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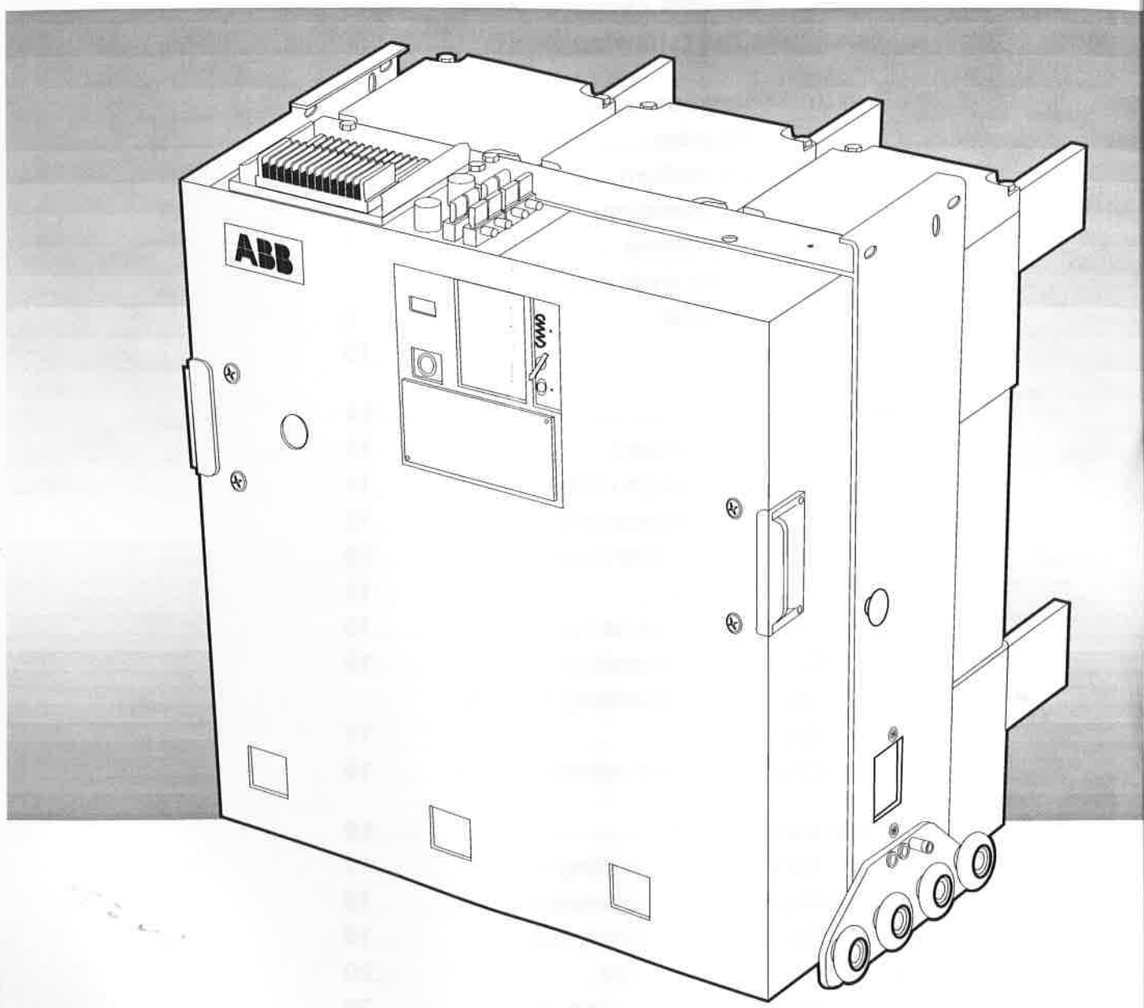
Manual 1VEB 580901-912, Edition1 99-12

HPA

Manual 1VEB 580901-912
Edition 1 99-12

SF_6-circuit breaker manual



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CONTENTS

HPA circuit breaker

0. Access zones

The HPA breaker is intended for use in metal-enclosed switchgear. The HPA breaker is to be operated behind a closed cubicle door. General access should not be allowed to a switchgear area. The operator's access zone is the tending area in front of the switchgear.

Only maintenance personnel may open the cubicle door. ABB service must be used where so stated.

1. Information, the HPA circuit breaker is available in the following models.

All pictures in this manual show the Safesix version of HPA. The manual is however valid for all versions.

Rated voltage	**kV**	**12**	**12-24**	**12-24**	**12-24**	**12-24**	**36*** **
Rated breaking current	kA	40	31,5	25	20	12	25
Rated current	A	630-3150	630-2500	630-2500	630-2500	630-2500	630-2000
Rated making current	kA	100	80	62.5	50	30	62.5
Rated short-time current	kA	40 1 sek	31.5 1 sek	25 3 sek	20 3 sek	12 3 sek	25 1 sek
Filling pressure* P_r	bar overpress.	2.5	2.5	2.5	2.5	2.5	2.5
Alarm pressure P_a	bar overpress.	2	2	2	2	2	2
Lowest operating pressure** P_m	bar overpress.	2	2	2	2	2	2
Electrical endurance, number of breaks at rated breaking current		10	16	25	40	100	25
Mechanical endurance number of mechanical operations		10 000	10 000	10 000	10 000	10 000	10 000

**) The pressure to be filled up to.*
***) For short-circuit breaking (rated breaking current).*
****) For UniSafe only.*

2. Design and operation

2.1. Breaking poles

The HPA designation refers to a puffer-type SF_6 circuit breaker.

When the breaking poles are produced they are dried internally by vacuum pumping. The poles are then checked through tightness and pressure tests. Within the pole there is an absorption medium to absorb the gas's decomposition products.

CAUTION! The breaking poles must only be opened by the manufacturer. The screw joints are tightened at the factory to a certain torque and are not to be retightened. If there is a risk that air has penetrated into a leaking breaking pole (gas pressure = atmospheric pressure) the pole is to be renovated at the factory. A replacement pole will be provided by ABB.

SF_6 gas that is exposed to arcs contains components that together with moisture become corrosive. Filling of gas is always to take place in accordance with item 3.4.1 "Gas pressure".

