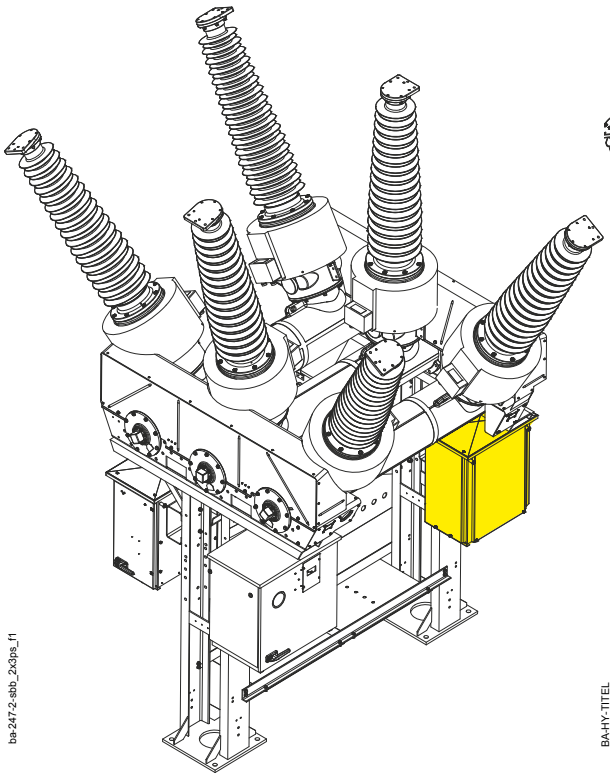
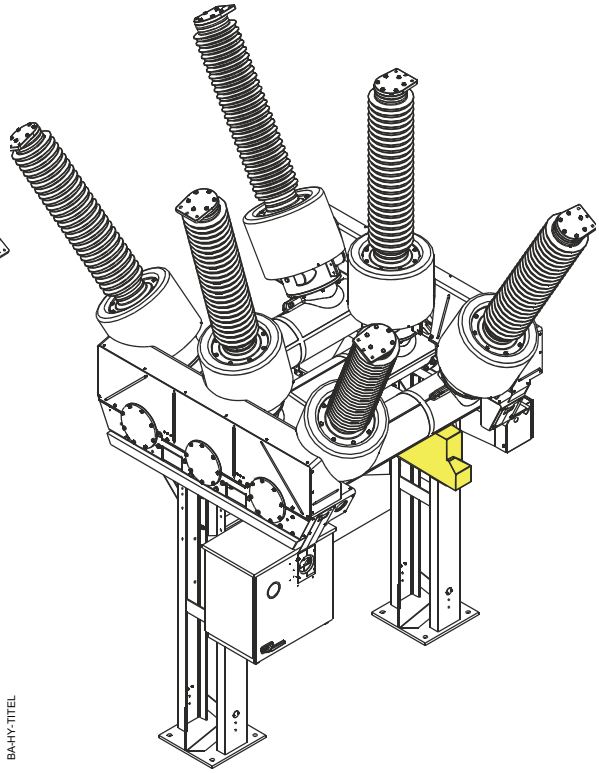
# Operating Instructions No. 247-2 (EN)

**Device:** **Hybrid Compact Switchgear Assembly**
**HYpact 72,5**
**HYpact 123**
**HYpact 145**
**HYpact 170**




**HYpact**
**with Type ME4 Motor-Operated Mechanism**




**HYpact**
**with Type ME1-3 Motor-Operated Mechanism**

**CAUTION**

The HYpact hybrid compact switchgear assembly is equipped with either a Type ME4 motor-operated mechanism or a Type ME1-3 motor-operated mechanism. Please follow the set of instructions pertaining to the specific type installed.

**Manufacturer:GE Grid GmbH**
**Lilienthalstrasse 150 - 34123 Kassel, Germany**

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# 1 Introduction

Your decision to use GE high voltage switchgear means that you have chosen a product that is very advanced technically and has proven effective and reliable in the field.

The entire development and production process for our high voltage switchgear is controlled by a DIN ISO 9001 certified quality management system, an ISO 14001 certified environmental management system, and the OHSAS 18001 occupational health and safety management system. Regular audits guarantee that our products and services meet a high quality standard.

In order to ensure optimum operation (and take advantage of all product benefits), please follow the instructions in this manual when installing, commissioning and operating the equipment. In the event of problems or equipment malfunction, please contact your local GE representative.

This manual describes installation, commissioning, operation, inspection, maintenance and reconditioning. Additional copies of this manual can be obtained from your local GE representative by specifying the OI-number.

GE's high voltage switchgear units are specifically designed to allow for long maintenance intervals. The operational reliability of the equipment is guaranteed by proper servicing and by following the instructions given in this manual. GE assumes no liability for damage due to failure to follow the manual instructions.

This document and the equipment described herein are subject to change without notice in the interest of further development. No claims of any kind may be derived from the specifications, figures or descriptions.

**GE Grid GmbH**
**Lilienthalstrasse 150**
**34123 Kassel**
**Germany**
**Telephone: +49 561 502-0**
**Fax: +49 561 502-2499**

| | |
|---|---|
| BG | Това оборудване съдържа флуориран парников газ ($SF_6$), обхванат в Протокола от Киото, който има потенциал за глобално затопляне (ПГЗ) 22200. $SF_6$ трябва да се улавя, а не да се изпуска в атмосферата. Повече информация относно използването и боравенето с $SF_6$ ще намерите в IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| CS | Toto zařízení obsahuje fluorový skleníkový plyn ($SF_6$), na který se vztahuje Kjótský protokol a který má potenciál ke globálnímu oteplování (GWP) 22200. $SF_6$ je třeba zpětně získat - nesmí se vypouštět do ovzduší. Více informací o použití a manipulaci s $SF_6$ viz IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| DA | Dette udstyr indeholder fluoreret drivhusgas ($SF_6$), omfattet af Kyoto-protokollen, som har et globalt opvarmningspotentiale (GWP) på 22200. $SF_6$ skal anvendes i et hermetisk lukket system og må ikke udledes i atmosfæren. For yderligere oplysninger om anvendelse og håndtering af $SF_6$, henvises til IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| DE | Das Betriebsmittel enthält das vom Kyoto-Protokoll erfasste fluorierte Treibhausgas $SF_6$ mit einem Treibhauspotenzial (GWP) von 22200. $SF_6$ muss zurückgewonnen werden und darf nicht in die Atmosphäre entlassen werden. Bei dem Umgang und der Handhabung mit $SF_6$ sind die Vorgaben in IEC 62271 High-Voltage Switchgear and Controlgear - Part 4 Use and Handling of Sulphur Hexafluoride ($SF_6$) zu beachten. |
| EL | Αυτός ο εξοπλισμός περιέχει φθοριούχο αέριο θερμοκηπίου ($SF_6$) που καλύπτεται από το Πρωτόκολλο του Κιότο και έχει Δυναμικό θέρμανσης του πλανήτη (GWP) 22200. Το $SF_6$ θα πρέπει να περισυλλέγεται και να μην απελευθερώνεται στην ατμόσφαιρα. Για περισσότερες πληροφορίες σχετικά με τη χρήση και το χειρισμό του $SF_6$, ανατρέξτε στο IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| EN | This equipment contains Fluorinated Greenhouse Gas ($SF_6$) covered by the Kyoto Protocol, which has a Global Warming Potential (GWP) of 22200. $SF_6$ should be recovered and not released into the atmosphere. For further information on the use and handling of $SF_6$, please refer to IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| ES | Este equipo contiene Gas Fluorado de efecto invernadero ($SF_6$) contemplado en el Protocolo de Kyoto, cuyo potencial de calentamietno global es de 22200 GWP. El $SF_6$ debe ser recuperado y no emitido a la atmósfera. Para más información del uso y gestión del $SF_6$, por favor ponerse en contacto con IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| ET | Käesolev seade sisaldab Kyoto protokolliga hõlmatud fluoritud kasvuhoonegaase ($SF_6$), millel on suur globaalse soojenemise potentsiaal (GWP) – 22200. $SF_6$ tuleks kokku koguda ning seda ei tohi atmosfääri lasta. Rohkem teavet $SF_6$ kasutamise ja käitlemise kohta vaadake IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| FI | Laite sisältää Kioton pöytäkirjassa mainittua fluorattua kasvihuonekaasua ($SF_6$) jonka globaali lämmityspotentiaali (GWP) on 22200 kertainen hiilidioksiidin GWP arvoon verrattuna. $SF_6$ kaasua ei saa päästää ilmakehään, vaan se on kerättävä asianmukaisesti talteen. Lisätietoja $SF_6$ kaasun käytöstä ja käsittelystä löytyy IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| FR | Cet équipement contient un gaz à effet de serre fluoré ($SF_6$) couvert par le protocole de Kyoto qui a un Pouvoir de Réchauffement Global de 22200 (PRG). Le $SF_6$ doit être récupéré et ne doit pas être relâché dans l'atmosphère. Pour plus d'information sur l'utilisation et la manipulation du $SF_6$ vous pouvez vous référer à la norme CEI 62271 : Appareillage haute tension - Partie 4 : Utilisation et manipulation de l'Hexafluorure de soufre ($SF_6$). |
| GA | Tá Gás Ceaptha Teasa Fluairínithe ($SF_6$), le Poitéinseal Téimh Domhanda (PTD) de 22200, a thagann faoin bPrótacal Kyoto, sa trealamh seo. Ba chóir $SF_6$ a aisghabháil agus ní cóir é a scaoileadh amach san atmaisféar. Chun breis faisnéise a rochtain ar conas $SF_6$ a úsáid agus a láimhseáil, déan tagairt le do thoil le IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| HU | A berendezés kén hexafluorid gázt ($SF_6$) tartalmaz a Kyoto szabályozásnak megfelelően, amelynek hatása van a 22200 föld felmelegítési képességére (GWP). Az $SF_6$ gázt vissza kell nyerni, és nem az atmoszférába kell engedni. Az $SF_6$ gázra vonatkozó kezeléssel kapcsolatos további információért lásd IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| IT | Questa apparecchiatura contiene Esafloruro di Zolfo ($SF_6$), disciplinato dal protocollo di Kyoto, che ha un Potenziale di Riscaldamento Globale (GWP) di 22200. Il gas $SF_6$ dovrebbe essere recuperato e non rilasciato nell'atmosfera. Per ulteriori informazioni sull'uso e la movimentazione del gas $SF_6$, per favore rivolgersi a IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| LT | Šis aprīkojums satur Kioto protokolā ietverto fluorinēto siltumnīcu gāzi ($SF_6$), kam piemīt globālās sasilšanas potenciāls (GWP) 22200. $SF_6$ ir jāatjauno un to nedrīkst izlaist atmosfērā. Papildinformāciju par $SF_6$ izmantošanu un apstrādi, lūdzu, skatiet IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| LV | Šios įrangos sudėtyje yra šiltnamio efektą sudarančių fluorintų dujų ($SF_6$), kurioms taikomas Kioto protokolas ir kurių globalinio klimato atšilimo potencialas („Global Warming Potential", GWP) yra 22200. $SF_6$ neturi būti išgaunamos ir išleidžiamos į atmosferą. Daugiau informacijos apie $SF_6$ naudojimą ir tvarkymą ieškokite IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| MT | Dan it-tagħmir jinkludi l-Fluorinated Greenhouse Gas ($SF_6$) koprut mill-Protokoll ta' Kjoto, li għandu Potenzjal ta' Tisħin tad-Dinja (Global Warming Potential) (GWP) ta' 22200. $SF_6$ għandu jinġabar lura u mhux jinħeles fl-atmosfera. Għal aktar informazzjoni dwar l-użu l-ġestjoni tal-$SF_6$, jekk jogħġbok irreferi għal IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| NL | Dit product bevat Gefluoreerd Broeikasgas ($SF_6$) dat is opgenomen in het Protocol van Kyoto. Dit gas heeft een aardopwarmingspotentieel (GWP) van 22200. $SF_6$ moet worden opgeslagen en mag niet in de atmosfeer terecht komen. Voor meer informatie over het gebruik en de behandeling van $SF_6$ verwijzen wij u naar IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| PL | To urządzenie zawiera sześciofluorek siarki ($SF_6$), fluorowany gaz cieplarniany objęty Protokołem z Kioto, którego potencjał tworzenia efektu cieplarnianego (Global Warming Potential - GWP) wynosi 22200. $SF_6$ powinien być odzyskiwany i nie uwalniany do atmosfery. Po dalsze informacje na temat użycia i obsługi $SF_6$, proszę zwracać się do IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| PT | Este equipamento contém gás hexafluoreto de enxofre ($SF_6$), o qual faz parte to Protocolo de Kyoto por possuir um Efeito Estufa de 22200. O gás $SF_6$ deve ser recuperado, não podendo ser lançado diretamente para a atmosfera. Para maiores informações sobre o use e manuseio de gás $SF_6$ , por favor consular o IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| RO | Acest echipament conţine gaz fluorurat cu efect de seră ($SF_6$), reglementat de Protocolul de la Kyoto, cu un potenţial de încălzire globală de 22200. $SF_6$ trebuie recuperat, nu eliberat în atmosferă. Pentru mai multe informaţii privind utilizarea şi manipularea gazului $SF_6$, consultaţi IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| SK | Toto zariadenie obsahuje fluorované skleníkové plyny ($SF_6$), ktoré podliehajú Kyotskému protokolu, a ktoré majú potenciál globálneho otepľovania (GWP) rovný 22200. $SF_6$ by mali byť recyklované a nie vypúšťané do atmosféry. Ak potrebujete ďalšie informácie ohľadom použitia a manipulácie s $SF_6$ , obráťte sa na IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| SL | Ta oprema vsebuje fluoriran toplogredni plin ($SF_6$), na katerega se nanaša Kjotski protokol, in ima potencial globalnega segrevanja (GWP) 22200. $SF_6$ se mora izločiti in shraniti in se ga ne sme izpuščati v ozračje. Več informacij o uporabi in rokovanju s $SF_6$, boste našli v IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| SV | Denna utrustning innehåller fluoriserad växthusgas ($SF_6$) vilken innefattas i Kyoto-protkollet och har en Global Warming-potential (GWP) om 22200. $SF_6$ bör återvinnas och ej avges till atmosfären. För ytterligare information om användning och hantering av $SF_6$, se IEC 62271: High-Voltage Switchgear and Controlgear - Part 4: Use and Handling of Sulphur Hexafluoride ($SF_6$). |
| HR | Radna tvar sadrži fluorirani stakleni?ki plin sumporov heksafluorid (SF6) koji je obuhva?en Kyotskim protokolom i ?iji stakleni?ki potencijal (potencijal globalnog zagrijavanja - GWP) iznosi 22200. SF6 mora se oporabiti i ne smije se ispuštati u atmosferu. Prilikom uporabe i rukovanja plinom SF6 potrebno je pridržavati se odredbi norme IEC 62271 - Visokonaponska sklopna aparatura, 4. dio - Uporaba i rukovanje sumpornim heksafluoridom (SF6). |

# 2 Safety

## 2.1 Safety Instructions

The operator of the high voltage switchgear described in this manual must make sure

- that work on high voltage switchgear is carried out solely by qualified personnel;
- that work complies with electrical codes and standards;
- that the individuals assigned to do the work are familiar with this manual and the safety instructions in the manual and that these instructions are followed.
  Personnel can obtain the necessary qualifications for operating the equipment by completing appropriate training programs at GE.

The five safety rules of electrical engineering must be followed:
- Disconnect the equipment from the power supply.
- Install safeguards to ensure that the power cannot be turned on again.
- Confirm that the equipment is de-energized.
- Earth (ground) and short-circuit the equipment.
- Cover or provide barriers for adjacent energized equipment.

This manual contains specific safety alert symbols and signal words that are defined as follows:

| | |
|---|---|
| **DANGER** | Dangerous situation that will result in death or serious injury. |
| **WARNING** | Dangerous situation that could result in death or serious injury. |
| **CAUTION** | Dangerous situation that could result in minor or moderate injury. |
| **CAUTION** | Situation that could result in damage to the product and/or a nearby object. |

# 3 Handling Sulfur Hexafluoride

Sulfur hexafluoride ($SF_6$) is an inert gas that is colorless and odorless, chemically neutral, non-combustible and approximately five times heavier than air. It is non-toxic and is not an ozone-depleting substance.

Pure $SF_6$ is completely safe for human beings and animals physiologically. Because of its weight, however, it can displace the air in poorly ventilated, lower-lying or underground spaces (e.g. basements, cable ducts and maintenance shafts).

$SF_6$ is not classified as a hazardous substance in European chemicals legislation.

It has no ecotoxic potential and does not contribute to destruction of the ozone layer. Because of its high global warming potential (22,200), it can contribute to the greenhouse effect if it is released into the atmosphere. Therefore do not dump or otherwise discharge $SF_6$ to the atmosphere, and reduce incidental emissions wherever possible.

If $SF_6$ is used to fill electrical switchgear, it must comply with standard IEC 60376.

**Standards governing $SF_6$ handling**

- IEC 60480 Guidelines for the checking and treatment of sulfur hexafluoride taken from electrical equipment and specification for its re-use.
- IEC 62271-4 Use and handling of sulphur hexafluoride ($SF_6$) in high-voltage switchgear and controlgear.

## 3.1 Safety Precautions When Handling $SF_6$

### 3.1.1 Oxygen Displacement

$SF_6$ is five times heavier than air and can accumulate in underground rooms or poorly ventilated spaces if it gets into the work environment in large quantities. In such cases air is displaced, which consequently reduces the amount of oxygen available. If the oxygen concentration drops below 16% (IEC 62271-4), there is the danger that personnel working in the surrounding area will suffocate. Poorly ventilated or non-ventilated underground spaces such as basements, cable ducts, maintenance shafts and drainage systems are especially vulnerable.

### 3.1.2 Mechanical Handling

The $SF_6$ operating pressure in the switchgear unit is higher than the atmospheric air pressure. To avoid the danger of injury resulting from mechanical breakage of housing components, personnel must comply with the safety precautions specified in the appropriate chapters of this operating manual.

### 3.1.3 Frostbite

If compressed $SF_6$ escapes quickly, the sudden expansion lowers its temperature. The gas temperature can drop substantially below 0°C. A person accidentally exposed to a gas jet may suffer severe frostbite. Therefore always wear safety goggles, leather gloves and appropriate work clothes when carrying out procedures involving components filled with $SF_6$.

**WARNING**

- Do not eat, drink, smoke or store food in rooms containing $SF_6$ systems or equipment.
- Make sure there is good room ventilation when servicing $SF_6$ switchgear (evacuating, filling, opening or cleaning the units).
- When carrying out procedures involving $SF_6$-filled components, always wear safety goggles, leather gloves and appropriate work clothes in order to prevent frostbite resulting from accidentally released gas.

### 3.2 Safety Precautions When Handling Used $SF_6$

$SF_6$ gas used in electrical equipment may contain decomposition products with toxic properties if it has been subjected to arcs. These decomposition products may exist in either a gaseous state or in the form of a powder.
Even small amounts of gaseous decomposition products give off warning signals (such as unpleasant pungent odors or irritation of nose, mouth and eyes), which allow people to escape in time to a safe location. Decomposition products in powder form irritate the skin.

**WARNING**

- Do not eat, drink, smoke or store food in rooms containing $SF_6$ systems or equipment.
- Make sure there is good room ventilation when servicing $SF_6$ switchgear (evacuating, filling, opening or cleaning the units).
- When carrying out procedures involving $SF_6$-filled components, always wear safety goggles, leather gloves and appropriate work clothes in order to prevent frostbite resulting from accidentally released gas.
- Do not stir up powdery decomposition products.
- Remove powdery decomposition products using an industrial vacuum cleaner equipped with a filter. The industrial vacuum cleaner must comply at a minimum with the specifications for dust class L (light).
- Avoid skin contact with, swallowing or inhaling powdery decomposition products by complying with the following rules:
- Wear appropriate protective respiratory equipment such as a full-face respirator (gas mask) or a respirator and gas-tight safety goggles.
- Wear a dustproof protective suit (disposable suit).
- Wear rubber gloves or disposable gloves.
- Wear rubber boots or disposable boots.
- After work is completed, wash the respirator, safety goggles and rubber gloves with water. Collect the water and dispose of it separately.
- After work is completed, wash your entire body thoroughly with soap and plenty of water.

Contaminated materials such as
- solid decomposition products,
- used drying agents,
- vacuum cleaner bags containing powdery decomposition products,
- or disposable protective clothing

must be neutralized and disposed of in accordance with the guidelines defined in IEC 62271-4 and local regulations.

### 3.3 Transport at the Installation Site

**CAUTION**

All pressure specifications are given in terms of relative pressure ($p_e$).

Pole units are shipped at a gas gauge pressure of approximately 0.03 MPa ($p_e$) (0.3 bar).

**DANGER**

The bursting of pressurized parts such as insulators or bushings may result in property damage or personal injury.
**Therefore:**
- **Do not handle pole units if the gas gauge pressure is higher than the shipping pressure.**

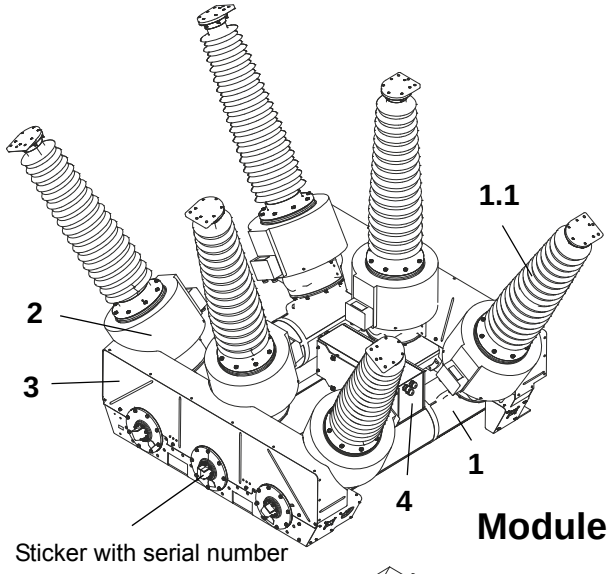
# 4 Components Supplied

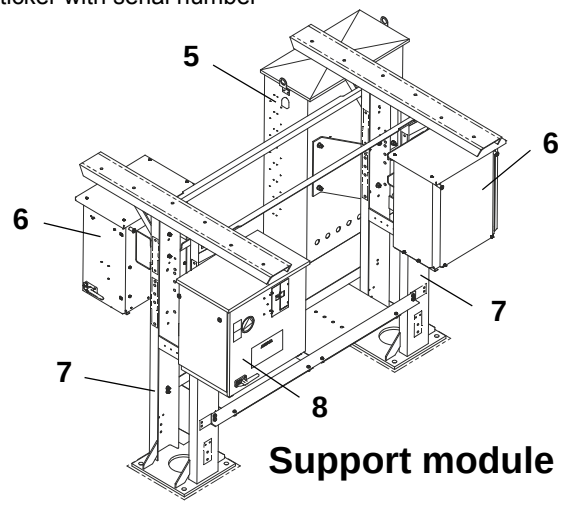
## 4.1 Scope of Supply (Standard)

For each HYpact compact switchgear assembly, the shipment contains the following components:

| | |
|---|---|
| **CAUTION** | **“HYpact with Type ME4 Motor-Operated Mechanism” on page 20**<br>**“HYpact with Type ME1-3 Motor-Operated Mechanism” on page 21** |

### 4.1.1 HYpact with Type ME4 Motor-Operated Mechanism

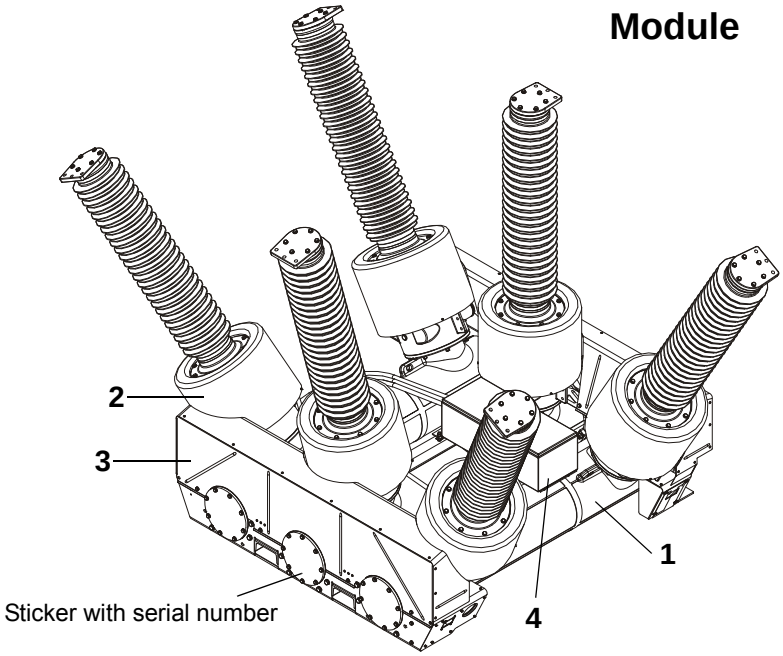


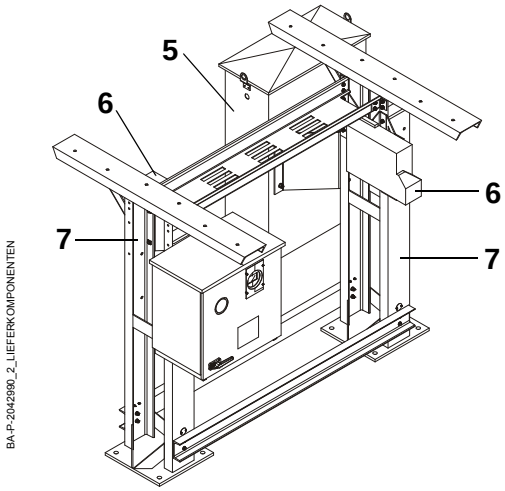




ba-247-2-lieferkomponenten

| | | |
|---|---|---|
| **1** | Pole | 3x |
| **1.1** | Insulator / Bushing | 6x |
| **2** | Current transformer | max. 6x |
| **3** | Ice guard (optional) | 2x |
| **4** | Transformer terminal box (optional) | 1x |
| **5** | Control cabinet | 1x |
| **6** | Operating mechanism for combination disconnector-earthing switch | 2x |
| **7** | Support | 2x |
| **8** | Operating mechanism for circuit breaker | 1x |
| **-** | Box containing accessories (not shown) | 1x |

### 4.1.2 HYpact with Type ME1-3 Motor-Operated Mechanism



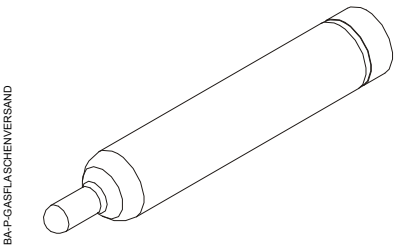




**Support module**

| | | |
|---|---|---|
| **1** | Pole | 3x |
| **1.1** | Insulator / Bushing | 6x |
| **2** | Current transformer | max. 6x |
| **3** | Ice guard (optional) | 2x |
| **4** | Transformer terminal box (optional) | 1x |
| **5** | Control cabinet | 1x |
| **6** | Operating mechanism for combination disconnector-earthing switch | 2x |
| **7** | Support | 2x |
| **8** | Operating mechanism for circuit breaker | 1x |
| **-** | Box containing accessories (not shown) | 1x |

## 4.2 Scope of Supply (Optional)

The gas for filling is not included in the scope of supply. If desired, it can be ordered separately.




Gas cylinder

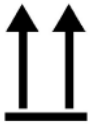
# 5 Transport and Storage

## 5.1 Transport and Handling

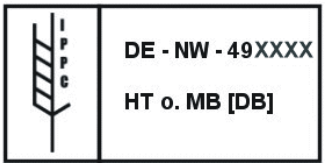
**WARNING**

Improper handling of the transport units may result in serious damage.
**Therefore:**
- **Comply with handling markings and labeling.**
- **Use hoisting equipment with adequate load-bearing capacity.**
- **Do not stand under suspended loads.**

The transport units are provided with handling markings and labeling. The type and number varies according to the type of transport unit. The handling markings give information about the safe handling of the transport units and must always be followed.

| | | | |
|---|---|---|---|
|  | Fragile |  | This way up |
|  | Sling here |  | Center of gravity |
|  | Use no forks |  | Use forks |
|  | Stacking limit by weight |  | Do not stack |
|  | Keep dry |  | Clamp as indicated |
|  | Do not damage barrier layer | | |

The wood used for the packaging may be chemically or thermally treated in order to prevent the spread of wood pests. Related rules and markings are defined in U.N. International Plant Protection Convention (IPPC) guidelines.

| | |
|---|---|
|   | IPPC-Symbol: Treated wood packaging |

## 5.2 Storage

The transport unit packaging is only designed for a limited storage period.

The following periods, figured from the shipping date, shall apply to storage in transport packaging:
- Storage outdoors: four months maximum
- Storage in a dry room: six months maximum.

The following periods and conditions shall apply to storage after unpacking:
- Storage outdoors: unlimited. The operating mechanism must be in the mounting position, and the anti-condensation heating unit must be connected and in operation.
- Storage in a dry room: unlimited.

**CAUTION**

Depending on the transport conditions, the operating mechanism may be wrapped and sealed in sheet or foil. This prevents penetration of moisture.
If the sheet or foil is damaged, the operating mechanism must be stored as described above.

# 6 Installation

## 6.1 Preparing for Installation

### 6.1.1 Documentation

The following documents are required for installation and commissioning and must be available at the installation site:

- Shipping documents
- Instruction manual with accompanying checklist
- Dimensioned drawing of the hybrid compact switchgear assembly
- Schematic diagram of the hybrid compact switchgear assembly
- Routine test certificate for the hybrid compact switchgear assembly

### 6.1.2 Checklist

The checklist is an essential supporting document for installation and commissioning and is enclosed with this manual as a colored sheet.
Performance of individual operations or steps must be confirmed on the checklist. For some operations, measured values must also be recorded.

A separate checklist must be filled out for each HYpact, and after commissioning it must be completed by filling in the date, name of authorized individual, company stamp and signature (clearly legible). A copy must be sent to the following address, indicating the serial no. of the circuit breaker in the subject:

GE Grid GmbH
Service Germany
Lilienthalstrasse 150
34123 Kassel
Germany
Hotline: +49 1803 257866
Fax: +49 561 502-2774
E-Mail: checkliste.kassel@alstom.com

The checklist is part of the warranty agreement between the customer and GE Grid GmbH. In the event of a warranty claim, the warranty claim may be reduced or declined if the completed checklist is not on file at GE Grid GmbH.

