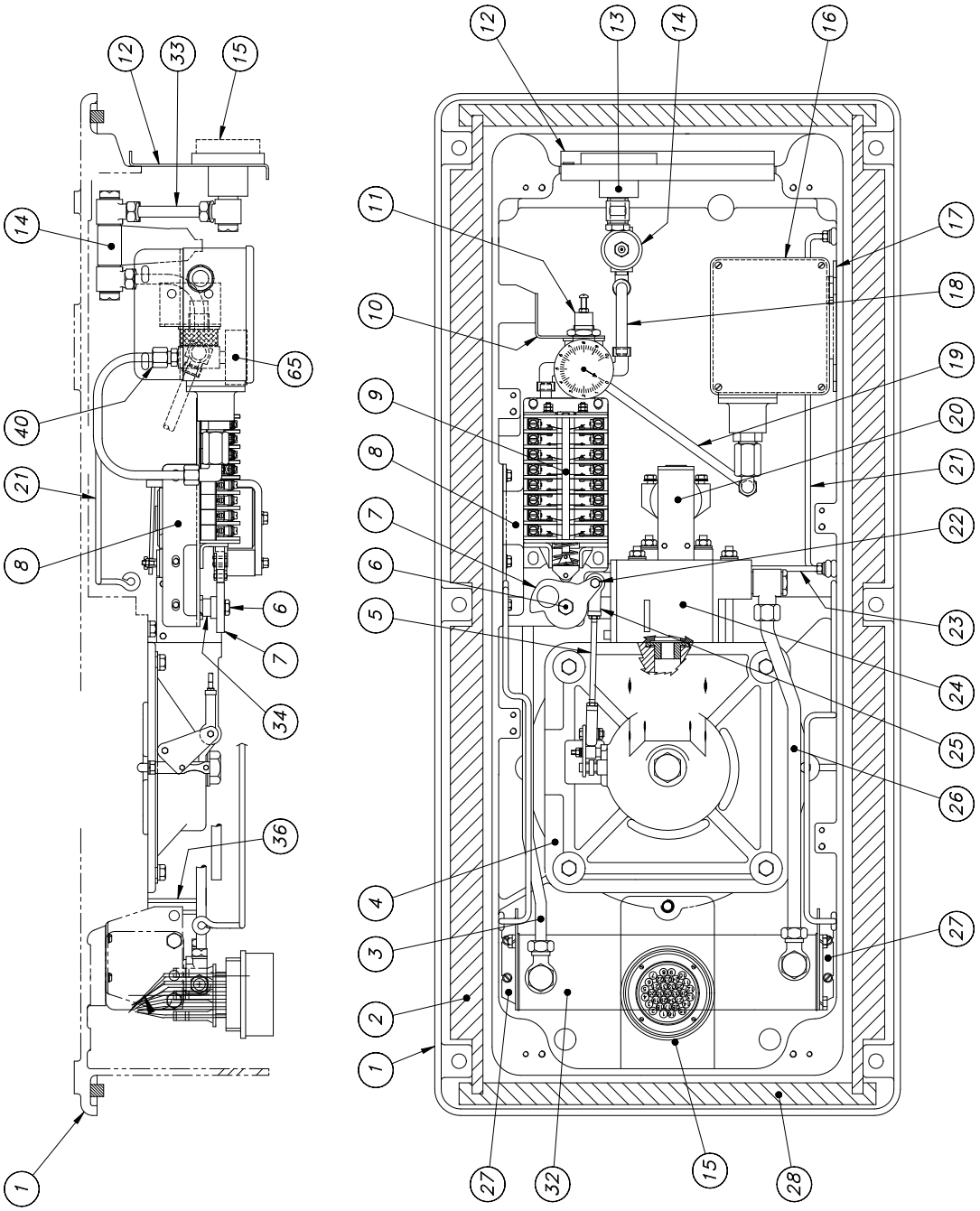


Vacuum Circuit Breaker Assembly

10.1 Vacuum Circuit Breaker Assembly

PART	CODE No.	QTY/	DESCRIPTION	DRG. No.

No.		VCB		
	5555555	***1***	***Vacuum circuit breaker assembly***	***LSC:585***
1	5510000	1	Baseplate assembly	LSB:561
2	5520000	1	Top insulator and mechanism assembly	VDRM00035-01
3	5530010	1	Bottom insulator assembly	VDRM00077-01
4	5510390	1	`O' ring	LSC:612/3
5	5510180	5	Shim washer	LSC:580
6	5510800	As req.	Packing washer	VDRM00044-01
7	5550000	1	Actuator rod assembly	LSC:545
8	5510790	1	Caution sticker	VDRM00043-01
9	5510600	1	Rating plate	LSC:664
10	5510480	8	No.4 x 8 mm Lg Hammer drive screw	--
11	5510500	4	Lifting hook - M20	--
12	VDRM00150-01	1	Magnet valve assembly (Rotex)	VDRM00150-01
13	5540000	1	Cylinder-piston assembly	--
14	5510440	1	Plug	LSC:618
15	5510450	1	Selon washer	--
16	--	1	M12 x 40 mm Lg. Hex skt csk hd screw	--
17	5510160	1	Bottom cover assembly	LSC:576
18	5370030	1	Name plate	LSC:26
19	5510420	6	No.4 x 6 mm Lg Hammer drive screw	--
20	5510470	1	Logo plate	LSC:581
21	5510170	4	Earthing stud	LSC:578
22	5510168	2	H.T. Terminal label	LSC:666/A
23	5510171	2	H.T. Terminal label	LSC:666/B
24	--	8	M8 x 25 mm Lg. Hex skt hd cap screw	--
25	5510230	1	Multi-pin electrical connector (22-pins)	--
26	5520220	--	Loctite - 242	--
27	5540120	--	Loctite - 542	--
28	5530020	--	"PUR.Flex" Polyurethane sealant	--
29	5510430		"OILDAG" Colloidal graphite in Oil	--