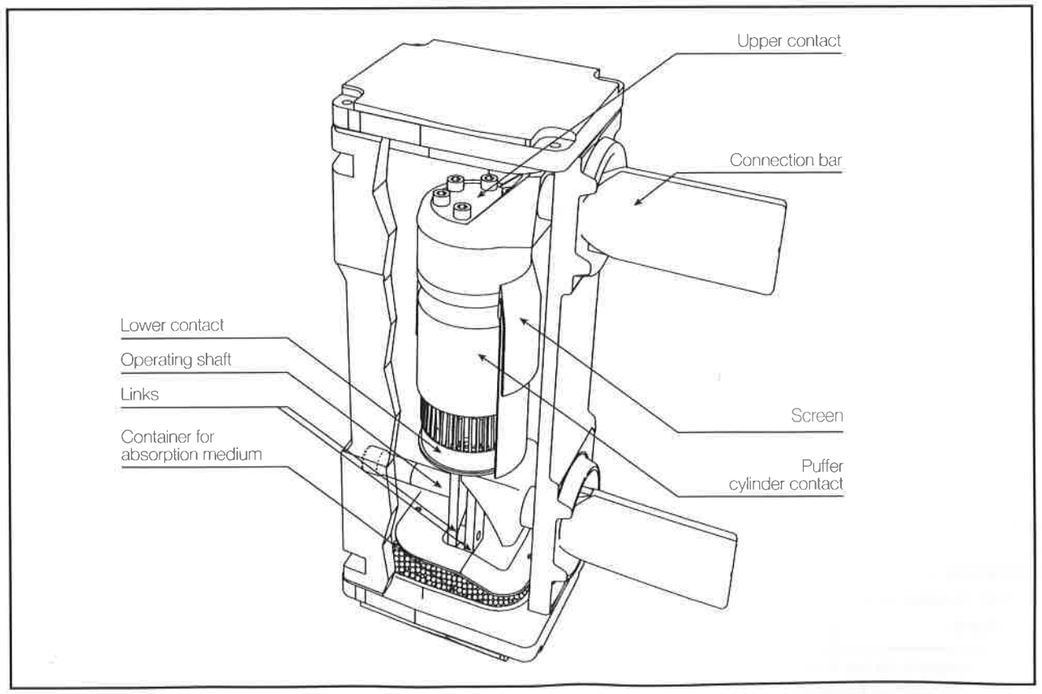


Fig. 1a. *Breaking pole in closed position.*

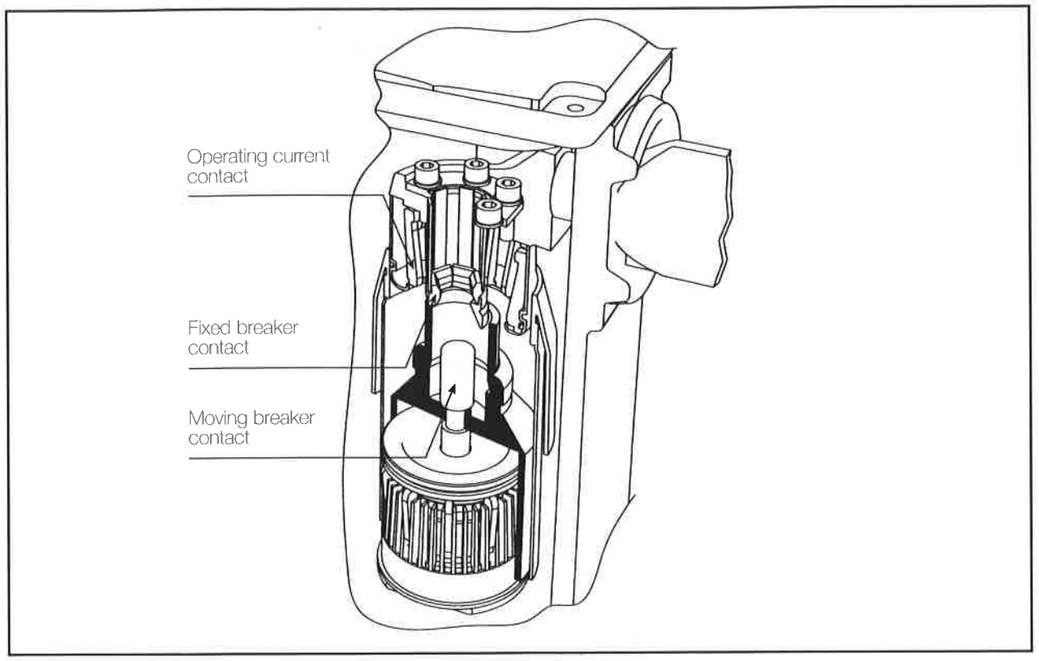


Fig. 1b. *Open breaking contact.*

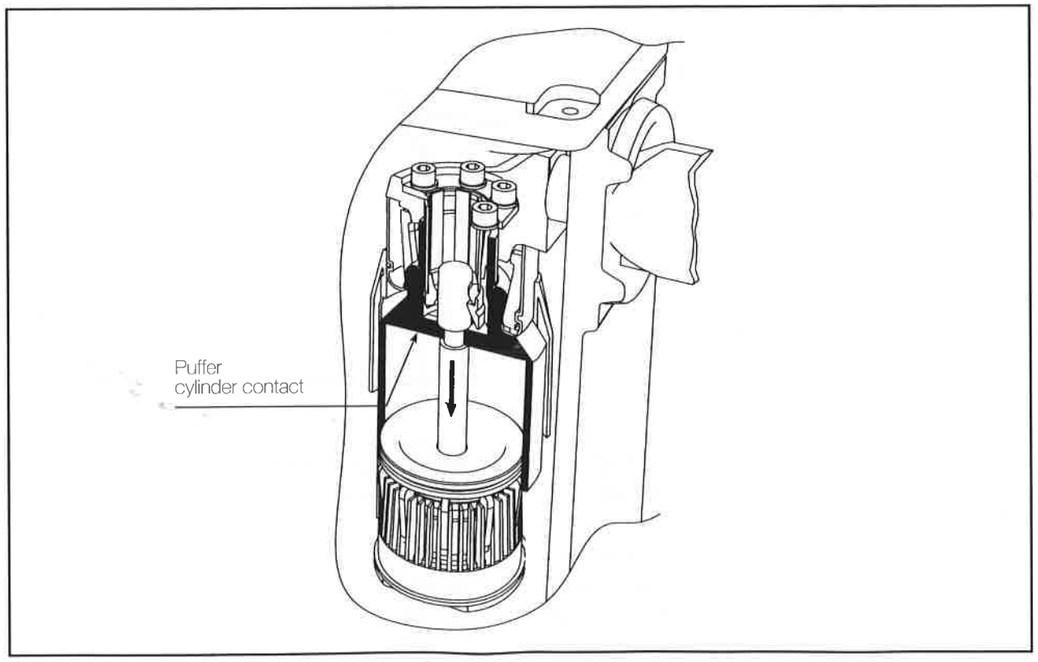


Fig. 1c. *Direction of movement upon opening.*

2.2. Breaking medium

The breaking poles contain SF_6 gas (sulphur hexafluoride). The following are characteristics of pure SF_6 gas:

- Non-toxic and non-flammable
- Chemically stable
- Good current breaking capacity due to excellent dielectric and thermal properties
- Breaking in SF_6 gas takes place very smoothly, which means that no dangerous overvoltages occur. No damping resistors or surge arresters are necessary, not even when breaking current to small motors
- SF_6 gas has an insulation strength some three times higher than air at an overpressure of 2.5 bar, which is approximately the same as for transformer oil
- Any leakage is easy to detect with the density gauge

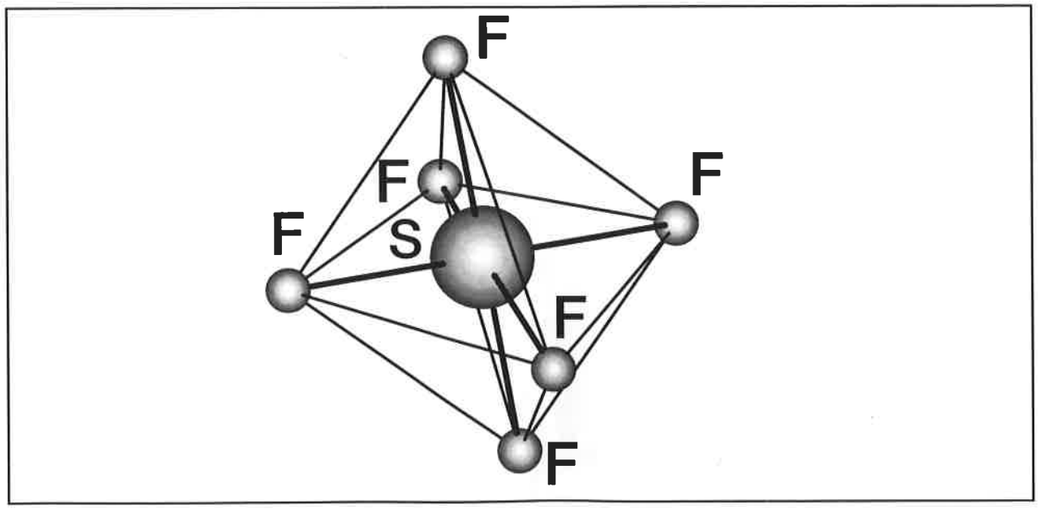


Fig. 2. *SF_6 molecular arrangement.*

SF_6 gas that is subjected to arcs contains toxic and corrosive substances both in gas and powder form. Gaseous substances are absorbed by the breaking pole's absorption medium. Breaking poles are not to be opened in the working field or emptied by inexperienced personnel. Since SF_6 is not a natural gas, it is to be captured and enclosed when scrapping. Get in touch with ABB who will attend to recycling of the gas.

WARNING!
BREAKING POLE NOT TO BE OPENED OTHER THAN BY THE MANUFACTURER

2.3. Breaking operation

The HPA breaker works according to the puffer principle. This means that gas is compressed in the tripping operation and is blown through a nozzle in which an arc burns. The breaking process is shown in Fig. 3.

The blow-through occurs when the arc is extinguished as the current passes through zero and cools the gas, thus preventing restriking of the arc.

The puffer breaker is characterised by a high electrical endurance and its capacity to break rated currents (load currents) even when the gas only has atmospheric pressure.

