

Operating Instructions No. 188 B (EN)

Device: **SF₆ Circuit Breaker**
 GL 311 F1/4031/VR (S 188/189)
 GL 312 F1/4031/VR (S 188/189)

Manufacturer: **AREVA Energietechnik GmbH**
 High Voltage Products
 Lilienthalstr. 150
 34123 Kassel
 Germany

Preliminary Remarks

1. The operating instructions consist of two parts:
Part A: Erection and Commissioning
Part B: Inspection, Maintenance, and Reconditioning
2. It is not possible to include in the operating instructions every possible eventuality that might occur when using technical equipment. Please contact your authorized AREVA representative if a situation arises that is not covered in detail by this manual.
3. Type GL circuit breakers have been specifically developed to be low-maintenance and to allow for long maintenance intervals. Experience has shown that the operational reliability of the equipment is guaranteed by proper servicing and by following the instructions given in this manual.
4. This document and the equipment described herein are subject to change without notice in the interest of further development.
5. No claims may be derived from the specifications, figures, or descriptions.
6. No part of this document may be duplicated in any way or passed on to a third party without the written consent of AREVA Energietechnik GmbH.

Table of Contents

| | |
|-------|---|
| 1 | Safety Instructions |
| 1.1 | General Safety Requirements |
| 1.2 | Special Safety Requirements |
| 1.3 | Handling SF ₆ Gas |
| 1.4 | Transport and Handling at the Erection Site |
| 2 | Introduction |
| 2.1 | General Information |
| 2.2 | Schedule |
| 2.3 | Ordering Accessories and Replacement Parts |
| 3 | Inspection Procedures |
| 3.1 | Safety Precautions |
| 3.2 | Visual Inspection |
| 3.3 | Checking for Corrosion |
| 3.4 | Checking Ventilation Ports and Vents |
| 3.5 | Checking the Anti-Condensation Heating System |
| 3.6 | Checking the SF ₆ Pressure. |
| 4 | Maintenance Procedures |
| 4.1 | Safety Precautions |
| 4.2 | Checking the Cable Joints |
| 4.3 | Checking the Connecting Linkage |
| 4.4 | Functional Check of the Electric Control Circuits |
| 4.5 | Checking the Gas Quality |
| 4.6 | Measuring the Resistance of the Main Current Path |
| 4.7 | Checking Threaded Assemblies |
| 5 | Circuit Breaker Reconditioning Procedures |
| 5.1 | Safety Precautions |
| 5.2 | Materials and Equipment to Be Provided by Station |
| 5.2.1 | Tools and Hoisting Equipment |
| 5.2.2 | Testing and Measuring Equipment |
| 5.2.3 | Indirect Materials and Factory Supplies |
| 5.2.4 | Replacement Parts |
| 5.3 | Purpose of Lubricating Greases |
| 5.4 | Replacing the Arcing Contacts |
| 5.4.1 | Detaching an Interrupter Chamber from the Support Porcelain |
| 5.4.2 | Disassembly of the Double Motion System |
| 5.4.3 | Reconditioning the Base |
| 5.4.4 | Reinstalling the Double Motion System |

- 5.4.5 Adjusting the Interrupter Chamber
- 5.4.6 Remounting the Interrupter Chamber on the Support Porcelain
- 5.4.7 Replacing the Adsorption Filter and Final Operations
- 5.5 Disassembly of Support Porcelain and Crankcase
 - 5.5.1 Requirements
 - 5.5.2 Procedure
- 6 Mechanism Reconditioning Procedures
 - 6.1 Replacing the Motor
 - 6.2 Replacing the Heating Unit
 - 6.3 Replacing the Motor Limit Switch and/or the Auxiliary Switch
 - 6.4 Replacing the Operations Counter
 - 6.5 Replacing the Closing and Opening Coils
 - 6.6 Lubricating the Mechanism
- 7 Using the Slow Operation Device
 - 7.1 Safety Instructions
 - 7.2 Principle of Operation of Spring Operating Mechanisms FK 3-1 and FK 3-2
 - 7.3 Procedure
 - 7.3.1 Manually Charging the Closing Spring
 - 7.3.2 Slow Closing Operation
 - 7.3.3 Slow Opening Operation

List of Figures

- Figure B 2.2: Permissible number of CO operations (n) before replacement of arcing contacts as a function of breaking current (I/kA)
- Figure B 4.7: Different tightening torques for threaded assemblies
- Figure B 5.4.1 a: Detaching an interrupter chamber from the support porcelain
- Figure B 5.4.1 b: Removing the coupling pin
- Figure B 5.4.1 c: Securing the interrupter chamber for disassembly
- Figure B 5.4.2 a: Lifting out the double motion system
- Figure B 5.4.2 b: Disconnecting the double motion unit
- Figure B 5.4.2 c: Disassembling the double motion unit
- Figure B 5.4.2 d: Disassembling the double motion system
- Figure B 5.4.3: Reconditioning the base
- Figure B 5.4.4: Installing the double motion system
- Figure B 5.4.5: Adjusting the interrupter unit
- Figure B 5.4.6: Remounting the interrupter chamber on the support porcelain
- Figure B 5.5.2: Crankcase
- Figure B 6.1: Motor
- Figure B 6.2: Heating unit
- Figure B 6.3: Connections to the motor limit switch and auxiliary switch
- Figure B 6.4: Operations counter
- Figure B 6.5: Coils
- Figure B 7.2: Principle of operation of FK 3-1 and FK 3-2
- Figure B 7.3.1: Charging the closing spring manually
- Figure B 7.3.2 a: Removing the side panel from the mechanism.
- Figure B 7.3.2 b: Manual lever
- Figure B 7.3.2 c: Blocking device
- Figure B 7.3.2 d: Slow operation device

1 Safety Instructions

1.1 General Safety Requirements

The circuit breaker operator must make sure

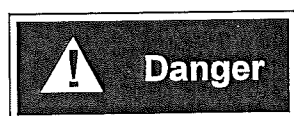
- that erection, commissioning, and reconditioning of the equipment described in these operating instructions are carried out only by a properly trained and qualified electrical technician or that the equipment is erected, commissioned, and reconditioned under the direction and supervision of a properly trained electrical technician in compliance with electrical codes and regulations;
- that both the circuit breaker and all adjacent active parts are de-energized before any work is begun and that the de-energized state is maintained until work is completed;
- that all installation, operating, and maintenance personnel are familiar with these operating instructions, including all safety instructions and warnings, with all safety regulations applicable locally, and with instructions regarding action to be taken in the event of accidents, and that they can consult these documents at any time.

The assigned personnel must keep in mind

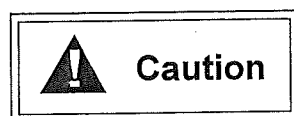
- that the specified maintenance intervals and instructions for reconditioning and part replacement must be followed,
- that certain parts of the circuit breaker will carry hazardous voltage levels and be under gas pressure during operation,
- that linkages and levers may suddenly move abruptly and unpredictably as the result of external control operations.

1.2 Special Safety Requirements

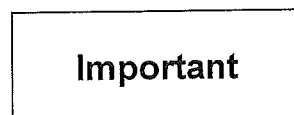
Special safety requirements are incorporated in the text of this manual and are specifically identified as follows:



Immediate danger that could potentially lead to death or serious injury.



Dangerous situation that could potentially lead to minor injuries or damage to the product or to something nearby.

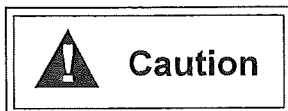


Useful tips and information

1.3 Handling SF₆ Gas

Sulfur hexafluoride (SF₆) is a colorless, odorless gas. Pure SF₆, in compliance with IEC 376, is not toxic. It is not a hazardous substance and is therefore not subject to regulations governing hazardous materials.

The applicable toxicity standard internationally is IEC 1634.



When SF₆ is used in high voltage switchgear, decomposition products of varying toxicity are formed as the result of electrical discharge and arcs.

These products can irritate mucous membranes, the respiratory tract, and other unprotected skin surfaces.

Personnel must therefore observe the following protective measures at all times when working on open switchgear:

- ⇒ Eating, drinking, smoking, and the storage of food are absolutely prohibited in rooms containing SF₆ systems. This applies particularly to maintenance work, when gas compartments are open.
- ⇒ Do not touch parts in the vicinity of the insulating gas without proper protective clothing and/or equipment.
- ⇒ Do not stir up the powdery decomposition products.
- ⇒ Make sure the room is well ventilated when working on indoor breakers.
- ⇒ Use only the minimum number of personnel absolutely necessary for performing the work.
- ⇒ Wash the entire body thoroughly after work.

Personnel must be equipped with the following items when doing any work involving used or contaminated SF₆ gas:

- ⇒ Appropriate protective respiratory equipment such as a full-face respirator (gas mask) or a respirator plus gas-tight safety glasses per DIN EN 175
- ⇒ Dust-tight protective suit made of nonwoven material (disposable coveralls)
- ⇒ Rubber or disposable gloves
- ⇒ Rubber or disposable boots

After work is completed, clean the respirator, safety glasses, rubber boots, and rubber gloves with water. Collect the water. Dispose of water and protective coveralls.

1.4 Transport and Handling at the Erection Site

Important

All pressure specifications are given in relative values.



Caution

Pole columns are shipped at a gas gauge pressure of approximately 0.05 MPa (0.5 bar).

If handled improperly, the support porcelains may burst and cause damage to persons and property.

⇒ To minimize the consequences of porcelain breakage, never move the pole columns if the pressure exceeds the shipping pressure.

Applicable safety regulations and the safety instructions given in Section 1 of this manual must be followed during all transport and handling operations.

The circuit breaker operator shall be responsible for compliance with safety requirements.

2 Introduction

2.1 General Information

Maintenance and reconditioning efforts focus on several parts that are subject to wear and aging.

The decisive influencing factors are the following:

- number of short-circuit operations,
- operating frequency,
- operating time (hours of operation).

The AREVA maintenance concept takes these influencing factors into account by staggering the inspection, maintenance, and reconditioning intervals.

Maintenance and reconditioning should be carried out in accordance with the following guidelines.

Important

In the case of service under extreme conditions, i.e.,

- continuously high ambient temperatures,
- presence of abrasive dust or grit,
- heavy dust accumulation,
- continuously high humidity,
- presence of aggressive gases or vapors,

it is recommended that the inspection and maintenance intervals be shortened.

Spring operating mechanisms are maintenance-free under normal operating conditions due to the use of long-lasting lubricants and self-lubricating bearings.

2.2 Schedule

| | |
|----------------|---|
| Inspection | On an occasional basis during station inspections, after 6 years at the latest. |
| Maintenance | After 12 and 24 years. |
| Reconditioning | After 2,500 operations at rated normal current or after a total current as shown in Figure B 2.2. |



Caution

Under certain operating conditions, such as switching of shunt reactors and capacitor banks (especially back-to-back conditions), maintenance procedures will be necessary after a lower numbers of operations.

Maintenance and reconditioning may only be performed by trained technicians.

Important

⇒ The time intervals given above are based on empirical values determined over many years of field experience. Regionally applicable standards and regulations may specify shorter intervals.

Training courses are held on a regular basis at the manufacturing plant. If necessary, one of our technicians can be requested at any time.

Arcing contacts must be replaced when a certain total current has been reached (r.m.s. value of the short-circuit breaking current). Figure B 2.2 shows the relationship between the number of operations under normal operating conditions and the breaking current.