**Checklist for Installation and Commissioning**

| | | | |
|---|---|---|---|
| **HYpact Data** | | | |
| **Type & Serial No.:** | | | |
| **Customer:** | | | |
| **Station:** | | **Bay:** | |
| **Installation** | | | |
| **No.** | **Operation to Be Performed** | **Section** | ✓ |
| 1 | Safety instructions have been carefully read and are understood | 2.1 | |
| 2 | Materials provided by station checked for completeness | A2 | |
| 3 | Shipment checked for completeness and lack of damage | 6.4 | |
| 4 | Component serial numbers checked for agreement | 6.4.1 | |
| 5 | Support module premounted | 6.6 | |
| 6 | Module mounted | 6.12 | |
| 7 | Drive rod for circuit breaker installed | 6.13.1 | |
| 8a | Drive rod for front combination disconnector-earthing switch installed and adjusted; test operations performed manually | 6.13.2 | |
| 8b | Drive rod for rear combination disconnector-earthing switch installed and adjusted; test operations performed manually | 6.13.2 | |
| 9 | Transport lock removed from operating mechanism (circuit breaker) | 6.13.3 | |
| 10 | High voltage terminal pads mounted | 6.14 | |
| 11 | Supports grounded | 6.16 | |
| 12 | Torques for bolted joints checked | 6.17 | |

**Checklist for Installation and Commissioning**

| | | | |
|---|---|---|---|
| **HYpact-Data** | | | |
| **Type & Serial No.:** | | | |
| **Customer:** | | | |
| **Station:** | | **Bay:** | |
| **Commissioning:** | | | |
| **No.** | **Operation to Be Performed** | **Section** | **✓ or Value** |
| 1 | Safety instructions have been carefully read and are understood | 2.1 | |
| 2 | Safety instructions for $SF_6$ handling have been carefully read and are understood | 3 | |
| 3 | Density monitor connected | 7.1.1 | |
| 4 | Operating points of density monitor checked | 7.1.2 | |
| 5 | $SF_6$ gas topped up to rated pressure as shown on nameplate | 7.3 | |
| 6 | $SF_6$ piping seals checked using $SF_6$ leak detector | 7.3 | |
| 7 | Operation of anti-condensation heater(s) of operating mechanism, control cabinet and transformer terminal box checked | 7.4 | Ω<br>Ω<br>Ω<br>Ω<br>Ω<br>Ω |
| 8 | Five closing and five opening operations executed by remote control | 7.6.1 | |
| 9 | Running time of charging motor measured | 7.6.2 | s |
| 10 | Closing time [ms] checked (circuit breaker) | 7.6.4 | A ms<br>B ms<br>C ms |
| 11 | Opening time [ms] checked (circuit breaker) | 7.6.4 | A ms<br>B ms<br>C ms |
| 12 | Closing time spread between phases (circuit breaker) | 7.6.4 | ms |
| 13 | Opening time spread between phases (circuit breaker) | 7.6.4 | ms |
| 14 | Manual closing & opening operations checked | 7.6.5 | |
| 15 | Anti-pumping system checked | 7.6.7 | |
| 16 | Functional lockout checked | 7.6.8 | |
| 17 | Count shown on operations counter recorded | 7.6.9 | |
| 18 | Testing and measuring equipment removed | 7.6.11 | |
| 19 | Remarks: | | |

| Combination disconnector-earthing switch (front) | | | |
|---|---|---|---|
| 20 | Nameplate checked | - | |
| 21 | Check to make sure that the screw locking compound on the mounting screws of the metal dial and on the mounting screw of the indicator is not damaged. | | |
| 22 | Operation of mechanism's anti-condensation heater checked | 7.4 | Ω |
| 23 | Operation of alarm contacts in closed and open positions checked | 7.6.10 | |
| 24 | Five closing and five opening operations executed by remote control | 7.6.1 | |
| 25 | Check to make sure the indicators are within the respective scale division in all positions of the combination disconnector-earthing switch. | *(see figure on page 70)* and *(see figure on page 71)* | |
| 26 | Running time of mechanism motor measured<br>- Closing operation, disconnector<br>- Opening operation, disconnector<br>- Closing operation, earthing switch<br>- Opening operation, earthing switch | 7.6.10 | |
| 27 | Power consumption of mechanism motor measured<br>- Closing operation, disconnector<br>- Opening operation, disconnector<br>- Closing operation, earthing switch<br>- Opening operation, earthing switch | 7.6.10 | |
| 28 | Crank hole bolt inserted in crank hole and secured with padlock | A7 | |

| Combination disconnector-earthing switch (rear) | | | |
|---|---|---|---|
| 29 | Nameplate checked | - | |
| 30 | Check to make sure that the screw locking compound on the mounting screws of the metal dial and on the mounting screw of the indicator is not damaged. | | |
| 31 | Operation of mechanism's anti-condensation heater checked | 7.4 | Ω |
| 32 | Operation of alarm contacts in closed and open positions checked | 7.6.10 | |
| 33 | Five closing and five opening operations executed by remote control | 7.6.1 | |
| 34 | Check to make sure the indicators are within the respective scale division in all positions of the combination disconnector-earthing switch. | *(see figure on page 70)* and *(see figure on page 71)* | |
| 35 | Running time of mechanism motor measured<br>- Closing operation, disconnector<br>- Opening operation, disconnector<br>- Closing operation, earthing switch<br>- Opening operation, earthing switch | 7.6.10 | |
| 36 | Power consumption of mechanism motor measured<br>- Closing operation, disconnector<br>- Opening operation, disconnector<br>- Closing operation, earthing switch<br>- Opening operation, earthing switch | 7.6.10 | |
| 37 | Crank hole bolt inserted in crank hole and secured with padlock | A7 | |

| Check of Overall Operation | | | |
|---|---|---|---|
| 38 | Resistance of main circuit measured with A | 7.6.3 | A<br>B<br>C |
| 39 | Interlocks between high voltage devices checked | - | |
| 40 | Wiring of control cabinet and/or individual devices checked | - | |
| 41 | Testing and measuring equipment removed | 7.6.11 | |

| Equipment VT and CT | | | |
|---|---|---|---|
| 42 | Removing the transport securing device on the CT or CT box | | |
| 43 | Check the VT terminal box for transport securing device (Grounding bridges compared with the circuit diagram) | - | |
| 44 | $SF_6$ gas topped up to rated pressure as shown on nameplate of the VT | - | A MPa<br>B MPa<br>C MPa |
| 45 | Check the shock indicators mounted on the inside of the VT (voltage transformer) terminal box. (If an indicator has tripped – shown by the fact that the steel balls and springs have separated from the positioning feature – notify the manufacturer immediately and provide all available information so that a decision can be made regarding further action.)<br>**CAUTION:**<br>**If an indicator has triggered, notify the manufacturer immediately and provide all available information so that a decision can be made regarding further action!** | | |

Please send one completed and signed copy of the checklist to:
GE Grid GmbH, Service Germany, Lilienthalstrasse 150, 34123 Kassel, Germany
**Fax: +49 561 502-2774, E-Mail: checkliste.kassel@alstom.com**

Place Date Stamp Signature

## 6.2 Materials and Equipment to Be Provided by Customer

Materials and equipment not included in the scope of supply are listed in the appendix. They include the following items:

- Tools
- Hoisting equipment
- Testing and measuring equipment
- Materials
- Foundations, anchor bolts and fasteners
- Gas for filling the HYpact

These materials and equipment must be provided by the station.

## 6.3 Use of Auxiliary Materials and Supplies

Auxiliary materials and supplies needed for installation are shipped in the box containing accessories.
Detailed instructions for use of required auxiliary materials and supplies such as lubricants and locking compounds are given in Appendix A2. The various procedures are indicated in the text of the instruction manual by abbreviations (such as L1 or S1), which are explained in the appendix.

## 6.4 Unpacking the Transport Units

Check the transport units for completeness and lack of damage. In the event of shipping damage, notify the freight forwarder and your authorized GE representative immediately.

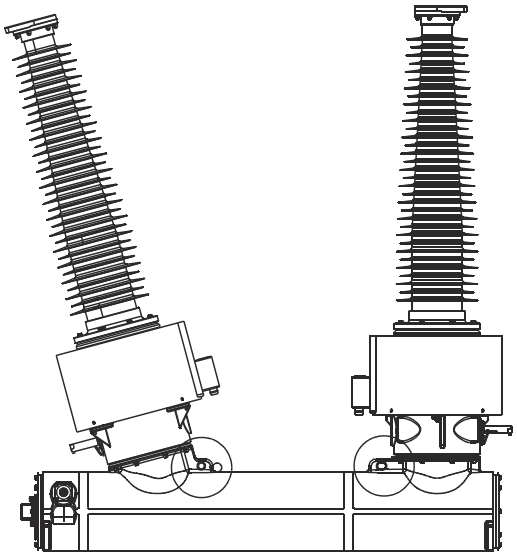

Improper handling of the transport units may result in serious damage.
**Therefore:**
- **Comply with handling markings and labeling.**
- **Use hoisting equipment with adequate load-bearing capacity.**
- **Do not stand under suspended loads.**

### 6.4.1 Checking Component Serial Numbers for Agreement

- Check the serial number of the support module. This number is on the nameplate of the control cabinet.
- Check to make sure the serial number agrees with the module serial number. The module serial number is located on a sticker on the module.
- Check to make sure that the serial number of the circuit breaker drive rod agrees with the serial number of the circuit breaker operating mechanism, which is on the nameplate of the circuit breaker operating mechanism.
- Check to make sure the serial number of the drive rod(s) of the combination disconnector-earthing switch(es) agrees with the serial number of the support module, which is on the nameplate of the control cabinet.

**CAUTION**

The cast-on lugs (1) on the tanks must not be used to lift the module.



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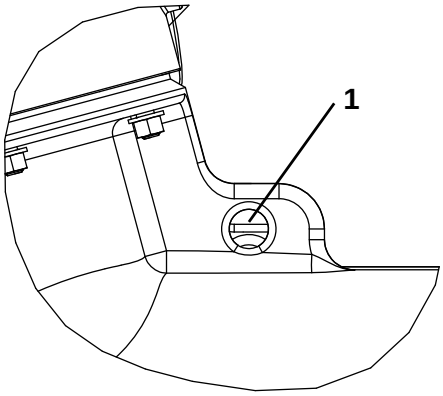


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## 6.5 Module

The module can be moved by using either a forklift truck (provided that the required forklifting fixtures [6] are mounted on the module and are included in the scope of delivery) or a crane.

**CAUTION**

To prevent damage to the tank when lifting the module using a forklift truck, forklifting fixtures (6) have been attached to the module ***(see "Mounting the Module" on page 62)***. These forklifting provisions must be installed if the module is to be lifted using a forklift truck.
Cast-on lugs are located on the tank, but they must not be used for lifting the module. To lift the module using a crane, proceed as shown in ***"Lifting the module using a crane" on page 34***.

**Lifting the module using a forklift truck**

- Lift the module using a forklift truck (fork length 2.30m, cross section 150x60mm) as shown in Figure and position it above the pre-mounted supports.
  - For safety reasons, do not retract the fork and back up the fork-lift truck until the module has been bolted to the supports.

**Lifting the module using a crane**

- Remove the forklifting fixtures (6).
- Secure the hoisting gear to the outer poles as shown in the figure. Lift the module using a crane and position it above the pre-mounted supports.
- Slowly lower the module.
- Lower the crane a few centimeters more in order to remove the tension from the hoisting gear.

## 6.6 Premounting the Support Module

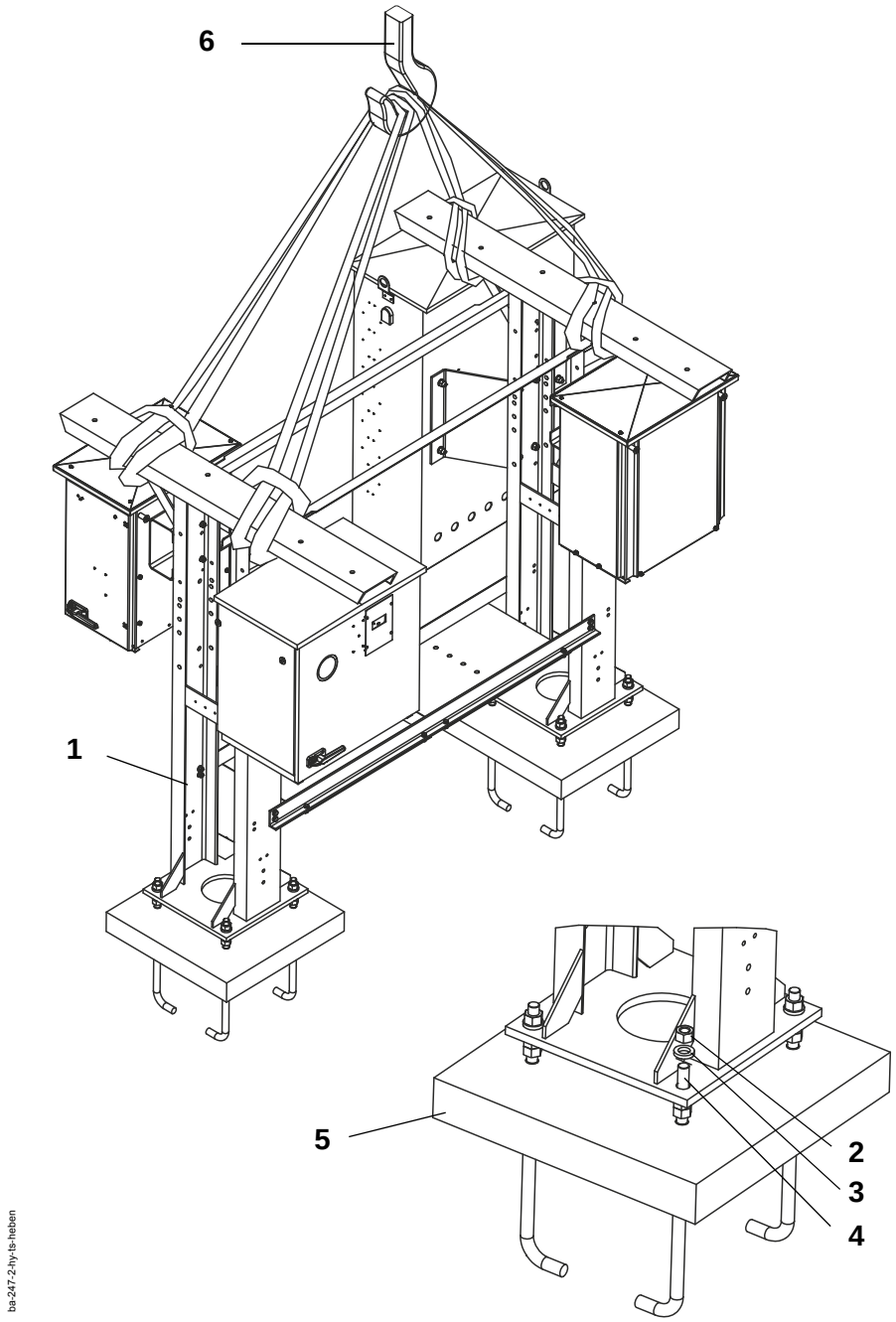
**CAUTION**

*“HYpact with Type ME4 Motor-Operated Mechanism” on page 36*
*“HYpact with Type ME1-3 Motor-Operated Mechanism” on page 37*

The support module is fastened using eight anchor bolts. Each anchor bolt has three nuts and two washers. The support module is adjusted using the lower two nuts and is fastened using the upper nut. One washer each is placed between the support and the nut immediately below and above it.

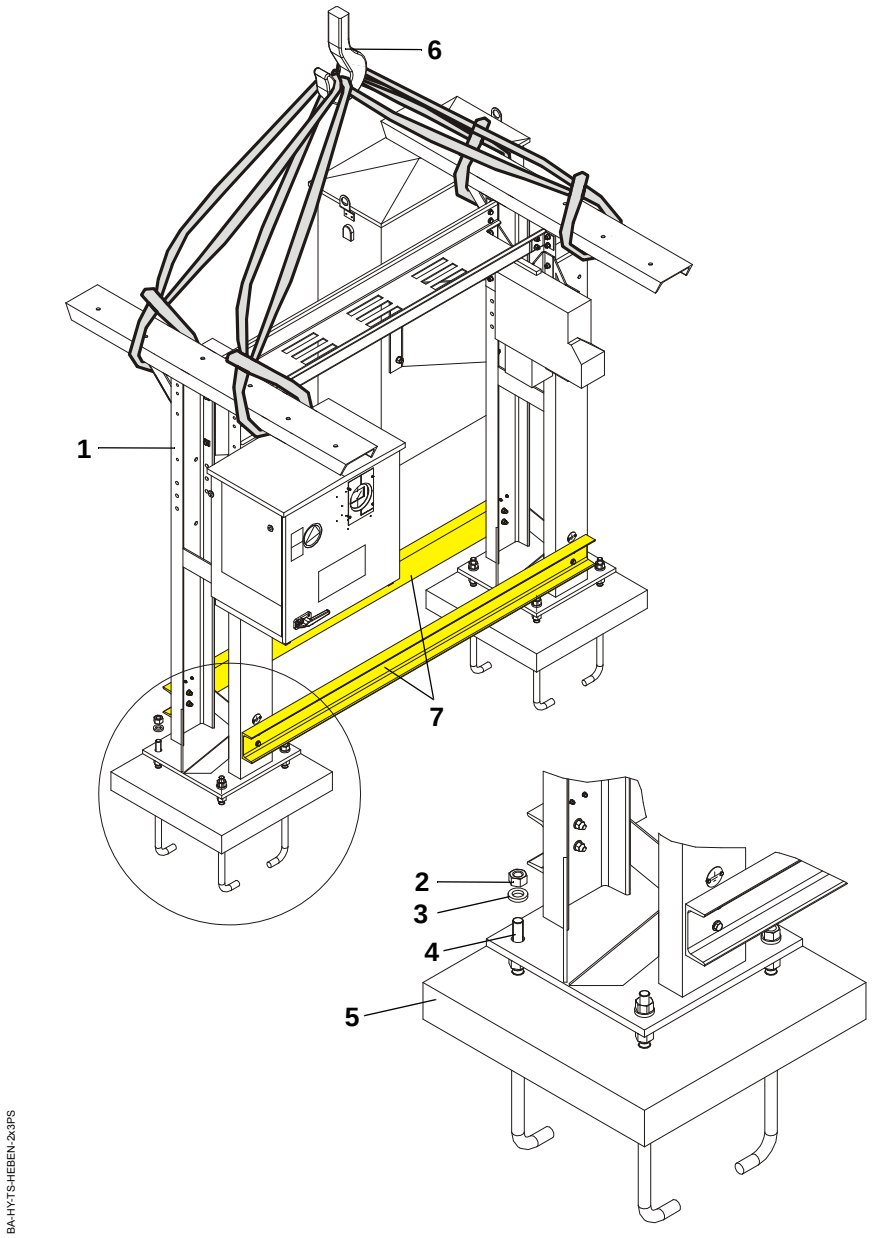
- Remove the upper nuts (2) and washers (3) from the anchor bolts.
- Screw the lower anchor bolt nuts (2) down until they are just above the foundation.
- Lubricate the anchor bolt threads as per L1.
- Attach the support module (1) to the crane.
- Lift the support module and set it down on the eight anchor bolts.
- Align the support module horizontally in both directions using a spirit level or hydrostatic level. Use the two upper support surfaces (mounting surfaces for the module) as the reference surface (support to support tolerance +/ -3 mm).
- Screw the upper washers (3) and nuts (2) on the anchor bolts, tighten them to a torque of 250 Nm and lock them.

### 6.6.1 HYpact with Type ME4 Motor-Operated Mechanism




| | | |
|---|---|---|
| **1** | Support module | 1x |
| **2** | Nut, M24 | 24x |
| **3** | Washer, 24 | 16x |
| **4** | Anchor bolts | Provided at site by customer (corrosion-resistant steel with minimum strength of Rp 235 N/mm$^2$) |
| **5** | Foundation | Provided at site by customer |
| **6** | Lifting tackle | - |

### 6.6.2 HYpact with Type ME1-3 Motor-Operated Mechanism

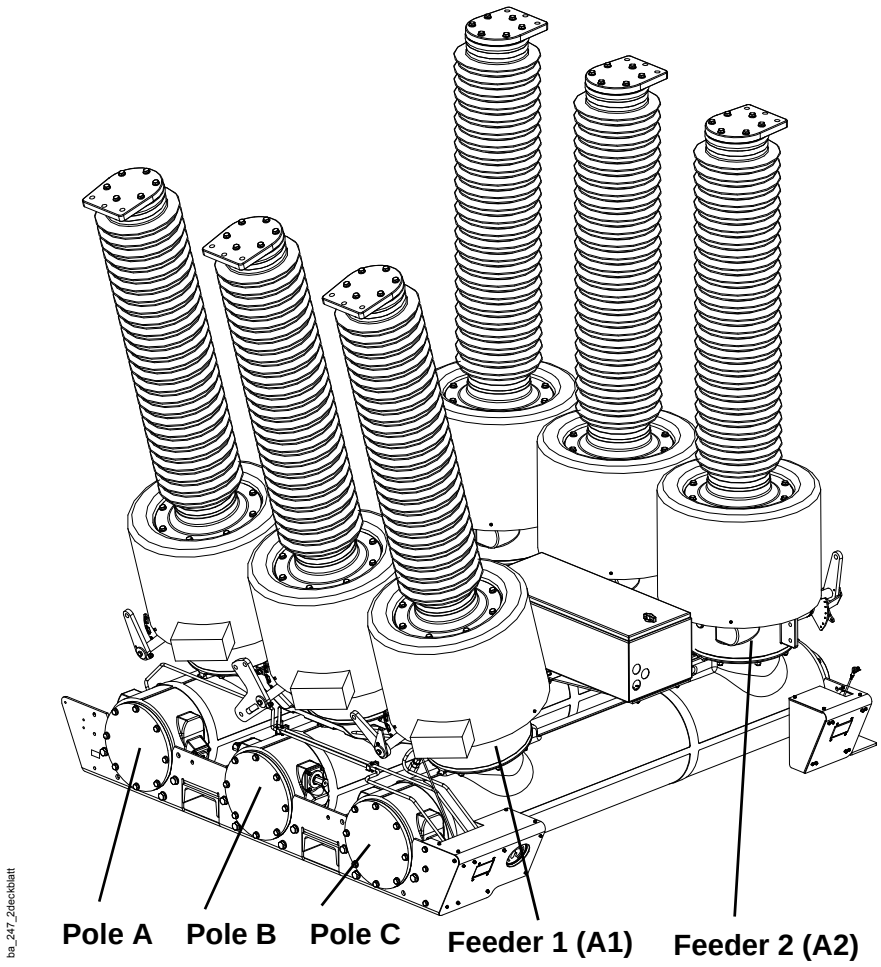


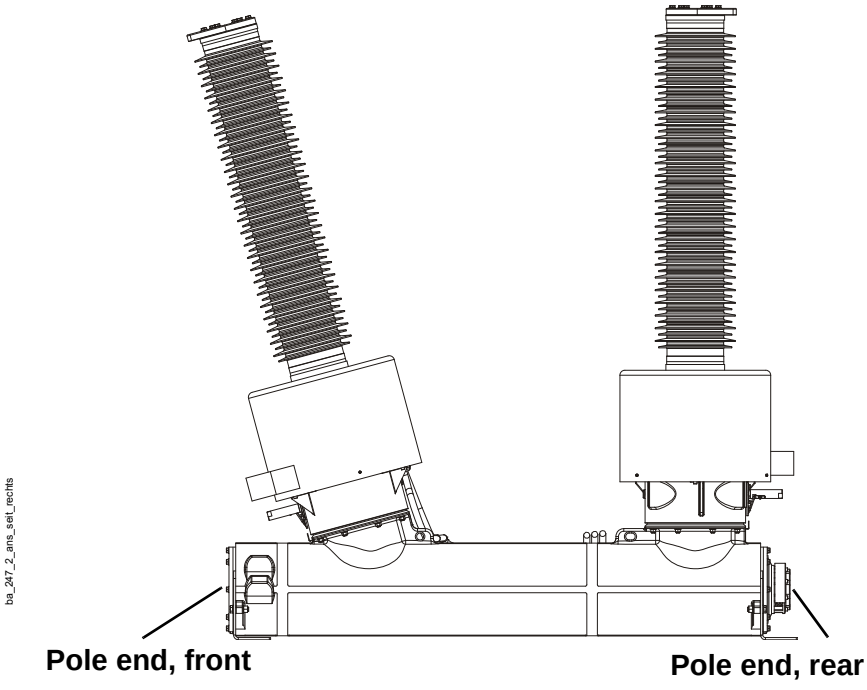

| | | |
|---|---|---|
| **1** | Support module | 1x |
| **2** | Nut, M24 | 24x |
| **3** | Washer, 24 | 16x |
| **4** | Anchor bolts | Provided at site by customer (corrosion-resistant steel with minimum strength of Rp 235 N/mm$^2$) |
| **5** | Foundation | Provided at site by customer |
| **6** | Lifting tackle | - |
| **7** | Stabilizers | 2x |

## 6.7 Spreading the Module (Pole A)

### 6.7.1 Preparing the Module for Spreading (Pole A)

**Module designations**



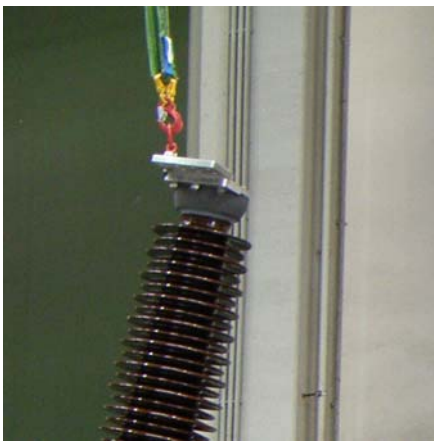



- Cut through all transport locks (cable ties) on the operating linkage and the indicating linkage so that the module will not be impeded during the spreading process

### 6.7.2 Spreading the Module (Pole A)

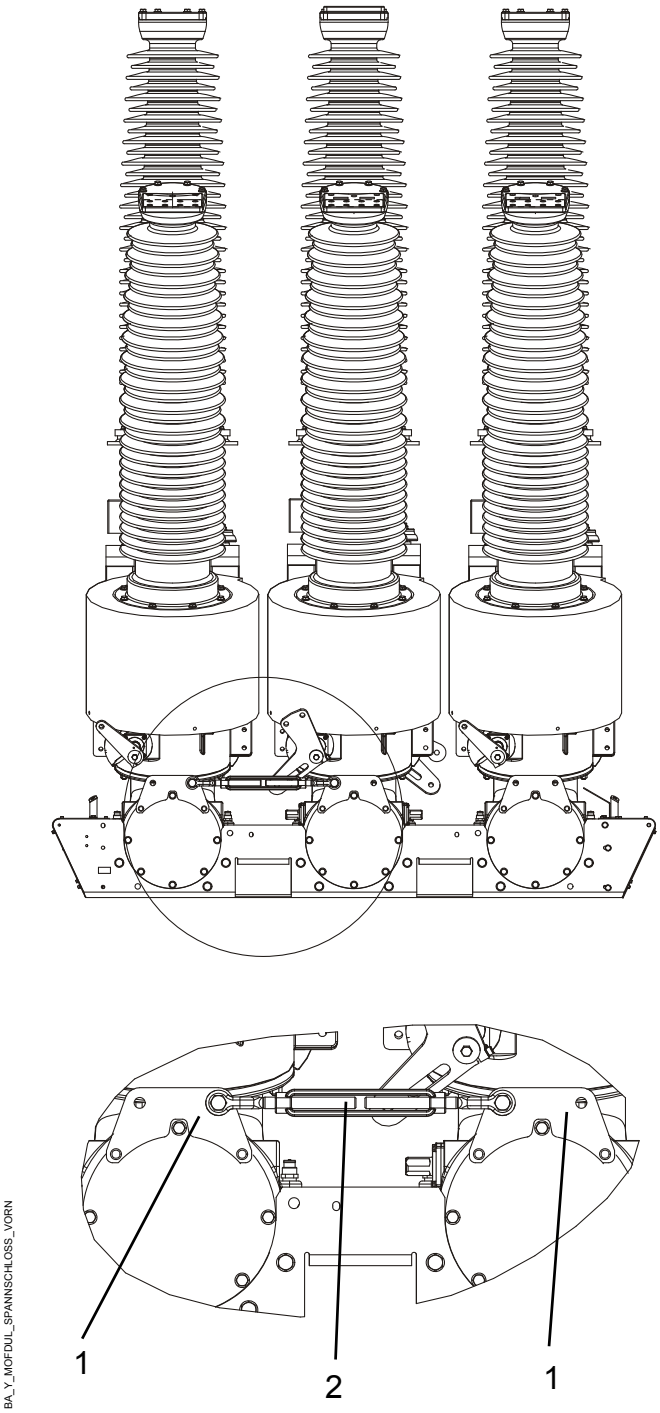
**DANGER**

For safety reasons, the pole being spread must be secured by a crane during the entire spreading process so that it will not tip over. The crane must be repositioned to follow the movement of the pole during the spreading process.



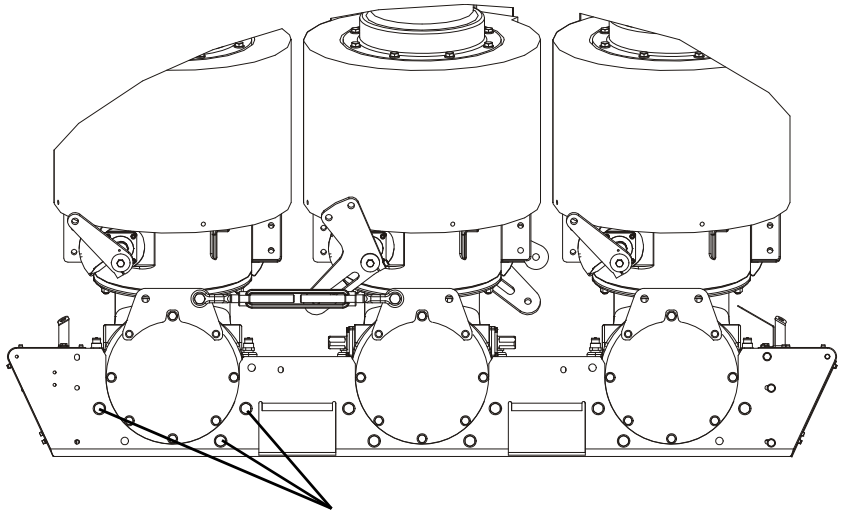
Securing the phase during the spreading process

- For spreading purposes, install the turnbuckle between Pole A and Pole B.




| | | |
|---|---|---|
| **1** | Turnbuckle eyes | 3x |
| **2** | Turnbuckle | 1x |

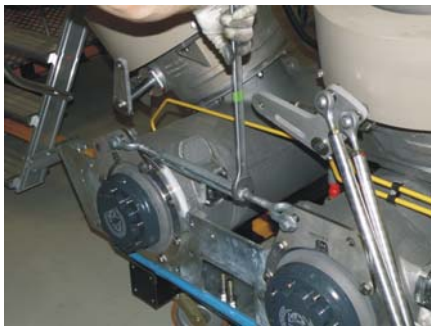
- Unscrew and remove all mounting bolts between pole mount and Pole A (remove three bolts each for A1 and A2). **Important: All Pole B mounting bolts must remain tightened.**

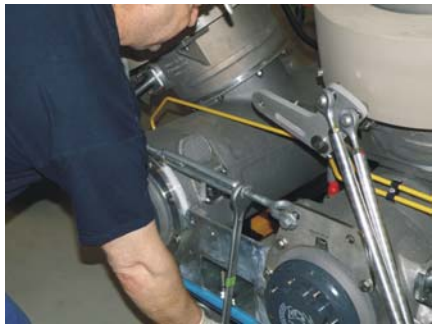


BA_Y_MODUL_POL_A_LOESEN

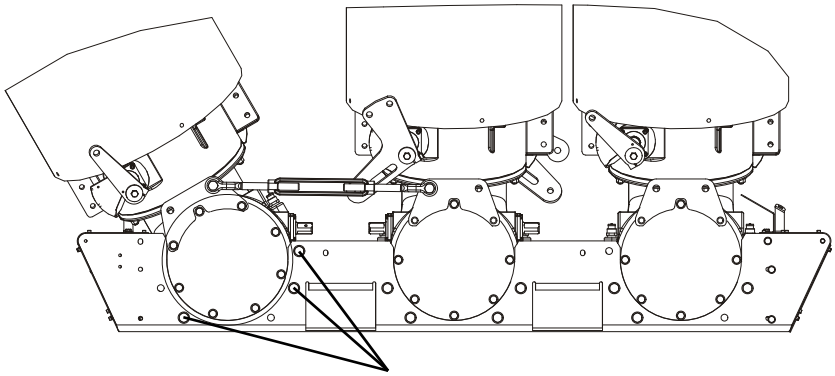
**Remove from feeders A1 and A2 (M16x60)**

- Check to make sure that all Pole A mounting screws have actually been removed.
- Fit the wrench over the hexagonal turnbuckle nut. The ends of the turnbuckle are lengthened when the turnbuckle nut is turned (make sure you are turning in the right direction). This pushes Pole A away from Pole B, and this movement is converted into a rotary motion by the bearing assembly in the pole mount. Continue turning the turnbuckle nut and lengthening the turnbuckle until the mounting holes in the tank line up with the next set of holes in the pole mount.



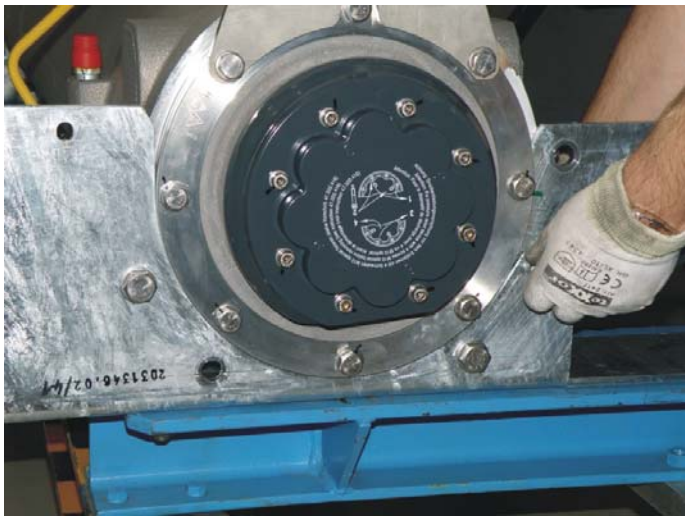


- When the holes in the pole mount line up again with the pole mounting holes, insert the mounting bolts and washers again and secure with the nuts (A1and A2) but do not tighten them yet.



BA_Y_MODUL_POL A GESPR

**New bolt position at feeders A1 and A2 (M16x60)**

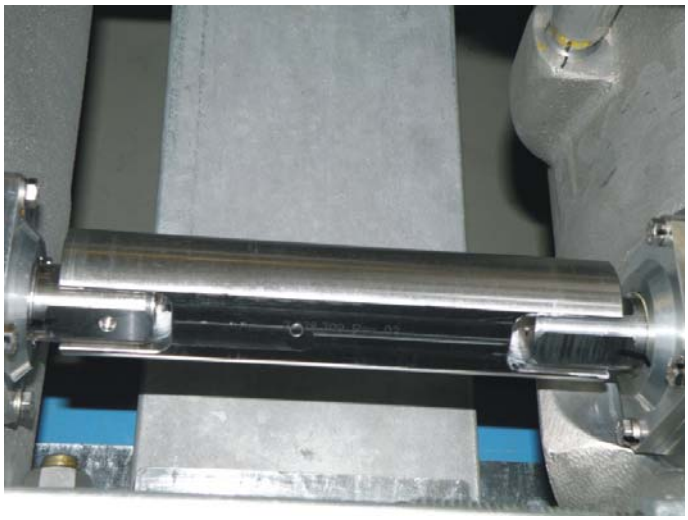


### 6.7.3 Connecting the Shaft Ends of Pole A to Pole B at Front Pole End

- When connecting the shaft ends to the connecting shaft, make sure that the position of the shaft ends in the tank is not changed or turned (the position of the shaft ends has been marked at the factory with a felt-tip pen).

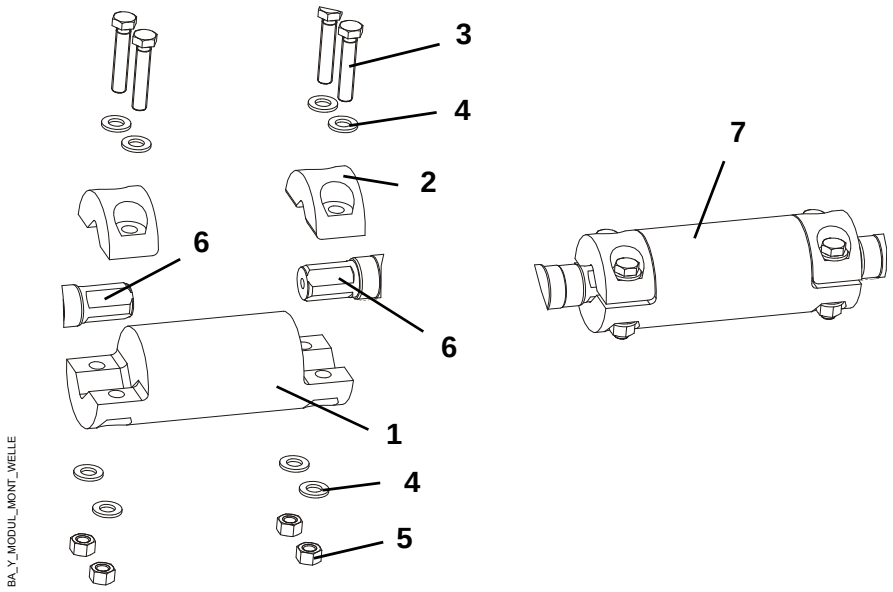
- The shaft ends of Pole A and Pole B must now be lined up exactly with one another (aligned). Use the coupling shaft for the mechanism side (see picture) to check the alignment of the shaft ends with one another.

