
PRODUCT MANUAL

LTA 145D1

Operating mechanism MSD2 3-Pole Operation

1HSB429954-30en



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1 Safety

1.1 Introduction, Safety

General Information

The section on safety describes safety risk levels and the symbols of these, hazardous working situations and safety-related instructions.

Personal safety equipment

Personal safety equipment must be used during all installation and maintenance work. Relevant training in the use of the safety equipment must be completed.

Particular attention must be paid to local safety regulations and the requirements at the specific assembly site.

Safety Risks

Throughout the manual, various types of safety risks are indicated. These are divided into five different levels, depending on the degree of danger. The most serious level on this scale provides a warning about serious personal injury or possible death, or major damage to a product, if the instructions are not observed. The least serious is simply a comment on important facts and conditions. The levels are indicated using symbols. Read more in *Levels of Safety Risks*, page 8.

Clearance that relevant parts have been de-energized and safety grounded must always be obtained from the electrical safety manager prior to starting work.

A person must be appointed to be responsible for workplace coordination and to ensure that local safety instructions are observed for all work on the circuit breaker. A risk assessment must always be carried out before starting work on the circuit breaker.

For all work on high-voltage circuit breakers and other high-voltage devices, work situations that involve risks must be noted and corresponding measures taken.

Comply with local regulations and requirements. Read more in *Hazardous Working Situations*, page 9.

Safety Related Instructions

For maintenance work or review of the circuit breaker that requires work on the circuit breaker or operating mechanism, it is important that both the close and trip springs are discharged. Read more at *Discharge the Springs Electrically*, page 10.

1.2 Levels of Safety Risks

Safety Risks - Symbols and Their Meanings.



DANGER!

The yellow, filled warning triangle warns that an accident **will** occur if the instructions are not complied with and that it will result in serious personal injury or death and/or major damage to the product.

It is used, for example, to warn such of dangers as: contact with high-voltage, explosion or fire risk, risk for toxic gases, risk of crushing, impacts, falls from high places, etc.



WARNING!

The red, unfilled warning triangle warns that an accident **can** occur if the instructions are not complied with, resulting in serious injury or death and/or major damage to the product.

It is used, for example, to warn such of dangers as: contact with high-voltage, explosion or fire risk, risk for toxic gases, risk of crushing, impacts, falls from high places, etc.



ELECTRIC CHOCK!

The symbol for electric shocks warns about electrical dangers that could cause serious personal injury or death.



CAUTION!

The round warning symbol warns that an accident could occur if the instructions are not observed, and that this could result in personal injury and/or damage to the product.

It is also used to warn of risks that entail burns, eye injuries, skin damage, impaired hearing, crushing or slipping injuries, tripping, impacts, falls from high places, etc.

In addition, it is used to warn about functional requirements when assembling or removing equipment where there is a risk of damage to the product or that it might cause downtime.



NOTE!

The comment symbols identify important facts and conditions.

Also used for any danger that could lead to damage to the plant only.

1.3 Hazardous Working Situations

Hazardous Working Situations

| Risk | Action/information |
|--|--|
| Working close to high-voltage | <p>Disconnect and earth around the workplace. If work must be carried out next to live plant components, the safety distance must satisfy the applicable safety regulations.</p> <p>All work on electrical equipment must follow local safety instructions and regulations concerning electrical safety.</p> |
| Working with low voltage | <p>Switch off the control voltage and where necessary the heater voltage as well. Both AC and DC can be connected to the operating mechanism and control cabinet.</p> <p>All work on electrical equipment must follow local safety instructions and regulations concerning electrical safety.</p> |
| Working with circuit breakers or in operating mechanisms | <p>For overhaul or maintenance work that requires work on the circuit breaker or operating mechanism, it is important that both the close and trip springs are discharged.</p> |
| Working on ladders and platforms | <p>Work must be executed in accordance with applicable safety regulations. Avoid climbing ladders and platforms in poor weather conditions.</p> |
| Working next to pressurized composite insulators | <p>It is not recommended to work near circuit breakers with composite insulators at the rated gas pressure. The gas pressure should be reduced to a maximum of 0.125 MPa (abs).</p> <p>If there is a specific need to perform work at the rated gas pressure, it is crucial to avoid subjecting the composite insulator to such mechanical stress that it risks being damaged.</p> |
| Handling gas | <p>Gas must be handled in accordance with the instructions set out on the safety data sheet from the gas supplier. Gas under pressure must be handled by persons with appropriate experience and training. Local regulations and instructions must always be observed.</p> <p>Specific training is required for all handling of SF₆-gas.</p> |
| Transport and warehousing | <p>It is important that both the close springs and trip springs are discharged during transport and warehousing.</p> |
| Handling of loads | <p>A lifting device or lifting equipment may only be used by those who are well acquainted with the work and have theoretical and practical knowledge for safe use. Such knowledge must include current workplace regulations, as well as the operation and handling of the lifting device and lifting equipment.</p> <p>Particular attention must be paid to local safety regulations and the requirements at the specific assembly site.</p> |
| Work from a personal lift | <p>Training in the use of safety equipment and personal lifts must be equivalent to local regulations and instructions.</p> <p>This applies to all persons who use the personal lift.</p> |

1.4 Discharge the Springs

1.4.1 Discharge the Springs Electrically

General Information



WARNING!

For maintenance work that requires work on the circuit breaker or operating mechanism, it is important that both the close and trip springs are discharged.



CAUTION!

The contactor must NOT be manually operated as this would cause the limit switch to malfunction. Consequently causing mechanical damage to the operating mechanism.



NOTE!

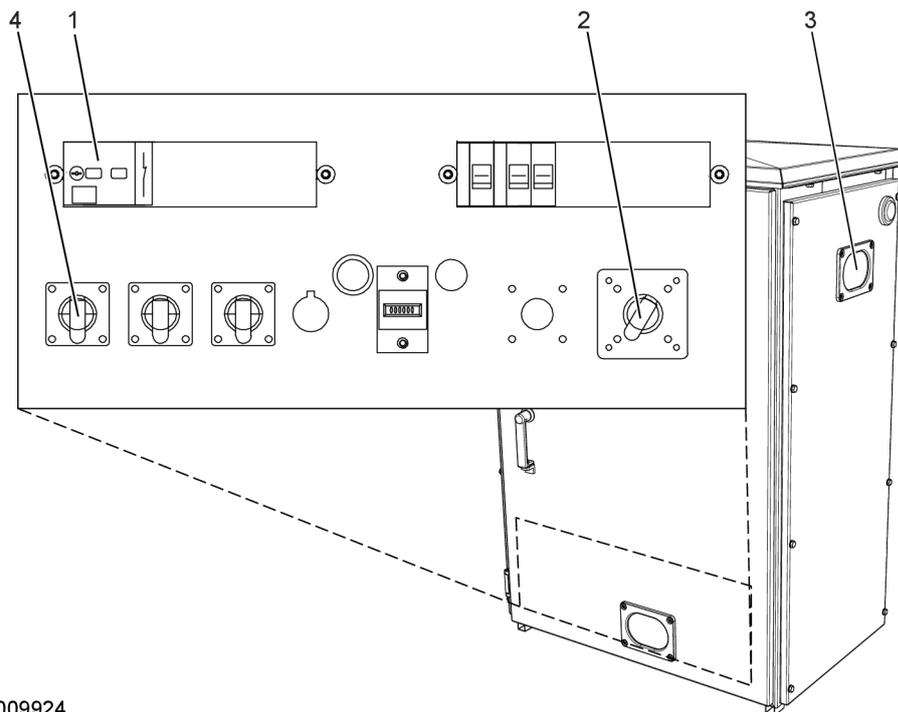
This type of work must only be executed by personnel trained by ABB.

Example of Component Placement



NOTE!

The positioning of the components is an example. See the circuit diagram for exact component placing.

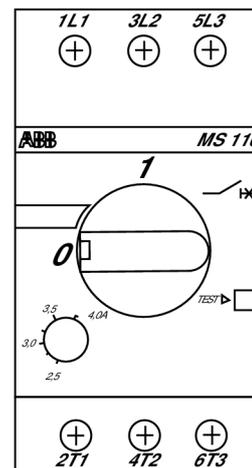


G009924

1. Protective motor switch
2. Local remote switch Local/Remote/Disconnected (S4)
3. Spring charge indicator
4. Closing/opening switch (S1)

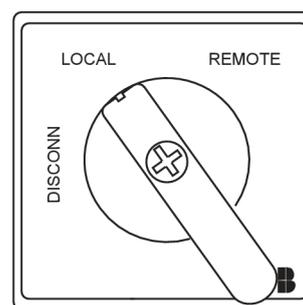
Discharge the Springs Electrically

1. Switch off the motor current by switching off the motor protection (1) (Stop/Off).



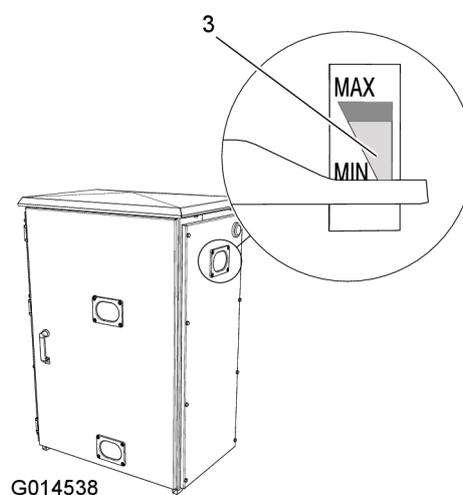
G014829

2. Set the local remote switch, Local/Remote/Disconnected (2) to the "Local" position.



G014537

3. Execute an Open-Close-Open operation. See *Preconditions for Different Operations*, page 25.
4. Check that the spring indicator (3) shows that the springs are discharged.



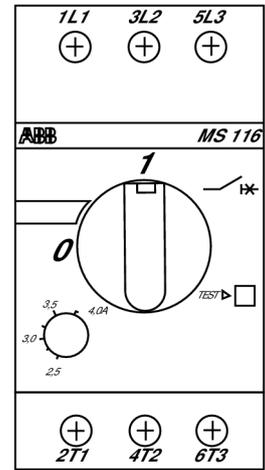
G014538

5. Check that the circuit breaker is in its open position.

6.

**NOTE!**

Following completion of work the motor protection (1) (Start/On) must be reset.



G014536

End of instruction

1.4.2 Discharge the Close Spring Manually

General Information

For maintenance work that requires work on the circuit breaker or operating mechanism, it is important that both the close and trip springs are discharged.



WARNING!

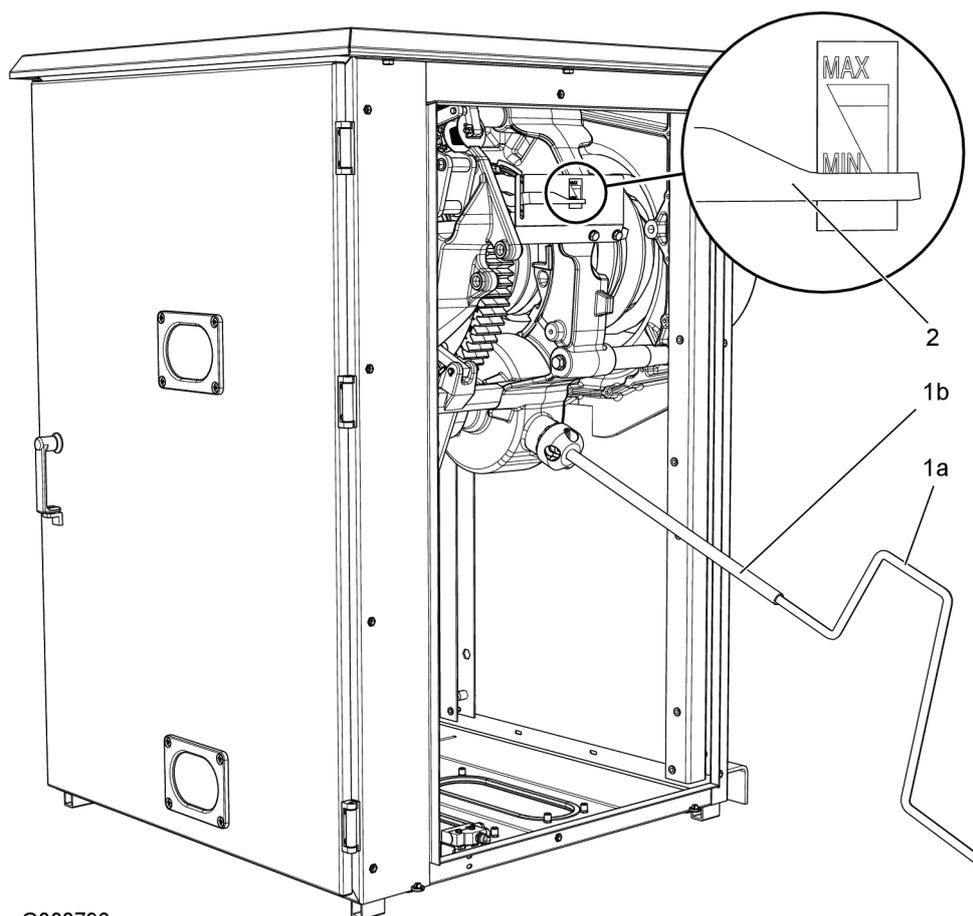
This section describes only the manual discharging of the close spring.



NOTE!

This type of work must only be executed by personnel trained by ABB.

Overview



G008796

1. a) Crank b) Crank extension
2. Close springs indicator

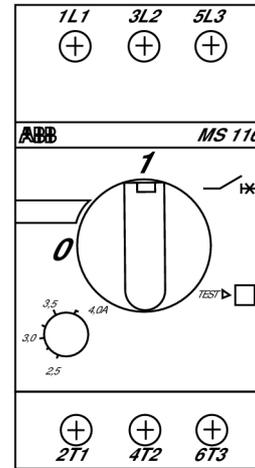
Discharge the Close Spring Manually



WARNING!

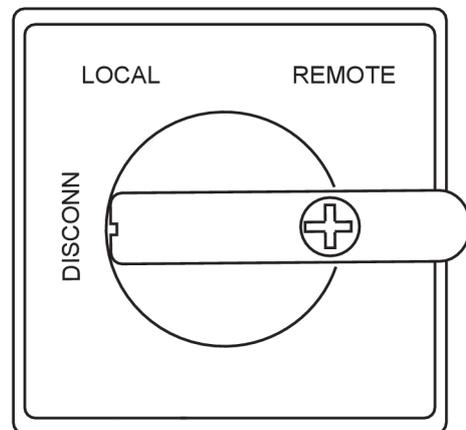
Manual discharging may only be performed if electrical discharging is not possible! Electrical discharging is described in section .

1. Open the door of the operating mechanism.
2. Switch off the motor current by switching off the motor protection (Stop/Off).



G014536

3. Set the local remote switch, Local/Remote/Disconnected, to "Disconnected".



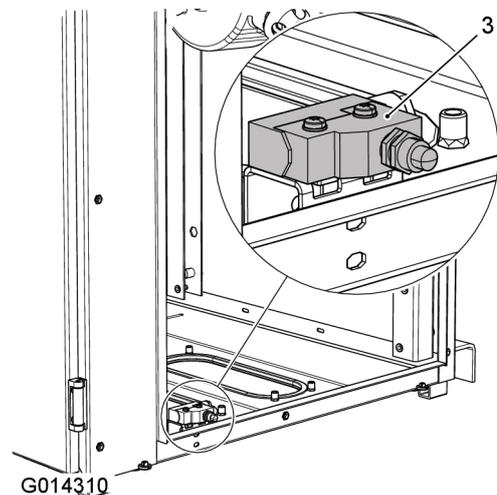
G014612

4. Remove the side plate from the operating cabinet.



NOTE!

The power supply to the motor is disconnected by contact Y7 (3) as long as the side plate remains dismantled.



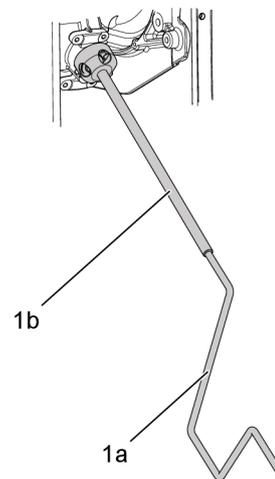
G014310

5. Open the operating mechanism component plate.

6. Attach the crank (1a) to the crank extension (1b) as illustrated.

**NOTE!**

The crank is on the inside of the right-hand door.

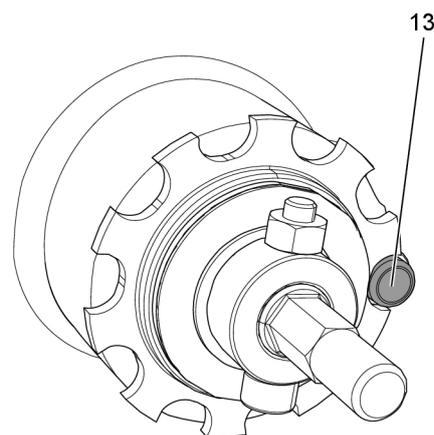


G008267

7. The crank must be held very firmly when it is being used to press in the button (13).

**NOTE!**

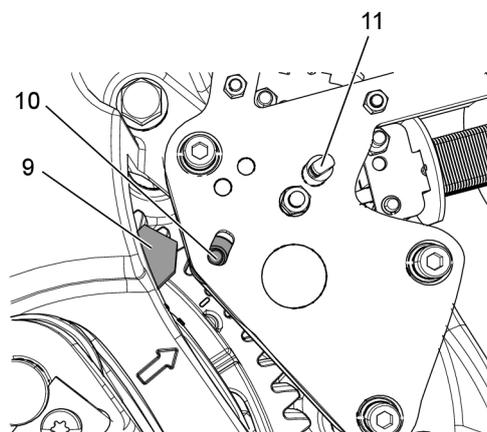
Ensure that the release button (13) is pushed all the way in by the cup of the crank extension (1b) before and during cranking.



G008797

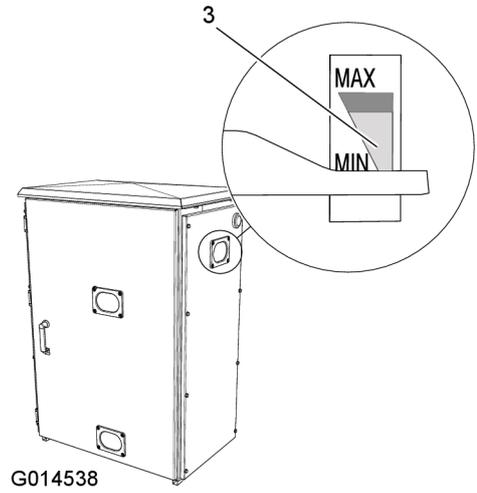
8. Crank counter clockwise with the release button pressed all the way in until the cam disc begins to move.

9. Check that there is 0-5 mm of play between the close catch (9) and the roller in the closing latch device (10).

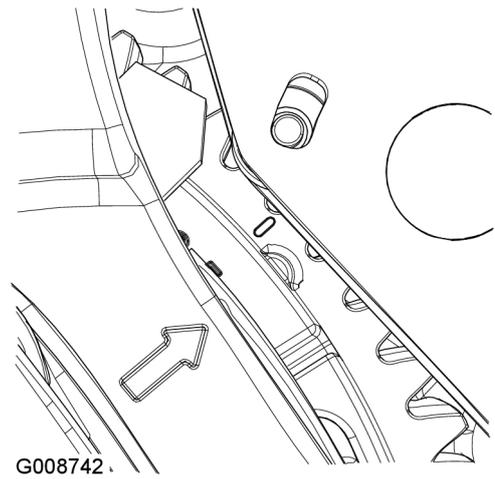


G008743

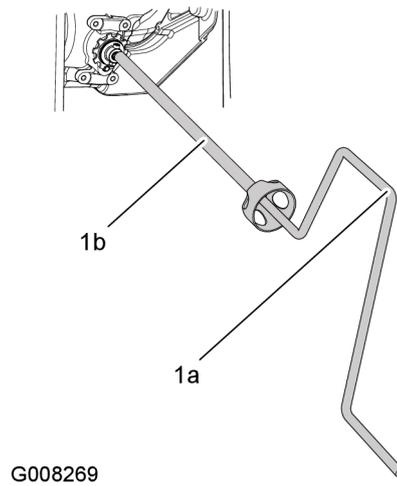
10. Check that the spring charge indicator (3) shows discharged spring.



11. Check that the drive rim marking has gone past the arrow on the frame.

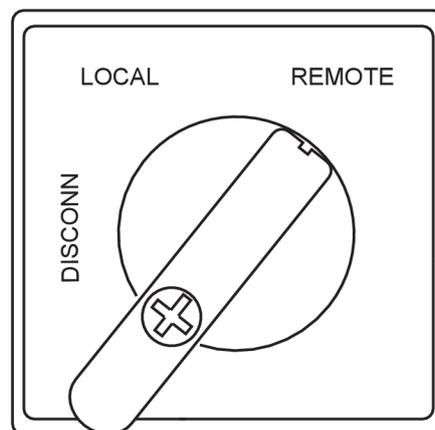


12. Turn the crank extension (1b) and fit in accordance with the illustration.



13. Crank counter clockwise until the release button (13) returns to its locked position.
-

14. Set the local remote switch, Local/Remote/Disconnected, to "Remote" and reset the protective motor switch (1) (Start/On) after completing the work (before the circuit breaker is put back into service).



G014613

See figure *Example of Component Placement*, page 10 .

15.  **WARNING!** Any residual pre-tensioning on the close spring can be gauged from the relationship between the graduation washer and the pin.

End of instruction

1.5 Mechanical Charging of the Close Spring

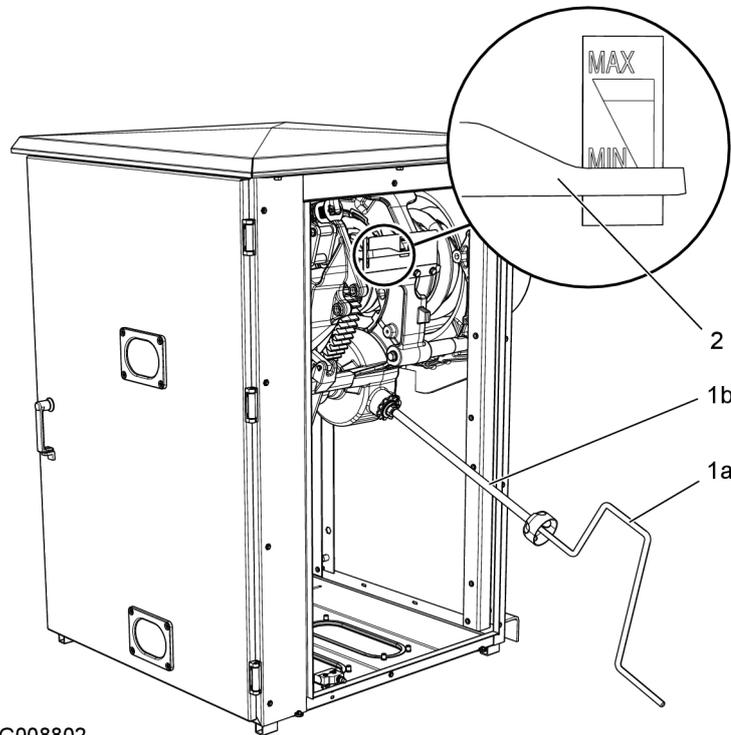
Safety



WARNING!

Mechanical charging is only to be done in emergencies, when there is no motor voltage and the circuit breaker must close. Incorrect handling may cause serious damage to the operating mechanism.

Drive Unit



G008802

1. a) Crank b) Crank extension
2. Close springs indicator

Required Equipment

| Equipment | Part number | Note |
|----------------------------|-------------|--|
| Continuity tester | - | E.g. a multimeter (not included) |
| Crank with crank extension | - | Included with each operating mechanism (mounted inside the operating cabinet). |
| Wiring diagram | - | Included on delivery |



CAUTION!

Do not use any tools other than the enclosed crank for manual charging of the close spring.

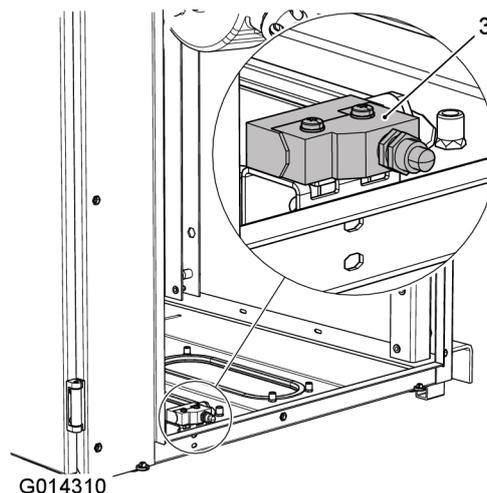
Instructions

1. Remove the side plate from the operating cabinet.

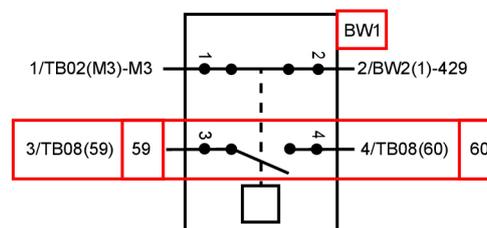


NOTE!

The power supply to the motor is disconnected by contact Y7 (3) as long as the side plate remains dismantled.



2. Identify the positions of open contacts for limit switch 1 (BW1), as shown in the circuit breaker wiring diagram. In this example the relevant positions are terminals 59 and 60.



G013998



NOTE!

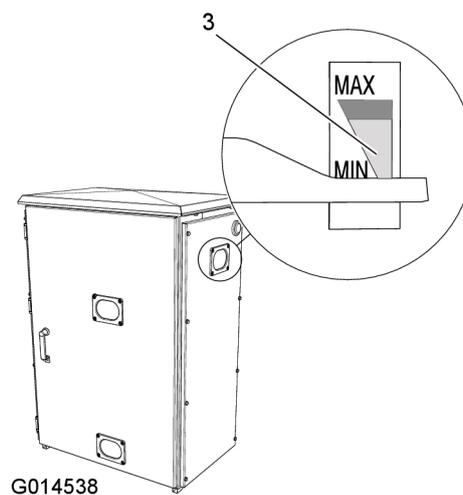
Example of terminals.

3. Connect a continuity tester between the terminals (e.g. 59 and 60).
4. Gently raise the close spring indicator (3) to activate the continuity tester.



NOTE!

If the continuity tester is not activated when the indicator lever reaches its end position, lower the lever again. Repeat steps 2-4 and ensure that the continuity tester is connected to the correct terminals.



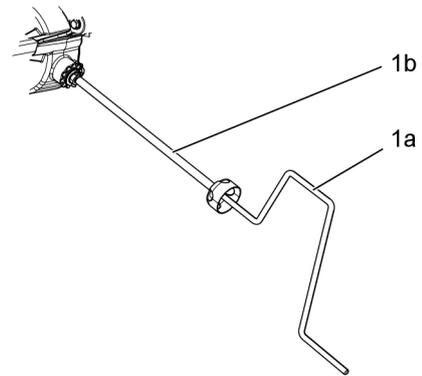
5. When the continuity tester is activated, move the indicator lever (3) back to its default position.

6. Attach the crank (1a) to the crank extension (1b).



NOTE!

In order to charge the close spring, the crank extension (1b) must be fitted the right way round.



G014051

-
7. Crank clockwise until the continuity tester is activated.



WARNING!

If the close spring is tensioned further after activation of the continuity tester, the operating mechanism can be severely damaged.

-
8. Disconnect the crank and remove the continuity tester from the operating mechanism.

-
9. Reinstall the side covers on the operating mechanism.



Torque
10 Nm

-
10. Perform a Close operation and leave the operating mechanism with the close spring discharged.

End of instruction

2 Product Description

2.1 Description

Standards

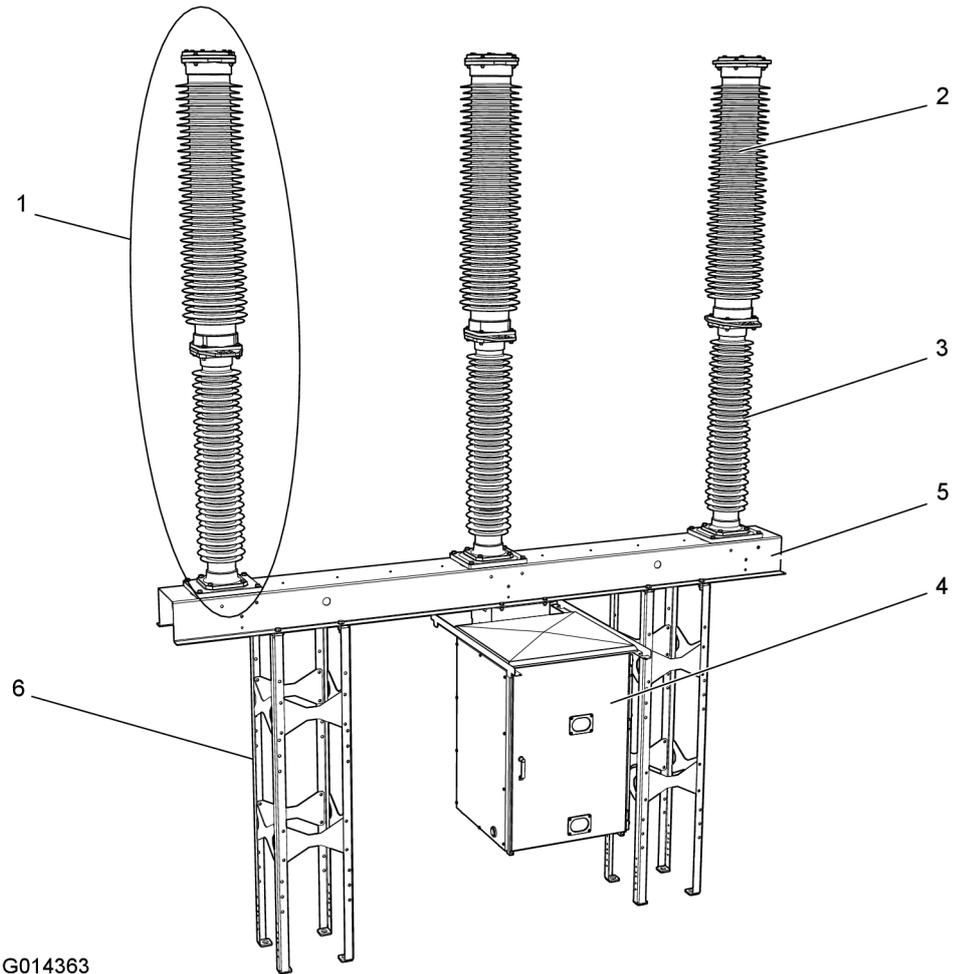
The circuit breaker complies in applicable parts with the requirements of the IEC or ANSI/IEEE standards.

Assembly

Each circuit breaker pole consists of three main components:

- a mechanism housing with a mechanism.
- a hollow post insulator with insulating pull-rod
- a interrupter unit that consists of a breaking chamber insulator with attendant flanges and adapter plates. The interior of the interrupter unit consists of a fixed upper and lower current path with integrated contact system and a moving puffer unit.

The Circuit Breaker's Main Components



| Item | Part | Weight, kg |
|------|--------------------------|--|
| 1 | Circuit Breaker Pole | See outline drawing for applicable order |
| 2 | Interrupter Unit | See outline drawing for applicable order |
| 3 | Post Insulator | See outline drawing for applicable order |
| 4 | Operating mechanism MSD2 | See outline drawing for applicable order |
| 5 | Pole beam | See outline drawing for applicable order |
| 6 | Support structure | See outline drawing for applicable order |

Summary, Operating Mechanism

General Information

The operating mechanism consists of close and trip springs with an associated motor that charges the close springs automatically after each close operation.

A close latch keeps the close springs charged and ready for close and charging of the trip springs. A trip latch keeps the trip spring ready for immediate release.

The components of the operating mechanism are integrated in a cabinet. To facilitate service and overhaul work in the operating mechanism, the roof and side covers of the cabinet can be removed and the control panel opened.

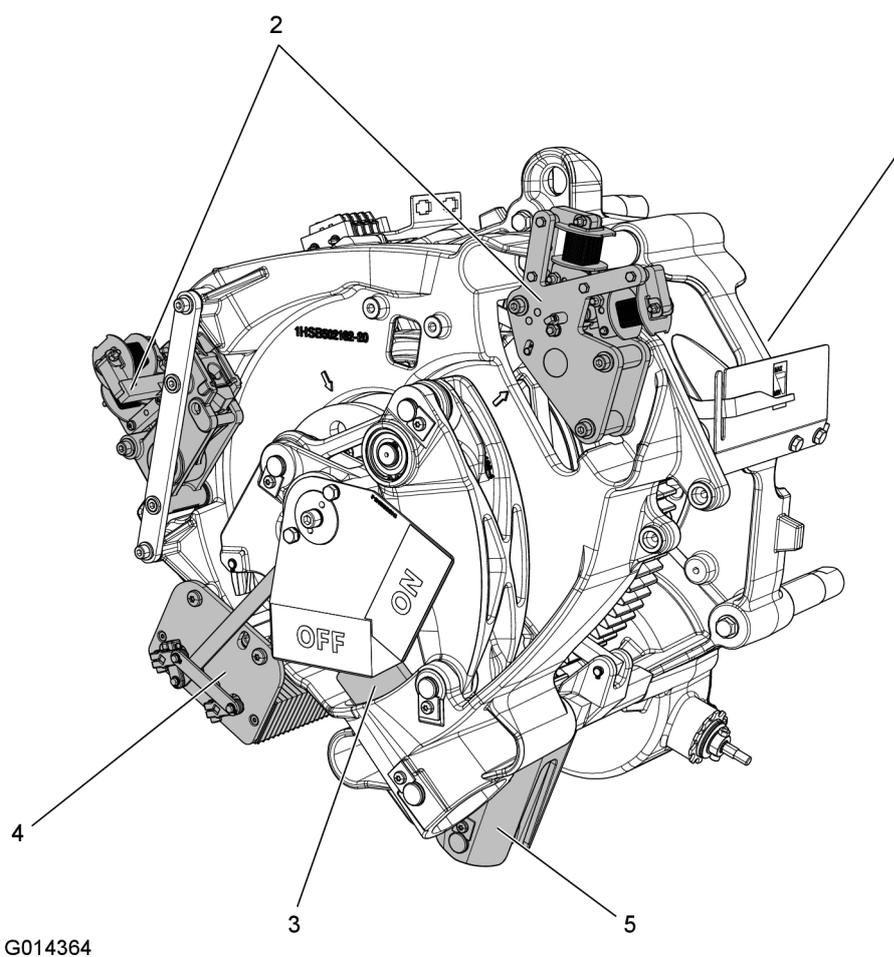
The standard operating cycle is O-0.3s-CO-3 min-CO or CO-15s-CO.



