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PART A.

1.0 GOODS MARKING AND TRANSPORT
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   1.2 Transport
   1.3 Lifting
   1.4 Lifting the breaker out of the case

2.0 STORAGE PRIOR TO ERECTION
   2.1 General
      2.1.1 Receipt
   2.2 Operating Mechanism
   2.3 Circuit-breakers
   2.4 Spare parts

3.0 SAFETY PROVISIONS AND ASSEMBLY INSTRUCTIONS FOR CIRCUIT-BREAKERS WITH OPERATING DEVICE
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   3.2 Safety Precaution
   3.3 Unpacking
PART A.
1.0 GOODS MARKING AND TRANSPORT
1.1 Goods marking
Each case is marked with the case number on at least two sides (for exports - four sides) and gross weight on one short side. Case number and gross weight are painted in black directly on the case. Other information is written on a plywood disc/label, which is max. 620 x 480mm with a standard text height of 20 mm. If not otherwise specified by the customer. This plywood disk/label is fastened on two sides of the case.
In addition to the above, the cases are marked with the following symbols, in black. These should be observed when choosing lifting equipment.

- Glass porcelain handle with care
- Up
- Center of gravity
- Must be protected from moisture and rain

Fig. A

Fig. B
1.2 Transport
The circuit-breakers shall be transported in their transport units and never without packing. The cases shall be transported in such a way that they:
- Do not stand in water.
- Are not exposed to damage
Every case must be secured during transport. They must be arranged so that the cases cannot move in any direction. The speed must be adapted to the road conditions.
- Factory packed Breaker should not be stacked one over the other.

1.3 Lifting
Before lifting the case, observe the information on it (such as symbol, weight, etc.). the cases shall be lifted by a lifting device equipped with forks or slings (see Fig C). If a crane is used, slings shall be used. The units must not be rolled or dropped.

Fig. C Lifting the case

1.4 Lifting the breaker out of the case
Lifting the breakers out of the transport cases is necessary only just before erection (see product information which can be found on the inner side of the operating device door). If they are to be stored during some time, see "Storage Prior to Erection".
2.0 STORAGE PRIOR TO ERECTION

2.1 General
Circuit-breakers intended for outdoor operation are generally delivered in units, which are designed for transport purpose.
Intermediate storage of these units should be avoided. If it is not possible, then to avoid intermediate storage, they should be stored indoors or under roof. They must also be stored on a plane surface above ground level to prevent breaking and water seepage. On arrival it is important that plastic sheets are removed in order to prevent corrosion by condensation (except for the spare parts; see separate instructions).
Storage in a humid climate without proper ventilation may lead to discoloration of the galvanized surface. This discoloration is normally known as "White rust" consisting mainly of Zinc hydroxide and is a result of a chemical process between the pure zinc on the surface and moisture.
The long-term corrosion protection is not influenced, since the iron-zinc layer below the surface remains unaffected. The presence of white rust is no reason for rejection of goods.
On arrival, each unit should be checked in the following way:
- Delivery is in accordance with order and delivery documents.
- Any damage in delivery, and material loss.
In cases where damage is detected or suspected, the units should be opened and damages must be photographed. Both damage and shortages should be reported.
In general all material should be stored in an approved storage (Note 1, Page 8). The ambient air should not be heavily contaminated by dust, smoke, corrosive or combustible gases, vaporous and salt, otherwise the equipment must be cleaned before erection.
The original transport unit may be used for storage. The coupling joints of the assemblies, as well as connections, are fitted with transport covers or protective caps, which shall not be removed till erection.
- Factory packed Breaker should not be stacked one over the other.
The medium voltage circuit breaker type VBF is delivered firmly secured to the floor/bottom of their containers or crates and must always be transported or stored with care. The circuit breaker is transshipped in suitable packing in the contact open position (off) and with closing spring discharged.

2.1.1 Receipt
Each delivery is to be checked on receipt for,
- Completeness and correctness. (Check against order and delivery documents)
- Any possible damage in transit and material losses.
- Abnormality, if any, must be notified immediately to: ABB, Nasik, forwarding agents and the insurance company.
2.2 Operating Mechanism
The operating mechanism should be unpacked on arrival. If it is not going to be stored in an approved storage (Note 1), the heating elements must be connected permanently to the electric supply to protect the control equipment from corrosion or freezing damage.

2.3 Circuit-breakers
The breaker should be stored in their original transport units, where they are well protected from damage. The unit shall be prevented from standing in water. The breakers which are stored outdoors, should be covered with at least a tarpaulin. The tarpaulin should not be placed directly onto the galvanized surface. An air gap should be left to prevent condensation.

The minimum allowed ambient temperature for the Outdoor Vacuum Circuit Breaker is -30°C.

2.4 Spare parts
The spare parts shall be stored indoors in an approved storage (Note 1), in their original units. This is particularly valid for rubber sealing parts, which must also be protected from sunlight in order to prevent them from ageing. Rubber sealing can be stored only for a limited period, so avoid storage of these parts. Structures may be stored outdoors.

Note 1: We define an approved storage with:
- Roof
- Solid ground
- Relative humidity less than 50%
- Temperature 20°C (± 10°C)
3.0 SAFETY PROVISIONS AND ASSEMBLY INSTRUCTIONS
FOR CIRCUIT-BREAKERS WITH OPERATING DEVICE

Read carefully the entire assembly instruction before starting assembly work.

3.1 Warning texts
Warning texts are stated in 5 different degrees of urgency, which should be carefully observed. These are described below:

- **DANGER** indicates an immediate risk situation that can lead to death or serious personal injury if not avoided.

- **Warning** indicates a risk situation that can lead to death or serious personal injury if not avoided.

- **Caution** indicates a risk situation that can lead to small or moderate damage.

- **Note** is used when there is danger that can lead to equipment damage only.

- **Important** indicates an operation or a suggestion for handling.

3.2 Unpacking
- Place the case horizontally on a flat surface before opening the cover.

- Check that all parts are included in the delivery. Check the packing list.

- Check that no parts have been damaged during transport; especially the porcelain insulators.

- Report any faults immediately to the ABB representative.
### 3.3 Safety Precaution

When working on high-voltage circuit breaker the below-mentioned risk must be taken into consideration and corresponding safety measures taken.

<table>
<thead>
<tr>
<th>RISK</th>
<th>SAFETY MESAURES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1) Work next to high voltage</strong></td>
<td>Warning plate is placed inside the door of the operating device.</td>
</tr>
<tr>
<td></td>
<td>Disconnect the supply and earth near the workplace. If work must be carried out near energized parts of the plant, it has to follow local safety regulation of the organization responsible for the circuit breaker.</td>
</tr>
<tr>
<td><strong>2) Work on ladders and platforms</strong></td>
<td>The work shall follow the directions of the authority for occupational safety and health. Avoid work in severe weather conditions, which entails a great deal of climbing for short periods.</td>
</tr>
<tr>
<td><strong>3) Work with low- voltage. Both D.C. and A.C. voltage may be drawn</strong></td>
<td>Do not connect control or heating voltage until all connection work is completed.</td>
</tr>
<tr>
<td><strong>4) Risk in operating mechanism and link system</strong></td>
<td>Warning plate is placed on the supporting frame. No work must be carried out unless the closing and opening springs are discharged, the circuit-breaker is in position OFF &quot;0&quot; and the supply to the motor is disconnected. The operating mechanism must not be operated unless it is connected to the circuit.</td>
</tr>
<tr>
<td><strong>5) Work on pressurized porcelain Insulators.</strong></td>
<td>Work close to the insulators of the circuit breaker that entails risk of porcelain damage must not be carried out until the gas pressure has been lowered to 1.0 bar absolute pressure.</td>
</tr>
</tbody>
</table>
PART B.
VBF Instructions for Erection, Operation & Maintenance.