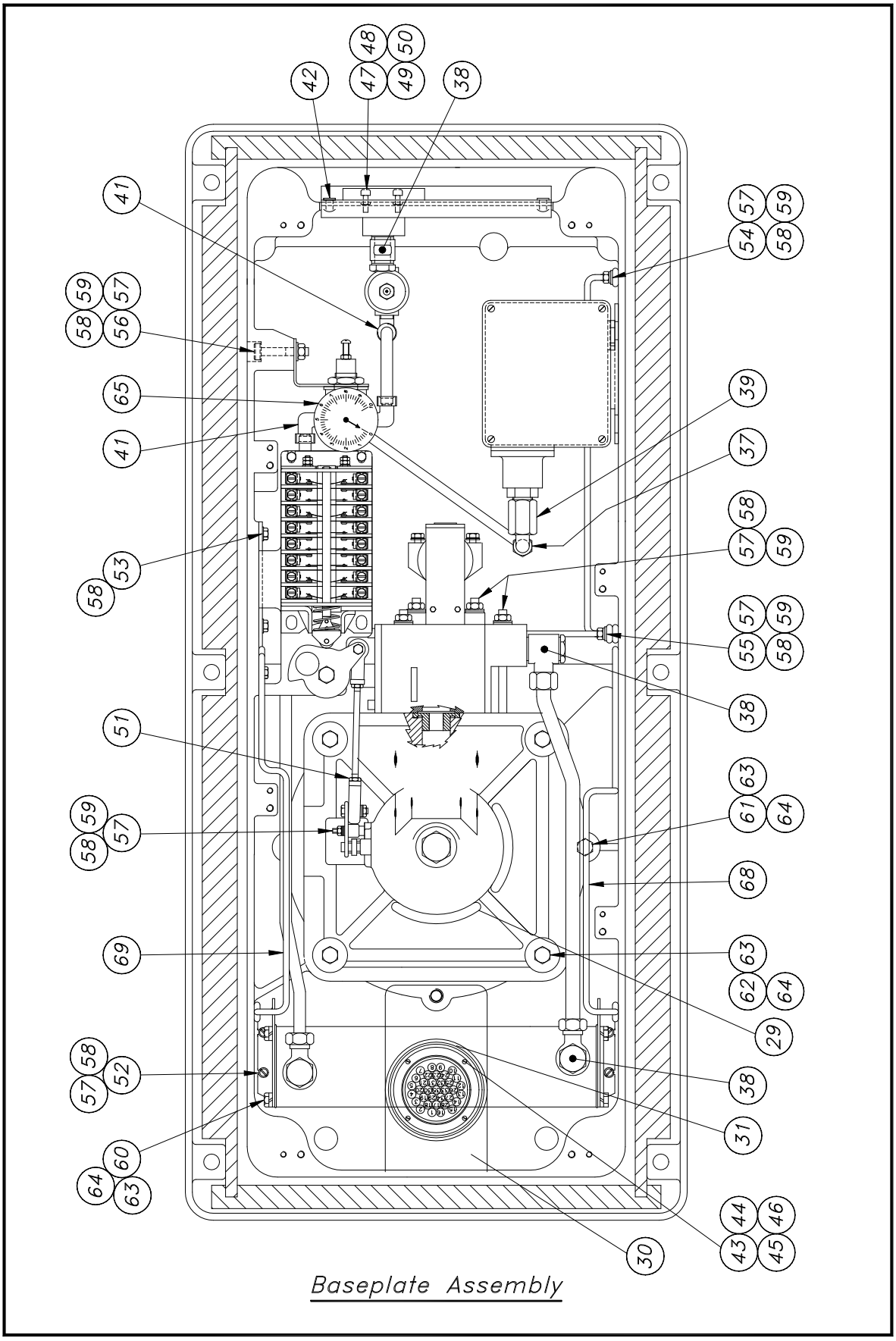


Baseplate Assembly

10.2 Baseplate Assembly

PART No.	CODE No.	QTY/ VCB	DESCRIPTION	DRG. No.
	VDRM00200-02	***1***	***Baseplate assembly***	***VDRM00200-02***
1	5510011	1	Baseplate	LSB:532
2	5510120	2	Gasket	LSC:571
3	5510670	1	Air pipe (air reservoir to pr. regulator)	LSC:665
4	5540000	1	Cylinder-piston assembly	--
5	5510100	1	Drive rod	VDRM00128-01
6	5510630	1	Special screw	LSC:646/2
7	5510660	1	Cam	LSC:644
8	5510610	1	Mounting bracket for auxiliary switch	VDRM00124-01
9	5203400	1	Auxiliary-contacts unit (8-way)	VDRM00123-01
10	VDRM00023-02	1	Regulator mounting bracket	VDRM00023-02
11	VDRM00036-01	1	Pressure regulator	VDRM00036-01
12	5510012	1	Connector mounting plate	VDRM00013-01
13	5510030	1	Air connector (supply)	LSC:563
14	5110010	1	Air filter	--
15	5510301	1	Multi-pin electrical connector (35-pins)	--
16	5250000	1	Pressure switch	LSD:181
17	5510410	1	Pressure switch mounting bracket	LSC:616
18	5510090	1	Air pipe (pr. regulator to air filter)	VDRM00019-01
19	5510060	1	Air pipe (Pr. Regulator to pr. switch)	VDRM00016-01
20	VDRM00150-01	1	Magnet valve assembly	VDRM00150-01
21	5510140	1	Cable tie-bar	LSC:573
22	5510650	1	Bearing pin for cam	LSC:647/2
23	5510130	1	Cable tie-bar	LSC:572
24	5570000	1	Relay valve assembly	LSC:534
25	5510310	1	Rod end spherical bearing	--
26	5510070	1	Air pipe (reservoir to relay valve)	VDRM00017-01
27	5510020	2	Reservoir mounting bracket	VDRM00014-01
28	5510110	2	Gasket	LSC:570
29	5511030	2	Grommet for Cylinder	--
30	5510700	1	Mounting Bracket of Connector	LSC:734
31	5290040	0.3 m	PVC Channel for Gimota Conn. Plate	--
32	5510190	1	Air reservoir	VDRM00034-01

33	5510250	1	Air pipe (air filter to air connector)	--
34	5510620	1	Cam shaft	LSC:646/1
--	--	--	--	--
36	5510560	1	Pillar	LSC:662

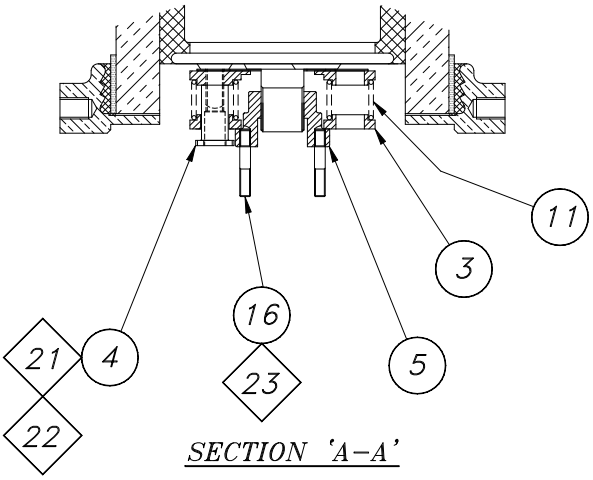


Baseplate Assembly

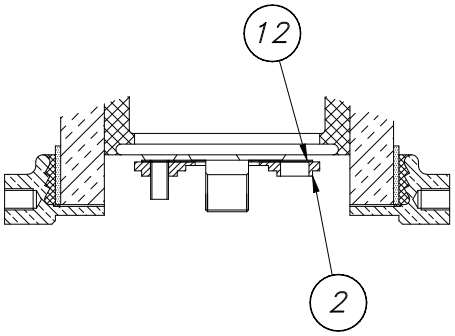
10.2 Baseplate Assembly (Contd.)

PART No.	CODE No.	QTY/ VCB	DESCRIPTION	DRG. No.
37	5110120	1	Elbow (for Pr. Switch pipe)	--
38	5510270	4	Single banjo coupling	--
39	5510530	1	Pressure switch adaptor	VDRM00041-01
40	5510720	1	Stud coupling for Pr. Switch pipe	--
41	5510260	4	Elbow	--
42	5510017	4	∅5 x 16 mm Lg. Blind aluminium rivet	--
43	--	4	M4 x 16 mm Lg. Slotted pan hd screw	--
44	--	4	M4 Plain washer	--
45	--	4	M4 Spring washer	--
46	--	4	M4 Hexagonal nut	--
47	--	4	M5 x 14 mm Lg. Hex skt hd cap screw	--
48	--	4	M5 Plain Washer	--
49	--	4	M5 Spring washer	--
50	--	4	M5 Hexagonal nut	--
51	--	2	M5 Nyloc Nut	--
52	--	4	M6 x 12 mm Lg. Slotted ch hd screw	--
53	--	3	M6 x 12 mm Lg. Hex head screw	--
54	--	6	M6 x 25 mm Lg. Slotted csk hd screw	--
55	--	1	M6 x 30 mm Lg. Slotted csk hd screw	--
56	--	2	M6 x 45 mm Lg. Hex head screw	--
57	--	18	M6 Plain washer	--
58	--	16	M6 Spring washer	--
59	--	9	M6 Hexagonal nut	--
60	--	4	M8 Hexagonal nut	--
61	--	4	M8 x 50 mm Lg. Hex. head screw	--
62	--	4	M8 x 60 mm Lg. Hex. head screw	--
63	--	12	M8 Plain washer	--
64	--	12	M8 Spring washer	--
65	51105400	1	Pressure gauge	--
66	5510550	2	Stud for terminal strips mounting bracket	LSC:661
67	5270000	2	Insulation plate	LSC:8/1
68	5510680	1	Cable tie-bar	LSC:667
69	5510710	1	Cable tie-bar	LSC:669

70	5510700	1	Mounting Bracket of Connector	LSC:734
71	5290040	1	PVC Channel for Gimota Conn. Plate	--



SECTION 'A–A'



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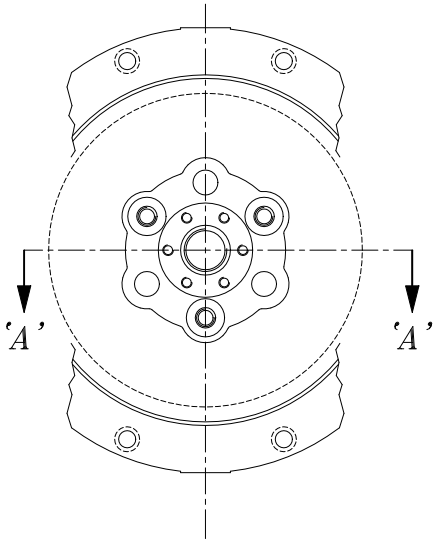