NOTE!

When testing circuit breakers and relay systems that include more than three close operations, the time between the operations should not be less than 1 minute.

Overview



1. Close spring (not visible in illustration)
2. Latch Device
3. Opening damper
4. Auxiliary Contact
5. Close damper

2.2 Functional description, operating mechanism

Description of Closing Operation

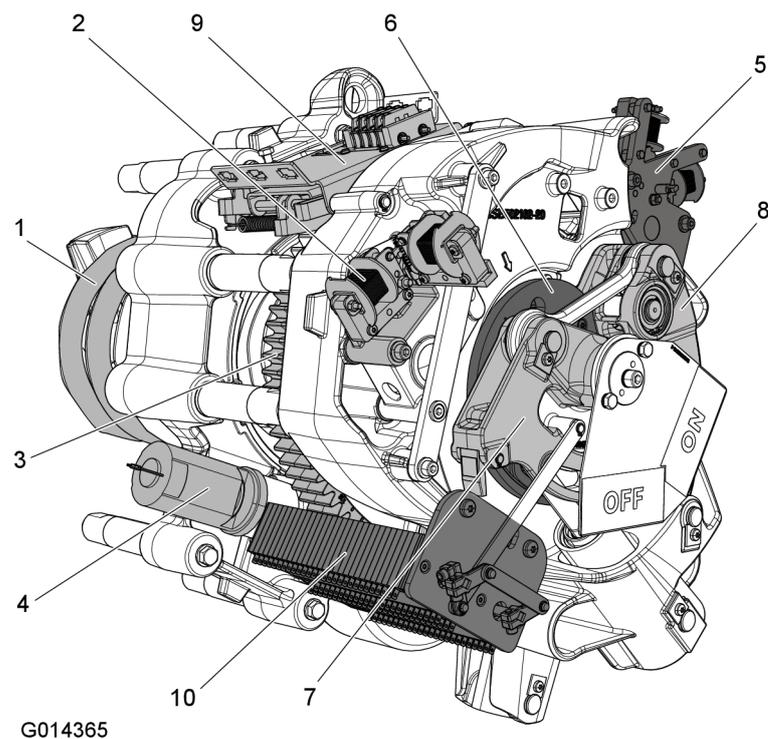
When the signal indicates that the circuit breaker will close, the closing latch device is released and the close springs activate. This means that the cam disc rotates and pushes the closing lever. The operating lever is put in motion and the circuit breaker closes, at the same time as the trip spring in turn is charged and the operating lever is locked in the closed position.

The motor then, via a gearbox, charges the close springs following each closing operation. When the springs are then charged, the motor current is switched off by the limit switches.

Description of Tripping Operation

When the signal indicates that the circuit breaker is to open, the trip latch device releases, and the trip spring activates, thereby opening the circuit breaker.

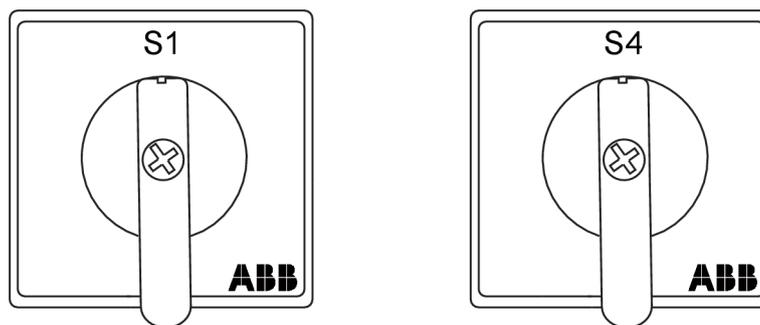
Affected Parts



1. Close spring
2. Trip latch device
3. Drive rim
4. Motor
5. Close latch device
6. Cam disc
7. Operating lever
8. Closing lever
9. Limit Switch
10. Auxiliary Contact

2.3 Preconditions for Different Operations

Switch



G010188

S1 Control switch, Close/Open

S4 Switch, Local/Remote/Disconnected

Remote/Local Operation

For normal operation, the "Local/Remote/Disconnected" switch is in the "Remote" setting for electrical remote control. In the "Local" setting, operation can only be executed using the "Close/Open" control switch. The "Disconnected" setting is used for maintenance.

Tripping Operation

A tripping operation can be performed with the "Closed/Open" control switch when:

- The circuit breaker is in the closed position
- The "Local/Remote/Disconnected" switch is in its "Local" position.
- The gas density is greater than the blocking level

Close Operation

A closing operation using the "Close/Open" control switch or electric remote impulse can only be done if:

- The circuit breaker is in the open position and unlocked
- The "Local/Remote/Disconnected" switch is in the "Remote" or "Local" setting
- The close spring is charged
- The gas density is greater than the blocking level

Auto-Reclosing

Auto-reclose, Open-0.3s-Close-Open is possible if:

- The circuit breaker is closed
- The "Local/Remote/Disconnected" switch is in the "Remote" setting

For auto-reclosing, the substation's relay equipment can supply an immediate trip impulse if there are still short circuits remaining in the network. As the control circuits are electrically interlocked via the auxiliary contact, a closing operation will always be completed before a tripping operation starts, even though a trip impulse has been given during the current closing operation.



WARNING!

A delay of 0.3 s must always occur and will normally take place via the relay equipment in the substation.

2.4 Gas System and Density Monitor

Gas pressure

The circuit breaker poles are delivered vacuum processed and filled with carbon dioxide gas to a pressure of 0.12-0.13 MPa abs at 20°C.

When commissioning, the carbon dioxide and oxygen gas must be filled to the pressure specified on the rating plate. Different gas pressures may occur depending on the different requirements with respect to the lowest ambient temperature.

Density Monitor

The circuit breaker is equipped with a density monitor for checking the density of the gas. All density monitors are equipped with a set of contacts that should be connected to give an alarm in the event of leakage. There are two levels for the alarm, these are:

- Level 1, alarm.
- Level 2, blocking.

**NOTE!**

A new or reconditioned circuit breaker must be gas system tightness checked through reading the density monitor after about one month. Following the initial check, it should be checked at 1-2 year intervals in connection with the routine visual inspections.

**NOTE!**

Density monitors supplied by ABB do not need to be adjusted or calibrated.

2.5 Description, Carbon Dioxide and Oxygen

Carbon monoxide

Carbon dioxide (CO₂) is a naturally occurring chemical compound that consists of two oxygen atoms covalently bound to a single carbon atom. It is a very common gas in the earth's atmosphere. Carbon dioxide is both odorless and colorless at normal temperature and pressure.

Carbon dioxide is heavy, suffocating and very difficult to make react.

Oxygen

Oxygen's (Oxygen, O₂) ground state is one of the universe's most common elements and consists of one oxygen atom with two unpaired electrons. At standard temperature and pressure (STP), oxygen is a gas.

O₂ is chemically highly reactive and combines with most other elements to form stable chemical compounds.

O₂ is a powerful oxidizing agent.

2.6 Breaking Principle

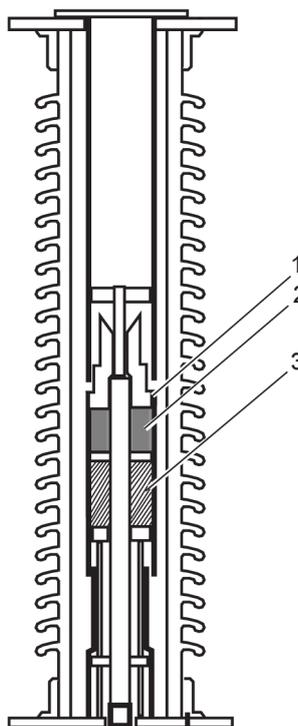
Auto-Puffer™ principle

The interrupter unit functions in accordance with the Auto-Puffer™ principle, with a puffer cylinder that is divided into two chambers: an Auto-Puffer™ section and a compression section.

When normal operating currents are interrupted, the gas in the compression section is compressed to an overpressure. When the arcing contacts separate, the gas in the compression section flows out and extinguishes the arc at a current zero passage.

When short-circuit currents are interrupted, the required extinguishing pressure is built up in the Auto-Puffer™ section by heat from the arc. The pressure increase is achieved with energy from the arc and no extra energy is required from the operating mechanism.

Interrupter Unit with Auto-Puffer™



G014660

1. Puffer cylinder
2. Auto-Puffer™ chamber
3. Compression section

3 Reference Information

3.1 Oil Types

General Information


CAUTION!

All lubricant and oil spills must be covered using absorbent material and be handled as chemical waste in accordance with locally applicable regulations.


CAUTION!

When handling oil, lubricants and locking fluids, long-sleeved overalls, protective goggles and protective gloves appropriate for the purpose must be worn at all times.


CAUTION!

Study the material safety data sheet from the supplier.

Oil A

Thin all-synthetic lubricant for precision mechanical components in the operating mechanism and circuit breakers. Also used when lubricating bearings that cannot be lubricated with grease “G” without removing, e.g. links and link gears.

| Property | Value |
|-------------------------------|-----------|
| Viscosity at 40 °C | 62-65 cSt |
| Lowest pour temperature point | -52°C |

| Supplier | Designation | Part number |
|----------|-----------------------|--------------|
| ABB | 1171 2039-1 | 1HSB875318-A |
| MOBIL | MOBIL 1 (481127)5W-30 | - |
| CASTROL | FORMULA RS5W-50 | - |
| SHELL | TMO Synthetic 5W-30 | - |
| OK | Super-Synthetic 5W-40 | - |

Oil S

Silicone oil designed for dampers in operating mechanisms, such as BLG, BLK and MSD models.

| Supplier | Designation | Part number |
|----------|---------------------|--------------|
| ABB | 1173 7011-106 | 1HSB875318-C |
| SHELL | DC 200 Fluid 200 CS | - |

3.2 Types of Grease

General Information


CAUTION!

All lubricant and oil spills must be covered using absorbent material and be handled as chemical waste in accordance with locally applicable regulations.


CAUTION!

When handling oil, lubricants and locking fluids, long-sleeved overalls, protective goggles and protective gloves appropriate for the purpose must be worn at all times.


CAUTION!

Study the safety data sheet from the supplier.

Grease G

Low temperature grease for all types of bearings, gear drives and worm gears as well as valves in air-blast circuit breakers. Also used for greasing nitrile rubber O-rings in SF₆ circuit breakers, as crevice corrosion protection for circuit breakers, and for movable contacts (opening contacts) in disconnectors.


NOTE!

Must not be used for greasing butyl rubber O-rings, as these are degraded by the grease. In these cases, use grease "T" instead.

| Supplier | Designation | Part number |
|----------|------------------------|-------------|
| ABB | 1171 4014-407 | 5316 381-A |
| GULF | 718EP Synthetic grease | - |
| MOBIL | Mobil grease 28 | - |
| SHELL | Aero Shell Grease 22 | - |

Grease K

Molycote lubricant for lubricating pins in link gears and in earthquake dampers.

| Supplier | Designation | Part number |
|-------------|---------------|-------------|
| ABB | 1263 0011-102 | 5316 381-M |
| Dow Corning | G-rapid plus | - |

Grease L

Low temperature grease specially designed for lubricating precision-engineered equipment parts, such as latching mechanisms in operating mechanisms that are to work in very cold conditions.

| Supplier | Designation | Part number |
|-------------|--|-------------|
| ABB | 1171 4016-606 | 5316 381-H |
| Maagtechnic | Glattol 4103982 | - |
| ASEOL AG | ASEOL SYLITEA 4-018 (No longer manufactured) | - |
| Shell | Shell Alvania 0982 (No longer manufactured) | - |

Grease M

Low temperature grease for long-term and permanent lubrication of worm gears, gear drives and other machine elements. Counteracts wear and corrosion.

Also reduces electrical resistance at the lubrication point, therefore making it suitable for electrical connections and for lubrication of contacts in disconnectors and earthing switches. The grease should be rubbed on in a very thin layer on the sliding surfaces of the contacts.

| Supplier | Designation | Part number |
|----------|---------------------|-------------|
| ABB | 1171 4016-612 | 5316 381-X |
| Klüber | Isoflex Topas NB 52 | - |

Grease N

To lubricate movable contacts and puffer cylinders in SF₆ circuit breakers, the grease should be applied in a very thin layer on the sliding surfaces of the contacts.

| Supplier | Designation | Part number |
|------------------|---------------|-------------|
| ABB | 1171 4016-607 | 5316 381-L |
| Montefluos S.p.A | Fomblin OT20 | - |

Grease P

Vaseline for treatment of contact surfaces in fixed joints internally in the interrupter unit.

| Supplier | Designation | Part number |
|----------|---------------------|-------------|
| ABB | 1171 5011-102 | 5316 381-N |
| SHELL | Shell Vaseline 8401 | - |

Grease S

Fluorosilicone grease for lubrication of EPDM O-rings and as crevice corrosion protection for ED type circuit breakers, as well as greasing of rotating shaft seals in circuit breaker types LTB and HPL.

| Supplier | Designation | Part number |
|--------------|---------------|-------------|
| ABB | 1171 4014-406 | 5316 381-G |
| Dow Corning | FS-3451 No. 2 | - |
| Fluortech AB | TP55 | - |

Grease T

Low-temperature grease for greasing butyl rubber O-rings in CO₂/O₂ circuit breakers and as crevice corrosion protection on all types of circuit breakers.

| Supplier | Designation | Part number |
|----------|-----------------|-----------------|
| ABB | 2GBA000351 | 2GHV062951P0001 |
| Klüber | Syntheso Glep 1 | - |

Grease U

Low-temperature grease for ball bearings in very cold conditions (-50 C and below). Also suitable for lubricating precision-engineered parts that operate in very cold conditions.

| Supplier | Designation | Part number |
|-----------------|--------------------|--------------------|
| ABB | 2GBA000339 | - |
| Dow Corning | Molykote 33L | - |

Grease SV

For lubrication of movable contacts (opening contacts) in disconnectors, silver-plated contacts and brushed aluminum surfaces in fixed joints outdoors.

| Supplier | Designation | Part number |
|-----------------|--------------------|--------------------|
| ABB | 1171 4016-610 | 5316 381-C |
| Statoil | Electrical grease | - |

3.3 Locking Fluid


CAUTION!

When handling oil, lubricants and locking fluids, long-sleeved overalls, protective goggles and protective gloves appropriate for the purpose must be worn at all times.


CAUTION!

Avoid breathing in any gases from thermosetting plastics when applying or heating.


CAUTION!

Study the material safety data sheet from the supplier.

Preliminary Treatment of Surfaces

The surfaces must be free from oil, grease, wax, paint and anti-rust agent.

Locking Fluid B

Medium strength locking fluid used to lock threads. Removable.

| Supplier | Designation | Part number |
|---------------|-------------------------|-------------|
| ABB | 1269 0014-429 | - |
| Locking fluid | Thread locker, grade 43 | - |

Locking Fluid C

Strong locking fluid used to lock threads. Difficult to remove.

| Supplier | Designation | Part number |
|---------------|-------------------------|-------------|
| ABB | 1269 0014-408 | - |
| Locking fluid | Thread locker, grade 70 | - |

Locking Fluid D

A thin fluid that penetrates quickly. Used for locking brackets following assembly or adjustment. The fluid can also impregnate porous welded joints, castings and sintered material. The interlocking has a high resistance against pressure, solvents and chemicals.

Fluid can only be used on clean and dry surfaces. Oily material must be washed with ethanol.

Spray the fluid on the surface in question or apply with a brush.

| Supplier | Designation | Part number |
|---------------|-------------------------|-------------|
| ABB | 1269 0014-409 | - |
| Locking fluid | Thread locker, grade 90 | - |

Locking Fluid F

Extra strong locking fluid for cylindrical attachment. Recommended for joints with sliding or forced fit. Must be heated in order to be removed (temperature resistance 175 °C).

| Supplier | Designation | Part number |
|---------------|-------------------------|-------------|
| ABB | 1234 0011-126 | - |
| Locking fluid | Thread locker, grade 48 | - |

3.4 Tightening Torque

General Information

**NOTE!**

The listed tightening torques are general values for installation, maintenance and overhaul. Use the tightening torques that are specified in the respective instructions.

**NOTE!**

Torque and lubrication of threads unless otherwise stated. Thread size M8 or larger must be lubricated using grease "T". Exceptions are joints where locking fluid is used. In such instances, the thread must be dry and free of oil and grease.

Tightening Torque, General

| Size | Tightening torque (Nm) |
|------|------------------------|
| M6 | 10 |
| M8 | 22.5 |
| M10 | 45 |
| M12 | 79 |
| M16 | 190 |
| M20 | 420 |

3.5 Operating Values

Times

| Events | Times |
|------------------------------|-------------|
| Closing time | Max. 90 ms |
| Opening time | 24-28 ms |
| Close-Open time ¹ | 90 - 130 ms |



NOTE!

Close-Open time stated refers to the time the arcing contacts are closed during a closing operation when the trip impulse is connected at the same time via the auxiliary contact.

Motor and Control Circuits

| Events | Values |
|---------------------------------------|-------------------------------|
| Charging time for motor | < 15 s |
| Control voltage trip coil I | V (according to rating plate) |
| Control voltage trip coil II | V (according to rating plate) |
| Control voltage close coil I (and II) | V (according to rating plate) |

Resistance

Main circuit resistance is maximum 42 $\mu\Omega$ per pole.

Stroke

The stroke is 125 \pm 2 mm.

4 Delivery

4.1 Delivery Inspection

General

The material is packed in boxes and on pallets. The boxes are marked with package numbers and gross weights. Other information is printed on a plate/label attached to two sides of the boxes.

When unpacking the boxed delivery, just lift off the cover from the package and lift the contents out.

All packaging material is recyclable.

Damaged Goods

Check on arrival that the delivery matches the order and delivery documents and that no transportation damage has occurred. If damage is found or suspected, the boxes must be opened and the damage photographed and documented.

In the event of missing material or if transportation damage has occurred, this must be reported immediately to ABB.

4.2 Storage Prior to Assembly

Storage Requirements

All components that are to be stored in an approved storage environment (conditions equivalent to indoors) must comply with the following storage requirements.

An approved storage environment must have:

a roof

solid ground

air humidity below 75% RH

a temperature of 20°C (± 10 °C)

Dust, smoke, abrasive or flammable gas, steam or salt must not be present in close proximity to the products. If this is the case, the equipment must be cleaned prior to assembly.

Storage in a Moist Environment

Storage in moist environments without ventilation can cause discoloring of zinc-coated surfaces. This discoloring is known as “white rust” and primarily consists of zinc oxide and zinc hydroxide. It is the result of a chemical reaction between the pure zinc on the surface and moisture.

The long-term rust protection will not be affected by the "white rust", and the steel-zinc layer under the surface will remain unaffected. In accordance with current practice "white rust" is not a reason for returning the goods.



NOTE!

Operating mechanisms must not be stored in damp environments as phosphatized surfaces can be attacked by corrosion.

Stacking of Packaging Boxes

Packaging boxes of different sizes must never be stacked on top of each other (the pressure could damage the lids of the lower boxes). If different sized boxes need stacking, a frame must be used between the boxes to distribute the pressure.



WARNING!

Never stack more than three boxes on top of each other. Due to instability and the risk of collapse the boxes need to be secured.

Circuit Breaker Poles

The circuit breaker poles must be stored in their original packaging, where they are protected from damage. The packaging must not stand in water and must primarily be kept in a horizontal position indoors and above ground level, so as to avoid cracking or water damage.

The circuit breakers may also be stored outdoors, but in that case in an area protected from rain on a dry, well-drained surface. If a tarpaulin is used, it must not be wrapped too tightly; air circulation to the zinc-plated surfaces must not be hindered. Any moisture must be easy to drain off.

Support structure

Support structures can be stored outdoors.

Operating Mechanism/Control Cabinet

Operating mechanisms and control cabinets must be stored in their original packaging to protect them against damage. For periods of storage greater than 3 months, the storage area must be protected from rain and consist of a dry, well-drained surface, with the heating element electrically connected to prevent corrosion on the sensitive equipment.

Spare Parts

Spares must be stocked indoors in their original packing. This is particularly important for rubber components (such as seals), which also need protecting from sunlight to avoid drying up. Gaskets have a limited service life, you should therefore avoid stocking them.

5 Installation

5.1 Installation in Short Steps

General Information

This section provides a summary of the installation procedure, describing the steps required for installing the complete circuit breaker with the support structure and operating mechanism.



WARNING!

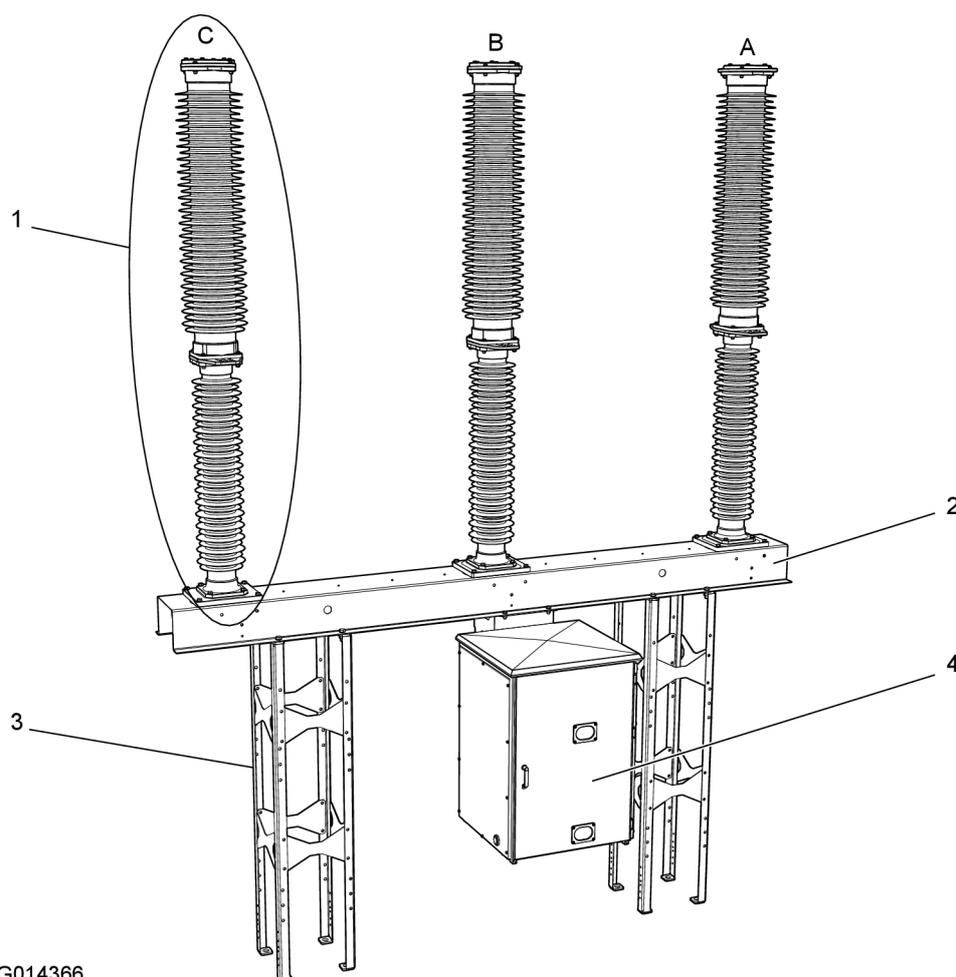
Before assembling, check that the serial numbers on the circuit breaker pole and operating mechanism match.



NOTE!

Before commencing installation, read *Introduction, Safety*, page 7.

Overview



G014366

1. Circuit Breaker Pole
2. Pole beam
3. Support structure
4. Operating mechanism MSD2

Summary of the Installation

| Instructions | Description |
|---|---|
| Delivery inspection. | <i>Delivery Inspection</i> , page 39 |
| Inspection of required tools. | <i>Required Equipment</i> , page 45 |
| Inspection of foundation. | <i>Foundations</i> , page 46 |
| Fit the support structure. | <i>Assembly of Support Structure</i> , page 47 |
| Assembling the support structure on the foundation | <i>Assembly of Support Structure on the Foundation</i> , page 48 |
| Lift off the pole beam. | <i>Lifting the Pole Beam</i> , page 50 |
| Assembly of pole beam. | <i>Assembly of Pole Beam on the Support Structure</i> , page 51 |
| Lifting the Operating Mechanism. | <i>Lifting the operating mechanism from the transport packaging.</i> , page 58 |
| Assembly of operating mechanism. | <i>Installation of Operating Mechanism</i> , page 60 |
| Lifting the Circuit Breaker Poles. | <i>Lifting the Circuit Breaker Poles</i> , page 53 |
| Assembly of circuit breaker poles. | <i>Assembly of Circuit Breaker Poles</i> , page 55 |
| Fit the gas monitoring system. | <i>Assembly of Gas Monitoring System</i> , page 76 |
| Install all electrical connections: | - |
| <ul style="list-style-type: none"> • Connect the operating mechanism • Fit the rails or lines | <ul style="list-style-type: none"> • <i>Connecting the Circuit Breaker's Operating Mechanism</i>, page 78 • <i>Assembly of the High-Voltage Terminals</i>, page 79 |
| Pressurizing of circuit breaker poles: | - |
| <ul style="list-style-type: none"> • Preparations • Equipment • Filling of Mixed Gas | <ul style="list-style-type: none"> • <i>Preparations for Gas Filling</i>, page 81 • <i>Gas Filling Equipment</i>, page 83 • <i>Filling of Mixed Gas</i>, page 84 |
| Check the bolted joints. | <i>Inspection of Bolted joints</i> , page 80 |
| Prepare for commissioning: | - |
| <ul style="list-style-type: none"> • Perform a gas system tightness check | <ul style="list-style-type: none"> • <i>Gas System Tightness Check</i>, page 89 |

5.2 Required Equipment

Required Tools

| Tool | ABB part no. | Note |
|---------------------------------------|--------------|---|
| MK toolbox | 6880 768-7 | Torque wrenches 10-550 Nm. NOTE! The MK toolbox is not included in the delivery; it must be ordered separately. Alternatively, the existing tool equipment may be used. |
| Lifting device and slings | | |
| Gas Filling Equipment | | |
| CO ₂ -sniffer | | |
| Fine abrasive material or emery cloth | | |
| Control pin | | Delivered with the operating mechanism placed inside the cabinet. |
| Crank extension | | |

Lubricant

| Agent | ABB part no. | Note |
|---------------|--------------|---|
| Grease "T" | | See sections <i>Types of Grease</i> , page 32 and <i>Oil Types</i> , page 31 for ABB part numbers, suppliers and trade names. |
| Grease "SV" | | |
| Contact paste | - | - |

Other Documentation

| Document | ABB part no. | Note |
|---|--------------|------|
| Outline drawing and diagram applicable to the order | - | |

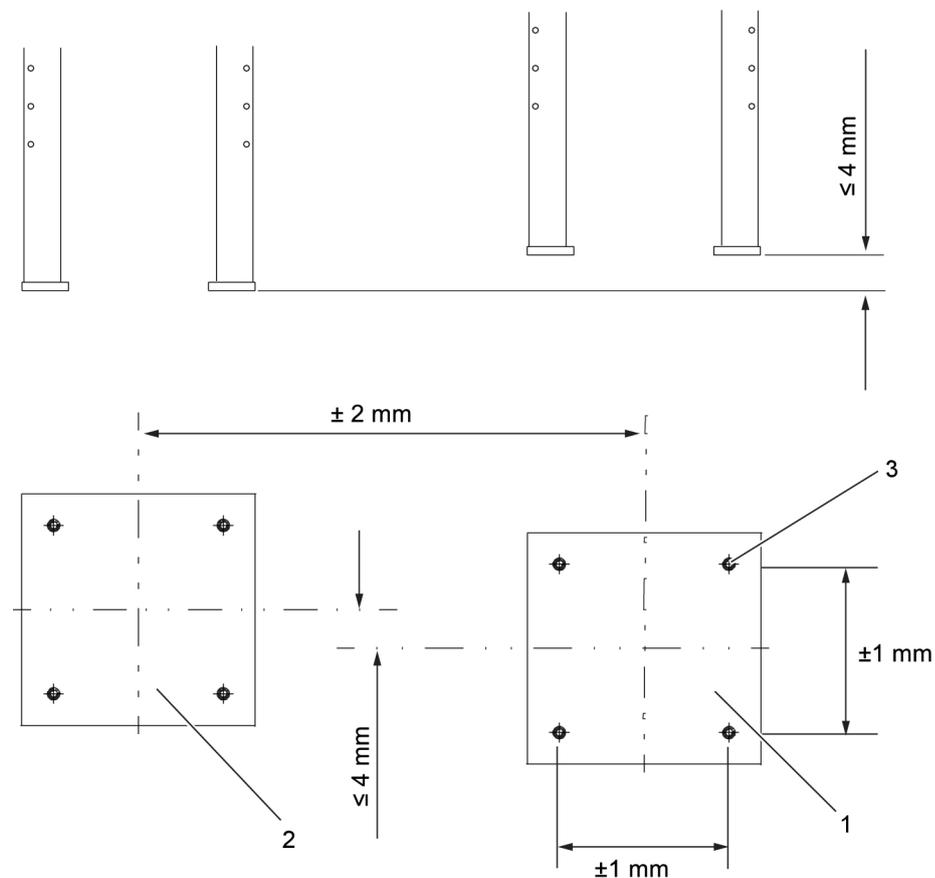
5.3 Foundations

General Information

The foundation for the circuit breaker must be flat and horizontal. The figure shows the permitted tolerances in millimeters for the position of the foundation bolts and for the phase spacing.

Any deviations should be adjusted using spacers; see section *Assembly of Support Structure on the Foundation*, page 48. The nominal dimensions, as well as the dimensions for the foundation bolts and nuts are specified in the outline drawing that is applicable to the order.

Tolerances



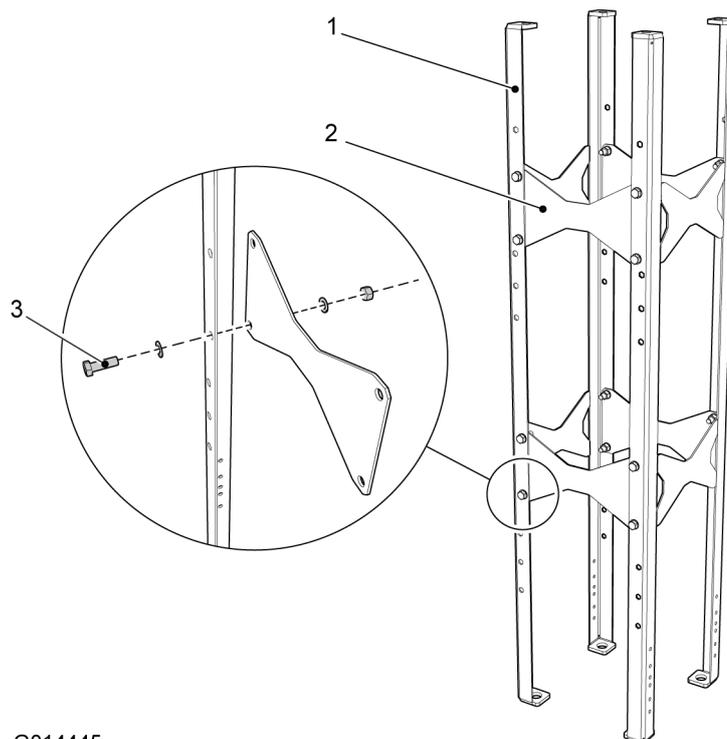
G014501

1. Support structure
2. Foundation for support structure
3. Foundation bolt, L > 130 mm

5.4 Assembly of Support Structure

Example of Fitting the Support Structure

The support structure is delivered as welded halves together with cross-bracings, and bolts, nuts and washers.



G014445

1. Support structure halves
2. Cross-bracing
3. Bolt M16x50, nut M16, washer 17x30x3

Required Equipment

| Equipment | Part number | Note |
|------------|-------------|------|
| MK toolbox | 6880 768-7 | |

Assembly Instructions

1. Connect the two halves of the support structure (1) to the cross-bracings (2) and secure with bolts, nuts and washers (3).
2. Tighten all bolts finger-tight.



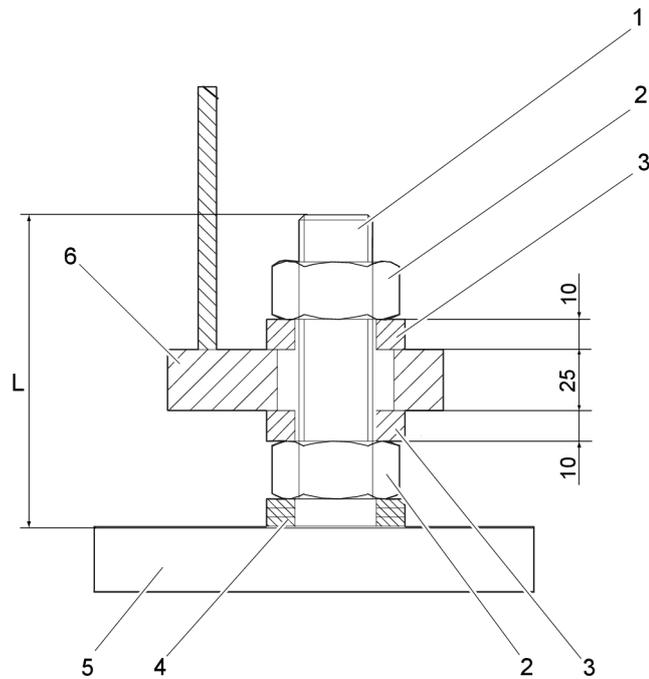
NOTE!

Final torque tightening takes place at a later stage of the installation.

End of instruction

5.5 Assembly of Support Structure on the Foundation

Overview



G002636

- | | |
|---|-----------------------------|
| 1 | Foundation bolt, L > 130 mm |
| 2 | Nut |
| 3 | Washer for M24 (26.5x50x10) |
| 3 | Washer for M30 (32x65x10) |
| 4 | Spacing washer |
| 5 | Foundations |
| 6 | Support structure |

Required Equipment

| Equipment | Part number | Note |
|---------------|-------------|--|
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque 300-350 Nm for M24. Torque 500-550 Nm for M30. |

Assembly



DANGER!

Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.

1. Fit the lower nuts (2) and washers (3) to the foundation bolt (1) and position the support structure (6).
2. Check that the support structure is vertical and level it by adjusting the lower nuts (2).
3. Fill the spaces between the lower nuts (2) and the foundation using spacers (4).



NOTE!

The space should be as small as possible.

4. Torque tighten the lower nuts (2) to the spacers (4).



Torque

M24: tightening torque 300-350 Nm.

M30: tightening torque 500-550 Nm.

5. Fit the washers (3) and upper nuts (2) as illustrated. Tighten finger tight.



NOTE!