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  1.1 Type designation
  1.2 Specifications
  1.3 Weight of the Circuit Breaker

2.0 Design
  2.1 Breaker Pole

3.0 Function
  3.1 Switching operations
  3.2 Closing operation
  3.3 Opening operation

4.0 Erection
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  4.2 Erection procedure
    4.2.1 Foundation details
    4.2.2 Various parts of structure assembly
    4.2.3 Assembly sequence for structure
  4.3 Dismantling of cases
    4.3.1 Unpacking of cabinet
    4.3.2 Unpacking of duct & pole assembly
  4.4 Assembly of duct-with-pole on cabinet
  4.5 Assembly of entire circuit breaker on structure
  4.6 Connection of driving-link with composite lever
  4.7 High voltage connection
  4.8 Low voltage connections
  4.9 Earthing
5.0 Commissioning
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  5.2 Wiring
  5.3 Cleaning
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  6.3 Lubrication
  6.4 Maintenance Schedule
  6.5 General Inspection of the circuit breaker
PART B.
VBF Instructions for Erection, Operation & Maintenance.

General

1.0 Validity

This operating instruction is applicable for Outdoor circuit Breaker type VBF.

1.1 Type designation

<table>
<thead>
<tr>
<th>Type designation</th>
<th>VBF</th>
<th>36</th>
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<td>Outdoor Vacuum Circuit Breaker</td>
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Type VBF

Rated voltage –

24 for 24kV
36 for 36kV

Rated normal current -

12 for 1250 Amp
16 for 1600 Amp

Rated breaking capacity – 26.3kA
1.2 Specifications

Specifications are contained in the order documentation and on the nameplate.

<table>
<thead>
<tr>
<th>Type</th>
<th>Vacuum Circuit Breaker VBF 36</th>
</tr>
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<tbody>
<tr>
<td>Sr. No.</td>
<td>Breaker production Serial No.</td>
</tr>
<tr>
<td>Year</td>
<td>Year of manufacture</td>
</tr>
<tr>
<td>Standard</td>
<td>IEC – 60056-1987</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>36kV</td>
</tr>
<tr>
<td>Frequency</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Insulation level</td>
<td>70/170kVp.</td>
</tr>
<tr>
<td>Normal current</td>
<td>1600 Amps.</td>
</tr>
<tr>
<td>Short circuit breaking current</td>
<td>26.3 kA</td>
</tr>
<tr>
<td>Operating sequence</td>
<td>0-0.3S-CO-3 Min.-CO</td>
</tr>
<tr>
<td>Weight</td>
<td>800 kg.</td>
</tr>
<tr>
<td>Auxiliary voltage</td>
<td></td>
</tr>
<tr>
<td>Closing coil</td>
<td>Voltage of closing coil</td>
</tr>
<tr>
<td>Operating coil</td>
<td>Voltage of opening coil</td>
</tr>
<tr>
<td>Motor (if applicable)</td>
<td>Voltage spring charging motor</td>
</tr>
<tr>
<td>Instruction Manual</td>
<td>1VDU28002-YN</td>
</tr>
</tbody>
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1.3 Weight of the Circuit Breaker

The weight of a complete circuit breaker is approximately contributed by

- Weight of Pole column without mechanism: 300 kg.
- Weight of structure with mechanism: 400 kg.
- Weight of Transmission system (with Duct): 100 kg.

(Without CT Structure)
2.0 Design
The circuit breaker type VBF is a three pole vacuum circuit breaker and designed in a column type construction with “spring stored energy operating mechanism” mounted beneath the middle part. It consists of, (Refer Fig.2 Page 61)

- Interrupting chambers – Fi
- Terminals (Al alloy) - Aa
- Supporting insulator-Vi
- Support structure – Vs
- Control cabinet with spring stored energy mechanism – Ms
- Foundation bolt – Fb.
- Current transformer [CT] mounting structure – VsCT [Optional]
- Earthing point - Ge

2.1 Breaker Pole
The breaker pole consists of (ref. Fig.3a, 3b Page 62,63)
- Insulator body - 10001
- Vacuum interrupter - 10201
- Lamellar contact - 10017
- Current collecting hub - 10502
- Upper and lower terminal - 10008 & 10501
- Insulating Rod - 10300
- Crank Housing - 10401

The poles are filled with SF6 or Nitrogen gas individually at a pressure of 1.6 bar (abs).

3.0 Function
The typical schematic circuit diagram of the breaker shown in Fig.4 (page 64). The control circuit can also be referred in the order-bound engineering drawings.

3.1 Switching operations
As supplied from ABB Limited, Nasik the circuit breaker will be in open position and closing spring in discharged condition. When the control supply is given to the breaker, closing spring will get charged automatically by means of spring charging motor.

3.2 Closing operation
To close the circuit breaker the “CLOSE” control element is actuated either electrically through the closing magnet or mechanically through push button arrangement. This enables the, spring stored energy mechanism to release the spring energy, through
the linkage system, which rotate the common shaft. The rotation of the common shaft moves the moving contact of all the poles upward through the operating stud, closing the circuit breaker. This movement also exerts the required contact pressure on the moving contact.

3.3 Opening operation
To open the circuit breaker, the "OPEN" control element is actuated either electrically through the opening magnet or mechanically through push button arrangement. This enables the spring stored energy mechanism to release the spring energy through the linkage system, which rotate the common shaft in opposite direction. This rotation forces the moving contact of all the poles to move downward, opening the circuit breaker.
4.0 ERECTION

4.1 General
As supplied from ABB Ltd., Nasik the circuit breaker are complete in all respect with all the necessary settings for smooth and trouble free operations of the circuit breaker. All the moving parts of the circuit breaker are positioned correctly and coupled together and they are well secured with the fasteners.
It is recommended to use standard tools and standard practices for lifting and transport of the circuit breaker at time of erection so as to avoid mechanical damage of the pole parts. In general the lifting of the circuit breaker shall be done as shown in Fig.1 (page 60).

4.1.1 Preparations
The following are to be made available --
An erection crane with a load carrying capacity of about 1500 kg, and a crane hook with height of at least 4 m (= 13 feet) above the floor.
● Lifting ropes.
● Dimension drawings, erection drawings, wiring and circuit diagram.
● Torque wrench for a range of 6-100 NM
● Circlip pliers.
● Commercially available set of open and ring spanners size from 7 mm to 43 mm.
● Cleaning and working material like cloth etc.
● Conducting grease.
● Spirit level.

4.2 Erection procedure
Circuit Breaker can be transported in three parts as explained below.
1 Cabinet with Spring-Mechanism Drive & Electrical wiring & apparatus.
2 Duct-with-Poles and the inter-pole-links.
3 Structure Assembly
In some cases CB is transported in two cases
1. Complete CB
2. Structure assembly.