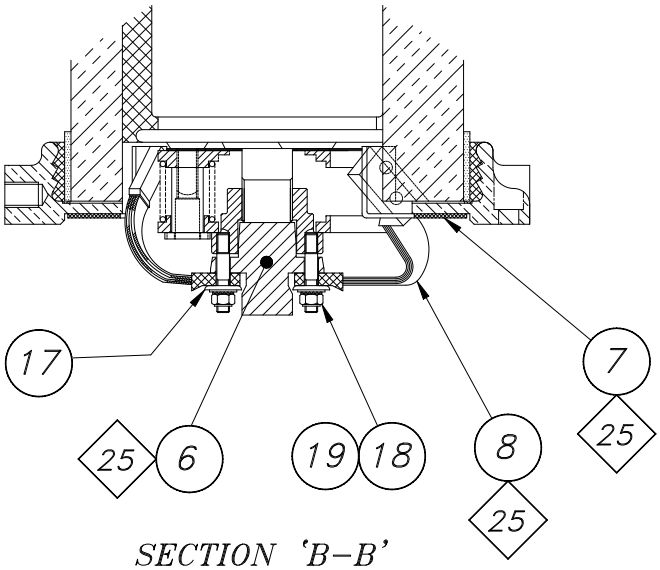

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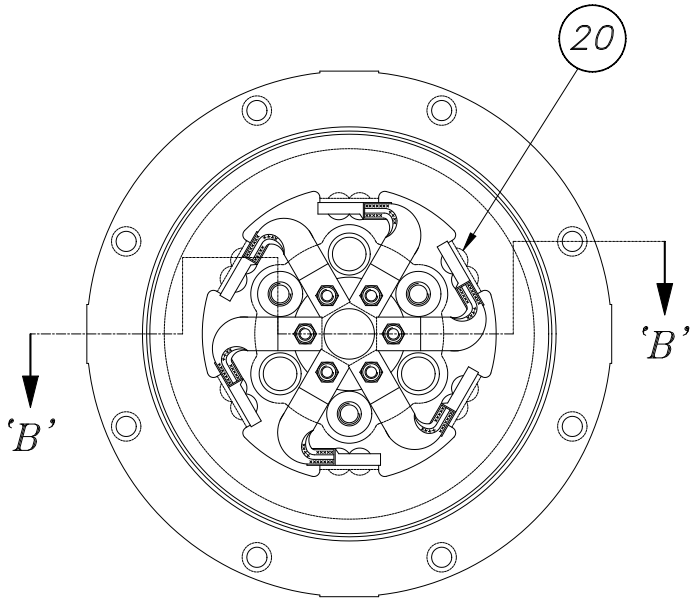
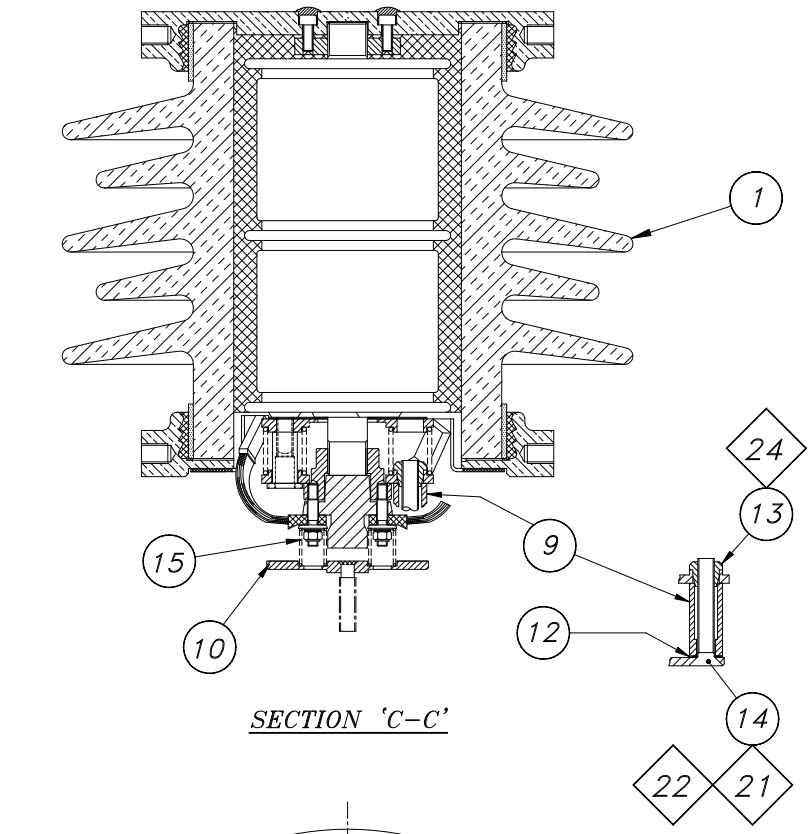


Top Insulator and Mechanism Assembly



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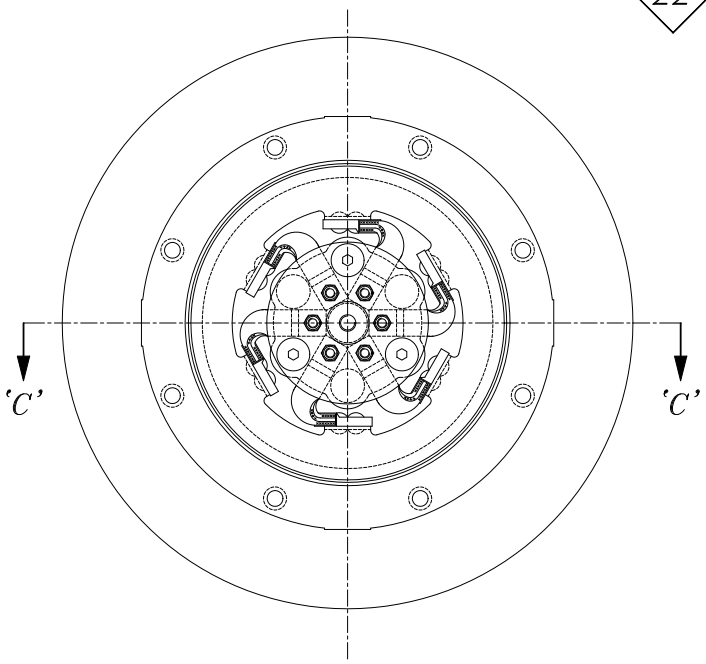
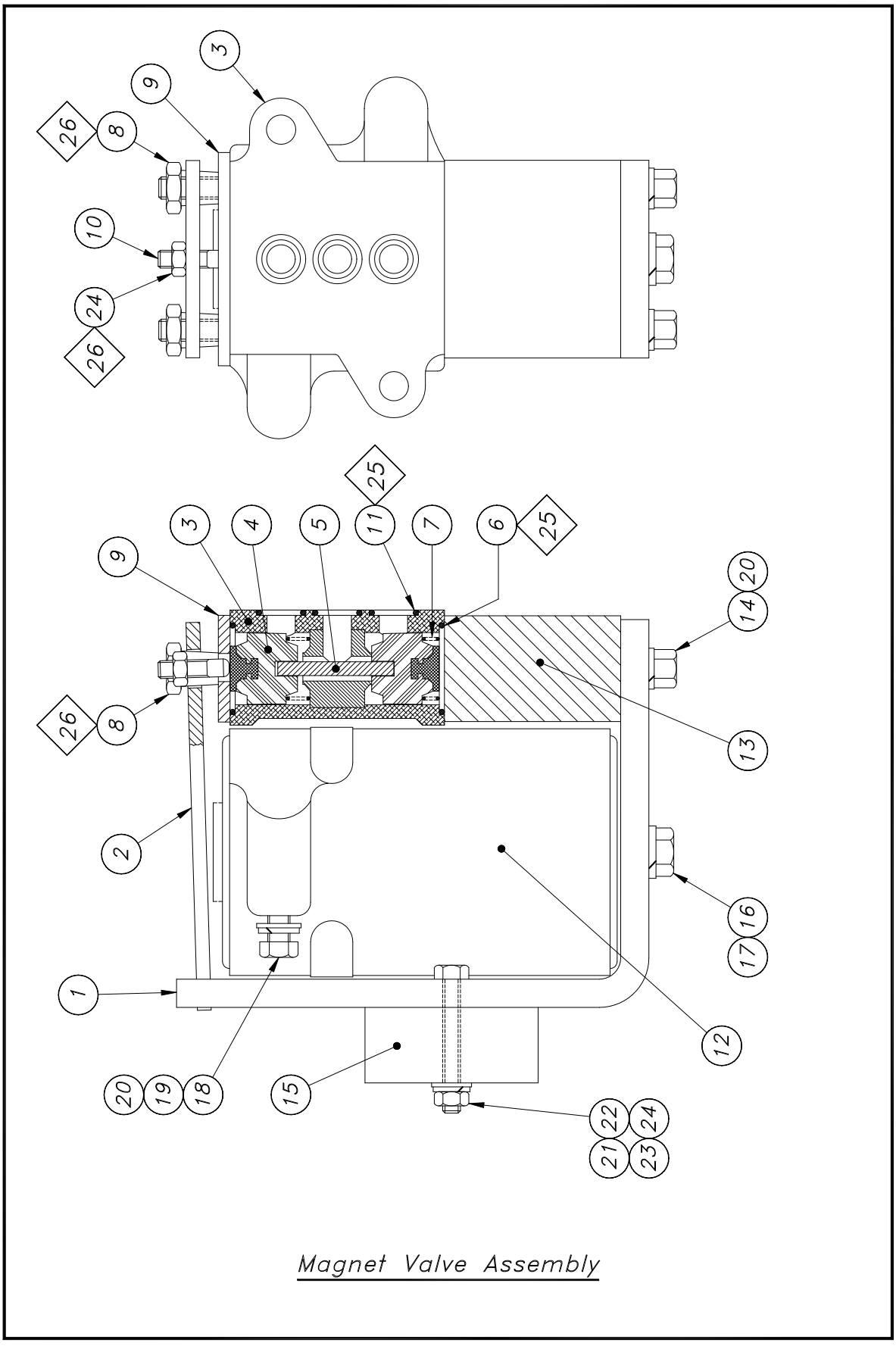