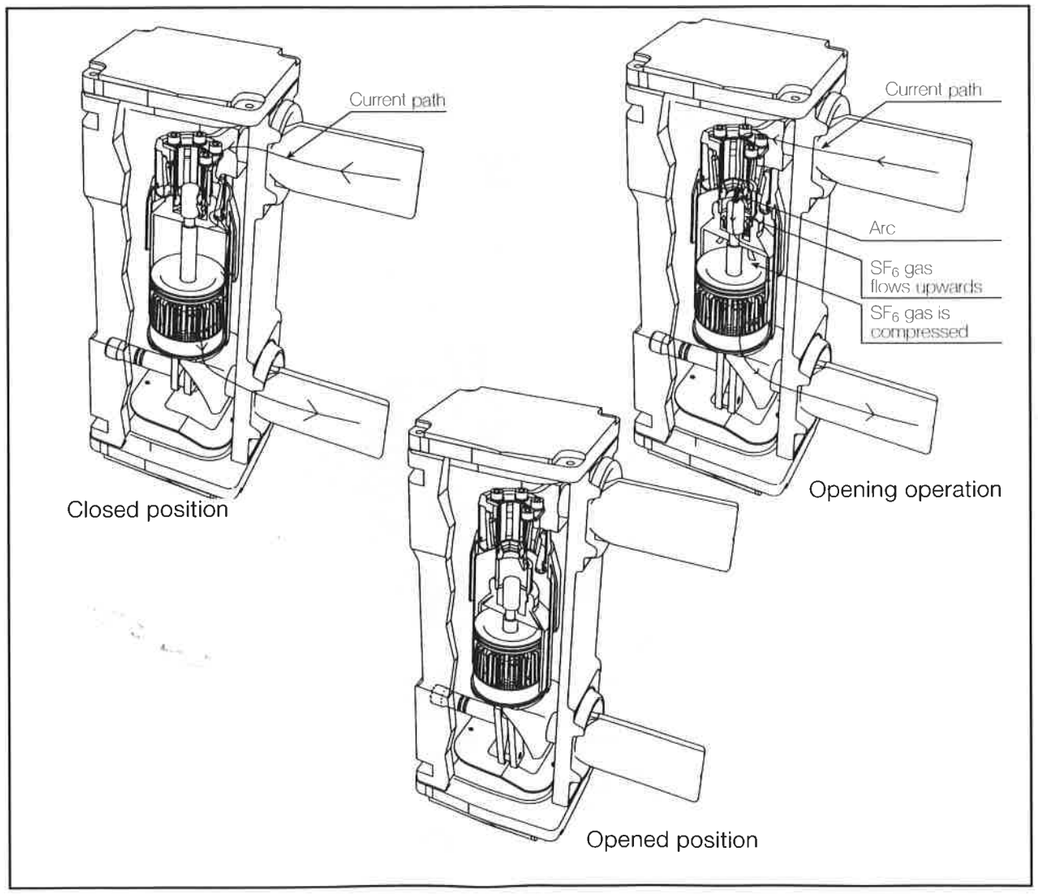


Fig. 3. *The pufferprinciple.*

2.4. Operating device

The operating device is provided with a spring-loaded gear that can be tensioned either by a motor or by hand. The breaker is so designed that when a Closing order is given, the breaker must close completely before it trips again. In this manner the correct contact speed and the full breaking capability are obtained.

The tripping spring is automatically tensioned when the breaker closes. A closed breaker with a tensioned closing spring can be operated Open-Close-Open without any intermediate motor or manual tensioning and the breaker can therefore be used for rapid auto-reclosing. The closing spring can be released by breaking the voltage to the motor and then switching Close and Open.

An indication shows whether the closing spring is tensioned and the number of trips are registered on a counter.

The power supply to the motor can be provided via a station battery, lighting network or a voltage transformer with a limit load of at least 500 VA. The motor starts after every Closing operation and tensions the closing spring within approx. 10 seconds. The breaker is provided with a pushbutton for mechanical tripping and shunt magnets for Closing and Opening operations. The same type of operating device is used for all types of HPA breakers.

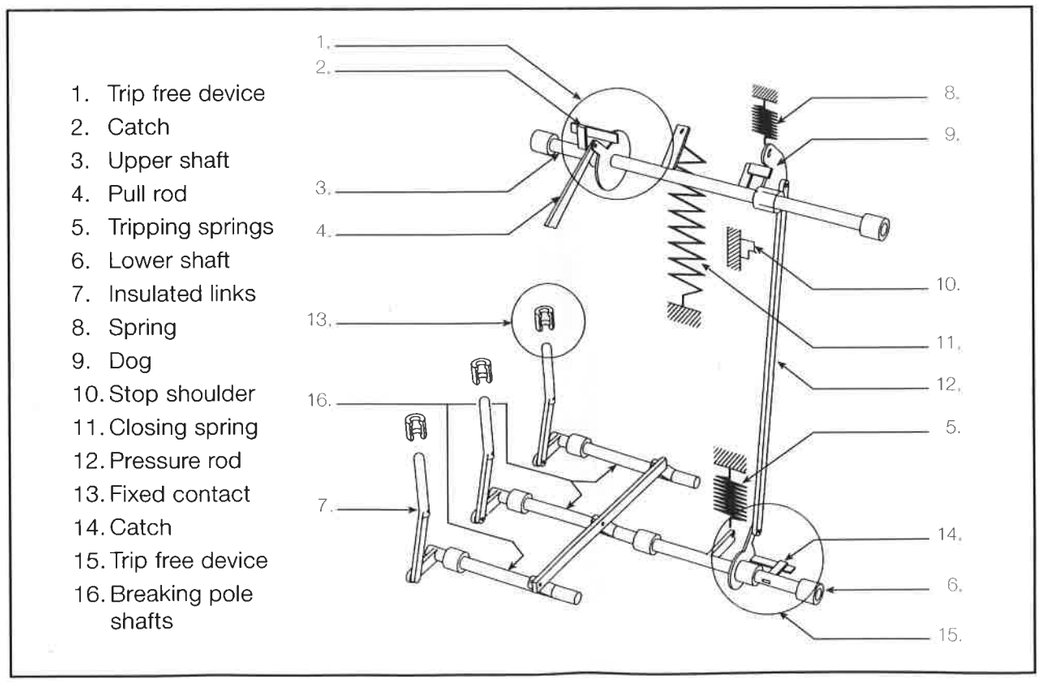


Fig. 4. *Design of operating device, elementary diagram. Tripped.*

Fig. 4 shows an elementary diagram of the operating device's design. The spring tensioning device has two shafts. The lower of these (6) is connected to the breaker shaft and is directly actuated by the tripping spring (5). The upper shaft (3) is linked directly to the closing spring (11). These two shafts are linked together via the dog (9) and the pressure rod (12) as well as the trip free device (15). The upper shaft is also linked to the tensioning device via the trip free device (1) and the pull rod (4).

The motor tensioning device consists of a set of gears with an excentrically-driven free hub as the last stage. The operating device also contains auxiliary contacts and tripping magnets.