Before delivery, both Tripping and Closing Springs are discharged and Circuit Breaker kept in OPEN position.
Before starting erection ensure that,
● Foundation with Foundation Bolts as per drawing is ready [Refer Fig. 1, 2 Page.18,19]
● Loose material as per list is available [ Refer Page No.20 for List]
● Crane for lifting the circuit breaker is available.
● General purpose tools for erection are available
4.2.1. Foundation Details:

![Diagram of Foundation Plan for Outdoor Circuit Breaker without CT Structure]

- **Figure 1.** Foundation Plan for Outdoor Circuit Breaker without CT Structure

- **SECTION ‘A-A’**
- **Foundation Bolt**
  - M20 X 500

- **TIGHTEN NUTS FULLY AFTER CEMENT HAS SET IN**
- **FRONT**
Figure 2. Foundation Plan for Outdoor Circuit Breaker with CT Structure

TIGHTEN NUTS FULLY AFTER CEMENT HAS SET IN

SECTION 'A-A'

Foundation Bolt M20 X 500
4.2.2. Various parts of Structure assembly:

List of the parts of structure
1. Upper Leg Assly - 2 Nos.
2. Lower Legs Assly – 2Nos
3. Support Angles(front and rear) 2 Nos
4. Stiffeners – 2Nos
5. Cross-Angles. – 2 Nos
6. Foundation Bolts- 4 Nos [2 Nos additional for CT structure ]

List of the additional parts for CT structure
7. Lower Leg Assly – 2Nos
8. Upper Leg – 2 Nos
9. Support Angles – 2 Nos
10. C-Channel for C.T/P.T.- 1 No

One Spanner each [open & ring] of size 18x19 & 24x27 needed to assemble the structure
4.2.3. Assembly sequences for Structure:

- Fix the Lower Leg Assly as shown in Fig. 4.
- Fix M20 Plain Washer, Spring Washer & Hex nut or Expansion Bolts in case the foundation is with expansion Bolts.
- Keep Nuts slightly loose for flexibility during entire assembly of structure,
- Fix Lower Legs of CT Structure Assembly [optional] as per Fig. 5.

Fig. 4 Arrangement without CT structure

Fig. 5 Arrangement with CT Structure [Optional]
Now fix Cross-Support Angles (5) as shown in Fig 6 Using M12 bolts, spring washers, plain washers & Hex Nuts.

Slide Upper Leg Assembly (1) into Lower Leg Assembly to achieve height as per your requirement, Structure can be adapted to three different heights.

Fix Support Angles(3) and M12 bolts, spring washers, plain washers & Hex Nuts.

For the sake of flexibility, do not fully tighten the fasteners.
Fig. 7 Circuit-breaker Structure Assembly with CTs

- Slide Upper Leg (7) in Lower Leg assembly & assemble using M12 bolts, spring washers, plain washers & Hex Nuts.

- Fix Support-Angles(9) on Upper Leg Assembly(1) & (7) as shown in Fig. 7

- Fix Cross-Angles (11)

- Fix CT Frame(10) on the Support Angles(9)

For the sake of flexibility, do not fully tighten the fasteners.
4.3 Dismantling of Cases

4.3.1 Unpacking of Cabinet

- Remove top & all side covers of casing containing Cabinet Assembly.
- Do not remove the bottom pallet.
4.3.2 Unpacking of Duct & Pole Assembly

- Remove top & all side covers of casing containing Poles-with-Duct Assembly.
- Hold Poles-with-Duct Assembly by lifting crane as shown in Fig.9
- Remove the M8 Bolts from the rear covers of the Duct & open the rear cover.
- Free Poles-with-Duct Assembly by removing bolts as shown in Fig.9
- Lift entire assembly & place it on the Cabinet.

Fig. 9 Unpacking of Poles-with-Duct Assembly
4.4 Assembly of Duct-with-Poles on Cabinet:

Assemble Poles-with-Duct & Cabinet assembly together using M12 bolts, spring washers plain washers. [M12 Nuts are welded inside the cabinet both at top & bottom]

Now remove the bolts from the pallet as shown in Fig.10 [Bolts can be removed without opening the Cabinet]

Lift the entire assembly to the ready structure.

Fig. 10 Assembly of Poles-with-Duct & Cabinet

- Assemble Poles-with-Duct & Cabinet assembly together using M12 bolts, spring washers plain washers. [M12 Nuts are welded inside the cabinet both at top & bottom]

- Now remove the bolts from the pallet as shown in Fig.10 [Bolts can be removed without opening the Cabinet]
4.5 Assembly of entire Circuit-Breaker on structure

- Refer Fig. 11 before going for assembly.
- Slowly lower the Circuit-Breaker in such a way that the Cabinet enters inside the Upper Leg Assemblies & rests on the support angles & the Duct rests on the Upper Leg Assemblies of structure.
- Ensure Stiffener-Plates are put inside the duct & assemble the structure with duct using M12 bolts, spring washers, plain washers & Hex Nuts.
- Engage Cabinet with the support angles. Fix M12 bolts, spring washers, plain washers from bottom of the support angles. [M12 Nuts are welded inside the cabinet]
- This completes the assembly.

Now fasten all hardware; do not remove ropes until all hardware are fastened fully & fix Current transformer on C-Channel frame (optional)
Fig. 11 Fixing the Breaker on the structure

- Ensure Stiffener plates are put inside the Duct
- Fix Cabinet with Duct Assembly on support-angles & fix M12 bolts, washer & Spring Washer from bottom
4.6 Connection of Driving-Link with composite-lever:

These figures are of Y-pole

- Remove the pin and U-Clip from the lever arm
- Rotate the Composite-Lever such that the hole of the lever-arm matches with the hole in Driving Link & insert the pin
- Insert the Pin from back and put U-Clip

- This completes the assembly.
- Now fasten all the hardwares
- Remove the lifting-ropes & wooden blocks.
- Carry out pre-commissioning tests as described in Commissioning Section
4.7 High voltage connection

The high voltage connection fasteners shall be preferable of M12 size stainless steel bolts/galvanized bolt and nut and at least one washer and 1 spring washer. Terminal connectors (Aa - Fig.2, page no 61) should be properly cleaned using SS wire brush to remove the aluminum oxide film and conducting grease to be applied. The cable terminals shall be connected in such a fashion that clearances are maintained properly.

4.8 Low voltage connections

The Auxiliary circuit connections shall be checked as per relevant schematic diagram for correctness (See Fig.4, page no.64 for typical schematics) A removable gland plate is provided in the bottom of the control cabinet (Fig.2 page no. 61), which can be suitably drilled as per control cable glands.

4.9 Earthing

Earthing connection should be made as shown in GA drawing (Fig. 2, page no. 61). All earthing joints should be securely bolted together. Connections to the station earthing should have a cross section, not less than that of the earth connection pad welded on the structure.
5.0 Commissioning

5.1 General checks
All necessary settings and adjustments have been made and the units have been fully tested both electrically and mechanically before dispatch at the factory. Hence, normally no setting and adjustment are required at the site.

5.2 Wiring
Unit wiring is identified by numbered ferrules. Any external wiring required should be done at site as per the relevant schematic diagram fig.4, Page 64.

5.3 Cleaning
All the insulating parts, porcelain insulator should be cleaned either with chamois leather or equivalent cloth. These insulating parts should not be cleaned with a material, which will deposit loose fibers.