Top Insulator and Mechanism Assembly

10.3 Top Insulator & Mechanism Assembly

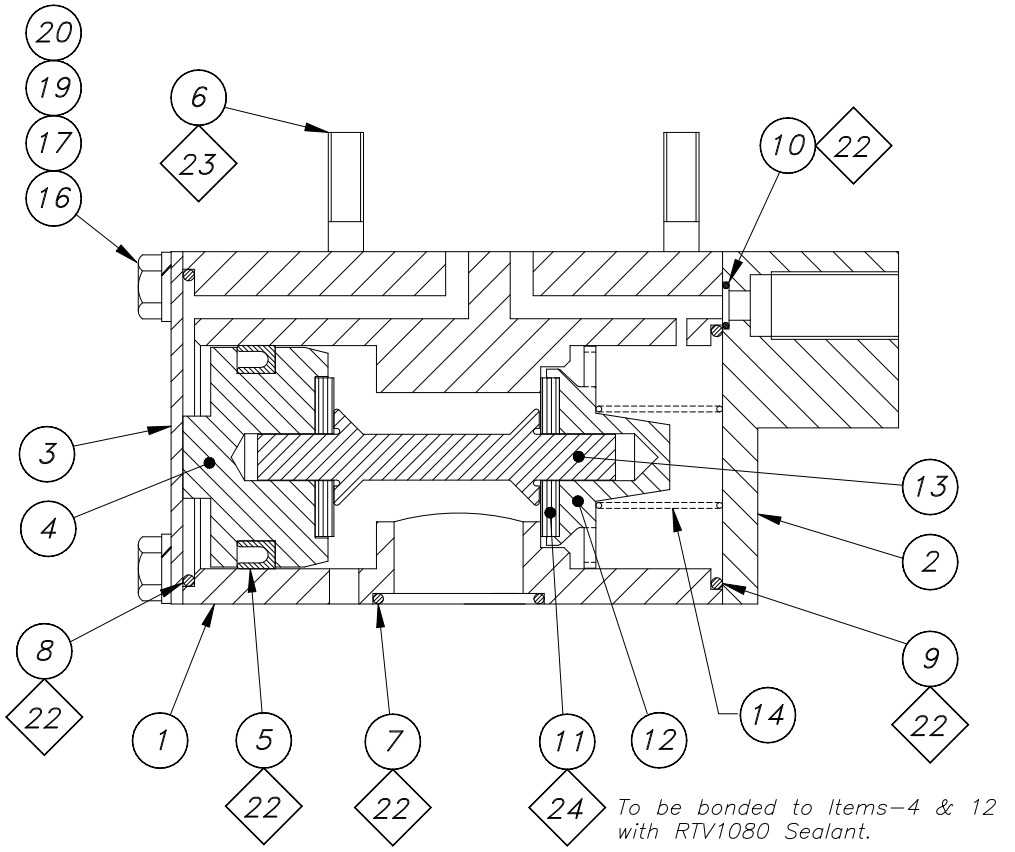
PART No.	CODE No.	QTY/ VCB	DESCRIPTION	DRG. No.
	5520000	***1***	***Top insulator & mechanism assembly***	***VDRM00035-01***
1	5520010	1	Top insulator & interrupter assembly	VDRM00048-01
2	VDRM00057-02	1	Upper spring plate	VDRM00057-02
3	5520050	1	Lower spring plate	VDRM00129-01
4	5520060	3	Mechanism stop	LSC:516
5	5520070	1	Compression ring	VDRM00062-01
6	VDRM00063-02	1	Connector block	VDRM00063-02
7	5520090	1	Shunt collector ring	VDRM00064-01
8	5520100	6	Shunt	VDRM00065-01
9	5520110	3	Spacer	VDRM00066-01
10	5520120	1	Drive plate assembly	VDRM00067-01
11	5520130	6	Spring	VDRM00070-01
12	5520150	4	Shim washer	VDRM00071-01
13	5520160	3	Special nut	LSC:526
14	89486196	3	Special screw	VDRM00072-01
15	5520180	6	Spring	VDRM00073-01
16	5520210	6	Stud	VDRM00074-01
17	5520190	6	Special washer	VDRM00075-01
18	89494537	6	Nyloc nut M6	--
19	5520200	6	Belleville washer M6	--
20	5520140	12	Rivet, copper ∅6 x 12 mm Lg.	--
21	5520240	--	Lubricant Molykote D-321R	--
22	5520220	--	Loctite - 242	--
23	5520230	--	Loctite - 270	--
24	5520250	--	Loctite - 638	--
25	86700910	--	“Unial” electrical jointing paste	--
26	5520150A	12	Shim Washer GEX2324602	GEX2324602

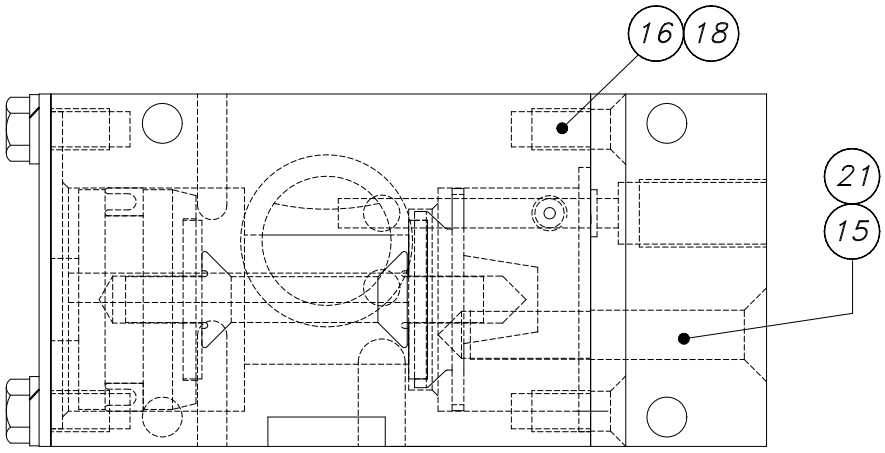


Magnet Valve Assembly

10.4 Magnet Valve Assembly

PART No.	CODE No.	QTY/ VCB	DESCRIPTION	DRG. No.
	VDRM00150-01	1	Magnet valve assembly (Rotex)	VDRM00150-01