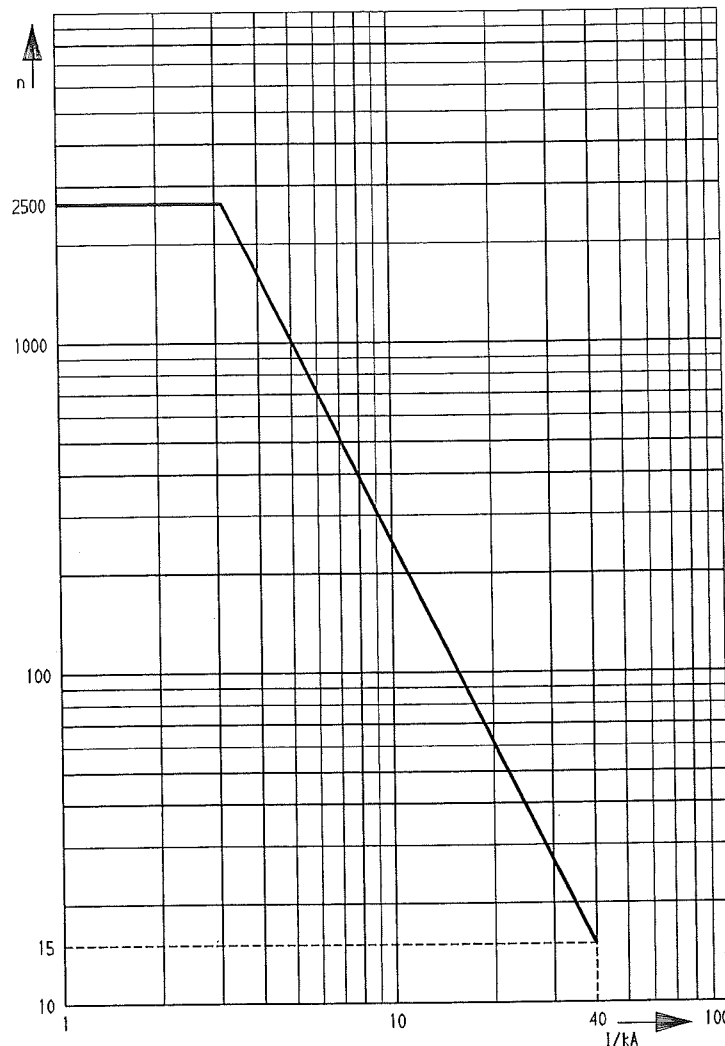


Figure B 2.2: Permissible number of CO operations (n) before replacement of arcing contacts as a function of breaking current (I/kA)

2.3 Ordering Accessories and Replacement Parts

- The following data is required for an order:
- Breaker type designation ► see nameplate
- Breaker serial number ► see nameplate
- Operation instructions number ► see cover
- Part number (see figures) or order number
- Part name or description
- Quantity

3 Inspection Procedures

3.1 Safety Precautions



Follow all regional and operator-specified safety precautions.

3.2 Visual Inspection

- Check the circuit breaker carefully for any damage.
Check the porcelains, in particular.

3.3 Checking for Corrosion

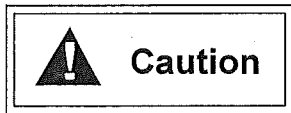
- Check all metallic parts and piping for corrosion and take steps to prevent corrosion, if necessary.

3.4 Checking Ventilation Ports and Vents

- Check ventilation ports and vents in the mechanism housing for any blockage and clear them, if necessary.

3.5 Checking the Anti-Condensation Heating System

- Check the mechanism's anti-condensation heating system (Part A, Figure A 2.3.2 b) for proper operation.



The anti-condensation heating unit is hot during operation.
It can burn skin or clothing.

Therefore:

⇒ Do not touch the heating unit directly.

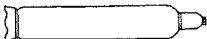

3.6 Checking the SF₆ Pressure.

Check the SF₆ pressure indication on the density monitor. The indicator must be in the green area of the scale. If the density monitor indicator is in the yellow or red area, fill up the breaker with SF₆.



The procedure for filling the circuit breaker with SF₆ is described in detail in Part A, Section 6.2.2.

Required supplies, measuring instruments, and maintenance equipment:

| Description | Illustration | Order No. |
|---|--|--------------------|
| SF ₆ gas 10 kg net / 27 kg gross 40 kg net / 110 kg gross (See required minimum quantities in Part A of the operating instructions, quality per IEC 376) |  | 1264374 1275703 |
| SF ₆ leak detector Type HI 300 Battery |  | 1274369 1001903 |
| SF ₆ service unit | | |

4 Maintenance Procedures

4.1 Safety Precautions



Follow all regional and operator-specified safety precautions.

In addition, observe the following instructions:

- Isolate the breaker.
- Closing spring position indicator must show "spring discharged."
- Ground the breaker at both ends as specified in DIN VDE 0105, Part 1.

Disconnect the supply and motor voltages. (Voltages are required for the procedures described in 4.4 and 4.5.)

4.2 Checking the Cable Joints

- Check to make sure all cable joints in the mechanism housing are tight.

4.3 Checking the Connecting Linkage

- Check all the fastening and locking elements (pins, nuts, screws, and bolts) on the connecting linkage.

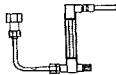
4.4 Functional Check of the Electric Control Circuits

- Carry out test operations as described in Part A, Section 6.3.1 and 6.3.4 to 6.3.6.

4.5 Checking the Gas Quality

- Check the gas quality for moisture content, SF₆ content, and acidity.

Required measuring instruments and maintenance equipment:

| Description | Illustration | Order No. |
|--|---|-----------|
| Dew point hygrometer | | 1003433 |
| SF ₆ analyzer Type AW |  | 1965464 |
| Acidity detector tube (10 each) | | 1000629 |
| SF ₆ content measuring instrument | | 1003654 |

Important

Dew point: ≤ -10 °C at rated pressure

SF₆ content: > 98 %

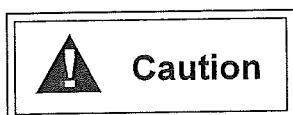
Acidity: ≤ 10 ppm

4.6 Measuring the Resistance of the Main Current Path

- Measure resistances directly at the terminals of the high voltage terminal pads. Reference values are given in the routine test certificate.

4.7 Checking Threaded Assemblies

- Check to make sure all accessible threaded assemblies (screwed joints) are tight. The respective tightening torques are given in the following table.



Note the exceptions to the tightening torques as shown in Figure B 4.7.

| Grade | 8.8 | | A2-70 | |
|-------|-----|------|-------|------|
| | Nm | ftlb | Nm | ftlb |
| M6 | 10 | 7 | 10 | 7 |
| M8 | 25 | 18 | 25 | 18 |
| M10 | 49 | 36 | 49 | 36 |
| M12 | 86 | 63 | 83 | 61 |
| M16 | 210 | 155 | 202 | 149 |
| M20 | 410 | 303 | 394 | 291 |
| M24 | 710 | 525 | 377 | 278 |

Important

Bolt threads are greased with the lubricant Molykote BR 2 plus.

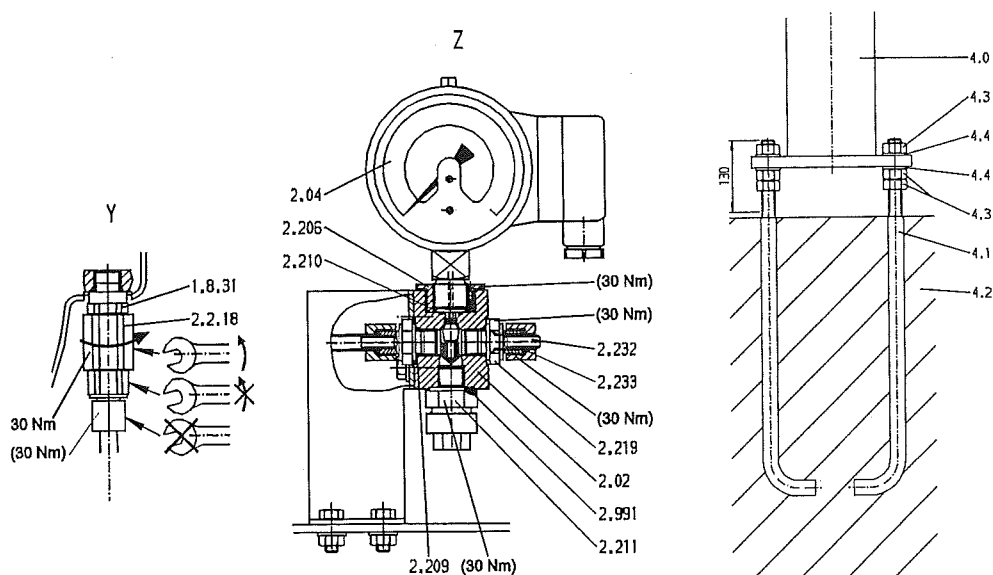


Figure B 4.7: Different tightening torques for threaded assemblies

5 Circuit Breaker Reconditioning Procedures

5.1 Safety Precautions



Follow all regional and operator-specified safety precautions.

In addition, always observe the following instructions:

- Isolate the breaker.
- Closing spring position indicator must show "Spring discharged."
- Ground the breaker at both ends as specified in regionally applicable safety regulations.
- Disconnect the supply and motor voltages.

Before opening the pole columns, draw off the SF₆ gas into a service unit and evacuate the breaker. Then ventilate the pole columns.

Important

When opening a pole column, proceed as follows:

- Wear rubber gloves, protective clothing, and respiratory protection when cleaning the pole column.
- Remove any dust immediately after opening the pole column or removing subassemblies.
- Remove the dust with a cleaning cloth or a vacuum cleaner.
- Do not stir up the dust.

Neutralize the dust, adsorption filters, and cleaning cloths for 24 hours in a 3% sodium carbonate solution or store them in a safe place and dispose of them separately as contaminated materials.

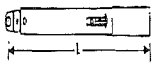
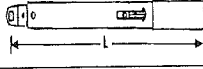
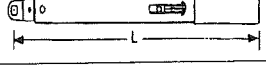





Follow the instructions in Section 1.3: "Handling SF₆ Gas."

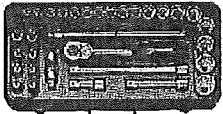





5.2 Materials and Equipment to Be Provided by Station

5.2.1 Tools and Hoisting Equipment

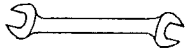
Torque wrenches and accessories

| Tool-No. | Description | Illustration | Order-No. |
|----------|--|--|-----------|
| T001 | Torque wrench 8...40 Nm; Seat 9x12 mm; length ≤ 390 mm |  | 2008994 |
| T002 | Torque wrench 40...200 Nm; Seat 14x18 mm |  | 2008995 |
| T003 | Torque wrench 80...400 Nm; Seat 14x18 mm |  | 2008996 |
| T004 | Ratchet handle; Reversible for torque wrenches $\frac{1}{2}$ "; seat 9x12 mm |  | 2008997 |
| T005 | Ratchet handle; Reversible for torque wrenches $\frac{1}{2}$ "; seat 14x18 mm |  | 2008998 |
| T006 | Seat-Adapter; Use of 14x18mm plug-ins with torque wrench seats 9x12 mm |  | 2009000 |

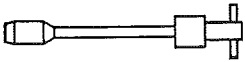
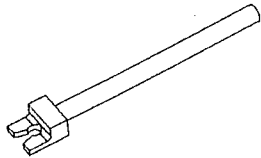
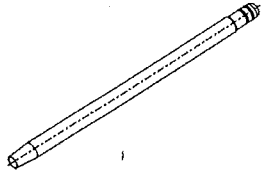
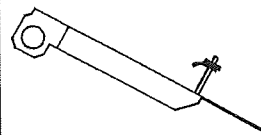
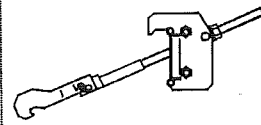
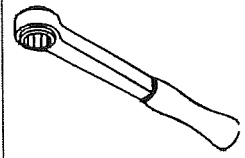
Plug-in-Tools for Torque Wrenches

| Tool-No. | Description | Illustration | Order-No. |
|----------|---|--|-----------|
| T007 | Socket wrenches; Seat ½"; set of: – Ratched spanner – Extensions – Plug-in-Tool 10...34 mm for hexagon head cap screw 4...14 mm for hexagon socket head cap screws |  | 2008999 |
| T008 | Open-ring-wrench 19 mm; Plug-in-tool for torque wrenches; seat 9x12 mm |  | 2009001 |
| T009 | Open-ring-wrench 24 mm; Plug-in-tool for torque wrenches; seat 9x12 mm |  | 2009002 |
| T010 | Open-end-wrench 27 mm; Plug-in-tool for torque wrenches; seat 14x18 mm |  | 2009003 |
| T011 | Open-end-wrench 36 mm; Plug-in-tool for torque wrenches; seat 14x18 mm |  | 2009004 |
| T012 | Ring-wrench 36 mm; Plug-in-tool for torque wrenches; seat 14x18 mm |  | 2009005 |