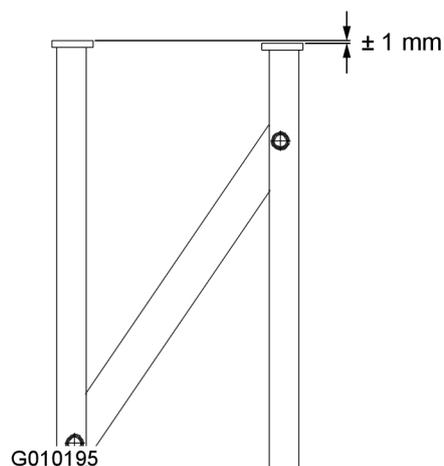
Final torque tightening takes place at a later stage of the installation.

6. Check that the top of the support structure is flat.



NOTE!

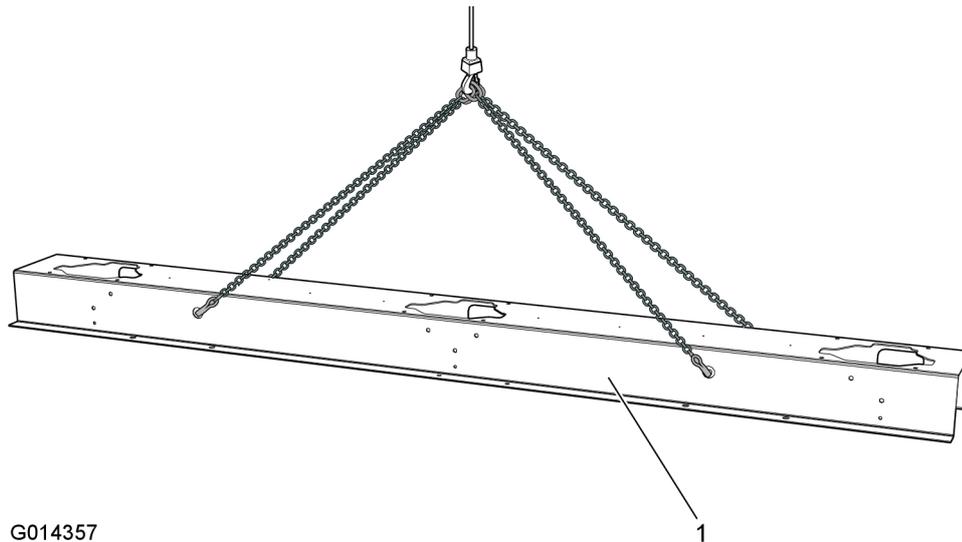
The top of the support structure must be level within 1 mm, otherwise it must be adjusted.



End of instruction

5.6 Lifting the Pole Beam

Lifting Illustration



1. Pole beam

Required Equipment

| Equipment | Part number | Note |
|----------------|-------------|------------------------------|
| Lifting tackle | | Not included in the delivery |
| Lifting device | | Not included in the delivery |

Lifting Instructions



DANGER!

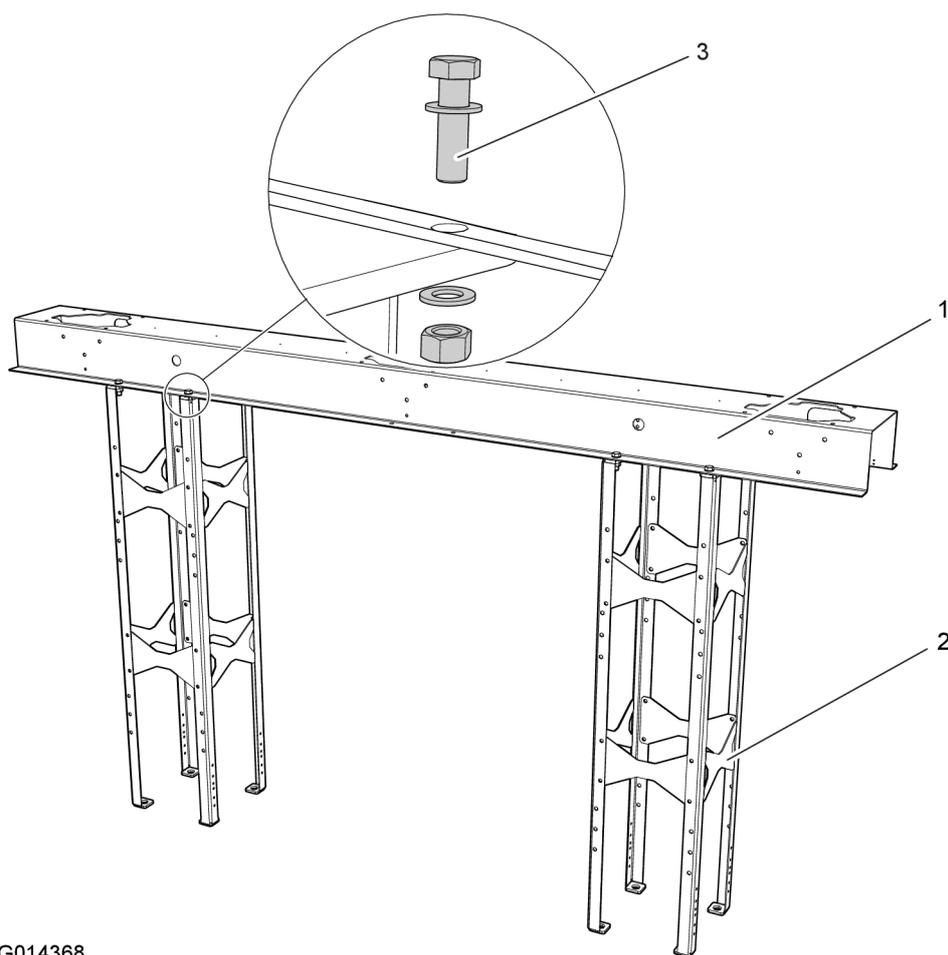
Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.

1. Attach the lifting device to the holes on the side of the pole beam.
2. Lift the pole beam.

End of instruction

5.7 Assembly of Pole Beam on the Support Structure

Overview



1. Pole beam
2. Support structure
3. Bolt M20x60 (8 pcs), washer 21x37x3 (16 pcs), nut M20 (8 pcs)

Required Equipment

| Equipment | Part number | Note |
|---------------|-------------|-------------------------|
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque range 300-350 Nm |

Assembly Instructions

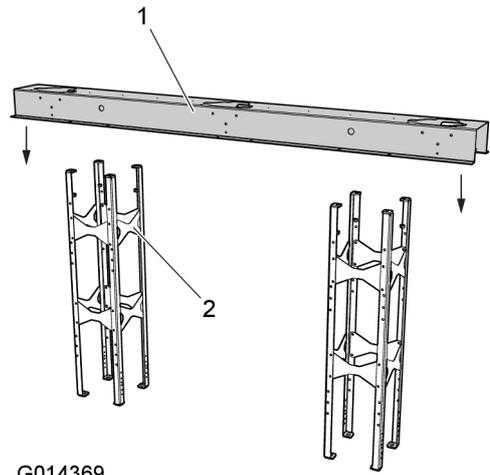


DANGER!

Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.

1. Lift the pole beam (1).

- Carefully lower the pole beam (1) on to the support structure legs (2).



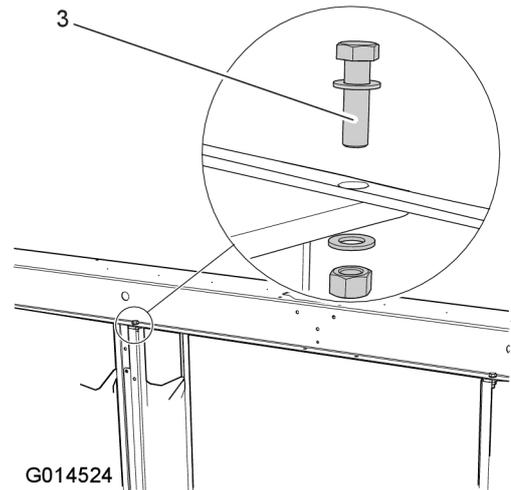
G014369

- Assemble the bolt with washer and nut (3) onto the support structure.



NOTE!

Apply grease to the bolts (3).



G014524

- Bolt M20x60 (8 pcs), washer 21x37x3 (16 pcs), nut M20 (8 pcs)

- Tighten the bolts.



Torque
300 Nm

- Torque tighten M16 bolts between cross-bracings and support structure halves.



Torque
190 Nm

- Conduct final tightening of the support structure in the foundation.



Torque
300-350 Nm

End of instruction

5.8 Lifting the Circuit Breaker Poles

Safety



WARNING!

In order to use the correct lifting tackle, it is extremely important to check the weight of the circuit breaker pole. The weight of the circuit breaker pole is specified on the outline drawing applicable to the order.



CAUTION!

Please note the positioning of the lifting sling! In respect of polymer insulators, the lifting sling must be placed as close as possible to the connecting flange and not on the rubber surface.



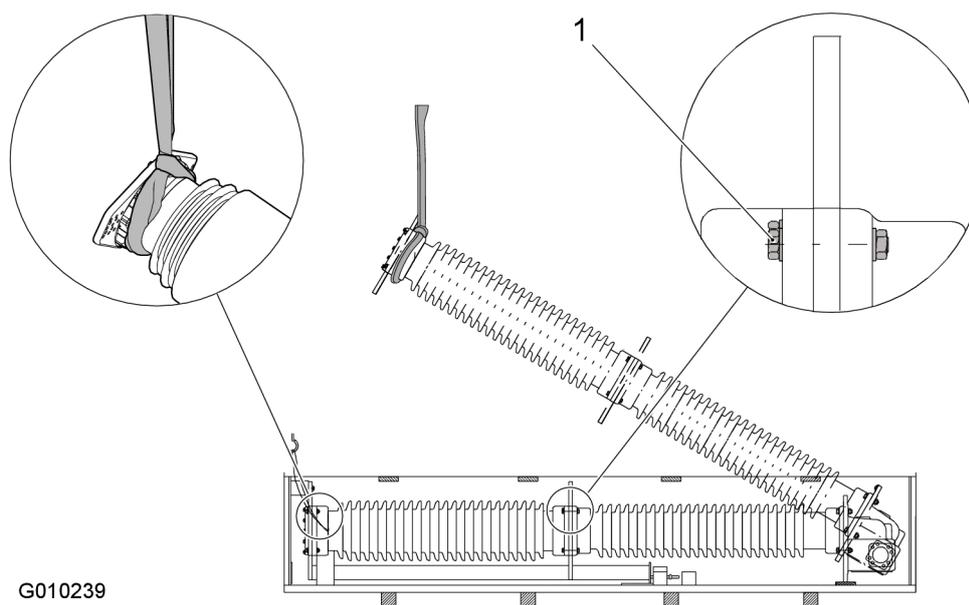
NOTE!

The circuit breaker pole/poles should be stored in transport boxes until immediately before assembly.

Required Equipment

| Equipment | Part number | Note |
|---------------------------|-------------|----------|
| Torque wrench | | 60-79 Nm |
| MK toolbox | 6880 768-7 | |
| Lifting device and slings | | |

Lifting Illustration



1. Bolted joint

Lifting Instructions**DANGER!**

Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.

1. Place a lifting sling around the top of the circuit breaker pole.

**CAUTION!**

Please note the positioning of the lifting sling! In respect of polymer insulators, the lifting sling must be placed as close as possible to the connecting flange and not on the rubber surface.

2. Check that the bolts (1), have the correct tightening torque.
3. Lift the circuit breaker pole from its horizontal position in the transport packaging.
Start with the pole that will be installed at the center.

4. Check that the circuit breaker pole is pressurized to the transport pressure. Use a pressure gauge.

**NOTE!**

Should the pressure be incorrect, this must be rectified before the circuit breaker pole is fitted. Check that the pressure on the poles exceeds atmospheric pressure.

End of instruction

5.9 Assembly of Circuit Breaker Poles

General Information



CAUTION!

The circuit breaker poles are always delivered in the open position, and this position must not be changed before fitting.



CAUTION!

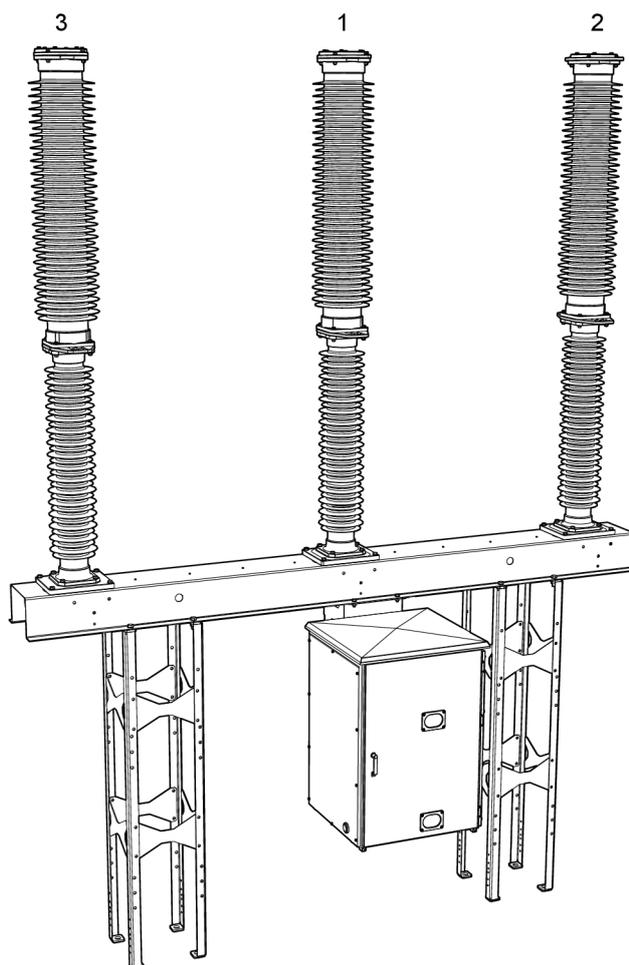
Wear gloves to avoid cuts.



CAUTION!

Exercise caution when assembling the circuit breaker poles, as there is a risk of crushing injuries due to the weight involved.

Structure



G014371

1. Circuit breaker pole B
2. Circuit breaker pole A
3. Circuit breaker pole C

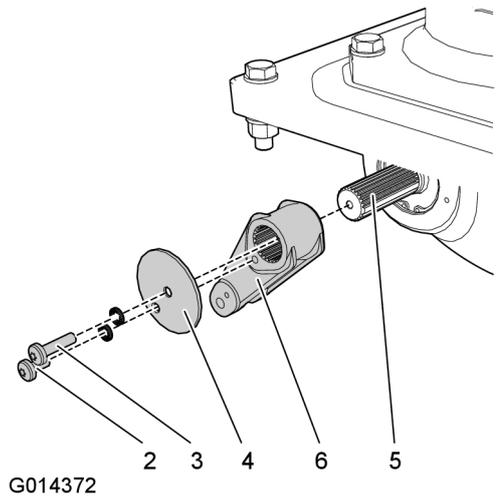
Required Equipment

| Equipment | Part number | Note |
|-------------|--------------|----------------------------------|
| MK toolbox | 6880 768-7 | |
| Torque tool | 1HSB426883-3 | Supplied in the accessories box. |

| Equipment | Part number | Note |
|---------------------------|-------------------------|--|
| Torque wrench | - | Torque range 10-350 Nm |
| Control pin | 1HSB539782-1 | Placed in a holder inside the operating mechanism. |
| Grease "T" | | See section <i>Types of Grease</i> , page 32 for details |
| Locking fluid "C" | Thread locker, grade 70 | |
| Lifting device and slings | | |

Assembly Instructions

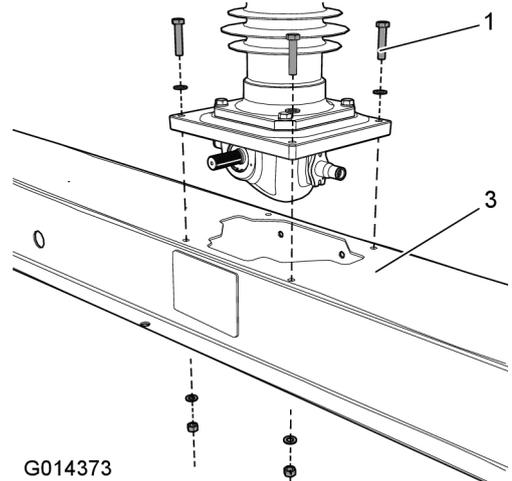
1. Remove the bolt with washer (2), bolt with washer (3), transport washer (4) and operating lever (6) from the operating shaft (5) on all circuit breaker poles.



2. Lift the circuit breaker pole B in place and install it on the pole beam (3).



CAUTION!
The gas tubes are fitted on the inside of the pole beam. Make sure that they are not damaged when assembling the circuit breaker pole.



- 1 Bolts M16x70 (4 pcs), washers 17x30x3 (8 pcs), nuts M16 (4 pcs)

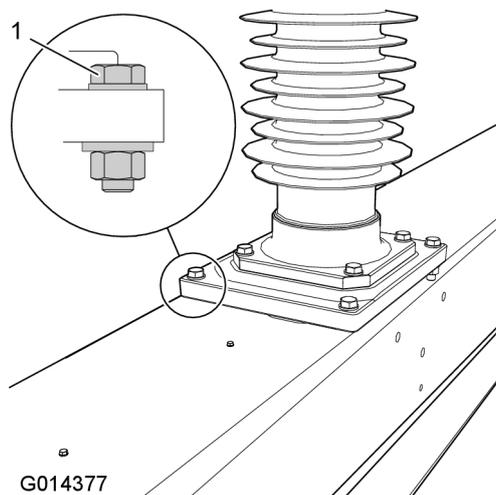


NOTE!
Check that the circuit breaker pole is turned so that operating shaft (5) is oriented on the same side as the operating mechanism transmission rod.

3. Assemble bolts, washers and nuts (1) and torque tighten.

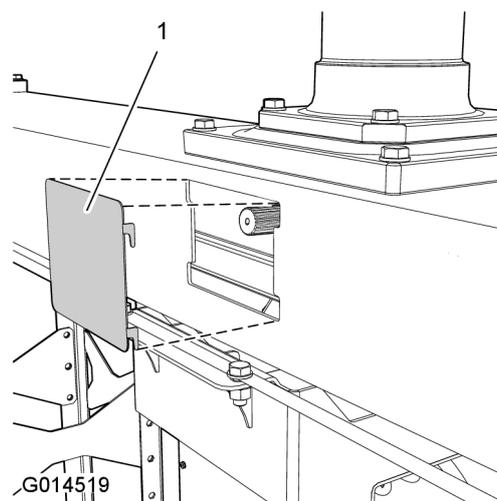


Torque
190 Nm



1. Bolts M16x70 (4 pcs), washers
17x30x3 (8 pcs), nuts M16 (4 pcs)

4. Assemble circuit breaker pole A and C on the pole beam in the same way as circuit breaker pole B.
5. Remove the protective plates (1).



End of instruction

5.10 Lifting the operating mechanism from the transport packaging.

Lifting Illustration



Required Equipment

| Equipment | Part number | Note |
|----------------|-------------|------|
| Lifting tackle | | |
| Lifting device | | |

Lifting Instructions



DANGER!

Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.



NOTE!

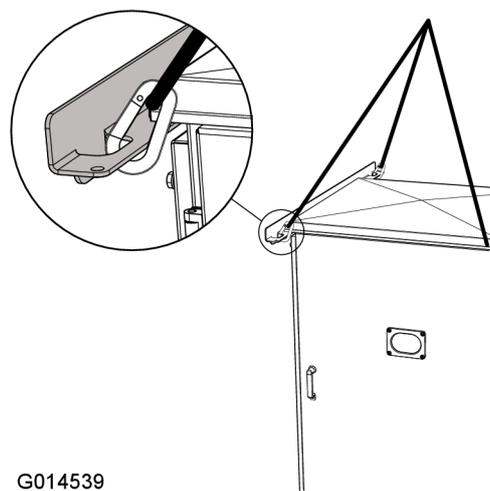
The lifting slings must not be placed around the cabinet when lifting.

1. Check that the retaining bolts for the lifting rails are securely tightened.

2. Attach the lifting devices to the horizontal part of the lifting rails.

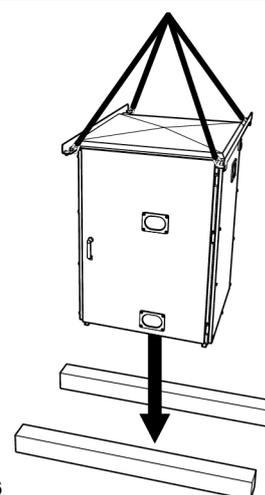
**NOTE!**

Note the direction in which the lifting device is turned.



G014539

3. Lifting the operating mechanism.
4. Position the operating mechanism on two beams in order to protect the trip mechanisms (not visible in illustration) and cable entries on the underside of the mechanism.



G014516

End of instruction

5.11 Installation of Operating Mechanism

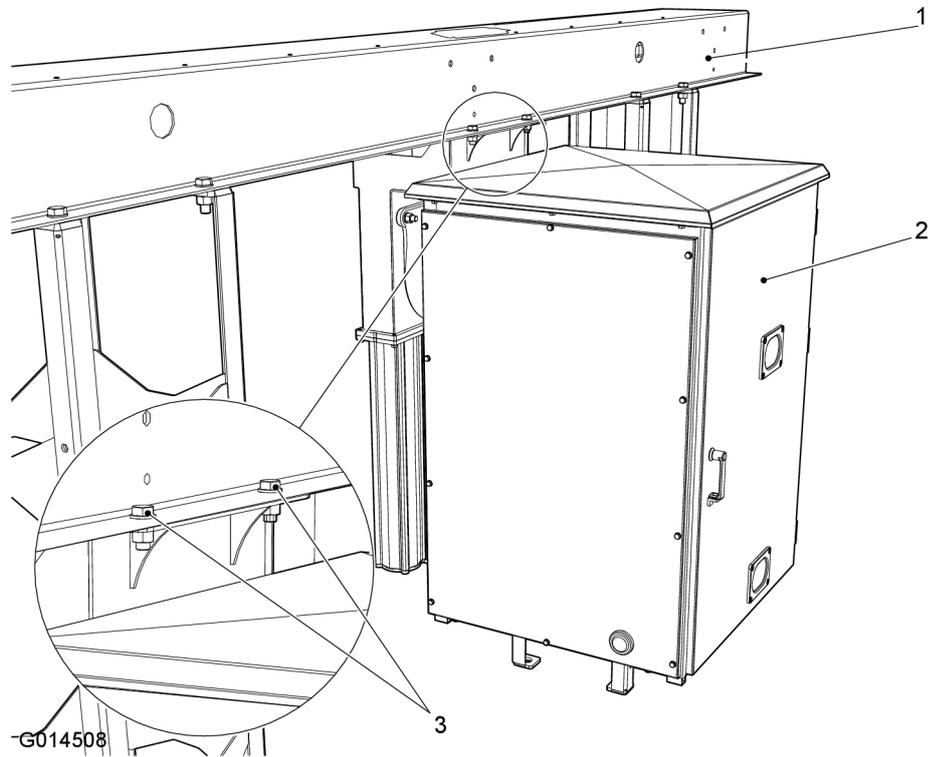
General Information



WARNING!

Before assembling, check that the serial numbers on the circuit breaker pole and operating mechanism match.

Operating Mechanism



1. Pole beam
2. Operating Mechanism
3. Bolt M16x40 (4 pcs), washer 17x30x3 (8 pcs), nut M16 (4 pcs)

Safety



WARNING!

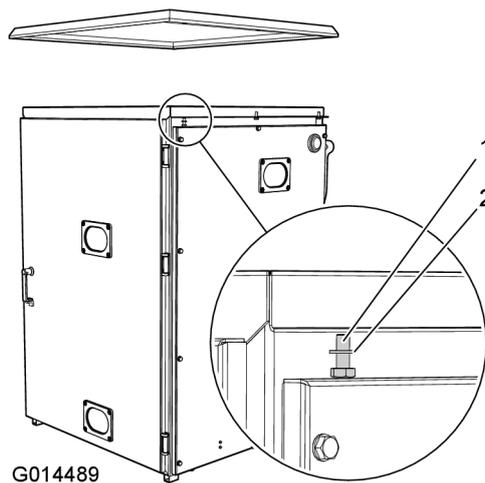
The operating mechanism must **not** be closed, operated nor have charged close springs until all tasks related to installation and adjustment of the circuit breaker have been completed.

Required Equipment

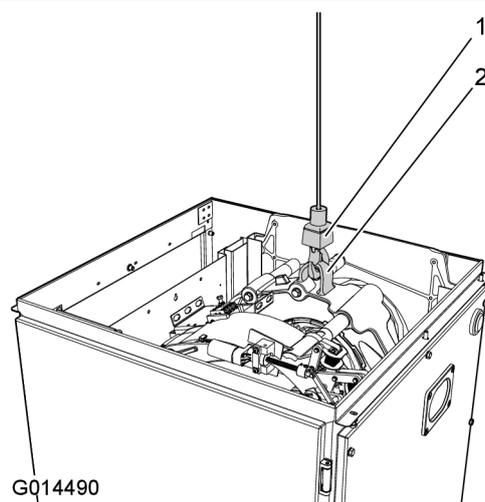
| Equipment | Part number | Note |
|------------|-------------|------|
| MK toolbox | 6880 768-7 | |

Assembly Instructions

1. Remove the top of the operating mechanism.



2. Attach the lifting tackle (1) to the lifting bracket (2) on the operating mechanism.

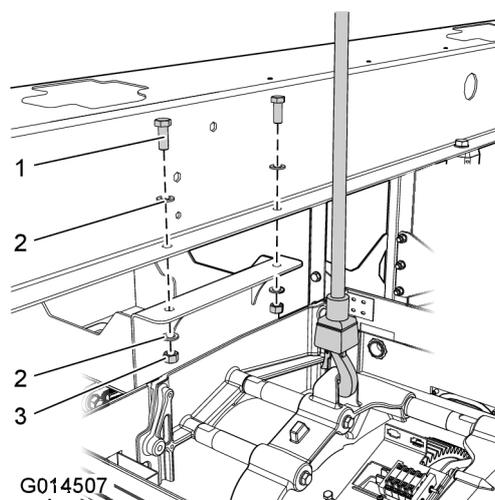


3. Align the operating mechanism attachment points against the pole beam.
4. Assemble bolt (1) and washer (2) with nut (3) and tighten finger-tight.



NOTE!

Apply grease "T" to the bolts (1).



1. Bolt M16x40 (4 pcs.)
2. 17x30x3 washer (8 pcs)
3. Nut M16, (4 pcs)

5. Tighten the bolted joint using a torque wrench.



Torque
190 Nm.

End of instruction

5.12 Fitting of Rod System

5.12.1 Assembly of operating lever on circuit breaker pole B

General Information

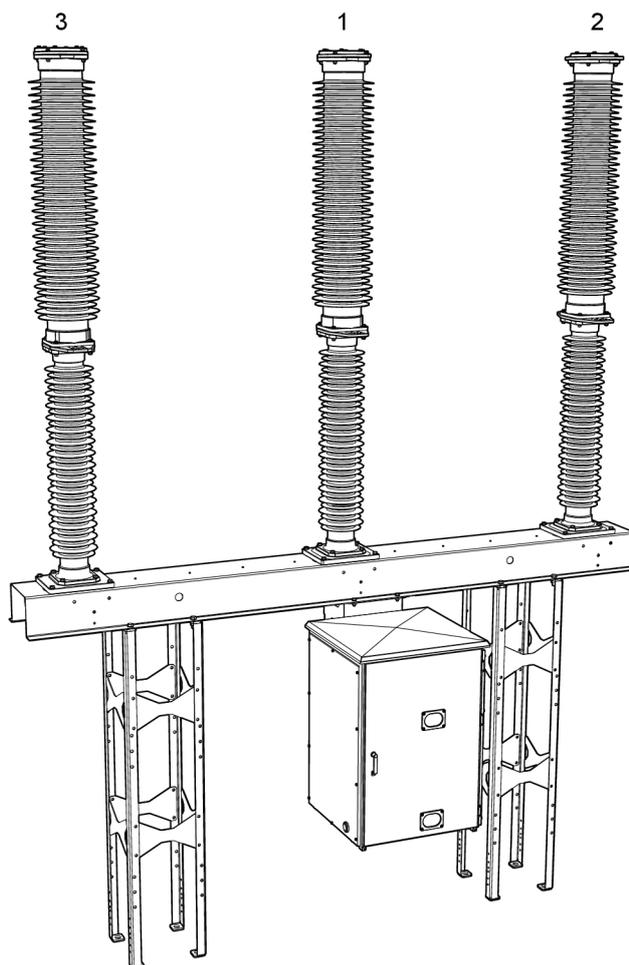

CAUTION!

The circuit breaker poles are always delivered in the open position, and this position must not be changed before fitting.


CAUTION!

Wear gloves to avoid cuts.

Structure



G014371

1. Circuit breaker pole B
2. Circuit breaker pole A
3. Circuit breaker pole C

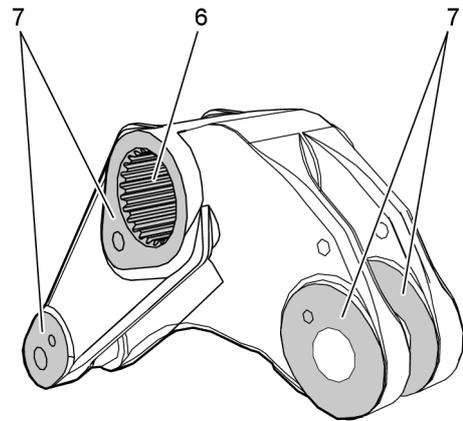
Required Equipment

| Equipment | Part number | Note |
|---------------|--------------|--|
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque range 10-350 Nm |
| Control pin | 1HSB539782-1 | Placed in a holder inside the operating mechanism. |

| Equipment | Part number | Note |
|---------------------------|-------------------------|--|
| Grease "T" | | See section <i>Types of Grease</i> , page 32 for details |
| Locking fluid "C" | Thread locker, grade 70 | |
| Lifting device and slings | | |

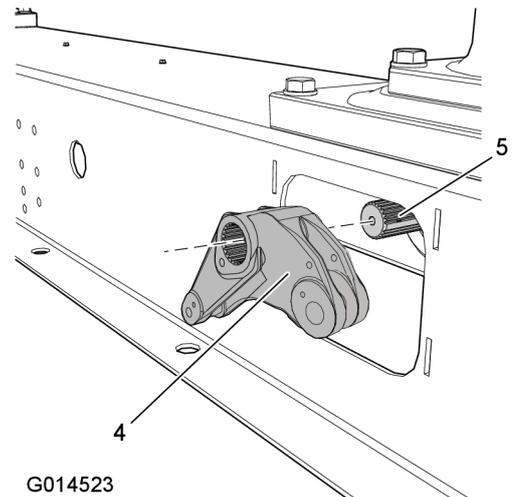
Assembly Instructions

1. Apply grease to the operating lever splines (6) and to all work surfaces (7) using Grease T.



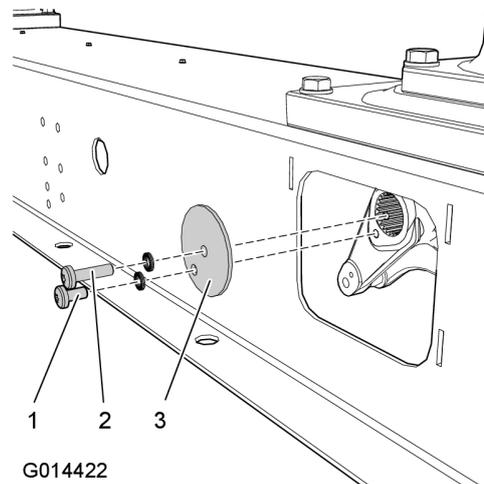
G014652

2. Assemble the operating lever (4) on shaft (5).



G014523

3. Assemble the washer (3) and lock with bolt with washer (1) and bolt with washer (2). Use locking fluid "C"



Torque
22.5 Nm

End of instruction

5.12.2 Assembly of operating lever on circuit breaker pole A and C

General Information

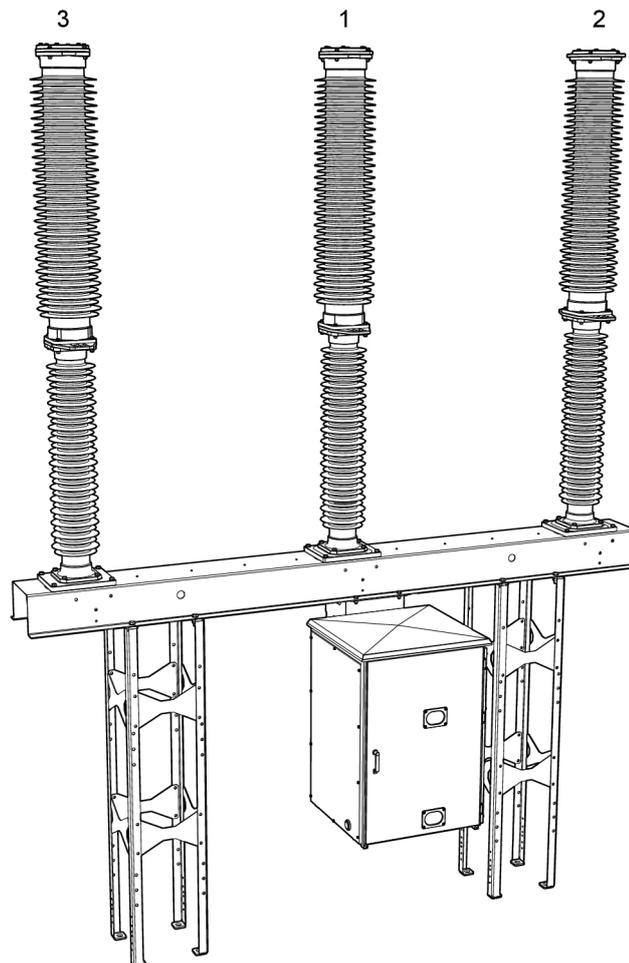

CAUTION!

The circuit breaker poles are always delivered in the open position, and this position must not be changed before fitting.


CAUTION!

Wear gloves to avoid cuts.