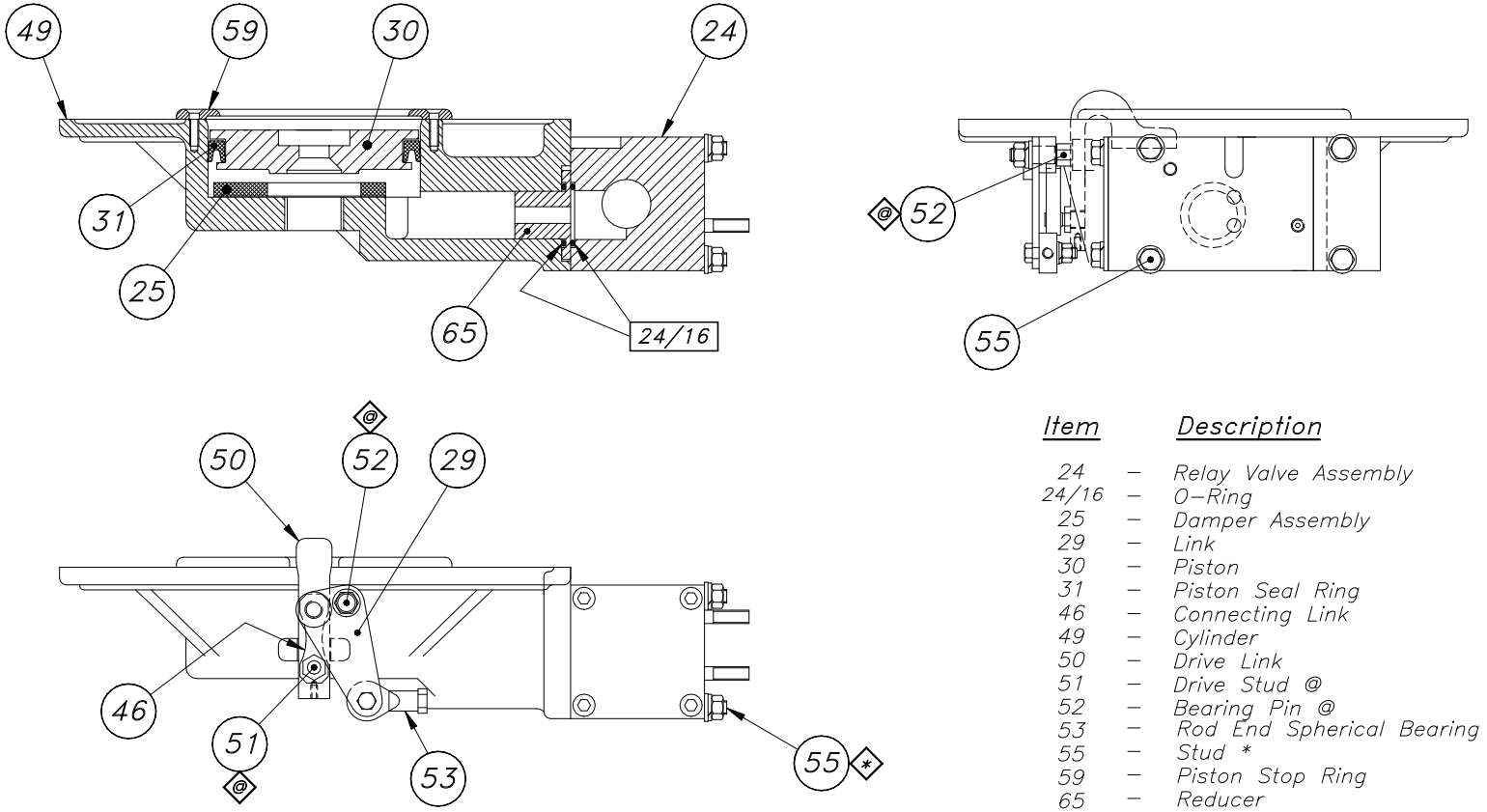


Relay Valve Assembly

10.5 Relay Valve Assembly

PART No.	CODE No.	QTY/ VCB	DESCRIPTION	DRG. No.
	5570000	***1***	***Relay valve assembly***	***LSC:534***
1	5570010	1	Valve body	LSB:535
2	5570020	1	Top plate	LSC:536
3	5570030	1	Bottom plate	VDRM00103-01
4	5570040	1	Piston	LSC:538
5	5570050	1	Piston seal ring	LSC:612/7
6	5570060	2	Stud	VDRM00105-01
7	5570080	1	`O' ring	LSC:612/4
8	5570090	1	`O' ring	LSC:612/2
9	5570100	1	`O' ring	LSC:612/1
10	5570110	1	`O' ring	LSC:612/5
11	5150020	2	Valve disc	VDRM00106-01
12	5150010	1	Poppet valve	VDRM00107-01
13	5150030	1	Stem	LSC:100
14	5150090	1	Spring	VDRM00109-01
15	5570070	1	M8 x 16 mm Lg. Helicoil insert	--
16	5180020	6	M6 x 9 mm Lg. Helicoil insert	--
17	--	4	M6 x 14 mm Lg. Hex head screw	--
18	--	2	M6 x 12 mm Lg. Hex skt csk hd screw	--
19	--	4	M6 Plain washer	--
20	--	4	M6 Spring washer	--
21	--	1	M8 x 40 mm Lg. Hex skt csk hd screw	--
22	5510380	--	Grease Molykote 55M	--
23	5520230	--	Loctite - 270	--
24	5510018	As req	RTV1080 Sealant	--

ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE



Item		Description
24	–	Relay Valve Assembly
24/16	–	O–Ring
25	–	Damper Assembly
29	–	Link
30	–	Piston
31	–	Piston Seal Ring
46	–	Connecting Link
49	–	Cylinder
50	–	Drive Link
51	–	Drive Stud @
52	–	Bearing Pin @
53	–	Rod End Spherical Bearing
55	–	Stud *
59	–	Piston Stop Ring
65	–	Reducer

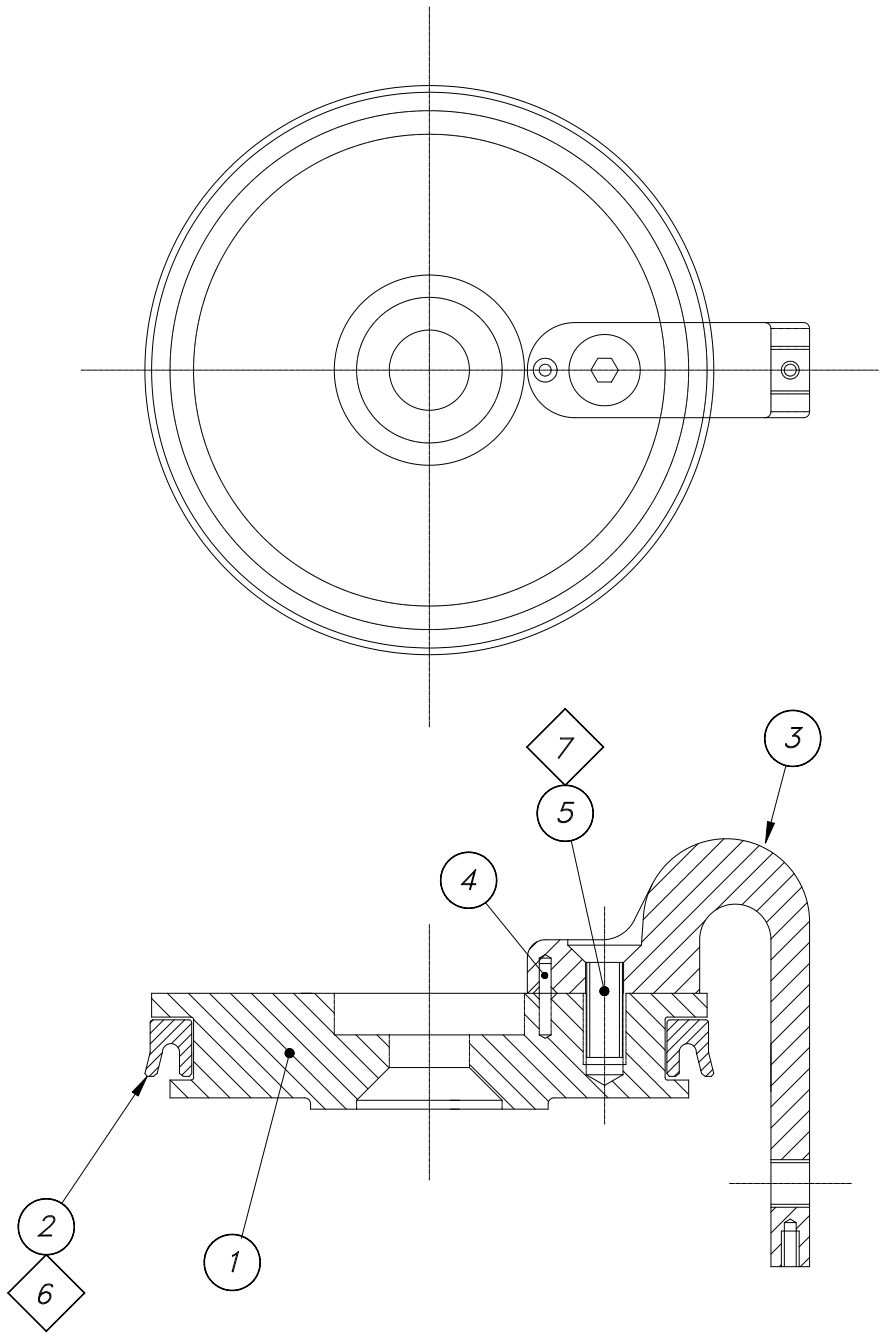
@ Secured with Loctite–242

* Secured with Loctite–270

Figure–12: Cylinder–Piston Assembly

10.6 Cylinder - Piston Assembly

PART No.	CODE No.	QTY / VCB	DESCRIPTION	DRG. No.
	5540000	***1***	***Cylinder - piston assembly***	***--***
1	5540010	1	Cylinder	VDRM00109-01
	5540012	6	M4 x 8 mm Lg. Helicoil insert	--
2	5540020	1	Piston assembly	VDRM00084-01
3	5540030	1	Damper assembly	VDRM00089-01
4	5540040	1	Piston stop ring	VDRM00092-01
5	5540060	1	Special washer	LSC:554
6	5540070	4	Stud	VDRM00094-01
7	5540080	1	Reducer	LSC:556
8	5570080	1	`O' ring	LSC:612/4
9	5540090	1	Connecting link	VDRM00096-01
10	5540050	1	Link	VDRM00097-01
11	5540100	2	Drive stud	LSC:559
12	5540110	1	Bearing pin	VDRM00099-01
13	5510310	1	M5 Rod end spherical bearing	--
14	5570000	1	Relay valve assembly	LSC:534
15	--	2	M4x8mm Lg. Brass Slotted csk hd screw	--
16	--	6	M4x12mm Lg. Hex skt csk hd HT screw	--
17	--	1	M5 x 20 mm Lg. Hexagonal head screw	--
18	--	1	M5 Spring washer	--
19	--	1	M5 Plain washer	--
20	--	1	M5 Hexagonal nut	--
21	--	5	M6 Spring washer	--
22	--	5	M6 Plain washer	--
23	--	5	M6 Hexagonal nut	--
24	5510380	--	Grease Molykote 55M	--
25	5510340	--	Loctite - 222	--
26	5520220	--	Loctite - 242	--
27	22CBLOCO_BELLOW		Bellow, Drg No - GEX2324302	1
28	GEX2324402		Spacer for bellow-GEX2324402	4
29	DTR0025274406		Tie for actuator rod	2