Double open ended wrenches

| Tool-No. |  | Order-No. |
|----------|---|-----------|
| T013 | 10x11 mm | 1053523 |
| T014 | 12x13 mm | 1053560 |
| T015 | 16x17 mm | 1053602 |
| T016 | 18x19 mm | 1053638 |
| T017 | 22x24 mm | 1053687 |
| T018 | 27x30 mm | 1053729 |
| T019 | 32x36 mm | 1053742 |
| T020 | 36x41 mm | 1053766 |





Special Tools

| Tool-No. | Description | Illustration | Order-No. |
|----------|---|--|-----------|
| T100 | Assembly tool for coupling bolt |  | 1915726 |
| T101 | Assembly tool for cotter pins |  | 9915937 |
| T102 | Guide tool for interrupter unit |  | 9915938 |
| T103 | Blocking device: device for the closing latch |  | 2012684 |
| T104 | Slow operation device: device for slow closing and opening operations. |  | 2012697 |
| T105 | Standard M16 ratchet box wrench (ring spanner): for use with the slow operation device |  | |

5.2.2 Testing and Measuring Equipment

- Multimeter
- SF₆ leak detector
- Timer for operating times and motor charging time

5.2.3 Indirect Materials and Factory Supplies

| Description | Illustration | Quantity | Order No. |
|---|---|--|-------------------------------|
| Molykote BR2 plus (grease) |  | 0.25 kg 0.5 kg 1.0 kg | 1266427 1266439 1266440 |
| SF 1377 silicone grease |  | 0.25 kg 0.5 kg 1.0 kg | 1001624 1001073 1241202 |
| Molykote PG 54 grease |  | 1.0 kg | 2009128 |
| Screw locking adhesive Loctite Type 243 (blue) |  | 10 cm ³ 25 cm ³ | 1271249 1250782 |
| Alcohol for cleaning | | 5 l | 1242244 |
| Scotch brand nonwoven material | | 10 m x 100 mm | 1260765 |

5.2.4 Replacement Parts

For disassembly and reconditioning of interrupter chamber

| Description | Figure | Item | Qty. per Pole |
|------------------------------|-----------------|---------|---------------|
| Gasket for chamber insulator | B 5.4.3 / 5.4.4 | 1.100 | 2 |
| Gasket for support porcelain | B 5.5.2 | 1.101 | 2 |
| Coupling pin, 6 x 24 | B 5.4.2 b / d | 1.103 | 4 |
| Coupling pin, 12 x 35 | B 5.4.1 b | 1.108 | 1 |
| Adsorption filter | B 5.5.2 | 1.8.04 | 1 |
| PTFE guide strip | B 5.4.2 c | 1.3.105 | 2 |
| Fixed arcing contact | B 5.4.2 c | 1.4.2 | 1 |
| Interrupter unit | B 5.4.2 c | 1.5 | 1 |
| Cotter pin, 8 x 1.2 | B 5.4.2 b / d | 1.606 | 4 |
| PTFE guide strip | B 5.4.3 | 1.7.2 | 1 |
| PTFE guide strip | B 5.4.3 | 1.7.9 | 1 |
| O-ring, 66.27 x 3.53 | B 5.5.2 | 1.8.36 | 1 |

For disassembly of support porcelain and crankcase

| Description | Figure | Item | Qty. per Pole |
|------------------------------|-----------------|--------|---------------|
| Gasket for chamber insulator | B 5.4.3 / 5.4.4 | 1.100 | 2 |
| Gasket for support porcelain | B 5.5.2 | 1.101 | 2 |
| Coupling pin, 12 x 35 | B 5.4.1 b | 1.108 | 1 |
| Adsorption filter | B 5.5.2 | 1.8.04 | 1 |
| O-ring, 34.52 x 3.53 | B 5.5.2 | 1.8.15 | 1 |
| O-ring, 12.37 x 2.62 | B 5.5.2 | 1.8.32 | 1 |
| O-ring, 38.82 x 5.33 | B 5.5.2 | 1.8.35 | 2 |
| O-ring, 66.27 x 3.53 | B 5.5.2 | 1.8.36 | 2 |

5.3 Purpose of Lubricating Greases

A total of three different greases are used. SF 1377 silicone grease is used for four different applications.

(In the figures, the different applications are indicated by the corresponding letters shown below.)

L-S01 SF 1377 silicone grease for sealing joints.

- Apply a thin coat of grease to the joints from the sealing groove to the outside edge using your fingers. Do not use a brush.

L-S02 SF 1377 silicone grease for lubricating gaskets and O-rings.

- Clean grooves, sealing surfaces, and sealing rings with alcohol, and then apply a thin coat of grease using your fingers. Do not use a brush or cloths that will deposit lint.

L-S03 SF 1377 silicone grease for lubricating sliding and bearing surfaces.

- Apply a thin coat of grease to sliding and bearing surfaces.

L-S04 SF 1377 silicone grease or acid-free Vaseline for treating contact surfaces of current-carrying connections (high voltage terminals).

- Apply a thin coat of grease over the entire contact surface.

L-C01 Molykote PG 54 for lubricating sliding and bearing surfaces on the interrupter unit inside SF₆ gas compartments.

- Apply a thin coat of grease to sliding and bearing surfaces.

L-B01 Molykote BR2 plus for lubricating highly stressed sliding and bearing surfaces outside SF₆ gas compartments.

- Apply a thin coat of grease to sliding and bearing surfaces.

5.4 Replacing the Arcing Contacts

Type GL 311 / 312 circuit breakers require minimum reconditioning time on site.

For this purpose, the circuit breaker is equipped with a disconnect (isolating point) between the interrupter chamber and the support porcelain. All interrupter chambers are interchangeable.

Because of this feature, it is possible to replace the arcing contacts using a quick-change method.

This reduces down time in the station and makes it possible to carry out reconditioning work in the shop.

Replacement of the arcing contacts is described in this section. Section 5.4 describes further disassembly of the pole columns.

Important

- ⇒ The arcing contacts should be replaced in closed, dry, and dust-free rooms.
- ⇒ Replacement of arcing contacts inside the station should only be done during dry weather when there is no wind.

All functional elements must be inspected, cleaned using a cleaning cloth soaked in alcohol, and lubricated in accordance with the lubrication specifications (Section 1) or replaced, if necessary.

If elastomer gaskets or seals are loosened during these operations, they must be replaced.

The adsorption filter must be replaced in each pole column that is opened.

Important

The period during which the gas compartments are open should be kept to a minimum. The ingress of water (rain) must be prevented in any case.

5.4.1 Detaching an Interrupter Chamber from the Support Porcelain

- Disconnect the supply voltage to the motor.
- Discharge the closing and opening springs.

This state is reached when the position indicator shows OPEN and the spring position indicator is on "discharged." The following operations are required to reach this state, depending on the starting situation:

| Breaker Position | State of the Closing Spring | Operations to Be Executed |
|------------------|-----------------------------|---------------------------|
| CLOSED | Charged | O-C-O |
| CLOSED | Discharged | O |
| OPEN | Charged | C-O |
| OPEN | Discharged | No operation required |

- Draw off the SF₆ gas using a service unit, and evacuate and ventilate the breaker.
- Attach a crane rope or cable to the upper high voltage terminal (Figure B 5.4.1 b) of the pole column.
- Mount the blocking and slow-operation devices in the mechanism (see Section 7).
- Using the slow-operation device, move the mechanism to the closed position.
- Unscrew the 8 screws, M12 x 65 (1.602), from the upper flange of the support porcelain (Figure B 5.4.1 a).

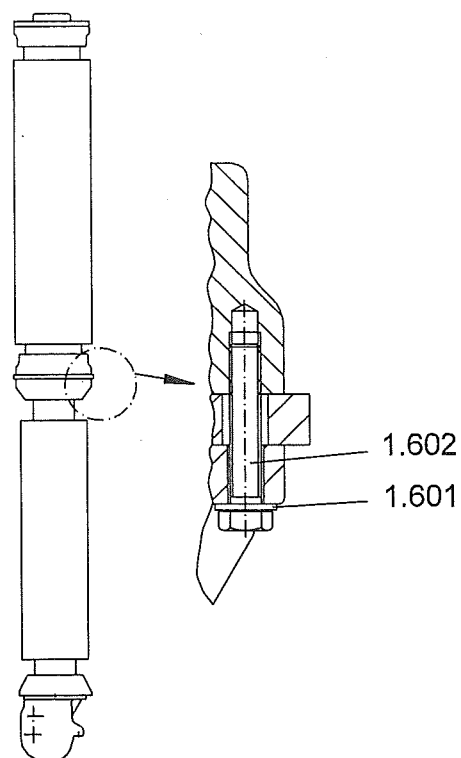


Figure B 5.4.1 a: Detaching an interrupter chamber from the support porcelain

1.601 Washer 13 A2

1.602 Screw M12 x 65 A2-70

- Lift up the interrupter chamber in order to remove the coupling pin (1.108).
The distance between the flanges of the interrupter chamber and the support porcelain must not exceed 80 mm (Figure B 5.4.1 b).

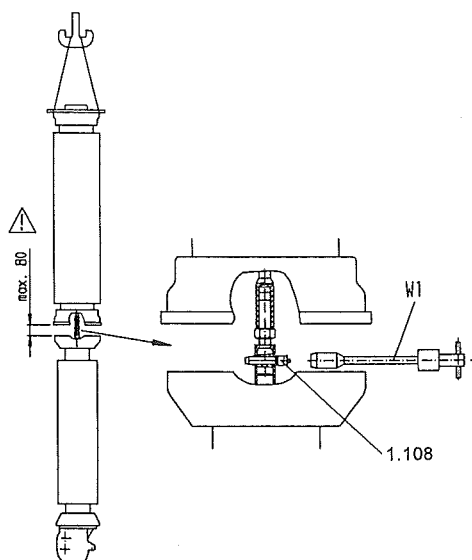
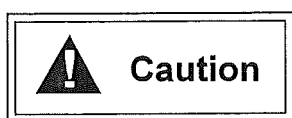


Figure B 5.4.1 b: Removing the coupling pin

1.108 Coupling pin 12 x 35



⇒ A gap dimension greater than 80 mm may lead to blocking of or damage to the pole column.

Therefore:

⇒ Make sure that the gap dimension does not exceed 80 mm.

- Remove the coupling pin (1.108) using assembly tool T100.
- Fasten the interrupter chamber to a suitable fixture by inserting four (4) M16 screws in the holes of the lower high voltage terminal.

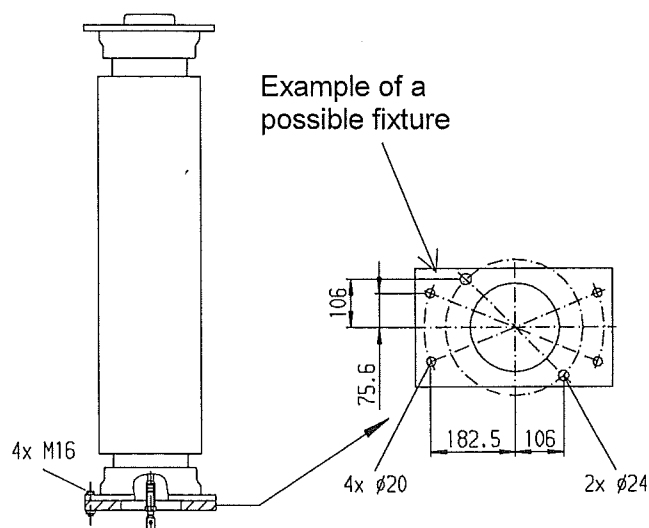


Figure B 5.4.1 c: Securing the interrupter chamber for disassembly

- If the entire interrupter chamber assembly is being replaced, skip over the following sections, Section 5.4.2 to 5.4.6.

5.4.2 Disassembly of the Double Motion System

- Remove the 8 screws, M12 x 45 (1.600), from the upper flange of the chamber porcelain (Figure B 5.4.2 a).
- Lift out the double motion system.