Structure



G014371

1. Circuit breaker pole B
2. Circuit breaker pole A
3. Circuit breaker pole C

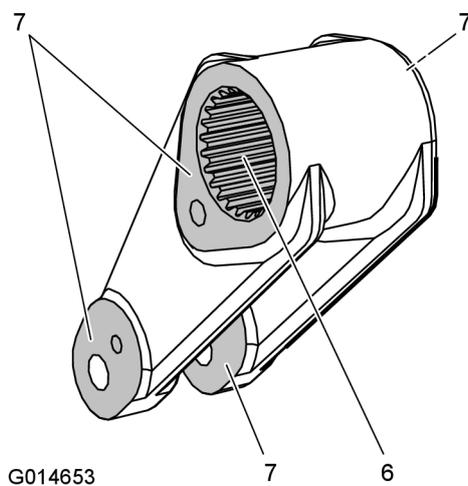
Required Equipment

| Equipment | Part number | Note |
|---------------|--------------|--|
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque range 10-350 Nm |
| Control pin | 1HSB539782-1 | Placed in a holder inside the operating mechanism. |
| Grease "T" | | See section <i>Types of Grease</i> , page 32 for details |

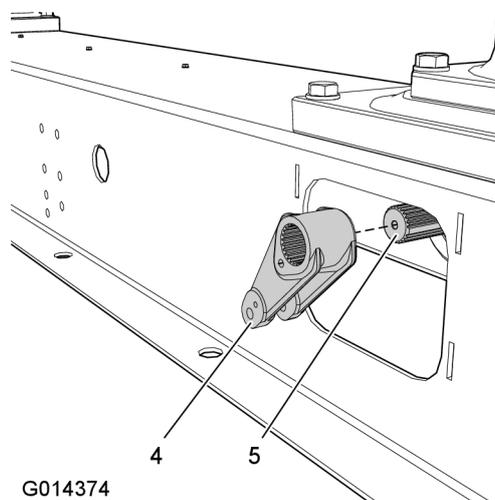
| Equipment | Part number | Note |
|---------------------------|-------------------------|------|
| Locking fluid "C" | Thread locker, grade 70 | |
| Lifting device and slings | | |

Assembly Instructions

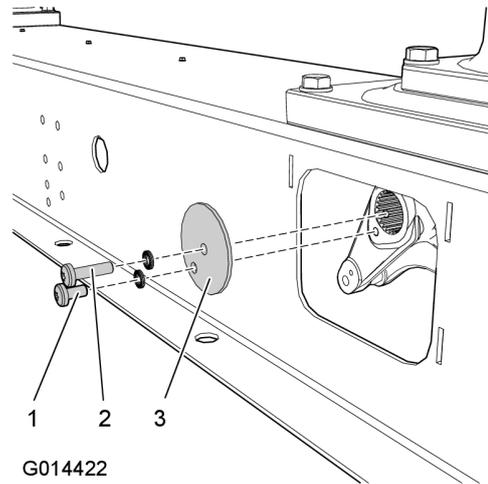
1. Apply grease to the operating lever splines (6) and to all work surfaces (7) using Grease T.



2. Assemble the operating lever (4) on shaft (5).



3. Assemble the washer (3) and lock with bolt with washer (1) and bolt with washer (2). Use locking fluid "C"



Torque
22.5 Nm

End of instruction

5.12.3 Fitting of transmission rod

General Information

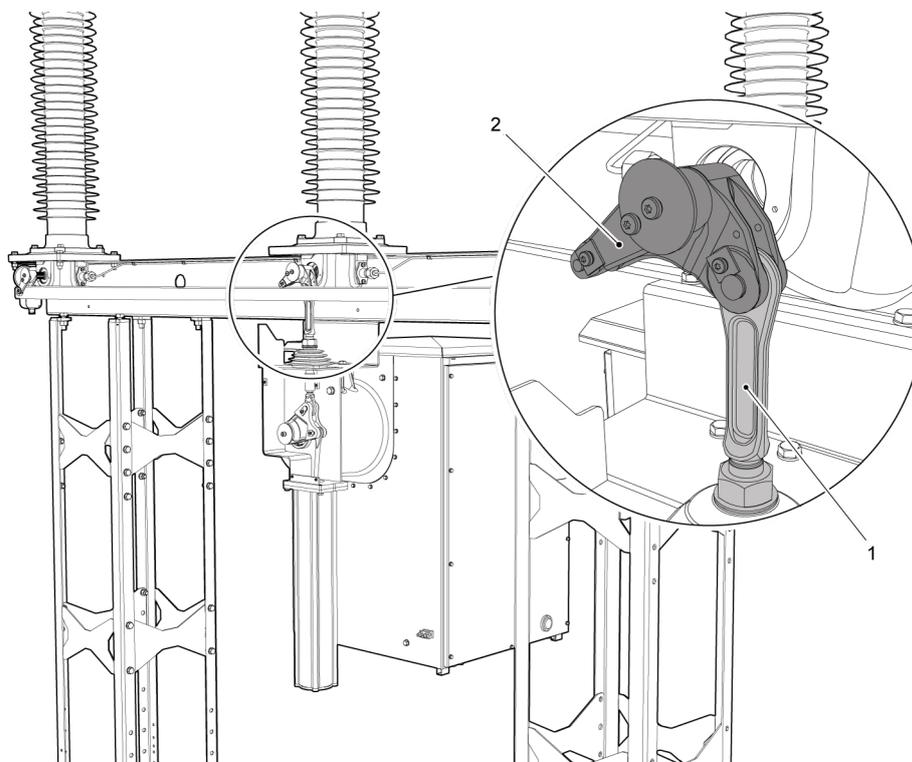

CAUTION!

The circuit breaker poles are always delivered in the open position, and this position must not be changed before fitting.


CAUTION!

Wear gloves to avoid cuts.

Structure



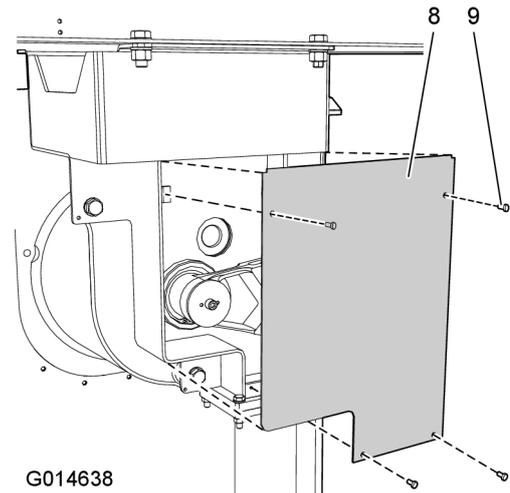
1. Transmission rod
2. Operating lever

Required Equipment

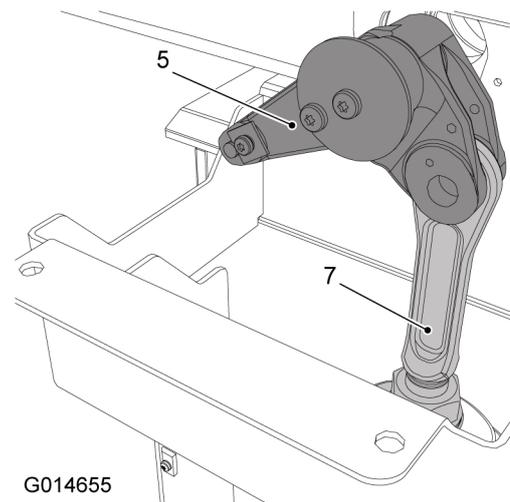
| Equipment | Part number | Note |
|---------------------------|-------------------------|--|
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque range 10-350 Nm |
| Control pin | 1HSB539782-1 | Placed in a holder inside the operating mechanism. |
| Grease "T" | | See section <i>Types of Grease</i> , page 32 for details |
| Locking fluid "C" | Thread locker, grade 70 | |
| Lifting device and slings | | |

Assembly Instructions

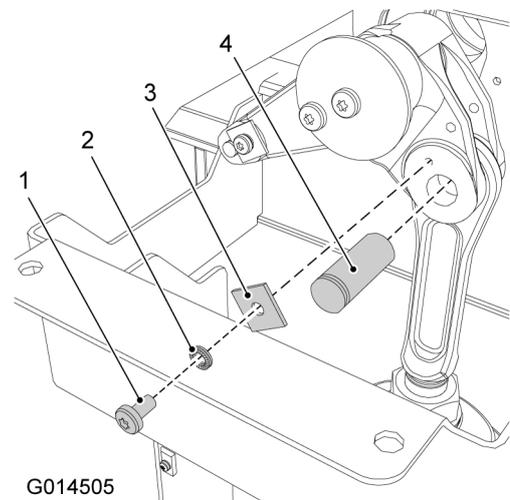
1. Unscrew the bolts (9) and remove the cover (8) from the welded bracket.



2. Assemble the transmission rod (7) with the operating lever (5).



3. Attach the joint pin (4) and lock with lock washer (3), bolt and washer (1, 2).

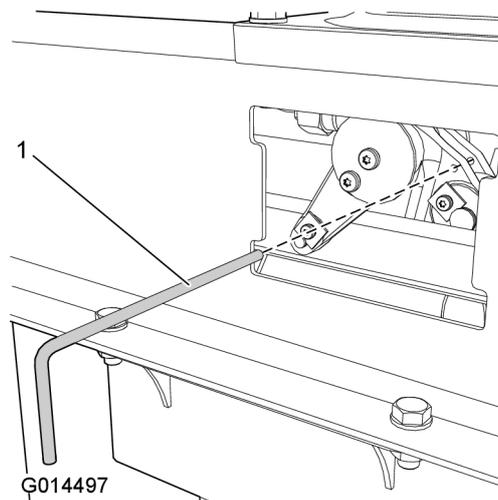


1. Bolt,

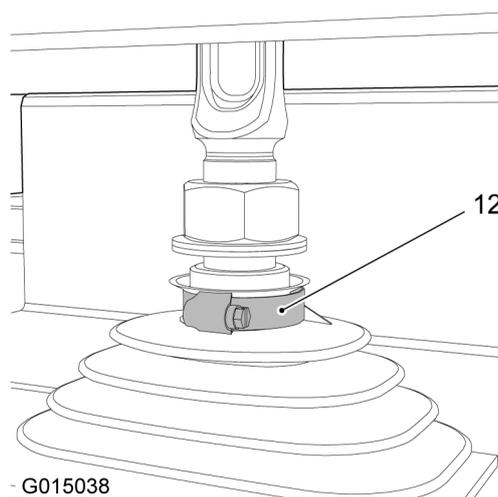
4. Check that the hole on the operating lever for the transmission rod on pole B aligns with the control hole in the mechanism housing when the circuit breaker is in the open position.

**NOTE!**

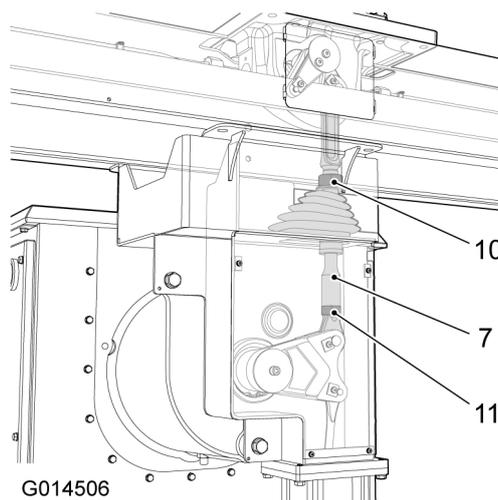
If the hole pattern does not align, the length of the transmission rod needs to be adjusted according to the next step.



5. Loosen the hose clamp bolt (12) so that the transmission rod can rotate in the bellows.



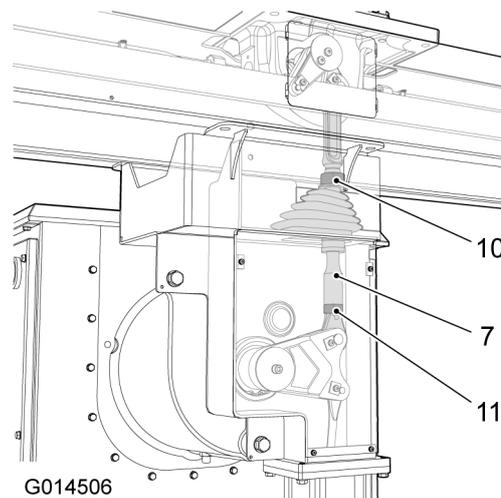
6. Loosen lock nuts (10) and (11) on the turnbuckle screw to adjust the length of the transmission rod (7).



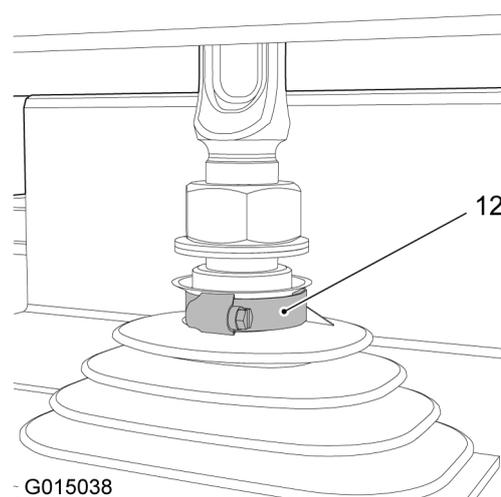
10 Lock nut M30

11 Lock nut M24

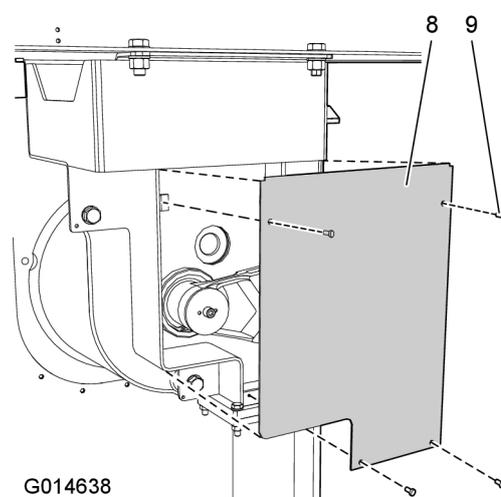
7. Torque tighten lock nuts (10) and (11) on the transmission rod (7) and adjust the bellows so that it is not twisted or folded.



8. Tighten the hose clamp bolt (12).



9. Install the cover (8) on the welded bracket using the bolts (9) and install the bolts (9).



End of instruction

5.12.4 Assembly of the pull rod between the circuit breaker poles

General Information



CAUTION!

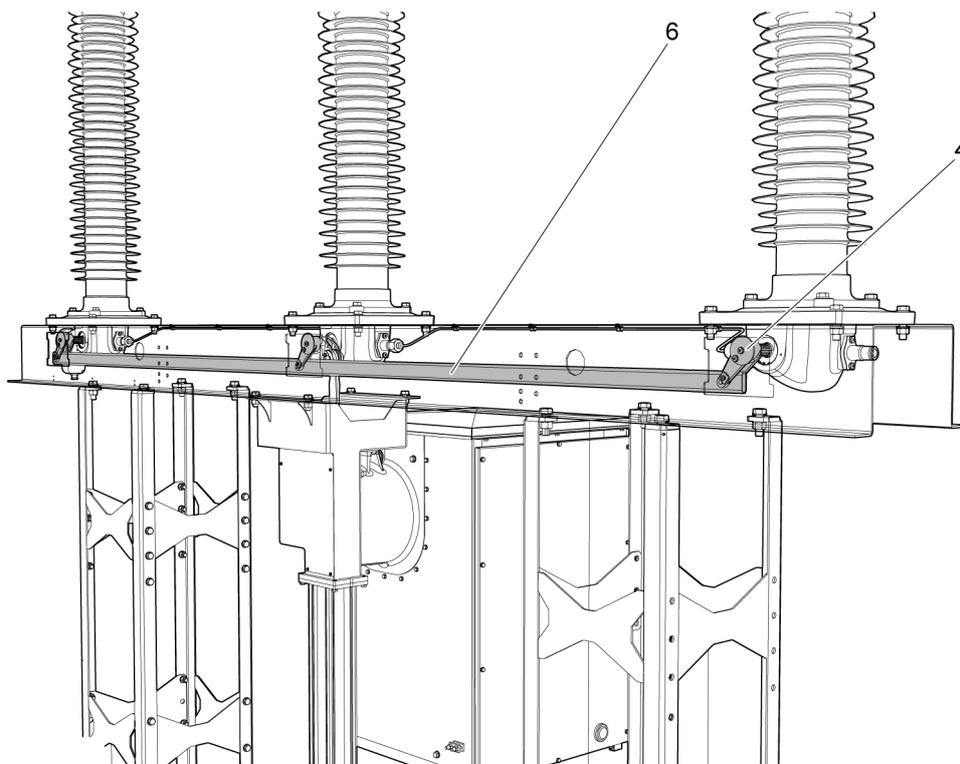
The circuit breaker poles are always delivered in the open position, and this position must not be changed before fitting.



CAUTION!

Wear gloves to avoid cuts.

Structure



4 Outer operating lever

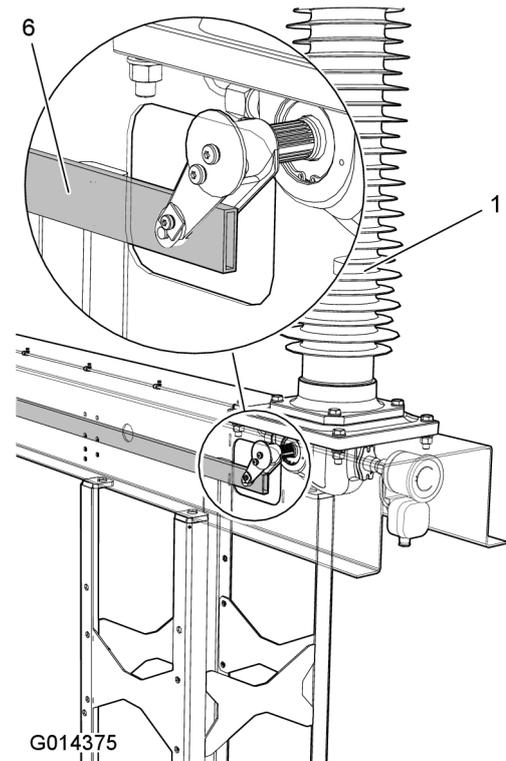
6 Pull-Rod

Required Equipment

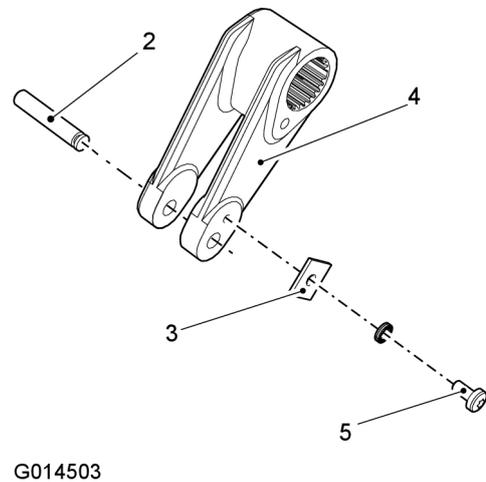
| Equipment | Part number | Note |
|---------------------------|-------------------------|--|
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque range 10-350 Nm |
| Control pin | 1HSB539782-1 | Placed in a holder inside the operating mechanism. |
| Grease "T" | | See section <i>Types of Grease</i> , page 32 for details |
| Locking fluid "C" | Thread locker, grade 70 | |
| Lifting device and slings | | |

Assembly Instructions

1. Position the pull rod (6) in the operating lever on the three circuit breaker poles (1).

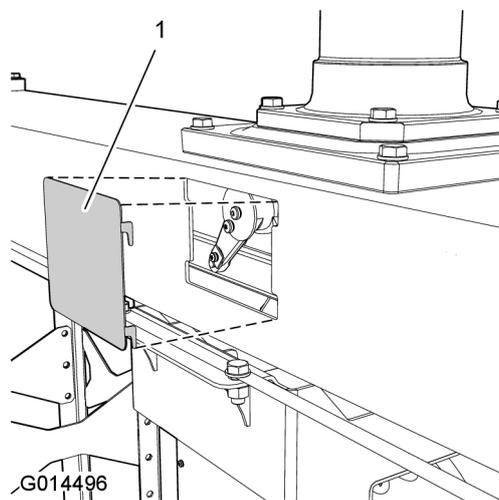


2. Secure the pull rod (6) in the operating lever (4) with the joint pin (2).



3. Lock the joint pin (2) with lock washer (3) and bolt with washer (5).

4. Install the protective plates (1).



End of instruction

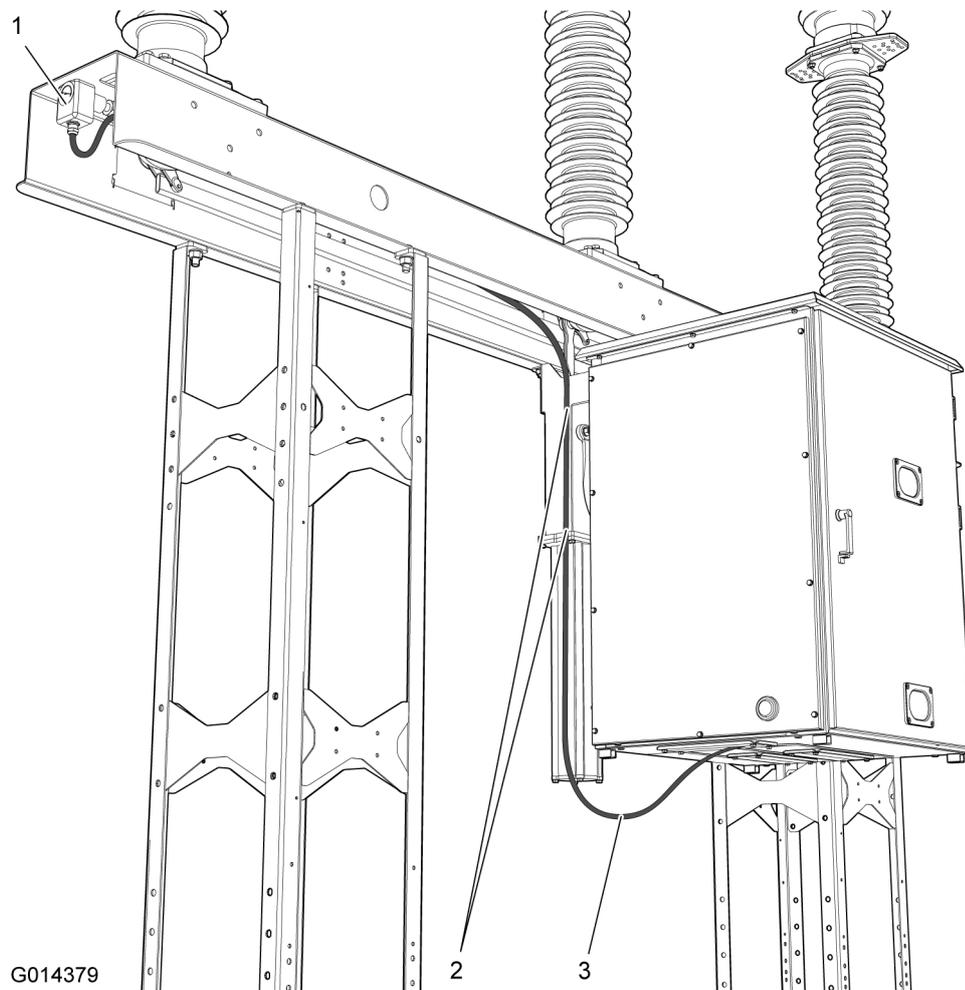
5.13 Assembly of Gas Monitoring System

General Information

The gas tubes are fitted to the pole beam on delivery, but are not connected. Connection is described in this section.

The density monitor can be an indicating or non-indicating model.

Overview



1. Density Monitor
2. Holes for cable ties
3. Density monitor cable

Required Equipment

| Equipment | Part number | Note |
|---------------|-------------|---|
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque 10 Nm |
| Grease "T" | 2GBA000351 | See section <i>Types of Grease</i> , page 32 for details. |
| Cable ties | 21660981-1 | Packed in the accessories box. |

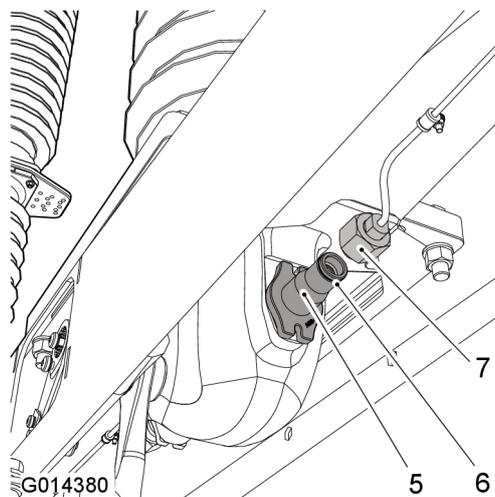
Assembly

- NOTE!**
The gas tubes are fitted on delivery, but are not connected. When fitting the gas monitoring system, the greatest possible cleanliness must be observed.

- NOTE!**
Ensure that the gas tubes do not come into contact with the pole beam. Risk of galvanic corrosion.

- Connect the gas tubes to the circuit breaker poles.
Lubricate the O-ring (6) using grease "T" prior to assembly.

- NOTE!**
Only thread on the clamp nut (7) to the slot in the non-return valve (5) ensuring the connection is tight, but the non-return valve has not opened.



5. Non-Return Valve

6. O-ring

7. Clamp nut

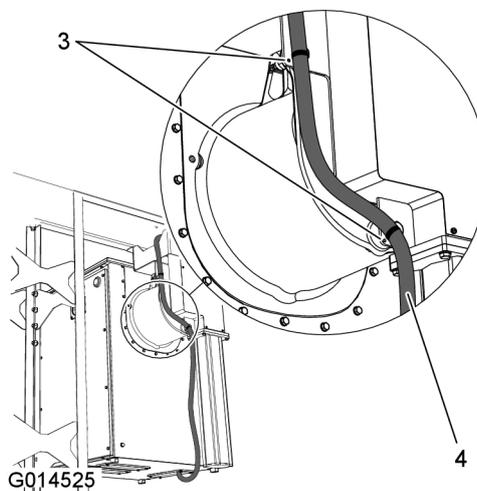
- When all circuit breaker poles are connected in this way: torque tighten the clamp nut (7).



Torque
10 Nm

- Connect the density monitor (2) to the gas block (1).
Lubricate the O-rings using grease "T" prior to assembly.

- Secure the cable (4) by a cable tie in the specified hole (3).



- Connect the cable (4) to the connection terminals as per the applicable connection diagram and tighten the cable entry.

End of instruction

5.14 Electrical Connections

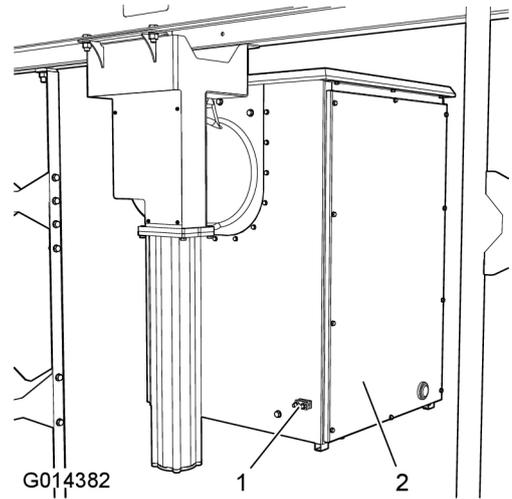
5.14.1 Connecting the Circuit Breaker's Operating Mechanism

Required Equipment

| Equipment | Part number | Note |
|---------------|-------------|-------|
| MK toolbox | 6880 768-7 | |
| Torque wrench | | 10 Nm |

Connection

1. Connect the earth wire to the earthing terminal (1) on the back of the cabinet.



1. Earthing terminal
2. Hatch

2. Remove the hatch (2) and run the operating and signal cables through the cable entry on the bottom of the cabinet.
3. Fit the flange with an appropriate seal for the cable in question.
4. Connect the cables to the coupling terminals as per the applicable connection diagram.

i **NOTE!**

As standard the terminals are of the plug-in type for multicore cable and are in conduit or disconnectable designs. The pass-through wiring design is for connecting conductors with a max. cross-sectional area of 4 mm², and the plug-in wiring design is for connecting conductors with a max. cross-sectional area of 6 mm². The disconnectable design is intended for motor, AC and power supply circuits.

5. Refit the hatch (2).



Torque
10 Nm

End of instruction

5.14.2 Assembly of the High-Voltage Terminals

Safety



NOTE!

Bimetal washers are positioned so that their aluminum sides face the aluminum surfaces. The copper sides are turned towards the copper- or silver-plated surfaces.



NOTE!

Contact paste must only be used on fixed joints. **It must not be used inside the interrupter units.**

Remember:

However, if copper bars or copper attachments are used for conductors, grease must be used and a bimetallic washer fitted to the connection. Bimetallic washers can be supplied from ABB on request.

Connect all support structures to the existing grounded net

Required Equipment

| Equipment | Part number | Note |
|---------------------------------------|---------------|---|
| Fine abrasive material or emery cloth | - | E.g. Scotch-Brite™ 7447 or equivalent |
| Grease "SV" | 1171 4016-610 | See section <i>Types of Grease</i> , page 32 for details. |

Treatment with Grease

1. Clean the contact surfaces of grease or old paste.
2. Polish the surfaces with a polishing cloth or an emery cloth.
3. Apply grease to the aluminum and copper surfaces immediately after polishing.
4. Assemble the joint
5. Wipe off any unnecessary grease.

End of instruction

5.15 Inspection of Bolted joints

General Information



WARNING!

Check that the operating mechanism's close spring is fully discharged before commencing work. If the close spring is not discharged, discharge as specified in section .

Inspection

- Make sure that all bolted joints that are assembled during the installation are tightened to the correct torque. See *Tightening Torque*, page [36](#)

5.16 Pressurizing of Circuit Breaker Poles

5.16.1 Preparations for Gas Filling

General

**WARNING!**

All extra equipment must be fitted to the circuit breakers before pressurizing the poles.

**NOTE!**

If gas tubes and gas blocks are stored outside of room temperature, we recommend that they should be flushed with nitrogen (N₂). Allow gas flush to continue for 4-5 minutes, to make sure the gas system is free from moist.

Safety, polymeric insulators

**WARNING!**

When commissioning, the gas must be filled to the pressure specified on the rating plate. Different gas pressures may occur depending on the different requirements with respect to the lowest ambient temperature.

**WARNING!**

Any transport damage to the insulators means there will be a safety risk when filling with gas. To avoid personal injury when filling, installation personnel must exercise caution and keep at a distance equivalent to at least twice the circuit breaker's height. The gas cylinder is placed at the same location as the filling device.

Local safety regulations must be applied.

Preparations

1. Check that the protective motor switch is set to "Off" and that all the springs are discharged.

2. Connect the cables to the operating mechanism's connection blocks for close and open operations.



WARNING!

The cables must be run from the circuit breaker to a protected location. For personal safety, the circuit breaker must be remotely operated from the protected location. Local safety regulations must be applied.

3. Connect the cables to suitable test equipment.

4. Set the operating mechanism Local/Remote switch to the "Remote" position.



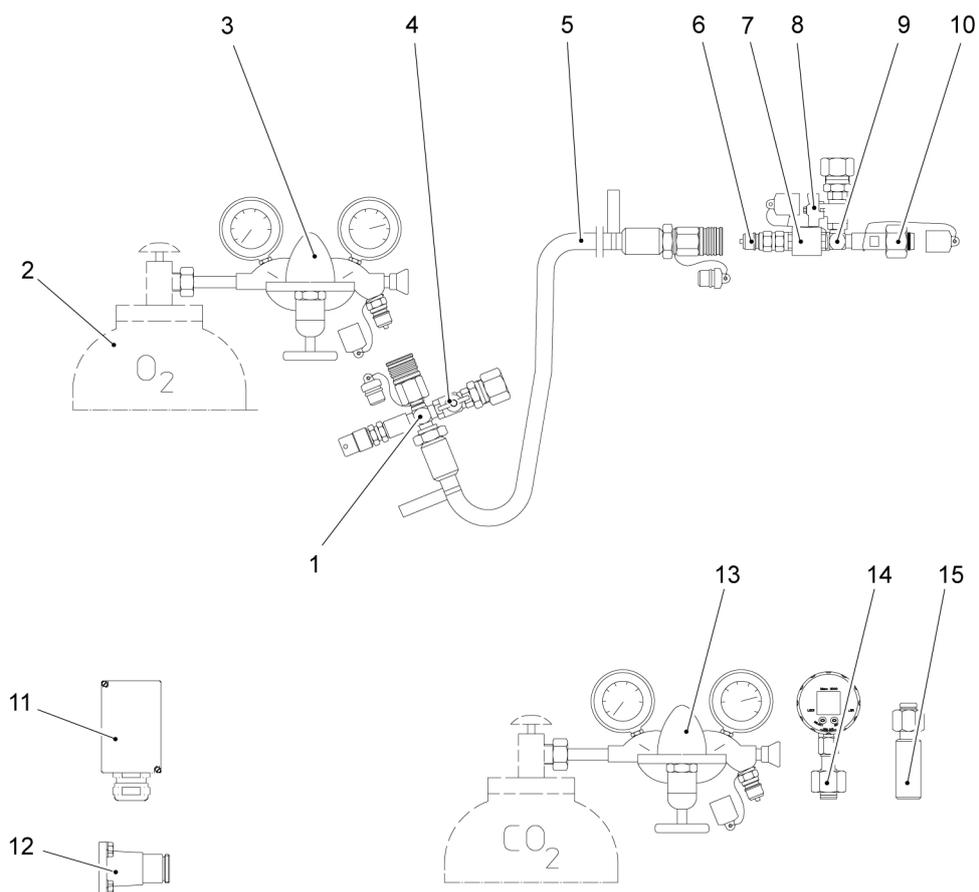
WARNING!

The circuit breaker must be filled with gas before it can be operated. Local safety regulations must be applied.

End of instruction

5.16.2 Gas Filling Equipment

Gas Filling Components



G014636

| | | | |
|---|-------------------------------------|----|--------------------------------------|
| 1 | Cross-connection | 9 | Coupling link |
| 2 | Gas bottle | 10 | Nipple with clamp nut |
| 3 | Regulator O ₂ (0-10 bar) | 11 | Density monitor (without indicator) |
| 4 | Valve | 12 | Circuit breaker gas valve |
| 5 | Hose | 13 | Regulator CO ₂ (8-28 bar) |
| 6 | Plug-in nipple | 14 | Precision pressure gauge |
| 7 | Non-Return Valve | 15 | Adapter |
| 8 | Valve | | |

5.16.3 Filling of Mixed Gas

General

The circuit breaker shall be filled with mixed gas (CO₂ and O₂).

Follow the information on the rating plate for the gas mixture proportions. **Example.** For a vacuum pumped circuit breaker with 1.2 MPa abs (+20°C) filling pressure, start by filling with 0.1 x 1.2 = 0.12 MPa abs (+20°C) O₂ and then CO₂ gas to 1.2 MPa abs (+20°C). Normally the circuit breaker is filled with CO₂-gas for transport pressure, see *Filling Pressure (Mixed Gas)*, page 84.



WARNING!

If the density monitor is turned immediately AFTER tightening, there is a risk of damaging the capillary tube inside the density monitor, resulting in gas leakage, incorrect indication and/or alarms not triggering.