- If the coupling shaft cannot be slid manually over the shaft ends, then the positional accuracy of the shafts relative to one another must be corrected by fine adjustment of Pole A.



The shaft ends are aligned when the coupling shaft can be slid manually over the shaft ends.

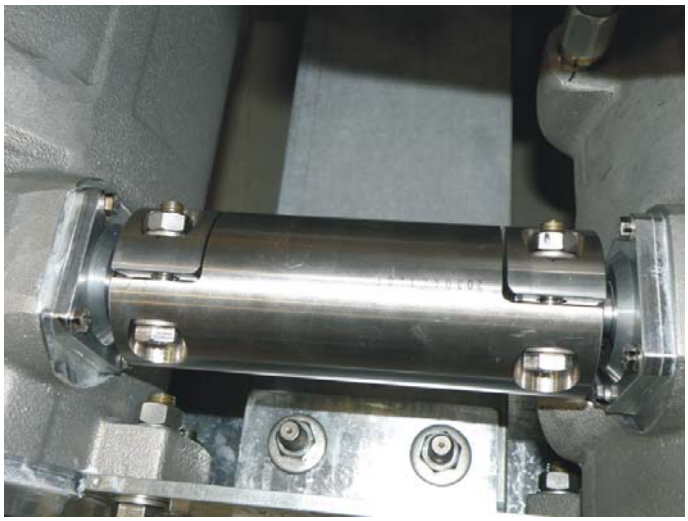
## 6.8 Installing the Connecting Shaft (Connecting Pole A and Pole B)




| | | |
|---|---|---|
| **1** | Connecting shaft HYP 312 | 1x |
| **2** | Clamp | 2x |
| **3** | Hexagon bolt, M12x60 A2-70 | 4x |
| **4** | Washer, 12 - 200HV-A2 | 8x |
| **5** | Hexagon nur, M12 A2-70 | 4x |
| **6** | Shaft end | 2x |
| **7** | Connecting shaft, already installed | - |

- Place the connecting shaft (1) against the shaft ends and screw on using the clamps (2).

- "Tighten all four nuts (5) to a torque of 60 Nm.



- After the coupling shaft has been installed, retighten all loose bolted joints between Pole A and the pole mount to a torque of 146 Nm.
- Remove the turnbuckle.

## 6.9 Spreading the Module (Pole C)

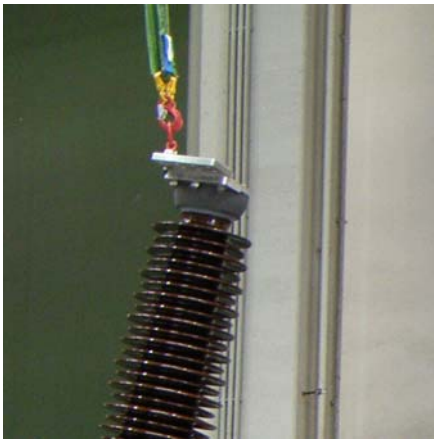
### 6.9.1 Preparing the Module for Spreading (Pole C)

- Cut through all transport locks (cable ties) on the levers and linkage between Pole B and Pole C so that the module will not be impeded during spreading..

### 6.9.2 Spreading the Module (Pole C

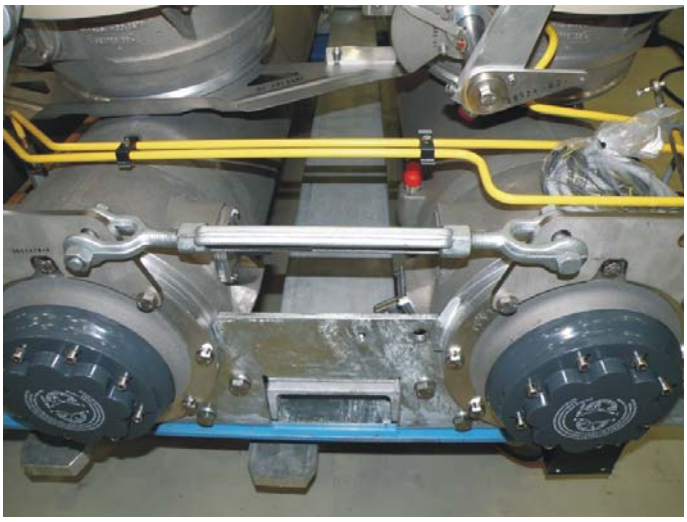
**DANGER**

For safety reasons, the pole being spread must be secured by a crane during the entire spreading process so that it will not tip over. The crane must be repositioned to follow the movement of the pole during the spreading process.

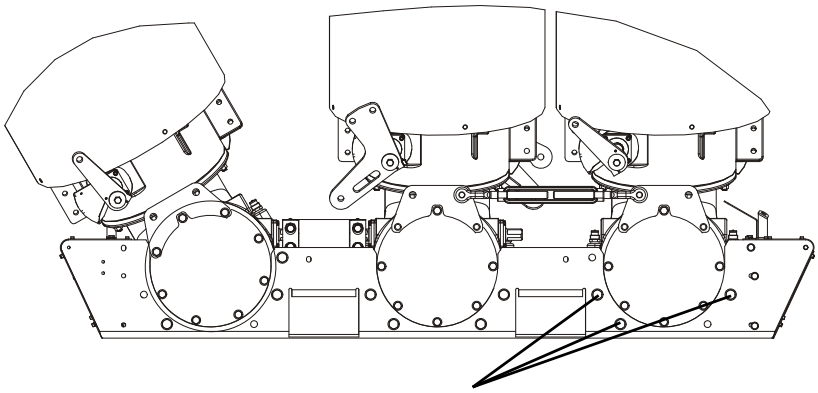


Securing the phase during the spreading process

- For spreading purposes, install the turnbuckle between Pole B and Pole C. ***(see figure on page 40)*** **and (picture below).**



- Loosen and remove all mounting bolts between the pole mount and Pole C (remove three bolts each at A1 and A2). **Important: All Pole B mounting bolts must remain tightened.**

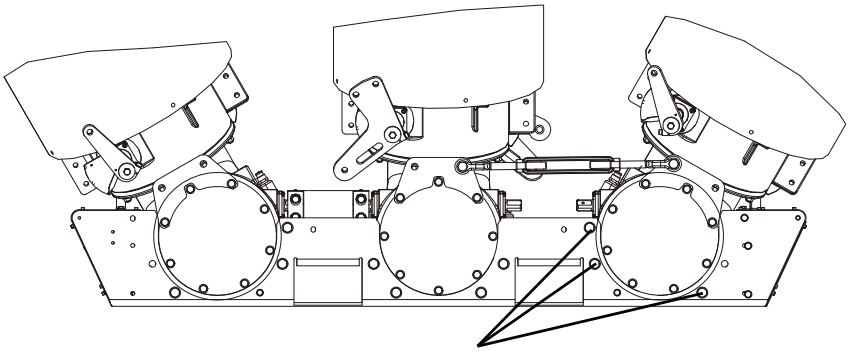


BA_Y_MODUL_POL_C_SPREIZEN

**Remove from feeders A1 and A2 (M16x60)**

- Complete the procedure for spreading Pole C, as already described for spreading Pole A ***(see "Spreading the Module (Pole A)" on page 38)***.

- When the holes in the pole mount line up again with the pole mounting holes, insert the mounting bolts and washers again and secure with the nuts but do not tighten them yet.



**New bolt position at feeders A1 and A2. (M16x60)**

## 6.10 Installing the Coupling Shaft Connecting between Pole C and Pole B

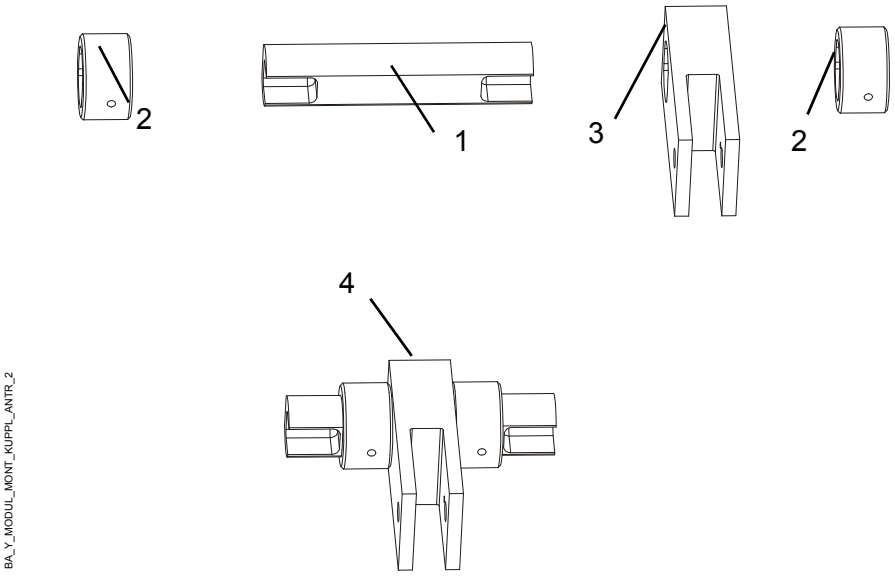
### Connecting the shaft ends at the front pole end

- When connecting the shaft ends of Pole B and Pole C, proceed in the same way as when connecting the shaft ends of Pole A and Pole B..

- Remove the coupling shaft (1) again from the shaft ends and lubricate the ends with PG54.

- Lubricate the hole for the coupling shaft (1) in the lever (3) with PG54.

- Now slide the lever (3) and both setting collars (2) on the coupling shaft (1) and push them in until the recesses for the shaft ends are exposed.



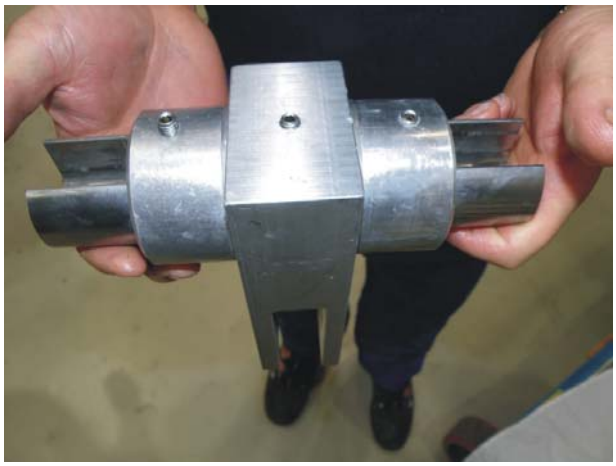

BA_Y_MODUL_MONT_KUPPL_ANTR_2

| | | |
|---|---|---|
| **1** | Coupling shaft | 1x |
| **2** | Setting collar for coupling | 2x |
| **3** | Lever of coupling shaft | 1x |
| **4** | Mechanism coupling assembly,<br>ready for installation | 1x |

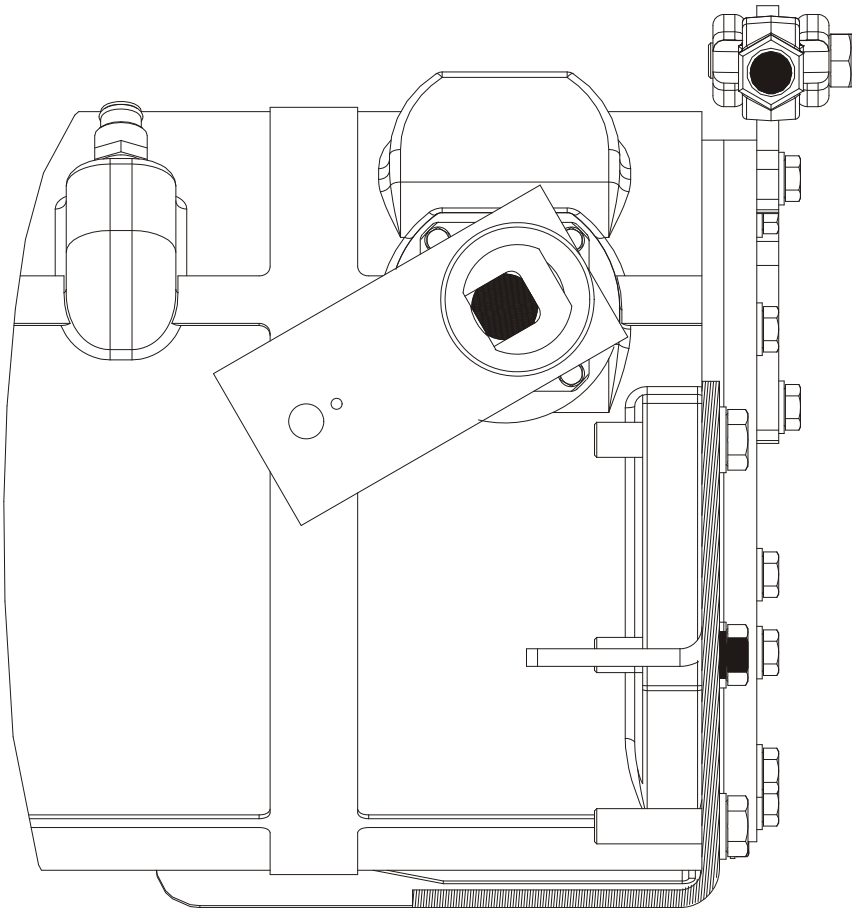
View of the mechanism coupling assembly

.

- Install the preassembled "coupling shaft (4)" assembly, as shown in the picture, between the shaft ends.



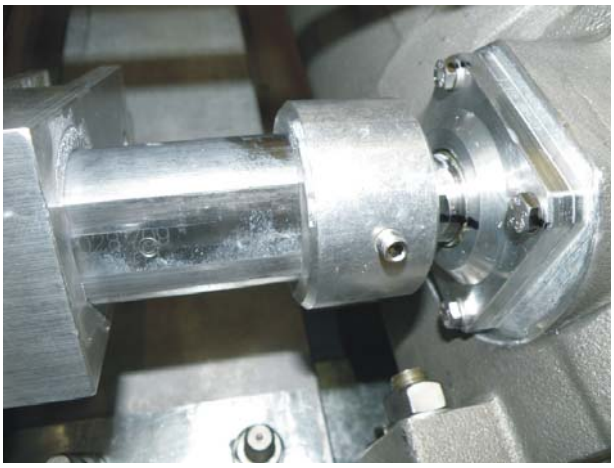
See diagram below for installation position of coupling.



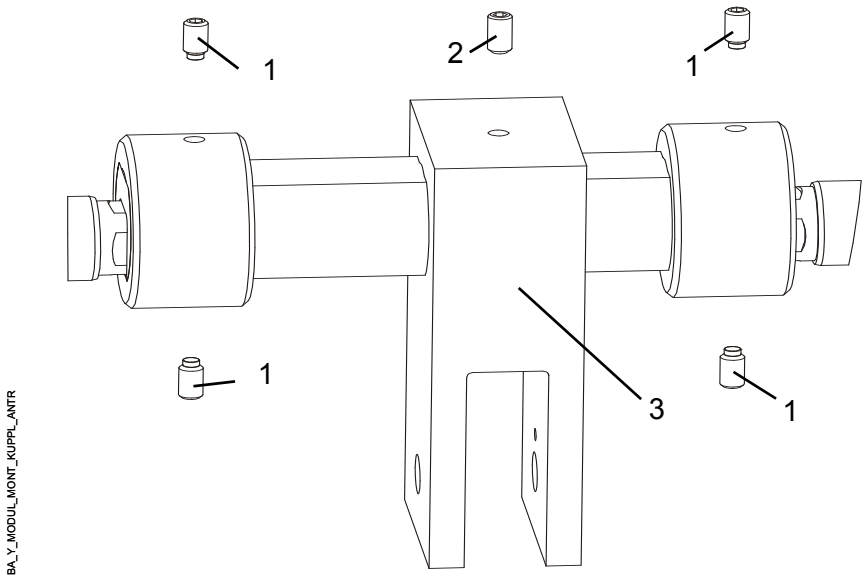
BA_V_MODUL_EINBAUL_KUPPL

- Slide out both setting collars again so that the setscrew in the setting collar is aligned with the locating hole in the shaft

.



- Tighten the setscrews (1) of the setting collars to a torque of 17 Nm, and just screw in the setscrew of the lever (2) but do not tighten so that the lever can still be moved laterally.




| | | |
|---|---|---|
| **1** | Setscrew M8x16 A2-70 (with full dog point) | 4x |
| **2** | Setscrew M8x16 A2-70 (with chamfered end) | 1x |
| **3** | Mechanism coupling assembly | 1x |

The connecting and coupling shafts are now completely installed, and the interrupter units of the poles (A, B and C) are connected to with another mechanically.

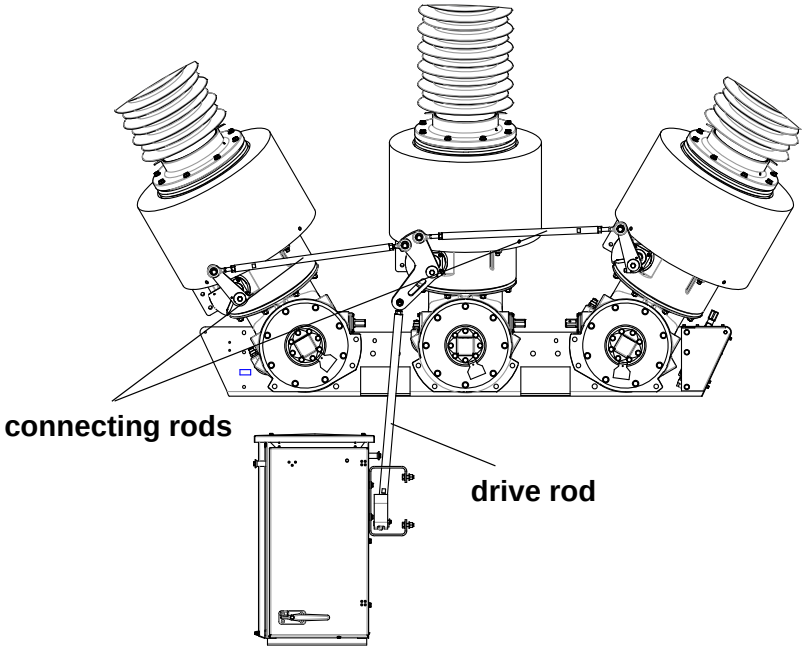
- Tighten the bolted joints between Pole C and the pole mount to a torque of 146 Nm.
- Remove the turnbuckle.

## 6.11 Installing the Operating Linkage for the Disconnector-Earthing Switch Module

**CAUTION**

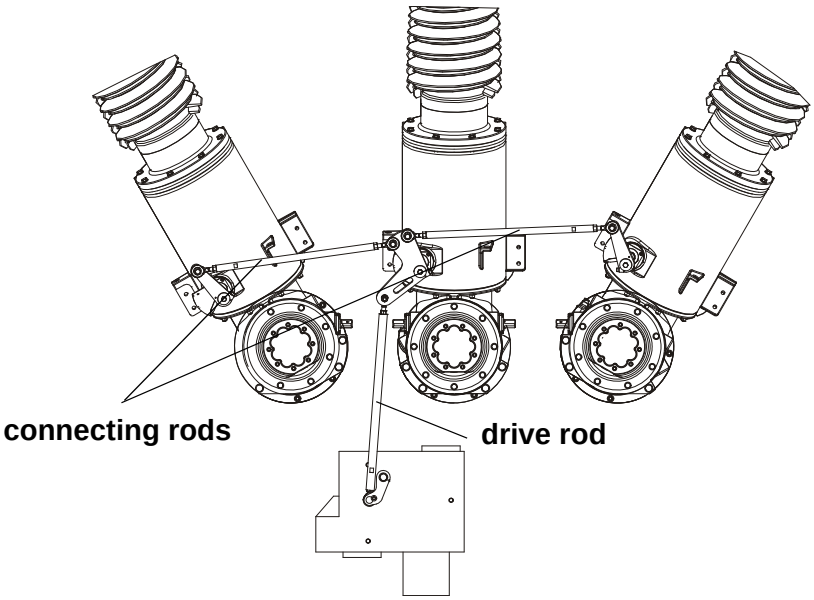
*“HYpact with Type ME4 Motor-Operated Mechanism” on page 56*
*“HYpact with Type ME1-3 Motor-Operated Mechanism” on page 56*

### 6.11.1 HYpact with Type ME4 Motor-Operated Mechanism




ba-247-hy_mont_schaltge

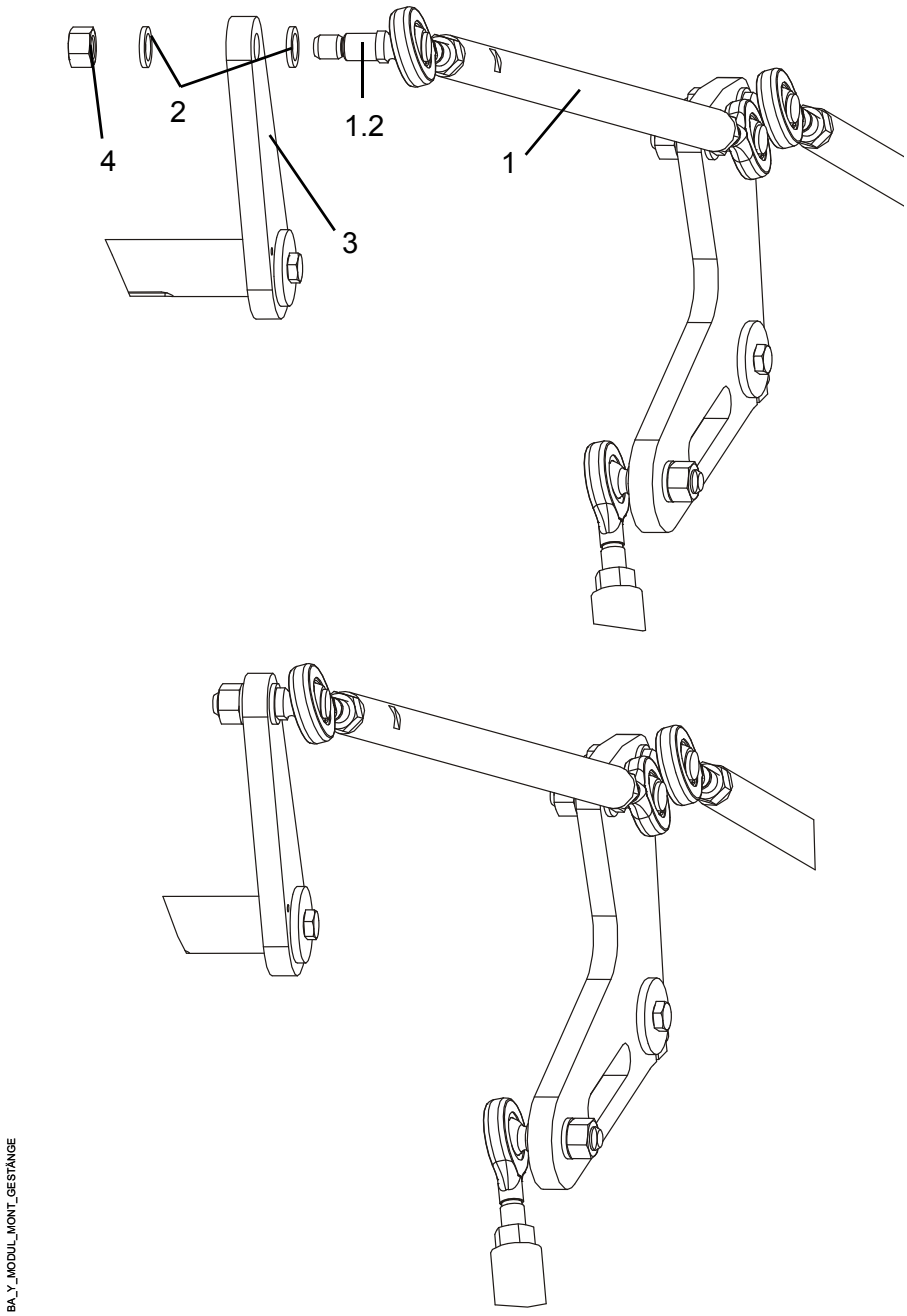
### 6.11.2 HYpact with Type ME1-3 Motor-Operated Mechanism




As many as two disconnector-earthing switch modules (A1 and A2) per pole may be installed, depending on the order. Each disconnector-earthing switch module must be connected with the ME mechanism by the linkage.

### 6.11.3 Mounting the Connecting Rods Between the Disconnector-Earthing Switch Modules

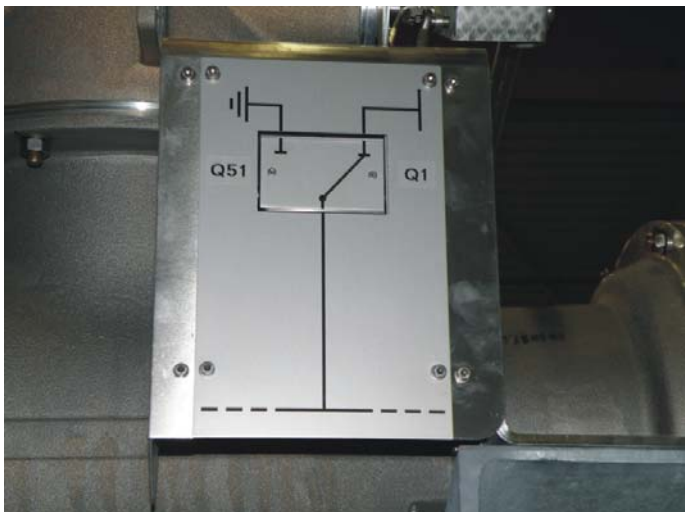
- Lubricate the joint head bolt (1.2) on the connecting rod (1) with Molykote BR2.
- Fit the washer (2) on the joint head bolt (1.2) and insert the bolt into the hole in the lever (3).
- Secure with washer (2) and nut (4) and tighten to a torque of 140 Nm.
- Repeat these steps for all 3-PS modules (optional).



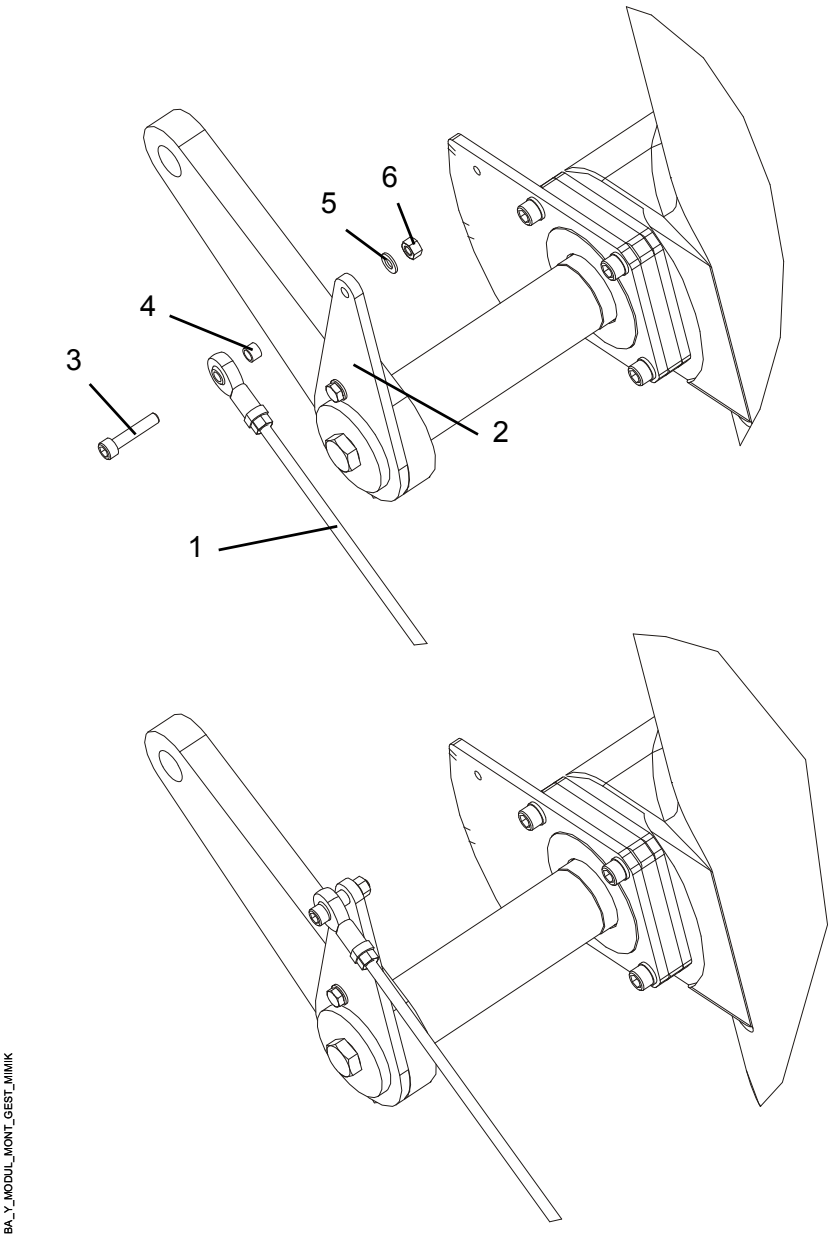

| | | |
|---|---|---|
| **1** | Connection rod | 1x |
| **1.2** | Joint head bolt | 1x |
| **2** | Washer, 16 A2-70 | 2x |
| **3** | Lever (disconnector-earthing switch module) | 1x |
| **4** | Hexagon nut, M14 R A2-70 | 1x |

### 6.11.4 Installing the Linkage for the Mimic Display

The disconnector-earthing switch modules are equipped with a display unit that shows the current position of the module based on a schematic diagram (see example pictured).




- This display unit is controlled mechanically by a lever system. The connecting rod must (1) therefore be bolted to the lever (2) of the disconnector-earthing switch module.
- To do so, fit the washer (5) on the bolt (3) and push the bolt through the lever hole and the linkage eye. Slide on the sleeve (4) and lock the assembly with the nut (6).




BA_Y_MODUL_MONT_GEST_MIMIK

| | | |
|---|---|---|
| **1** | Connecting rod | 1x |
| **2** | Lever | 1x |
| **3** | Cylinder bolt, M5x25 A2-70 | 1x |
| **4** | Sleeve, 7 / 5,2 / 5 | 1x |
| **5** | Washer, 5-200HV - A2 | 1x |
| **6** | Hexagon nur, M5 A2-70 | 1x |

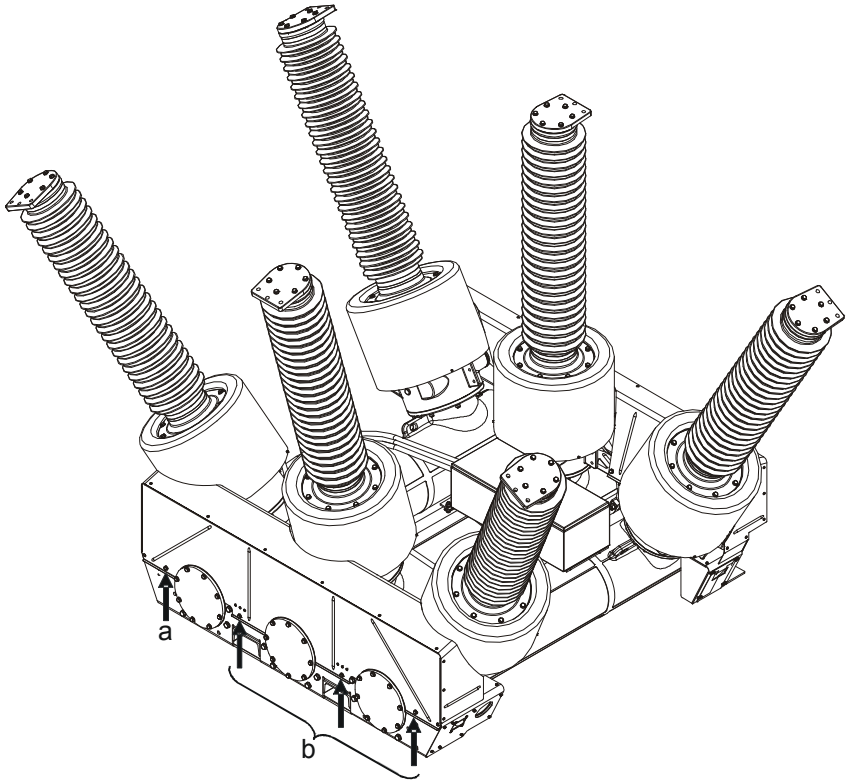
- Tighten the bolt to a torque of 4 Nm.
- Connect each mimic display to the lever of the disconnector-earthing switch module by following this procedure.

**Removal of ice guard(s) (Optional)**

The ice guard(s) (if applicable) has (have) been pre-mounted at the factory.

To remove the ice guard(s), proceed as follows:

- Loosen the eight mounting bolts - four on the front and four on the back - and lift up the front of the ice guard to remove.