The double motion system consists of the following subassemblies:

- Fixed contact (1.3)
- Double motion unit (1.4)
- Interrupter unit (1.5)

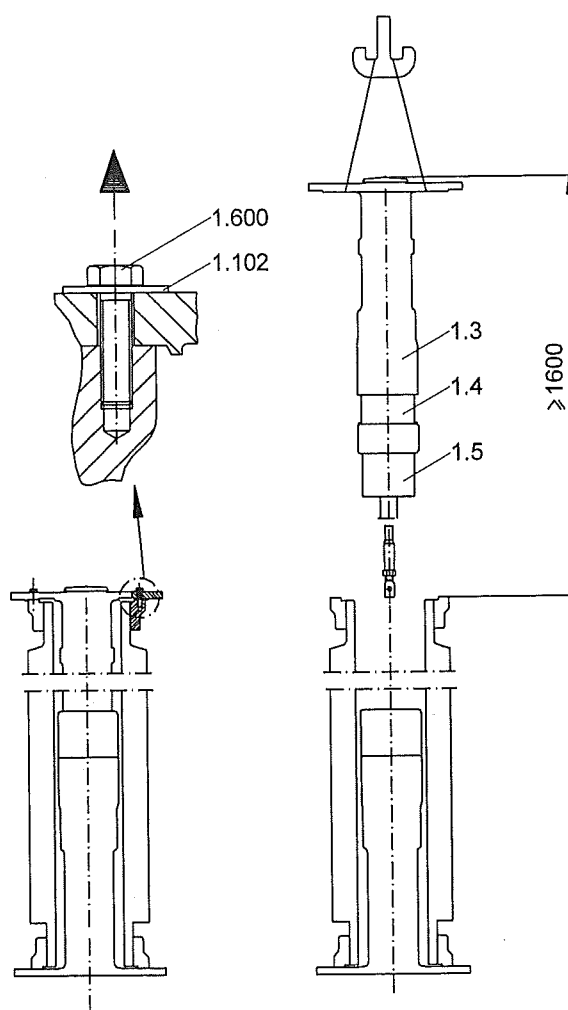


Figure B 5.4.2 a: Lifting out the double motion system

| | | | |
|-----|------------------------|-------|-----------------------|
| 1.3 | Fixed contact assembly | 1.102 | Washer, fixed contact |
| 1.4 | Double motion unit | 1.600 | Screw M12 x 45 A2-70 |
| 1.5 | Interrupter unit | | |

- Remove the cotter pin (1.606) and coupling pin (1.103) from the two double motion levers (1.6) (Figure B 5.4.2 b).

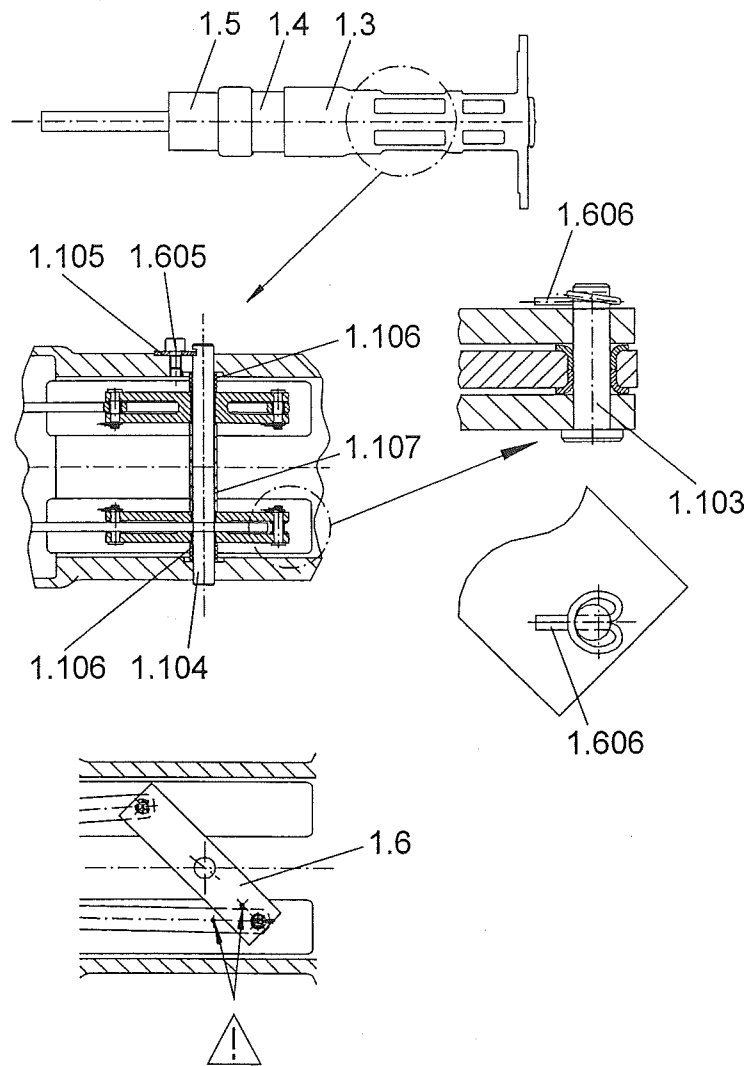


Figure B 5.4.2 b: Disconnecting the double motion unit

| | | | |
|-----|------------------------|-------|---------------------|
| 1.3 | Fixed contact assembly | 1.103 | Coupling pin 6 x 24 |
| 1.4 | Double motion unit | 1.104 | Double motion shaft |
| 1.5 | Interrupter unit | 1.105 | Shaft retainer |
| 1.6 | Double motion lever | 1.106 | Spacer sleeve |
| | | 1.107 | Spacer sleeve |
| | | 1.605 | Screw M8 x12 A2-70 |
| | | 1.606 | Cotter pin 8 x 1.2 |

- Pull the interrupter unit (1.5) and the double motion unit (1.4) out of the fixed contact assembly (1.3).

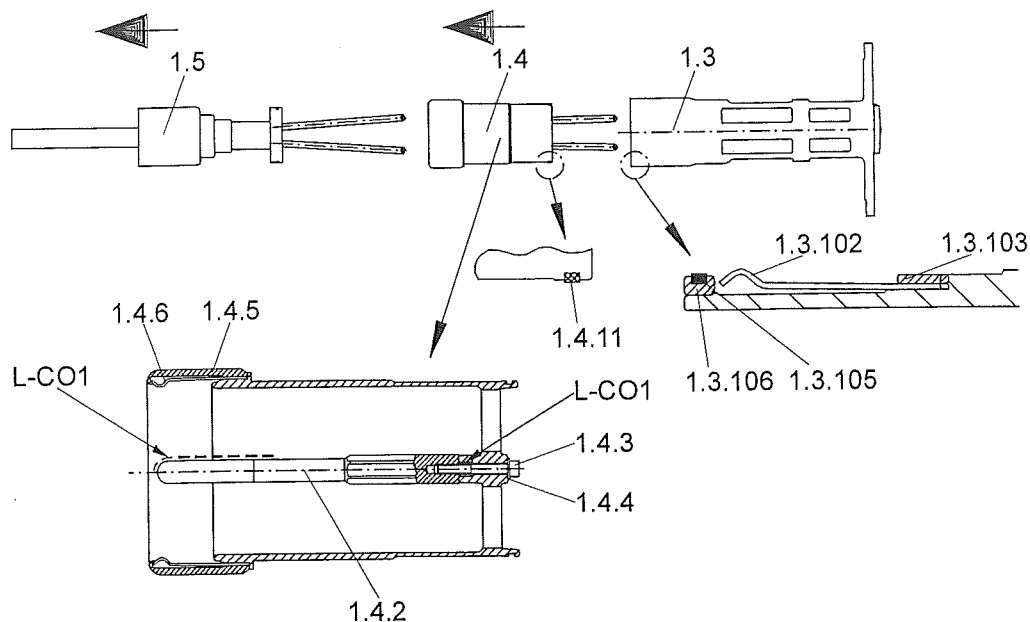


Figure B 5.4.2 c: Disassembling the double motion unit

| | | | |
|-------|-------------------------------|---------|-------------------------------|
| 1.3 | Fixed contact assembly | 1.3.102 | Rated current contact segment |
| 1.4 | Double motion unit | 1.3.103 | Contact retaining ring |
| 1.4.2 | Fixed arcing contact | 1.3.105 | PTFE guide strip |
| 1.4.3 | Screw M8 x 60 A2-70 | 1.3.106 | Guide ring |
| 1.4.4 | Washer 8.4 A2 | 1.4.11 | PTFE guide strip |
| 1.4.5 | Contact retaining ring | | |
| 1.4.6 | Rated current contact segment | | |
| 1.5 | Interrupter unit | | |

- Replace the fixed arcing contact (1.4.2). Treat the contact surfaces as specified in the lubrication instructions (Section 5.3); tighten screw M8 x 60 A2-70 (1.4.3) to 24 Nm.
- Replace the PTFE guide strips (1.3.105 and 1.4.11). The PTFE guide strips are located in dovetail grooves. Therefore it is necessary to overcome mechanical resistance when replacing them.
- Slide the double motion unit (1.4) into the fixed contact assembly (1.3). While doing so, thread the rods of the double motion unit into the levers (1.6). The rods of the double motion units and their respective lever arms are marked with a dot and are mounted together.

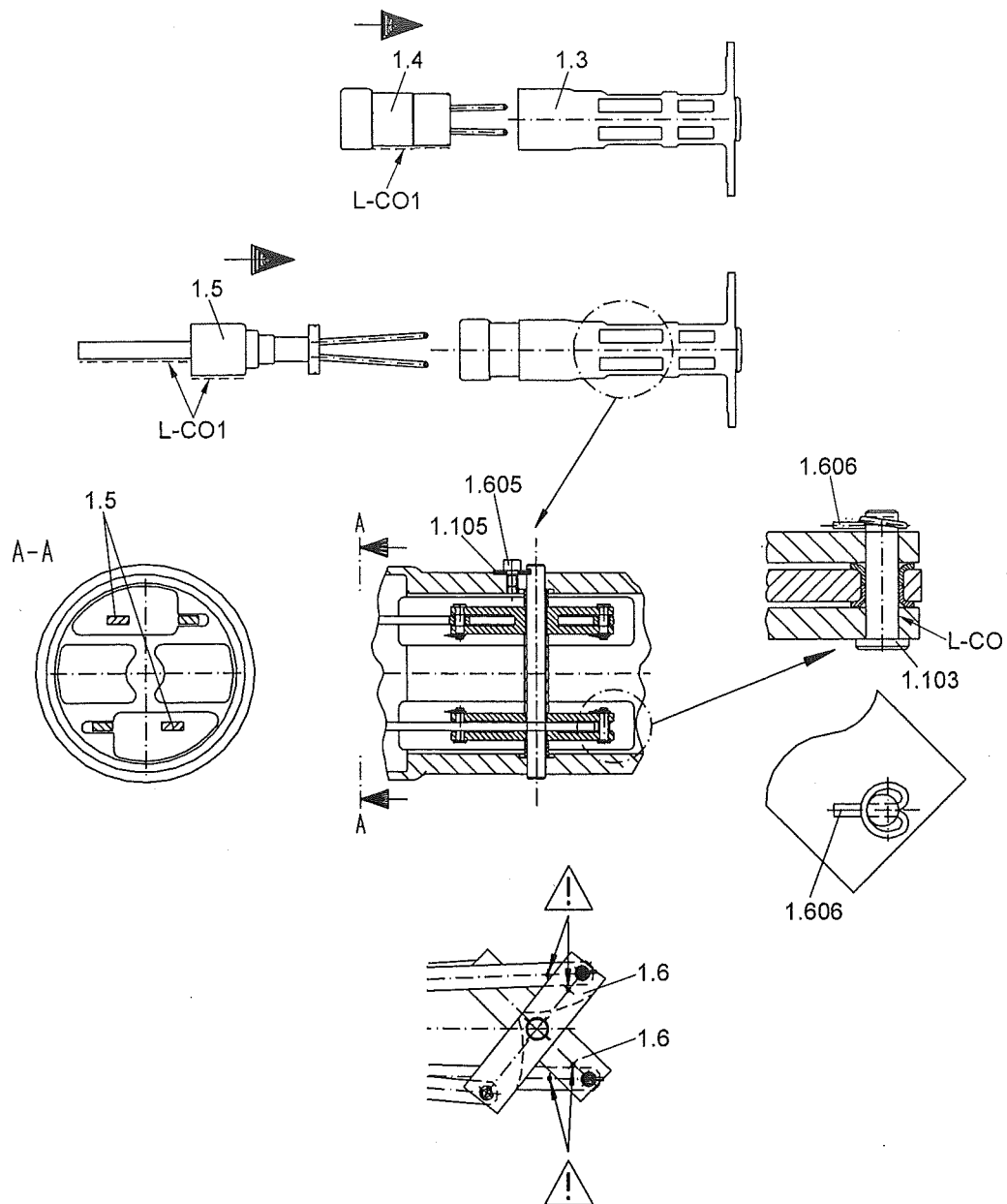


Figure B 5.4.2 d: Disassembling the double motion system

| | | | |
|-----|------------------------|-------|---------------------|
| 1.3 | Fixed contact assembly | 1.103 | Coupling pin 6 x 24 |
| 1.4 | Double motion unit | 1.105 | Shaft retainer |
| 1.5 | Interrupter unit | 1.605 | Screw M8 x12 A2-70 |
| 1.6 | Double motion lever | 1.606 | Cotter pin 8 x 1.2 |

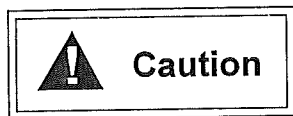


- ⇒ The levers (1.6) of the double motion system are the same length, but the accompanying arms are of different lengths.
- ⇒ Mismatching of rods and levers can result in damage during subsequent assembly.