5.4 Electrical checking

5.4.1 Low voltage circuits
The auxiliary circuit wiring shall be checked with a 500V or 1kV Megger. The insulation resistance shall be about 2 mega ohms.

5.4.2 High voltage circuits
Prior to commissioning the breaker, or putting it back into service after a maintenance outage, the insulation resistance of the high voltage circuit shall be checked using a 5kV Megger.
The breaker shall be earthed and isolated from other equipment before doing this test. All insulation parts shall be clean and dry.
The insulation resistance shall be checked for the following configuration,

A Circuit breaker in open position
- Across open contact of each phase.
- Between top terminal and earth of each phase.

B Circuit breaker in close position
- Between terminals and earth.

If the insulation resistance values are satisfactory (more then 100 mega ohms), then a high voltage test with 70kV for 1 minute shall be done for other configurations, similar to Megger test.
If the insulation resistances are appreciably lower then 100 mega ohms, an inspection for insulation fault should be made before proceeding with high voltage test.
5.5 Checking the soundness of vacuums interrupters
Before putting the breaker in service or if any interrupter is suspected for leakage, then the interrupter shall be checked for satisfactory level of vacuum by applying a high voltage of 56 kV across the open gap of the interrupter for a period of 1 minute. Care should be taken to ensure that the external sequential isolators are opened prior to high voltage application.

5.6 Space heaters
A space heater is provided in the control cabinet. The heater switch must be always "ON" when the breaker is in service to prevent condensation.

5.7 Final commissioning check
When breaker has been installed and all mechanical and electrical connection completed, EXCEPT ENERGIZING THE POWER LINE, the following points of inspection are recommended.

Mechanical and electrical inspection
1. See that the unit is properly bolted in place and essentially level on its foundation.
2. Make a check for the tightness of hardware.
3. See that the operating mechanism is free of packing or foreign material, and operate freely. Lubrication is generally not required and should be applied sparingly if necessary.
4. Terminal connection should be secured tightened.
5. Check control cable entrance fitting for tightness.
6. Examine control wiring insulation for evidence of chafing or abrasion. If desired, a dielectric test can be made, duplicating details of production tests, as described earlier in this book.
   Check connections, according to schematic or connection diagram.
7. See that all covers and bolted connectors are securely in place.
8. Make a continuity check, preferably one, which involves measuring resistance in micro-ohm magnitude, to determine tightness of bolted joints. Also make the over voltage test on each interrupter for at least one minute. If interrupter has lost the vacuum, the open contacts quickly flash over, in a positive manner, well before the adjustable hi-pot tester can reach 70kV.

All the data/parameters, which are checked and measured, shall be entered in a commissioning record and kept for comparison. The final trial switching operations shall be carried out on fully erected circuit-breaker isolated from the high voltage system and earthed according to recommendations. Once the auxiliary circuit is connected to the low voltage system, in case of spring charged operating mechanism, the spring charging motor gets the supply and charges the spring. The supply will cut off automatically by means of the motor cut off micro-switch. Now, the breaker is ready for closing operations and the closing operation can be done as described earlier.
5.8 **Starting conditions**
The erected circuit breaker is isolated from high voltage system and earthed according to regulation. The control current circuit is connected to the low-voltage system.

5.9 **Function test**
Check correspondence with the customer related diagram and that the connections have been made correctly. Then the trial switching can be carried out from a protected position.

The trial switching may be performed if:
- The circuit breaker is isolated from the high voltage and earthed according to regulations.
- The spring tension indicator of the spring operated mechanism indicates the position “tensioned”

5.10 **Trial switching operations**
Give few Close/Open command and see that the breaker Close/Open Properly.

5.11 **Anti-pumping device**
- Issue a "close" command by applying a control voltage to terminal 101 & 102 leave the voltage applied. The breaker will close.
- Issue open command by applying a voltage to terminal 103 & 104. The breaker will open.
- After the interruption by OPEN command the circuit breaker should not re-close in spite of the CLOSE command still being present.

Note:
The ESH operating mechanism on VBF circuit breaker is fitted with a mechanical anti-pumping device, which prevents re-closing due to either electrical or mechanical commands.

5.12 **Check of heaters:**
Measure the resistance or apply voltage and measure the current, when the thermostat controlled additional heater is installed, check the adjustment of thermostat.

5.13 **Concluding Work:**
- Remove all test and measuring equipment.
- Connect circuit breaker to high voltage power lines.
- Make sure that safety regulations are followed.
- Take the breaker in to service.
6.0 Maintenance

6.1 Caution
Before carry out any maintenance it is essential to follow the procedure given below:
- The circuit-breaker is opened and the external sequential isolators are opened and the unit is properly earthed.
- The closing spring is discharged.

6.2 General
During normal service the circuit breaker require only limited maintenance. The frequency and the sort of inspection and maintenance basically depend on the service conditions.
Various factors must be taken into account e.g. frequency of operation; interrupted current values and relative power factor as well as the installation ambient.
The following table gives the maintenance schedule showing the relative time intervals between maintenance work. As far as the time interval between this operation is concerned, it is advisable to comply with specification given in the table.
On the basis of the result obtained during the periodic inspection, it is possible to set the optimal time limits for carrying out maintenance work.
Any circuit-breaker which will only operate a few times or which will remain closed (ON) or open (OFF) for long periods should be operated from time to time to prevent clogging which may cause a reduction in the closing or opening speed.

6.3 Lubrication
All the sliding parts of operating mechanism and linkages subjected to friction must be lubricated at the specified time interval with self-lubricating grease BR plus 100.
## 6.4 Maintenance Schedule