Fig. 4 shows the operating device in the Open position. The

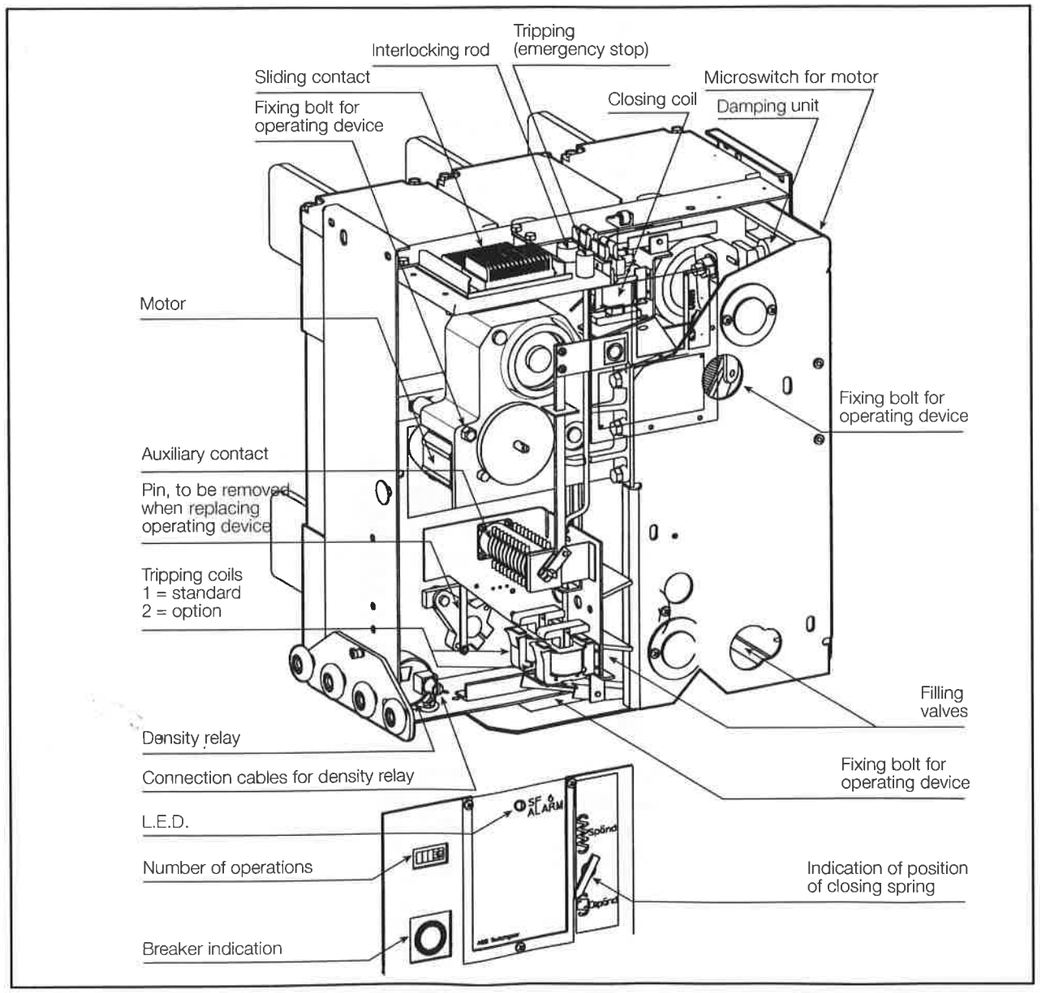


Fig. 5. *Operating device (cover removed).*

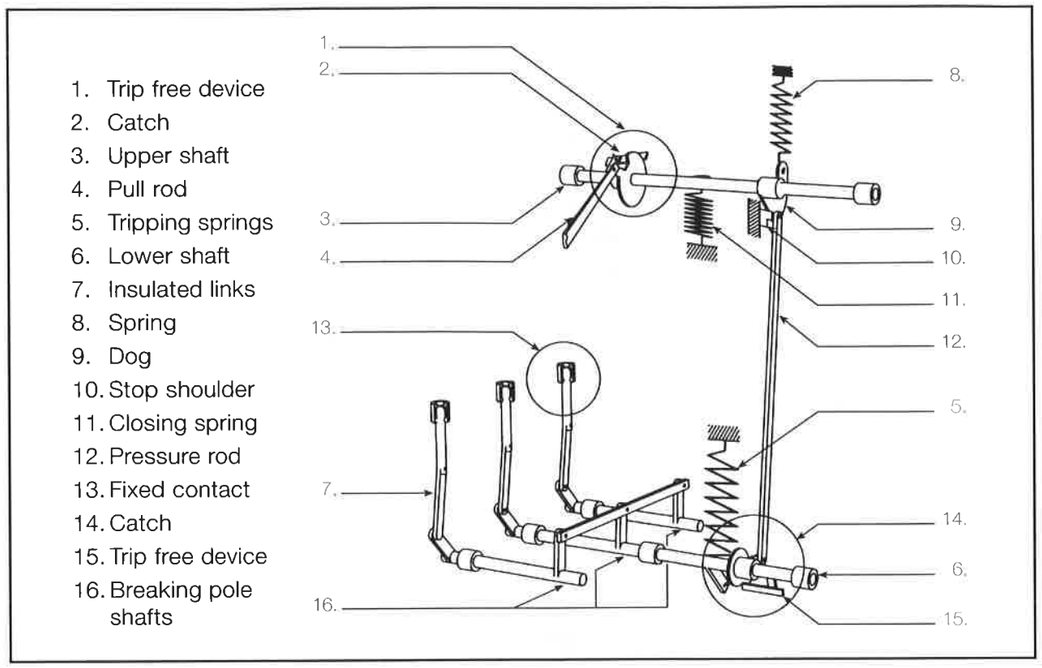


Fig. 6. *Design of operating device, elementary diagram. Closed.*

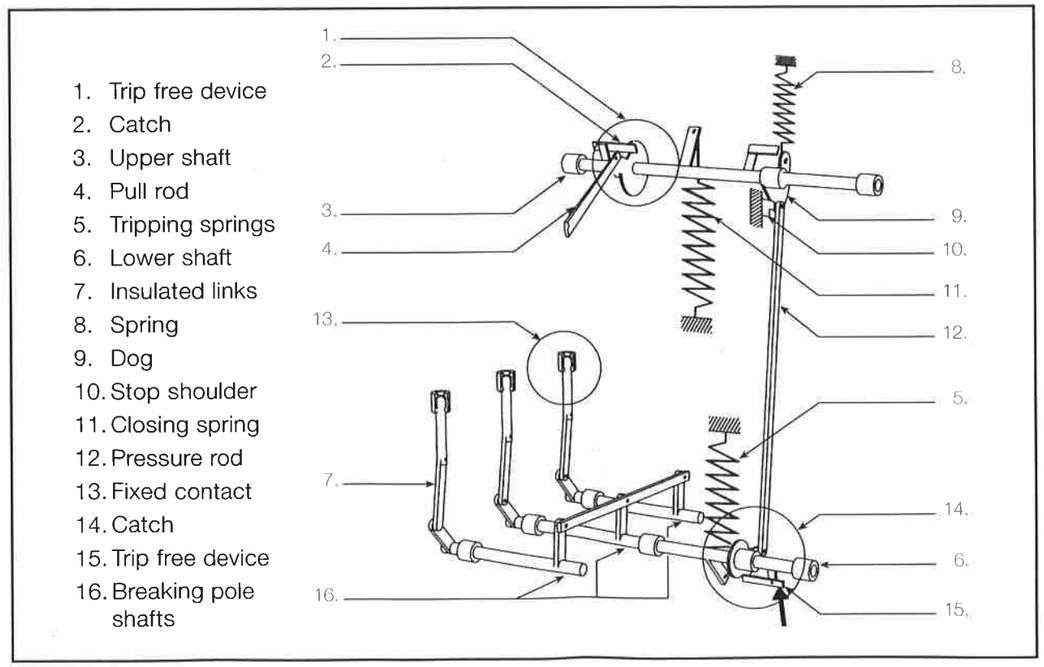


Fig. 7. *Design of operating device, elementary diagram. Closing spring tensioned.*

closing spring (11) is tensioned. If the catch (2) is released, the upper shaft is freed and its rotation is transferred via the pressure rod (12) to the breaking pole shafts.

In Fig. 6, the breaker is in the Closed position and the tripping spring (5) has been tensioned. The dog (9) rests against the stop shoulder (10). The dog, together with the pressure rod (12), forms a toggle joint that via the trip free device (15) prevents the tripping spring from rotating the breaking pole shafts (16). Now the tensioning device starts up and the pull rod (4) moves until the catch (2) once again engages. There the pull rod (4) turns and the upper shaft is rotated and tensions the closing spring again and the position in Fig. 7 is reached.

Upon tripping, the catch (15) is released and thereby the breaking pole shafts (16) as well, which via the insulated links (7) actuate the contacts and a break is effected. The spring (8) returns the pressure rod (12) with its dog to its previous position and the operating device again takes up the position shown in Fig. 4.

The HPA breaker can also be provided with an extra tripping magnet or an undervoltage release.

2.5. Interlocking chain of the circuit breaker

The following conditions must be fulfilled for the Closing operation to take place:

1. The interlocking rod must be in its upper position (test or service position on the transfer unit, can be checked through the microswitch in the Closing circuit)
2. The operating voltage should be 85 – 110% of the nominal voltage.
   CAUTION! If the voltage is incorrect, the operating coil may be damaged
3. The closing spring must be tensioned (can be checked through the microswitch in the Closing circuit)

Once the Closing operation has taken place, the following occurs:

1. Mechanical blocking of the selector in the transfer unit (Safesix)
2. Link emerges on the right-hand side (to prevent that a breaker in closed position is moved into the service position)

Conditions that must be fulfilled for the tripping to take place:

1. The circuit breaker must be in Closed position (can be checked with the auxiliary contact)
2. The operating voltage must be 70 – 110% DC nominal or 85 – 110% AC nominal

Mechanical tripping with emergency release can always be carried out (not affected by mechanical or electrical blocking)

Optional anti-pump relay:
The Closing operation is blocked as long as a Closing command remains after an Closing-Opening operation

Optional undervoltage release:
Automatically trips a circuit breaker in Closed position when the control voltage becomes too low. Tripping takes place in the range 60 – 70% of the nominal control voltage.