Therefore:

- ⇒ Make sure that the rods and levers are matched up correctly. The rods and levers of the double motion unit that belong together are marked with a punch mark.

Insert a new interrupter unit (1.5) into the double motion unit. During this process, fit the rods of the interrupter unit through the large holes of the double motion unit into the levers (1.6) (Figure B 5.4.2 c, Section A-A). The rods of the interrupter unit are not marked with a punch mark and need to be matched up with the non-marked lever arms.



- ⇒ The lever arms (1.6) are not identical.
- ⇒ Mismatching of rods and levers can result in damage during subsequent assembly.

Therefore:

- ⇒ Make sure that the rods and levers are matched up correctly. The rods and levers of the interrupter unit that belong together are not marked with a punch mark.

Fasten the four rods and two levers together using new cotter pins (1.606) and coupling pins (1.103). Install cotter pins using assembly tool T101, and lubricate coupling pins as described in Section 5.3. Align pins so that heads are on the outside of the levers.

5.4.3 Reconditioning the Base

- Attach crane rope or cable to the upper flange of the interrupter chamber.
- Loosen screws M8 x 20 A2-70 (1.604) on the lower end of the chamber porcelain (1.7.1).
- Lift off the chamber porcelain (1.1).
- Replace the PTFE guide strips (2 x 1.7.9 and 1 x 1.7.2). The PTFE guide strips are located in dovetail grooves. Therefore it is necessary to overcome mechanical resistance when replacing them.
- Lubricate the sealing and flange surfaces and replace the gasket (1.100).
- Replace the chamber porcelain and fasten it to the base with 2 screws, M8 x 20 A2-70 (1.604). Tighten the screws to a torque of 24 Nm, and fill the counterbores in the base completely with SF 1377 grease.

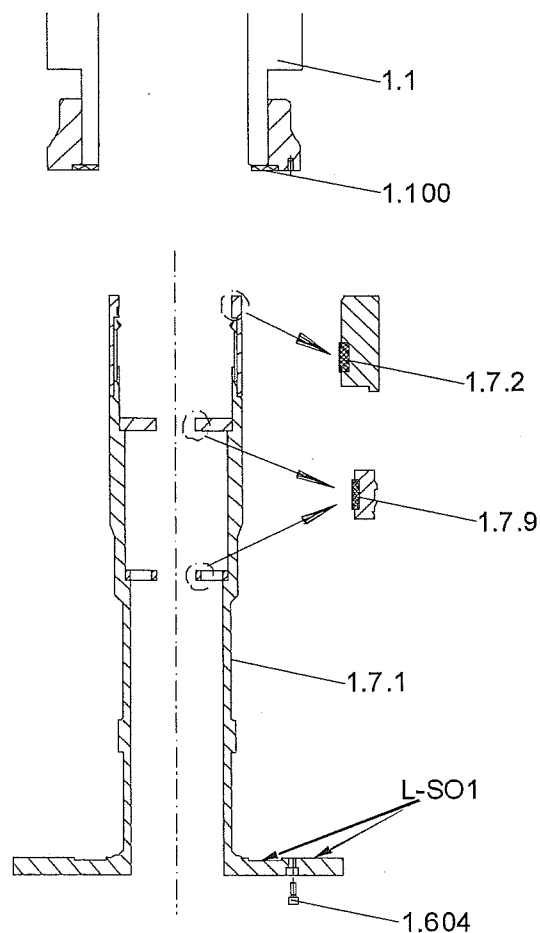
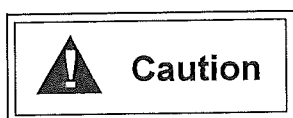


Figure B 5.4.3: Reconditioning the base

| | | | |
|-------|-------------------|-------|---------------------|
| 1.1 | Chamber porcelain | 1.100 | Chamber gasket |
| 1.7.1 | Base | 1.604 | Screw M8 x 20 A2-70 |
| 1.7.2 | PTFE strip | | |
| 1.7.9 | PTFE strip | | |

5.4.4 Reinstalling the Double Motion System

- Lubricate the sealing and flange surfaces on the fixed contact and replace the gasket (1.100).
- Lift the double motion system above the chamber porcelain and align it coaxially.
- Move guide tool T102 above the connecting rods of the interrupter unit and insert it into the interrupter tube. Guide tool is held in the interrupter tube by its O-rings.
- Install the double motion system using guide tool T102.



Improper installation of the double motion system can cause damage to the porcelain or the PTFE guide strips.

Therefore:

⇒ Never install the double motion system without using guide tool T102.

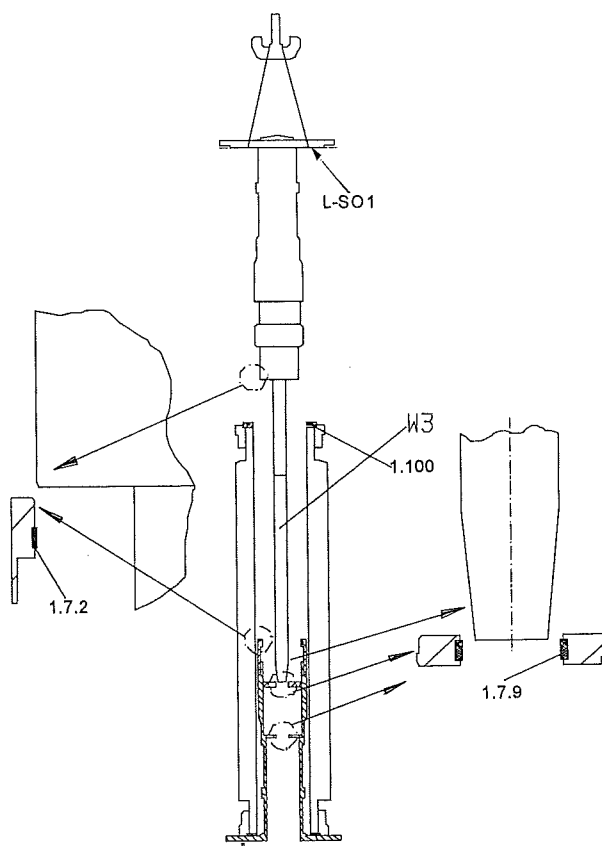


Figure B 5.4.4: Installing the double motion system

1.7.2 PTFE strip
1.7.9 PTFE strip

1.100 Chamber gasket

5.4.5 Adjusting the Interrupter Chamber

- Fasten the double motion system to the chamber porcelain using screws (1.600) and washers (1.102). Tighten to a torque of 83 Nm.
- Remove guide tool T102.
- Pull the interrupter unit down to the stop (required tensile force approx. 100 N).
- Align the flattened sides of the connecting rod (1.5.42) so they are parallel with the high voltage terminal pads. Alignment is accomplished by turning the interrupter unit.
- Adjust the distance between the lower edge of the base and the center of the hole in the coupling piece (1.5.44) to $71.5 \pm 1\text{mm}$. The hole in the coupling piece must point in the same direction as the flattened sides of the connecting rod.
- Tighten the nut (1.5.45) to a torque of 130 Nm.

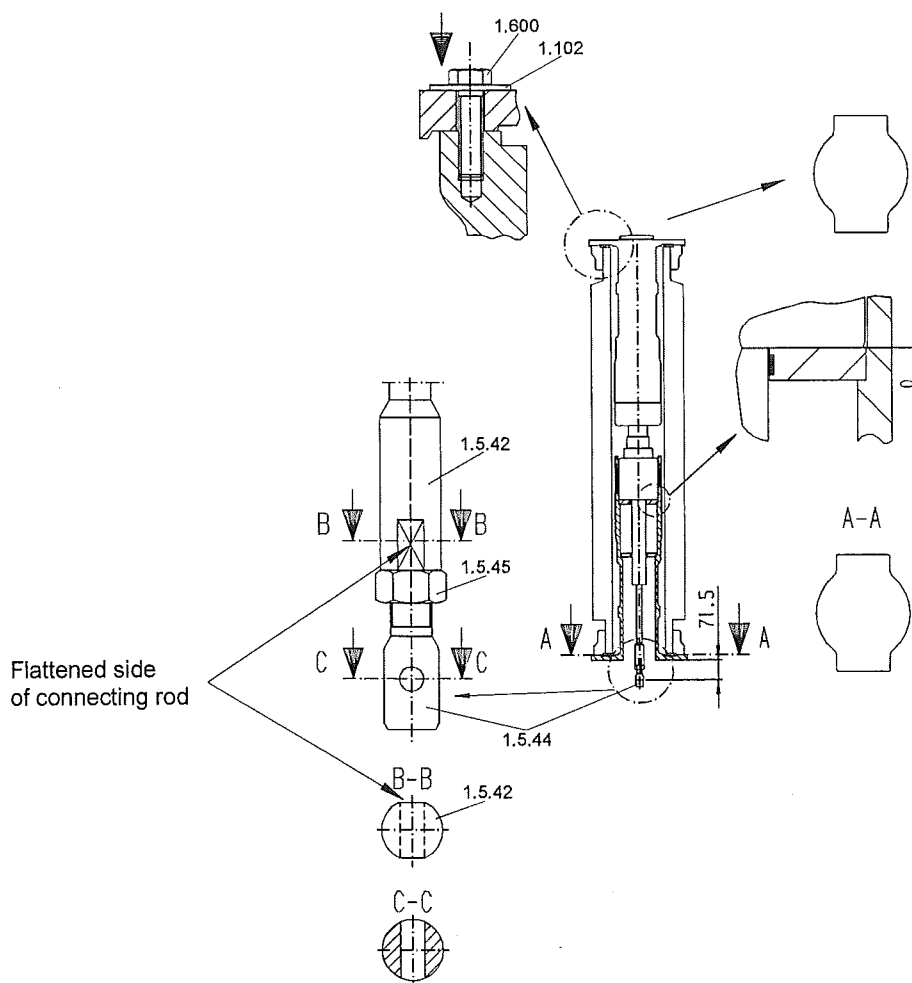
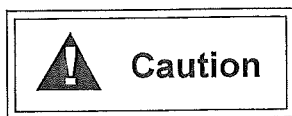


Figure B 5.4.5: Adjusting the interrupter unit

| | | | |
|--------|-----------------------|--------|----------------------|
| 1.102 | Washer, fixed contact | 1.5.45 | Nut |
| 1.5.42 | Connecting rod | 1.600 | Screw M12 x 45 A2-70 |
| 1.5.44 | Coupling piece | | |



⇒ Improper adjustment of the interrupter unit can cause damage during breaker operations.

Therefore:

⇒ Carefully adjust and check the following:

- Distance of $71.5 \text{ mm} \pm 1 \text{ mm}$
- Position of the flattened side of the connecting rod
- Position of the holes in the coupling piece

5.4.6 Remounting the Interrupter Chamber on the Support Porcelain

- Requirements: Insulating rod has been moved to the closed position using the slow-operation device.
- Lubricate the flange surfaces of the support porcelain and replace the gasket (1.101).
- Lift the interrupter chamber and insert the coupling piece into the insulating rod (1.8.07).
- Connect the interrupter chamber and the insulating rod by means of the coupling pin (1.108) using assembly tool T100.
- Lower the interrupter chamber completely and fasten it to the support porcelain using 8 screws, M12 x 65 (1.602), and 8 washers (1.601). Tighten to a torque of 83 Nm.