Piston Assembly

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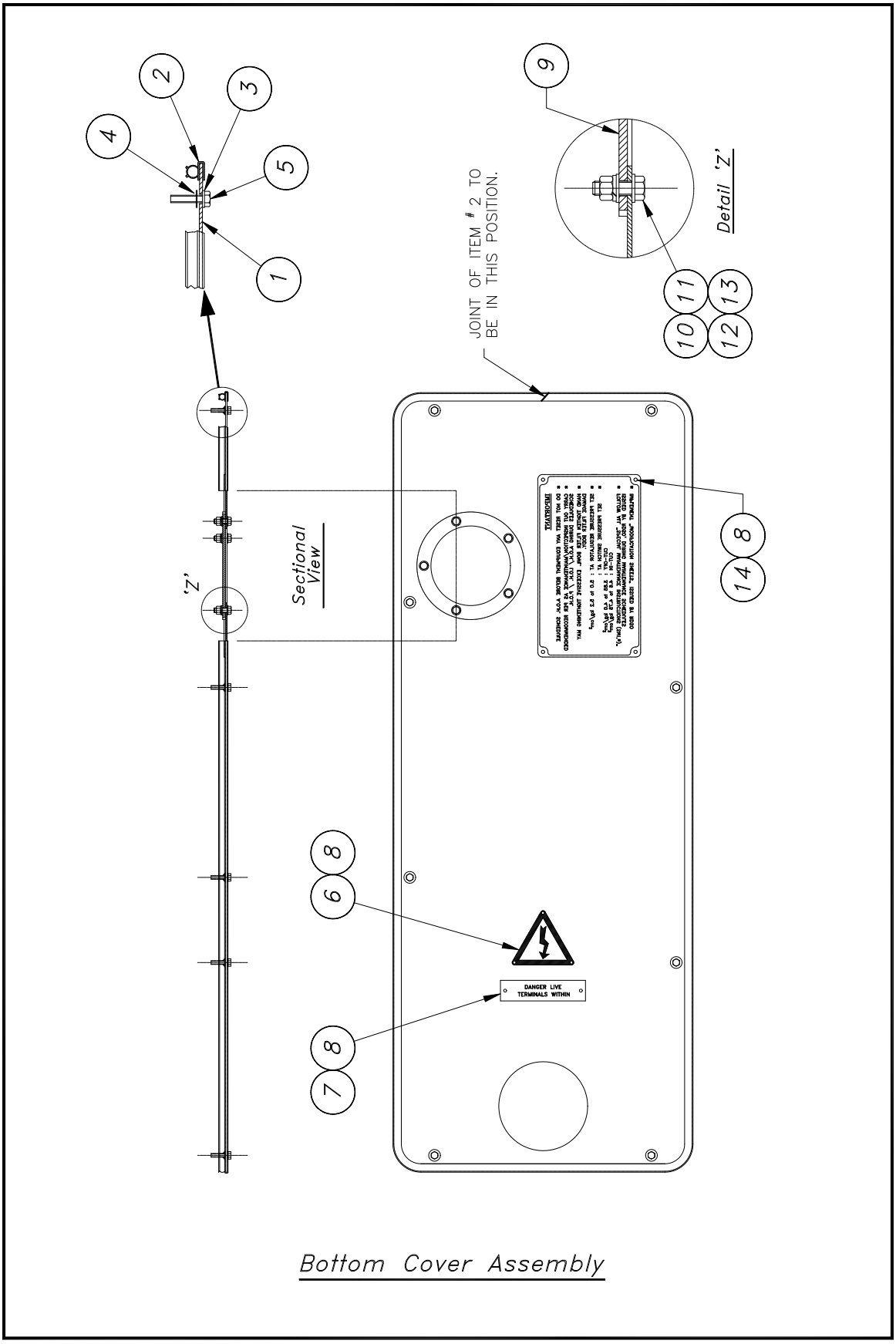
10.7 *Piston Assembly*

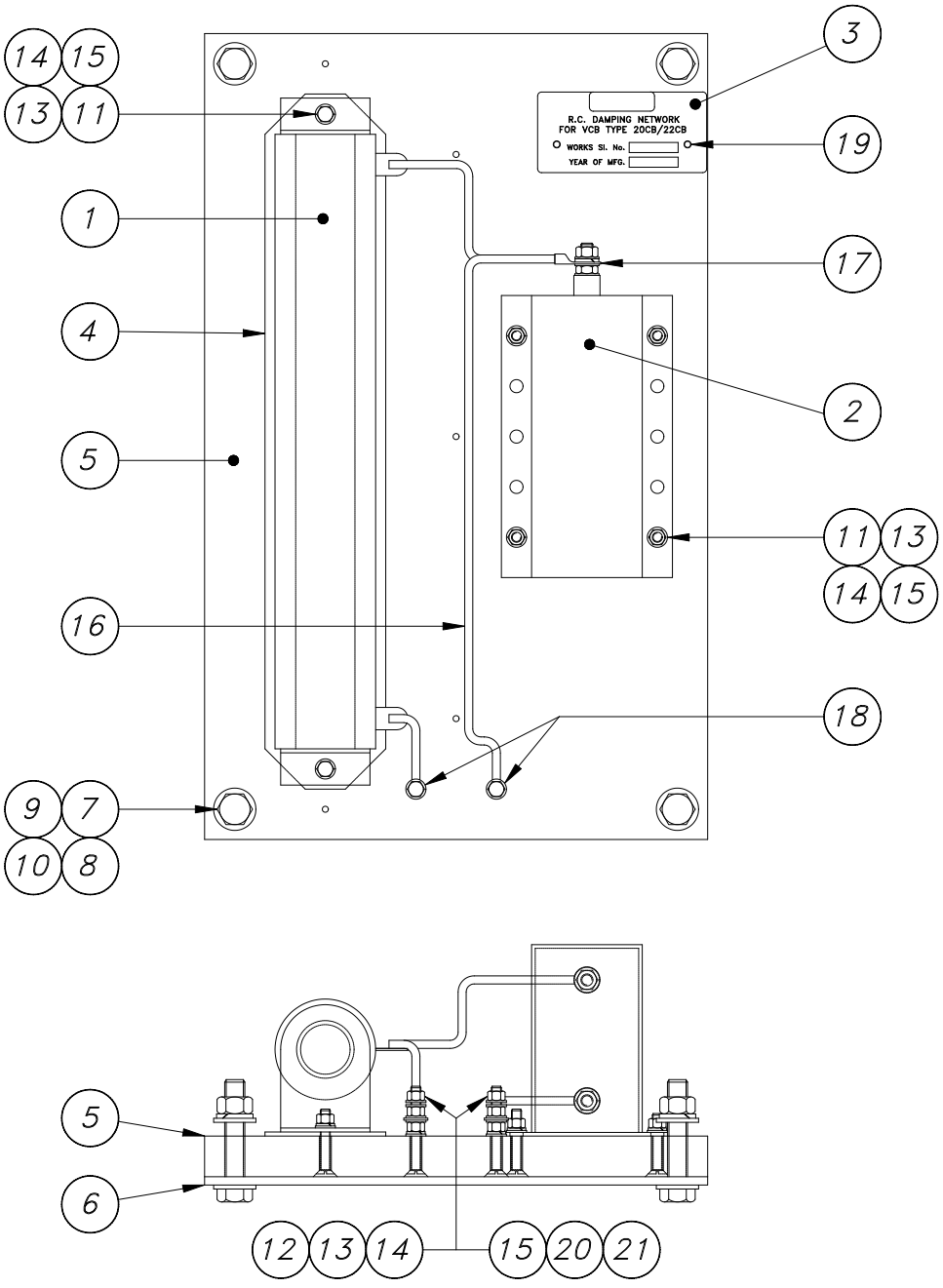
PART No.	*CODE No.*	*QTY/ VCB*	*DESCRIPTION*	*DRG. No.*
	5540020	***1***	***Piston assembly***	***VDRM00084-01***
1	5540021	1	Piston	VDRM00085-01
	5180020	1	M6 x 9 mm Lg. Helicoil insert	--
2	5540023	1	Piston seal ring	LSC:612/8
3	5540024	1	Drive link	VDRM00087-01
4	5540026	1	∅2 x 12 mm Lg. Spirol pin	--
5	--	1	M6 x 16 mm Lg. Hex skt csk hd screw	--
6	5510380	--	Grease Molykote 55M	--
7	5520220	--	Loctite - 242	--