Closing is prevented when the control voltage is less than 70% of the nominal voltage.

2.6. Monitoring

The HPA breaker can be fitted with various types of monitoring equipment:

Alternative 1 — Density gauges (one per pole) with indicator and alarm contact. The alarm contact is connected to a condition indicator with alarm indication on the front of the breaker and to an external alarm circuit via the breaker's auxiliary contact.

Alternative 2 — SafeGuard relay monitoring several functions of the breaker:
1. Closing time
2. Closing speed
3. Opening time
4. Tripping speed
5. Gas density
6. Contact wear
7. Time elapsed since last operation

The SafeGuard breaker monitor provides an alarm and makes possible remote transfer of information values. For a detailed description, see separate manuals.

CAUTION! Before taking steps, follow the safety instructions on page 11.

3. Maintenance

3.1. Safety instructions

CAUTION! Only service personnel may open the door of the circuit breaker cubicle. ABB service must be used where so stated. If a lifting trolley (article no. 1VES 841 930-AAA) is used, transporting of the breaker on the trolley should only take place when cranked down to the lowest position.

CAUTION! Do not leave the circuit breaker in its cranked-up position.

Before dismantling and maintenancing of the breaker, the following must be done:
1. Switch off the breaker
2. Pull the breaker out of the cubicle
3. Check that the operating voltage to the motor is switched off
4. Release the closing spring manually (to avoid the risk of crushing injuries)
5. Release the tripping spring manually (to avoid the risk of crushing injuries)
6. If the front cover is to be removed, this should not be done until the closing and tripping spring have been released. When the front cover is to be removed, the cover should be gripped by its handles (risk of injury otherwise due to sharp edges). Covers without handles must be handled with extra care.

3.2. General views on maintenance

The frequency and method of inspection depend on how the equipment is used. Various factors must be taken into account such as operating frequency, breaking currents and power factor, as well as the ambient circumstances. Chapter 3.3 shows the maintenance programme in tabular form and suitable time intervals in maintenance work.
These rules should be followed:
— Breakers which are only operated a few times a year or which remain closed or tripped for a lengthy period, should be periodically calibrated in order to avoid excessive friction, which can otherwise reduce closing and tripping speed.
— When breakers are in use, they should be subjected to ocular inspection from the outside in order to detect dust, dirt or damage. Check the reading on the pressure meter (if there is one installed).

CAUTION! Before taking steps, follow the safety instructions on page 11.

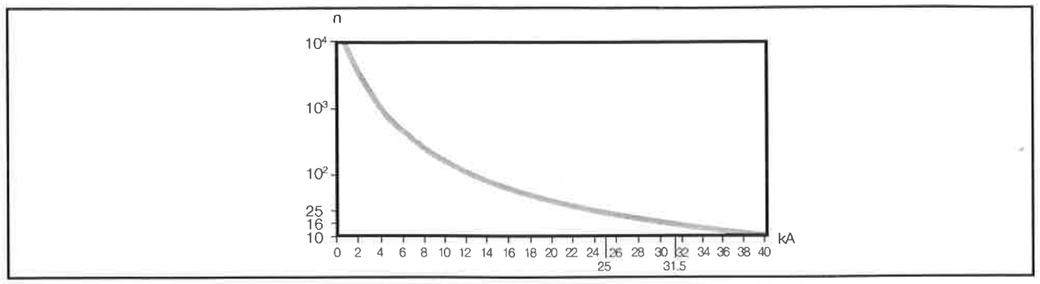


Fig. 8. Electrical endurance of SF_6 circuit breaker HPA.

3.3. Maintenance programme

To do	Before commiss:	After 5000 operations or every 5th year	After 7500 operations	After 10000 operations	After max number of short-circuit breakings (see Fig. 8):	At alarm from SafeGuard:
Check gas pressure, see 3.4.1	O if density gauge		O	O	O	X
Check of speed and resistance, see 4.7 and 3.4.2		O	O	O	O	X
Check of operating gear		O, X	O	O	O	X
Overhaul of operating gear, by authorized partner				O, X		

Overhaul table: O = Without SafeGuard, X = With SafeGuard.

3.4. Maintenance instructions

3.4.1. Gas pressure

CAUTION! A breaking pole may not be opened except by the manufacturer!

In order to fill with gas, it is necessary to have a fully equipped SF_6 gas flask with pressure regulator and instruments to check and control the pressure. Checking and filling can take place with the front plate still mounted on. However, filling should not take place with the breaker in the service position.

The gas pressure should be between 2 and 2.5 bar (overpressure) at 20° C. Currents lower than 25 kA can be

CAUTION! Before taking steps, follow the safety instructions on page 11.

interrupted at lower pressures too. Rated currents up to 2000 A can be interrupted at atmospheric pressure provided that there is SF_6 gas in the breaking pole, which is the case if there is a slight overpressure. At other gas temperatures than 20° C, the overpressure should be recalculated according to the table below.

Change of overpressure in bar, at temperatures:			
0°C	**10°C**	**20°C**	**30°C**
0.4	0.4	0.5	0.6
0.9	0.9	1.0	1.1
1.3	1.4	1.5	1.6
1.8	1.9	2.0	2.1
2.3	2.4	2.5	2.6
2.8	2.9	3.0	3.1

The HPA circuit breaker can be provided with a density gauge with alarm contacts and indicators. A green field indicates the correct pressure; a yellow field indicates sufficient pressure for breaking rated current up to 2000 A. In the event of red colour, the pole must be renovated at the factory. If there is no density gauge, the pressure can be measured manually with a special instrument. Measurement should take place at 5-year intervals.

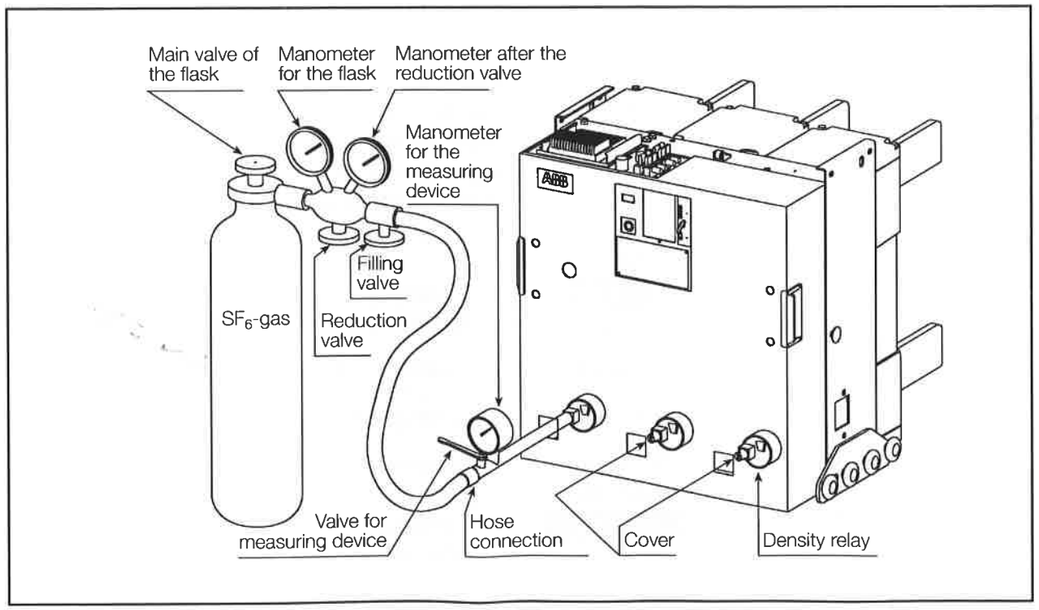


Fig. 9. Connecting up for gas filling.

CAUTION! Before taking steps, follow the safety instructions on page 11.

CAUTION! When working with SF_6 gas, smoking is absolutely forbidden! Checking and filling of SF_6 gas is to be carried out according to the following instructions. The equipment shown in Fig. 9 is required.
N.B. The filling hose and filling device must be clean and dry so that no dirt or moisture enters the breaking pole. The hose should not be unnecessarily long.