**Maintenance check schedule**

<table>
<thead>
<tr>
<th>Maintenance operation</th>
<th>Installation in normal ambient</th>
<th>Installation in dusty or polluted ambient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carry out the general inspection (For details, refer clause 7.4)</td>
<td>2 years</td>
<td>1 year</td>
</tr>
<tr>
<td>Measure the insulation resistance</td>
<td>4 years</td>
<td>2 years</td>
</tr>
<tr>
<td>Lubricate the sliding points</td>
<td>2 years</td>
<td>1 year</td>
</tr>
<tr>
<td>Carrying out the operating mechanism maintenance</td>
<td>Five years or every 10000 operations</td>
<td>Three years or every 5000 operations</td>
</tr>
<tr>
<td>Complete overhaul</td>
<td>Ten years or every 10000 operations</td>
<td>Five years or every 10000 operations</td>
</tr>
<tr>
<td>Connection of electronics circuit</td>
<td>2 years</td>
<td>1 year</td>
</tr>
<tr>
<td>Cleaning of electronic circuit</td>
<td>2 years</td>
<td>1 year</td>
</tr>
<tr>
<td>Retention of spring circlips and spring washer</td>
<td>2 years</td>
<td>1 year</td>
</tr>
<tr>
<td>Part subjected to</td>
<td>Abnormalities noticed</td>
<td>Remedies</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Spring operated mechanism</td>
<td>Presence of dust on the mechanism</td>
<td>Clean with a dry brush or cloth</td>
</tr>
<tr>
<td></td>
<td>Distorted or oxidised spring</td>
<td>Replace the damaged spring</td>
</tr>
<tr>
<td></td>
<td>Locking rings out of place, loose nuts or screws.</td>
<td>Re-fix the locking rings in Their position and tighten the nuts &amp; screws</td>
</tr>
<tr>
<td>High voltage breaker pole parts</td>
<td>Presence of dust or dirt on the the insulating parts</td>
<td>Clean with a dry brush or cloth</td>
</tr>
<tr>
<td></td>
<td>Locking rings out of place, loose nuts or screws.</td>
<td>Re-fix the locking rings in Their position and tighten the nuts &amp; screws</td>
</tr>
<tr>
<td></td>
<td>Distortion or cracking of the insulating parts</td>
<td>Ask ABB Nasik for replacement of the damaged parts</td>
</tr>
<tr>
<td></td>
<td>Trace of overheating or loose screws on the connection to the circuit breaker terminals</td>
<td>Clean the connections and the breaker terminals with a rough rag soaked in a suitable solvent cover them with neutral grease and tighten the screw</td>
</tr>
<tr>
<td>Earthing connection</td>
<td>Trace of the oxidation and / or loose nuts</td>
<td>Clean with a rough cloth soaked in a suitable solvent. Tighten the earthing connection fully and cover it with neutral grease</td>
</tr>
<tr>
<td>Auxiliary circuit supply voltage</td>
<td>Check the supply voltage of the operating mechanism electrical accessories</td>
<td>The close/ opening coils must operate correctly for values between 85% and 110% of the relative rated voltage</td>
</tr>
<tr>
<td>Operating and control elements</td>
<td>Carry out the functional tests</td>
<td>Replace the damaged or faulty elements (if necessary as ABB Nasik)</td>
</tr>
</tbody>
</table>
PART C OPERATING MECHANISM WORKING PRINCIPLE AND MAINTENANCE

1.0 Spring charged mechanism
  1.1 General
  1.2 Construction
  1.3 Operating mechanism - Working principle
    1.3.1 Electrical spring charging
    1.3.2 Manual spring charging
  1.4 Breaker Operation
    1.4.1 Closing operation
    1.4.2 Opening operation
  1.5 Maintenance of Operating Mechanism
    1.5.1 Maintenance Schedule.
    1.5.2 Fault finding chart
    1.5.3 Replacement of operating coils
    1.5.4 Replacement of micro-switch
    1.5.5 Replacement of motor
    1.5.6 Replacement of mechanism
    1.5.7 Recommended spares parts

2.0 Breaker pole
  2.1 General
  2.2 Dismantling
  2.3 Assembly of the pole
PART C

OPERATING MECHANISM

1.0 Spring charged mechanism

1.1 General
The operating mechanism has a spring charging device, which can be operated by motor or manually. The operating device has helical tension spring for closing and opening. The opening spring is charged automatically when the breaker is closed. A closed breaker with charged closing spring can thus be operated OPEN - CLOSE - OPEN without intermediate motorized or manual charging, and the breaker can, therefore, be used for auto re-closing duty cycle.

An indication shows whether the closed spring is charged or not, and the number of opening operations are recorded by the counter.

The motor can be supplied via station battery, a network or via transformer with a limit load of at least 500 VA. The motor starts after each closing operation and charges the closing springs within 15 seconds.

1.2 Construction
The construction of the operating mechanism is shown in FigA, Page 39

Major components of ESH mechanism are:

1. Closing Spring
2. Tripping Spring
3. Geared-Motor
4. Push Button Assembly
5. Closing Coil
6. Tripping Coil.
8. Auxiliary switch.
9. Spring Charged indication
10. Breaker ON/OFF indications
11. Bottom Shaft (Charging Shaft)
12. Top Shaft (Power Shaft)
Fig. A
1.3 Operating mechanism - Working principle
There are two options for charging the springs

1. By electric motor.
2. Manual operation

1.3.1 Electrical Spring Charging (Ref Fig B)
Spring charging unit consists of Arm (1), Charging gear (2), Closing Spring (3), latches (4), reduction gear with Spring charging Motor and Cam (5). Closing - Spring assembly & charging gear are mounted on power shaft. When the Motor rotates, the reduction gear connected to that gives 1/144 reduction. Reduction gear assembly is connected axially with the Cam that rotates the spring-charging arm.

The arm rotates the charging gear, at the same time; the latches hold the charging gear and arm returns to its position. Closing spring gets stretched and this continues till the spring gets fully charged. The backward rotation of the charging gear (2) is prevented by latches (4). A plastic cam activates Motor-cut-off switch & Spring Charged indication will appear after full charging. Closing lever (6) stops the shaft from further rotation. Motor cutoff switch disconnect the supply of the motor.

Fig F (page 31) shows initial stage of closing spring and associated lever (L1).
FigG (page 31) shows the condition after closing spring gets fully charged. During this process latch L1 rotates of about 180°.
Fig C Mechanism in open condition & both the springs in discharged condition

Fig D Closing spring is charged, ready for closing operation
The spring charging motor charges the springs after each closing operation until the spring-charged indication appears. Should there be no voltage during charging, the geared motor stops, and starts recharging the springs automatically when the voltage is on again. It is, however, always possible to complete the charging operation manually. Motor supply gets cut-off automatically as the spring gets completely charged.

1.3.2 Manual Spring Charging
For charging the Closing-springs manually, fully insert the charging handle into the seat and rotate it clockwise until you see the spring-charged indication. **Ensure the handle is engaged with the seat.**
The force, which can normally be applied to the charging handle, is 130 N. In any case, the maximum force applied must not exceed 170 N. As the springs get charged, a sound [internal latches getting engaged] can be heard.
The arm won’t rotate the charging-gear further, since the charging-gear has no teeth on remaining periphery.

1.4 Breaker Operations:

1.4.1 Closing Operation:
Consider both the springs are in discharged condition and breaker is open (Ref Fig. E, Page 43) In this condition neither close nor open operation is possible to perform on the breaker. Latch assembly (La) and (Lb) are in released condition. The closing spring can be charged either electrically or manually as explained in section 1.3. During the process of charging pin (P1) comes in contact with closing lever (Ref Fig F, Page 43). Pin (P1) will creates pressure on closing lever as closing spring is fully charged. Position of the closing lever in this condition is retained by half shaft.
If close command is initiated now, it will rotate half shaft (Ref Fig. G). Rotation of half shaft will release closing lever and hence charging gear. Due to this spring energy stored in closing spring acts on power shaft, which will cause the rotation of the cam mounted on the power shaft. Mechanism lever (Ref. Fig.G) is resting on the outer periphery of this cam, which is directly connected to charging shaft. Rotation of cam will push this mechanism lever upwards, this will results in rotation of the charging shaft. Tripping lever is mounted on same charging shaft. One end of this tripping lever is connected to common shaft of the breaker via link, and another end is connected to tripping spring. Rotation of around 90° will close the circuit breaker as well as charging of the tripping spring.
1.4.2 Tripping Operation:

Now with previous reference consider tripping spring is in charged condition. Fig. H shows the charged condition of the tripping spring and internal detail for position of different components. Latch Assembly (La) and (Lb) engaged with each other. Engagement of (La) and (Lb) will confirm that breaker will not open in this condition unless and until the opening command is initiated.
If trip command is initiated now, it will pull the latch (Ref. Fig. I). Hence its engagement with the latch assembly will break. This will move the latch assembly La in downward direction. Downward movement of latch assembly will release the latch Lb. Hence there is no more pressure or any engagement that will retain the current poison of arm and leverage. Armand leverages are free to move now. As previously discussed these components are directly connected to charging shaft. Tripping spring directly exerts pressure on the shaft via tripping lever. As leverage becomes free to move tripping spring will pull back the tripping lever and open the circuit breaker.
1.5 Maintenance of Operating Mechanism

Before carrying out the maintenance of operating mechanism ensure that the breaker is open, the sequential isolators are open and the closing and opening springs are discharged.