Bottom Cover Assembly

10.8 Bottom Cover Assembly

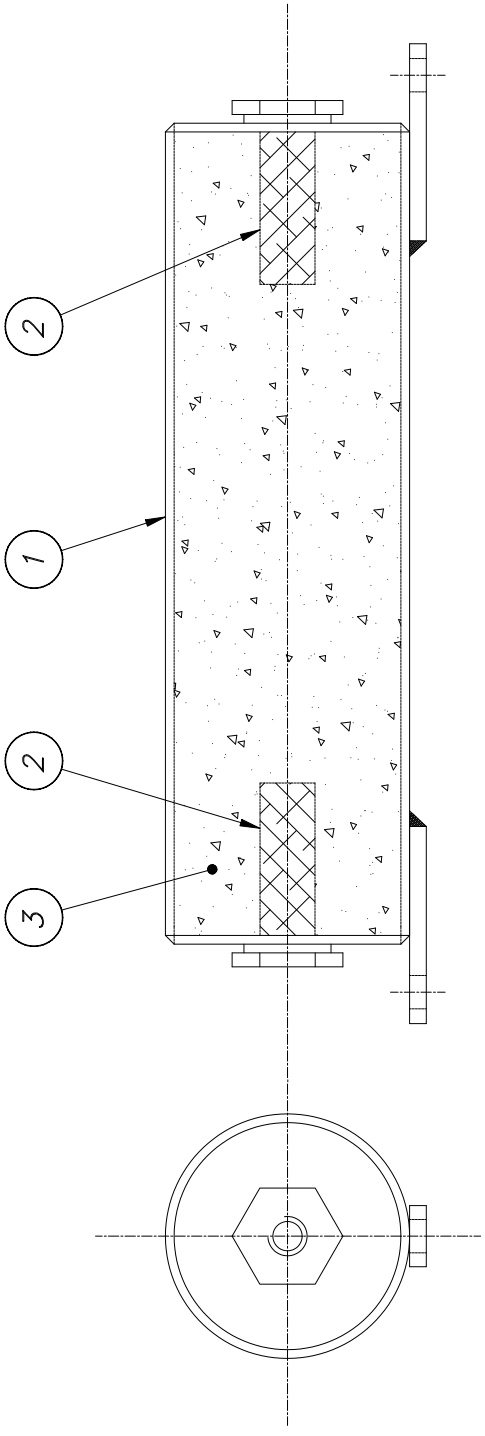
PART No.	CODE No.	QTY/ VCB	DESCRIPTION	DRG. No.
	5510160	***1***	***Bottom cover assembly***	***LSC:576***
1	5510169	1	Baseplate cover	LSC:577
2	5510162	2	Sealing strip	--
3	5510163	8	Sealing washer	LSC:612/6
4	5511110	8	Retaining washer	LSC:826
5	5511090	8	M6 x 20 Half threaded Hex hd screw	--
6	5510165	1	Danger label	LSC:607
7	5510166	1	Danger label plate	LSC:608
8	--	9	∅3 x 5.5 Lg Pop Rivet	--
9	5510161	1	Inspection window	VDRM00031-01
10	--	5	M5 x 15 Lg Hex hd screw	--
11	--	5	M5 Plain washer	--
12	--	5	M5 Spring washer	--
13	--	5	M5 Hexagonal nut	--
14	5510780	1	“IMPORTANT” Label	VDRM00032-01



R–C Network Assembly

10.9 R-C Network Assembly

PART No.	CODE No.	QTY/ VCB	DESCRIPTION	DRG. No.
	5400000	***1***	***R-C Network assembly***	***VDRM00144-01***
1	5400020	1	Resistor	VDRM00145-01
2	5400031	1	Capacitor	VDRM00146-01
3	5370050	1	Name plate	VDRM00147-01
4	5400040	1	Asbestos sheet, 2 mm thick	LSD:29/A
5	5400050	1	Panel board, 10 mm thick	VDRM00149-01
6	5400060	1	Sealing board, 2 mm thick	LSD:29/B
7	--	4	M10x40mm Lg. Hexagonal head screw	--
8	--	4	M10 Spring washer	--
9	--	8	M10 Plain washer	--
10	--	4	M10 Hexagonal nut	--
11	--	6	M5 x 25 mm Lg. Slotted ch. hd. screw	--
12	--	6	M5 x 40 mm Lg. Slotted ch. hd. screw	--
13	--	12	M5 Spring washer	--
14	--	22	M5 Plain washer	--
15	--	12	M5 Hexagonal nut	--
16	5380040	1 Mt	Elastomeric cable 3 mm^2	--
17	5500011	4	Cable socket (6.2mm, I/D)	--
18	5500010	4	Cable socket (5.2mm, I/D)	--
19	--	7	No.6x1/4"Lg Self tapping screw	--
20	--	6	M5 Brass Hexagonal nut (tin plated)	--
21	--	8	M5 Brass Plain washer (tin plated)	--



Air Dryer Assembly

10.10 Air Dryer Assembly

PART No.	CODE No.	QTY/ VCB	DESCRIPTION	DRG. No.
	5390010	***1***	***Air-dryer assembly***	***LSC:105***
1	5390020	1	Air-dryer body assembly	LSB:106
2	5390030	2	Filter assembly	LSB:106
3	5390090	4 kg (Apprx)	Drying agent (Molecular sieves)	--

10.11 Special Tools

PART No.	CODE No.	QTY/ VCB	DESCRIPTION	MANUAL REFERENCE	DRG. No.
1	5560050	1	Peg spanner	Figure - 26	LSC:594
2	5560070	1	21 mm Setting gauge	Figure - 27	LSD:597
3	5560060	3	Setting spacers (Set of three)	Figure - 28	LSD:595
4	--	2	Forcing tool	Figure - 29	--
5	5560120	1	Alignment gauge	Figure - 30	LSC:602
6	5560010	1	1 mm / 2.75 mm Gap gauge	Figure - 31	LSD:591
7	5560030	1	6 mm Gap gauge	Figure - 32	LSD:593
8	5560110	1	28 mm Dimension gauge	Figure - 33	LSC:601
9	5560020	1	4.0 mm / 4.9 mm Gap Gauge	Figure - 34	LSD:592

MFR38245	AOH REPLACEMENT KIT-22CB (LOCOMOTIVE)	QNTY
Item Code	Description	
NPRM2230260	PVC TROPICALISED GASKET,2D 527156B	0,300
NPRM5110600	REPAIR KIT FOR AIR FILTER	1
NPSC5150020	VALVE DISC LSC-99/1 REV-A	2
NPRM5510163	SEALING WASHER FOR 22CBLSC-612/6 REV-A	8
NPRM5510980	PLASTIC WASHER, LEGRIS PT NO 0602231120	8
NPRM5511030	GROMMET FOR CYLINDER	2
NPRM5511090	M6 X 20 PARTIAL THREADED SCREW	8
NPRM5511110	RETAINING WASHER FOR 22CBLSC-826	8
NPRM5540060	SPECIAL WASHERLSC-554 REV-A	1
NPRM5570080	O-RINGLSC:/4	2
NPRM5570090	O-RINGLSC:612/2 REV-A	1
NPRM5570100	O-RINGLSC:612/1 REV-A	1
NPRM5570110	O-RINGLSC:612/5 REV-A	1
MFR14532	AOH KIT FOR ROTEX MAGNET VALVE	1
MFR13791_01	IOH KIT FOR PARKER REGULATOR	1

MFR38246	IOH REPLACEMENT KIT-22CB (LOCOMOTIVE)	QNTY
Item Code	Description	
NPRM5150010	POPPET VALVE	1
NPRM5390100	MOLECULAR SIEVE(4KG/NOS)	1
NPRM5510162	SEALING STRIP	1
NPRM5510390	O-RINGLSC:612/3 REV-A	1
NPRM5510450	SELON WASHER (NYLON)	1
NPRM5510490	FILTER ELEMENT FOR AIR FILTER	1
NPRM5510810	GASKET WASHER	1
NPRM5540023	PISTON SEAL	1
NPRM5570050	PISTON SEAL	1
NPSF5540030	DAMPER ASSY	1
MFR14533	IOH KIT FOR ROTEX MAGNET VALVE	1
NPRM2230260	PVC TROPICALISED GASKET,2D 527156B	0,300
NPRM5110600	REPAIR KIT FOR AIR FILTER	1
NPSC5150020	VALVE DISC LSC-99/1 REV-A	2
NPRM5510163	SEALING WASHER FOR 22CBLSC-612/6 REV-A	8
NPRM5510980	PLASTIC WASHER, LEGRIS PT NO 0602231120	8
NPRM5511030	GROMMET FOR CYLINDER	2
NPRM5511090	M6 X 20 PARTIAL THREADED SCREW	8
NPRM5511110	RETAINING WASHER FOR 22CBLSC-826	8
NPRM5540060	SPECIAL WASHERLSC-554 REV-A	1
NPRM5570080	O-RINGLSC:/4	2
NPRM5570090	O-RINGLSC:612/2 REV-A	1
NPRM5570100	O-RINGLSC:612/1 REV-A	1
NPRM5570110	O-RINGLSC:612/5 REV-A	1
MFR13791_01	IOH KIT FOR PARKER REGULATOR	1