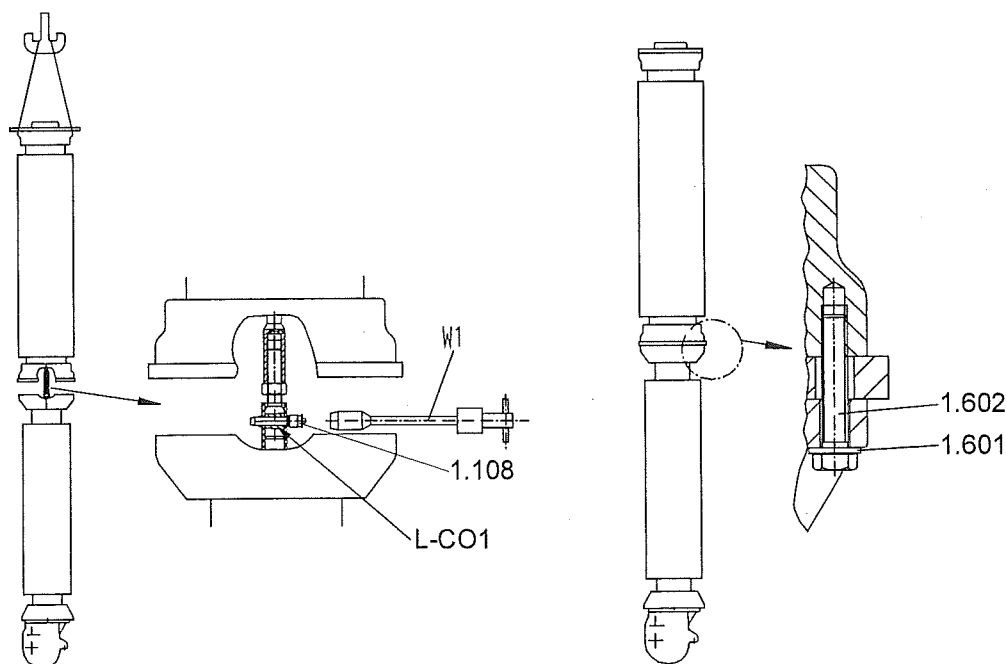


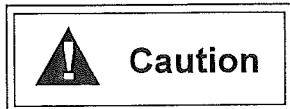
Figure B 5.4.6: Remounting the interrupter chamber on the support porcelain

- 1.108 Coupling pin 12 x 35
- 1.601 Washer 13 A2
- 1.602 Screw M12 x 65 A2-70

- Using the slow operation device, move the circuit breaker to the open position (see Section 7).
- Remove the slow operation device and the blocking device.

5.4.7 Replacing the Adsorption Filter and Final Operations

- Remove levers from all poles in accordance with Part A (Sections 5.4 and 5.5).
- Detach the filter lids (1.8.21) and remove the filter chambers (1.8.05), as shown in Figure B 5.5.2.
- Remove the filter bags (1.8.04) from the filter chambers, insert a new bag, and slide the filter chambers back into the crankcases.
- Replace the O-ring (1.8.36).
- Reinstall the lid and tighten the screws to 10 Nm.
- Reinstall all levers.



- ⇒ When reinstalling the levers, make sure the levers match up with the pole columns.
- ⇒ Match up the position markings on the levers and shafts.

- Evacuate the breaker, fill it with SF₆ to rated pressure, and carry out commissioning operations as described in Section 6 of Part A.
- Check all pole column flange connections that were opened during inspection and also the SF₆ piping for leaktightness using the SF₆ leak detector.

5.5 Disassembly of Support Porcelain and Crankcase



Follow the safety precautions given in Section 1.1 and the instructions in Section 1.2.

5.5.1 Requirements

- The interrupter chamber has been disconnected from the support porcelain, as described in Section 5.4.
- The connecting rods have been disconnected by reversing the sequence given in Part A, Section 5.4.
- The following items shall be provided:
 - + Tools listed in section 5.2.1
 - + Indirect materials and factory supplies listed in Section 5.2.3
 - + Replacement parts listed in section 5.2.4

5.5.2 Procedure

- Attach crane rope to the upper flange of the support porcelain.
- Loosen the 4 fastening screws on the lower flange of the support porcelain.
- Lift the support porcelain and crankcase assembly out of the base frame and set it down on a suitable work surface.
- Unscrew the 6 screws, M12 x 40 A2-70 (1.602), from the flange of the crankcase.
- Lift out the crankcase.

Important

Avoid damaging the insulating rod during disassembly.

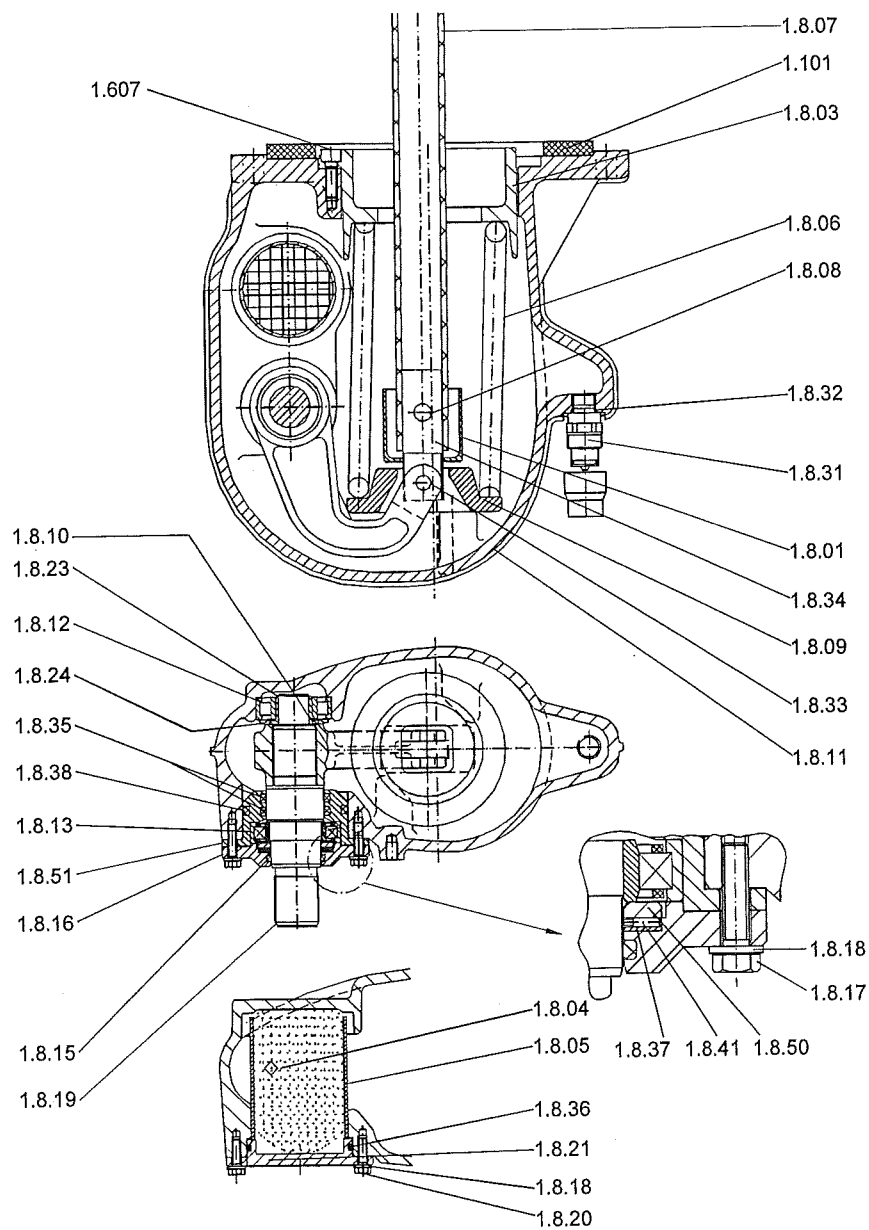


Figure B 5.5.2: Crankcase

| | | | |
|--------|------------------------------|--------|--------------------------|
| 1.101 | Gasket for support porcelain | 1.8.18 | Washer |
| 1.607 | Screw M8 x 25 A2-70 | 1.8.19 | Torque shaft |
| 1.8.01 | Sleeve | 1.8.20 | Screw M6 x 20 |
| 1.8.03 | Spring bushing | 1.8.21 | Lid |
| 1.8.04 | Filter bag | 1.8.23 | Gasket |
| 1.8.05 | Filter chamber | 1.8.24 | Gasket |
| 1.8.06 | Opening spring | 1.8.31 | SF ₆ coupling |
| 1.601 | Washer 13 A2 | 1.8.32 | O-ring 12.37 x 2.62 |
| 1.8.07 | Insulating rod | 1.8.33 | Screw |
| 1.108 | Coupling pin 12 x 35 | 1.8.34 | Coupling piece |
| 1.8.08 | Coupling pin | 1.8.35 | O-ring 38.82 x 5.33 |
| 1.8.09 | Spring seat | 1.8.36 | O-ring 66.27 x 3.53 |
| 1.8.10 | Inside lever | 1.8.37 | Bearing plate |
| 1.8.11 | Crankcase | 1.8.41 | Bearing |
| 1.8.12 | Ball bearing | 1.8.50 | Bearing plate |
| 1.8.13 | Cylindrical roller bearing | 1.8.51 | Insert bearing |
| 1.8.15 | O-ring 34.52 x 3.53 | | |
| 1.8.16 | Bearing cap | | |
| 1.8.17 | Screw M6 x 25 | | |

- Unscrew 3 screws, M8 x 25 A2-70 (1.607) and remove the spring bushing (1.8.03) from the opening spring (1.8.06).

Important

The precharging travel of the opening spring is smaller than the screw thread length (1.607).

Therefore:

- ⇒ A special tool is not necessary for completely discharging the spring.
- ⇒ Unscrew the 3 screws gradually and evenly by alternating screws in order to prevent the spring bushing from tilting.

- Remove the opening spring from the crankcase.
- Detach the lid (1.8.21) of the filter chamber (1.8.05) and remove the filter chamber.
- Unscrew the screws (1.8.17) and remove the bearing cap (1.8.16).
- Remove the insert bearing (1.8.51) and the outer ring of the cylindrical roller bearing (1.8.13).
- Remove the torque shaft (1.8.19) and the inner ring of the roller bearing.



Caution

Do not damage the sealing surfaces during disassembly.

- Lift the assembly consisting of insulating rod (1.8.07), spring seat (1.8.09), and inner lever (1.8.10) up out of the crankcase.
- Unscrew the bolts (1.8.33) and separate the individual parts of the assembly.
- Clean all parts to remove any decomposition products adhering in the form of dust; inspect the parts and replace them, if necessary. See Section 1.3.
- Reassemble the parts in reverse order.

Important

The following instructions must be followed when assembling the parts:

- ⇒ Follow the lubrication specifications for contact and joining surfaces and for static and dynamic seals.
 - ⇒ Replace all seals and gaskets.
 - ⇒ Tighten the 3 screws (1.603) to a torque of 24 Nm.
 - ⇒ When reassembling the unit, do not forget the sleeve (1.8.01).
 - ⇒ Do not install a new filter until right before evacuating the assembled pole column.
 - ⇒ The tightening torques are given in Section 4.7.
- Mount the interrupter chamber as specified in Section 5.4 and re-commission the breaker as described in Part A, Section 6.

6 Mechanism Reconditioning Procedures

6.1 Replacing the Motor

- Disconnect both wires on the terminal board of the motor (70.01).

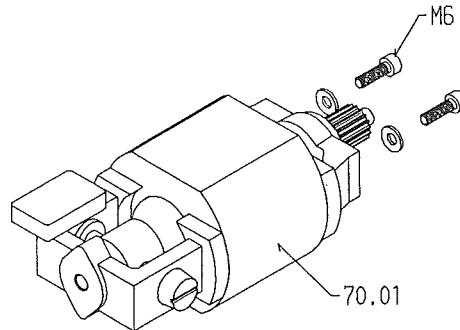


Figure B 6.1: Motor

- Unscrew the fastening screws (M6) and remove the motor.
- Check the bridge connection on the motor terminal board of the new motor and compare it with the old motor.
- Install the new motor and tighten the fastening screws to a torque of 9 Nm.



Lubrication of the motor pinion may cause the mechanism to malfunction.

Do not grease or lubricate the pinion of the motor.

- Reconnect the wires on the terminal board.