1.5.1 Maintenance schedule

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Description</th>
<th>Before start Up</th>
<th>Every 1000 operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Checking of operating mechanism.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2.</td>
<td>Checking of fastener tightness.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3.</td>
<td>Checking of shock absorbers for leakage or struck up.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4.</td>
<td>Checking of various tension springs and bending springs for their proper place.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>5.</td>
<td>Closing and tripping spring assembly and split pin/ Circlip on them.</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>6.</td>
<td>Bearing items.</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>7.</td>
<td>Checking of Operation box Assembly for proper open/close operation.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>8.</td>
<td>Checking of setting. Proper engagement of lever on shaft.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>9.</td>
<td>Spring cut off micro switches.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10.</td>
<td>Lubrication of charging device and operating gear</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

**NOTE**

1. Complete overhaul of circuit breaker operating mechanism to be done after 10000 operation or 10 years, whichever is earlier.

2. Ask ABB Nasik for details of overhaul procedure.
# 1.5.2 Fault finding chart

<table>
<thead>
<tr>
<th>FAULT CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
</table>
| Spring does not get charged | Motor has wrong or no operating voltage.  
Motor shaft broken.  
Motor gear damaged.  
The latch for the tripping device does not function.  
Disconnection in the wires.  
Micro-switch arm wrongly adjusted.  |
| Closing of breaker does not take place although there is an indication that the springs are charged. | Breaker closes then opens again.  
Operating coils does not operate.  
The toggle joints of the mechanism are incorrectly adjusted.  
Wrong wiring of the auxiliary circuit.  
Wrongly adjusted clearances of opening magnets armature.  |
| Breaker continuously opens and closes. | Anti pumping relay wrong or faulty.  |
| | Measure voltage on the motor leads.  
Change motor.  
Change motor.  
Change mechanism.  
Check by measuring.  
Adjust the micro-switch operating arm.  |
| | Measure the voltage adjust the coils adjustment screw.  
Check the springs.  
Adjust the toggle joints.  
Check the wiring as per schematic drawing.  
Adjust the opening magnet.  |
| | Change relay.  |
1.5.3 Replacement of operating coil
Refer Fig.6 to 9, (page no 68 to 69) indicates the mounting arrangement for closing coils and the tripping coils.

1.5.4 Replacement of micro-switch
Refer fig. 14 & 15, (page no. 72) indicates the mounting arrangement for micro-switch.

1.5.5 Replacement of motor
Refer fig.11 to 13,(page no. 70 & 71) indicates the mounting arrangement for motor.

1.5.6 Replacement of operating mechanism
The operating mechanism shall be replaced in the following manner.
a. Disconnect the linkage of the operating mechanism to the main shall be replaced in the following manner.
b. Disconnect the electrical connection.
c. Loosen screws that fix the operating mechanism cabinet.
d. Take out the operating mechanism and fix new one.
e. Reconnect the electrical connections and the linkage of the main shaft. After fixing the operating mechanism the following check shall be carried out.
f. Charge the closing spring.
g. Close the breaker.
h. If required then adjust the micro-switch for proper operation.
i. Check the breakers with the auxiliary supply connect while charging at minimum operating voltage of the motor.
j. Take few operations for the new mechanism.
k. Seal various lock nuts of various settings with red paint.

1.5.7 Recommended spares parts
The following spares shall be kept to take care of any contingency

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name of parts</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spring charging motor</td>
<td>15032</td>
</tr>
<tr>
<td>2</td>
<td>Tripping/closing coils</td>
<td>15030(A,B)</td>
</tr>
<tr>
<td>3</td>
<td>Micro-switches</td>
<td>15033</td>
</tr>
<tr>
<td>4</td>
<td>Auxiliary switches</td>
<td>15027</td>
</tr>
<tr>
<td>5</td>
<td>Shock absorber</td>
<td>15007</td>
</tr>
<tr>
<td>6</td>
<td>Operating box assembly</td>
<td>15012</td>
</tr>
<tr>
<td>7</td>
<td>Opening transmission lever</td>
<td>15010</td>
</tr>
<tr>
<td>8</td>
<td>Closing transmission lever</td>
<td>15011</td>
</tr>
<tr>
<td>9</td>
<td>Operating Mechanism</td>
<td>15000A</td>
</tr>
</tbody>
</table>
2.0 Breaker pole

2.1 General
The Circuit Breaker uses well proven vacuum interrupters. Excellent arc quenching and insulating properties of vacuum offer long reliable service.

The construction of the pole of this breaker is very simple and has very less number of moving parts, so the operating energy level is very low, thus it requires practically no maintenance. The pole assembly is an independent assembly. Before you start dismantling the pole ensure that the breaker is isolated from the system and auxiliary supply. Also ensure that the breaker is in open condition and spring is in discharge condition.

2.2 Dismantling

1. Three poles of the breaker are mounted on the cross member called duct (fig 2, page 61). Remove the cover of the duct and disconnect the pole-operating pin.
2. Remove the hardware (10005, 10006, 10007) which connects the top insulator, lower terminal plate and bottom insulator, now lift the upper insulator and lower terminal plate such that pin 10018 and split pin 10019 can be easily visualize. Remove pin 10018 and split pin 10019 hence coupling between actuating stud 10204 and insulating rod 10300 will break.
3. Lift upper insulator 10001 and lower terminal plate assembly 10500 and keep it in clean and dust free area.
4. Pull out the lower terminal plate to detach it from upper insulator and interrupter assembly 10200.
5. Remove the top machined cover 10012 and bolt 10015 (which holds the vacuum interrupter) from upper terminal plate 10008 and take out the interrupter 10201.
6. Remove hardware (10003 to 10006), which will detach crank housing and support insulator, to separate out insulating rod 10300 from crank housing lift the support insulator such that pin 10412 and special clip 10413 can be easily visualize. Now remove pin and special clip and detach insulating rod from crank housing.
7. Lift support insulator and crank housing assembly and keep it in clean and dust free area.
8. Now, observe each and every component of the assembly for damage and wear.
9. Check the vacuum interrupter for its correctness. The correctness of vacuum interrupter can be checked for its vacuum level by following method. Hold the vacuum interrupter firmly and pull out.

2.3 Assembly of the pole (Refer Fig. 3a, 3b page 62, 63)
1. Clean all the components used in the pole.
2. Interrupter Assembly: -Insert the plug for lamellar contactor 10203 on the stem of the interrupter, next attach the actuating stud 10204 to same stem and tighten the assembly by applying proper torque. Fix the lamellar contact 10208 and guide ring 10203 in proper grooves provided on the plug 10202. Lubricate plug and lamellar contact with contact grease.
3. Place crank housing over duct; make attachment of insulating rod 10300 and lever 10417 by inserting pin 10412 and special pin 10413. Now lift the support insulator and place it over crank housing. Using appropriate hardware connect them to duct, tighten the entire component with proper torque.