BA-HY-2033591

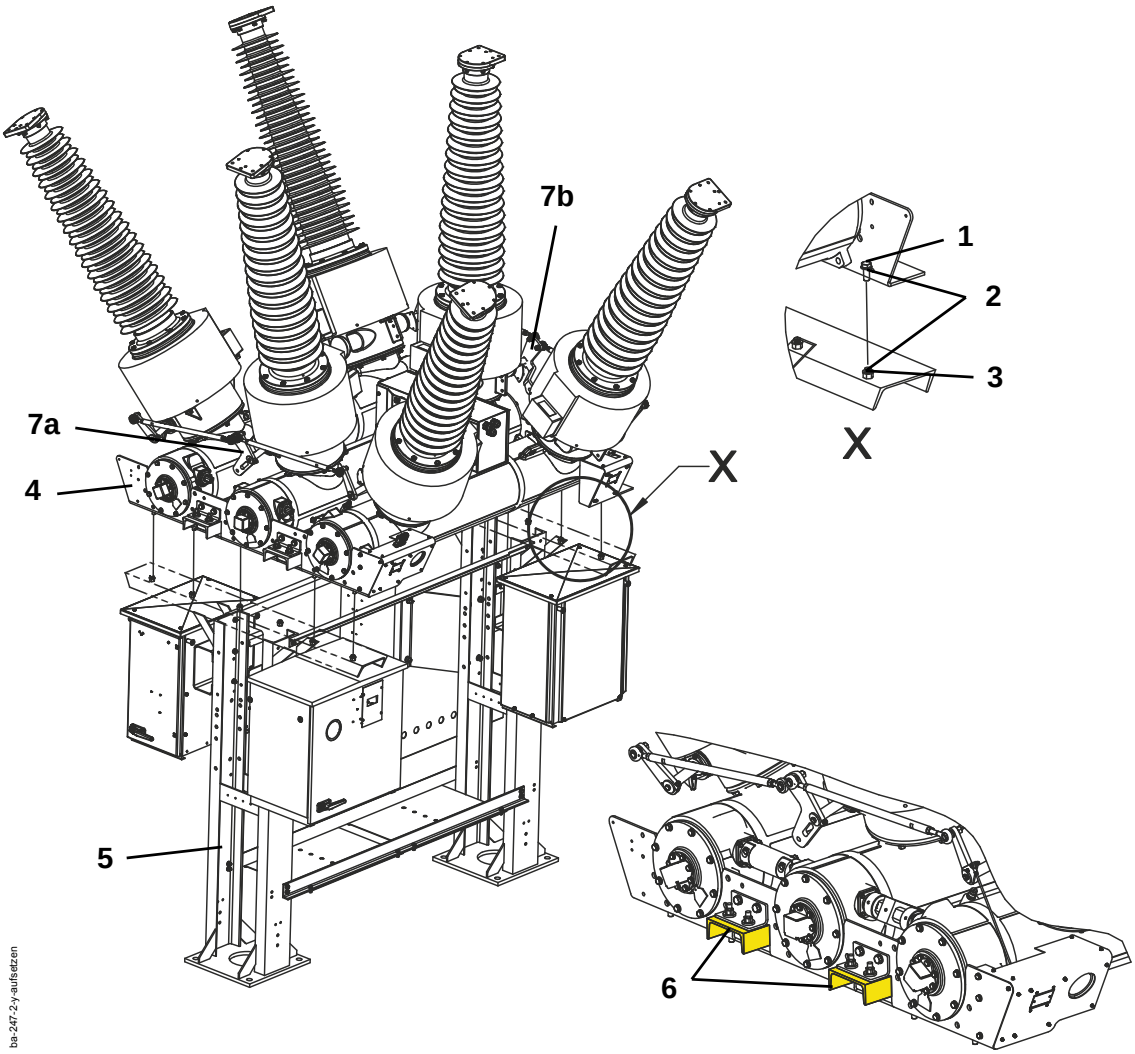
| | | |
|---|---|---|
| **a** | Nut | - |
| **b** | Riveted nut | - |

## 6.12 Mounting the Module

| | |
|---|---|
| **CAUTION** | *“HYpact with Type ME4 Motor-Operated Mechanism” on page 63*<br>*“HYpact with Type ME1-3 Motor-Operated Mechanism” on page 64* |

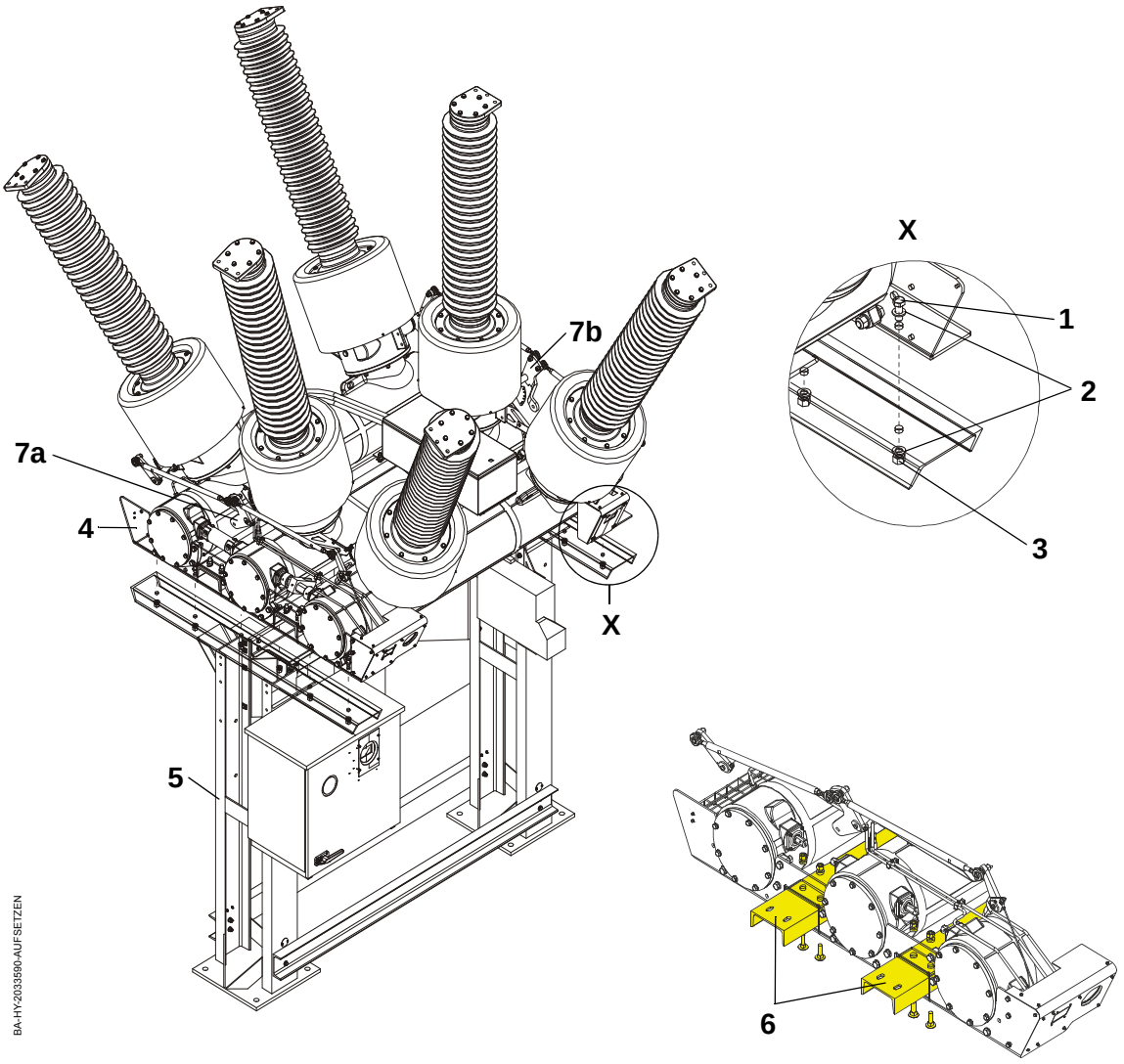
- Mount the module on the support module using the mounting screws (1), washers (2) and nuts (3), tightening to a torque of 146 Nm.
- Using a level, align the module horizontally in both planes by adjusting the lock nuts on the anchor bolts so that the module is level.
- Tighten the nuts on the anchor bolts to a final torque of 250 Nm and lock them.
- Remove the hoisting gear.
- Remove the forklifting fixtures (6).
- Mount transformer terminal box (if included) using the appropriate mounting hardware (see dimensioned diagram for position of transformer terminal box).

### 6.12.1 HYpact with Type ME4 Motor-Operated Mechanism




| | | |
|---|---|---|
| **1** | Hexagon bolt M16x40 A2-70 | 12x |
| **2** | Washer 16 200 - HV - A2 | 24x |
| **3** | Hexagon nut M16 A2-70 | 12x |
| **4** | Module | 1x |
| **5** | Support module with pre-mounted mechanisms | 1x |
| **6** | Forklifting fixtures (optional) | 2x |
| **7a** | Front combination disconnector-earthing switch | 1x |
| **7b** | Rear combination disconnector-earthing switch | 1x |

### 6.12.2 HYpact with Type ME1-3 Motor-Operated Mechanism




| | | |
|---|---|---|
| **1** | Hexagon bolt M16x40 A2-70 | 12x |
| **2** | Washer 16  200 - HV - A2 | 24x |
| **3** | Hexagon nut M16 A2-70 | 12x |
| **4** | Module | 1x |
| **5** | Support module with pre-mounted mechanisms | 1x |
| **6** | Forklifting fixtures (optional) | 2x |
| **7a** | Front combination disconnector-earthing switch | 1x |
| **7b** | Rear combination disconnector-earthing switch | 1x |

## 6.13 Connecting the Operating Mechanisms

### 6.13.1 Mounting the Circuit Breaker Drive Rod

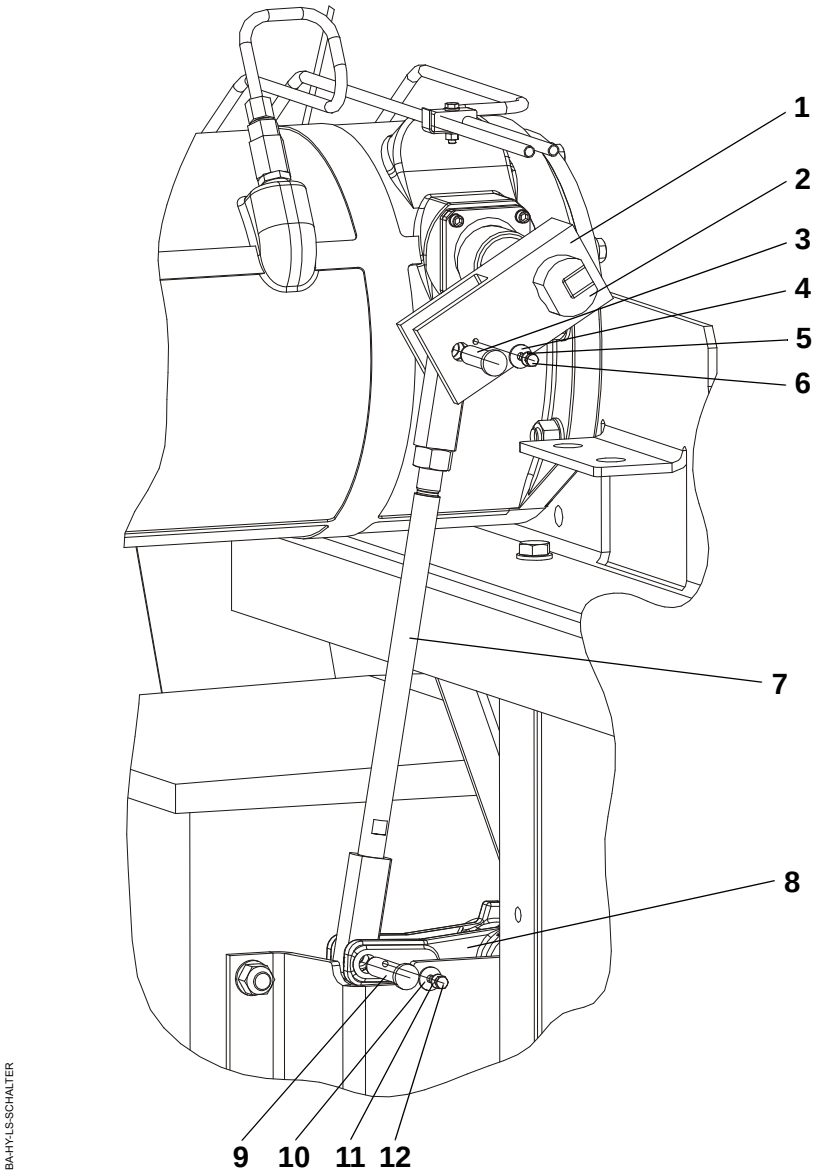
The drive rod has already been set to the correct length. This setting must not be changed during installation.
The drive lever has been mounted on the operating mechanism at the factory.

**CAUTION**

Any change in the setting of the drive rod from the manufacturer's marking may cause the circuit breaker to malfunction.
**Therefore:**
**- Do not change the rod length.**

- Lubricate the studs (3, 9) with Molykote BR2 plus (see figure).
- Insert the drive rod (7) into the drive lever (8) and insert the stud (9).
- Lock the stud (9) with the screw (12), sleeve (10) and washer (11), and tighten to a torque of 7 Nm. Apply locking adhesive S1 to the screw (12).
- Insert the drive rod (7) into the circuit breaker lever (1) and insert the stud (3).
- Lock the stud (3) with the bolt (6), sleeve (4) and washer (5), and tighten to a torque of 7 Nm. Apply locking adhesive S1 to the bolt (6).

If the holes in the drive rod and the lever of the circuit breaker do not align, proceed as follows:
- Position the circuit breaker lever (1) by twisting the coupling shaft (2) so that the holes in the drive rod (7) and the lever are aligned.




| | | |
|---|---|---|
| **1** | Circuit breaker lever | 1x |
| **2** | Coupling shaft | 1x |
| **3** | Stud, 16x54 | 1x |
| **4** | Sleeve (stud lock) | 1x |
| **5** | Washer 6  200 - HV - A2 | 1x |
| **6** | Hexagon bolt M6x18 A2-70 | 1x |
| **7** | Drive rod | 1x |
| **8** | Drive lever | 1x |
| **9** | Stud, 16x68 | 1x |
| **10** | Sleeve (stud lock) | 1x |
| **11** | Washer 6  200 - HV - A2 | 1x |
| **12** | Hexagon screw M6x18 A2-70 | 1x |

### 6.13.2 Mounting the Drive Rod of the Combination Disconnector-Earthing Switches

| | |
|---|---|
| **CAUTION** | ***"HYpact with Type ME4 Motor-Operated Mechanism" on page 68***<br>***"HYpact with Type ME1-3 Motor-Operated Mechanism" on page 69*** |

Caution: The drive rods for the disconnector-earthing modules are labeled with a sticker. The drive rod must be matched to the correct disconnector-earthing module in accordance with the sticker labeling. See the dimensioned drawing for the correct position.

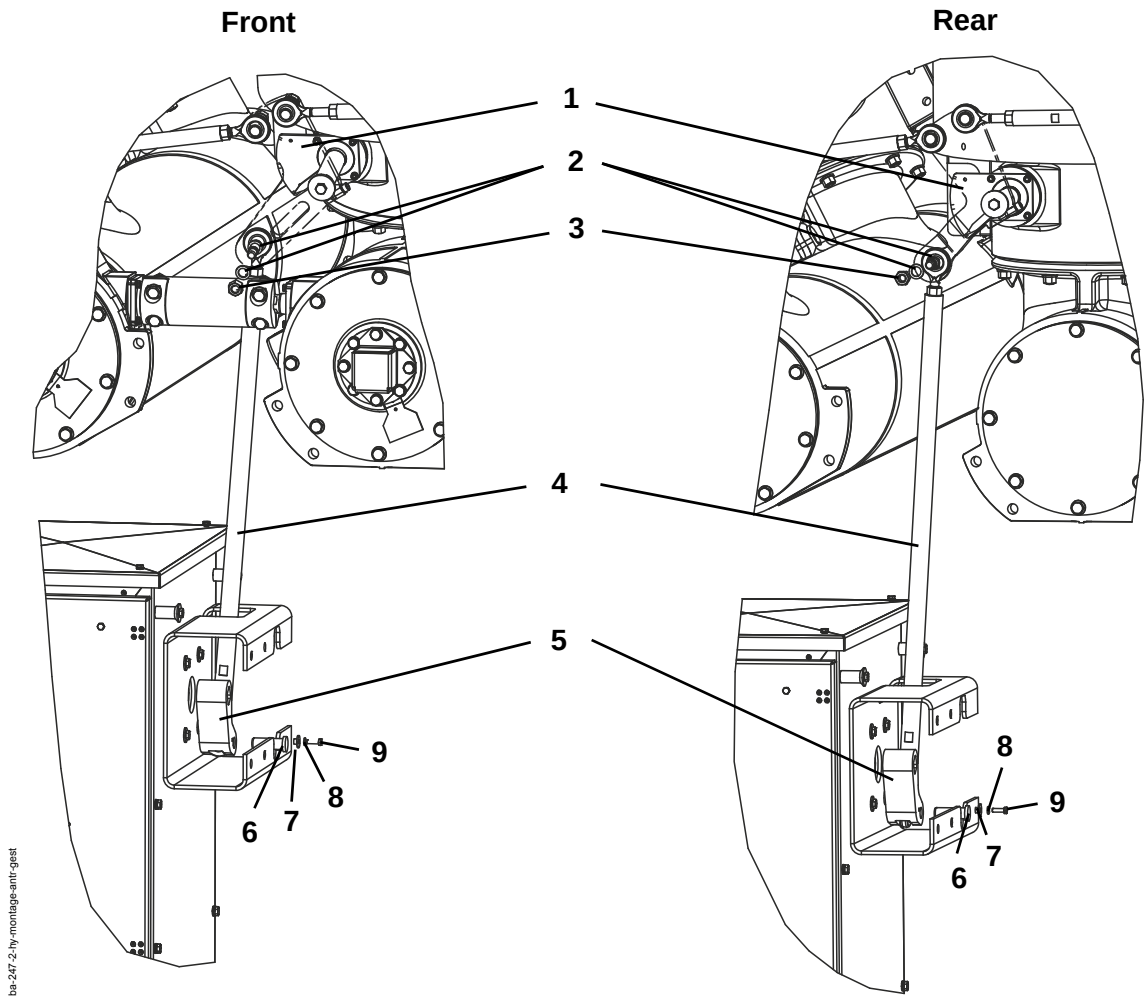
| | |
|---|---|
| **CAUTION** | Changing the factory-set position of the drive lever can result in malfunction of the mechanism.<br>**Therefore:**<br>**- Do not change the position of the drive lever.** |

- Lubricate the stud (6) and ball journal (K) of the drive rod (4) with Molykote BR2 plus plus **((for ME4 mechanism *(see figure on page 68)*; for ME1-3 mechanism *(see figure on page 69)*)**.
- Note that the length of the drive rod (4) only fits either the front, the middle or the rear combination disconnector-earthing switch. Insert the drive rod (4) into the drive lever (5) and insert the stud (6).
- Lock the stud (6) with the screw (9), sleeve (7) and washer (8), and tighten to a torque of 7 Nm. Apply locking adhesive S1 to the screw (9).
- Fit the washer (2) on the ball journal of the drive rod. Insert the drive rod (4) into the lever of the combination disconnector-earthing switch (1).
- Slide on the washer (2) and tighten the nut (3) to a torque of 140 Nm.

If the holes in the drive rod and the lever of the combination disconnector-earthing switch do not align, proceed as follows:

- Twist the lever of the combination disconnector-earthing switch (1) and position it so that the holes of the drive rod (4) and the lever are aligned.

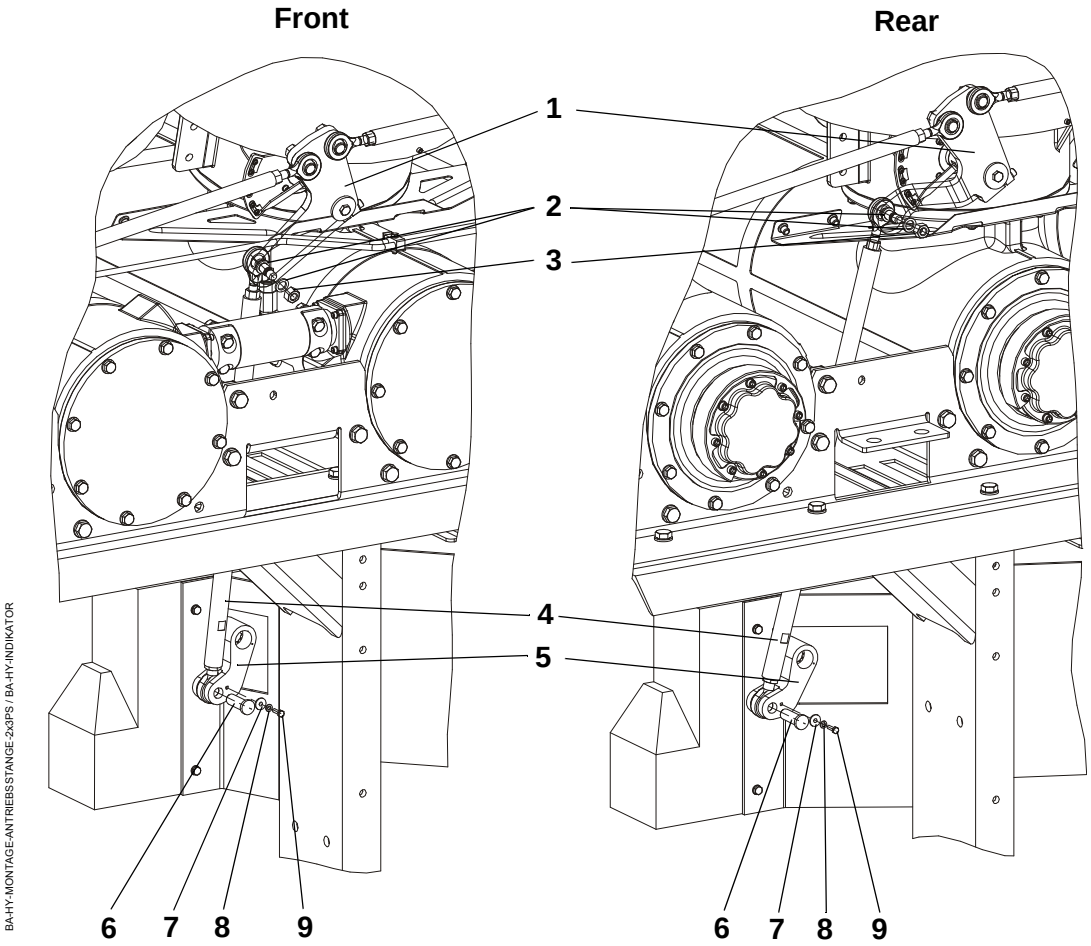
### 6.13.2.1 HYpact with Type ME4 Motor-Operated Mechanism




**Supports and pole mounts not shown**

| | | |
|---|---|---|
| **1** | Lever of combination disconnector-earthing switch | 2x |
| **2** | Washer, 16 A2 | 4x |
| **3** | Nut, M14 | 2x |
| **4** | Drive rod | 2x |
| **5** | Drive lever | 2x |
| **6** | Stud, 18x52 | 2x |
| **7** | Sleeve (stud lock) | 2x |
| **8** | Washer 6 200 - HV - A2 | 2x |
| **9** | Hexagon screw M6x20 A2-70 | 2x |

### 6.13.2.2 HYpact with Type ME1-3 Motor-Operated Mechanism




| | | |
|---|---|---|
| **1** | Lever of combination disconnector-earthing switch | 2x |
| **2** | Washer, 16 A2 | 4x |
| **3** | Nut, M14 | 2x |
| **4** | Drive rod | 2x |
| **5** | Drive lever | 2x |
| **6** | Stud, 18x52 | 2x |
| **7** | Sleeve (stud lock) | 2x |
| **8** | Washer 6 200 - HV - A2 | 2x |
| **9** | Hexagon screw M6x20 A2-70 | 2x |

**The following instructions apply to both the Type ME4 Motor-Operated Mechanism and the Type ME1-3 Motor-Operated Mechanism.**

### Applies to direct earthing:

Factory-set adjustment devices for connecting the drive rod are located on the combination disconnector-earthing switches of the poles. The diagram shows the device for the "earthing switch closed" position (as-delivered condition).

After connecting the drive rod, check to see whether the indicators are within the respective scale graduation or division in all positions of the combination disconnector-earthing switch. To do so, proceed as follows:

- Carry out a test operation manually (earthing switch closed > earthing switch open) and check the position. If necessary, the drive rod length must be readjusted until the correct position is reached.
- Carry out a test operation manually (earthing switch open > disconnector closed) and check the "disconnector closed" position.
- Carry out a test operation manually (disconnector closed > earthing switch open > earthing switch closed ) and check the position.
- The respective positions can be read on the position indicator ***(see "Direct Earthing" on page 156)***.

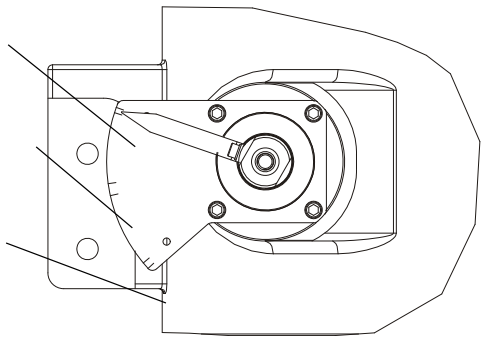
Caution:
Before commissioning the combination disconnector-earthing switch, always make sure that the indicator is within the scale graduation at the "Disconnector in CLOSED position."

**Adjustment device for „direct“ disconnector-earthing switch (DEd)**

**Disconnector in CLOSED position**

**Disconnector and earthing-switch in OPEN position.**

**Earthing-switch in CLOSED position**



**„Disconnector CLOSED“ position**

**Applies to integral earthing:**
Factory-set adjustment devices are located on the combination disconnector-earthing switches of the poles.
The figure shows the device for the "disconnector closed" position (as-delivered condition).
After connecting the drive rod, check to see whether the indicators are within the respective scale graduation or division in all positions of the combination disconnector-earthing switch. To do so, proceed as follows:

- Carry out a test operation manually (disconnector closed > disconnector open) and check the position. If necessary, the drive rod length must be adjusted until the correct position is reached.
- Carry out a test operation manually (disconnector open > earthing switch closed) and check the "earthing switch closed" position.
- Carry out a test operation manually (earthing switch closed > disconnector open > disconnector closed ) and check the position.
- The respective positions can be read on the position indicator ***(see "Integral Earthing" on page 157)***.

Caution:
Before commissioning the combination disconnector-earthing switch, always make sure that the indicator is within the scale graduation at the "Disconnector in CLOSED position."

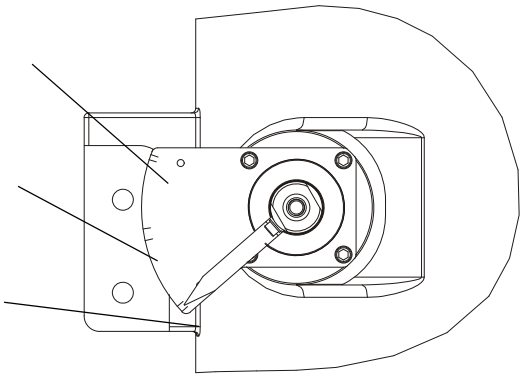
..

**Adjustment device for „indirect" disconnector-earthing switch (DEi)**

**Earthing switch in CLOSED position**

**Disconnector and earthing-switch in OPEN position**

**Disconnector in CLOSED position**



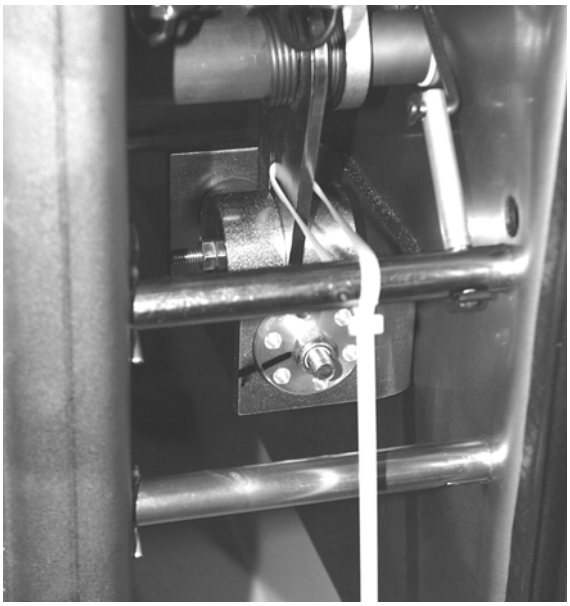
Grafik MEI-3

**„Disconnector CLOSED" position**

### 6.13.3 Removing the Transport Lock (Circuit Breaker)

The opening latch of the operating mechanisms may be immobilized by a transport lock. The transport lock consists of a cable tie with an attached identification card.

- Cut through the cable tie and remove the transport lock.



## 6.14 Mounting the High Voltage Terminal Pads

The high voltage terminal pads are shipped in the box containing the accessories. Oxide films can form on the terminal pad mounting plates and the high voltage terminal pads during transport and storage, and these films can result in higher contact resistances. Oxide films in the contact areas must be removed before installation. Use a wire brush with stainless steel bristles as the appropriate tool for this job.

- Brush the contact surfaces of the high voltage terminal pads (2) and terminal pad mounting plates (1) until all oxide film has been removed.
- Lubricate contact surfaces on both sides in accordance with lubrication specification L3.
- Lubricate bolts per lubrication specification L1.

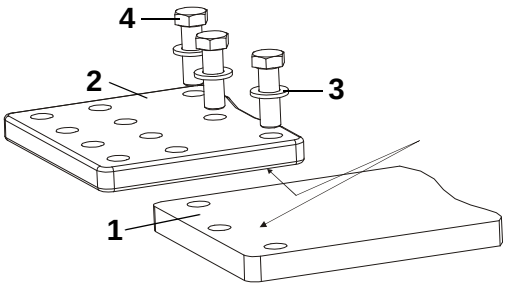
**Mounting the high voltage terminal pads (A)**
**(conical composite insulator)**

- Bolt the high voltage terminal pads to the terminal pad mounting plates using bolts (4) and washers (3). Tighten to a torque of 146 Nm.

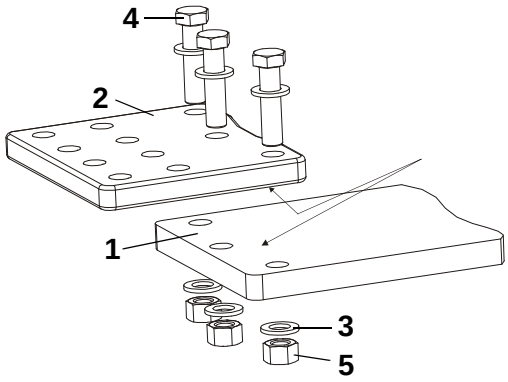
**Mounting the high voltage terminal pads (B)**
**(cylindrical composite insulator / conical porcelain insulator)**

- Bolt the high voltage terminal pads to the terminal pad mounting plates using bolts (4), washers (3) and nuts (5). Tighten to a torque of 146 Nm.

**A (Conical composite insulator)**




**B (Cylindrical composite insulator / conical porcelain insulator)**




BA-P-HS-ANSCHLUSS

| | | A | B |
|---|---|---|---|
| **1** | Terminal pad mounting plates | 1x | 1x |
| **2** | High voltage terminal pads | 1x | 1x |
| **3** | Washer, 16 A2 | 3x | 6x |
| **4** | Hexagon bolt, M16x50 A2-70 **(A)** / Hexagon bolt, M16x65 A2-70 **(B)** | 3x | 3x |
| **5** | Hexagon nut, M16 A2-70 | - | 3x |

## 6.15 Connecting the Cables

**DANGER**

Improper connection of cables can pose a threat to personnel and system safety.
The individual responsible for safety must give approval for connecting the cables.

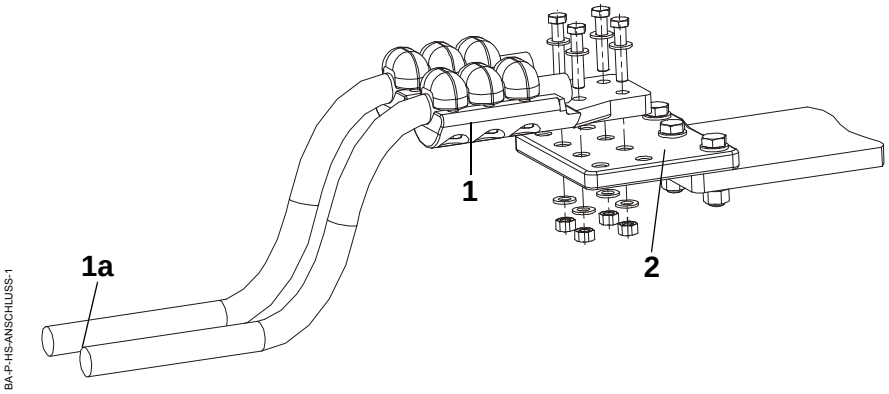
**DANGER**

When connecting the cables after filling the HYpact to rated pressure, there is the danger that insulators will burst if they have been damaged.
**Therefore:**
- **The cables may only be connected by qualified personnel using extreme caution.**

To avoid working on gas-filled poles, we recommend that the cables (1) be connected to the HYpact´s high voltage terminal pads (2) before the gas is filled.
The ends of the cables facing away from the HYpact (1a) must not be connected yet.

Cable ends (1a) must not be in contact with earth potential (potential to ground) simultaneously during later commissioning tests. The resulting auxiliary circuit would affect the test results.

- Brush the contact surfaces of high voltage terminal pads (2) and cable clamp (1) until all oxide film has been removed.
- Lubricate contact surfaces on both sides in accordance with lubrication specification L3.
- Bolt high voltage terminal pads and cable clamp together.
- Keep cable end (1a) isolated from earth potential (potential to ground).




| | | |
|---|---|---|
| **1** | Cable with cable clamp | 1x |
| **1a** | Cable end facing away from breaker | - |
| **2** | High voltage terminal pads | 1x |

## 6.16 Earthing (Grounding) the HYpact

The supports are equipped with earth (or ground) connections. The hybrid compact switchgear assembly is conductively connected to the support module by the mounting points and earthed or grounded through the support module (the earthing surfaces are shown in the dimensioned drawing).