All warranty obligations are invalidated by incorrect operation.

Remember:



NOTE!

When filling with mixed gas, the CO₂ gas must always be filled last.



NOTE!

When reading the precision measuring instrument, the filling pressure must be corrected depending on the temperature as per the table below.

Filling Pressure (Mixed Gas)

| Transport pressure 0.125 MPa at 20°C | | | |
|--------------------------------------|---|----------------|-----------------|
| | Transport pressure CO ₂ | O ₂ | CO ₂ |
| | As read off the pressure gauge, the filling pressure in | | |
| Temperature during gas filling °C | MPa (abs) | MPa (abs) | MPa (abs) |
| +40 | 0,134 | 0,262 | 1,292 |
| +30 | 0,129 | 0,253 | 1,246 |
| +20 | 0,125 | 0,245 | 1,200 |
| +10 | 0,121 | 0,237 | 1,154 |
| ±0 | 0,116 | 0,228 | 1,107 |
| -10 | 0,112 | 0,220 | 1,060 |
| -20 | 0,108 | 0,211 | 1,013 |
| -30 | 0,103 | 0,203 | 0,965 |

bar = MPa x 10
 MPa (atm) = MPa (abs) - 0,1

G007896

Required Equipment

| Equipment | Part number | Note |
|-----------------------|--------------|--|
| Gas Filling Equipment | 1HSB822590-A | Use only for CO ₂ and O ₂ gas! When delivered, the hose included in the equipment is vacuum pumped and filled with CO ₂ gas. |

Gas Filling



WARNING!

Keep the valves and connections to the O₂ gas bottle free of oil and grease.



NOTE!

Do not use any sharp tools!

1. Put the gas bottles (2) in a protected place.
2. Check the filling pressure on the circuit breaker's rating plate.
3. Fit the regulator (3) to the gas bottle with O₂.



WARNING!

When filling with mixed gas, the CO₂ gas must be filled **last!**

4. Connect a precision pressure gage (14) to the coupling link (9) or cross-connection (1).

Precision pressure gauges are not included in the delivery.



WARNING!

If the density monitor is turned immediately **AFTER** tightening, there is a risk of damaging the capillary tube inside the density monitor, resulting in gas leakage, incorrect indication and/or alarms not triggering.

All warranty obligations are invalidated by incorrect operation.

5. Open valve (8) on the coupling link (9) or else valve (4) so that the gas reaches the precision pressure gage.
 - If the pressure gauge is connected to the coupling link (9) the valve (4) must be closed.
 - If the pressure gauge is connected to the cross-connection (1) the valve (8) must be closed.

6. Connect the coupling link (10) to the gas valve (12) on circuit breaker pole A.



NOTE!

If the gas valve on the circuit breaker pole is green, it has a M32 connecting thread; in this case, the enclosed adapter (15) must be used for the connection.

7. Connect the gas filled hose (5) to the coupling link (6).

8. Set the correct filling pressure on the regulator, temperature compensated, as specified in table *Filling Pressure (Mixed Gas)*, page 84.

**NOTE!**

Check the current transport pressure.

9. Connect the gas filled hose (5) to the gas bottle (2) via the regulator (3).

10. Open the gas bottle (2) valve and allow the gas to flow until the regulator switches off.

Porcelain insulators**WARNING!**

For personal safety, the circuit breaker must be filled with gas from a protected location. Local safety regulations must be applied.

Polymer insulators**WARNING!**

For personal safety, the circuit breaker must be filled with gas from a distance that is at least twice the circuit breaker's height. Local safety regulations must be applied.

11. Wait until the gas temperature has reached the circuit breaker's temperature level and then read the pressure on the precision pressure gauge.

12. Adjust the pressure where necessary.

**NOTE!**

When reading the pressure gauge, the filling pressure must be corrected depending on the temperature specified in table *Filling Pressure (Mixed Gas)*, page 84.

13. Close the gas bottle (2) tap.

14. Disconnect the hose (5) from the regulator (3).

15. Fit the regulator (13) to the gas bottle with CO₂.

16. Repeat points 9 to and including 14 with CO₂.

17. Remove the hose (5) from the coupling link (6).

18. Shut off the tap to the pressure gauge.

19. Remove the coupling link from the circuit breaker.

20. Relieve the pressure at the pressure gauge by opening valve (4) or valve (8).

21. Remove the pressure gauge from the coupling link.

22. Disconnect the hose (5) from the gas cylinder (2).

23. If several breakers need to be filled, repeat from point 6. Otherwise, discharge the regulators (3, 13) by pressing in the back valve.

24. Relieve the regulator's adjustment pressure by turning the adjuster tap ensuring the pressure is correct for the next circuit breaker to be fitted.

25. Connect the operating mechanism for remote control, set the switch to the Remote position, and test run the circuit breaker Close-Open once.

Porcelain insulators



WARNING!

For personal safety, the circuit breaker must be remotely operated from a protected location. Local safety regulations must be applied.

Polymer insulators



WARNING!

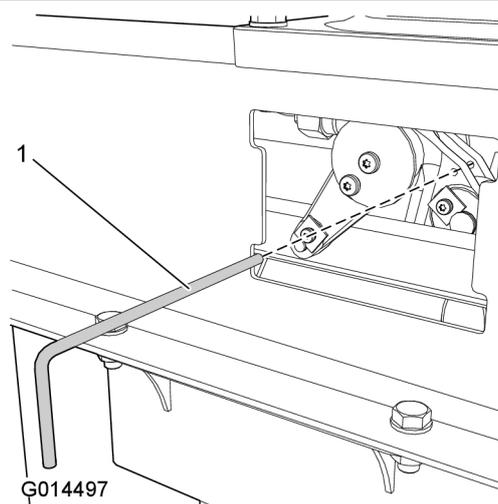
For personal safety, the circuit breaker must be remotely operated from a distance that is at least twice the circuit breaker's height. Local safety regulations must be applied.

26. Check that the hole on the operating lever for the transmission rod on pole B aligns with the control hole in the mechanism housing when the circuit breaker is in Open position with control pin (1).



NOTE!

If the hole pattern does not align, the length of the transmission rod needs to be adjusted according to *Fitting of transmission rod*, page 69.



27. Perform a gas system tightness check.

See *Gas System Tightness Check*, page 89.



NOTE!

A new or overhauled circuit breaker should have its gas system tightness checked by reading the density monitor after **1 month** and then as specified in the maintenance schedule.

End of instruction

5.16.4 Density reduction

General

For safety reasons, the circuit breaker is equipped with insulators made of a composite material. Some of the gas inside the circuit breaker is absorbed by the composite insulators, which means that the pressure in the circuit breaker drops according to the table below. The pressure drop is greatest during the first 6 months after filling gas in a new circuit breaker. After that, absorption diminishes and results in very little gas leakage, so-called permeation, primarily through the walls of the insulators and less through the sealing rings on the ends of the insulators.

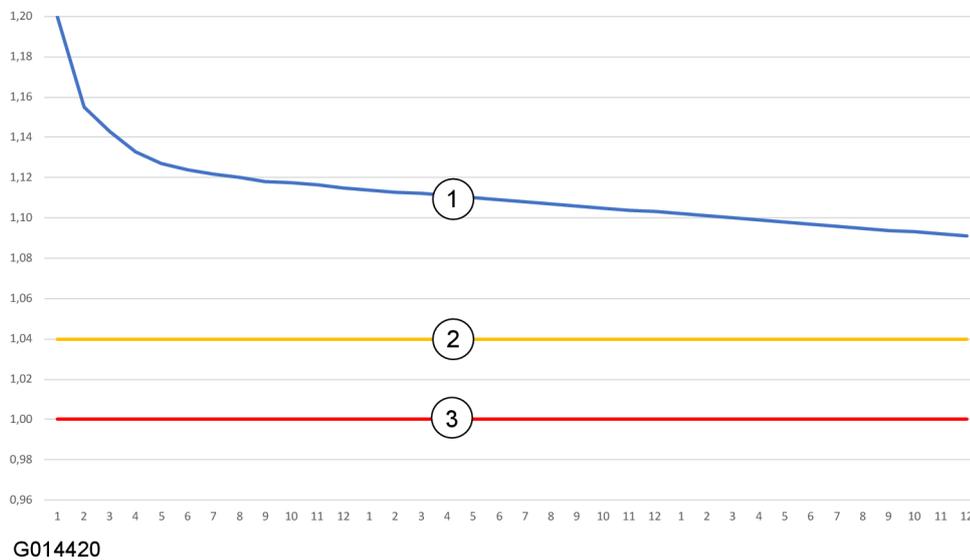
The filling pressure for this circuit breaker is 1.20 MPa (abs) at 20 degrees C. The alarm level on the circuit breaker density monitor is 1.04 MPa (abs), and the blocking level on the circuit breaker density monitor is 1.00 MPa (abs).

When the pressure has dropped to 1.04 MPa (abs), the circuit breaker density monitor will emit an electric alarm signal, and gas will need to be refilled to the nominal filling pressure. This occurs after approximately 7 years. Fill with both CO₂ and O₂ gas according to the prescribed mix ratio of 90 % CO₂ and 10 % O₂ gas.

After an additional period of approximately 15 years, the pressure will again drop to 1.04 MPa (abs). Refill with gas again up to the nominal filling pressure. Fill with both CO₂ and O₂ gas according to the prescribed mix ratio of 90 % CO₂ and 10 % O₂ gas.

Density reduction curve

The graph below describes the density reduction when filling a new circuit breaker.



- 1. Density
- 2. Alarm level
- 3. Blocking level

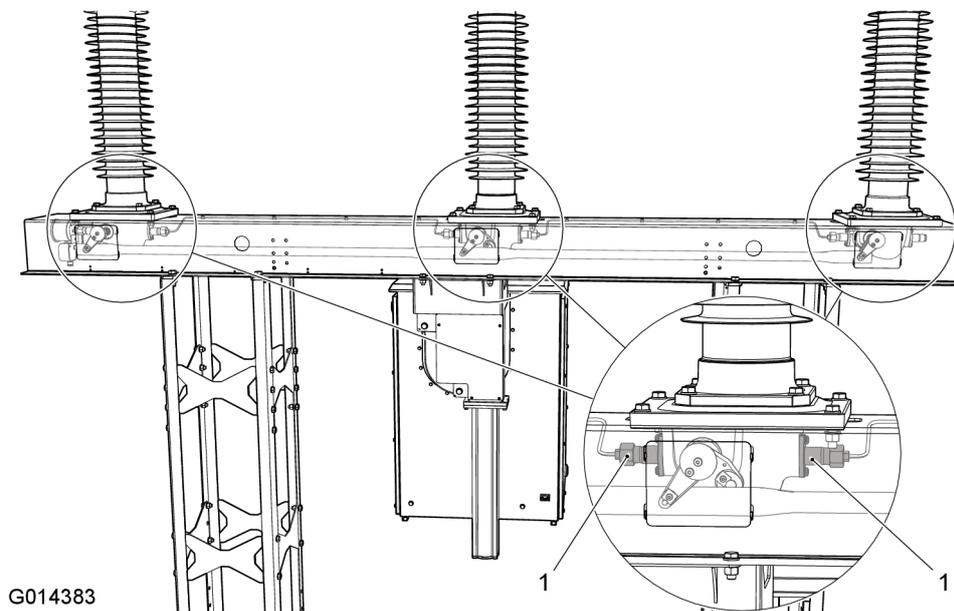
5.17 Inspection Prior to Commissioning

5.17.1 Gas System Tightness Check

General

This section describes how to perform a gas system tightness check with a CO₂-sniffer around the density monitor and the gas tube's connections.

Connections



G014383

1. Pole connections

Required Equipment

| Equipment | Description |
|--------------------------|-------------|
| CO ₂ -sniffer | - |

Instructions

1. Use a CO₂-sniffer to check around the connections.
2. If the connections are not tight:
 - disconnect the connections.
 - check the O-rings and contact surfaces.
 - replace the seals where necessary.
3. Perform a new gas system tightness check.

End of instruction

6 Commissioning

6.1 Introduction

General

Before the circuit breaker is put into service, all the inspections in accordance with *Pre-Commissioning Checklist*, page 92 for installation and commissioning must have been carried out and the operating values for the installation completed, see *Operating Values and Signature*, page 94.

Reset all connection circuits as per the applicable circuit diagram and verify the tightening torque for the affected coupling terminals.

6.2 Pre-Commissioning Checklist

General Information



WARNING!

Check that the operating mechanism's close spring is fully discharged before commencing work. If the close spring is not discharged, discharge as specified in section .



DANGER!

Always check the tightening torque before gas filling. Must not be checked on a pressurized circuit breaker.

Before the circuit breaker is put into service:

- all checks for circuit breaker poles, operating mechanism and gas filling must have been conducted as described in this section.
- the checklist must always be completed and filed.

Identification

Date:

Installation:

Serial number (circuit breaker manufacturing number):

Inspection of Circuit Breaker Pole

1. Check that the circuit breaker and the operating mechanism have been assembled as per the installation instructions.
2. Make sure that all bolted joints that are assembled during the installation are tightened to the correct tightening torque.

End of instruction

Check of Operating Mechanism

1. Make a visual inspection to check if the damper has leaked oil into the operating mechanism.
2. Verify the torque of the bolts in the connection blocks that have been affected by the assembly.
3. Check that the covers and side plates are fitted if they were removed during installation.
4. Check the functionality of the heating element.
5. Check that the thermostat, if any, is set to 10° C. Other settings may occur in accordance with customer specifications.
6. Check the positions of the keyshafts. See *Inspection of Latch Devices*, page 115.

End of instruction

Check of Gas Filling

1. Check the gas filling and test run as per instructions See *Filling of Mixed Gas*, page [84](#).
-

End of instruction

6.3 Operating Values and Signature

Check of Operating Values

Check the operating values for the circuit breaker against data applicable to the circuit breaker in *Operating Values*, page 37 and note the measured values in the table below.

| Check Below | Measured values | Measured values | Measured values |
|--------------------------------------|-----------------|-----------------|-----------------|
| | Pole A | Pole B | Pole C |
| Closing time (close coil I) | ms | ms | ms |
| Closing time (close coil II) | ms | ms | ms |
| Opening time (trip coil I) | ms | ms | ms |
| Opening time (trip coil II) | ms | ms | ms |
| Close-Open time | ms | ms | ms |
| Lowest control voltage close coil I | V | V | V |
| Lowest control voltage close coil II | V | V | V |
| Lowest control voltage trip coil I | V | V | V |
| Lowest control voltage trip coil II | V | V | V |
| Main circuit resistance | $\mu\Omega$ | $\mu\Omega$ | $\mu\Omega$ |
| Filling pressure ⁽²⁾ | MPa (abs) | MPa (abs) | MPa (abs) |

⁽²⁾ Filling pressure is as specified on the rating plate.



CAUTION!

Signing

After the inspections have been completed, this document must be signed. If all the inspections in this section have been carried out, the circuit breaker can be put into service.

Inspection conducted by: _____

7 Maintenance

7.1 Introduction

General Information

These maintenance instructions give recommendations for care and guidelines for maintenance of high-voltage circuit breakers.

**NOTE!**

Before commencing maintenance work, read *Introduction, Safety*, page 7.

**WARNING!**

For maintenance work that requires work on the circuit breaker or operating mechanism, it is important that both the on and off springs are discharged. See *Discharge the Springs Electrically*, page 10 or *Discharge the Close Spring Manually*, page 13 .

Instructions

The instructions are divided into:

- Inspection intervals
- Instructions for preventive maintenance of operating mechanisms

The periodic maintenance should be carried out at specified time intervals or number of operations.

7.2 Required Equipment

Tool

| Tool | ABB part no. | Note |
|------------|--------------|--|
| MK toolbox | 6880 768-7 | Torque wrenches 5-550 Nm. NOTE! The MK toolbox is not included in the delivery; it must be ordered separately. Alternatively, the existing tool equipment may be used. |
| Multimeter | - | |

Cleaning Equipment

| Equipment | ABB part no. | Note |
|-------------------------|--------------|------|
| Vacuum cleaner | - | |
| Lint-free drying cloths | - | |

Lubricant

| Agent | ABB part no. | Note |
|---------------------------------------|---------------|---|
| Grease "M" | 1171 4016-612 | See sections <i>Types of Grease</i> , page 32 and <i>Oil Types</i> , page 31 for ABB part numbers, suppliers and trade names. |
| Grease "T" | 2GBA000351 | |
| Anti-rust agent, Valvoline Tectyl 506 | 1241 0011-108 | |

7.3 Description of Maintenance Categories

Maintenance Categories

The following inspection schedule includes important checking points, acceptable tolerances, functional values for certain adjustments and recommended inspection intervals, along with competence requirements.

In corrosive or polluted air environments and in climates with high humidity, it may be necessary to halve the inspection interval. The specified inspection intervals should be regarded as recommended guidelines that can either be extended or shortened depending on local conditions.

Category A

| Action/explanation | Interval | Condition of Circuit Breaker | Requirement |
|--------------------|-----------|------------------------------|-------------|
| Visual inspection | 1-2 years | a1 | a2 |

Category B

| Action/explanation | Interval | Condition of Circuit Breaker | Requirement |
|---|--|------------------------------|-------------|
| Preventive Maintenance General overhaul of circuit breaker and operating mechanism Thermography | 15 years or 5000 operations ²⁾ | b1 | b2 |

Category C

| Action/explanation | Interval | Condition of Circuit Breaker | Requirement |
|--|-------------------------------|------------------------------|-------------|
| Overhaul of breaking chamber | | c1 | c2 |
| Overhaul of line and transformer circuit breakers | $\sum nxI^2 = 20000$ | c1 | c2 |
| Overhaul of capacitor bank circuit breakers, reactor circuit breakers and filter circuit breakers without point-on-wave control | 2500 operations | c1 | c2 |
| Overhaul of capacitor bank circuit breakers, reactor circuit breakers and filter circuit breakers with point-on-wave control | 5000 operations ¹⁾ | c1 | c2 |

Category D

| Action/explanation | Interval | Condition of Circuit Breaker | Requirement |
|---|--|------------------------------|-------------|
| Overhaul of complete circuit breaker and operating mechanism. | After 30 years or 10000 operations ²⁾ | d1 | c2 |

Explanations

- 1) The load currents from normal close and tripping operations should not be calculated. These are only calculated when counting the total number of mechanical Close and Trip operations.
- 2) Special requirements for resistance checks for circuit breakers; >100 close and tripping operations executed per year.

Condition of Circuit Breaker

The following specifies the condition in which the circuit breaker should be for the various maintenance activities.

- a1 Circuit breaker in operation.
- b1 Close spring discharged, circuit breaker open, disconnected and grounded. If thermography (heat measurement) is part of the maintenance activity, this should be done during normal load before the circuit breaker trips.
- c1 Close spring discharged, circuit breaker open, disconnected and grounded. The circuit breaker poles/interrupter units are dismantled and transported to the workshop.
- d1 Close spring discharged, circuit breaker open, disconnected and grounded. The entire circuit breaker with operating mechanism is transported to the workshop.

Competence Requirements

The following describes the necessary requirements for personnel carrying out maintenance work.

- a2 Substation personnel without special training.
- b2 Personnel authorized by ABB to carry out assembly, commissioning and maintenance work.
- c2 Personnel authorized by ABB to carry out assembly, commissioning and maintenance work. In some cases support may be required from ABB.

7.4 Maintenance Schedule

7.4.1 Category A

| Inspected | In respect of: | Instructions/Tools |
|---|---|---|
| Circuit breaker and operating mechanism | External cleanliness Heating element function Gas Pressure Valves and draining holes | <i>Exterior Cleaning</i> , page 109 , <i>Inspection of Heating Element</i> , page 113 . |

7.4.2 Category B

| Inspected | in respect of: | Instructions/Tools |
|----------------------------------|---|---|
| Rating plates | Note serial number | |
| Operation counter | Note the number of operations | |
| CO ₂ + O ₂ | Gas level (filling if required) Dew point, for normal gas pressure in the circuit breaker | Gas-filling equipment . See <i>Gas System and Density Monitor</i> , page 27. Dew point meter . Dew point max. -5°C at specified filling pressure and +20°C |
| Composite insulators | Damage to the insulator | |
| Main circuit | Resistance Measurement | Resistance values as specified in section <i>Operating Values</i> , page 37. Resistance bridge, using a test current of 200-400 A DC. In the case of circuit breakers with a load current of less than 400 A, a resistance value of up to 1000 µOhm is permitted per interrupter unit. |
| Thermography | The temperature increase in the outer parts of the interrupter unit | Carried out at full load prior to shutting down. The highest permitted temperature difference between the phases is 5°C. Thermal camera. Consideration must be taken to the load current during measurement, both to the larger variations of the load current 3-4 hours prior to measurement. See the manual for the thermal camera. |
| Function times | Opening time Closing time Close-Open time Deviations between phases Auxiliary switch Travel curve Contact damping | Measuring with electronic timing. Nominal control voltage. For times, see <i>Operating Values</i> , page 37. Maximum time deviation between phases: 4 ms for closing and 3 ms for tripping. |
| Rod system | Tightening torque | Check the tightening torques for nuts in the rod system turnbuckles and joints. |
| Anti-pumping relay | Function | With the circuit breaker in Open position and the operating mechanism charged, a simultaneous Close and Open operation is produced (Close button pressed in). The circuit breaker carries out a Close/Open operation and must not Close when the operating mechanism is charged. The anti-pump function must be activated as long as the close impulse lasts. The lowest control voltage should be measured for the relay (85% of nominal). |

| Inspected | in respect of: | Instructions/Tools |
|----------------------------|--------------------------------|--|
| Motor | Motor brushes Motor current | <p>Check the carbon brushes on the motor/motors. If they are less than 9 mm, replace the motor.</p> <p>The motor current must be measured towards the end of the max. current, which occurs towards the end of the charging process.</p> <p>The maximum permitted motor current is 110 % of the measurement values received during routine tests.</p> <p>The permitted variation in charge time is 30% of the measurement value obtained during routine tests.</p> |
| Latch Device | Visual inspection of settings | <p>For instructions on setting the play in the latch device, see <i>Inspection of Latch Devices</i>, page 115.</p> <p>Surfaces on shafts and latches are lubricated using Grease "L". See section <i>Types of Grease</i>, page 32.</p> |
| Coils (latch device) | Coil resistance and current | The coil resistance and current is allowed to vary ± 10 % of the measurement values received during routine tests. |
| Heating Element | Resistance Measurement | <p>Check the signal for voltage drop, if applicable.</p> <p>See <i>Inspection of Heating Element</i>, page 113.</p> |
| Thermostat (if applicable) | Adjusted value | <p>Check that the thermostat is adjusted to comply with the set value.</p> <p>See <i>Pre-Commissioning Checklist</i>, page 92.</p> |
| Terminal blocks | Bolts and clamps | Check that bolts and clamps are properly tightened. |
| Protective motor switch | Signal for voltage drop | Check the signal for voltage drop, if any. |
| Gas-tight seals | Density monitoring | Remove the density monitor and verify that an alarm signal is activated at the correct pressure, in accordance with the markings on the density monitor or the rating plate. |

 **NOTE!**
In the event of pressure drop, various technical safety functions are available. Check the circuit breaker wiring diagram before commencing work to minimise the risk of uncontrolled operations.

 **NOTE!**
Carry out a controlled pressure reduction without releasing SF6 gas into the atmosphere.

Minimum permitted voltage when checking: 30 V

| Inspected | in respect of: | Instructions/Tools |
|-------------------|--------------------------------|---|
| Blocking relays | Relays | The relays must switch off when a density monitor is removed from a circuit breaker pole, pressurized at filling pressure.  WARNING! May only be carried out when the circuit breaker is out of service. |
| Corrosion | Operating Mechanism | |
| Lubrication | Latches Rim Close damper | |
| Tightening Torque | Bolted joint | Check the tightening torque on all bolted joints. Do not walk on poles that are filled with gas. |
| Operation | Test and measurement | Operation tests in combination (if possible) with function time measurement (incl. closing and tripping). |

7.4.3 Category C

| Inspected | Interval | Instructions/Tools |
|---|--|--|
| Line and transformer circuit breaker | $\Sigma n \times I^2 = 20000$ | Evacuate the gas, dismantle the circuit breaker poles and transport to a clean workshop. |
| Capacitor, reactor and filter circuit breakers without point-on-wave control | 2500 operations | Replacement of an interrupter unit or a complete pole. |
| Capacitor, reactor and filter circuit breakers with point-on-wave control | 5000 operations | Equipment: Standard equipment, tight fitting face mask for dust protection, long-sleeved overalls, protective gloves of plastic or rubber. |
| All types of maintenance. | During diagnostic testing with non-conformities. | |

7.4.4 Category D

| Inspected | Interval | Instructions/Tools |
|---|--|--|
| Overhaul of complete circuit breaker and operating mechanism. | 30 years or 10000 mechanical Close and Trip operations | <p>Dismantling of circuit breaker pole and mechanism. Replacement of an interrupter unit or a complete pole. Replacement of other worn components.</p> <p>If the circuit breaker and the operating mechanism are being overhauled for a further 2.000 operations, all wear parts must be replaced.</p> <p>If the circuit breaker and the operating mechanism are overhauled for a further 10.000 operations, the entire circuit breaker should be reconditioned.</p> <p>Protection against by-products as per standard equipment above</p> |

7.5 Maintenance, Circuit Breaker Pole

7.5.1 The Service Life of the Circuit Breaker

General Information

Assuming that the recommended inspection intervals and actions have been observed, the circuit breaker will have a service life greater than 30 years or 10000 mechanical operations.

Maintenance Points

The following points ensure a long service life.

- Contact wear of the arcing contacts is small
 - Bearings in the gas space are maintenance-free.
 - The seals are designed to have O-rings with double sealing surfaces.
-

Replacement of Interrupter Unit

In general there are only three reasons for changing the interrupter units:

| Reasons | |
|---------|--|
| 1 | If the number of short-circuits x short-circuit current (kA) approaches the curve, see figure . |
| 2 | If the number of operations on the line, reactor or capacitor switching, as well as the switching of load current ¹⁾ has reached the number under the heading "Interval" in . |
| 3 | A mechanical fault or incorrect adjustment of the drive system has damaged components in the interrupter unit. |

¹⁾ The load currents from normal Close and Open operations are not calculated in the formula. These are only calculated when counting the total number of mechanical Close and Trip operations.

**NOTE!**

Changing the interrupter unit calls for special instructions and must only be carried out by qualified and authorized personnel.

Calculations

The graph that shows the restriction to the number of permitted short circuits can be given roughly as:

| Formula | Explanation |
|-------------------------------|--|
| $\Sigma n \times I^2 = 20000$ | n = number of short circuits I = short-circuit current kA (RMS) |

In the formula, all levels of short-circuit current are included. E.g. $10 \times 30^2 + 20 \times 20^2 + 20 \times 10^2 = 19000$.

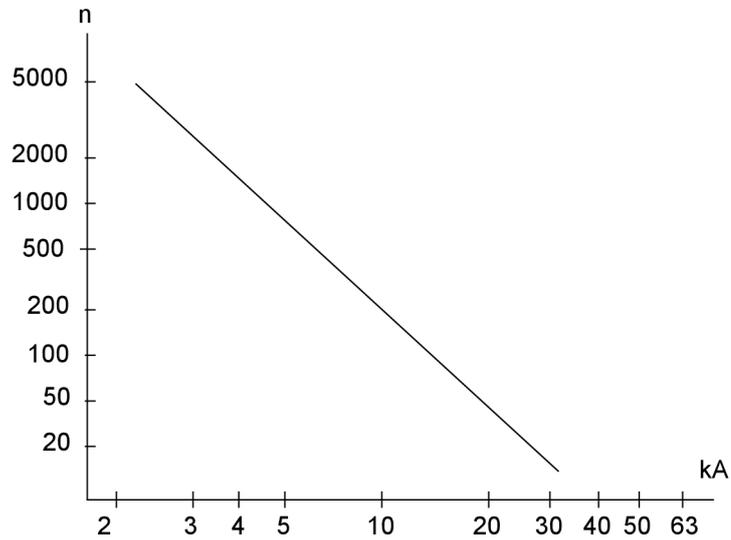
7.5.2 The Service Life of the Arcing Contacts in the Event of Short Circuit Breaking

General Information

The graph shows the number of breaks as a function of the breaking current that the contacts in a circuit breaker can undergo before contact wear is so great that they must be replaced.

Wear on the interrupter unit depends largely on the actual loading and frequency. These values are only a rough guideline in order to determine when maintenance needs to be carried out.

No. of Operations



G006847

n Number of short-circuit current breaks

kA Short-circuit current/Commutation current

7.5.3 Cleaning and Lubrication of Circuit Breakers

Exterior Cleaning

**WARNING!**

Work on the circuit breaker when there is a risk for mechanical damage to the insulators should be executed at reduced gas pressure, 0.125 MPa (abs).

**NOTE!**

Composite insulators do not normally require cleaning. Solvents or water rinsing with high pressure could damage the silicone surface on the insulator.

Lubricant

Only use lubricants recommended in section *Types of Grease*, page 32. This is particularly important at temperatures below -25 °C.

Lubrication of Circuit Breakers

The circuit breaker bearings are lubricated with grease on delivery and do not normally need to be lubricated other than for larger overhauls.

Rust Protection

The close and trip springs are anti-rust protected with two-component paint.

See *Maintenance of Rust Protection*, page 120.

7.6 Summary, Operating Mechanism

7.6.1 Preparatory Measures and Overview of the Operating Mechanism

General Information

This section describes the actions that must/can be made prior to commencing maintenance work.

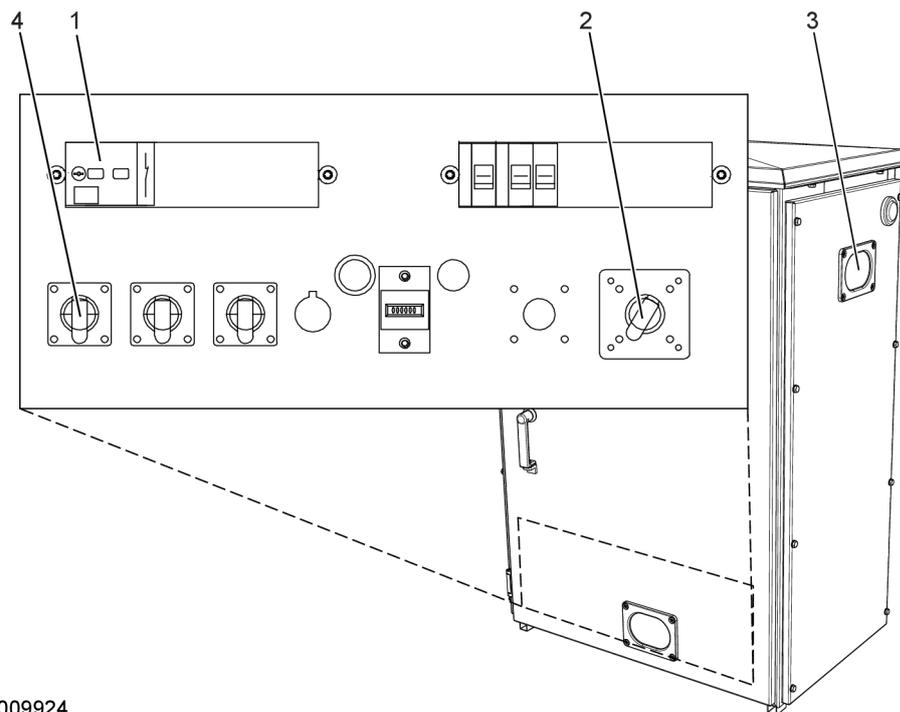


WARNING!

Do not operate the operating mechanism without a load! Operation must not be conducted until the device has been connected and adjusted as appropriate for the associated pressurized circuit breaker.

Overview

The components in the operating mechanism are integrated into a cabinet that also contains a control panel with control equipment.



G009924

1. Protective motor switch
2. Switch Local/Remote/Disconnected (S4)
3. Close springs indicator
4. Control switch, Close/Open (S1)

Before Commencing Maintenance the Following Must Be Done:

1. Switch off the motor current by switching off the motor protection (1).
2. Set the Local/Remote/Disconnected switch (2) on the control panel to the Local position.
3. Execute an Open-Close-Open operation.
4. Check that the springs are discharged. The indicator (3) shows discharged spring.
5. Check that the circuit breaker is in open position.
6. Switch off the control voltage and where necessary the heater voltage as well.
7. Disconnect and earth.

End of instruction

To Facilitate Maintenance, the Following Can Be Performed:

1. Remove the side plate from the operating cabinet.
2. Open the operating mechanism door and component plate.

End of instruction

7.6.2 Cleaning, Lubrication, and Rust Protection of Operating Mechanism

Safety



WARNING!

Work on the operating mechanism with the circuit breaker in closed position and charged springs always represents a risk.

It is therefore important to observe the safety instructions before commencing work. See *Hazardous Working Situations*, page 9.

Lubricant

The table shows the greases and oils that are needed for this maintenance. For suppliers and trade names of oils and greases, see sections *Oil Types*, page 31 and *Types of Grease*, page 32.

| Lubricant | Part number | Note |
|------------|-------------|------|
| Grease "M" | 5316 381-J | |
| Grease "T" | 2GBA000351 | |

Cleaning

Clean the operating mechanism where necessary through vacuuming. The time interval for this cleaning operation depends on the degree of air pollution in the local environment.

Rust Protection

On delivery, the operating mechanism is treated with desiccant as transport protection against moisture.

Despite good anti-rust treatment, minor corrosion may occur, particularly if the circuit breaker is installed in a highly corrosive environment.

Rust spots must be polished off and new anti-rust agent applied, see *Maintenance of Rust Protection*, page 120

Spare Parts

Spare parts must be stored indoors in an approved storage area¹⁾ and in original packaging. This applies especially to rubber components (seals etc.) that must also be protected against sunlight to prevent drying out. Gaskets can be stored only for a limited period, so avoid stocking them. Support structures can be stored outdoors.

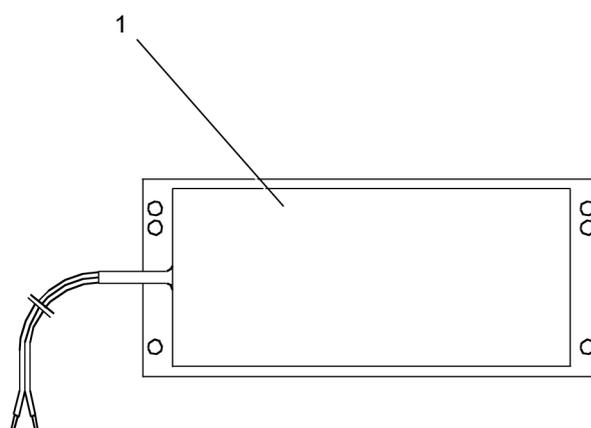
¹⁾ Approved storage areas: Under roof, on solid ground, ambient humidity below 75% RH, temperature +20 °C (±10 °C).