4. Lift lower terminal plate assembly, insert the O-ring (big) 10002 on both the sides of the lower terminal plate 10501 and apply sealing grease. Before placing lower terminal plate over support insulator insert pin 10018 and split pin 10019 hence coupling between actuating stud 10204 and insulating rod 10300 will take place.

5. Now, insert the interrupter assembly in current collector hub 10018, which is fixed on lower terminal plate.

6. Lift upper insulator and place it over lower terminal plate, use appropriate hardware and assemble Upper insulator, lower terminal plate, support insulator.

7. Cover the top insulator by top terminal plate, before that fix O-ring 10002 on the top terminal plate and apply sealing grease. Engage it with flange of top insulator by appropriate hardware; eyebolts 10009 must be placed at their original position.

8. Fix the bolt 10015 & washer 10016 on the top terminal plate 10008, which firmly holds the interrupter. Initially keep this bolt loose till the relaxation of the contacts takes place.

9. Perform 5-10 manual operations on the poles by pulling the operating stud down for relaxation and alignment of the whole assembly. This will ensure the setting of lamellar contact assembly in the current collector hub.

10. Tighten the bolt 10015 on the top terminal plate with a torque of 90 Nm. Tighten all other nut bolts with torque of 67 Nm.

11. Insert O-ring 10011 on Cap 10012 and apply sealing grease, Fix the Cap on Top Terminal Plate using M12 bolt 10013 & Conical Washer 10014. Tighten the bolt.

This completes Breaker Pole Assembly
In case of failure please take a copy of this form is and complete it as fully as possible, to make feasible failure analysis and rectify it. For selecting options tick suitable box. If no alternative is applicable, proper description can be filled out in the space provided. Item description should be given for both circuit-breaker and operating mechanism.

### 1. Identification

<table>
<thead>
<tr>
<th>Date</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item designation</td>
<td>Serial number</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
</tr>
</tbody>
</table>

Order number -----------------------

### 2. Historical data

Condition of the breaker when the failure was detected (only one alternative to be selected)

- [ ] In service
- [ ] During maintenance
- [ ] During installation

------------------------------------------
Use of the circuit-breaker (Only one alternative to be selected)

☐ Line breaker
☐ Reactor breaker
☐ Capacitor breaker
☐ Transformer breaker
☐ By-pass breaker

Date taken into service----------------- Date of failure-------------------
Date of last overhaul------------------
Total number of operating cycles since taken into service------------------
Total number of operating cycles since last overhaul------------------

3. Characteristics of the failure (many alternatives may be selected)

☐ Does not close on command.
☐ Does not open on command.
☐ Closes without command
☐ Open without command
☐ Does not make the current
☐ Does not break the current
☐ Fails to carry current
☐ Breakdown to earth
☐ Breakdown between poles
☐ Internal breakdown across open pole
☐ External breakdown across open pole
☐ Locking on open or closed position
☐ Corona
☐ Loose parts
☐ Missing parts
☐ Faulty parts
☐ Corrosion
☐ Surface defect other than corrosion
☐ Incorrect function
Change in functional characteristics
- Incorrect closing time
- Incorrect opening time, coil I
- Incorrect opening time, coil II
- Incorrect damping
- Incorrect CLOSE/OPEN time
- Too high resistance
- Incorrect pre-insertion time for the resistors
- Incorrect time span between contacts

4. External circumstances
(Many alternatives may be selected)
- Strong wind
- Rain
- Sudden variation in temperature
- Snow, ice or hoar-frost
- Corrosive atmosphere
- Fog or high humidity
- Lightning

Ambient temperature( °C)

5. Component responsible (Many alternatives may be selected)

COMPONENT AT SERVICE VOLTAGE

Making and breaking unit
- Current collector hub
- Plug
- Laminar contact
- Top cap
- Interrupting Chamber insulator
- Vacuum interrupter
- Top terminal plate
- Bottom terminal plate

Main insulation to earth
- Post insulator
- Interrupting Chamber insulator

**ELECTRICAL CONTROL AND AUXILIARY CIRCUITS**
- Operating magnet
- Closing magnet
- Auxiliary contact
- Counter
- Control panel
- Limit switch
- Micro switch
- Thermal relay or heater
- Terminal blocks, cables
- Driving motor for mechanism

**OPERATING MECHANISM UNIT**
- ESH mechanism

Different Assemblies in ESH Mechanism
- Opening coil set up
- Closing coil set up
- Tripping spring assembly
- Electric motor
- Auxiliary switch
- Indicators
- Counter
- Opening breaker indicator
- Closing breaker indicator
Latch assembly for charging gear
Charging gear assembly
Charging lever group assembly
Shock absorber
Closing lever
Opening box assembly
Opening transmission lever
Closing transmission lever

Different assemblies in magnetic actuator
Electronics Unit
Charging Capacitor
Magnetic Actuator

Mechanical transmission
Mechanism housing
Operating Shaft
Lever
Common Shaft

Plates
Instruction plate
Rating plate
Cabinet
Packing

6. Consequences (Multiple alternatives may be selected)
Unplanned removal from service
Planned removal from service
Major disturbance
Minor disturbance
Fire or explosion
Removal from service of other breakers to prevent repetition of failure
Circuit-breaker downtime,
Beyond planned time (hours)
7. **Action taken** (Select only one alternative)
- Repair of defective component
- Exchange of defective component
- Exchange of circuit-breaker pole
- Exchange of operating device
- Exchange of circuit-breaker

**Action to be taken** (Select only one alternative)
- By personnel from ABB in Nasik
- By personnel from ABB in current company
- By customer's personnel

Time required to obtain spare parts (hours) ---------
Time required for repair (hours)-----------------------

Place: --------------------- Signature
Date: ---------------------- (Name & Designation)
# LIST OF DRAWINGS

<table>
<thead>
<tr>
<th>FIG. NO.</th>
<th>NAME OF THE FIG.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Lifting of Circuit Breaker.</td>
</tr>
<tr>
<td>2.</td>
<td>Circuit Breaker with ESH mechanism GA drawing.</td>
</tr>
<tr>
<td>3a &amp; 3b</td>
<td>Breaker pole Assembly</td>
</tr>
<tr>
<td>4.</td>
<td>Schematic Circuit Diagram</td>
</tr>
<tr>
<td>5A.</td>
<td>Parts of ESH Mechanism (detailed view)</td>
</tr>
<tr>
<td>5B.</td>
<td>ESH Mechanism with Cabinet.</td>
</tr>
<tr>
<td>5C.</td>
<td>ESH Mechanism with Operating rod and lever.</td>
</tr>
<tr>
<td>6.</td>
<td>Dismantling of operating coils setup.</td>
</tr>
<tr>
<td>7.</td>
<td>Steps for replacement of shunt opening release (Y02).</td>
</tr>
<tr>
<td>8.</td>
<td>Steps for replacement of shunt opening release (Y01).</td>
</tr>
<tr>
<td>10.</td>
<td>Operating Coils setup for temperature -10°C</td>
</tr>
<tr>
<td>11- 12</td>
<td>Steps for replacement of motor.</td>
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<td>14/15.</td>
<td>Steps for replacement of micro-switches.</td>
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### LEGENDS FOR FIG.3a, 3b (Page 62, 63)