- Earth (or ground) the supports.

## 6.17 Checking the Bolted Joints

- Check the torques of all previously assembled bolted joints.

# 7 Commissioning


Serious personal injury or property damage can result during commissioning if the equipment is live or energized.
**Therefore:**
- **Make sure that the HYpact is disconnected from the high voltage system.**
- **Make sure the HYpact is earthed (grounded).**

The five safety rules of electrical engineering must be followed:
- Disconnect the equipment from the power supply.
- Install safeguards to ensure that the power cannot be turned on again.
- Confirm that the equipment is de-energized.
- Earth (ground) and short-circuit the equipment.
- Cover or provide barriers for adjacent energized equipment.

## 7.1 Density Monitor

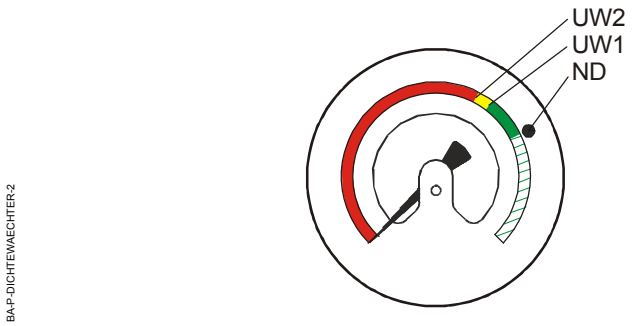
### 7.1.1 Connecting the Cable

The cable is already connected to the density monitor. The cable entry gland is located on the rear side of the operating mechanism.

- Insert the cable into the operating mechanism through the cable gland and connect it according to the schematic diagram.

### 7.1.2 Checking the Operating Points

The density monitor is temperature-compensated. The ambient temperature does not affect the indication or the operating points.
For a check of the operating points, only the gas piping is filled with gas. The pole connections for the gas piping are equipped with check valves. The check valves prevent uncontrolled gas leakage.



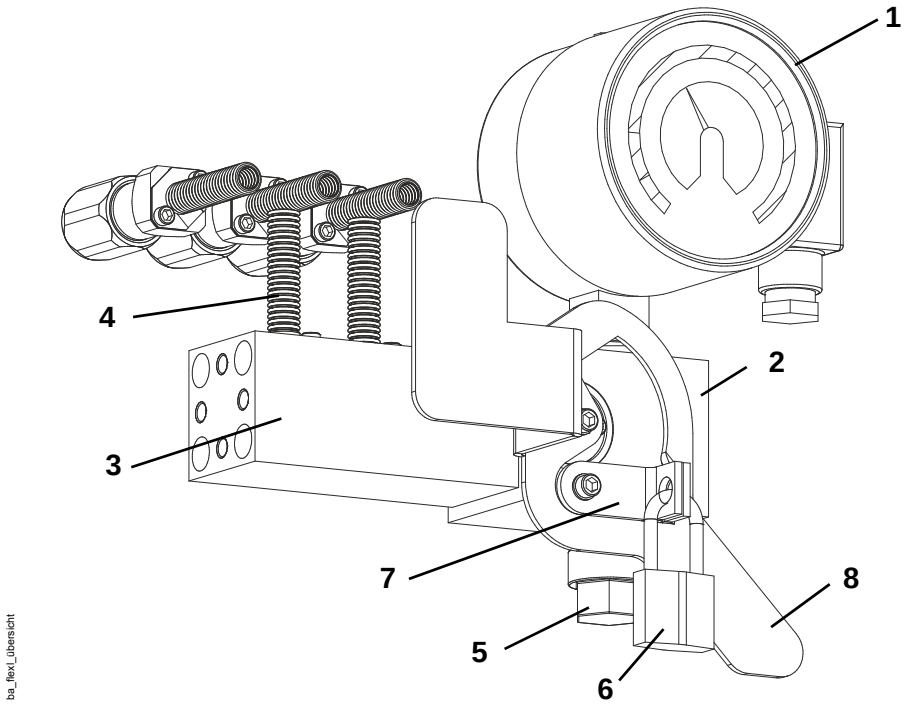

The density monitor has two operating points:
- UW1: Alarm. This signals gas loss, but the HYpact remains ready for operation.
- UW2: Lockout. Severe gas loss is indicated, and switching operations are prevented by the electrical control system.
- ND: Rated pressure.

- Unscrew the protective cap from the central supply connection.
- Connect the filling hose of the gas-filling device to the central supply connection (type DILO DN8 coupling; the location of the gas-filling device is shown in the dimensioned drawing).
- Fill the gas piping with $SF_6$ until rated pressure (ND) is reached. The rated pressure is marked by the black dot on the indicator dial.
- Disconnect and remove the filling hose.
- Connect a device suitable for discharging and collecting $SF_6$ - such as the $SF_6$ Multi-Analyzer manufactured by DILO Armaturen und Anlagen GmbH - to the central supply connection.
- Connect the multimeter to the terminals for UW1 in the operating mechanism.
- Slowly reduce the gas pressure in the piping until UW1 is reached. As you do so, compare the electric operating point with the density monitor indication.
- Connect the multimeter to the terminals for UW2.
- Reduce the gas pressure further until UW2 is reached. As you do so, compare the electric operating point with the density monitor indication.

### 7.1.3 Gas Filling and Monitoring Device with Shut-off Valve EasyCheck Valve Unit (Optional)

The **EasyCheck** technology makes it particularly easy to perform the emission-free density monitor test in correspondence with the "**F-gases regulation EU 517/2014**" quickly and safely.

#### 7.1.3.1 Overview EasyCheck Valve

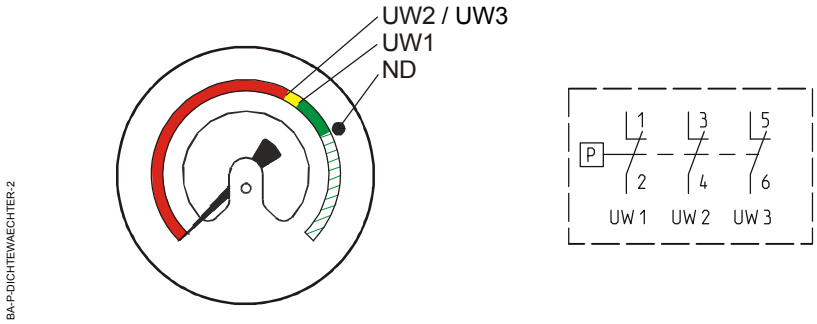



| | |
|---|---|
| **1** | Density Monitor |
| **2** | Shut-off block |
| **3** | Distributor block |
| **4** | FlexLink Gas Piping |
| **5** | Testing connection/filling connection Dilo DN 20 with cover plate |
| **6** | Padlock |
| **7** | Unlocking latch |
| **8** | Lever to Separate the Gas Chamber Areas |

### 7.1.3.2 Description Density Monitor

SF6 density is monitored by a temperature-compensated density monitor (F1). The density monitor (F1) has a display with a color scale and three metallically separated contacts:

- ND (green): Rated operating pressure (black dot on the color scale gives the rated operating pressure.)
- UW1 (yellow): Alarm pressure add SF6
- UW2 / UW3 (red): Lockout pressure range notpermitted



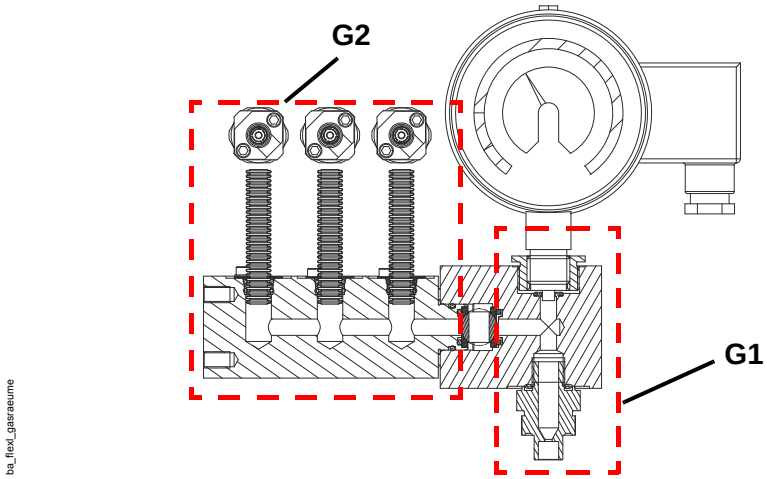

### 7.1.3.3 Setup of the central gas monitoring unit

The central gas unit monitoring offers the following functions:
- Monitoring of the gas density with a density monitor.
- Filling and emptying the switch via a gas connection of type Dilo DN8 or DN20.
- Separation of the gas chambers G1 (piping/pole columns) and G2 (gas connection/density monitor).

The following functions are implemented for this purpose:
- Verifying the density monitor without influencing the gas pressure in the pole columns.
- Exchange of the density monitor without influencing the gas pressure in the pole columns.
- Emission-free review of the density of the gas connection.

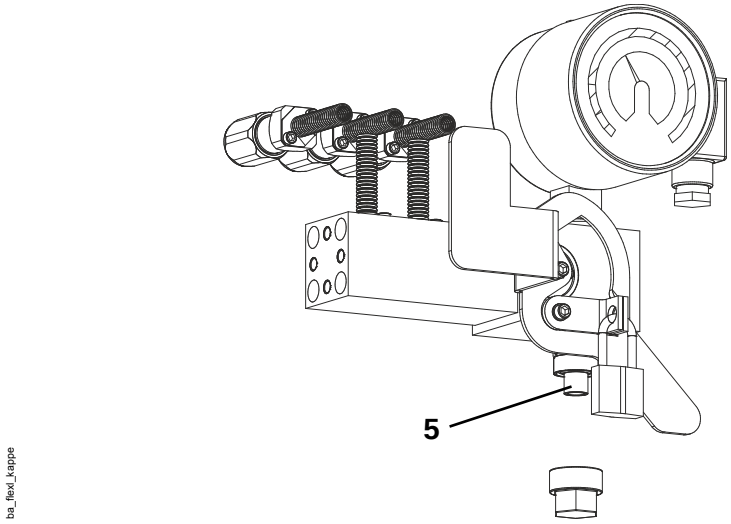
### 7.1.3.4 Principle of operation

The gas chambers G1 and G2 can be connected to or disconnected from each other via the valve in the shut-off block (2).



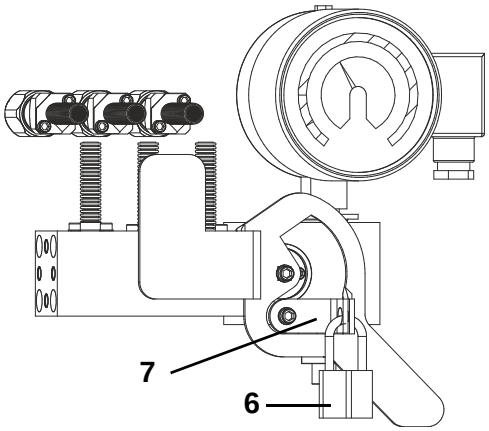

### 7.1.3.5 Separating the gas chambers G1 and G2

Gas compartments G1 and G2 connected (operating condition).



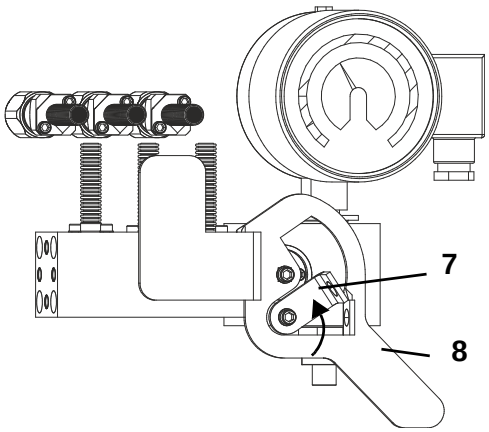

- Remove the covering cap from the Dilo DN8 or DN20 supply connection (5).
- Top up the gas chamber of the compact switchgear to the rated operating pressure via the testing and supply connection (5).

This reduces the risk of gas transfer from gas chamber (G1) to gas chamber (G2).



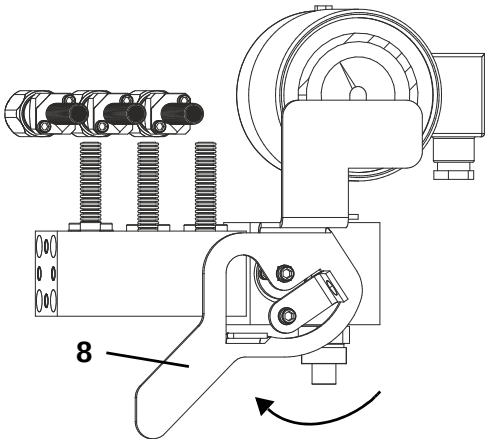

ba_flexl_abgeschlossen

- Remove the padlock (6) from the unlocking latch (7).




ba_flexl_entriegelt

- Unlock the lever (8) by pulling up the unlocking latch (7).




ba_flexl_prüfstellung

- Turn the lever (8) clockwise to the stop.

As an additional indication that the gas chamber is now in testing condition, the lever covers part of the density monitor scale.
Monitoring of this gas chamber by density monitor is interrupted. The contacts of the density monitor can now be checked via the testing and supply connection (5) without influencing the gas pressure in the compact switchgear gas chamber.

**The gas chambers G1 and G2 are now separated (testing condition).**

**DANGER**

The gas density in the pole columns is not monitored in separated gas chambers.
Without sufficient gas density, the circuit breaker is unable to extinguish the light arc resulting during switching.
There is a direct danger to the staff and the circuit breaker!
**Therefore:**
**Never operate the circuit breaker with separated gas chambers.**

The testing device (not enclosed) now can be used to check the contacts of the density monitor in the gas chamber (G1) ***(see "Checking the Operating Points" on Page 78).***

- After testing of the density monitor, remove the testing facilities again and unscrew the closure cap of the testing connection (5).

**Connect the gas chambers in the reverse order:**

- Turn the lever (8) counter-clockwise until the unlocking latch (7) locks the rotary movement.
- Align the unlocking latch (7) so that the bore in the unlocking latch (7) is flush with the bore in the lever (8).
- Secure the unlocking latch (7) with a padlock against inadvertent actuation.

**The gas chambers G1 and G2 are now connected again (operating condition).**
The density monitor monitoring of this gas chamber is ensured again.

**WARNING**

Inadvertent opening of the interim valve during testing permits test gas to enter the poles. To avoid mixing of different gases in the gas chamber of the compact switchgear, the testing and filling gases should be identical.

**WARNING**

In order to prevent unwanted passage of gas from gas chamber G1 to gas chamber G2, the pressure in gas chamber G1 must never be set higher than the pressure in gas chamber G2.

**WARNING**

The temperature compensation feature of the density monitor is adjusted to the filling gas of the compact switchgear assembly.
If the test gas and the filling gas of the compact switchgear assembly are not identical, it will only be possible to get a correct result at an ambient temperature of 20°C. At other ambient temperatures, the compensation error must be taken into account.

## 7.2 Gas Piping

**WARNING**

The pressurized components of the pole components can be damaged by improper handling. If the components are damaged, they may burst when the gas pressure is increased. This can result in serious personal injury or property damage.

**Therefore:**

- **Inspect the poles visually for damage before beginning the filling operation.**
- **Carry out the filling operation from a protected position.**

**CAUTION**

If the rated pressure is exceeded, it may cause the pressure relief device to respond.

**Therefore:**

- **Never set the pressure reducing valve of the gas-filling device higher than the rated pressure of the HYpact.**

The rated pressure (ND) is shown on the nameplate and the density monitor (black dot on the density monitor indicator).

If there are any doubts about gas quality, always check it ***(see "Checking the Gas Quality" on Page 117)***.

Contamination of $SF_6$ gas by foreign gases is not permitted. Make sure that the filling hose is filled with $SF_6$ before the filling operation. In case of doubt, purge the filling hose before the filling operation.

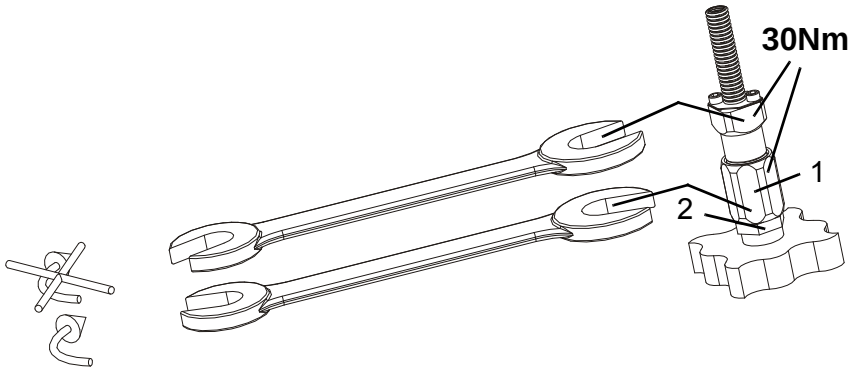
The density monitor indication can be checked using a test manometer and a thermometer. The indicated value of the test manometer must be corrected as a function of the ambient temperature in accordance with the $SF_6$ pressure curve.

### 7.2.1 If FlexLink Gas Piping Is Already Installed

To check all gas piping seals we recommend the use of the following tools:

- T016: Compact open-end wrench (open-ended spanner), SW24
- WK001: Torque wrench (spanner) with ratchet adapter and SW27 open-end wrench head

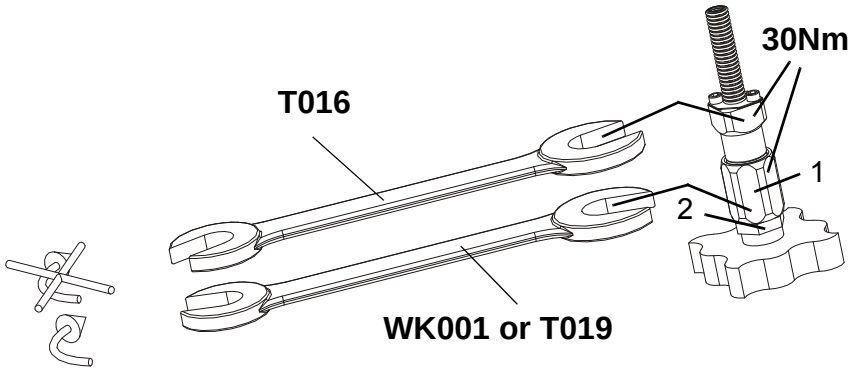
- Retighten filling connections using tool T016 and tool set WK001 to a torque of 30 Nm.
- Retighten all couplings in the gas piping system.




| | | |
|---|---|---|
| **1** | Union nut | 1x |
| **2** | Valve | 1x |

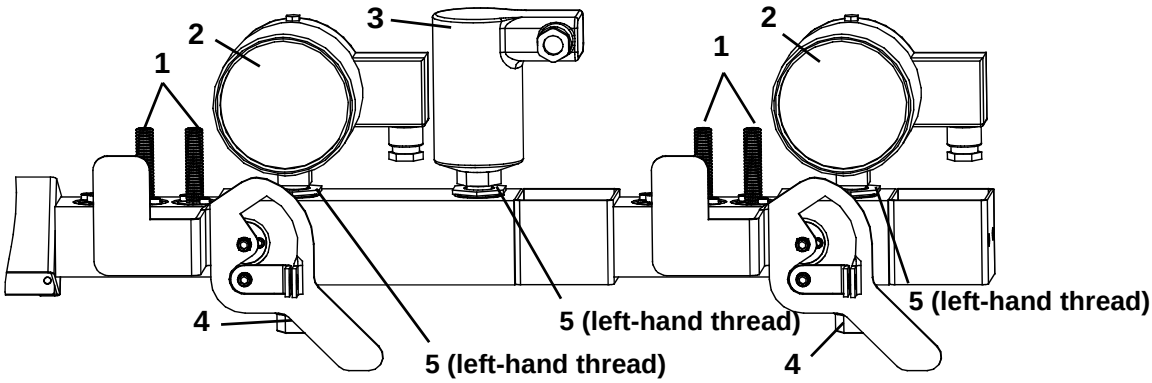
### 7.2.2 FlexLink Gas Piping Still Needs To Be Installed

To check all gas piping seals we recommend the use of the following tools:




- T016: Compact open-end wrench (open-ended spanner), SW24
- WK001: Torque wrench (spanner) with ratchet adapter and SW27 open-end wrench head
-

- Remove the protective caps from the gas couplings on the pole columns and the gas piping.
- Lubricate the threads of the gas couplings as per L4.
- Connect the gas piping to all pole columns. The gas couplings are equipped with threads for this purpose. First screw on the gas couplings by hand, then tighten them provisionally using tool T016, and finally tighten them using tool set WK001. Tighten to a torque of 30 Nm.
- Retighten all couplings in the gas piping system.




ba_2p_dbb_dw

| | | |
|---|---|---|
| **1** | Gas pipe | 1-3x |
| **2** | Density monitor | 1-3x |
| **3** | Density switch | 1x |
| **4** | Central supply connection / manifold | 30Nm |
| **5** | Threaded sleeve / manifold | 30Nm<br>Left-hand thread |

We recommend that the gas cylinder be weighed before and after the filling operation and that the weight difference be compared with the gas weight specified on the nameplate.
This makes it possible to verify that the filling process has beencarried out correctly.

### 7.2.3 If Rigid Gas Piping Is Already Installed

We recommend that the following tools be used to check all the bolted joints of the gas couplings:

- T016: Compact open-end wrench (open-ended spanner), SW24
- WK001: Torque wrench (spanner) with ratchet adapter and SW27 open-end wrench head

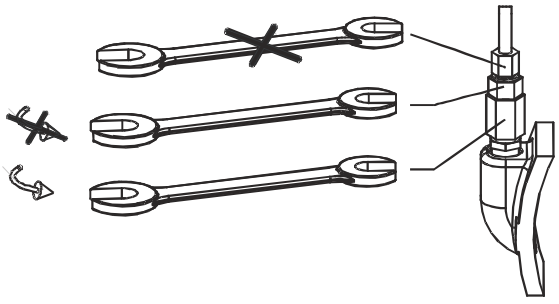
- Retighten gas couplings to a torque of 30 Nm using tool T016 and tool set WK001.
- Retighten all couplings in the gas piping system.

### 7.2.4 Rigid Gas Piping Still Needs To Be Installed

We recommend that the following tools be used to connect the gas couplings:

- T016: Compact open-end wrench (open-ended spanner), SW24
- WK001: Torque wrench (spanner) with ratchet adapter and SW27 open-end wrench head

- Remove the protective caps from the gas couplings on the pole columns and the gas piping.
- Apply a thin layer of silicone grease SF 1377 to the external threads of the connections.
- Connect the gas piping to all pole columns. The gas couplings are equipped with threads for this purpose. First screw on the gas couplings by hand, then tighten them provisionally using tool T016, and finally tighten them using tool set WK001. Tighten to a torque of 30 Nm.
- Retighten all couplings in the gas piping system.



We recommend that the gas cylinder be weighed before and after the filling operation and that the weight difference be compared with the gas weight specified on the nameplate.
This makes it possible to verify that the filling process has beencarried out correctly.

## 7.3 Filling the Module with Gas

**WARNING**

Due to damage that may have occurred during transport, a visual inspection of the insulators' condition is required before every initial filling and commissioning, as well as after maintenance work or any other actions.
**Therefore:**
- **all present persons must take cover or**
- **comply with the following minimum distance:**
  **for porcelain insulators: approx. 50 m**
  **for composite insulators: the height of the device**
  **(measured from ground level to the upper edge device)**

The filling gas must be used purs. to IEC 60376.

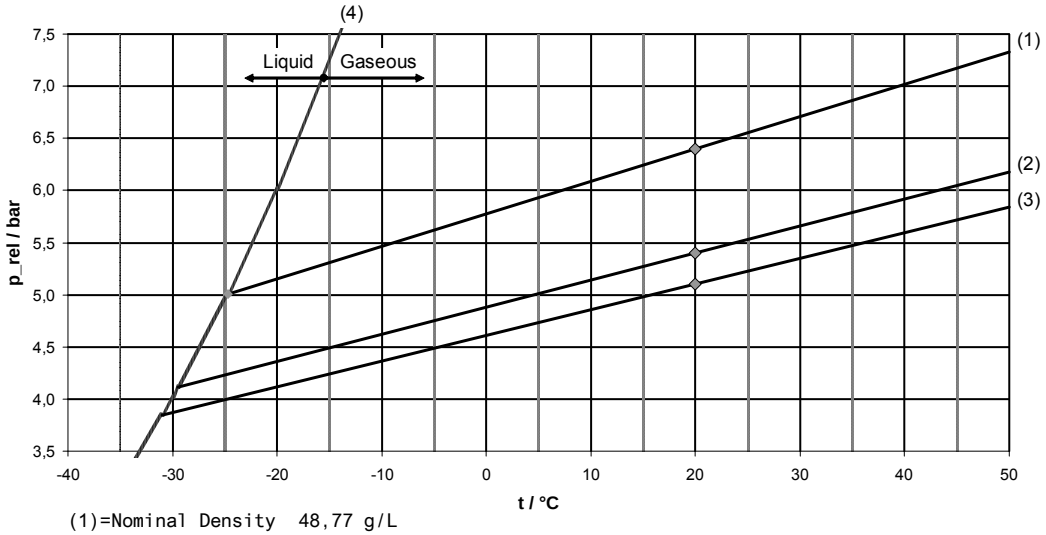
**CAUTION**

All pressure specifications are given in terms of relative pressure ($p_e$).

The pressure curve shown also applies to application at ambient temperatures <-30°C in connection with heating elements.

- Connect the filling hose of the gas-filling device (gas cylinder with pressure-reducing valve or gas handling cart) to the central supply connection (type Dilo DN8 coupling).
- Fill the HYpact gradually until rated pressure is reached. Never set the pressure-reducing valve higher than the rated pressure.
- After a temperature equalization period of approximately 1 hour, check the gas pressure again and correct it, if necessary.
- Check all gas piping seals for leaks using a leak detector.
- Screw on the protective cap for the central supply connection.

**$SF_6$ pressure curve for ND 6,4 bar**

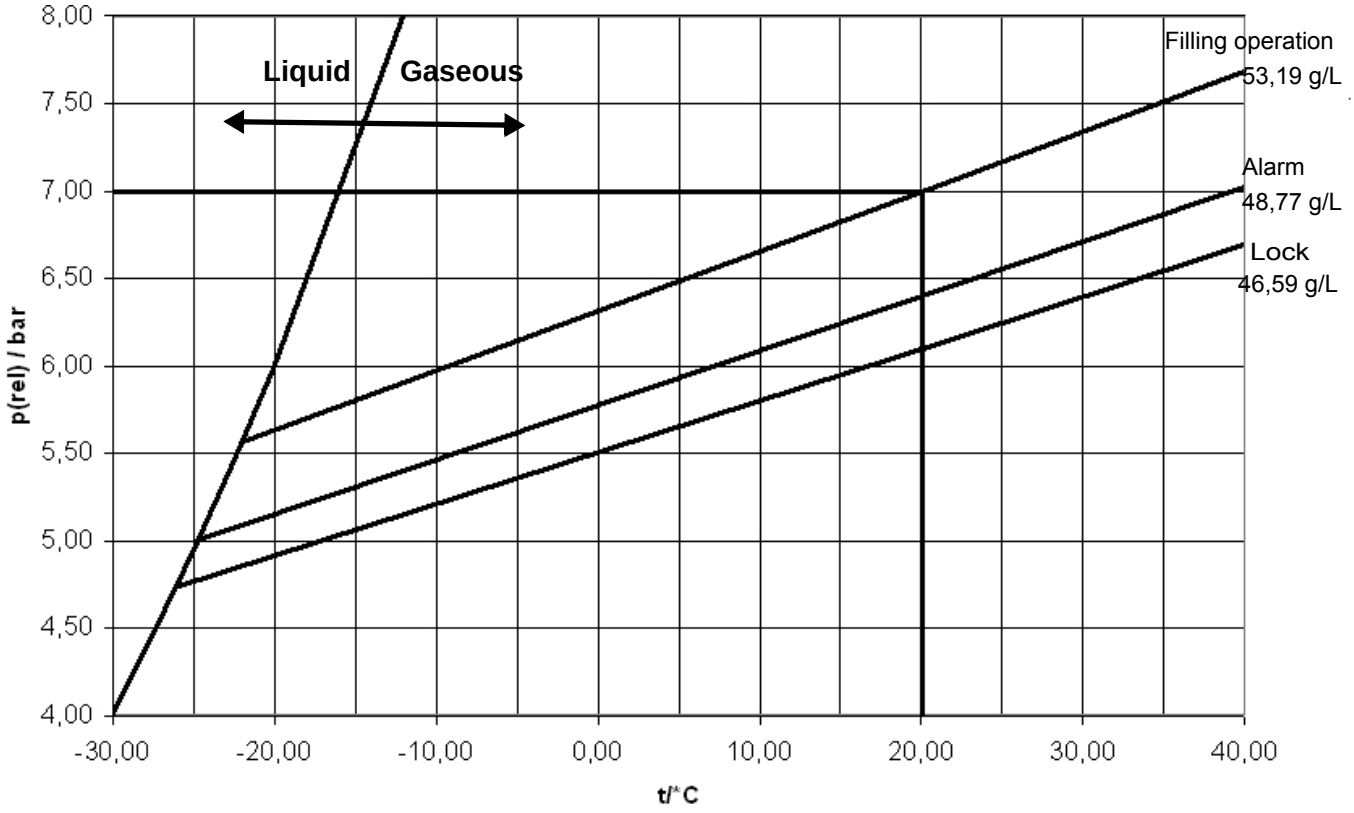



(1)=Nominal Density 48,77 g/L
(2)=Alarm Density 41,58 g/L
(3)=Lockout Density 39,46 g/L
(4)=Liquifaction Curve

$SF_6$ pressure curve -30°C
(ND =0,64 MPa [$p_e$] / UW1=0,54 MPa [$p_e$] / UW2=0,51 MPa [$p_e$])

| | | |
|---|---|---|
| **1** | Rated pressure curve | - |
| **2** | Alarm pressure curve | - |
| **3** | Lockout pressure curve | - |
| **4** | $SF_6$ liquefaction curve | - |

**$SF_6$ pressure curve for ND 7,0 bar**
p(rel) @ 20°C: Filling operation 7.0 bar/alarm: 6.4 bar/lock: 6.1 bar
Application: Switching station for a minimum ambient temperature of -25°C




The hybrid module HYpact is suitable for a minimum ambient temperature of -25°C. As insulating gas pure SF6 gas is used.

| | SF6-Density | Relative pressure at 20°C / bar |
|---|---|---|
| Filling pressure/ nominal pressure | 53,19 g/L | 7,0 bar |
| Warning pressure | 48,77 g/L | 6,4 bar |
| Lock-out pressure | 46,59 g/L | 6,1 bar |

The pressure in the module depends on the ambient temperature.

### 7.4 Checking the Anti-Condensation Heater

- Measure the resistance of the anti-condensation heaters of the operating mechanisms (of the circuit breaker and combination disconnector-earthing switch[es]), the control cabinet and transformer terminal box at the terminals in the control cabinet and transformer terminal box.
- Check the measured value against the reference value on the routine test certificate and enter it on the checklist.

### 7.5 Connecting the Supply and Control Cables

**WARNING**

Serious personal injury or property damage can result during commissioning if the equipment is live or energized.
**Therefore:**
**- Make sure the supply and control cables are not live before connecting them.**

**CAUTION**

Current transformers are short-circuited by means of earthing (or grounding) jumpers until commissioning begins. These jumpers may need to be removed.
**Therefore:**
**- Make sure that all earthing jumpers are installed in accordance with the applicable schematic diagram.**

**WARNING**

The mechanism's charging process will begin immediately after the supply and control voltages are connected.
**Therefore:**
**- Keep parts of the body and other objects away from the moving parts of the operating mechanism and the entire connecting linkage.**

**CAUTION**

The anti-condensation heater will heat up after the supply and control voltages are connected. Touching the anti-condensation heater can result in burns.
**Therefore:**
**- Do not touch the anti-condensation heater.**

- Insert the supply and control cables through the cable entry plate on the underside of the control cabinet and transformer terminal box. This plate must be fitted with cable glands by the station (and can be removed for repairs or maintenance). Connect the cables in accordance with the schematic diagram.

## 7.6 Functional Testing

**CAUTION**

Operations at gas pressures below UW2 may result in mechanical damage to the HYpact.
**Therefore:**
- **Never operate the HYpact at gas pressures below UW2 (red area on the density monitor indicator).**

**WARNING**

The pressurized components of the pole components can be damaged by improper handling. Such damage may cause the poles to burst as the result of vibrations. This can result in serious personal injury or property damage.
**Therefore:**
- **Always carry out test operations from a protected position.**

**CAUTION**

Long-lasting applied voltage may damage the shunt release coils.
**Therefore:**
- **Connect coils only by way of the terminals provided.**
- **Apply voltage to the coils for no longer than three seconds.**

### 7.6.1 Test Operations

- Carry out five closing and five opening operations by remote control.

### 7.6.2 Measuring the Running Time of the Charging Motor

After each closing operation, the charging motor automatically recharges the closing spring.
- Carry out a closing operation and measure the running time of the charging motor.
- Compare the running time with the reference values in the routine test certificate and enter it in the checklist.

### 7.6.3 Measuring the Contact Resistance

- Connect the measurement and supply leads to the **high voltage terminal pads**.
- Measure the contact resistance (> 100A DC).
- Compared the measured contact resistance with the reference values in the routine test certificate and enter it in the checklist.

If the contact resistances are higher than the values given in the routine test certificate, repeat the measurement on the **terminal pad mounting plate**.

- Connect the measurement and supply leads to the terminal pad mounting plate.
- Measure the contact resistance (> 100A DC).
- Compared the measured contact resistance with the reference values in the routine test certificate and enter it in the checklist.