7.6.3 Inspection of Heating Element

General Information

Cabinets containing equipment that is sensitive to damp are equipped with a heating element to prevent condensation.

Heating Element



G003167

1. Heating Element

Data

| Voltage | Resistance $\pm 15\%$ | Power |
|---------|-----------------------|-------|
| 220 V | 691 ohm | 70 W |
| | 346 ohm | 140 W |
| 110 V | 173 ohm | 70 W |
| | 86 ohm | 140 W |

Instructions

1. Measure the resistance of the element, and compare with the value in the table above to ensure that the element is intact.
2. Measure the power supply voltage to the element

End of instruction

7.6.4 Inspection of Drive Unit

General Information

This section describes how to check the drive unit.

Data IEC

| 48 VDC | 110 VDC | 220 VDC | 120 VAC | 230 VAC |
|--------------|--------------|--------------|--------------|--------------|
| 85 % - 110 % | 85 % - 110 % | 85 % - 110 % | 85 % - 110 % | 85 % - 110 % |

The value is a percentage of the nominal IEC voltage.

Data IEEE

| 48 VDC | 125 VDC | 250 VDC | 120 VAC | 240 VAC |
|-------------|--------------|---------------|---------------|---------------|
| 36 V - 56 V | 90 V - 140 V | 180 V - 280 V | 104 V - 127 V | 208 V - 254 V |

Inspection of Drive Unit

1. Measure the motor current at the end of the charging process.



NOTE!

The motor must be able to charge the springs at the nominal voltage.

2. Check that the signal for tripped motor protection is working.



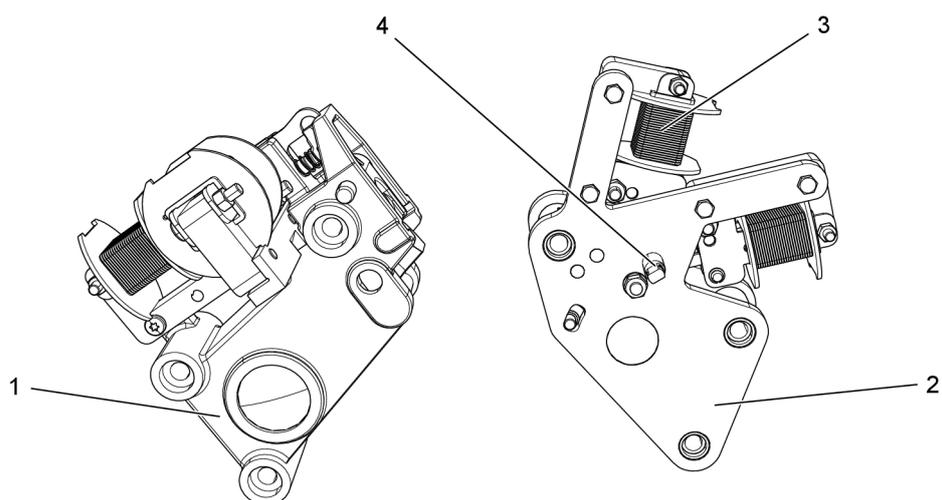
NOTE!

If this is not the case, replace the protective motor switch.

End of instruction

7.6.5 Inspection of Latch Devices

Latch Device



G008800

1. Trip latch device
2. Closing latch device
3. Additional coil (option)
4. Keyshaft

Required Equipment

| Equipment | Part number | Note |
|--------------|---------------|------|
| Grease "L" | 1171 4016-606 | |
| Multimeter | | |
| Feeler gauge | | |

Data IEC

| | 48 VDC | 110 VDC | 220 VDC |
|------------|--------------|--------------|--------------|
| Trip coil | 70 % - 110 % | 70 % - 110 % | 70 % - 110 % |
| Close coil | 85 % - 110 % | 85 % - 110 % | 85 % - 110 % |

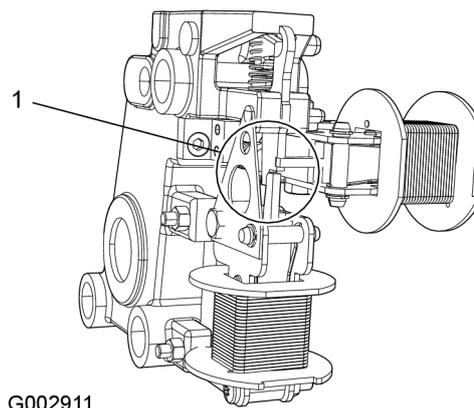
The value is a percentage of the nominal IEC voltage.

Data IEEE

| | 48 VDC | 125 VDC | 250 VDC |
|------------|-------------|--------------|---------------|
| Trip coil | 28 V - 56 V | 70 V - 140 V | 140 V - 280 V |
| Close coil | 36 V - 56 V | 90 V - 140 V | 180 V - 280 V |

Check Play in the Trip Latch Device

1. Check and clean the arms (1) in the triple latch device and lubricate them with grease "L".



G002911

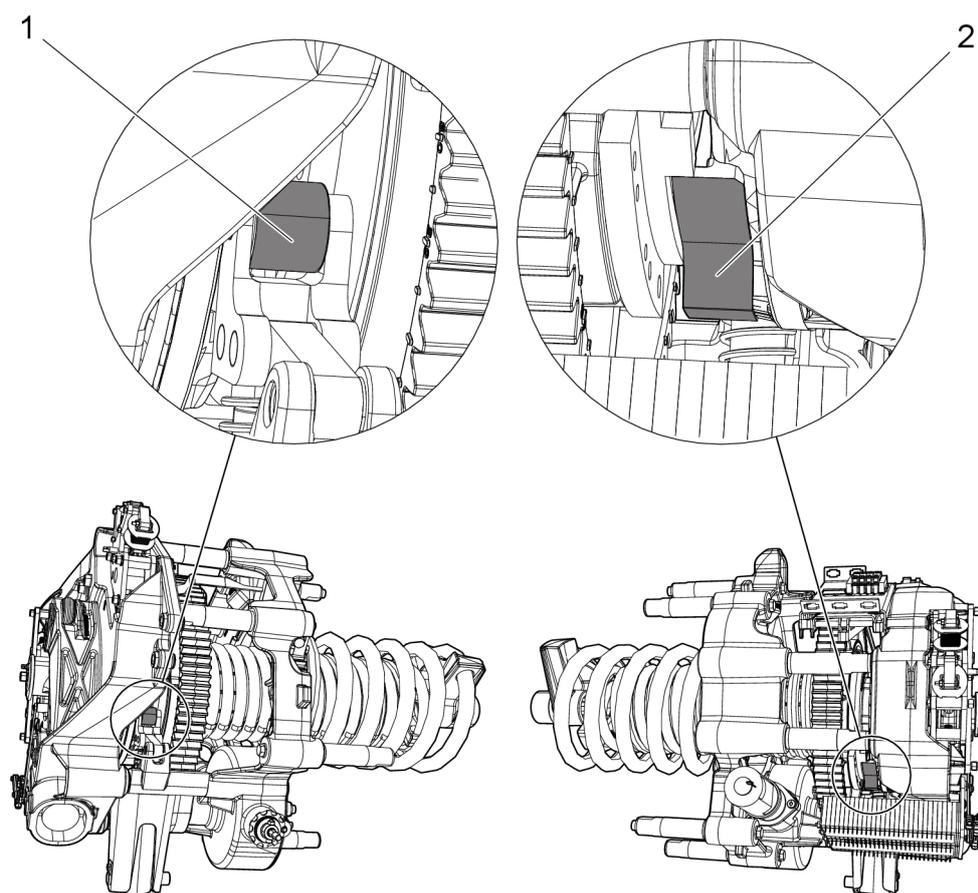
2. Check that the voltage to the coils is not lower than the nominal voltage.

See the operating mechanism's delivery document.

End of instruction

7.6.6 Lubrication of roller and cam for closing damper.

Overview



G011565

1. Roller
2. Cam

Required Equipment

| Equipment | Part number | Note |
|-----------|---------------|------------|
| Grease | 1171 4016-612 | Grease "M" |

Lubrication

1. Apply grease "M" on roller (1) for closing damper.
2. Apply grease "M" on cam (2) on the cam mechanism.

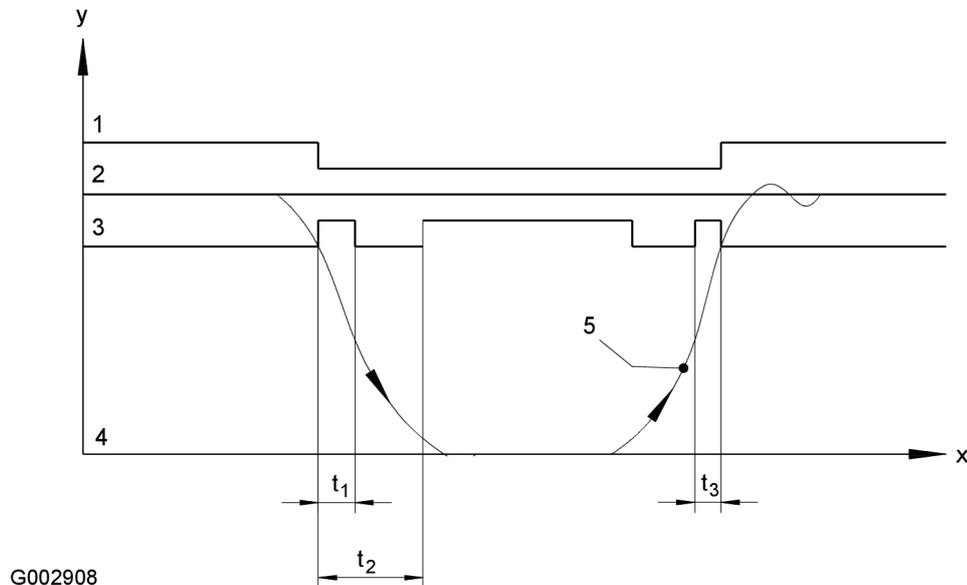
End of instruction

7.6.7 Check of Limit Switch and Auxiliary Contact

General

The shaft of the auxiliary contact is in direct connection to the operating mechanism's operating lever and therefore follows the travel of the circuit breaker contacts.

Time Measurement Contact Movement



y Contact movement

x Time

1 Arcing contact

2 Closed position

3 Auxiliary Contact

4 Open position

5 Contact movement

t1 Proportional to the contact's opening speed.

t2 Time that determines the contact damping.

t3 Proportional to the contact's closing speed.

Instructions

Check the contact movement using time measurement after 15 years or 5.000 operations and compare with the times obtained when commissioning. The comparison can then be used as condition checks for contact movement and damping. The measurement must be performed on a disconnected circuit breaker with connected timing equipment.

1. Connect the timing equipment to the respective terminals in accordance with the wiring diagram.
2. Perform the operation.
3. Measure and note the times t_1 , t_2 and t_3 .
4. Disconnect the timing equipment.

End of instruction

7.6.8 Inspection of Connection Terminals

Instructions

1. Make a visual inspection to ensure that everything is intact and that all connections are fitted.
-

End of instruction

7.7 Maintenance of Rust Protection

General

Despite good anti-rust treatment, minor corrosion may occur, particularly if the circuit breaker is installed in a highly corrosive environment.

Many steel mechanical components in the operating mechanism are surface treated through manganese phosphating agent and protected by being dipped in oil. The close and trip springs can be protected against corrosion with two-component paint or manganese phosphating.

The support structure is hot dip galvanized.

Phosphated Surface

1. Polish out rust stains.
 2. Brush or spray on new rust protection.
-

End of instruction

Hot Dip Galvanized/Electroplated Surface

1. Polish out rust stains.
 2. Brush or spray on new rust protection, in the form of zinc-rich paint. The thickness of the new surface must be at least double the original zinc thickness.
-

End of instruction

8 Overhaul

8.1 Introduction

General Information

This chapter includes instructions for a general overhaul of the complete circuit breaker. The time interval for the overhaul is specified in *Maintenance Schedule*, page 100.

Before commencing the overhaul, read *Introduction, Safety*, page 7

Scope

If the overhaul is conducted for a further 10000 operations, all moving parts must be replaced.

If the overhaul is conducted for a further 2000 operations, certain worn parts must be replaced.

Competence Level

Personnel who are to carry out maintenance work as set out in this chapter must have competence level C: they must be authorized by ABB to perform assembly, commissioning and maintenance work. In some cases support may be required from ABB.

8.2 Preparations for Overhaul

General Information

The overhaul can be carried out according to two methods:

The latter method does not require as much work, but must only be applied in clement weather that resembles indoor working conditions.



WARNING!

The following points must be observed before beginning the overhaul.

- The springs must be discharged, see *Discharge the Springs Electrically*, page 10
- The gas must be evacuated; see *Evacuation of CO2 gas*, page 125



NOTE!

Under no circumstances may the interrupter unit be opened during rainy or unstable weather, or when the humidity is 80% or higher.

Instructions

1. Check and note the circuit breaker's operating values prior to dismantling.
 - Deviations from the recommended values indicate that something needs to be checked with extra care for the overhaul.
2. Switch off the motor current by switching off the motor protection.
3. Set the "Local/Remote/Disconnected" switch on the control panel to the "Local" position.
4. Execute an Open-Close-Open operation.
5. Check that the springs are discharged.
6. Check that the circuit breaker is in the Open position.
7. Switch off the control voltage and where necessary the heater voltage as well.
8. Disconnect and earth.

End of instruction

8.3 Required Equipment

Tool

| Tool | ABB part no. | Note |
|--|--------------|---|
| MK toolbox | 6880 768-7 | Torque wrenches 10-300 Nm. NOTE! The MK toolbox is not included in the delivery; it must be ordered separately. Alternatively, the existing tool equipment may be used. |
| Lifting devices and slings. | | Weights for the current circuit breaker are specified on the outline drawing applicable to the order. |
| Cleaning Equipment | | |
| Gas treatment equipment | | For evacuation, cleaning, compression and storage of used gas and instruments for monitoring pressure and vacuums. |
| Test equipment for recording damping curves and operating values | | For example Programma or ABB SA10. |
| Multimeter | | |
| Feeler gauge | | |
| Ethanol | | >95% ethanol, for cleaning internal surfaces |
| Cleaning and drying cloths | | |

Lubricants and Locking Fluids

| Agent | ABB part no. | Note |
|---------------------------------------|---------------|--|
| Grease "N" | 1171 4016-612 | See sections <i>Types of Grease</i> , page 32 for ABB part numbers, suppliers and trade names. |
| Grease "P" | 1171 5011-102 | |
| Grease "S" | 1171 4014-406 | |
| Grease "T" | 2GBA000351 | |
| Anti-rust agent, Valvoline Tectyl 506 | 1241 0011-108 | |
| Locking fluid "C" | 1269 0014-408 | See sections <i>Locking Fluid</i> , page 35 for ABB part numbers, suppliers and trade names. |

Spare Parts

| Spare | ABB part no. | Note |
|---------------------------------------|---------------------|--|
| Gasket sets | - | As per spare parts list for current circuit breaker. |
| Protective cover for interrupter unit | 5237 736-R | |
| Protective cover for post insulator | 5439 142-A | |

8.4 Evacuation of CO₂ gas

Safety



CAUTION!

Work on the circuit breaker's insulators or live parts, as well as transport and dismantling of all circuit breaker poles from the support structure, must not be executed until the gas has been evacuated to a maximum pressure of 0.125 MPa abs.



WARNING!

CO₂, N₂ and nitrogen gas may be dispersed into fresh air. This must be done through a dust and adsorption filter. Evacuation must take place outdoors and at ground level, or in accordance with local rules and regulations.

Required Equipment

| Equipment | Part number | Note |
|----------------------------|-----------------|------|
| Gas treatment equipment | | |
| Dust and adsorption filter | 2GHV074444P0001 | |

Evacuation

1. Connect the gas treatment equipment.
2. Evacuate the CO₂ gas.
3. Vacuum-pump the circuit breaker poles.
4. Fill the circuit breaker poles with dry nitrogen to atmospheric pressure.
5. Vacuum-pump the circuit breaker poles again.
6. Refill the circuit breaker poles with dry nitrogen to atmospheric pressure.
7. The circuit breaker poles are now ready for disassembly.

End of instruction

8.5 Cleaning and Waste Treatment

Safety


NOTE!

Drying cloths, protective gloves and vacuum cleaner bags should be thoroughly rinsed using plenty of water.

Required Equipment

| Equipment | Note |
|---------------------------------------|---|
| Protective equipment | Protective gloves of plastic or rubber. Long-sleeved overalls. |
| Facemask | With filter to counter act fine dust and acidic gases. |
| Vacuum cleaner | With fine dust filter and plastic nozzle. |
| Drying cloths | Of non-lint material. |
| Sealed storage vessels | |
| Steel brush | For contact surfaces of aluminum. |
| Fine abrasive material or emery cloth | E.g. Scotch-Brite™ 7447 or equivalent. |
| Ethanol | >95 % ethanol, for cleaning internal surfaces. |
| Thick plastic foil and plastic bags | To prevent moisture penetration and to protect cleaned parts prior to assembly. |

Cleaning

- The dust (by-products) formed in the circuit breaker must be removed by a vacuum cleaner fitted with a fine dust filter and wiped off using drying cloths moistened with ethanol.

8.6 Treatment of Sealing Surfaces and Seals

General Information

In conjunction with installation, all sealing surfaces should be cleaned, degreased and checked.

Required Equipment

| Equipment | Part number | Note |
|---------------------------------------|---------------|---|
| Ethanol | | >95% ethanol, for cleaning internal surfaces |
| Fine abrasive material or emery cloth | | E.g. Scotch-Brite™ 7447 or equivalent |
| Grease "T" | 2GBA000351 | For static seals, see <i>Types of Grease</i> , page 32. |
| Grease "S" | 1171 4014-406 | For moving seals, e.g. shaft seals, see <i>Types of Grease</i> , page 32. |

Remember:



NOTE!

Be careful of the sealing surfaces. Place the parts on a suitable surface, such as wooden blocks, so that the sealing surfaces will not be damaged.



NOTE!

The sealing grooves and other sealing surfaces must **not** have transverse scratches. Any minor scratches on the sealing surfaces can be removed using a fine abrasive material, such as Scotch-Brite. Polish along the sealing line and **never** across it.

Instructions

1. Replace all seals with new ones when reassembling the circuit breaker.
2. Sparingly lubricate the sealing surfaces and seals. Surfaces and seals are lubricated to facilitate the seal's fitting to the surface and as corrosion protection.
Excess grease that could be pressed out of the flanges inside the gas space must not occur.
3. Coat the flange surfaces outside the external seals with a thin, fully covering layer of corrosion protective agent adapted to suit the pertinent flange material.

End of instruction

8.7 Removal of Circuit Breaker Pole for Transport

General Information

The circuit breaker pole must be taken out of service before the circuit breaker is dismantled (see section *Preparations for Overhaul*, page 122) and the gas emptied (see section *Evacuation of CO₂ gas*, page 125).

Preconditions



NOTE!

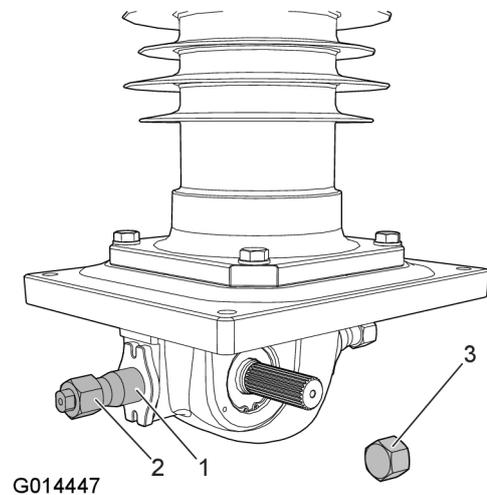
This type of work must only be executed by personnel trained by ABB.

Required Equipment

| Equipment | ABB part no. | Note |
|---------------------------|--------------|------|
| MK toolbox | 6880 768-7 | |
| Torque tool | 1HSB426883-3 | |
| Lifting device and slings | - | |

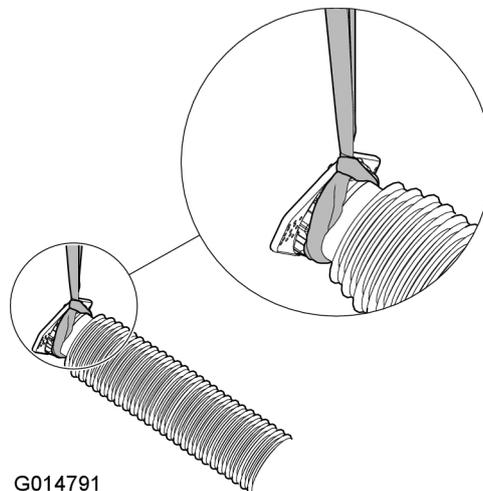
Dismantling

1. Loosen the pole gas connections by removing all three nuts (2) to the mark on the non-return valve (1).



2. Now remove all nuts.
3. Fit the sealing caps (3).

4. Put a lifting sling under the interrupter unit's upper flange and secure with a lifting crane.



G014791

**DANGER!**

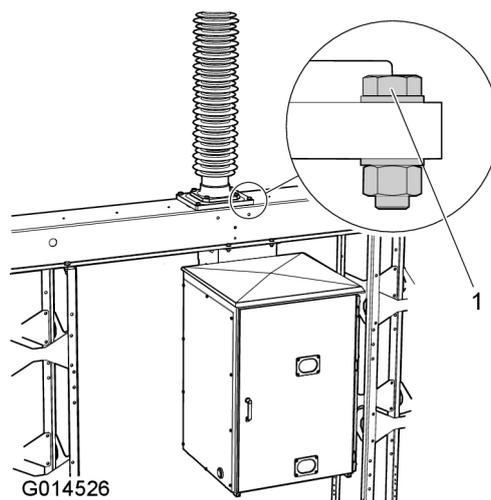
The breaker pole must be lifted with lifting equipment that is designed for the weight!

See outline drawing for the exact weights.

**NOTE!**

For composite insulators: place the lifting sling as close as possible to the flange. Do **not** place it on the rubber surface.

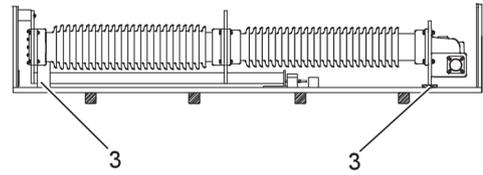
5. Loosen the transmission rod eye bolt from the circuit breaker operating lever on pole B by removing the joint pin (4), after first loosening bolt (1) on the lock washer (3).
6. Loosen the circuit breaker pole at the four bolts (1) in the pole beam.



1. Bolt M16x70 (4 pcs), nut M16 (4 pcs), washer 17x30x3 (8 pcs) M16x70 (4 pcs)

7. Lift up the circuit breaker pole and carefully lay it on a handling trolley. Block up underneath so that it is horizontal.

8. The blocks (3) under the interrupter unit's insulators should be of elastic material e.g. wood or rubber.



G002723

End of instruction

8.8 Overhaul of Circuit Breaker Pole

8.8.1 Removal of the Interrupter Unit From the Post Insulator

General Information

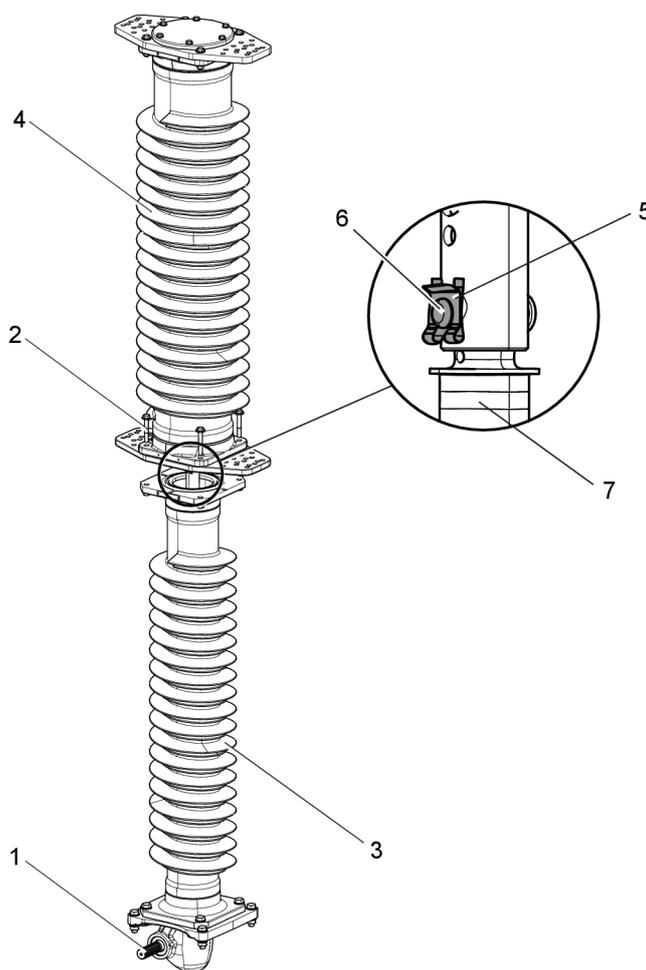
This section describes the removal of a interrupter unit, after the circuit breaker pole has been dismantled and transported to a workshop.



NOTE!

The circuit breaker pole is fitted vertically on a suitable support structure, e.g. a circuit breaker support or a frame of the floor of the workshop.

Overview



G003813

1. Operating shaft
2. Bolt M12x80 (4 pcs), washer 13x28x3 (8 pcs), nut M12 (4 pcs)
3. Post Insulator
4. Interrupter Unit
5. Lock washer SL12
6. Pin Ø12
7. Insulating pull-rod

Required Equipment

| Equipment | ABB part no. | Note |
|---------------------------|--------------|------|
| MK toolbox | 6880 768-7 | |
| Lifting device and slings | - | |
| Torque tool | 1HSB426883-3 | |

Instructions



DANGER!

Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.

1. Turn the operating shaft (1) counter clockwise to the contacts' closed position.



NOTE!

Use the torque tool!

2. Fit the lifting straps from the top of the interrupter unit to the lifting device.

Stretch the lifting strap moderately.



NOTE!

For composite insulators: place the lifting sling as close as possible to the end flange and not on the rubber surface.

3. Remove the bolts (2) between post insulator (3) and interrupter unit (4)

4. Lift the interrupter unit 75-100 mm.



NOTE!

The interrupter unit must not be lifted more than 100 mm to avoid damage to the inside of the circuit breaker.

5. Remove the lock washer (5) and the pin (6).



NOTE!

Ensure that no lock rings or washers fall down in the post insulator when dismantling.

Cover the opening by e.g. a cloth rag.

6. Lift off the interrupter unit completely and place it vertically on a suitable surface, such as on two cross bars, to ensure it does not tip over.

End of instruction

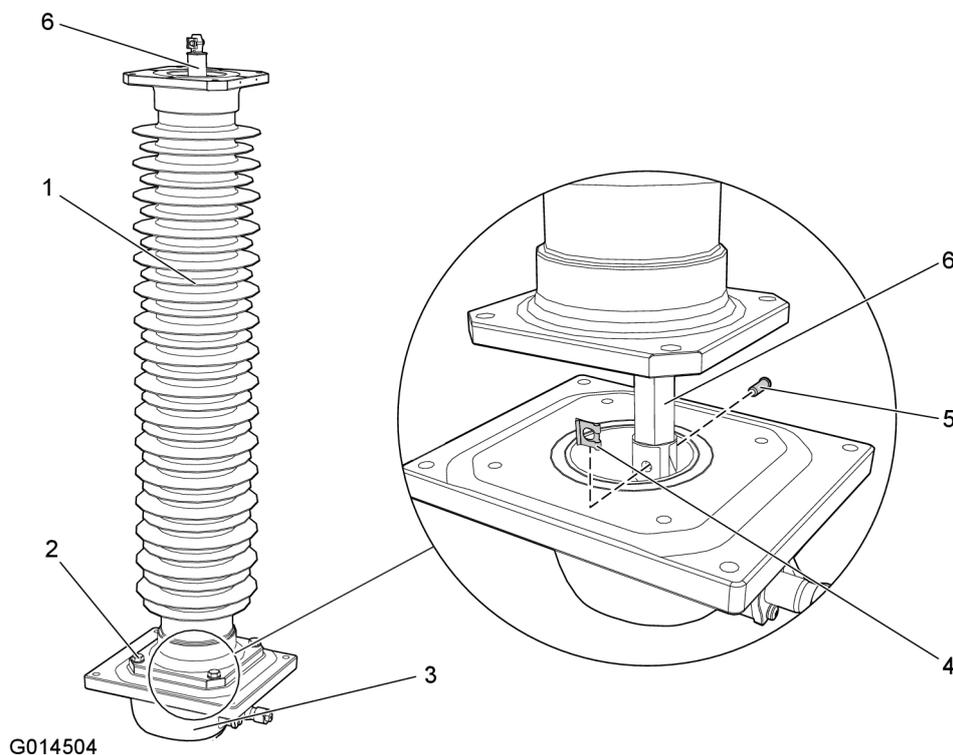
8.8.2 Removal of Post Insulator

General Information

This section describes the removal of post insulators, after the interrupter unit has been removed from a dismantled circuit breaker pole.

To prevent moisture in the air coming into long-term contact with dust in the post and insulating pull-rods, the work on removal and cleaning must be planned to ensure it can be executed quickly and without long breaks.

Overview



1. Post Insulator
2. Bolt M 16x50, washer 17x30x3
3. Mechanism housing
4. Lock washer SL16
5. Pin Ø20
6. Insulating pull-rod

Safety



NOTE!

Use personal safety equipment:

- long-sleeved overalls
- protective gloves of plastic or rubber
- tight fitting facemask for dust protection

Required Equipment

| Equipment | ABB part no. | Note |
|---------------------------------|--------------|---|
| MK toolbox | 6880 768-7 | |
| Lifting device and slings | - | |
| Vacuum cleaner | - | With fine dust filter and plastic nozzle. |
| Drying cloths | - | Of non-lint material. |
| Sealed storage vessels | - | For waste products. |
| Ethanol 99.9% (denatured) | - | For cleaning internal surfaces. |
| Thick plastic foil/plastic bags | - | To prevent moisture penetration and to protect cleaned parts prior to assembly. |

Instructions



DANGER!

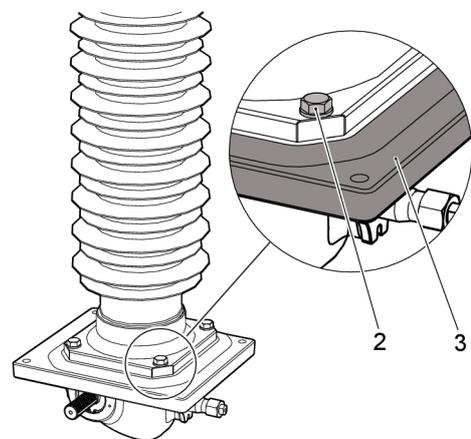
Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.

1. Fit the lifting strap from the top of the support isolator to the lifting device.
2. Remove the post insulator bolts (2) from the mechanism housing (3).



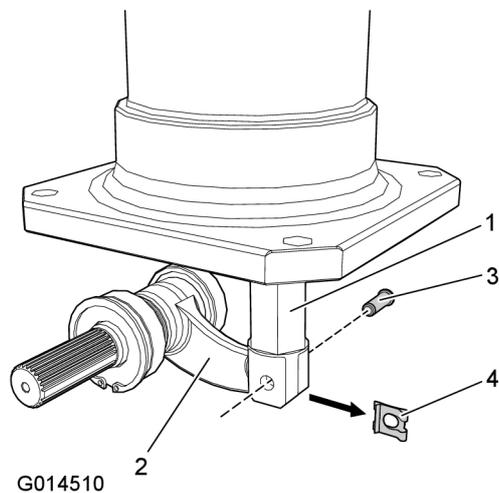
NOTE!

Do not position the lift strap on the rubber surface.



G014528

3. Remove the SL16 lock washer (4) and joint pin (3).



4. Lift the post insulator (1) straight up from the mechanism housing (3) until the insulating pull-rod (2) moves freely. Hold the insulating pull-rod when lifting.

**NOTE!**

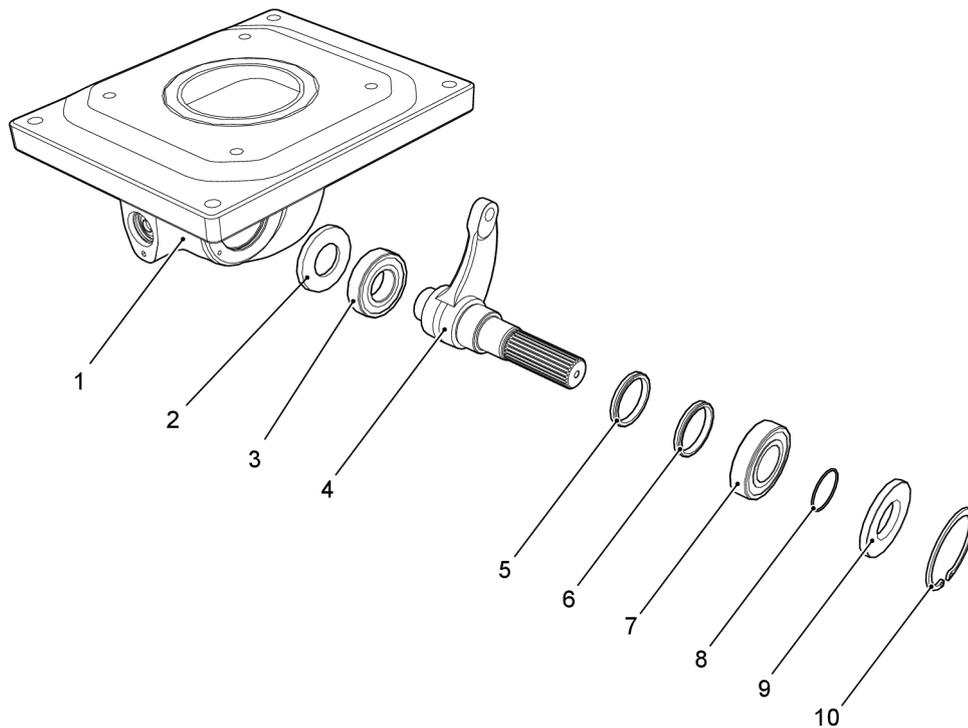
Be careful not to damage the insulating pull-rod.

5. Clean the insulating pull-rod with care and protect it with plastic foil.
6. Clean the post insulator with care internally and externally and protect it with plastic foil.

End of instruction

8.8.3 Overhaul of Mechanism

Overview



G014449

1. Mechanism housing
2. Seal
3. Ball bearings
4. Inner operating lever
5. x-ring
6. x-ring
7. Ball bearings
8. O-ring
9. Seal

Remember:



NOTE!