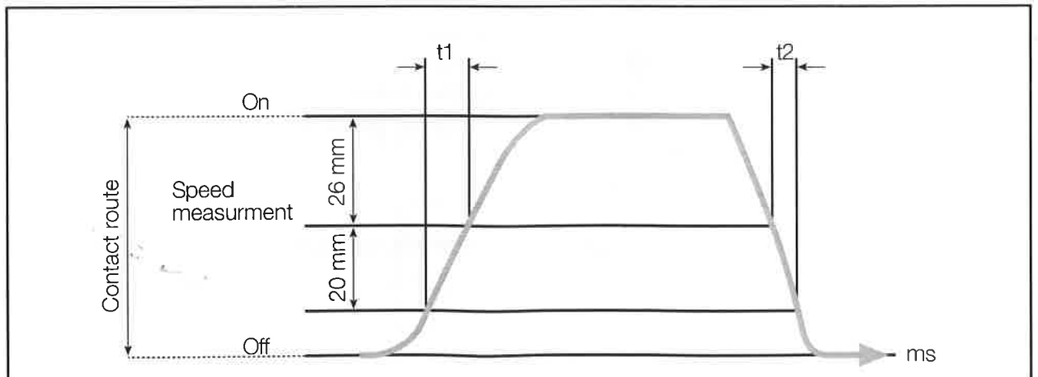
1. Unscrew the filling cover on the breaking pole with tool LV 899 361-B.
2. Close the valve on the measuring and filling device LV 899 361-C (for breakers without density relay) or LV 899 361-D (for breakers with density relay). Screw the measuring device on where the cover was removed.
3. Read off the pressure, and if necessary correct the temperature value as indicated on the previous page. If the corrected overpressure is between 2.0 and 2.5 bar, remove the measuring device as described under item 15.
4. Close the gas cylinder's reduction valve (N.B. Left-hand thread).
5. Close the filling valve.
6. Open the cylinder's main valve; the manometer then shows the cylinder's pressure (approx. 70 bar with the cylinder full).
7. Open the reduction valve cautiously to 2.5 bar overpressure. If the manometer shows an excessive pressure, close the reduction valve and reduce the pressure by opening the filling valve. The hose should not be connected. Close the filling valve and make a new attempt. It is important that the reduction valve limits the pressure to 2.5 bar overpressure.
   CAUTION! If this pressure is higher, the breaking pole can explode when the filling valve is opened.
8. Connect the hose's quick coupling to the measuring device.
9. Open the measuring device's valve.
10. Check that the manometer after the reduction valve shows an overpressure of 2.5 bar.
    CAUTION! If this pressure is higher, the breaking pole may explode when the filling valve is opened.
11. Open the filling valve entirely until the measuring device's manometer shows 2.5 bar at 20° C overpressure.
12. Close the cylinder's main valve.
13. Close the filling and measuring device valves.
14. Release the quick coupling. N.B. The hose's pressure of 2.5 bar overpressure is then blown out.
15. Loosen the measuring device until the gas begins to hiss, then immediately open the measuring device's valve so that the non-return valve closes. This minimises the release of gas.
16. Remove the measuring device entirely.
17. Replace the O-ring of the cover, greasing the new one with ABB grease no. 1171 4014-409. (N.B. The O-ring cannot be greased with mineral grease since it is made of EPDM.) Fit the cover on the connection nipple.

CAUTION! Before taking steps, follow the safety instructions on page 11.

3.4.2. Checking of operating device

3.4.2.1. Checking of operating speed

The operating speed can be checked using resistive, mechanical or optical measuring equipment.



Closing speed (20/t1).....min.2.0 - 2.5 m/s
Opening speed (20/t2).....3.6 - 4.3 m/s
Closing time at nom. voltage ...max 75 ms

Opening time
at nom. voltage .....36 - 40 ms
Contact travel.....63 - 66 mm

Fig. 10. *Motion diagramme.*

CAUTION! Before taking steps, follow the safety instructions on page 11.

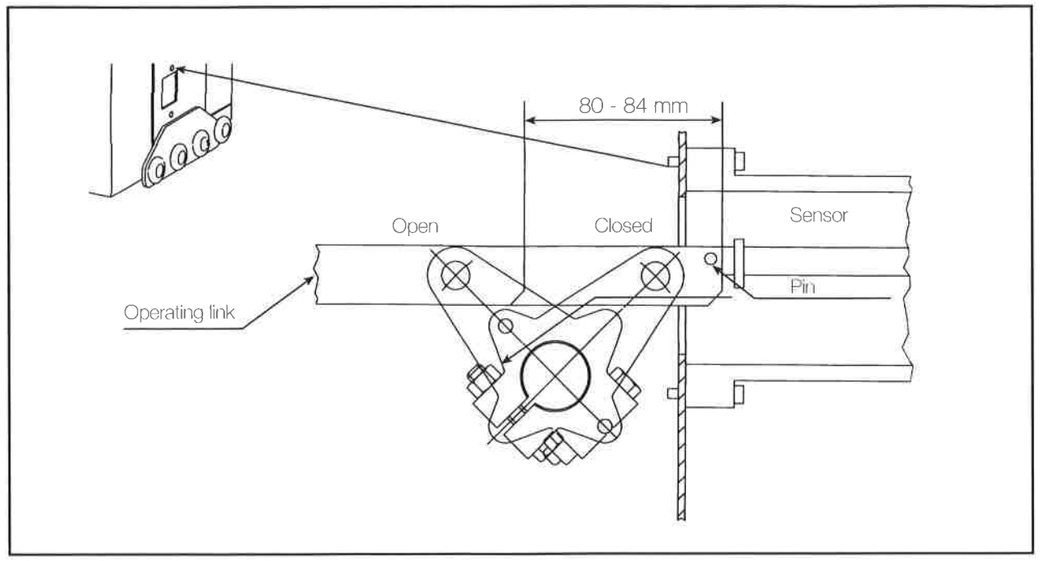


Fig. 11. *Connection transducer.*

Checking of the operating speed is carried out as follows:

1. Connect the transducer (article no. LV 899 361-R) on the coupling link of the breaking poles, see Fig. 11 (page 16).

2. Check with the aid of a vernier calliper that the movement between the making and breaking actions is 80 – 84 mm (corresponds to 63 – 66 mm inside the pole).

3. Carry out one breaker closing and one breaker tripping. **CAUTION!** The link comes out of the rack approx. 20 mm upon tripping the breaker. If a graph is obtained, it should agree with Fig. 10 (page 15).

4. Evaluate the graph.

5. If the values are incorrect, contact ABB service.

CAUTION! Before taking steps, follow the safety instructions on page 11.

3.4.2.2. Checking of operating device's toggle joint

CAUTION! Only service personnel may open the breaker's cubicle door. ABB service must perform this job where so stated. If a lifting trolley (article no. 1VES 841 930-AAA) is used, the breaker must only be transported on the trolley in the cranked-down position.

CAUTION! Do not leave the breaker in the cranked-up position.

Before dismantling the breaker and carrying out maintenance on it, perform the following:

1. Switch off the breaker.
2. Pull the breaker out of the cubicle.
3. Check that the operating voltage to the motor is switched off.
4. Release the Closing spring manually (to avoid risk of crushing).
5. Release the Tripping spring manually (to avoid risk of crushing).
6. Remove the front cover. When dismantling, the cover should be gripped by its handles (risk of injury due to sharp edges otherwise). Covers without handles should therefore be handled with extreme care.

Check the toggle joint. See Fig. 12.

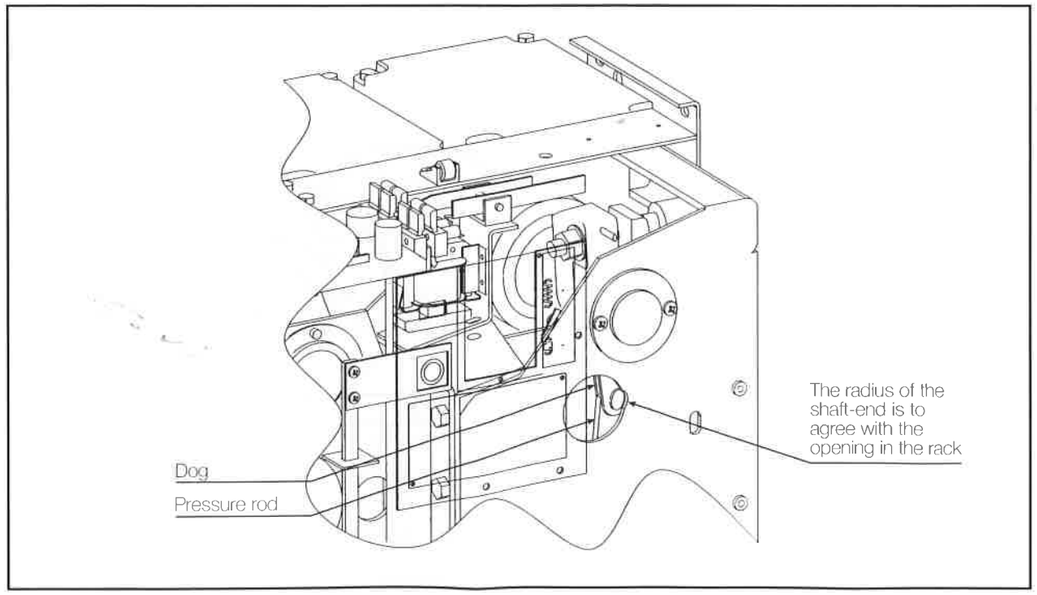


Fig. 12. *Checking the toggle joint.*

CAUTION! Before taking steps, follow the safety instructions on page 11.