If these measured values now correspond to those in the routine test certificate, then the error is due to incorrect installation of the high voltage terminal pads ***(see "Mounting the High Voltage Terminal Pads" on Page 73)***.

### 7.6.4 Measuring the Operating Times

**Closing time:**
from the start of the electrical tripping pulse until the contacts touch.

**Opening time:**
from the start of the electrical tripping pulse until the contacts separate.

- Connect the operating time measuring device to the pole terminal pads.
- Carry out a closing operation and measure the pole operating times.
- Carry out an opening operation and measure the pole operating times.
- Compare the measured operating times with the reference values in the routine test certificate and enter them in the checklist.

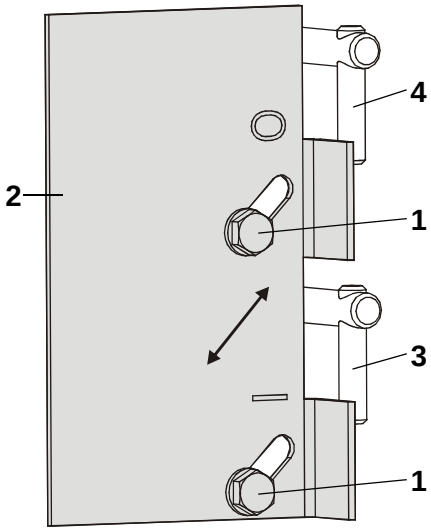
### 7.6.5 Checking Manual Operation

**WARNING**

Manual operation bypasses any circuit breaker interlock system.
**Therefore:**
- **Make sure that the gas pressure in the HYpact corresponds at least to the UW2 value before beginning manual operation.**

The manual operating levers are protected against accidental operation by a locking plate.

- Loosen the locking bolts (1) one full turn and push the locking plate (2) down and to the left.
- Carry out one closing operation and one opening operation using the manual operating levers. The circuit breaker will immediately carry out the corresponding operation.
- Push the locking plate up and to the right, and tighten the two locking bolts again.

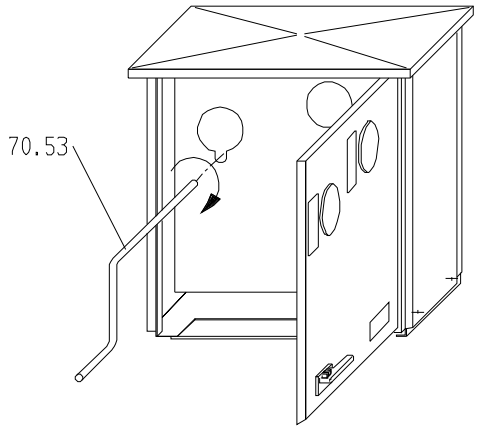



BA-P-HANDSPERRE

| | | |
|---|---|---|
| **1** | Locking bolt | - |
| **2** | Locking plate | - |
| **3** | Manual operation for closing operation | - |
| **4** | Manual operation for opening operation | - |

### 7.6.6 Manually Charging the Closing Spring

- 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 clockwise until the spring position indicator shows "closing spring charged".




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

### 7.6.7 Checking the Anti-Pumping System

**Type with Closing Priority (Standard)**

- Circuit breaker in open position:
- Apply a continuous electrical opening command and at the same time give an electrical closing command: the circuit breaker will complete just one closing operation and one opening operation.
- Circuit breaker in closed position:
- Apply a continuous electric closing command and at the same time give an electric opening command: the circuit breaker will complete just one opening operation.

**Type with Opening Priority (Optional)**

- Circuit breaker in open position:
- Apply a continuous electrical opening command and at the same time give an electrical closing command: the circuit breaker will not execute a closing operation.
- Circuit breaker in closed position:
- Apply a continuous electric closing command and at the same time give an electric opening command: the circuit breaker will complete just one opening operation.
- After removal of the opening command, the circuit breaker is not allowed to carry out a closing operation.

The anti-pumping system is automatically reset if there are no more operating commands.

### 7.6.8 Checking the Functional Lockout

The contacts of the density monitor will close when the gas pressure drops.

- Jumper the UW2 density monitor contacts at the terminal strip.
- Give one closing command and one opening command. The circuit breaker must not carry out any switching operations.
- Remove the jumpers from the terminal strip.

### 7.6.9 Operations Counter

- Check the operation of the operations counter.
- Read the count shown on the counter and enter the values in the checklist.

### 7.6.10 Electrical Operation Test of Motor-Operated Mechanism for Disconnector-Earthing Switch

- Operate using local control (optional feature) in both closed and open positions.
- Check the alarm contacts in closed and open positions.
- Check heater operation

Carry out closing and opening operations and
- Measure the running time of the mechanism motor.
- Compare the running time with the reference values in the routine test certificate and enter it in the checklist.

Carry out closing and opening operations and
- Measure the power consumption of the mechanism motor.
- Compare the power consumption with the reference values in the routine test certificate and enter it in the checklist

.

**CAUTION**

Manual operation of the control contactors in motor-operated mechanisms is not permitted.

### 7.6.11 Final Tasks

- Remove all testing and measuring equipment from the HYpact.
- After work is finished, install the roof and side panels of the spring mechanism cabinet (see illustration on page 152). Tighten bolts (3) and nuts (2) to a torque of 17 Nm.
- Clean up the installation site.

The HYpact is ready to be connected to the high voltage system.

## 7.7 Handling and On-Site Testing of Current Transformers

### 7.7.1 Handling

Current transformers (CTs) are designed as low-power transformers and are provided for the connection of electrical protective and measuring equipment under field conditions.


To prevent hazards caused by high voltages, current transformers must never be operated with an open circuit or with fuse protection at the electrical terminals on the secondary side. One terminal on the secondary side must be securely earthed or grounded so that the earth potential (potential to ground) will be clearly defined.

Use extreme caution when handling current transformers in order to ensure that the insulation is not damaged and also that no additional electrical and mechanical loads are applied to the magnetic core material; such loads could have a negative effect on the magnetic properties of the core material over the long term.
After these devices have been received, inspect them visually to make sure that they do not show any sign of external damage, including moisture.

### 7.7.2 On-Site Testing

The current transformers that are used have already undergone routine testing at the factory in compliance with applicable standards so that on-site testing can be reduced to a minimum.
Check the devices for damage and make sure that the current transformers have been properly connected electrically on the secondary side and properly earthed (grounded).
Further inspection and testing of current transformers in compliance with special customer specifications may include the following procedures:

- Checking the terminal markings
- Testing the insulation property (dielectric strength) of the secondary winding
- Testing the current transformation ratio and the connected load
- Polarity testing
- Measuring the magnetizing current for protection cores

Such procedures are not included in our on-site inspection and testing program and may only be performed by experienced and trained technicians.
Performance of these additional tests for current transformers also requires the availability of special testing and measuring instruments on site.


Current transformers must never be operated with open, unearthed (ungrounded) secondary circuits.
Current in the primary circuit with an open secondary circuit generates hazardous high voltages that will destroy the current transformer and endanger the lives and health of personnel.

If it should become necessary to perform any of the tests listed above, then both the appropriate technical personnel and the proper testing and measuring equipment are available at our Product Service Center on request.

### 7.8 Mounting the Ice Guard (Optional)

To mount the ice guard, proceed as follows:
• Attach the ice guard using the eight mounting screws - four on the front and four on the back.

# 8 Troubleshooting

## 8.1 Electrical Switching Commands Are Not Correctly Executed

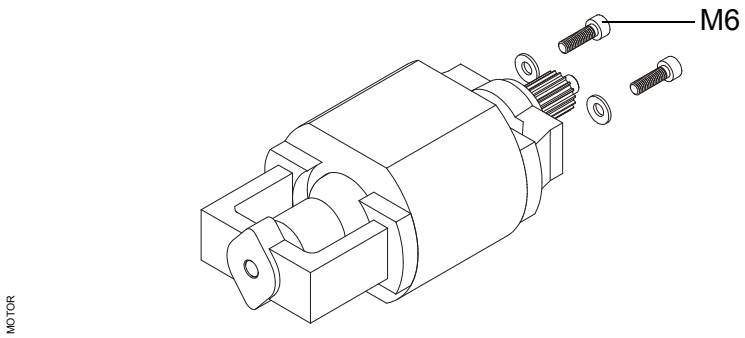

Work on the control system involves the danger of electric shock. Sudden movements of the charging system or the circuit breaker linkage can cause serious injury.
Troubleshooting tasks should be handled by qualified staff only. Such staff must follow the safety rules of electrical engineering.

- Check the control voltage.
- Check the gas pressure on the density monitor. If the gas pressure is UW2 or less, no switching commands will be executed.
- Check the charging state of the closing spring. If the closing spring is not charged, no closing operations can be carried out. It is possible that a motor protection switch has tripped and disconnected the charging motor from the power supply.
- Check the shunt releases. Replace defective coils, determine the cause of a potential overload and eliminate the cause.
- Check the terminal connections to make sure they are tight and properly connected.
- Check the contactors in the faulty control circuit.
- Check the electric operating points of the density monitor.

## 8.2 Mechanism Reconditioning Procedures (Circuit Breaker)

### 8.2.1 Replacing the Charging Motor

- Disconnect both wires from the motor limit switch.




- Unscrew the M6 mounting screws and remove the motor.
- Install the new motor and tighten the mounting screws to a torque of 7Nm.

**CAUTION**

Lubrication of the motor pinion may cause the operating mechanism to malfunction.
Do not grease or lubricate the motor pinion.

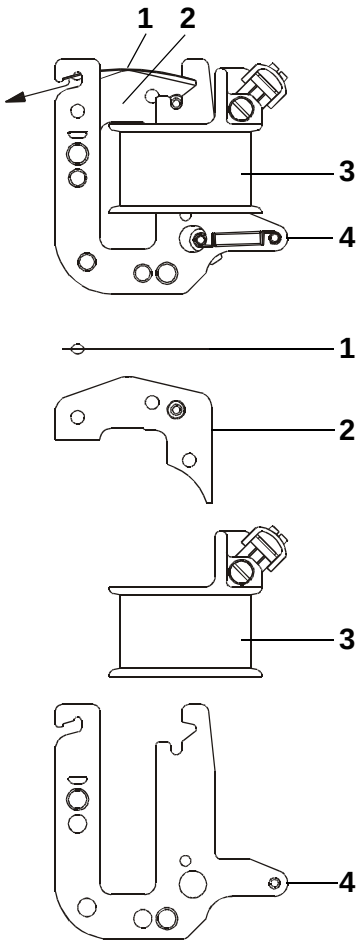
- Reconnect the wires to the motor limit switch.

**CAUTION**

If the wiring is incorrect, the motor will stall and may become damaged.
Turn on the power to the motor briefly and check to see whether the motor drives the gear unit.
**If this is not the case:**
- **Turn off the power to the motor immediately.**
- **Check the connections and correct if necessary.**

### 8.2.2 Replacing the Closing and Opening Coil

- Disconnect the wire connections from the coil (3).




| | | |
|---|---|---|
| **1** | Leaf spring | - |
| **2** | Yoke | - |
| **3** | Coil | - |
| **4** | Side plate | - |

- Push aside the leaf spring (1) with your finger in the direction of the arrow.
- Lift out the yoke (2) and place it on a clean surface.

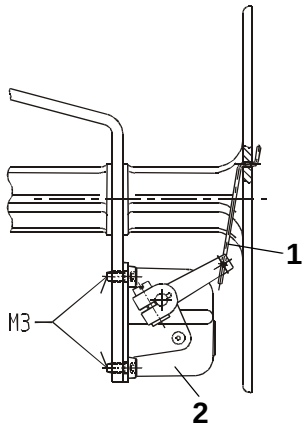
**CAUTION**

Remove the coil being replaced and insert a new coil over the side plates (4).
The wrong coil type can cause the mechanism to malfunction.
**Make sure you have the correct coil type. Compare the part number on the coils.**

- Replace the yoke (2) and mount the leaf spring (1).
- Check the fit of the leaf spring (1): it must snap into place.
- Connect the coil (3).

### 8.2.3 Replacing the Operations Counter

- Detach the operating link (1).

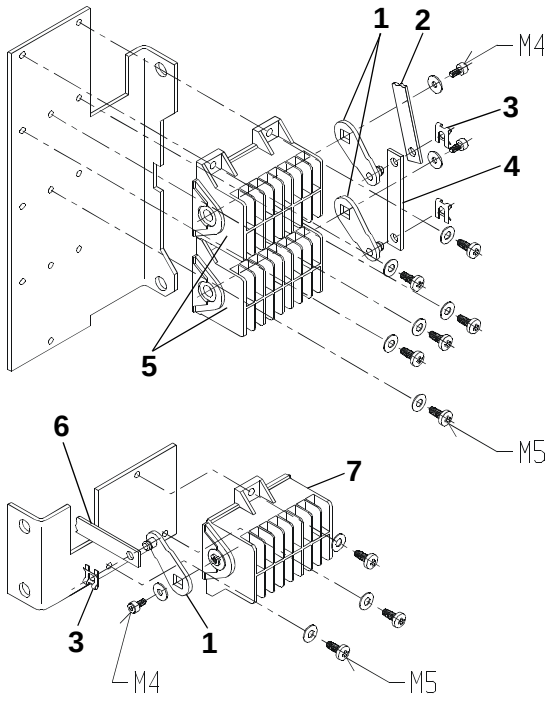



| | | |
|---|---|---|
| **1** | Operating link | - |
| **2** | Operations counter | - |

- Remove the operations counter (2) by unscrewing the four M3 mounting screws.
- 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 circuit breaker).
- Mount the new operations counter.
- Reattach the operating link.

### 8.2.4 Replacing the Motor Limit Switch and/or the Auxiliary Switch

- Disconnect the wire connections to the motor limit switch (7) and/ or the auxiliary switch (5).




| | | |
|---|---|---|
| **1** | Lever | - |
| **2** | Drive rod | - |
| **3** | Locking clamp | - |
| **4** | Connecting rod | - |
| **5** | Auxiliary switch | - |
| **6** | Drive rod | - |
| **7** | Motor limit switch | - |

- Remove the locking clamps (3). Remove the drive rod (2 or 6) and the connecting rod (4).
- Unscrew the M5 mounting screws.
- Remove the motor limit switch or auxiliary switch.
- Unscrew the M4 screw(s) and remove the lever (1).
- Mount the lever on the new motor limit switch or auxiliary switch.

| | |
|---|---|
| **CAUTION** | If the drum controller is positioned incorrectly, operation of the mechanism will be negatively affected.<br><br>Therefore check the position of the drum controller.<br>- **Motor limit switch:** Contacts 15-16 are open in the "closing spring discharged" position.<br>- **Auxiliary switch:** Contacts 15-16 are closed in circuit breaker position "O". |

- Install the motor limit switch (or the auxiliary switch).
- Tighten the M5 screws.
- Mount the operating and connecting rods.
- Reinstall the locking clamps.
- Tighten the wire connections.
- Check to see whether there is play in the linkage.

## 8.3 Replacing the Density Monitor

**CAUTION!**
The gas chambers of the compact module are pressurized.
Before opening any of the compact module's gas chambers, pump out all of the $SF_6$ gas from the respective gas chamber and evacuate the chamber ***(see "Handling Sulfur Hexafluoride" on page 15).***.

- Remove the density monitor cover by loosening the five threaded joints (see diagram).

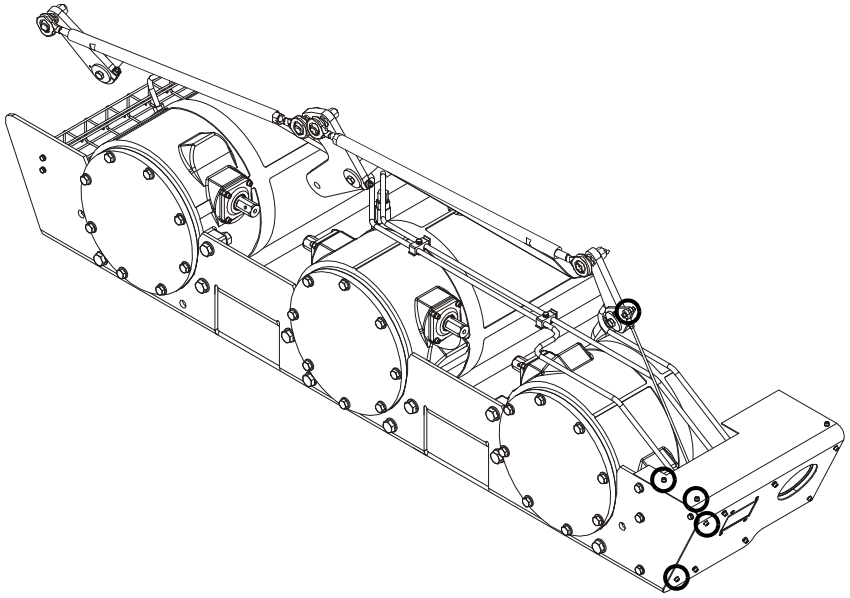
**CAUTION**

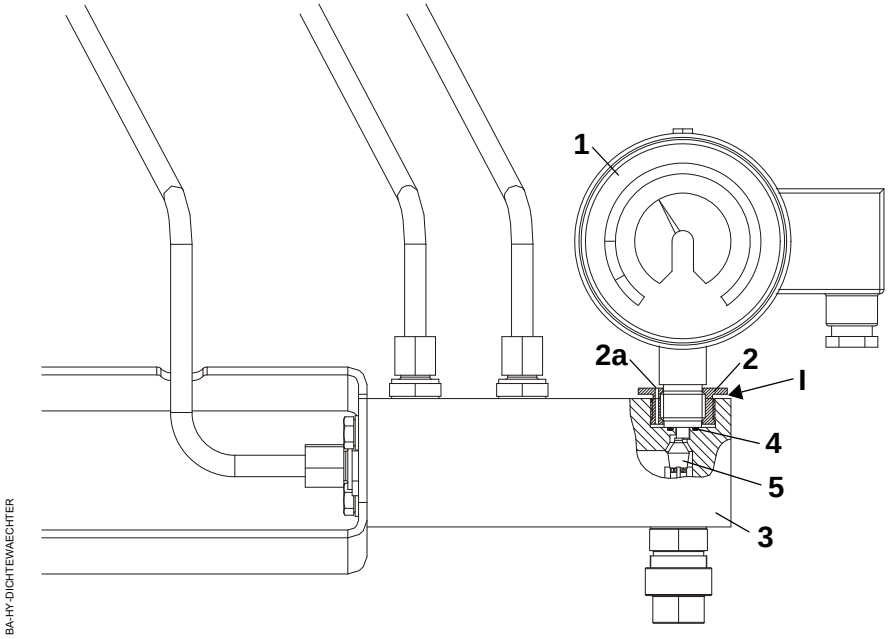
Once the threaded joint of the connecting linkage is loosened, the length of the connecting linkage may change if the spherical heads turn in opposite directions.

**Therefore:**
- **Do not turn the spherical heads of the connecting linkage in opposite directions while replacing the density monitor.**

The density monitor (1) is connected to the manifold (3) by the threaded bushing (2). The O-ring (4) seals the connection.
The internal thread (female thread) of the threaded bushing is a right-hand thread, whereas the external thread (male thread) is a left-hand thread.
If no density monitor is attached, the check valve (5) closes the hole in the manifold. This makes it possible to replace the density monitor without disconnecting the gas couplings from the poles.

- Hold the density monitor firmly and unscrew and remove the threaded bushing from the manifold **(left-hand thread)**. Because of the left-hand and right-hand thread combination, the density monitor will move out of the threaded bushing simultaneously.
- Remove the threaded bushing (2) from the old density monitor.
- Replace the O-ring (4). Lubricate the O-ring and sealing surfaces as per L5.
- Lubricate both threads of the threaded bushing as per L4.
- Screw the threaded bushing two full turns onto the new density monitor.
- Place the threaded bushing and density monitor on the manifold. Align the density monitor and screw the threaded bushing into the manifold **(left-hand thread)**. Because of the left-hand and right-hand thread combination, the density monitor will move into the threaded bushing simultaneously.
- Tighten the threaded bushing to a torque of 30Nm.
- After installation, there must be a gap (2 to 4mm) between the collar of the threaded bushing and the manifold. The gap ensures that the density monitor will rest securely on the manifold.
- Fill the vent hole (2a) in the threaded bushing with grease as per L4.
- Replace the density monitor cover by tightening the five threaded joints (see diagram).





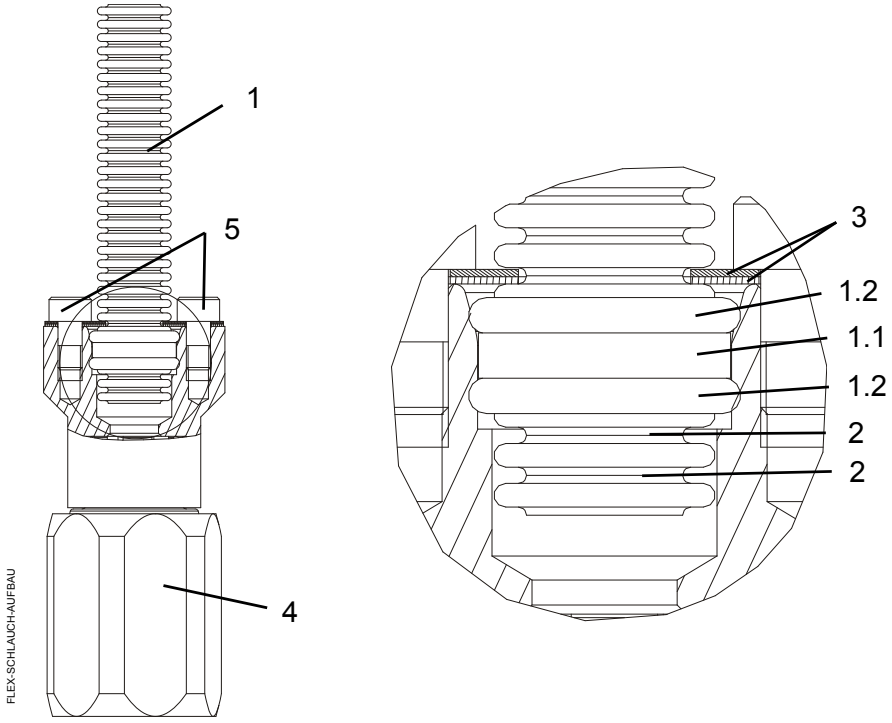

| | | |
|---|---|---|
| **1** | Density monitor | 1x |
| **2** | Threaded bushing | 1x |
| **2a** | Vent hole | 1x |
| **3** | Manifold | 1x |
| **4** | O-ring | 1x |
| **5** | Check valve | 1x |

## 8.4 Gas Piping

**CAUTION!**
The gas chambers of the compact module are pressurized.
Before opening any of the compact module's gas chambers, pump out all of the $SF_6$ gas from the respective gas chamber and evacuate the chamber ***(see "Handling Sulfur Hexafluoride" on page 15).***.

### 8.4.1 Replacing the Flexible Metal Hose of the Gas Piping

The flexible metal hose is fitted for sealing purposes with a sealing set consisting of a plastic bushing (1.1) flanked by two O-rings (1.2). For the sealing set to fit properly on the end of the flexible metal hose (1), two corrugation valleys (2) must remain uncovered. Two locking plates (3) offset radially from one another prevent the sealing set from sliding when inserted into the sealing area of the coupling (4). A secure fit of the flexible metal hose (1) is ensured by screwing on the locking plates (3).




| | | |
|---|---|---|
| **1** | Flexible metal hose | 1x |
| **1.1** | Plastic bushing | 1x |
| **1.2** | O-ring | 2x |
| **2** | Corrugation valley | - |
| **3** | Locking plate | 2x |
| **4** | Coupling (filling connection) | 1x |
| **5** | Screw | 2x |

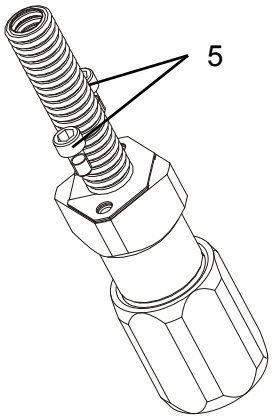



diagram 1

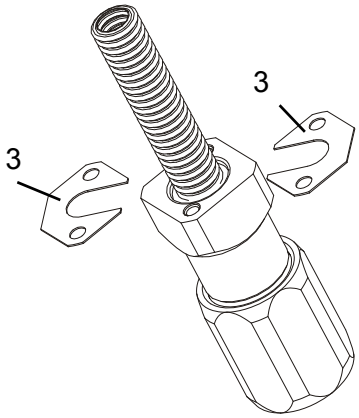



diagram 2

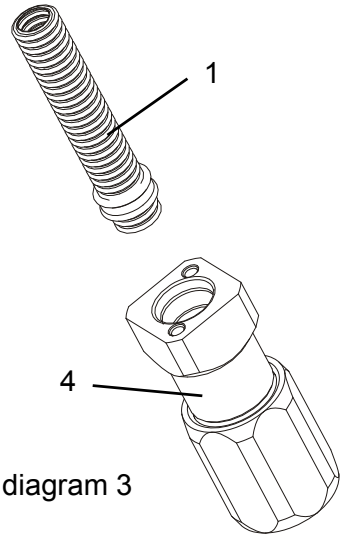



diagram 3

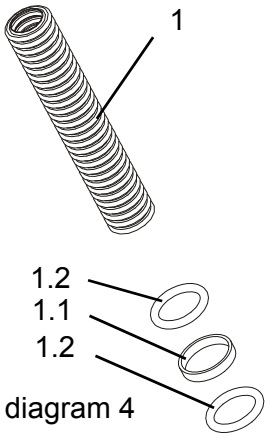



diagram 4

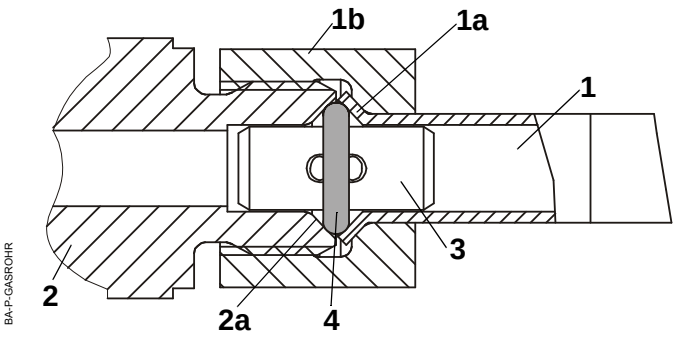
FLEX-SCHLAUCH-DEMONTAGE

- Disconnect the gas coupling. This will disconnect the gas compartments of the poles from the gas piping.
- Unscrew the screws (5) (see diagram 1).
- Push the locking plates (2) to one side (diagram 2)
- Carefully pull the metal hose (1) out of the coupling (4) (diagram 3).
- Apply lubricant to two new O-rings (1.2) as per L5, and slide the O-rings and the plastic bushing (1.1) onto the new flexible metal hose (1) past the first two corrugation valleys (2), leaving the latter uncovered.
- Apply lubricant to the sealing areas on the flexible metal hose (1) and the coupling (4) as per L5.
- Lubricate the threads of the junction points as per L4.
- Fit the locking plates (3) on opposite sides of the corrugation valley immediately following the O-ring (1.2).
- Insert the flexible metal hose (1) together with the locking plates (3) into the sealing area of the coupling (4) until the locking plates (3) are in contact with the end of the coupling (4).

Secure the locking plates (3) with two screws (5) and tighten to a torque of 7 Nm.

### 8.4.2 Replacing the Rigid Gas Pipe

The ends of the gas pipes (1) are flared (1a). The inner surface of the flaring is the sealing surface. The gas pipes are connected by union nuts (1b). The flaring allows the union nuts to be captivated to the gas pipe.
The piping junction points (2) have an external thread and an inside tapered contour (2a). The inside tapered contour forms the sealing surface.
A tubular stiffener (3) stabilizes the joint mechanically. The O-ring (4) fitted onto the stiffener seals the connection.




| | | |
|---|---|---|
| **1** | Gas pipe | 1x |
| **1a** | Flaring | - |
| **1b** | Union nut | - |
| **2** | Junction point | - |
| **2a** | Inside tapered contour | - |
| **3** | Tubular stiffener | 1x |
| **4** | O-ring | 1x |

- Disconnect all gas couplings. This will disconnect the gas compartments of the poles from the gas piping.
- Unscrew the gas pipe that is to be replaced from the junction points.
- Check the sealing surfaces of the junction points for damage.
- Apply grease to a new O-ring (4) as per L5 and fit onto the tubular stiffener (3).
- Lubricate the sealing areas on the gas pipe and the junction points as per L5.
- Lubricate the threads of the junction points as per L4.
- Insert the tubular stiffener and O-ring and screw the gas pipe together with the junction point until it is finger-tight.
- Align the gas pipe and tighten it to a torque of 30Nm.

# 9 Inspection and Maintenance

Inspection and maintenance procedures are carried out according to a schedule.
Reconditioning work is a function of the HYpact's operating frequency and breaking current load.

The specified inspection and maintenance intervals apply to normal operating conditions. Extreme ambient conditions such as
- continuously high ambient temperatures,
- heavy dust accumulation,
- continuously high humidity,
- severe air pollution by aggressive gases or vapors,
- and service in coastal areas

may make shorter inspection and maintenance intervals necessary.

The intervals are as follows:

| | |
|---|---|
| Inspection: | On an occasional basis during routine inspections, after 6 years at the latest; |
| Maintenance: | After 12 and 24 years. |

**CAUTION**

Oil and cleaning additives attack the silicone surface of the insulator.
**Therefore:**
- **Clean and wash the silicone shielding using only water or isopropyl alcohol.**

The operating mechanisms have already been provided with lifetime lubrication at the factory and are therefore maintenance-free under normal operating conditions.

**CAUTION**

Improper relubrication of the mechanisms may lead to problems or cause the mechanism to malfunction.

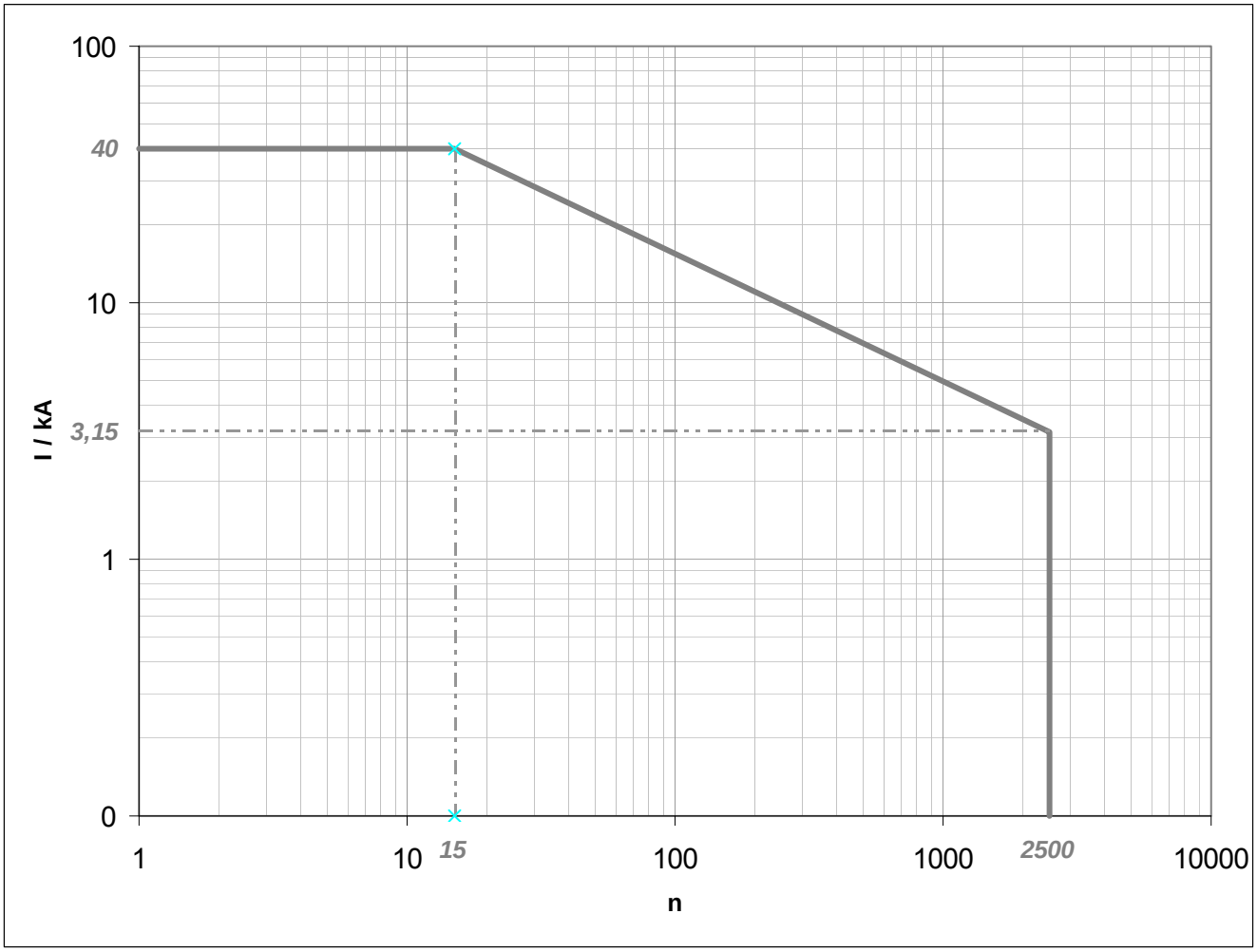
Maintenance and reconditioning may only be performed by trained technicians.

Qualified personnel can be requested from GE. The customer's staff can be trained at the manufacturer's plant. GE offers training courses for this purpose.

The arcing contacts will exhibit wear due to the switching of normal and short-circuit currents. The effective value of the short-circuit breaking current is used to evaluate wear.
Reconditioning is necessary after 2,500 operations at rated normal current or after a specific total breaking current (see figure) has been reached.