MFR38248	POH REPLACEMENT KIT-22CB (LOCOMOTIVE)	QNTY
Item Code	Description	
NPRM5150090	SPRING	1
NPRM5510310	ROD END SPHERICAL BEARING M5 FEMALE	2
NPRM5520130	COMPRESSION SPRINGLSC-525 REV-A	6
NPRM5520180	COMPRESSION SPRINGLSC-528 REV-A	6
NPRM5520200	BELEVILLE WASHER TYPE B 12.5 X 6.2 X 0.5	6
NPRM5203400	AUXILIARY CONTACT SWITCH (4NC+4NC)	1
MFR14534	POH KIT FOR ROTEX MAGNET VALVE	1
NPRM5150010	POPPET VALVE	1
NPRM5390100	MOLECULAR SIEVE(4KG/NOS)	1
NPRM5510162	SEALING STRIP	1
NPRM5510390	O-RINGLSC:612/3 REV-A	1
NPRM5510450	SELON WASHER (NYLON)	1
NPRM5510490	FILTER ELEMENT FOR AIR FILTER	1
NPRM5510810	GASKET WASHER	1
NPRM5540023	PISTON SEAL	1
NPRM5570050	PISTON SEAL	1
NPSF5540030	DAMPER ASSY	1
NPRM2230260	PVC TROPICALISED GASKET,2D 527156B	0,300
NPRM5110600	REPAIR KIT FOR AIR FILTER	1
NPSC5150020	VALVE DISC LSC-99/1 REV-A	2
NPRM5510163	SEALING WASHER FOR 22CBLSC-612/6 REV-A	8
NPRM5510980	PLASTIC WASHER, LEGRIS PT NO 0602231120	8
NPRM5511030	GROMMET FOR CYLINDER	2
NPRM5511090	M6 X 20 PARTIAL THREADED SCREW	8
NPRM5511110	RETAINING WASHER FOR 22CBLSC-826	8
NPRM5540060	SPECIAL WASHERLSC-554 REV-A	1
NPRM5570080	O-RINGLSC:/4	2
NPRM5570090	O-RINGLSC:612/2 REV-A	1
NPRM5570100	O-RINGLSC:612/1 REV-A	1
NPRM5570110	O-RINGLSC:612/5 REV-A	1
MFR13791_01	IOH KIT FOR PARKER REGULATOR	1

ROTEX
Engineering For The Future

MAINTENANCE SCHEDULE

Schedule of AOH (18 months) (Pink colored parts)		
AOH KIT FOR 3486 CONTAINS FOLLOWING PARTS:		
Pt.No.	Description	Quantity
19	Seat O Ring	2 Nos.
20	Body O Ring	3 Nos.
105	Sleeve O Ring	2 Nos.
30	Anker Assembly	1 No. (Consist of Spring & O-ring)
32	Guide O Ring	1 Nos.
83	Adapter O Ring	3 Nos.
35	Coil Gasket	1 Nos.
201	Copper Washer	1 Nos.

Schedule of IOH (54 months) (Pink + Yellow colored parts)		
IOH KIT FOR 3486 CONTAINS:		
AOH KIT FOR 3486 + FOLLOWING PARTS:		
Pt.No.	Description	Quantity
07	Ventilteller	1 No.
101	Sleeve	1 No.
107	M Holder	1 No.
37	Nut	1 No.
33	Guide Assembly	1 No.
165	Star Washer	1 No.
199	Stopper Plate	1 No.

Schedule of POH (108 months) (Pink + Yellow + Green colored parts)
POH KIT FOR 3486 CONTAINS:
AOH KIT FOR 3486 + IOH KIT FOR 3486 + Solenoid assembly (Pt. No.34)

SERVICE KIT FOR PARKER PRESSURE REGULATOR (COMMON FOR AOH,IOH & POH SCHEDULE)

ORDERING CODE : MFR13791_01

LIST OF MATERIALS :

A) Piston & Poppet Kit – PS2426P

1. Locking Nut
2. Piston
3. Seal
4. O Ring
5. Poppet + Spring

B) Bonnet Assembly Kit – LO1369

1. Bonnet

C) Grease

1. Grease for lubrication

Consumables required during maintenance do not form a part of the replacement kits and hence are to be arranged separately.

IA- Monthly overhauling
IB- Overhauling after every two months
IC- Overhauling after every three months
AOH- Overhauling after every one year,
IOH- Overhauling after every two years,
POH- Periodic overhauling after every six years

10.14 Consumable Kit

	CONSM_LOCO_VCB	QNTY
NPRM5510380	MOLYKOTE `55M' SPECIALTY GREASE 100GMS	1
NPRM5380740	SILASTIC RTV-1080 (WHITE)	1
NPRM5520220	MED.STRENGTH ADHESIVE LOCTITE -242-50ML	2
NPRM5560720	LOCTITE SEALANT 518	1
NPRM5110270	PTFE THREAD SEALING TAPE0.075 X 12	1
NPRM5511420	LOCTITE MAKE CHISEL PAINT STRIPPER	1
NPRM5510340	SCREW LOCK LOCTITE - 222	1
NPRM5540120	LOCTITE HYDRAULIC SEALANT 542 100ML PACK	1
NPRM86700910	UNIAL ELEICAL JOINTING PASTE	1
NPRM5520240	MOLYKOTE D321R LUBRICATG SPRAYCAN -400ML	1

COMMENTS

- *If you observe the recommendations contained in this Installation, Operation and Maintenance Manual, you will benefit from our experience and will ensure the highest reliability for our products.*
- *A technical manual cannot foresee all the eventualities that may occur during operation. We therefore strongly urge you to consult us, when there is any incident which is not mentioned in this manual.*
- *We explicitly refuse to accept any responsibility relating to damage, suffered by our product, caused by incorrect operation and this applies even if this manual does not include any instruction relating to the case in question.*
- *We reserve all rights on this document, as well as on the object appearing in it. Reproduction of this manual, even extracts from it, are forbidden without our permission.*
- *Information / drawings contained in this publication are of general nature only. Contractual commitment will be strictly governed by information / drawings furnished with order acknowledgement.*
- *The Company's policy is one of continuous improvement of its products and, therefore, the right is reserved to supply product which may differ slightly with that described and illustrated in this publication.*

Schneider Electric Infrastructure Ltd.

MV Switchgear Division

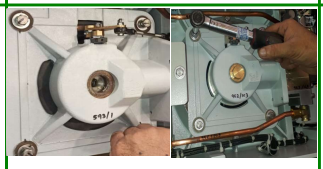
Schneider Electric Infrastructure Ltd.
Milestone-87,
Vadodara Halol HIGHWAY,
Kotambi,
Jarod,
Vadodara - 391510

Phone: 02668-663002
Fax: 02668-663260

10.13. Assembly Instruction of Bellow Fitment

DOC. NO.	SLW_LOCO_Bellow fitment	Rev.	1
Process	Loctite use process during Top & Bottom pole fixing	Product	22CB LOCO

Process steps for Bellow fitment

SL NO	Which	What	How	Illustration	Why	Symbol		Who	Inspection report (OK/NOK)
		Important Step and step no.	Key Point			Icon	Explanation of Icon		
1	Bottom insulator	Clean top flange of bottom insulator & internal surface of Insulator	Clean the Surface with clean dry cloth and Isopropyl and allow it to completely dry		Clean bottom insulator internal surface .		No dust , no grease , Inner surface should be free of any dust/foreign particles	Operator	
2	Bottom insulator	Remove trapped atmospheric moist air by heating with hot air gun	Set the hot air gun temperature to 90 °C to 100 °C apply uniformaly inside inner surface of the bottom insulator. Do not concentrate on any point more than 2 seconds continously.		to ensure the air inside insulator is dry and to prevent condensation post bellow fixation		Mositure or condensation on inner surface of insulator can cause dielectric failure	Operator	
3	Actuator rod	Use modified Actuator rod	Visually check and confirm the actuator assembled is modified one. Ensure the external surface of the actuator rod is clean from dust/impurities and ensure the sealing area between bellow and Actuator rod is smooth and burr free		To ensure bellow can be fitted around the actuator rod and provide necessary tightness		Revised actuator rod	Operator	
4	Actuator rod	1. Assemble Actiator rod 2. Place four spacers around the four mounting holes	fix four 1mm spacers on the mounting holes places concentrically with loctite 401		To ensur eth espacers are secured in place during fitment of bellow			Operator	
5	Bellow	Cleaning by dry cloth	Clean the Surface with help of dry cloth.		Clean bellow Surface before use.		No dust , no grease , no scratch mark on Bellow.	Operator	
6	Bellow	Put bellow inside the actuator rod and ensure all four corner are match with base plate.	Bellow should not above the washer		for maintain the torque		rubber should not above the washer	Operator	
8	Bellow	Fixed bellow on actuator rod by using cable tie	Secure the bellow in it place and secure it using cable tie sufficiently tight to ensure air tightness. Do not exert more force which might result in bellow damage. (Width :3.4 mm . Length:200 mm ,Tensile Strength : 135 N)		To ensure proper fit of bellow on actuator rod		Tie should be cut through special tie cutter.	Operator	
9	Cylinder assembly	Fix cylinder assembly with bolt (M8 X 60)	Fasten bolts to 18Nm		To complete the cylider assembly		Torque marking	Operator	

Date	Description
16-02-22	Bellow fitment