If the wiring is incorrect, the motor stalls and can be damaged.

Briefly turn on the power to the motor and check to see whether the motor drives the gearing. If this is not the case:

⇒ Immediately disconnect the power to the motor.

⇒ Check connections, including bridge connection, and correct, if necessary.

6.2 Replacing the Heating Unit

- Disconnect the wire terminations from the terminals of the heating unit (70.67).

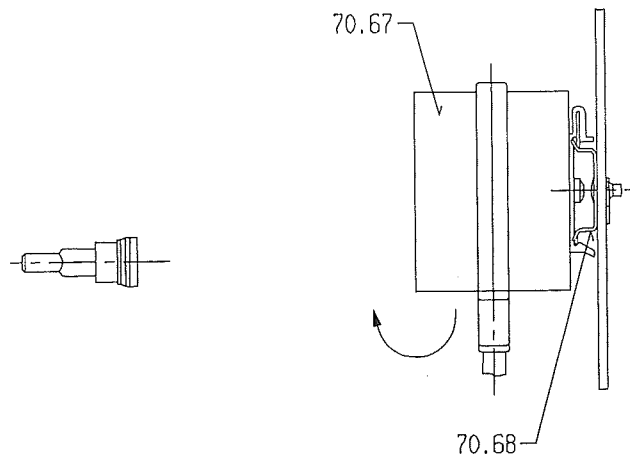


Figure B 6.2: Heating unit

- Snap the heating element out of the top hat rail (70.68) by pressing down slightly.
- Snap a new heating element into the top hat rail.
- Connect the heating unit.
- Connect a voltage source to the heating unit and check to see whether it heats up.



The surface temperature of the heating element is approximately 80 °C.

Touching the heating element may cause burn skin or clothing.

The heating unit is located in the vicinity of moving parts. Therefore there is great risk of injury during remote tripping.

Check heat radiation from a safe distance. Keep body parts away from the heating element and from any moving parts or parts charged by springs.

6.3 Replacing the Motor Limit Switch and/or the Auxiliary Switch

- Disconnect the wire connections to the motor limit switch (70.24) and/or the auxiliary switch (70.21).

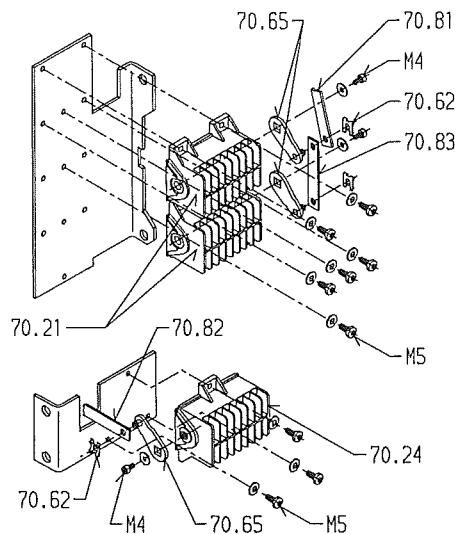


Figure B 6.3: Connections to the motor limit switch and auxiliary switch

- Remove the locking clamps (70.62). Remove the drive rod (70.81 or 70.82) and the coupling rod (70.83).
- Unscrew the M5 fastening screws.
- Remove the motor limit switch or auxiliary switch.
- Unscrew the M4 screw(s) and remove the lever (70.65).
- Mount the lever on the new motor limit switch or auxiliary switch.



Caution

If the drum controller is positioned incorrectly, operation of the mechanism is negatively affected.

Therefore check the position of the drum controller.

Motor Limit Switch Contacts 15-16 are open in the "closing spring discharged" position.

Auxiliary Switch Contacts 15-16 are closed in breaker position "O".

- Install the motor limit switch (or the auxiliary switch).
- Tighten the M5 screws.
- Mount the drive and coupling rods.
- Reinstall the locking clamps.
- Tighten the wire connections.
- Check to make sure there is play in the linkage.

6.4 Replacing the Operations Counter

Detach the drive rod (70.64).

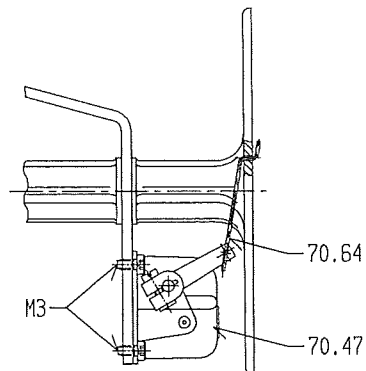


Figure B 6.4: Operations counter

- Remove the operations counter (70.47) by unscrewing the 4 fastening screws (M3).
- Set the new operations counter manually to indicate the number of operations shown on the old operations counter (so that it will be possible later to determine the life of the breaker).
- Mount the new operations counter.
- Reattach the drive rod.

6.5 Replacing the Closing and Opening Coils

- Disconnect the wire connections from the coil (70.59).

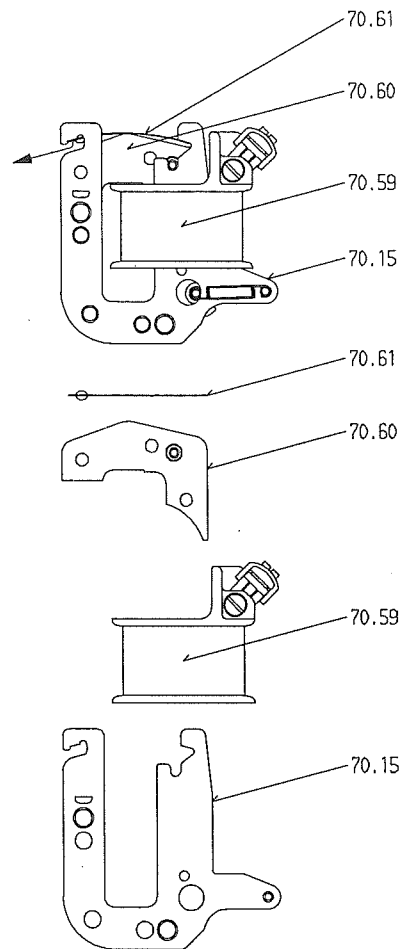


Figure B 6.5: Coils

- Push away the leaf spring (70.61) by pressing your finger on the copper rivet.
- Lift out the yoke (70.60) and place it on a clean surface.



Caution

Remove the coil being replaced and insert a new coil over the side plates (70.15).

An incorrect coil model can cause the mechanism to malfunction.

Make sure you have the correct coil. Compare the part number on the coils.

- Reinstall the yoke and mount the leaf spring.
- Check the fit of the leaf spring: it must snap into place.
- Connect the coil.

6.6 Lubricating the Mechanism

The mechanism has been lubricated at the factory. Additional lubrication of the unit is not necessary.



Mixing lubricants used at the factory with other lubricants may result in gum formation and may cause the mechanism to malfunction.

For this reason, the following is prohibited:

- ⇒ Using non-approved lubricants
- ⇒ Spraying parts of the mechanism with oil-based rust preventatives or other sprays
- Using solvents for cleaning procedures

7 Using the Slow Operation Device

The following manual operations are described in this section:

- Charging the opening spring.
- Slow closing operation.
- Slow opening operation.

The operations described below are necessary for setting, inspecting, and testing the circuit breaker and for troubleshooting.

7.1 Safety Instructions

Important

- ⇒ Before working with the mechanism, follow the safety precautions listed in the general safety requirements.
- ⇒ Follow these instructions exactly.



If the mechanism is operated without the circuit breaker, the entire amount of energy is transferred in the mechanism.

The mechanism can be damaged in the process.

- ⇒ Therefore, do not operate the mechanism without connecting it to the circuit breaker.

Slow closing or opening of the breaker during operation can destroy the breaker.

- ⇒ Before working with the mechanism, open the breaker and ground it.

During operation, the components of the electrical equipment are energized.

Any contact with energized parts can be dangerous to life and limb.

- ⇒ Disconnect the control voltage before working on the mechanism.

When the closing spring is charged, the circuit breaker can be closed.

The closed circuit breaker can always be opened; this does not depend on manual charging of the closing spring.

- ⇒ Contact with moving parts during closing and opening operations can cause serious injury.

The noise level during closing and opening operations can damage hearing.

- ⇒ Make sure ear protection is being used before any operations are carried out.
- ⇒ Prevent undesired operations during work on the mechanism.

7.2 Principle of Operation of Spring Operating Mechanisms FK 3-1 and FK 3-2

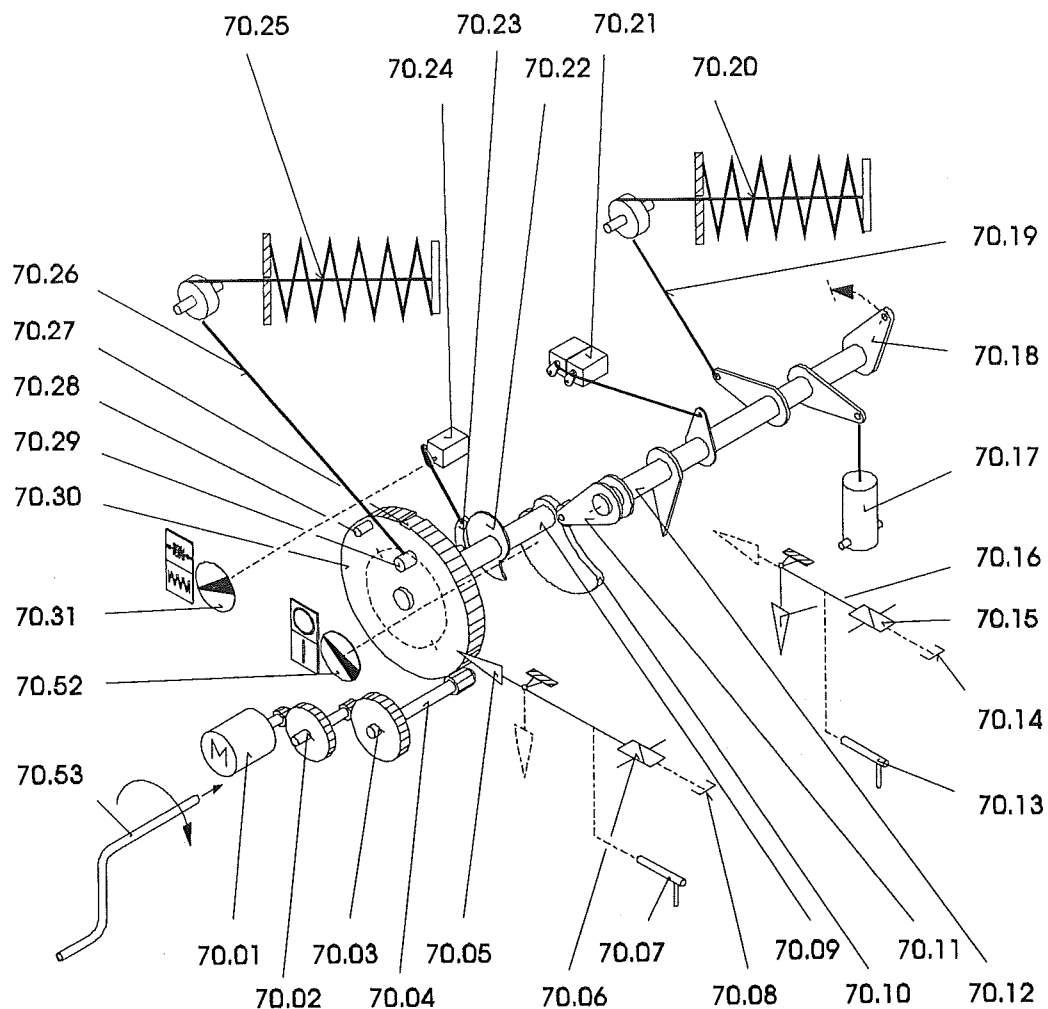


Figure B 7.2: Principle of operation of FK 3-1 and FK 3-2

| | | | |
|-------|-------------------------|-------|----------------------------|
| 70.01 | Motor | 70.18 | Drive lever |
| 70.02 | Return stop | 70.19 | Chain |
| 70.03 | Free-wheeling mechanism | 70.20 | Opening spring |
| 70.04 | Gearing | 70.21 | Auxiliary switch |
| 70.05 | Closing latch | 70.22 | Control cam |
| 70.06 | Closing coil | 70.23 | Lever |
| 70.07 | Manual closing lever | 70.24 | Motor limit switch |
| 70.08 | Close button | 70.25 | Closing spring |
| 70.09 | Closing shaft | 70.26 | Chain |
| 70.10 | Cam disk | 70.27 | Tooth gap |
| 70.11 | Roller follower | 70.28 | Roller |
| 70.12 | Main shaft | 70.29 | Crankpin |
| 70.13 | Manual opening lever | 70.30 | Crank wheel |
| 70.14 | Open button | 70.31 | Spring position indicator |
| 70.15 | Opening coil | 70.52 | Breaker position indicator |
| 70.16 | Opening latch | 70.53 | Hand crank |
| 70.17 | Trip dashpot | | |

7.3 Procedure

7.3.1 Manually Charging the Closing Spring

- The part names and numbering refer to the description of the principle of operation of the FK 3-1 and FK 3-2 in Section 7.2.
- Check the operating state of the circuit breaker and the mechanism:
 - Closing spring discharged.
 - Breaker either in closed or open position.
 - Control voltage disconnected.
- Open the door of the mechanism.
- Using the hand crank (70.53), turn the gearing (70.04) clockwise until the spring position indicator (70.31) shows "closing spring charged" and the tooth gap (70.27) of the crank wheel (70.30) has reached the pinion of the gearing (70.04).