**CAUTION**

Under certain operating conditions, such as operation of reactors and capacitor banks (especially back-to-back conditions), reconditioning will be necessary after fewer operations.
Special approval by GE is required for service under these conditions.



## 9.1 Ordering Accessories and Replacement Parts

The following data are required for an order:

- Type designation — on nameplate
- Serial number — on nameplate
- Instruction manual number — on cover
- Figure number and position number in the figure
- Part description
- Quantity required

## 9.2 Inspection

The HYpact may remain in operation during inspection.


Danger due to electric shock.
**Therefore:**

- **Never reach into the high voltage insulation area of the module.**
- **Never touch the contacts of the control system.**

Follow all regional and operator-specified safety precautions.

### 9.2.1 Visual Inspection

- Check the HYpact carefully for damage or corrosion. In particular, check the insulators from the ground for possible damage.
- If corrosion is detected, take steps to prevent or control corrosion.
- Check the ventilation ports and vents of the operating mechanisms (of the circuit breaker and the combination disconnector-earthing switch[es]), the control cabinet (if applicable) and the transformer terminal box to make sure they are not obstructed. Remove any blockages.

### 9.2.2 Anti-Condensation Heater

Check the heat dissipation from the anti-condensation heater. To do so, place a contact thermometer on the anti-condensation heater and measure the temperature rise.


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

**Therefore:**

- **Never touch the heating unit directly.**

### 9.2.3 Checking Gas Pressure

Check the density monitor indicator. If the indicator is not in the green area, top up with gas until rated pressure is reached ***(see "Filling the Module with Gas" on Page 89)***.

## 9.3 Maintenance

The HYpact must be shut down for maintenance work. It is not necessary to open the three phases of the module.

- Disconnect the module from the high voltage system, and ground (earth) the module at both ends.
- 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 operations shown in the table below are required to reach this state, depending on the starting situation:

| Circuit Breaker Position | State of the Closing Spring | Operations to Be Executed |
|---|---|---|
| CLOSED / I | Charged | O-C-O |
| CLOSED / I | Discharged | O |
| OPEN / 0 | Charged | C-O |
| OPEN / 0 | Discharged | No operation required |


Danger due to electric shock.
**Therefore:**
**- Disconnect the module from the high voltage system and ground (earth) the module at both ends.**


Danger due to suddenly moving linkage.
**Therefore:**
**- Discharge the closing and opening springs by carrying out closing and opening operations.**

### 9.3.1 Checking the Cable Connections

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

### 9.3.2 Checking the Connecting Linkage

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

### 9.3.3 Checking the Control Circuits

- Carry out test operations in accordance with the commissioning procedure ***(see "Test Operations" on Page 93)***.

### 9.3.4 Checking the Gas Quality

Take a gas sample and check for compliance with the limits.

- Dew point: ≤ -5°C [1)]
- $SF_6$ $conten_t$: ≥ 97%
- Acidity ($SO_2$): < 180 ppmv [2)]

1) Based on the operating pressure and 20°C.
2) Measurements earliest perform three days after a short circuit.

The required measuring and testing equipment is listed in ***"Tools and Auxiliary Equipment" on Page 159***.

### 9.3.5 Checking the Contact Resistance

- Check the contact resistance as described in the commissioning section.

### 9.3.6 Checking the Operating Times

- Check the operating times as described in the commissioning section.

### 9.3.7 Combination Disconnector-Earthing Switch(es) (Direct Earthing)

Check to make sure the indicators are still within the respective scale graduation or division. To do so, proceed as follows:

- Carry out a test operation manually (earthing switch closed > earthing switch open) and check the position. If necessary, the drive rod length must be adjusted until the correct position is reached.
- Carry out a test operation manually (earthing switch open > disconnector closed) and check the "disconnector closed" position.
- Carry out a test operation manually (disconnector closed > earthing switch open > earthing switch closed ) and check the position.
- The respective positions can be read on the position indicator ***(see "Direct Earthing" on Page 156)***.

### 9.3.8 Combination Disconnector-Earthing Switch(es) (Integral Earthing)

Check to make sure the indicators are still within the respective scale graduation or division. To do so, proceed as follows:

- Carry out a test operation manually (earthing switch closed > earthing switch open) and check the position. If necessary, the drive rod length must be adjusted until the correct position is reached.
- Carry out a test operation manually (earthing switch open > disconnector closed) and check the "disconnector closed" position.
- Carry out a test operation manually (disconnector closed > earthing switch open > earthing switch closed ) and check the position.
- The respective positions can be read on the position indicator ***(see "Integral Earthing" on Page 157)***.

### 9.3.9 Checking the Threaded Connections

- Check all accessible threaded connections (screwed or bolted joints) to make sure they are tight.

The tightening torques are given in the following sections:

- Installation
- Commissioning
- Troubleshooting
- Reconditioning

# 10 Reconditioning

**CAUTION!**
The gas chambers of the compact module are pressurized.
Before opening any of the compact module's gas chambers, pump out all of the $SF_6$ gas from the respective gas chamber and evacuate the chamber ***(see "Handling Sulfur Hexafluoride" on Page 15)***.

## 10.1 HYpact Module

Comprehensive reconditioning requires lifting up the HYpact module. This means that the operations described in the sections listed below must be carried out in reverse order:

- Connecting the Density Monitor Cable
  ***(see section 7.1.1 on Page 77)***
- Earthing (Grounding) the HYpact
  ***(see section 6.16 on Page 75)***
- Connecting the Cables
  ***(see section 6.15 on Page 74)***
- Mounting the Circuit Breaker Drive Rod
  ***(see section 6.13.1 on Page 65)***
- Mounting the Drive Rod of the Combination Disconnector-Earthing Switch
  ***(see section 6.13.2 on Page 67)***
- Mounting the Module
  ***(see section 6.12 on Page 62)***
- In addition, follow the instructions for moving the module using a forklift truck or a crane ***(see section 6.5 on Page 33)***.

### 10.2 Detaching and Connecting FlexLink Gas Piping from/to Pole Columns

We recommend that the following tools be used to loosen the gas couplings:

-T016: double open-ended wrench (spanner) SW24
-T019: double open-ended wrench (spanner) SW27

First loosen gas coupling using tools T016 and T019 and then unscrew completely by hand.

For connecting the gas couplings ***(see "FlexLink Gas Piping Still Needs To Be Installed" on Page 86)***

### 10.3 Detaching and Connecting Rigid Gas Piping from/to Pole Columns

We recommend that the following tools be used to loosen the gas couplings:

- T016: double open-ended wrench (spanner) SW24
- T016: double open-ended wrench (spanner) SW27

First loosen gas coupling using tools T016 and T019 and then unscrew completely by hand.

For connecting the gas couplings ***(see "Rigid Gas Piping Still Needs To Be Installed" on Page 88)***

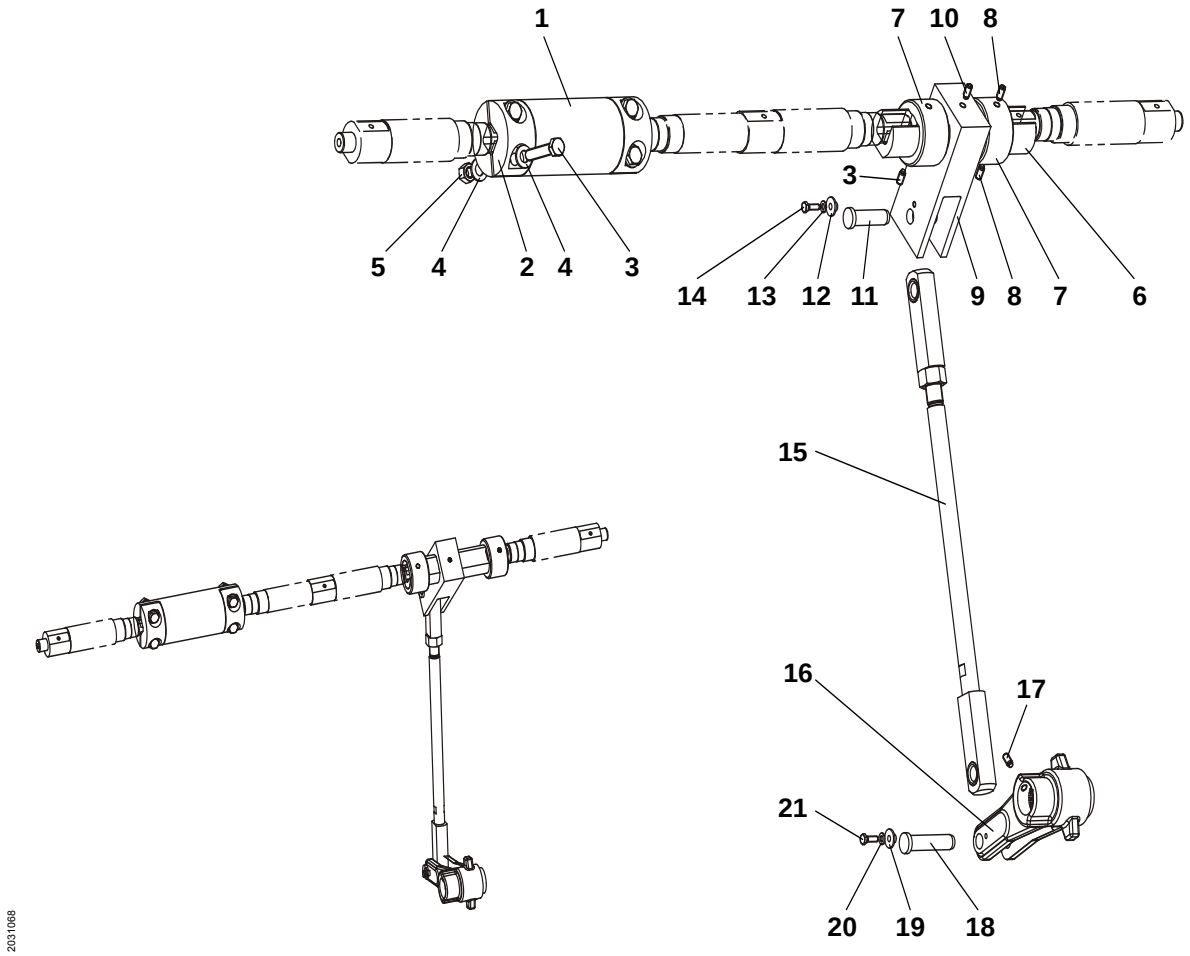
### 10.4 Linkage for Circuit Breaker

The coupling shafts A/B and B/C must be removed in order to recondition the poles.

- Remove the four bolts (3), eight washers (4) and four nuts (5) from the bolted joints on coupling shaft A/B (1) and remove the coupling shaft and the clamps (2).
- Remove the three setscrews (8) from the screwed joint of coupling shaft B/C (6) and push in the setting collars (7). Remove the coupling shaft and the setting collars.

Reverse the sequence to mount the coupling shafts.

- Apply lubricant to the bolts (3) per lubrication specification L1. Tighten to a torque of 83 Nm.
- Apply locking adhesive S1 to the setscrews (8). Tighten to a torque of 17 Nm.




| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | Coupling shaft A/B | 1x | | **12** | Sleeve (stud lock) | 1x |
| **2** | Clamp | 2x | | **13** | Washer, 6 200 HV-A2 | 1x |
| **3** | Hexagon bolt, M12x60 A2-70 | 4x | | **14** | Hexagon screw, M6x18 A2-70 | 1x |
| **4** | Washer, 12 200 HV-A2 | 8x | | **15** | Drive rod | 1x |
| **5** | Hexagon nut, M12 A2-70 | 4x | | **16** | Drive lever | 1x |
| **6** | Coupling shaft B/C | 1x | | **17** | Setscrew M8x16 A2-70 | 1x |
| **7** | Setting collar | 2x | | **18** | Pin 16x68 | 1x |
| **8** | Setscrew M8x16 A2-70 | 3x | | **19** | Sleeve (stud lock) | 1x |
| **9** | Circuit breaker lever | 1x | | **20** | Washer, 6 200 HV-A2 | 1x |
| **10** | Setscrew M8x16 A2-70 | 1x | | **21** | Hexagon screw, M6x18 A2-70 | 1x |
| **11** | Pin 16x54 | 1x | | **-** | - | - |

## 10.5 Linkage for Combination Disconnector-Earthing Switch

| | |
|---|---|
| **CAUTION** | ***"HYpact with Type ME4 Motor-Operated Mechanism" on Page 123***<br>***"HYpact with Type ME1-3 Motor-Operated Mechanism" on Page 124*** |

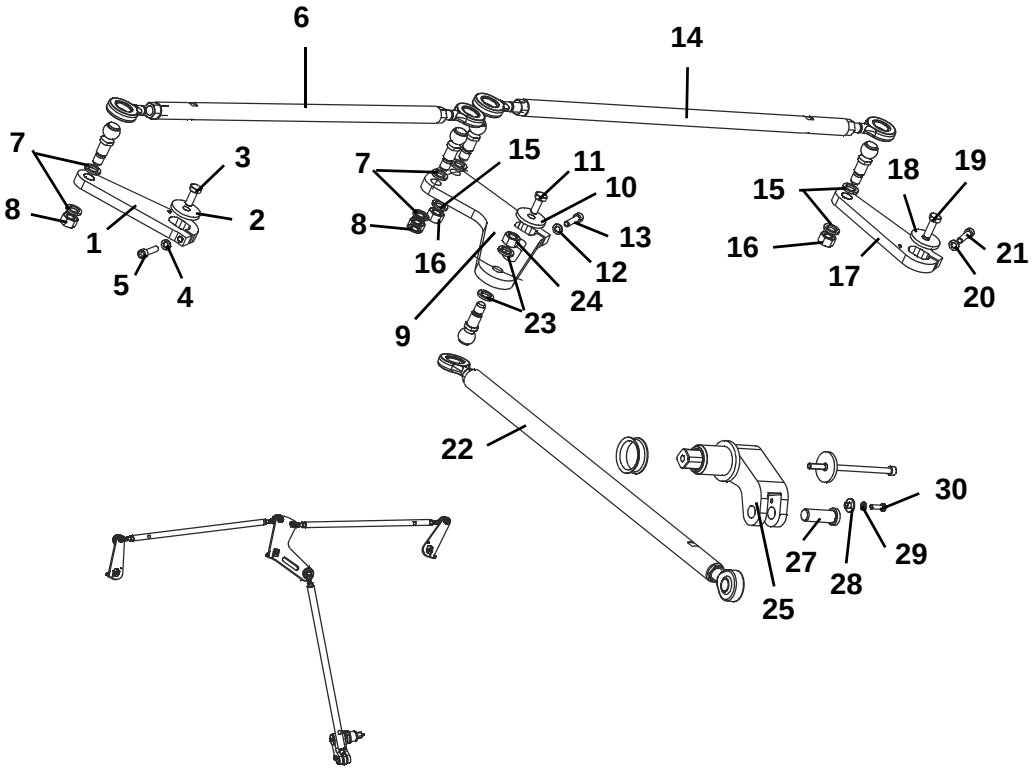
The connecting rods A/B and B/C must be removed in order to recondition the poles:

- Remove the two nuts (8) and two washers (7) on the back side of the levers (1 and 9) and remove connecting rod A/B (6) along with two washers (7).
- Remove the two nuts (16) and two washers (15) on the back side of the levers (9 and 17) and remove connecting rod B/C (14) along with two washers (15).

Reverse the sequence to mount the connecting rods.

- Apply lubricant to the threads of the joint heads per lubrication specification L1. Tighten to a torque of 140 Nm.
- If the holes in the levers no longer line up with the connecting rods, especially after replacing the poles, proceed as follows:
  - Loosen the lock nuts of the respective rod.
  - Install one end of the connecting rod.
  - Hold the free joint head securely and turn the rod until the rod is in exact alignment. Tighten the lock nuts. Tighten the lock nuts to a torque of 92 Nm.
- Always follow the instructions on page 67 for "Direct Disconnector-Earthing Switch (DEd)" and on page 68 for "Indirect Disconnector-Earthing Switch (DEi) before commissioning the combination disconnector-earthing switch."

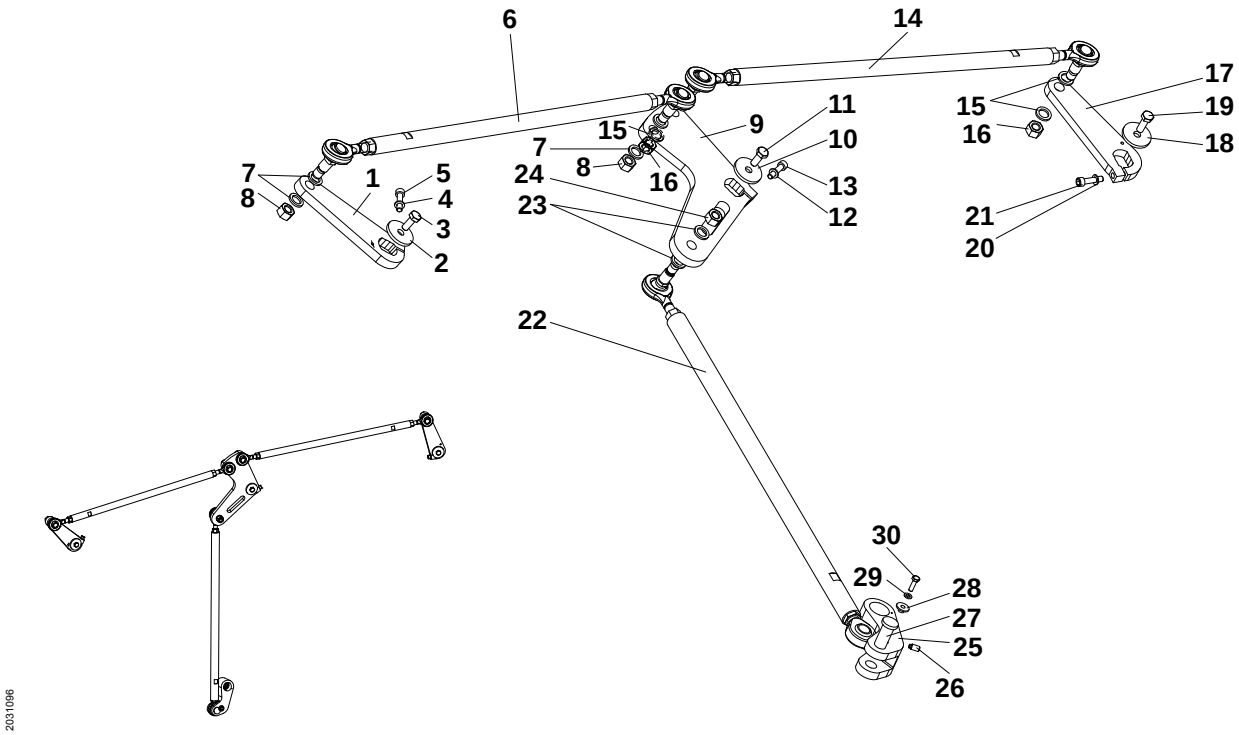
### 10.5.1 HYpact with Type ME4 Motor-Operated Mechanism




ba-247-hygest_me4_trenn_erder

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | Lever, pole A | 1x | | **16** | Hexagon nut, M14R A2-70 | 2x |
| **2** | Washer, 45x11x5 NIRO | 1x | | **17** | Lever, pole C | 1x |
| **3** | Hexagon screw, M10x25 A2-70 | 1x | | **18** | Washer, 45x11x5 NIRO | 1x |
| **4** | Washer, 8 200 HV-A2 | 1x | | **19** | Hexagon screw, M10x25 A2-70 | 1x |
| **5** | Cap screw, M8x35 A2-70 | 1x | | **20** | Washer, 8 200 HV-A2 | 1x |
| **6** | Connecting rod A-B | 1x | | **21** | Cap screw, M8x35 A2-70 | 1x |
| **7** | Washer, 16 200 HV-A2 | 4x | | **22** | Drive rod | 1x |
| **8** | Hexagon nut, M14R A2-70 | 2x | | **23** | Washer, 16 200 HV-A2 | 2x |
| **9** | Lever, pole B | 1x | | **24** | Hexagon nut, M14R A2-70 | 1x |
| **10** | Washer, 45x11x5 NIRO | 1x | | **25** | Drive lever | 1x |
| **11** | Hexagon screw, M10x25 A2-70 | 1x | | **27** | Pin 18x52 | 1x |
| **12** | Washer, 8 200 HV-A2 | 1x | | **28** | Sleeve (stud lock) | 1x |
| **13** | Cap screw, M8x35 A2-70 | 1x | | **29** | Washer, 6 200 HV-A2 | 1x |
| **14** | Connecting rod B-C | 1x | | **30** | Hexagon screw, M6x20 A2-70 | 1x |
| **15** | Washer, 16 200 HV-A2 | 4x | | | | |

### 10.5.2 HYpact with Type ME1-3 Motor-Operated Mechanism




| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | Lever, pole A | 1x | | **16** | Hexagon nut, M14R A2-70 | 2x |
| **2** | Washer, 45x11x5 NIRO | 1x | | **17** | Lever, pole C | 1x |
| **3** | Hexagon screw, M10x25 A2-70 | 1x | | **18** | Washer, 45x11x5 NIRO | 1x |
| **4** | Washer, 8 200 HV-A2 | 1x | | **19** | Hexagon screw, M10x25 A2-70 | 1x |
| **5** | Cap screw, M8x35 A2-70 | 1x | | **20** | Washer, 8 200 HV-A2 | 1x |
| **6** | Connecting rod A-B | 1x | | **21** | Cap screw, M8x35 A2-70 | 1x |
| **7** | Washer, 16 200 HV-A2 | 4x | | **22** | Drive rod | 1x |
| **8** | Hexagon nut, M14R A2-70 | 2x | | **23** | Washer, 16 200 HV-A2 | 2x |
| **9** | Lever, pole B | 1x | | **24** | Hexagon nut, M14R A2-70 | 1x |
| **10** | Washer, 45x11x5 NIRO | 1x | | **25** | Drive lever | 1x |
| **11** | Hexagon screw, M10x25 A2-70 | 1x | | **26** | Setscrew, M8x16 A2-70 | 1x |
| **12** | Washer, 8 200 HV-A2 | 1x | | **27** | Pin 18x52 | 1x |
| **13** | Cap screw, M8x35 A2-70 | 1x | | **28** | Sleeve (stud lock) | 1x |
| **14** | Connecting rod B-C | 1x | | **29** | Washer, 6 200 HV-A2 | 1x |
| **15** | Washer, 16 200 HV-A2 | 4x | | **30** | Hexagon screw, M6x20 A2-70 | 1x |

## 10.6 Inner Conductor

- Before removing the inner conductor, mark the installation position with a waterproof marker.
- Remove the six screws (4) and six washers (5) of the inner conductor joint on the insulator, which is mounted vertically on a suitable device.

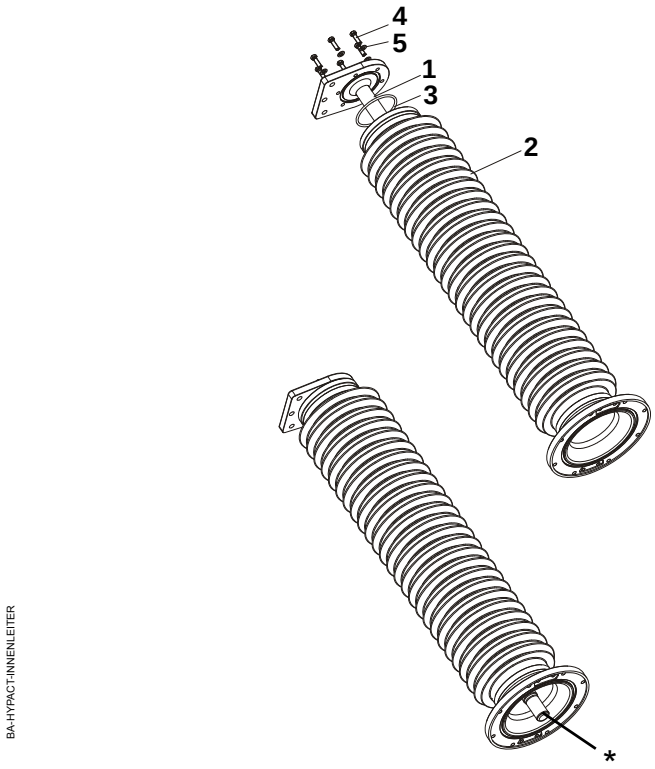
**CAUTION**

The inner conductor must not touch the inside of the insulator. Using alcohol and a lint-free cloth, carefully remove any grease residue adhering to the inside surface of the insulator.

- Pull the inner conductor vertically out of the insulator without touching the inside of the insulator.

Reverse the sequence to install the inner conductor.

- Replace the O-ring (3). Apply lubricant per lubrication specification L5 before installation.
- Apply lubricant to the sealing areas per lubrication specification L5.
- Apply lubricant to the connecting surfaces per lubrication specification L3.
- Apply lubricant to the screws (5) per lubrication specification L1. Tighten to a torque of 60 Nm.
- Apply lubricant to the contact surface (*) of the inner conductor per lubrication specification L6.




| | | |
|---|---|---|
| **1** | Inner conductor | 1x |
| **2** | Insulator | 1x |
| **3** | O-ring, 139.07x6.99 EPDM | 1x |
| **4** | Hexagon screw, M12x40 A2-70 | 6x |
| **5** | Washer, 13 200 HV – A2 | 6x |

## 10.7 Insulator

The bushings must be in an upright vertical position for replacement purposes.

- Before removing the insulator, mark the installation position with a waterproof marker.
- Remove the two opposite screws from the inner conductor joint and fasten the lifting tackle to the insulator (1) using two M12 eyebolts and two shackles.
- Remove every second screw (3) and washer (4) from the insulator joint and replace them with the four guide pins (T109).
- Remove the remaining screws (3) and washers (4) and carefully lift up the insulator in the axial direction.

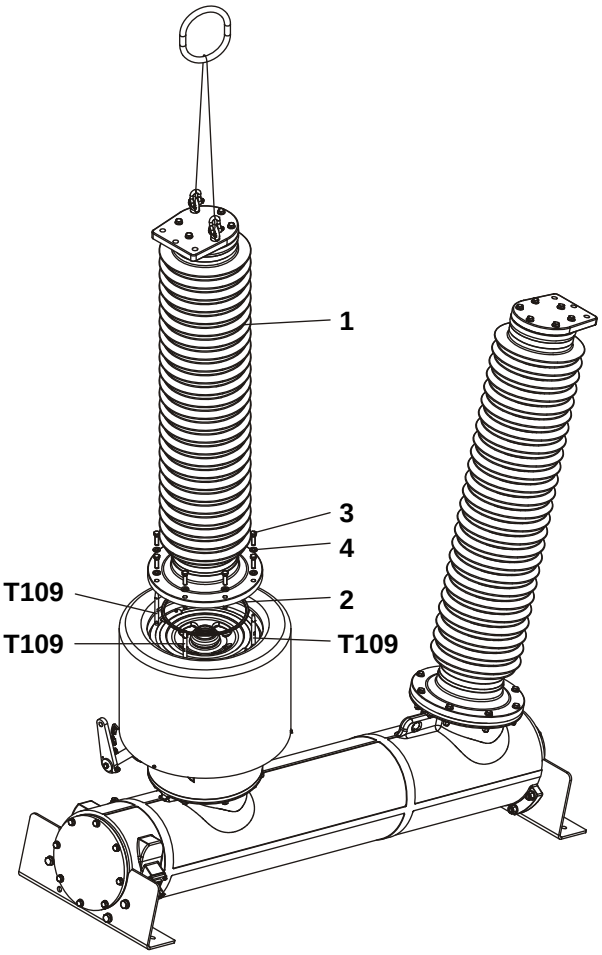
**CAUTION**

The contact surface of the inner conductor protrudes beyond the insulator's lower flange surface. Pay attention to this when moving and especially when setting the insulator down on a suitable fixture.

- Fasten the insulator in a vertical position to a suitable fixture using four M12 screws. Use the holes in the lower insulator flange for this purpose
- Remove the two guide pins (T109).

Reverse the sequence to install the insulator.

- Replace the O-ring (2). Apply lubricant per lubrication specification L5 before installation.
- Apply lubricant to the sealing areas per lubrication specification L5.
- Apply lubricant to the connecting surfaces per lubrication specification L3.
- Apply lubricant to the screws (3) per lubrication specification L1. Tighten to a torque of 60 Nm.




BA-HYPACT-ISOLATOR-ABNEHMEN

| | | |
|---|---|---|
| **1** | Insulator | 1x |
| **2** | O-ring, 266.07x6.99 EPDM | 1x |
| **3** | Hexagon screw, M12x40 A2-70 | 6x |
| **4** | Washer, 12 200 HV-A2 | 6x |
| **T109** | Guide pin | 4x |

## 10.8 Combination Disconnector-Earthing Switch

- Fasten the lifting tackle to the combination disconnector-earthing switch (1) using two M16 eyebolts and two shackles.
- Remove the eight nuts (3) and eight washers (4), and carefully lift up the combination disconnector-earthing switch (1) in the axial direction.

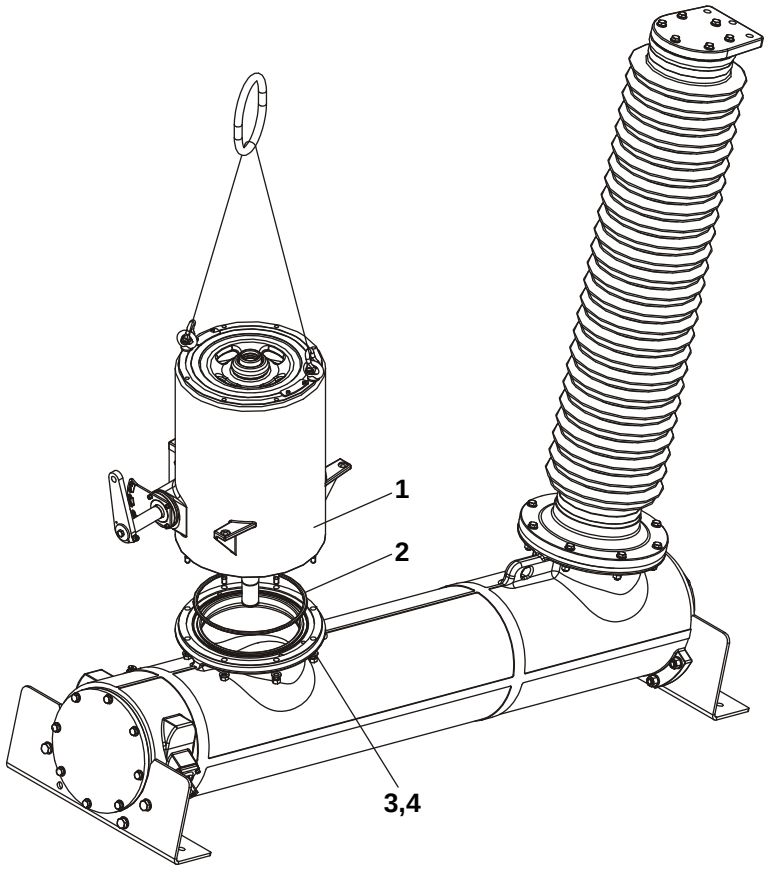
**CAUTION**

The contact surface of the inner conductor protrudes beyond the lower flange surface of the combination disconnector-earthing switch. Pay attention to this when moving and especially when setting the combination disconnector-earthing switch down on a suitable surface.

- Set the combination disconnector-earthing switch down vertically on a suitable surface.

Reverse the sequence to install the combination disconnector-earthing switch.

- Replace the O-ring (2). Apply lubricant per lubrication specification L5 before installation.
- Apply lubricant to the sealing areas per lubrication specification L5.
- Apply lubricant to the connecting surfaces per lubrication specification L3.
- Apply lubricant to the stud bolts of the combination disconnector-earthing switch per lubrication specification L1. Tighten to a torque of 60 Nm.



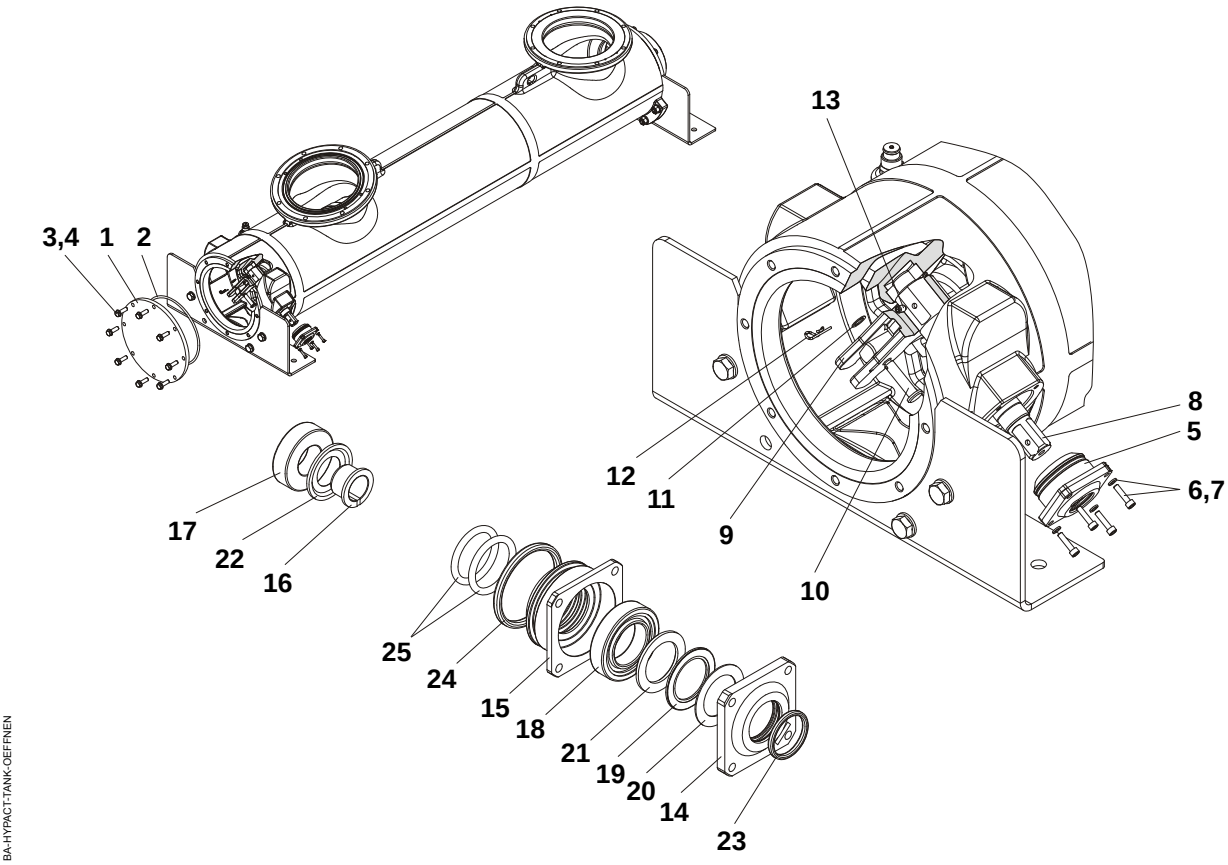

| | | |
|---|---|---|
| **1** | Combination disconnector-earthing switch | 1x |
| **2** | O-ring, 266.07x6.99 | 1x |
| **3** | Hexagon nut, M12 A2-70 | 8x |
| **4** | Washer, 12 200 HV-A2 | 8x |

## 10.9 Inner Lever

- Remove the eight screws (3) and eight washers (4) and take off the end flange (1).
- Remove the cotter pin (12) using tool T101, remove the shim ring (11) and pull out the pin (10).
- Remove the setscrew (13).
- Remove the four screws (6) and four washers (7) and pull out the entire bearing insert (5).
- Pull out the shaft (8) and remove the inner lever (9).