Clean the mechanism housing by vacuuming and drying. Check for corrosion, the bearings and replace all sealing rings. Apply anti-rusting agent to untreated or manganese phosphated steel outside the gas space using Valvoline Tectyl.

Required Equipment

| Equipment | Part number | Note |
|----------------|---------------|--|
| MK toolbox | 6880 768-7 | |
| Grease "S" | 1171 4014-406 | Detailed information is specified in section <i>Types of Grease</i> , page 32. |
| Tectyl | 1241 0011-108 | Valvoline Tectyl |
| Vacuum cleaner | | |
| Drying cloths | | |

Instructions

1. Remove the outer lock ring (9).
2. Remove the seal (8).
3. Knock/pull out the operating shaft (3). The ball bearings and the bushing on one side follow when you knock/pull out the operating shaft.
4. Knock/pull out the other ball bearings and the other bushing.
5. Inspect the ball bearings (6). Replace the ball bearings where damage is identified!
 - Do **not** lubricate these.
6. Replace the seals (2, 9) and lubricate with grease "S".
7. Check that there are no burrs in the locking ring groove. Any burrs that may be present are to be carefully ground off. Thoroughly clean the locking ring groove before fitting new X-rings and O-rings.
8. Vacuum and dry the mechanism housing interior.
9. Press in the seal (2) and ball bearings (3) on one side.
10. Refit the inner operating lever (4).
11. Press in the ball bearings (6) on the other side.
12. Fit the O-ring (8).
13. Fit the new seal (9).
14. Fit the outer lock rings (10) and coat them with Tectyl.

End of instruction

8.9 Assembly of Circuit Breaker Pole

8.9.1 Treatment of Sealing Surfaces and Seals

General Information

In conjunction with installation, all sealing surfaces should be cleaned, degreased and checked.

Required Equipment

| Equipment | Part number | Note |
|---------------------------------------|---------------|---|
| Ethanol | | >95% ethanol, for cleaning internal surfaces |
| Fine abrasive material or emery cloth | | E.g. Scotch-Brite™ 7447 or equivalent |
| Grease "T" | 2GBA000351 | For static seals, see <i>Types of Grease</i> , page 32. |
| Grease "S" | 1171 4014-406 | For moving seals, e.g. shaft seals, see <i>Types of Grease</i> , page 32. |

Remember:



NOTE!

Be careful of the sealing surfaces. Place the parts on a suitable surface, such as wooden blocks, so that the sealing surfaces will not be damaged.



NOTE!

The sealing grooves and other sealing surfaces must **not** have transverse scratches. Any minor scratches on the sealing surfaces can be removed using a fine abrasive material, such as Scotch-Brite. Polish along the sealing line and **never** across it.

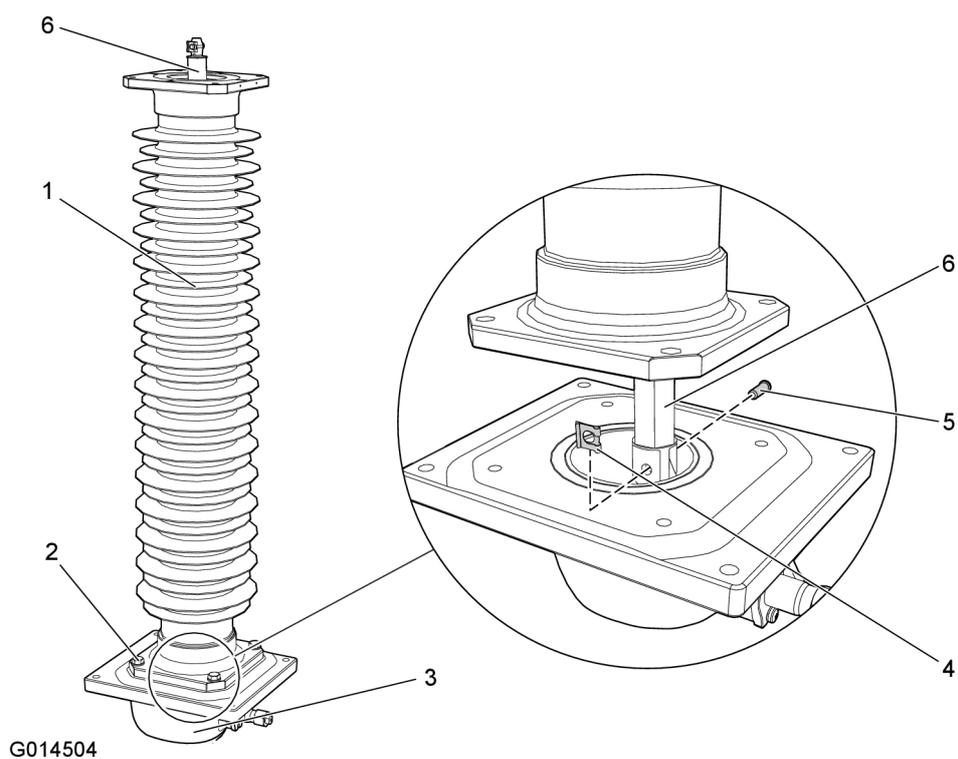
Instructions

1. Replace all seals with new ones when reassembling the circuit breaker.
2. Sparingly lubricate the sealing surfaces and seals. Surfaces and seals are lubricated to facilitate the seal's fitting to the surface and as corrosion protection.
Excess grease that could be pressed out of the flanges inside the gas space must not occur.
3. Coat the flange surfaces outside the external seals with a thin, fully covering layer of corrosion protective agent adapted to suit the pertinent flange material.

End of instruction

8.9.2 Assembly of Post Insulator

Overview



1. Post Insulator
2. Bolt M 16x50, washer 17x30x3
3. Mechanism housing
4. Lock washer SL16
5. Pin Ø20
6. Insulating pull-rod

Required Equipment

| Equipment | Part number | Note |
|-------------------|---------------|--|
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque 79-100 Nm. |
| Torque tool | 1HSB426883-3 | |
| Locking fluid "C" | 1269 0014-408 | More information about locking fluid is specified in <i>Locking Fluid</i> , page 35. |

Instructions



DANGER!

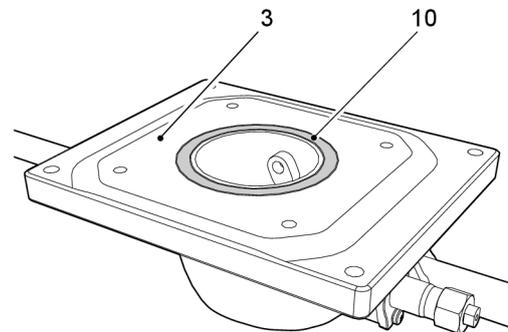
Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.



NOTE!

Be careful not to damage the insulating pull-rod.

1. Lubricate and place the sealing ring (10) in the groove on the mechanism housing (3).



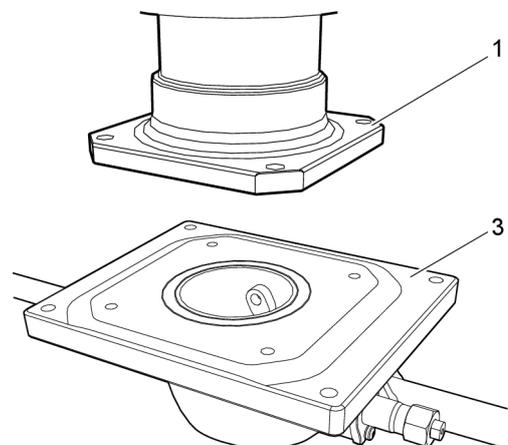
G014511

2. Place the post insulator (1) on the mechanism housing (3).



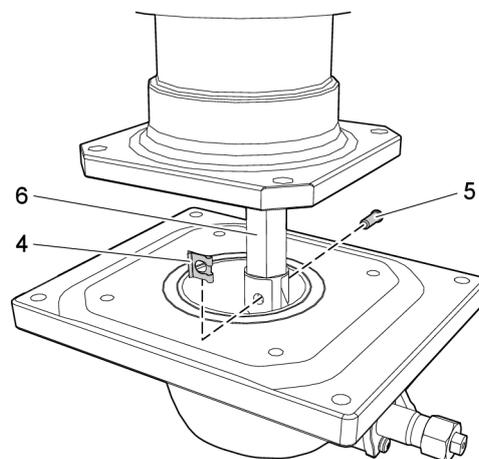
NOTE!

Hold the insulating pull-rod during assembly so that it does not scratch the post insulator.



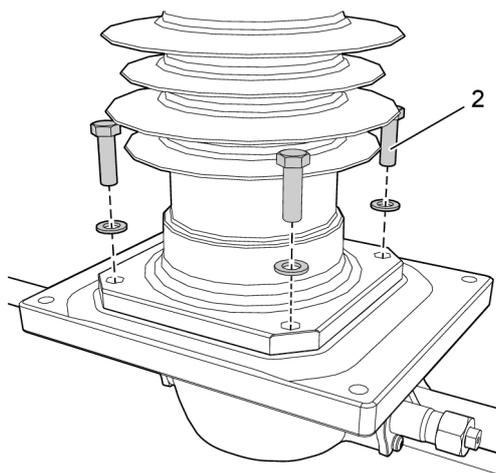
G014513

3. Fit together the insulating pull-rod (6) and the inner operating lever with the pin (5) and lock washer (4).



G014514

4. Fit bolts with washers (2) and torque tighten.



G014512

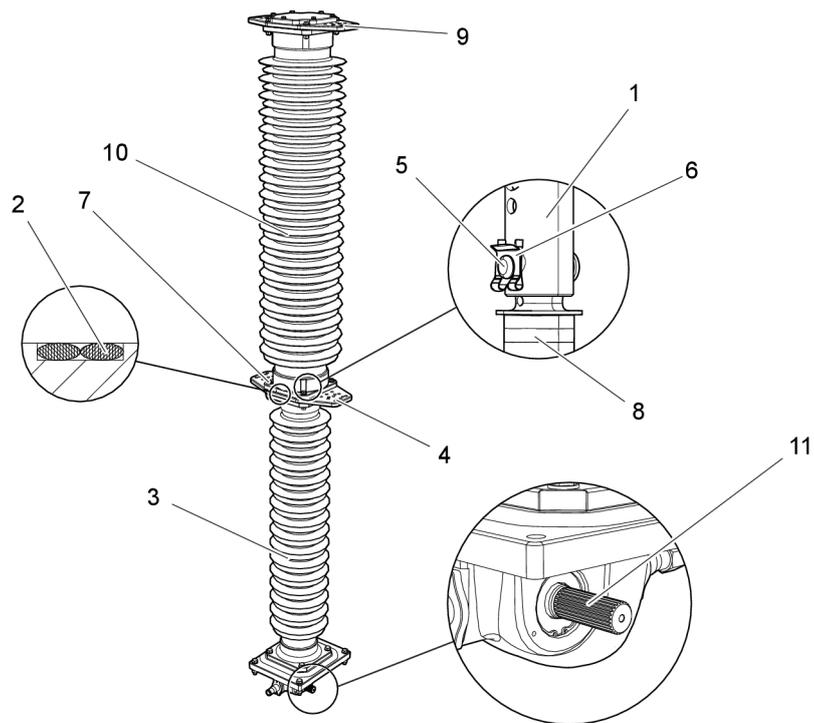


Torque
79 Nm

End of instruction

8.9.3 Assembly of Interrupter Unit on the Post Insulator

Overview



G014450

1. Puffer pull-rod
2. Sealing ring 169.6 x 5.6
3. Post Insulator
4. Lower adapter plate
5. Pin Ø12
6. Lock washer SL12
7. Bolt M12x80 (4 pcs), washer 13x28x3 (8 pcs), nut M12 (4 pcs)
8. Insulating pull-rod
9. Upper adapter plate
10. Interrupter Unit
11. Operating shaft

Required Equipment

| Equipment | Part number | Note |
|---------------------------|--------------|-------------|
| Lifting device and slings | - | |
| MK toolbox | 6880 768-7 | |
| Torque tool | 1HSB426883-3 | |
| Torque wrench | - | 45 - 79 Nm. |

Instructions



DANGER!

Use lifting equipment that is designed for the weight of the interrupter unit. See outline drawing for the exact weights.

1. When assembling the replacement unit:

Reduce the nitrogen pressure in the interrupter unit (10) to atmospheric pressure and remove the protective cover.

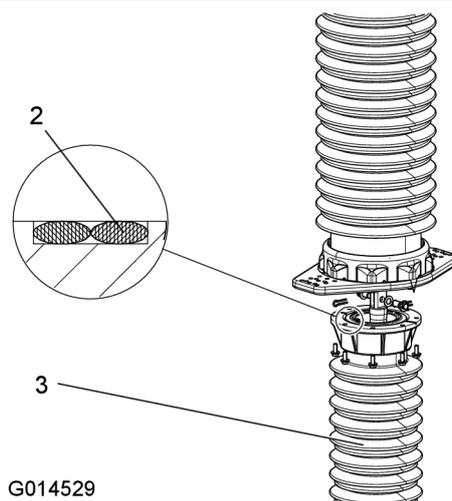
2. Suspend the interrupter unit in the lifting device and pull down the puffer pull-rod (1) to fully extended position making it accessible for assembly.



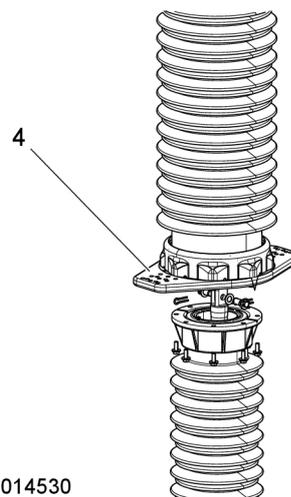
NOTE!

For composite insulators: place the lifting sling as close as possible to the end flange and not on the rubber surface.

3. Clean the sealing surface for the sealing ring (2) on the post insulator (3) carefully.



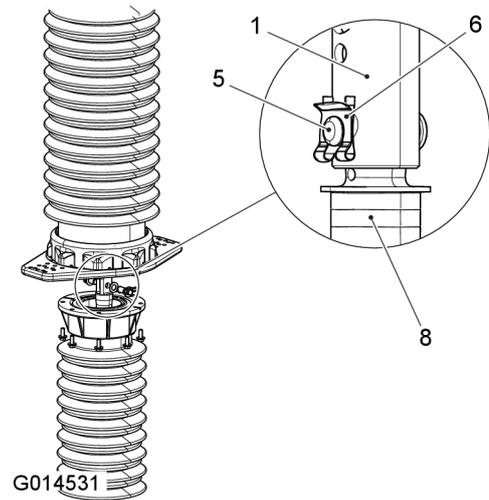
4. Also clean the lower flange and adapter plate (4) and lubricate generously with grease to ensure that the sealing ring is kept in place during assembly.



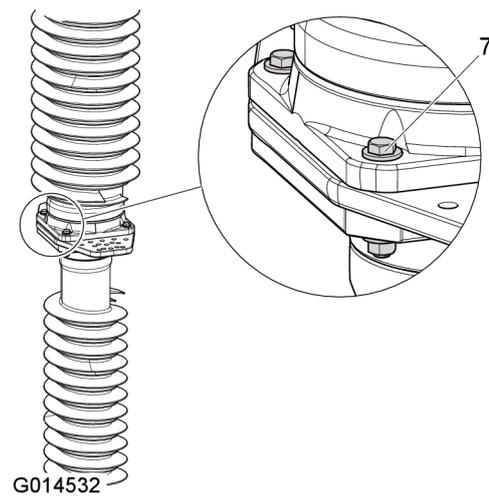
5. Place the sealing ring (2) in its groove.

6. Slowly lower the interrupter unit (10) so that it comes into position for fitting the pin (5), about 75-100 mm above the post insulator (3).

7. Connect the puffer's pull-rod (1) to the insulating pull-rod (8) with the pin (5) and lock using a lock washer (6).



8. When the pin is fitted, lower the interrupter unit carefully towards the post insulator and centre.
9. Fit the interrupter unit, secure with bolts, washers and nuts (7) and torque tighten.



- 7 Bolt M12x80 (4 pcs), washer 13x28x3 (8 pcs), nut M12 (4 pcs)

 **Torque**
79 Nm

End of instruction

8.9.4 Filling Gas Before Transport

General information

Before the circuit breaker pole can be moved, it must be treated with gas as per this section.

Instructions

1. Vacuum pump down to a pressure of 100 Pa (abs) and let the vacuum pumping continue for at least one hour after this pressure has been reached.

 2. Stop the vacuum-pumping and fill the circuit breaker with dry and clean nitrogen to atmospheric pressure. Let it stand a couple of hours or overnight.

 3. Vacuum pump back down to a pressure of 100 Pa (abs) and fill with clean CO₂ gas to 0.125 MPa (abs). The filling hoses should be stored to ensure that they are not exposed to moisture and contamination. They must not be used for anything other than their intended purpose.

 4. The circuit breaker pole is now ready for transport.
-

End of instruction

8.10 Replacement of Interrupter Unit

8.10.1 Dismantling of Interrupter Unit for Transport

General Information

This section describes the dismantling of the interrupter unit for transport. Dismantling the interrupter unit on site is an option to the recommendation (removing the whole circuit breaker pole, and then dismantling the interrupter unit in a workshop) and should only be applied in stable weather which gives indoor-like working conditions.

Preconditions

**WARNING!**

The circuit breaker must be removed from service before the interrupter unit is dismantled, see *Preparations for Overhaul*, page 122, the gas evacuated, see *Evacuation of CO₂ gas*, page 125, and filled to atmospheric pressure with nitrogen.

**NOTE!**

Under no circumstances may the interrupter unit be dismantled or opened during rainy or unstable weather.

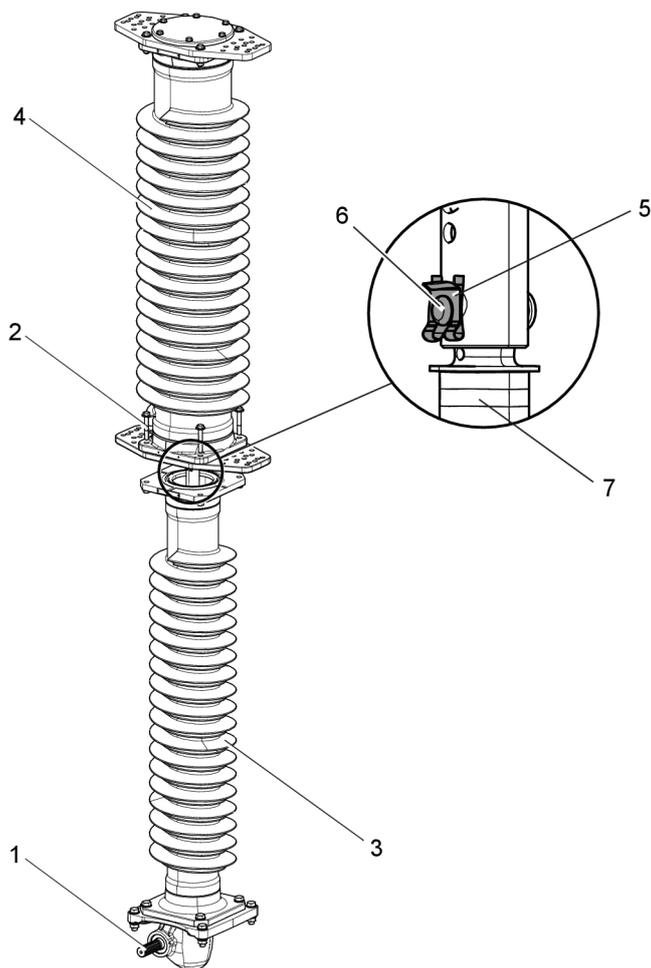
**NOTE!**

This type of work must only be executed by personnel trained by ABB.

**NOTE!**

If the post insulator or breaking unit is to be left for an extended period without being refitted, the post insulator, alternatively the breaking unit, must be vacuum pumped and filled with nitrogen.

Overview



G003813

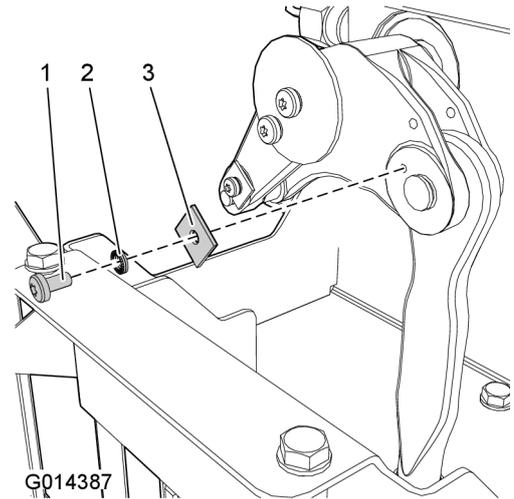
1. Operating shaft
2. Bolt M12x80 (4 pcs), washer 13x28x3 (8 pcs), nut M12 (4 pcs)
3. Post Insulator
4. Interrupter Unit
5. Lock washer SL12
6. Pin Ø12
7. Insulating pull-rod

Required Equipment

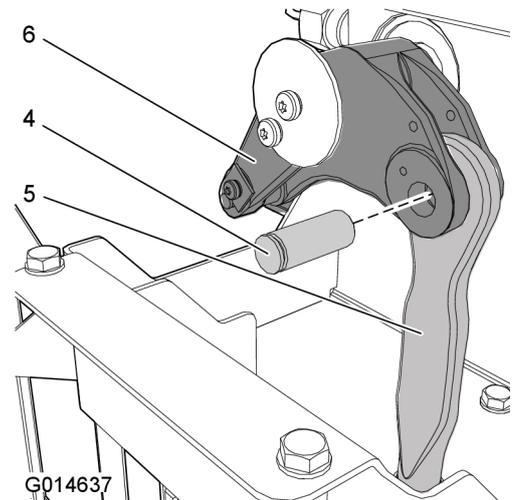
| Equipment | ABB part no. | Note |
|---------------------------|--------------|----------------------------------|
| MK toolbox | 6880 768-7 | |
| Lifting device and slings | - | |
| Torque tool | 1HSB426883-3 | |
| Protective cover A | 5439 142-A | Fitted above the post insulator. |
| Protective cover R | 5237 736-R | Fitted on the interrupter unit. |

Instructions

1. Fill the circuit breaker with nitrogen to atmospheric pressure.
2. Loosen the bolt (1) with the washer (2) and disassemble the lock washer (3).



3. Disassemble the joint pin (4) and the transmission rod eye bolt (5) from the circuit breaker pole operating lever (6).



4. Turn the operating lever (1) counter clockwise to the contacts' closed position.



NOTE!

Use the torque tool!

5. Fit the lifting devices from the top of the interrupter unit to the hoist or overhead crane.

Stretch the lifting device moderately.



DANGER!

Use lifting equipment dimensioned for the weight and suitable for the lifting to be performed. See the applicable outline drawing.



NOTE!

For composite insulators: place the lifting sling as close as possible to the end flange and not on the rubber surface.

6. Remove the bolts (2) between post insulator (3) and interrupter unit (4)

7. Remove the lock washer (5) and the pin (6).

**NOTE!**

Ensure that no lock rings or washers fall down in the post insulator when dismantling.

Cover the opening by e.g. a cloth rag.

8. Lift off the interrupter unit completely and place it vertically on a suitable surface, such as on two cross bars, to ensure it does not tip over.

**NOTE!**

If large amounts of moisture enter the post insulator, this must be immediately sealed and filled with nitrogen to be transported as soon as possible to the workshop for dismantling and careful cleaning.

9. Press the insulating pull-rod (7) down into the post insulator (3) so that the entire insulating pull-rod is below the edge.

10. Fit the protective cover A with the sealing ring above the post insulator (3).

The cover part number is specified in *Required Equipment*, page 147.

**NOTE!**

When the protective cover has been fitted, the nitrogen pressure in the post insulator is raised to 0.125 MPa (abs).

11. Push the puffer pull-rod into the interrupter unit (4).

12. Fit protective cover R with a sealing ring on the interrupter unit.

The cover part number is specified in *Required Equipment*, page 147.

13. The interrupter unit is now ready for transport.

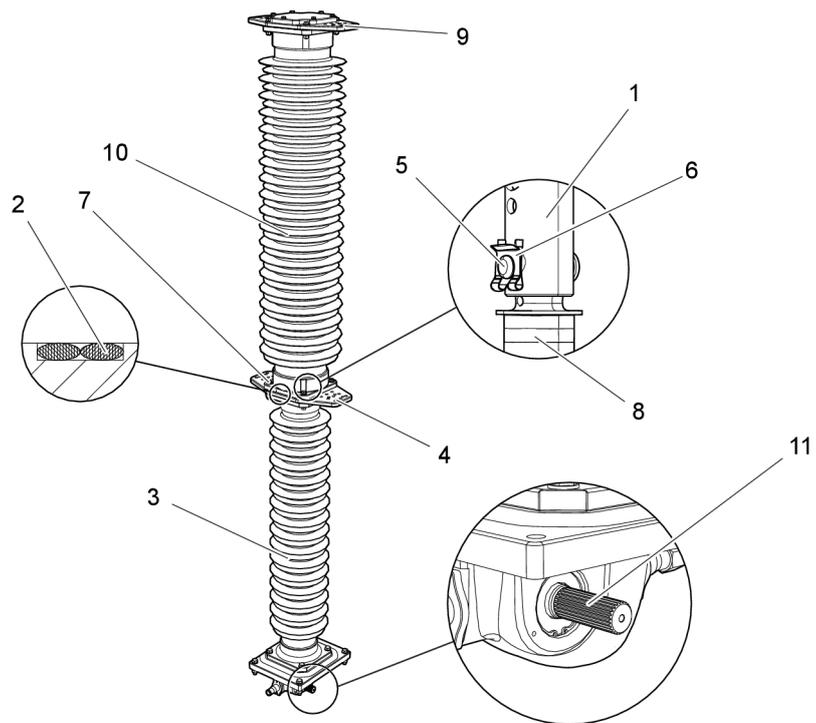
**NOTE!**

If the post insulator or interrupter unit is left in this condition for a long period without the unit being refitted, the post insulator, or interrupter unit, should be vacuum pumped and filled with nitrogen.

End of instruction

8.10.2 Assembly of the Interrupter Unit on Site Following an Overhaul

Circuit Breaker Pole



G014450

1. Puffer pull-rod
2. Sealing ring 169.6 x 5.6
3. Post Insulator
4. Lower adapter plate
5. Pin Ø12
6. Lock washer SL12
7. Bolt M12x80 (4 pcs), washer 13x28x3 (8 pcs), nut M12 (4 pcs)
8. Insulating pull-rod
9. Upper adapter plate
10. Interrupter Unit
11. Operating shaft

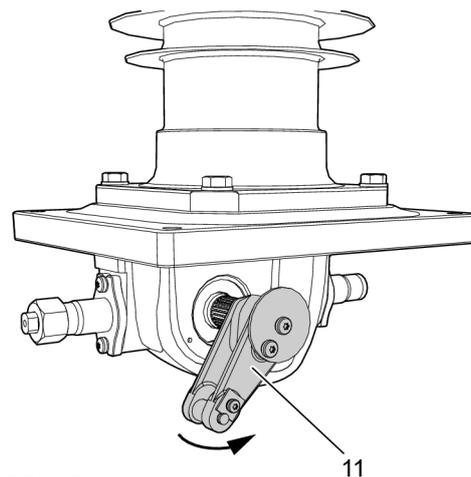
Required Equipment

| Equipment | Part number | Note |
|---------------------------|--------------|---|
| Lifting device and slings | - | |
| MK toolbox | 6880 768-7 | |
| Torque wrench | - | Torque range 45-79 Nm. |
| Torque tool | 1HSB426883-3 | |
| Control pin | - | Used to check the open position after assembly. |

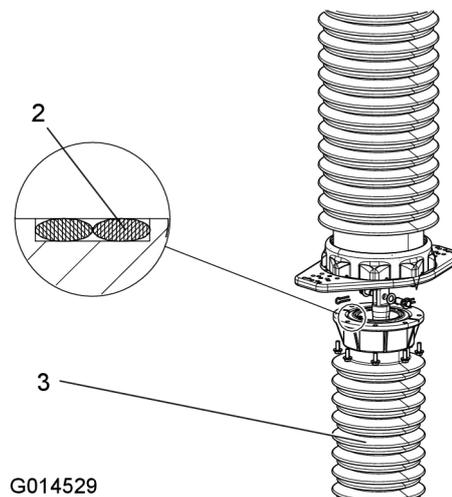
Instructions

-  **DANGER!** Use lifting equipment that is designed for the weight of the interrupter unit. See outline drawing for the exact weights.
- Suspend the interrupter unit in the lifting device and remove the protective cover.

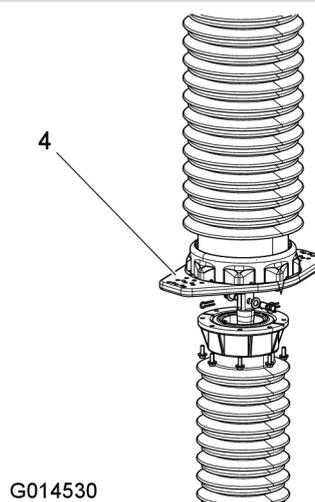
 **NOTE!** Place the lifting sling as close as possible to the end flange and not on the rubber surface.
- Pull down the puffer pull-rod (1) to its fully extended position so that it is accessible for assembly.
- Reduce the nitrogen pressure in the post insulator (3) to atmospheric pressure and remove the protective cover from the post insulator. The protective covers must be removed on all poles at the same time.
- Turn the operating lever (11) counter clockwise to its closed position to ensure that the interrupter unit can be fitted.



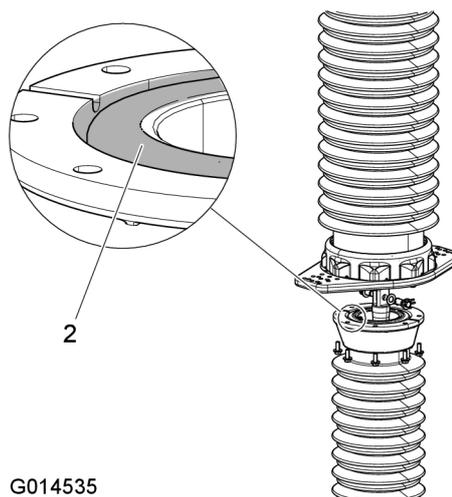
6. Clean the sealing surface for the sealing ring (2) on the post insulator (3) carefully.



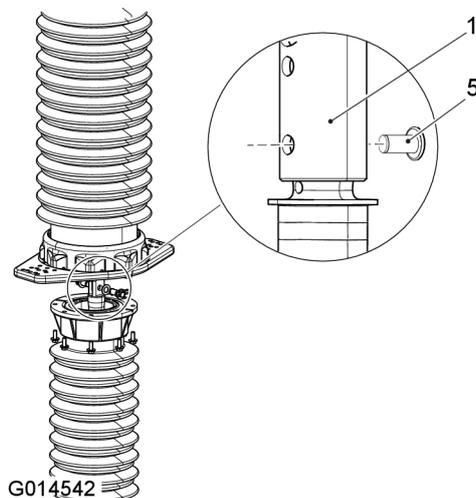
7. Also clean the lower flange and adapter plate (4) and lubricate generously with grease to ensure that the sealing ring is kept in place during assembly.



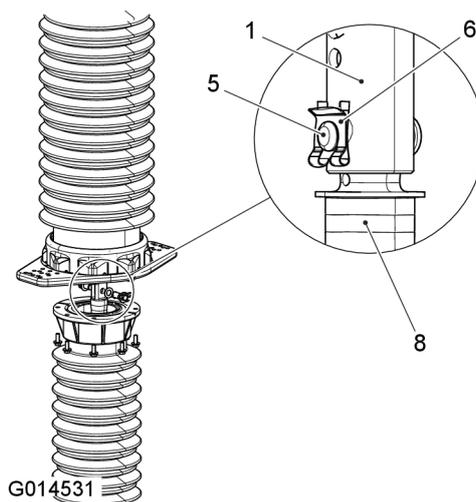
8. Place the sealing ring (2) in its groove.



9. Slowly lower the interrupter unit with the puffer pull-rod (1) so that it comes into position for fitting the pin (5).

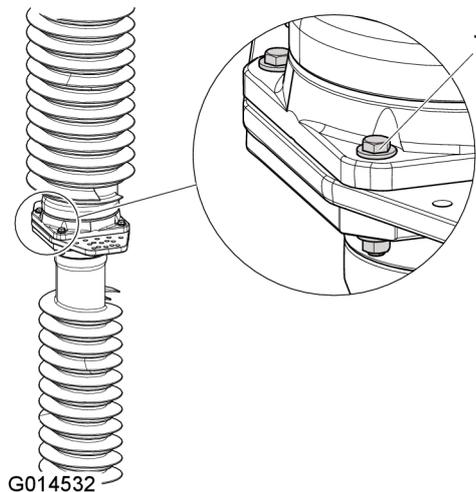


10. Connect the puffer's pull-rod (1) to the insulating pull-rod (8) with the pin (5) and lock using a lock washer (6).



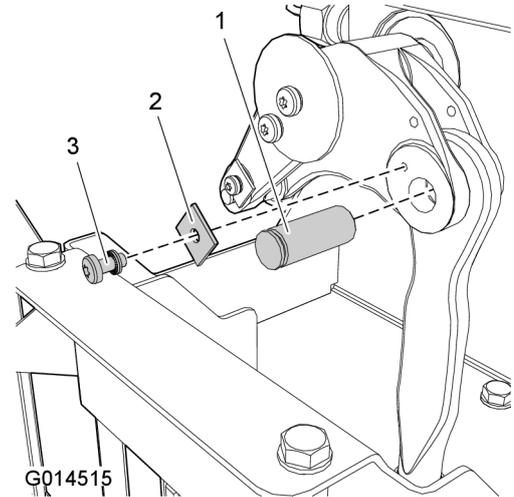
11. When the pin is fitted, lower the interrupter unit carefully towards the post insulator and centre.

12. Fit the interrupter unit, secure with bolts, washers and nuts (7) and torque tighten.

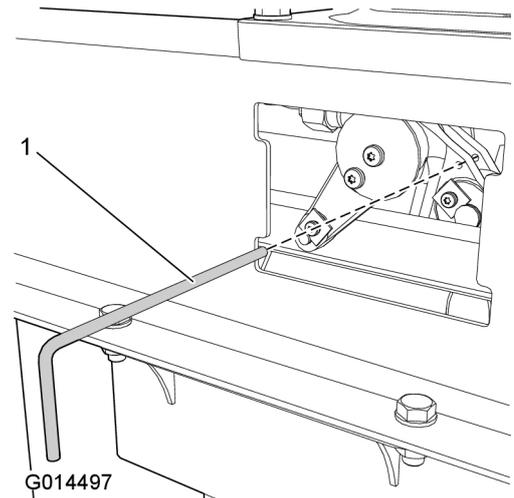


Torque
79 Nm

13. Attach the transmission rod eye bolt to the circuit breaker pole's operating lever with the pin (1) and a lock washer (2) and secure it with a bolt and washer (3).