3.4.2.3. Checking the free motion margin

1 Tension the closing spring with the crank.

CAUTION! Risk of crushing fingers at the gearwheels and the link arms.

Check that the free motion is 0.5 – 1.0 mm between the cover at the upper trip free unit and the gripping posi tion of the long catch when the tensioning device has been cranked to the maximum tensioning position. If there is need of adjustment, contact an authorised ABB service unit.

2. Continue to crank so that the cover at the upper shaft lies against the gripping position of the long catch.
CAUTION! Risk of crushing fingers at the gearwheels and the link arms.

3. Check that the lower trip free unit is gripping.
CAUTION! Risk of crushing if the breaker with its emergency stop is tripped by mistake. Free motion 0.5 – 1.0 mm. If there is need of adjustment, contact an authorised ABB service unit.

4. Check the setting of the microswitches for tensioned closing spring.
CAUTION! Risk of crushing if the breaker with its emergency stop is tripped by mistake.

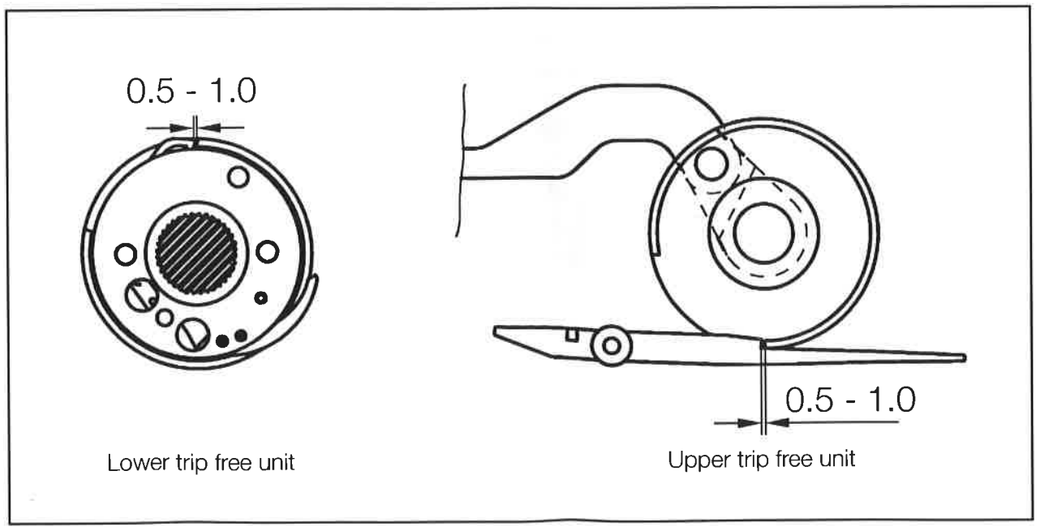


Fig. 13. *Checking of free motion margin.*

CAUTION! Before taking steps, follow the safety instructions on page 11.

4. Service instructions

CAUTION! Only service personnel may open the breaker's cubicle door. Use ABB service where so stated.

If a lifting trolley is used, the breaker must only be transported on the trolley in the cranked-down position. **CAUTION!** Do not leave the breaker in the cranked-up position.

Before dismantling the breaker and carrying out maintenance on it, perform the following:

1. Switch off the breaker.
2. Pull the breaker out of the cubicle.
3. Check that the operating voltage to the motor is switched off.
4. Release the Closing spring manually (to avoid risk of crushing).
5. Release the Trip spring manually (to avoid risk of crushing).
6. Remove the front cover. When dismantling, the cover should be gripped by its handles (risk of injury due to sharp edges otherwise). Covers without handles should therefore be handled with extreme care.

4.1. Replacing of operating coils

For location of operating coils (Closing coil, Trip coil), see Fig. 5. Unscrew four screws to remove the coil.

4.2. Replacing of microswitch

For location of microswitches, see Fig. 5. Unscrew two screws to remove each microswitch.

4.3. Replacing of auxiliary contact

For location of auxiliary contact, see Fig. 5. Unscrew six screws to remove the auxiliary contact. Remove the two link arms, one on the inside and one on the outside of the auxiliary contact. Remove cables (these are marked).

CAUTION! Before taking steps, follow the safety instructions on page 11.

4.4. Replacing of motor

Unscrew four screws to remove the motor, see Fig. 5. The large gearwheel must be dismantled in order to get at one of the screws. There is a quick connection for cables.

4.5. Replacing of damping device

Never operate the circuit breaker without damping units, since the breaker may then be damaged.
When replacing the upper damping unit, the closing spring must be tensioned. During this work, the tripping mechanism for the spring package must be secured using a cord or bundling strip. See Fig. 14.

When replacing the lower damping unit, the tripping spring must be tensioned, i.e. the circuit breaker switched on. The lower trip free unit is to be secured in this case with a cord or bundling strip, see Fig. 14. No attempt should be made to repair a damping unit.

1. Remove the breaker on the door for Safesix with the closing spring tensioned and remove the cover. When dismantling, the cover should be gripped by its handles (risk of injury due to sharp edges otherwise). Covers without handles should therefore be handled with extreme care.

2. **CAUTION!** Be extremely careful not to leave hands in the mechanism when the breaker is being operated. Make a closing movement on the breaker if the lower damping unit is to be replaced.

3. **CAUTION!** Be extremely careful not to leave hands in the mechanism when the breaker is being operated and the spring package is released. Lock and block the tripping mechanism as described above.

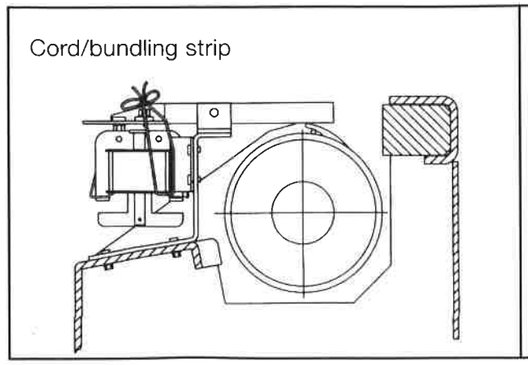


Fig. 14a. *Blocking of upper tripping mechanism.*

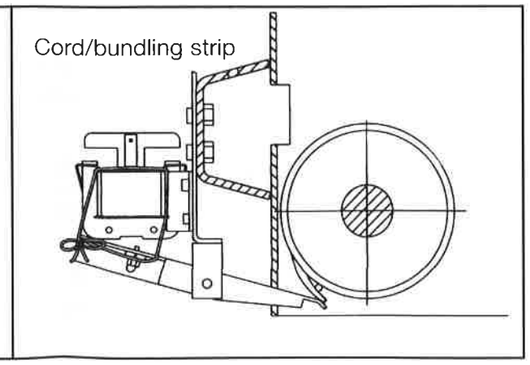


Fig. 14b. *Blocking of lower tripping mechanism.*

CAUTION! Before taking steps, follow the safety instructions on page 11.