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<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>10001</td>
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<tr>
<td>10002</td>
<td>O-Ring between Insulator Body &amp; Terminal Plates</td>
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<tr>
<td>10003</td>
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<td>10004</td>
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<td>10006</td>
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<td>10007</td>
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<td>10009</td>
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<td>10011</td>
<td>O-Ring between Top-Plate &amp; Cap</td>
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<tr>
<td>10012</td>
<td>Cap</td>
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<tr>
<td>10013</td>
<td>Hexagonal Head Bolt M8 x 30</td>
</tr>
<tr>
<td>10014</td>
<td>Conical Washer M8</td>
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<tr>
<td>10015</td>
<td>Hexagonal Head Bolt M16x40</td>
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<td>10016</td>
<td>Conical Washer M16</td>
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<tr>
<td>10018</td>
<td>Split Pin</td>
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<tr>
<td>10019</td>
<td>Pin</td>
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<td>10202</td>
<td>Guide Ring</td>
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<td>10203</td>
<td>Plug For Lamellar Contact</td>
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<td>Adapter</td>
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<td>10205</td>
<td>Safety Washer VS12 - FST</td>
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<tr>
<td>10206</td>
<td>M.S. Hex lock nut (M12X1.75X7)</td>
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<td>M12 Plain Washer</td>
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<td>10208</td>
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<td>10300</td>
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<td>10401</td>
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<tr>
<td>10402</td>
<td>Circlip for holding damper</td>
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<td>10403</td>
<td>Damper</td>
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<td>10405</td>
<td>Washer</td>
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<td>SPRING WASHER M6</td>
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<td>Pin</td>
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<td>Special Pin</td>
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<td>10415</td>
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<tr>
<td>10417</td>
<td>Crank Lever [inside]</td>
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<tr>
<td>10500</td>
<td>Bottom Terminal Assembly</td>
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<td>10501</td>
<td>Bottom Terminal Plate</td>
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<td>10502</td>
<td>Current Collector Hub</td>
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<td>10503</td>
<td>Bolt M8 X 35</td>
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<td>10504</td>
<td>M8 Conical Washer</td>
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## LEGEND FOR FIG. 5a, 5b, 5c (Page 65, 66, 67)

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<tbody>
<tr>
<td>15000A</td>
<td>Operating Mechanism</td>
<td>15017</td>
<td>Column For fixing Shield</td>
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<tr>
<td>15000</td>
<td>Closing Lever</td>
<td>15018</td>
<td>Bending Spring</td>
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<td>15001</td>
<td>Cam</td>
<td>15019</td>
<td>Hook Assembly</td>
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<td>15002</td>
<td>Charging Gear Assembly</td>
<td>15020</td>
<td>Hook Support Shaft</td>
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<td>15003</td>
<td>Charging lever group Assembly</td>
<td>15021</td>
<td>Intermediate Plate</td>
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<td>Tension Spring</td>
<td>15022</td>
<td>Front Plate</td>
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<td>Closing Spring Assembly</td>
<td>15023</td>
<td>Power Shaft</td>
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<td>15006</td>
<td>Indicator</td>
<td>15024</td>
<td>Bearing Spacer</td>
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<td>Shock Absorber</td>
<td>15025</td>
<td>Bearing</td>
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<td>15008</td>
<td>Counter</td>
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<td>Charging Shaft</td>
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<td>Tripping Spring Assembly</td>
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<td>15030</td>
<td>Shunt operating release(Y01,Y02)</td>
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<tr>
<td>15013</td>
<td>Shaft for Spring</td>
<td>15031</td>
<td>Shunt Closing release</td>
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<tr>
<td>15012</td>
<td>Operation Box Assembly</td>
<td>15032</td>
<td>Electric Motor</td>
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<tr>
<td>15013</td>
<td>Push button For Closing</td>
<td>15033</td>
<td>Micro-Switch</td>
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<tr>
<td>15014</td>
<td>Push button For Opening</td>
<td>15034</td>
<td>Common Shaft</td>
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<tr>
<td>15015</td>
<td>Opening Breaker Indicator</td>
<td>15035</td>
<td>Lever</td>
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<tr>
<td>15016</td>
<td>Posterior Plate Assembly</td>
<td>15036</td>
<td>Operating Rod</td>
</tr>
</tbody>
</table>
Fig. 1 Lifting of Circuit Breaker
CT - Current Transformer (Optional)

SECTION A-A

Total weight 900Kgs approx.
Creepage distance of bushing insulator 900 mm
Paint shade for control cabinet: As per Customer requirement
Insulator colour: Brown

Fig. 2 General Arrangement Drawing With ESH Mechanism
Fig. 3a Breaker Pole Assembly
Fig. 3b Details of Pole Assembly [* Refer Legend]
FIG. 4 TYPICAL SCHEMATIC DIAGRAM FOR VBF36
Fig. 5a  ESH Mechanism with Cabinet [* Refer Legend]
Fig. 5b  ESH Mechanism with Cabinet  [* Refer Legend]
Fig 5c  View from Rear side (Covers removed)
Dismantling of Operating Coils Setup

Unscrew the fixing screw of the release group mount

Withdraw the release group mount from the front of the operating mechanism. For assembly, proceed in the reverse order.

Steps for replacement of shunt opening release (Yo2)

Unscrew the four coil fixing screws (14) and withdraw the relative YC coil (15).

Unscrew the four coil fixing screws (19) and withdraw the relative Yo1 coil (18).

FOR ASSEMBLY, PROCEED IN REVERSE ORDER

Fig. 6

Fig. 7
Steps For Replacement of Shunt Opening Release (YO1) 15030

YO1 SHUNT OPENING RELEASE

When the YC shunt closing release is present, unscrew the four fixing screws (14) and withdraw it (15)

Unscrew the four fixing screws (17) and withdraw the relative YO1 release (16).

FOR ASSEMBLY, PROCEED IN REVERSE ORDER

Fig. 8

Steps For Replacement of Shunt Closing Release (YC) 15031

Disconnect the power supply connectors of the additional shunt opening release

YC SHUNT CLOSING RELEASES

Unscrew the four fixing screws and withdraw release (8)

FOR ASSEMBLY, PROCEED IN REVERSE ORDER

Fig. 9
Operating Coil Set-Up for Temperature –10 deg. C

Steps For Replacement of Motor 15032

1. Release the return spring, raise the pair of charging pawls and push the lever towards (4).

2. Un螺丝 the motor flange fixing screws (6)

3. Raise the pair of driving latches using screwdriver and push the lever (3) forward.

4. Remove the two motor limit microswitch fixing screws (2)

5. Release the return spring, raise the pair of charging pawls and push the lever towards (4).

6. Unscrew the motor flange fixing screws (6)

Fig. 11
Disconnect the motor power supply (7)

Fig. 12
Steps for replacement of micro-switch 15033

1. Disconnect the microswitch connection
2. Unscrew the microswitch fixing screws
3. Pull down cover of microswitch
4. Unscrew the microswitch fixing screws (2)
5. Disconnect the microswitch connection (4)

For assembly connect the Faston as it was in its original position

To assemble, proceed in reverse order

Fig. 14

Fig. 15