14. Check the open position using a control pin (1). The control pin should pass through the hole in the outer lever and the hole on the mechanism housing.



15. Fill the circuit breaker pole with gas.
1. Vacuum pump down to a pressure of 100 Pa (abs) and let the vacuum pumping continue for at least one hour after this pressure has been reached.
 2. Stop the vacuum-pumping and fill the circuit breaker with dry and clean nitrogen to atmospheric pressure. Let it stand a couple of hours or overnight.
 3. Vacuum pump back down to a pressure of 100 Pa (abs) and fill with clean CO₂ gas to 0.125 MPa (abs)

**NOTE!**

The filling hoses should be stored to ensure that they are not exposed to moisture and contamination.

They must not be used for anything other than their intended purpose.

16. The circuit breaker is now ready for gas filling. See *Filling of Mixed Gas*, page 84.

End of instruction

8.11 Installation of Circuit Breaker Poles and Commissioning

General Information

Circuit breaker poles are installed and commissioned in accordance with the installation and commissioning instructions applicable to the circuit breaker. See sections *Installation*, page 43 and *Pre-Commissioning Checklist*, page 92.

Following assembly the operating values of the circuit breaker must be checked and recorded.

First Overhaul



CAUTION!

The circuit breaker must not be operated Open-Close without an intermediate delay of 300 ms.

Check Below

| Control Points | Measured values | Measured values | Measured values |
|--------------------------------------|-----------------|-----------------|-----------------|
| | Pole A | Pole B | Pole C |
| Closing time (close coil I) | ms | ms | ms |
| Closing time (close coil II) | ms | ms | ms |
| Opening time (trip coil I) | ms | ms | ms |
| Opening time (trip coil II) | ms | ms | ms |
| Close-Open time | ms | ms | ms |
| Lowest control voltage close coil I | V | V | V |
| Lowest control voltage close coil II | V | V | V |
| Lowest control voltage trip coil I | V | V | V |
| Lowest control voltage trip coil II | V | V | V |
| Main circuit resistance | $\mu\Omega$ | $\mu\Omega$ | $\mu\Omega$ |
| Filling pressure ⁽²⁾ | MPa (abs) | MPa (abs) | MPa (abs) |

⁽²⁾ Filling pressure is as specified on the rating plate.

Inspection conducted on (date): _____

Inspection conducted by (name): _____

Second Overhaul



CAUTION!

The circuit breaker must not be operated Open-Close without an intermediate delay of 300 ms.

Check Below

| Control Points | Measured values | Measured values | Measured values |
|--------------------------------------|-----------------|-----------------|-----------------|
| | Pole A | Pole B | Pole C |
| Closing time (close coil I) | ms | ms | ms |
| Closing time (close coil II) | ms | ms | ms |
| Opening time (trip coil I) | ms | ms | ms |
| Opening time (trip coil II) | ms | ms | ms |
| Close-Open time | ms | ms | ms |
| Lowest control voltage close coil I | V | V | V |
| Lowest control voltage close coil II | V | V | V |
| Lowest control voltage trip coil I | V | V | V |
| Lowest control voltage trip coil II | V | V | V |
| Main circuit resistance | $\mu\Omega$ | $\mu\Omega$ | $\mu\Omega$ |
| Filling pressure ⁽²⁾ | MPa (abs) | MPa (abs) | MPa (abs) |

⁽²⁾ Filling pressure is as specified on the rating plate.

Inspection conducted on (date): _____

Inspection conducted by (name): _____

9 Disposal and Environmental Information

9.1 Disposal and Recycling

General Information

ABB strives to minimize the product's impact on the environment throughout its entire life cycle. Technical and product development focuses on environmental aspects. The ecocycle approach is strived for and consideration is taken to the materials' environmental impact and recycling alternatives. The manufacturing processes are selected to be as safe to the environment as possible.

Disposing of Worn-Out Equipment

Worn-out equipment must be phased out in an environmentally sound manner.

When disposing of used equipment, much of the material, or energy content in the material, can be recycled following sorting and cleaning. The amount that is recycled varies depending on the technical resources and experience in each country. Non-recyclable components should be sent to an approved environmental waste treatment plant for destruction or disposal.

Electronics

Electronic equipment should be sent to an approved recycling company or sorted into different component materials for appropriate treatment.

Metals

Metals should be sorted according to type and surface treatment and sent to an approved recycling company. Following the removal of any paint or other surface treatment, clean metal can as a rule, be melted down and used in new products. Many metal components of iron, steel and aluminum are large and easy to identify, e.g. support structures and mechanism housings.

ABB strives to reduce the use of precious metals and the release of environmentally hazardous metals. Recycling of these is particularly important. Precious metals such as copper and silver are expensive and are only present in small amounts in the earth's crust. Copper is primarily used in current paths, puffers, contacts and cables. Silver plating of contacts may occur. Emissions from certain metals may cause damage. This applies to copper, but also zinc and nickel, which are used sparingly as surface treatments.

Plastics

The different types of plastic should be separated and sent to an approved environmental waste treatment plant or recycling company. The energy content in thermoplastics and thermosetting plastics can often be recovered through combustion at a plant designed for the purpose. Thermoplastics can as a rule, be melted down and reused without any major loss of quality. Composites can be fractioned and used as filling materials in other materials or be disposed of.

There are various amounts of composites in the insulators and piping. The cable entries are made of a thermosetting plastic. Thermoplastic is present in components such as guide rings, tape, bushings and support rings. Thermoplastic in sleeves, nozzles, piping and collars contains fluoride and is not suitable for recycling. However, it can be disposed of without the risk of leaking hazardous substances.

Oils and Greases

Before disposal, oil, grease and similar products must be removed and sent to an approved environmental waste treatment plant or recycling company. By utilizing gravimetric forces, oil waste can be separated into oil, water and a range of contaminants. In many cases, the oil can then be reused. Alternatively, the energy content in oil can be recovered through combustion at a plant designed for the purpose.

Oil occurs in dampers where grease is used as a lubricant.

Rubber

Rubber can be sent to an approved environmental waste treatment plant, either for disposal or reused for various purposes.

Rubber is present in various seals.

Other Materials

Other materials are sorted and sent to an approved environmental waste treatment plant.

10 Spare Parts

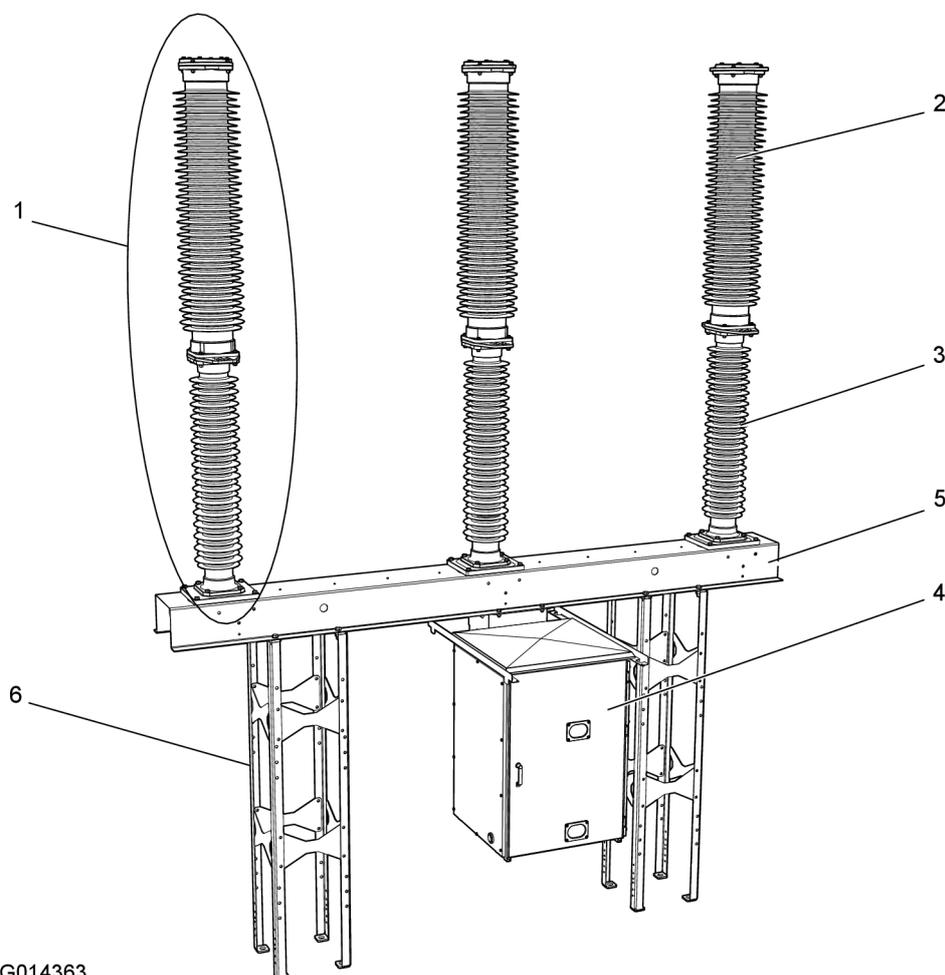
10.1 Introduction

General Information

The replacement modules for the operating mechanism are delivered complete and tested.

Spare parts recommended for stock are marked with R. For more than ten circuit breakers in service, the spare parts marked with RR are also recommended. Parts with RRR can be kept in stock in order to facilitate quick replacement and to avoid long downtime.

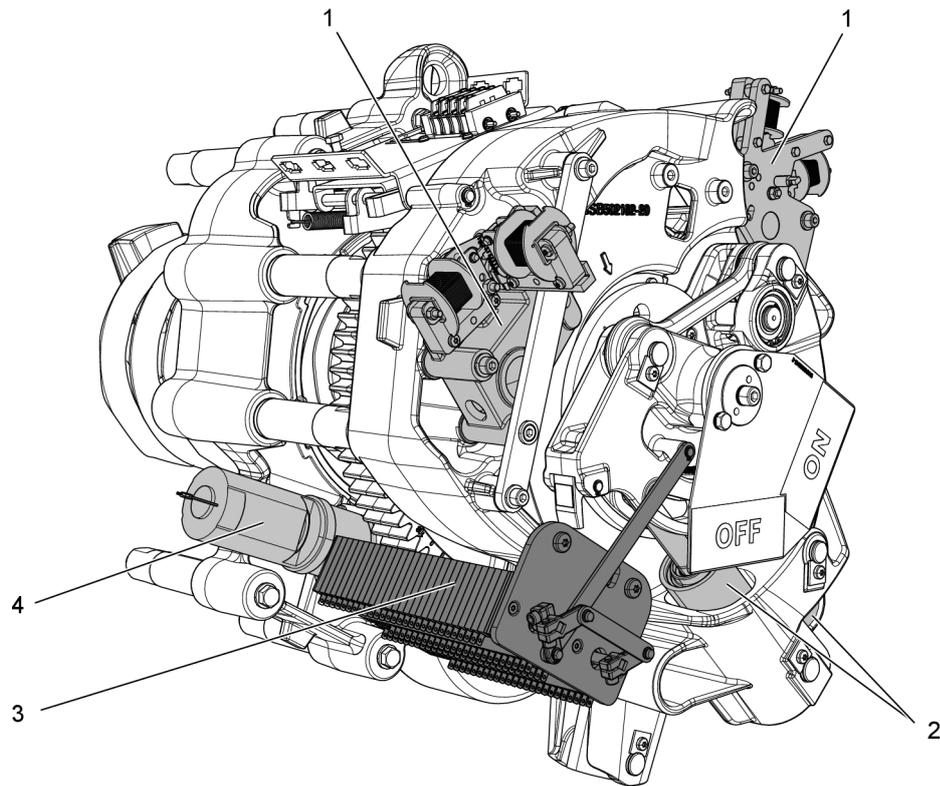
Summary, Circuit Breaker



G014363

1. Circuit breaker pole, RRR
2. Interrupter Unit
3. Post insulator unit, RRR
4. Operating mechanism, RRR
5. Pole beam
6. Support structure

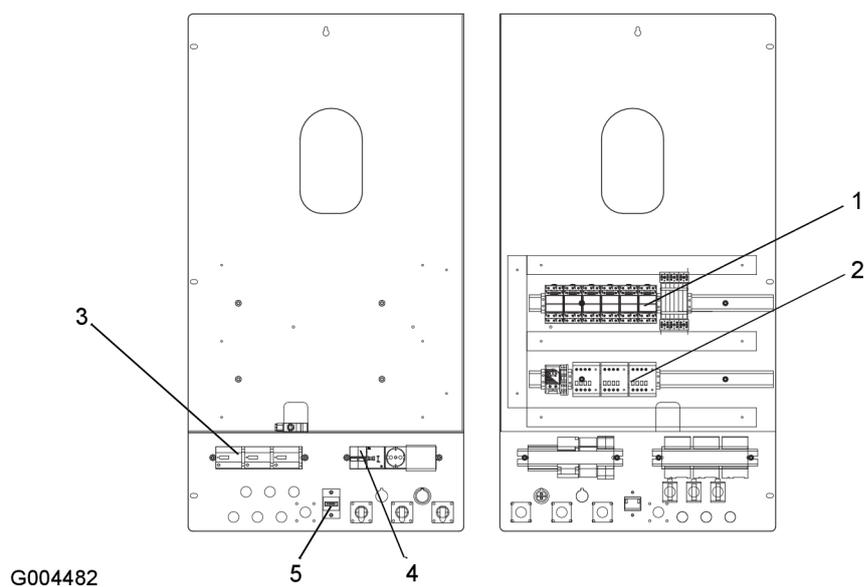
Summary, Operating Mechanism



G008859

- | | |
|---|---|
| 1 | Latch device/R |
| 2 | Damper/R |
| 3 | Auxiliary contact/RR |
| 4 | Motor/R |
| - | Heating element (not visible in illustration) / R |

Overview, Electrical Equipment

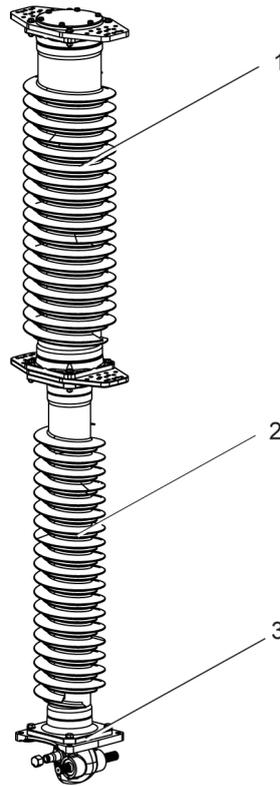


1. Relay / R
2. Motor contactor / R
3. Protective motor switch / R
4. Miniature circuit breaker, heater (MCB) / R
5. Counter / R

10.2 Circuit Breaker Pole

10.2.1 Circuit Breaker Pole

Overview



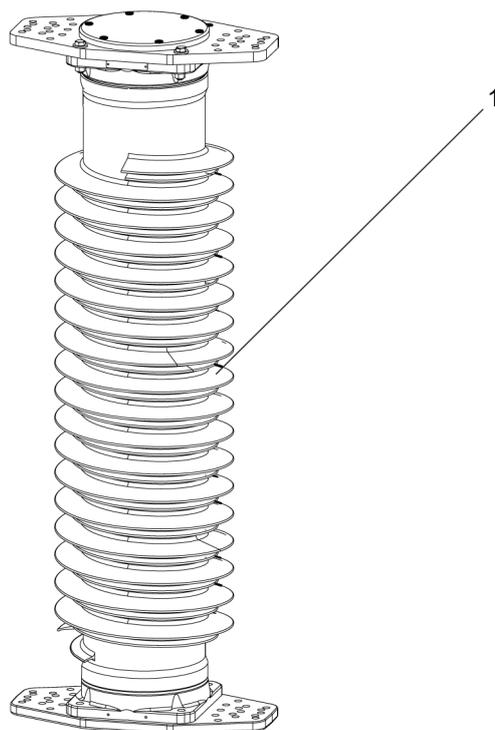
G003685

Component Parts

| Item | Designation | Note |
|------|-------------------------------|------|
| 1 | Interrupter Unit | |
| 2 | Post Insulator | |
| 3 | Mechanism | |
| - | Complete circuit breaker pole | |

10.2.2 Interrupter Unit

Illustration



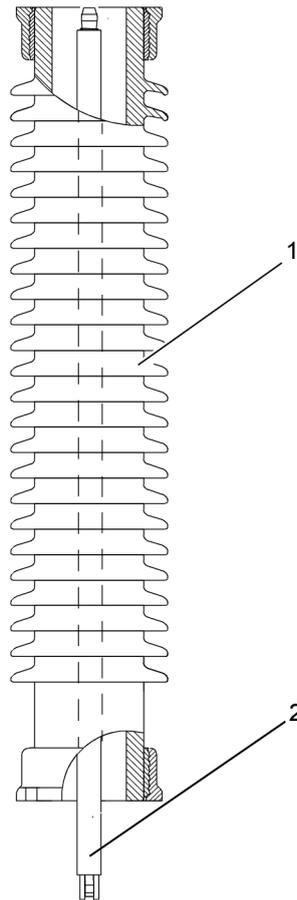
G003783

Component Parts

| Item | Designation | Note |
|------|---------------------------|------|
| 1 | Complete interrupter unit | |

10.2.3 Post Insulator and Insulating Pull-Rod

Structure



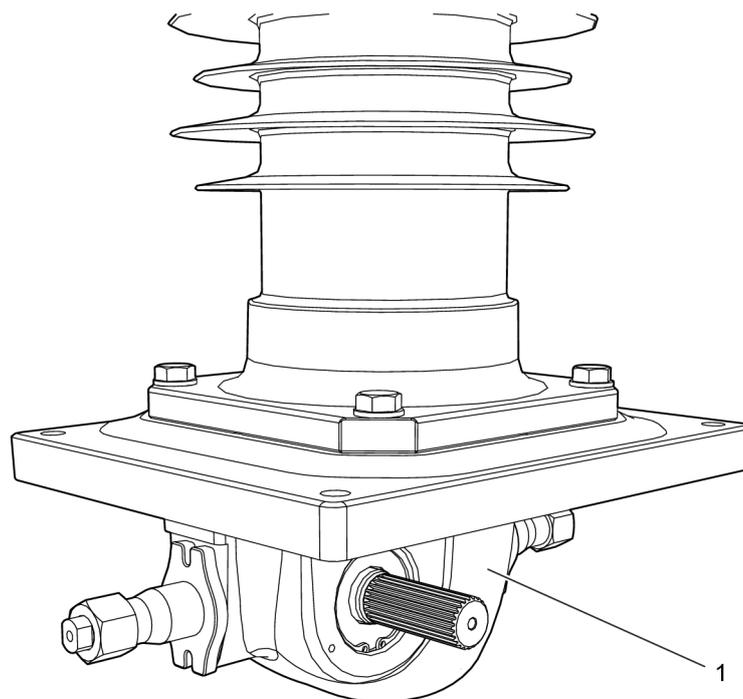
G002971

Component Parts

| Item | Designation | Note |
|------|---------------------|------|
| 1 | Post Insulator | |
| 2 | Insulating pull-rod | |

10.2.4 Mechanism

Illustration



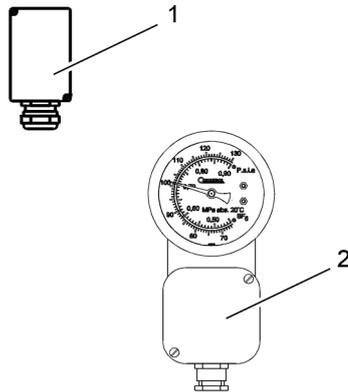
G014453

Component Parts

| Item | Designation | Note |
|------|-------------|------|
| 1 | Mechanism | |

10.2.5 Accessories

Density Monitor



G003211

| Item | Designation | Note |
|------|--|------|
| 1 | Density monitor (temperature compensated reference volume) | |
| 2 | Density monitor (temperature compensated bimetal) | |

Gasket Set

Gasket set for full circuit breaker.

| Designation | Part number | Note |
|-------------|-------------|------|
| Gasket set | | |

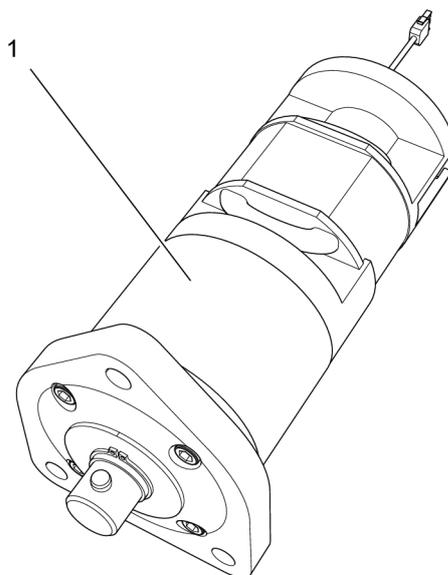
Protective Cover

| Designation | Part number | Note |
|---------------------------------------|-------------|------|
| Protective cover for interrupter unit | 5237 736-R | |
| Protective cover for post insulator | 5439 142-A | |

10.3 Operating Mechanism

10.3.1 Motor and Gearbox

Component Parts

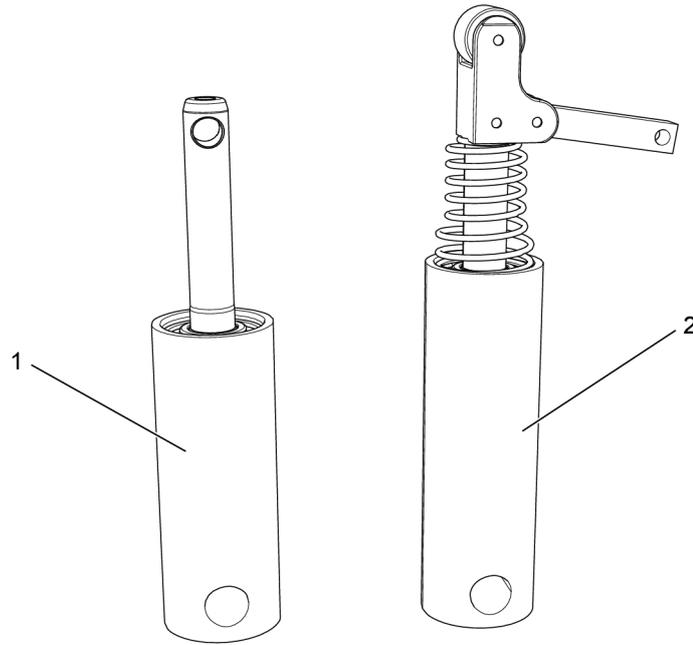


G004463

| Item | Designation | Part number |
|------|------------------------------|-------------|
| 1 | Motor, type 220 -250 V AC/DC | |
| 1 | Motor, type 110 -127 V AC/DC | |

10.3.2 Damper

Damper

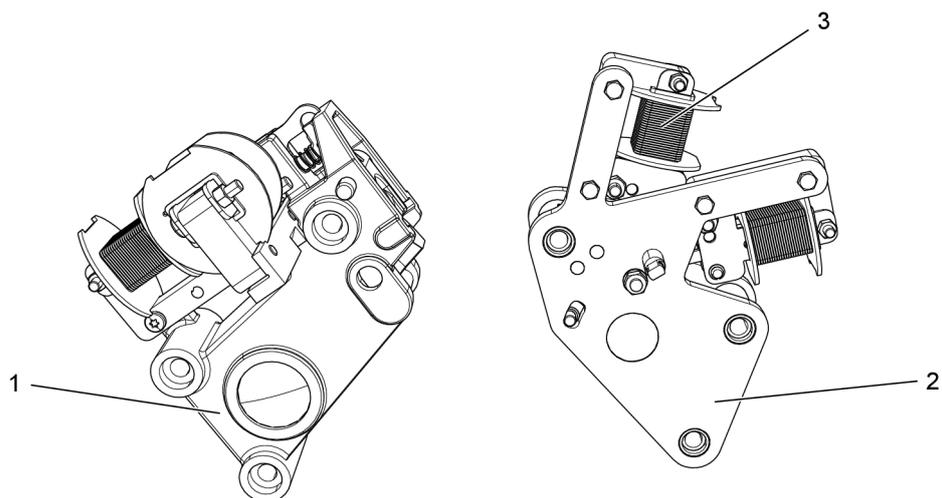


G008795

| Item | Designation | Part number |
|------|----------------|---------------|
| 1 | Opening damper | 1HSB505256-H |
| 2 | Close damper | 1HSB505256-AA |

10.3.3 Latch Device

Component Parts

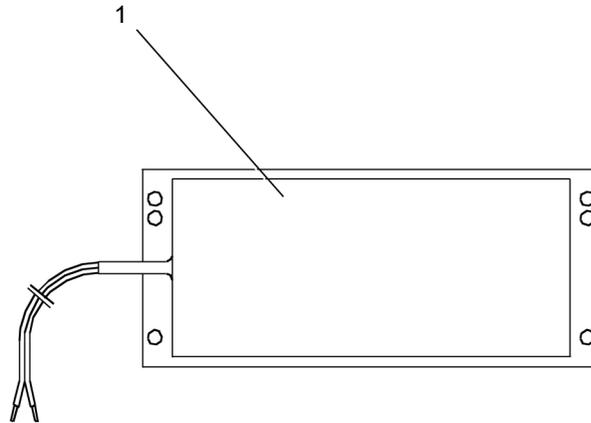


G008794

| Item | Designation | Part number |
|------|--|---|
| 1 | Trip latch device | State the serial number of the circuit breaker when ordering. |
| 2 | Closing latch device | State the serial number of the circuit breaker when ordering. |
| 3 | Closing latch device with additional coil (option) | State the serial number of the circuit breaker when ordering. |

10.3.4 Heating Element

Component Parts

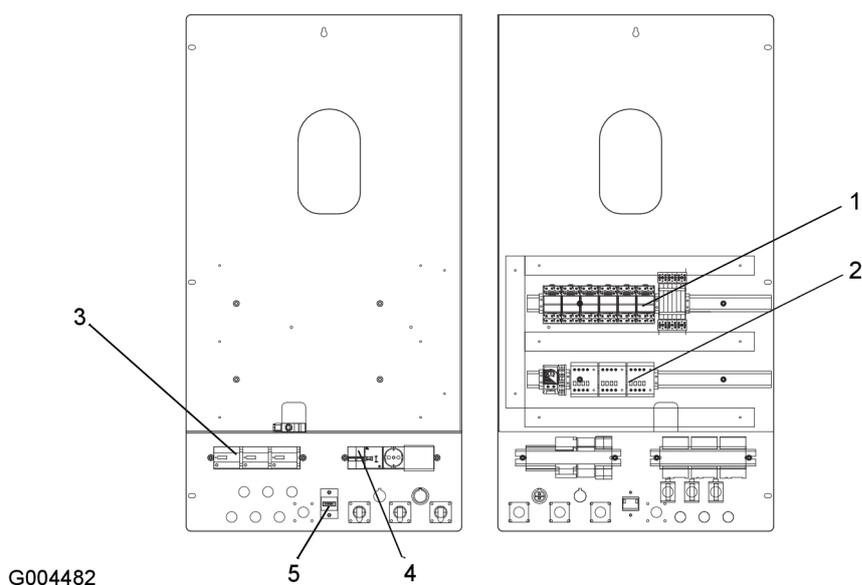


G003167

| Item | Designation | Part number |
|------|------------------|-------------|
| 1 | 110-127 V, 70 W | 5291 805-1 |
| | 220-254 V, 70 W | 5291 805-2 |
| | 110-127 V, 140 W | 5291 805-3 |
| | 220-254 V, 140W | 5291 805-4 |

10.3.5 Electrical Equipment

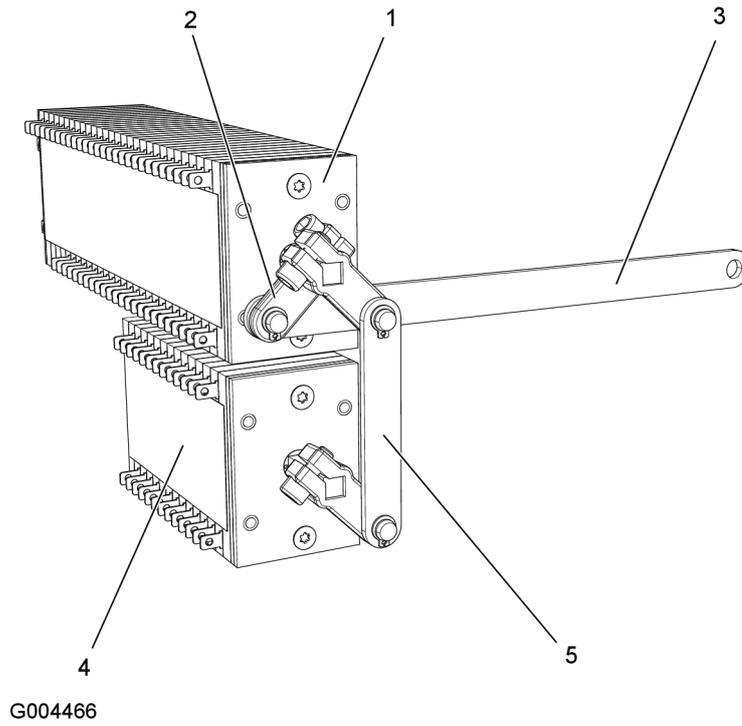
Component Parts



| Item | Designation | Part number |
|------|--|-------------|
| 1 | Relay: | |
| | 250 V DC | 5619 758-7 |
| | 220 V DC | 5619 758-1 |
| | 125 V DC | 5619 758-8 |
| | 110 V DC | 5619 758-2 |
| | 60-72 V DC | 5619 758-3 |
| | 42-48 V DC | 5619 758-4 |
| 2 | Motor contactors: | |
| | 220-250 V DC | 5351 749-1 |
| | 110-125 V DC | 5351 749-2 |
| | 220-250 V 50/60 Hz AC | 5351 749-3 |
| | 110-130 V 50/60 Hz AC | 5351 749-4 |
| 3 | Protective motor switch: | |
| | 110-250 V DC | 55760760-1 |
| 4 | Miniature circuit breaker, heater (MCB): | 5344 027-38 |
| 5 | Counter: | |
| | 220-250 V DC | 5692 965-11 |
| | 110-125 V DC | 5692 965-12 |
| | 42-48 V DC | 5692 965-13 |

10.3.6 Auxiliary Contact

Component Parts



| Item | Designation | Part number |
|------|---|---------------------------------|
| 1 | Auxiliary Contact | Refer to the delivery document. |
| 2 | Lever | |
| 3 | Linkage | |
| 4 | Additional auxiliary contact (option) | Refer to the delivery document. |
| 5 | Linkage for additional auxiliary contact (option) | |

Non Conformance Report

ABB AB, High Voltage Circuit Breakers

| | | | |
|---|--|-------------------------------|--|
| Name | | Phone | |
| E-mail | | | |
| Reporting company | | Date | |
| SEABB OrderNo | | | |
| Serial No Breaker | | Serial No Operating device | |
| Type of Breaker | | | |
| End customer | | | |
| Site | | Country | |
| Delivery address (incl. postal code) for spares | | | |
| Contact person (name and phone) | | | |

Type of Operating Mechanism:

| | | | | | | | | | | | |
|--------------------------|---------|--------------------------|-----------|--------------------------|-----|--------------------------|----|--------------------------|-----|--------------------------|--------|
| <input type="checkbox"/> | BLK 222 | <input type="checkbox"/> | BLG 1002A | <input type="checkbox"/> | FSA | <input type="checkbox"/> | MD | <input type="checkbox"/> | MSD | <input type="checkbox"/> | SM 800 |
|--------------------------|---------|--------------------------|-----------|--------------------------|-----|--------------------------|----|--------------------------|-----|--------------------------|--------|

Circuit breaker type:

| | | | | | | | |
|--------------------------|-------|--------------------------|-------|--------------------------|-------|--------------------------|-----|
| <input type="checkbox"/> | LTB D | <input type="checkbox"/> | LTB E | <input type="checkbox"/> | LTA D | <input type="checkbox"/> | HPL |
|--------------------------|-------|--------------------------|-------|--------------------------|-------|--------------------------|-----|

Disconnecter/option:

| | | | | | | | | | |
|--------------------------|-----|--------------------------|-----|--------------------------|-------|--------------------------|------------|--------------------------|-------|
| <input type="checkbox"/> | WCB | <input type="checkbox"/> | DCB | <input type="checkbox"/> | Truck | <input type="checkbox"/> | Spareparts | <input type="checkbox"/> | Other |
|--------------------------|-----|--------------------------|-----|--------------------------|-------|--------------------------|------------|--------------------------|-------|

Specification of problem:

| | | | | | | | |
|--------------------------|-----------------------|--------------------------|---------------------|--------------------------|-----------------------|--------------------------|--------------------|
| <input type="checkbox"/> | Delayed delivery | <input type="checkbox"/> | Incomplete delivery | <input type="checkbox"/> | Wrong delivery | <input type="checkbox"/> | Torque |
| <input type="checkbox"/> | Documentation | <input type="checkbox"/> | Poor packing | <input type="checkbox"/> | Corrosion | <input type="checkbox"/> | Wiring |
| <input type="checkbox"/> | Not according to spec | <input type="checkbox"/> | Transport damage | <input type="checkbox"/> | Functional values | <input type="checkbox"/> | Mechanical failure |
| <input type="checkbox"/> | Quality of material | <input type="checkbox"/> | Storage of material | <input type="checkbox"/> | Leakage gas/oil/water | | |
| <input type="checkbox"/> | Other | | | | | | |

Who discovered the problem:

| | | | | | |
|--------------------------|--------------|--------------------------|--------------------|--------------------------|-------|
| <input type="checkbox"/> | End customer | <input type="checkbox"/> | ABB representative | <input type="checkbox"/> | Other |
|--------------------------|--------------|--------------------------|--------------------|--------------------------|-------|

When was the problem discovered

| | | | | | | | |
|--------------------------|---------------------|--------------------------|---------------------|--------------------------|----------------------|--------------------------|------------------|
| <input type="checkbox"/> | Before Installation | <input type="checkbox"/> | During Installation | <input type="checkbox"/> | During Commissioning | <input type="checkbox"/> | After Energizing |
|--------------------------|---------------------|--------------------------|---------------------|--------------------------|----------------------|--------------------------|------------------|

Description of problem:

Contact information:

| | | |
|---|--|----------------------------|
| ABB AB CustomerComplaints SE-771 80 Ludvika, Sweden | Telephone: +46(0) 240 782000 Telefax: +46(0) 240 782320 bqc.customercomplaints@se.abb.com | Click here to send! |
|---|--|----------------------------|



ABB Power Grids Sweden AB

SE-771 80 Ludvika

Sweden

new.abb.com/high-voltage