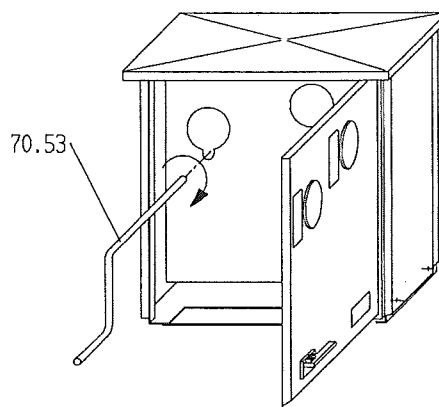


Figure B 7.3.1: Charging the closing spring manually

- In this position the gearing (70.04) is in idling position and can be turned further.
- While the closing spring is being charged, the return stop (70.02) prevents the crank wheel (70.30) from slipping backwards when manual charging is interrupted or stopped.
- Close the cabinet door.

7.3.2 Slow Closing Operation

- Check the operating state of the circuit breaker and the mechanism:
 - Closing spring discharged or charged: the closing spring is charged when the roller (70.28) is engaged with the closing latch (70.05).
 - Breaker in open position.
- Remove the right side panel (Figure B 7.3.2):
 - Remove the M8 screws.
 - Pull the panel out and downward.

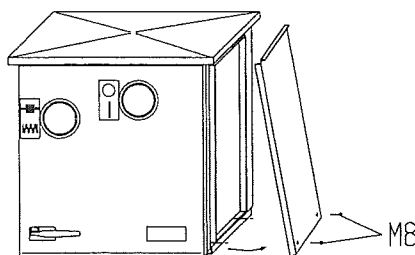


Figure B 7.3.2 a: Removing the side panel from the mechanism.

Important

Take the following safety precautions:

- ⇒ Disconnect the control voltage.
- ⇒ Block the manual opening levers (70.13):
- ⇒ Loosen the M6 screws.
- ⇒ Push the plate (70.58) up to the right.
- ⇒ Retighten the M6 screws.

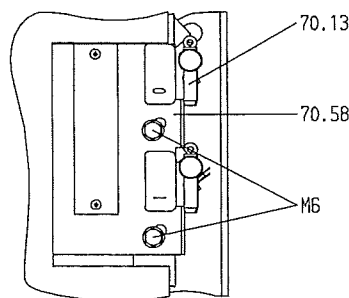


Figure B 7.3.2 b: Manual lever

- If the closing spring is charged, insert the blocking device (70.71) for the closing latch (Figure B 7.3.2 c, part 70.05), and attach to the axis of the manual opening lever (70.13).
- Mount the slow operation device (Figure B 7.3.2 d, part 70.72):
 - Place the support plate (70.73) of the device on the upper right spacer sleeve (70.76) and prop the device against the mechanism housing.
 - Attach the hook (70.74) of the device to the bolt (70.77) of the support latch (70.78).
- Execute a slow closing operation:
 - Turn the M 16 nut (70.75) clockwise until the support latch (70.78) of the roller follower (70.11) engages with the opening latch (70.16) by audibly snapping into place.

Overcharging is prevented by the stop sleeve (70.80). The breaker position indicator now shows closed position. During the slow closing operation, the opening spring (70.20) is charged simultaneously.
- Remove the slow operation device (70.72).
 - Turn the M16 nut (70.75) counterclockwise until the pressure is removed from the hook (70.74).
 - Remove the device.
- If mounted, remove the blocking device (70.71) for the closing latch (70.05).

- Replace the right side panel.
- Connect the control voltage.

Important

If the control voltage is connected again when the closing spring (70.25) is discharged, the motor (70.01) will immediately begin to charge it.

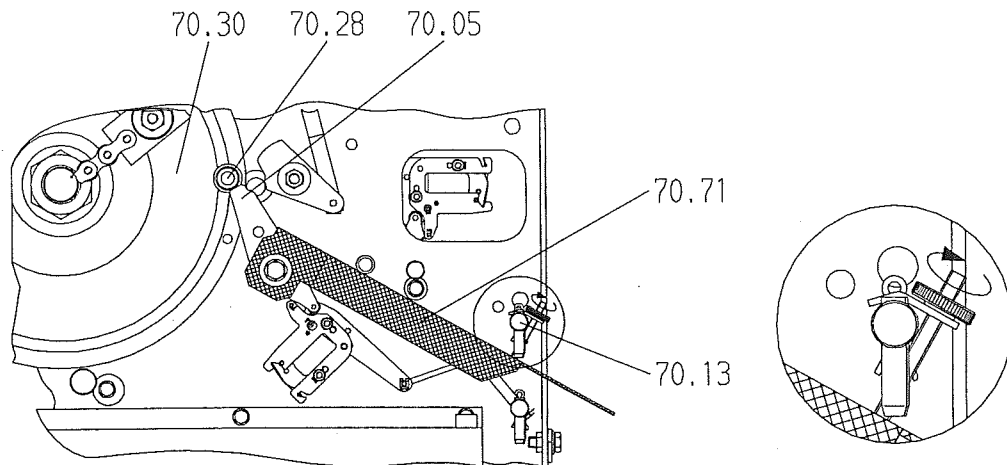


Figure B 7.3.2 c: Blocking device

Pos. 70.71 Blocking device (T103)

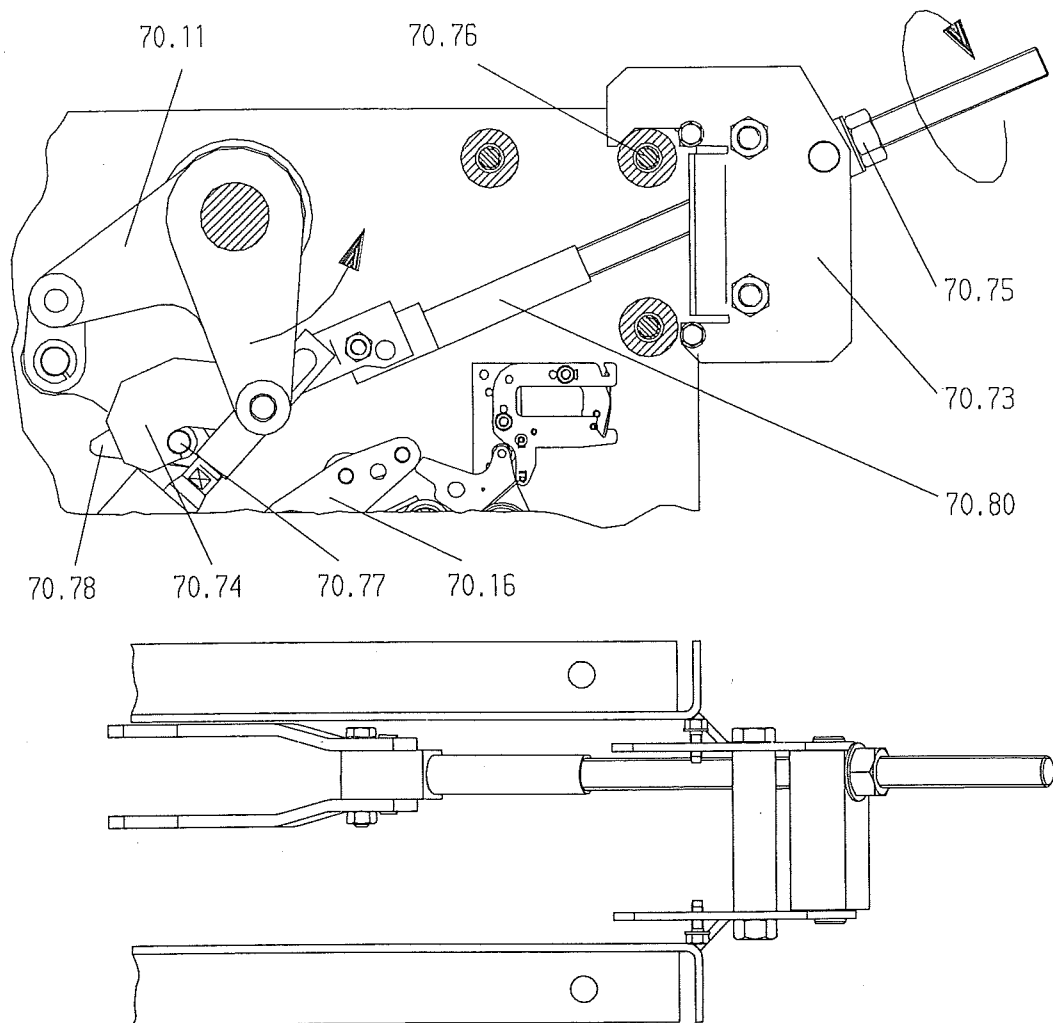


Figure B 7.3.2 d: Slow operation device

Pos. 70.72 Slow operation device (T104)

7.3.3 Slow Opening Operation

- Check the operating state of the circuit breaker and the mechanism:
 - Closing spring discharged or charged: the closing spring is charged when the roller (70.28) is engaged with the closing latch (70.05).
 - Breaker in closed position.
- Remove right side panel:
 - Remove M8 screw.
 - Pull the panel out and downward.

Important

- ⇒ Take safety precautions.
- ⇒ Disconnect the control voltage.
- ⇒ Block the manual opening levers (70.13):
- ⇒ Loosen the M6 screws.
- ⇒ Push the plate (70.58) up to the right.
- ⇒ Retighten the M6 screws.

- If the closing spring is charged, insert the blocking device (Figure B 7.3.2 c, part 70.71) for the closing latch (70.05), and attach to the axis of the manual opening lever (70.13).
- Mount the slow operation device (Figure B 7.3.2 d, part 70.72):
 - Place the support plate (70.73) of the device on the upper right spacer sleeve (70.76) and prop the device against the mechanism housing.
 - Attach the hook (70.74) of the device to the bolt (70.77) of the support latch (70.78).
- Turn the M16 nut (70.75) clockwise until the pressure is removed from the opening latch (70.16).
- Release the block on the manual opening lever (70.13).
- Push the plate (70.58) down.
- Execute a slow opening operation:
 - Unlock the opening latch (70.16) using the manual opening lever (Figure B 7.3.2 b, part 70.13).
 - At the same time, turn the nut (70.75) counterclockwise until the support latch (70.78) of the roller follower (70.11) has passed the opening latch (70.16).
 - Continue turning the nut (70.75) counterclockwise until the pressure is removed from the hook (70.74).
 - At the end of this operation, the opening spring (70.20) is discharged and the breaker position indicator (70.52) indicates "Breaker open."
- Block the manual opening levers (Figure B 7.3.2 b, part 70.13):
 - Push the plate (70.58) up.
 - Tighten the M6 screws.
- Remove the slow operation device (70.72).
- Remove the blocking device (70.12) for the closing latch.
- Replace the right side panel.
- Connect the control voltage.

| |
|-------------------------|
| <p>Important</p> |
|-------------------------|

If the control voltage is connected again when the closing spring (70.25) is discharged, the motor (70.01) will immediately begin to charge it.