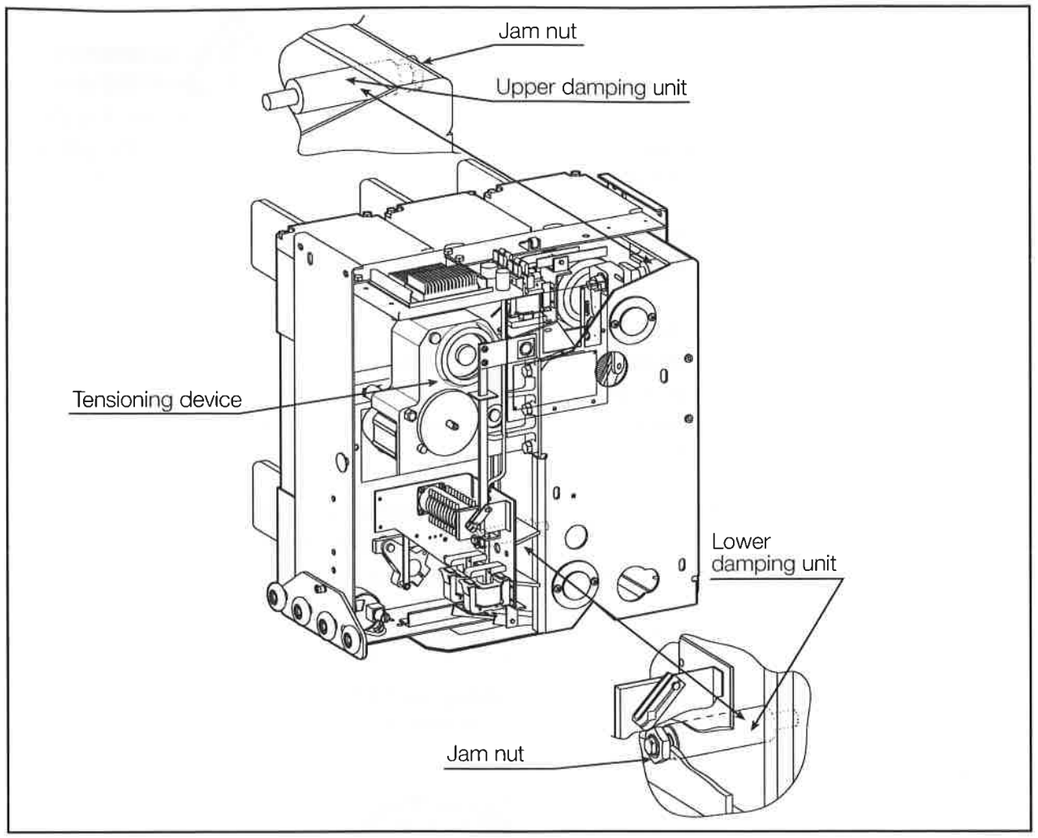


Fig. 15. *Overview of location of damping units.*

4. Remove the device's jam nut. Unscrew the device from the plate. No other units need be removed.
   CAUTION! If other units are removed, there is a risk that the spring packages may be released.

5. Introduce the new damping unit using existing spacers.

6. Tighten the jam nut.

7. Release the catches on the tripping mechanisms.

8. Operate the circuit breaker and check the location of the device. The plunger is to have a free motion of 0.5 – 4 mm.

9. Where necessary, adjust the position using the spacers.

CAUTION! Before taking steps, follow the safety instructions on page 11.

4.6. Replacing of operating mechanism

When replacing an operating mechanism, it is recommended to use a hoisting arrangement as assistance when disconnecting the unit (which weighs approx. 60 kg). However, it is possible to slide the device on its lower fixing section during removing/docking if there is no hoisting arrangement available.

1. Take the circuit breaker out of the cubicle and place it on the floor.
2. Remove the breaker's cover, see Fig. 5. When dismantling, the cover should be gripped by its handles (risk of injury due to sharp edges otherwise). Covers without handles should therefore be handled with extreme care.
3. Remove the sliding contact's screws, pin, connection cables for density relay and the four screws as per Fig. 5. N.B. Let the lower fixing section accompany the device.
4. Pull the device straight out.
5. Fix the lower fixing section on the new device at the same distance from the drive shaft as on the old one.

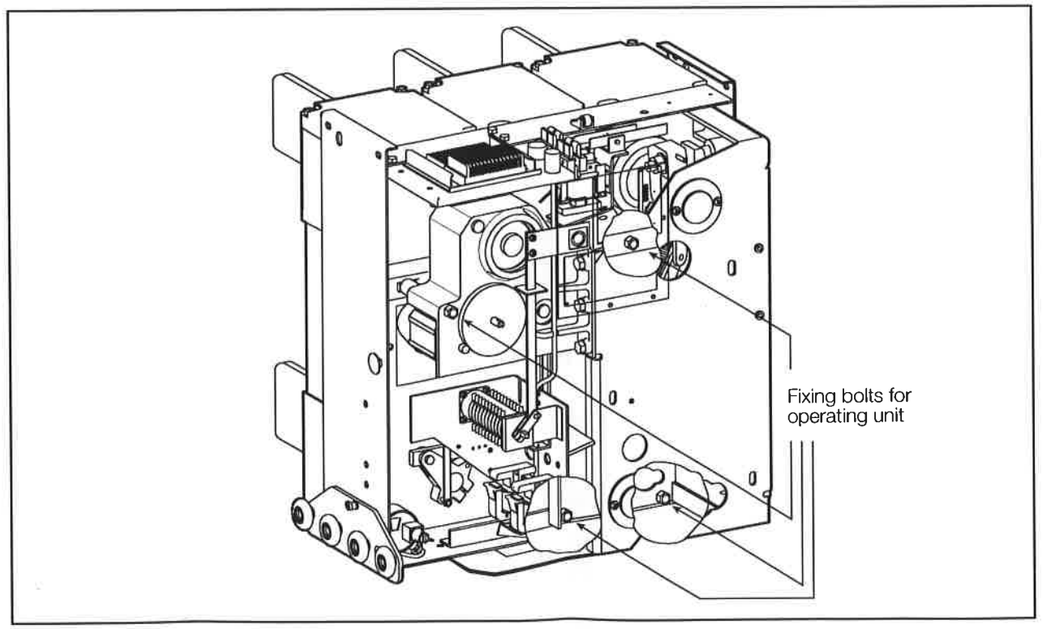


Fig. 16. *Overview of the location of the operating units.*

CAUTION! Before taking steps, follow the safety instructions on page 11.

4.7. Replacing of breaking pole

CAUTION! A breaking pole may not be opened by anyone but the manufacturer.

1. Remove the operating device, see item 4.6 "Replacing of operating device".
2. Unscrew the two screws for the operating arms (the pole in the middle has no screws). Lift off the links and the arms.
3.* Remove the contact unit. Take off the gas filling lid using the special key (article no. LV 899 361-B). Remove the nut using the special tool (article no. LV 899 361-H) behind the cover holding the density relay. Pull out the relay. N.B. Avoid pushing in the non-return valve.
4.* Fix on the long cover that accompanies a new pole. N.B. Do not affix the short cover since the non-return valve will then open and gas will flow out.
5. Remove the pole using key 32 mm and 55 mm. Remove the M12 screws.
6.* Move the long cover over on to the new pole.
7. Mount the new pole in place.
8.* Move the long cover back to the old pole.
9.* Check that the O-ring is not damaged. Mount the new density relay. Tighten the locking ring using the special tool (article no. LV 899 361-H). Fix on the cover using the special key (article no. LV 899 361-H). Mount the contact device.

Items marked with * apply if there is a density relay.

4.8. Replacing of density relay

1. Remove the contact unit. Remove the gas filling lid using the special key (article no. LV 899 361-B). Remove the nut using the special tool (article no. LV 899 361-H) behind the cover holding the density relay. Pull out the relay. N.B. Avoid pushing in the non-return valve.
2.* Check that the O-ring is undamaged.
3. Fit the new density relay. Tighten the nut with the special tool (article no. LV 899 361-H).
4. Fit on the cover using the special key (article no. LV 899 361-B). Mount the contact unit.

5. Troubleshooting diagram

N.B. Read the safety instructions in Chapter 4 before taking any steps!

Fault	Reason	Measure to be adopted
Impossible to tension Closing spring	The motor has no or wrong supply voltage.	Measure the voltage at the motor connection terminal.
	The motor is defective.	Replace the motor.
	The cath for tripping the spring has got caught.	Check the mechanism.
	Cable disconnected or damaged.	Check by measuring.
The breaker cannot be closed although there is an indication that the spring is tensioned	Operating coils do not pull.	Measure to check the supply voltage. Adjust the coil's adjustment screw if necessary. Check the main side of the relay.
	The undervoltage release trips.**	Check the supply voltage.*
The breaker closes and opens again	Toggle joint in the mechanism wrongly set.	Check the toggle joint.*
	Fault in the operating circuit.	Troubleshoot and correct.
	Free motion wrongly set on the tripping magnet's "tongues".	Troubleshoot and correct the fixing position.
The breaker opens and closes continuously	Anti-pump relay defective.**	Replace relay.

* *If adjustment is necessary, contact an authorised ABB service unit.*
** *Undervoltage release and anti-pump relay are optional extras.*

Notes