Reverse the sequence to install the inner lever.

- Replace all seals and gaskets. Apply lubricant per lubrication specification L5 before installation.
- Apply lubricant to the sealing areas per lubrication specification L5.
- Apply lubricant to the sliding and bearing surfaces per lubrication specification L7.
- Apply lubricant to the screws (3 and 6) and setscrew (13) per lubrication specification L1.
- Apply lubricant to the connecting surfaces per lubrication specification L3.
- Tighten screws (3) to a torque of 60 Nm, screws (6) to a torque of 7 Nm, and setscrew (13) to a torque of 17 Nm.



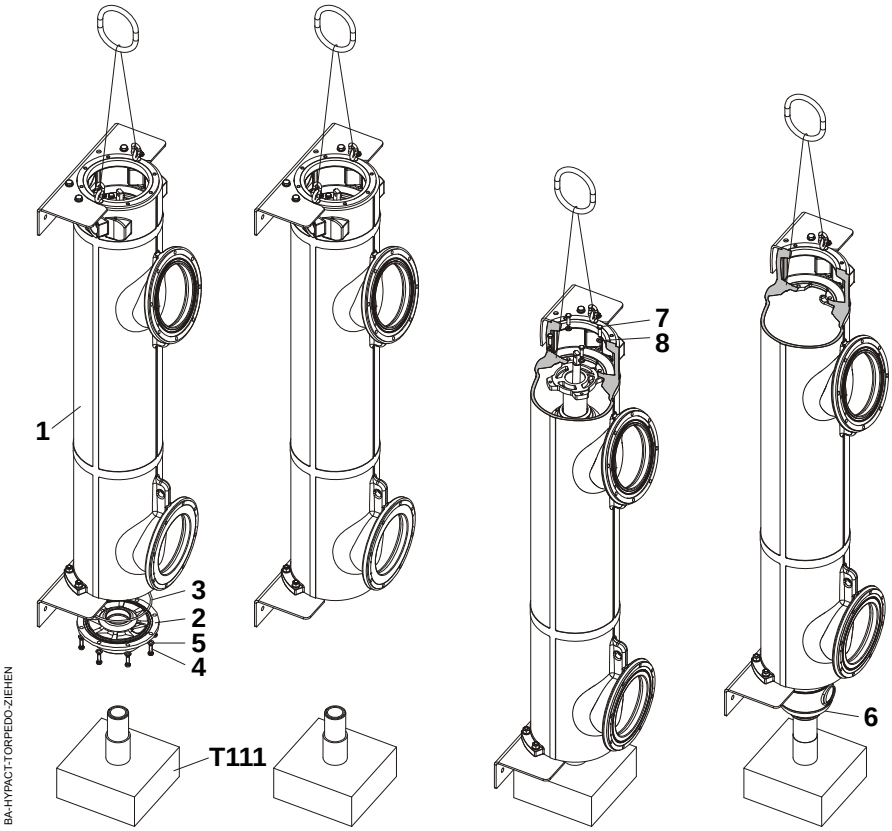

BA-HYPACT-TANK-OEFFNEN

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | End flange | 1x | | **14** | Bearing cap | 1x |
| **2** | O-ring, 253.37x6.99 | 1x | | **15** | Bearing insert | 1x |
| **3** | Hexagon screw, M12x40 A2-70 | 8x | | **16** | Bearing sleeve | 1x |
| **4** | Washer, 12 200 HV-A2 | 8x | | **17** | Roller bearing | 1x |
| **5** | Bearing insert | 1x | | **18** | Roller bearing | 1x |
| **6** | Cap screw, M6x25 A2-70 | 4x | | **19** | Axial needle roller assembly | 1x |
| **7** | Washer 6 A2 | 4x | | **20** | Axial ring | 1x |
| **8** | Shaft | 1x | | **21** | Bearing ring | 1x |
| **9** | Inner lever | 1x | | **22** | Sealing ring | 1x |
| **10** | Pin B 12F8x50 | 1x | | **23** | O-ring, 34.52x3.53 | 1x |
| **11** | Shim ring, 12x18x1 DIN 988 | 1x | | **24** | O-ring, 62.87x5.33 | 1x |
| **12** | Cotter pin | 1x | | **25** | O-ring, 38.82x5.33 | 2x |
| **13** | Setscrew, M8x16 A2-70 | 1x | | **-** | - | - |

## 10.10 Interrupter system

**CAUTION**

Do not remove the interrupter unit from the aluminum packaging until right before installation in the tank. Check the interrupter unit for shipping damage and for loose material or small particles. Repair or replace damaged components. Remove loose material. In addition, carefully remove any grease residues adhering to the insulation materials - support tubes or interrupter insulating tube - using alcohol and a lint-free cloth. After inspection and cleaning, the interrupter unit must be installed in the tank as quickly as possible. If this is not possible, the interrupter unit must be packed again in the packing materials. The interrupter unit must never be stored outside closed rooms.




| | | |
|---|---|---|
| **1** | Base pole | 1x |
| **2** | End flange | 1x |
| **3** | O-ring, 253.37x6.99 EPDM | 1x |
| **4** | Hexagon screw, M12x40 A2-70 | 8x |
| **5** | Washer, 12 200 HV-A2 | 8x |
| **6** | Interrupter system | 1x |
| **7** | Hexagon screw, M12x40 A2-70 | 4x |
| **8** | Washer, 12 200 HV-A2 | 4x |
| **T111** | Holding fixture for interrupter unit | 1x |

- Fasten the lifting tackle (6) to the base pole (1) using two M12 eyebolts and two shackles.
- Lift the base pole to an upright position over the rear mounting bracket.
- Remove the eight screws (4) and eight washers (5) and then remove the end flange (2) including the pressure relief device.
- Place the holding fixture (T111) in an axial position under the base pole and lower the pole. The seat of the holding fixture (T111) must be inserted into the lower insulating tube.
- Remove the four screws (7) and four washers (8) from the screwed joint of the interrupter unit and carefully lift the tank again. Make sure there is no contact between the interrupter unit and the tank.
- Then, using a crane, carefully lower the interrupter unit on to a suitable surface in a horizontal position. Attach the lifting tackle to the mounting flange of the interrupter unit using two M12 eyebolts and two shackles.

Reverse the sequence in order to install the interrupter unit.

- Replace the O-ring (3). Apply lubricant per lubrication specification L5 before installation.
- Apply lubricant to the sealing areas per lubrication specification L5.
- Apply lubricant to the connecting surfaces per lubrication specification L3.
- Apply lubricant to the screws (4 and 7) per lubrication specification L1.
- Tighten the screws (4 and 7) to a torque of 60 Nm.
- Carefully remove the interrupter unit.
- Clean the inside surfaces of the tank before installing a new interrupter system.

**CAUTION**

- Replace all O-rings and gaskets.

**CAUTION**

- Replace the locking pin.
- Install new gaskets.
- Follow the lubrication instructions.
- Check for proper alignment of the annular (female) contact.

Never apply Molykote lubricants to any inside surfaces that come in contact with $SF_6$.

- All flanges and surfaces exposed to water must be coated with special silicone grease to prevent moisture penetration and to lubricate the O rings and O-ring grooves. Apply the lubricant or grease by hand using your fingers. Never use brushes or other tools that could deposit particles on surfaces during the lubricating operation. If you feel any particles while applying lubricants to a surface, clean these areas thoroughly. Then reapply the proper lubricants or greases. When lubricating the O-rings, make sure that they are not damaged and that no particles have been deposited on them that would prevent a gastight seal.
- Install the interrupter unit in the tank so that the interrupter unit's annular contacts are aligned concentrically with the tank's outgoing flanges.
- Clean all functional elements with a cloth soaked in alcohol. Apply lubricants in accordance with the lubricating instructions. Replace parts if necessary.
- Retighten any screwed or bolted connections that were loosened during these operations. Replace any fasteners exhibiting visible damage.
- Always use new O-rings during installation. Follow the lubrication specifications for seals and gaskets.
- Replace the desiccant whenever a pole unit has been opened and exposed to the ambient air for a long period of time or has been contaminated with $SF_6$ byproducts. Do not remove the desiccant from the protective containers or insert it until the breaker pole has been completely assembled and is ready for evacuation.

### 10.11 Current Transformer (CT)

The insulator must be removed before the current transformer can be detached ***(see "Insulator" on Page 127)***. In addition, the current transformer cable on the terminal strip in the transformer terminal box must be disconnected ***(see "Connecting the Supply and Control Cables" on Page 92)***.

- Remove the four screws used to protect the threads of the holes for the lifting tackle.
- Fasten the lifting tackle to the current transformer (1) using four M8 or M12 eyebolts and four shackles.

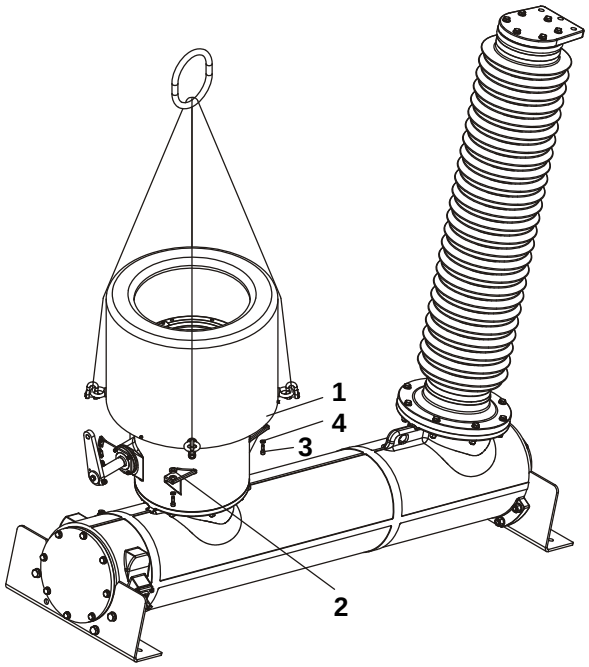
**CAUTION**

Take appropriate steps to prevent the edges of the current transformer from being damaged by the lifting tackle or by setting it down on a surface at an angle.

- Remove the three cap screws (3) and three washers (4) and carefully lift off the current transformer (1) in the axial direction.
- Set the current transformer down vertically on a suitable surface.
- Remove the three washers (2) from the current transformer supports and save them.

Reverse the sequence to install the current transformer.

- Apply lubricant to the screws (3) per lubrication specification L1. Tighten to a torque of 17 Nm.
- After removing the lifting tackle, apply lubricant to the thread-protection screws per lubrication specification L1 and screw them in. Tighten to a torque of 17 Nm.




BA-HYPACT-WANDLER-ABNEHMEN

| | | |
|---|---|---|
| **1** | Current transformer | 1x |
| **2** | Washer, 12x23x6 | 3x |
| **3** | Cap screw, M8x35 A2-70 | 3x |
| **4** | Washer, 8 200 HV-A2 | 3x |

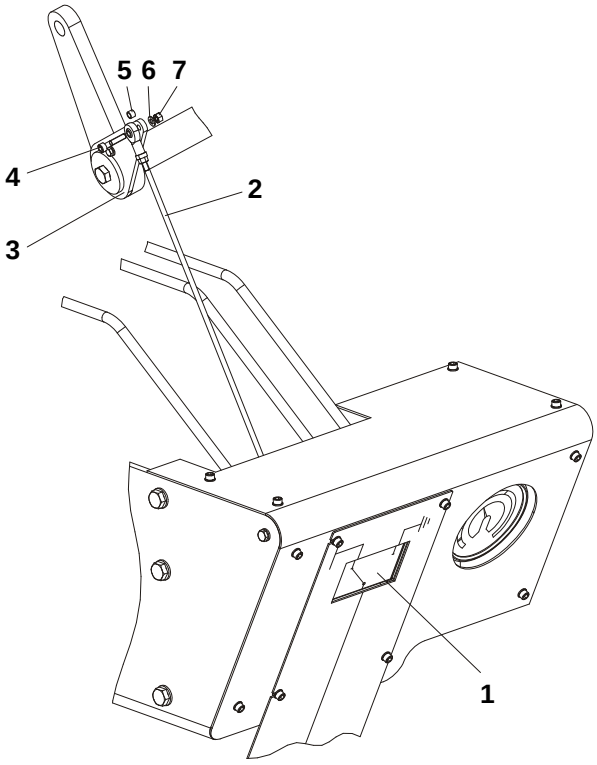
### 10.12 Position Indicator Linkage

The position indicator linkage must be disconnected in order to recondition pole C:

- Loosen the nut (7) and washer (6) on the rear of the lever (3) and remove them along with the bolt (4) and the sleeve (5).

Reverse the sequence to install the position indicator linkage.

- Apply lubricant to the bolt (4) per lubrication specification L1. Tighten to a torque of 4 Nm.
- If the settings for the position indicator in the three positions of the combination disconnector-earthing switch are no longer correct, especially after the poles are reinstalled, then proceed as follows:
  - Loosen the lock nuts of the rod.
  - Hold the free joint head securely and turn the rod until the indicator is correctly aligned again. Tighten the lock nuts. Tighten the lock nuts to a torque of 4 Nm




BA-HYPACT-ANZEIGENGESTAENGE

| | | |
|---|---|---|
| **1** | Position indicator | 1x |
| **2** | Linkage | 1x |
| **3** | Lever | 1x |
| **4** | Cap screw, M5x25 A2-70 | 1x |
| **5** | Sleeve | 1x |
| **6** | Washer, 5 200 HV-A2 | 1x |
| **7** | Hexagon nut, M5 A2-70 | 1x |

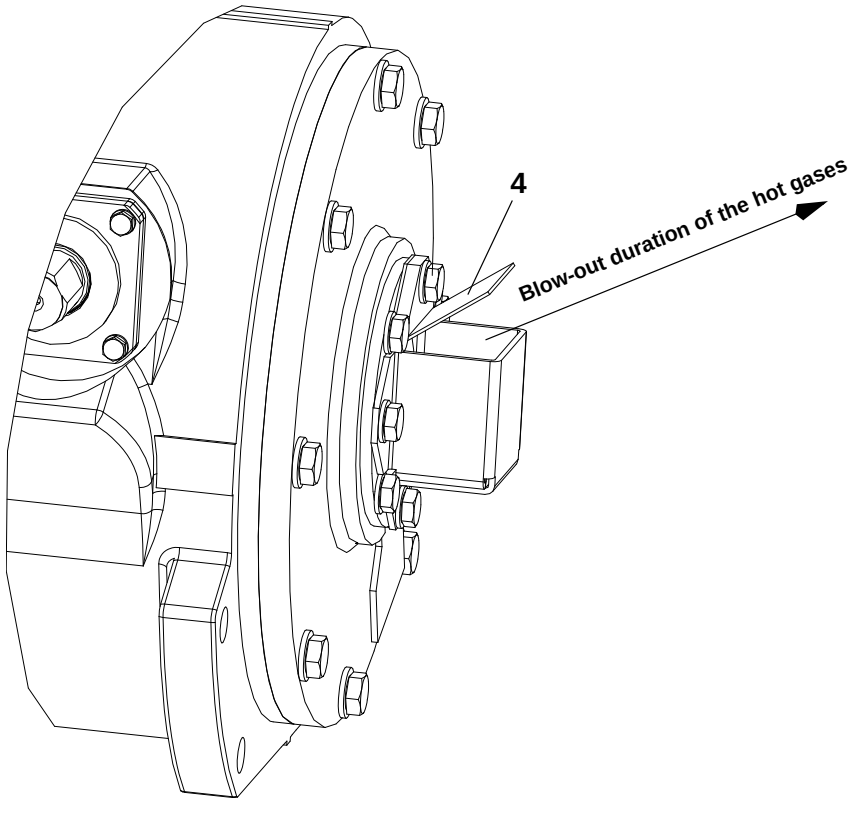
## 10.13 Pressure relief device

### 10.13.1 Rupture disc

**Function**

If a fault causes the gas pressure within the encapsulation of the compact switchgear combination to rise above the permitted pressure, the rupture disc will trigger within a few milliseconds. The overpressure destroys a previously sealing metal diaphragm. The resulting opening leads to pressure balancing with the environment; the hot gas flowing out will bend a baffle plate (4) and specify the blow-out direction. The gas loss will switch the plant to fault mode at once, locking it for further switching. After the rupture disc triggers, the fault cause must be removed and the respective gas chamber must be inspected.

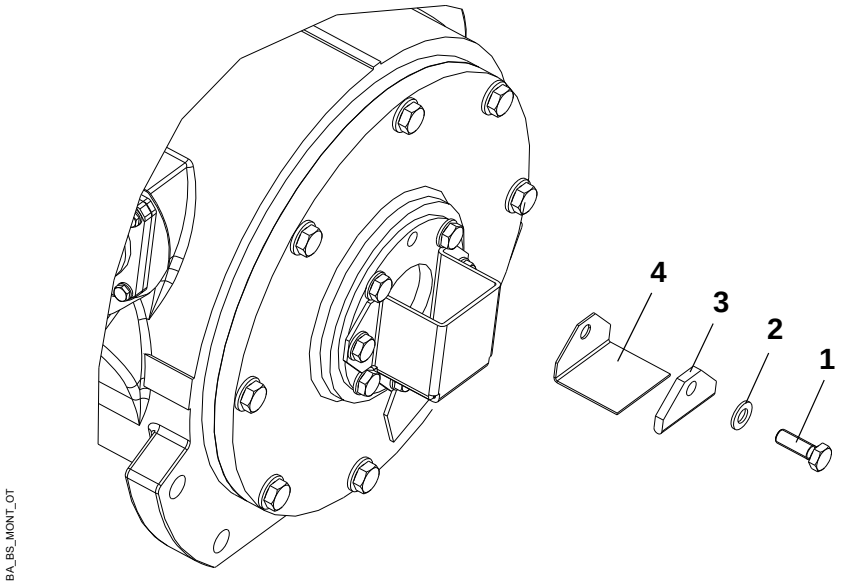
All parts that have come into contact with the hot gas flow must be inspected for damage. Damaged parts must be exchanged before recommissioning. SF6 disintegration products that will pose danger to health may also have occurred ***(see "Safety Precautions When Handling Used SF6" on Page 17)***. In any case, the rupture disc must be replaced with a new one before recommissioning.




| | | |
|---|---|---|
| **4** | Baffle plate | 1x |

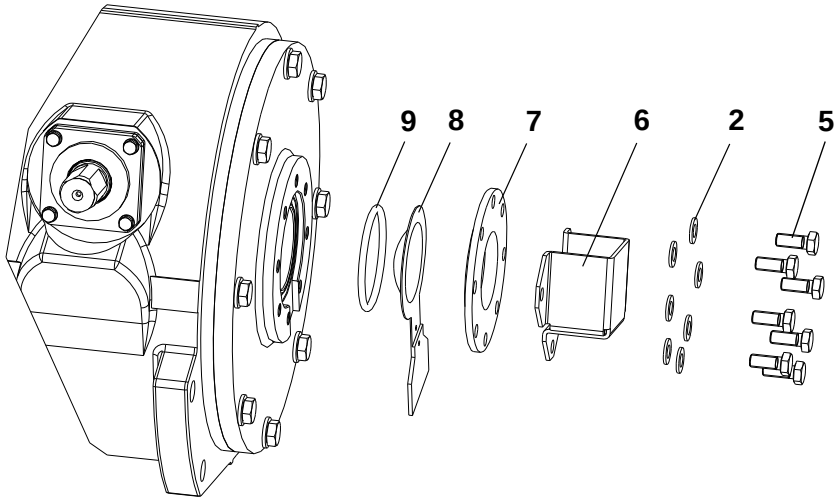
**Disassembel**

- Loosen the screw (1) and remove it with the U-disc (2), reinforcement plate (3) and baffle plate (4).




BA_BS_MONT_OT

- Loosen the screws (5) and remove them with the U-discs (2), cover sheet (6), pressure ring (7), metal diaphragm (8) and O-ring (9).



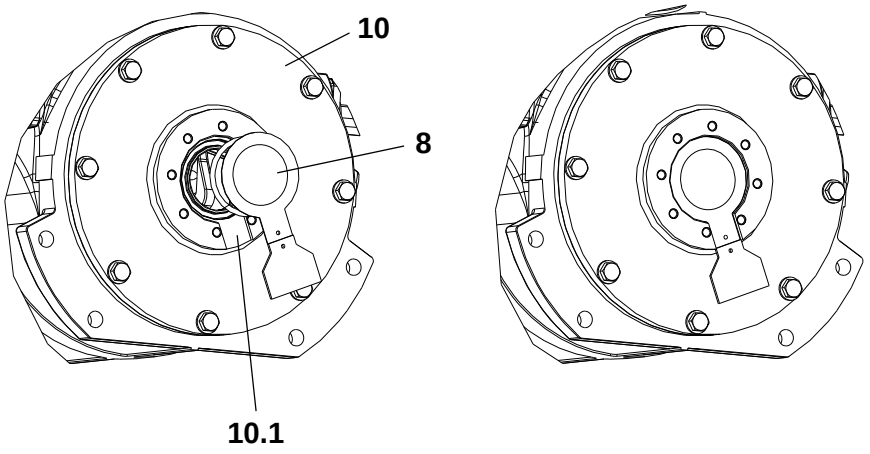

BA_BS_DEMONT

| | | |
|---|---|---|
| **1** | Hexagon screw, M10x30 A2-70 | 1x |
| **2** | Washer 10 200 HV-A2 | 8x |
| **3** | Reinforcement plate | 1x |
| **4** | Baffle plate | 1x |
| **5** | Hexagon screw M10x25 A2-70 | 7x |
| **6** | Cover | 1x |
| **7** | Pressure ring | 1x |
| **8** | Metal diaphragm | 1x |
| **9** | O-ring 72,39x5,33 | 1x |

**Montage**

Reassemble in the reverse order.

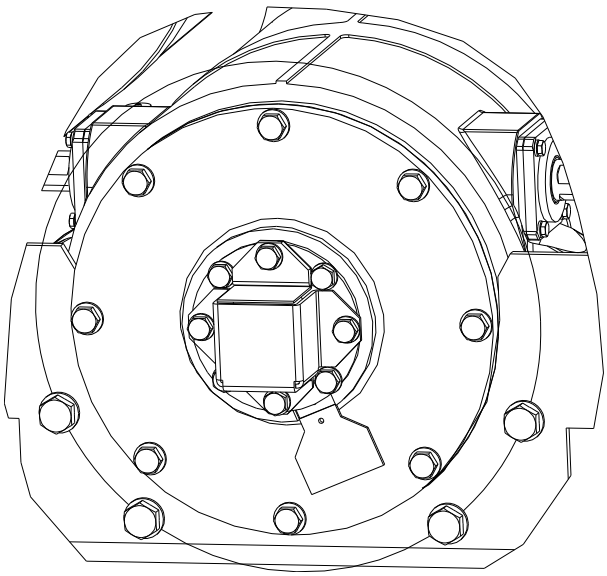
- Replace the O-ring (9). Apply lubricant per lubrication specification L5 before installation. Apply lubricant to the sealing areas per lubrication specification L5. Apply lubricant to the bolted surfaces per lubrication specification L3. The metal diaphragm (8) must be aligned with the cut-out (10.1) in the end flange (10) at mounting.




BA_BS_MONT

| | | |
|---|---|---|
| **8** | Metal diaphragm | 1x |
| **10** | End flange | 1x |
| **10.1** | Cut-out | 1x |

- Apply lubricant to the screws per lubrication specification L1.
- Install the O-ring (9) with metal diaphragm (8), pressure ring (7), cover (6), and discs (2) with screws (5). Tighten to a torque of 35Nm.
- Install baffle plate (4), reinforcement sheet (3) and disc (2) with screw (1). Tighten to a torque of 35Nm.



BA_BS_KPL

### 10.13.2 Spring-stressed pressure relief

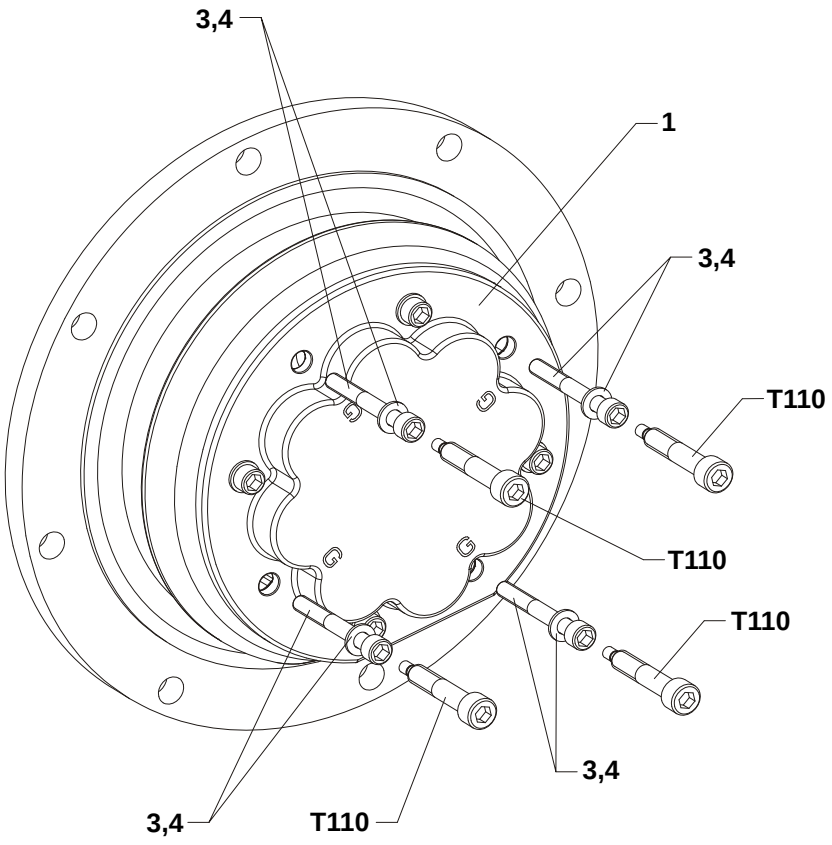
**Disassembly**

**WARNING**

Since the pressure springs of the pressure relief device are prestressed, a minimum of four mounting bolts (3) or transport bolts (T110) must be installed.

The pressure relief device and the gaskets are maintenance-free. If the pressure relief device has to be removed for maintenance purposes, proceed as follows:

- Remove the four mounting bolts (3) and four washers (4) at the "G" marks and replace with transport bolts (T110).
- Then remove the other four mounting bolts (3) and four washers (4).
- Remove the pressure relief device (1).



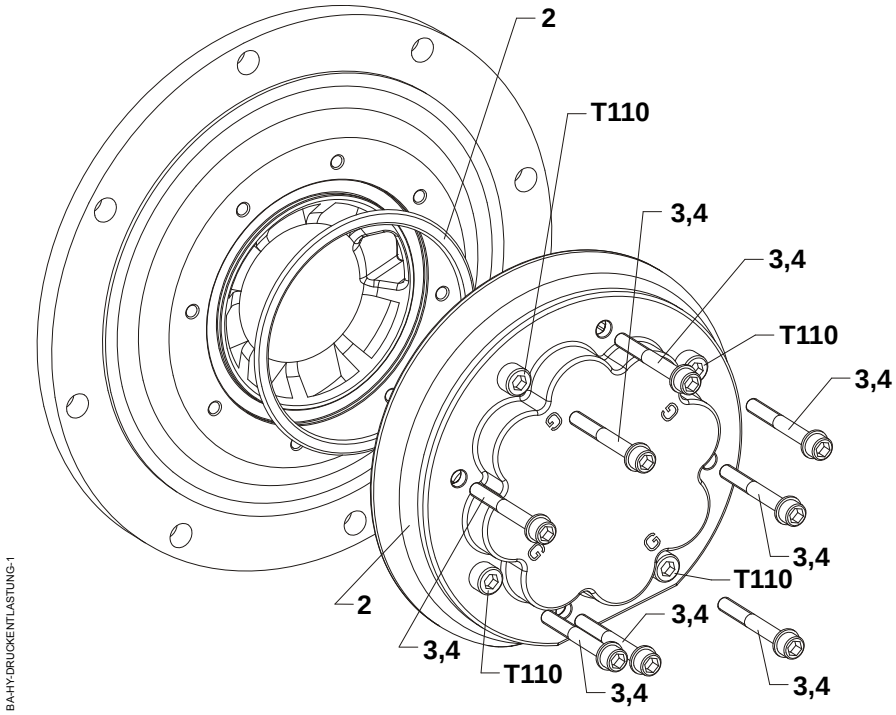

| | | |
|---|---|---|
| **1** | Pressure relief device | 1x |
| **2** | O-ring 124.2x5.33 (not shown) | 1x |
| **3** | Mounting bolt M8x65 A2-70 | 8x |
| **4** | Washer, 8 200 HV-A2 | 8x |
| **T110** | Transport bolt M10 | 4x |

## 10.14 Installation

**WARNING**

Since the pressure springs of the pressure relief device are prestressed, a minimum of four mounting bolts (3) or transport bolts (T110) must be installed.

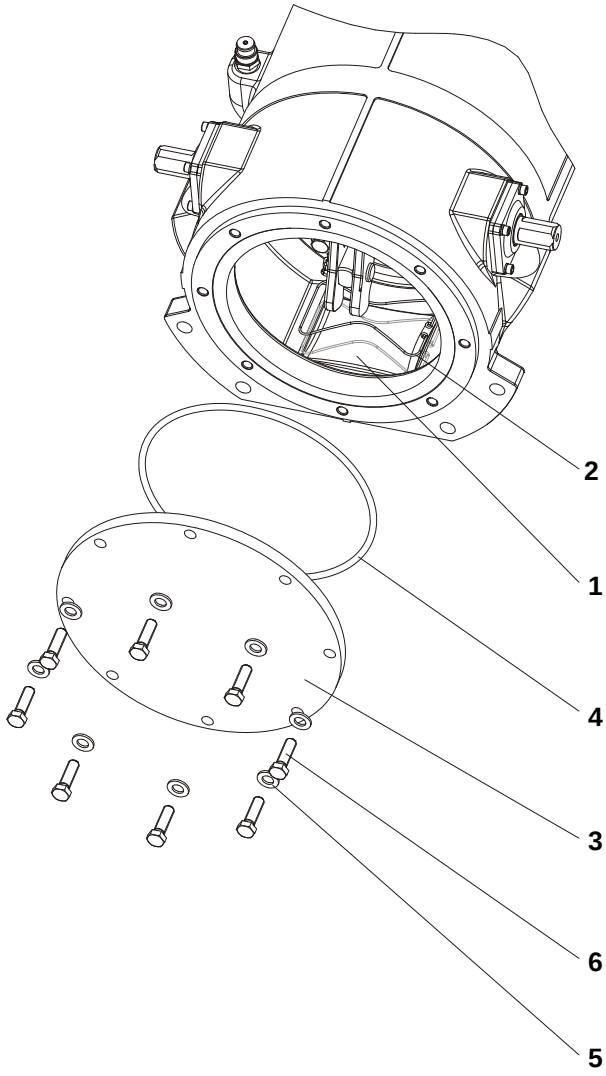
- Replace the O-ring (2). Apply lubricant per lubrication specification L5 before installation.
- Apply lubricant to the sealing areas per lubrication specification L5. Apply lubricant to the bolted surfaces per lubrication specification L3.
- Install the pressure relief device (1) using four mounting bolts (3). Apply lubricant to the bolts per lubrication specification L1.
- Remove the four transport bolts (T110) at the "G" marks and replace with mounting bolts (3) and washers (4). Apply lubricant to the bolts per lubrication specification L1.
- Tighten the mounting bolts (3) in diagonally opposite sequence to a torque of 17 Nm ±10%.




| | | |
|---|---|---|
| **1** | Pressure relief device | 1x |
| **2** | O-ring, 124.2x5.33 | 1x |
| **3** | Cap screw, M8x65 A2-70 | 8x |
| **4** | Washer, 8 200 HV-A2 | 8x |
| **T110** | Transport bolt M10 | 4x |

### 10.15 Desiccant

- Remove the eight screws (5) and eight washers (6) and take off the end flange (3).
- Remove the spring clamp (2) and replace the desiccant bag (1) with a new one. Clamp the spring clamp (2) into the side brackets again.
- Replace the O-ring (4). Apply lubricant per lubrication specification L5 before installation.
- Apply lubricant to the sealing areas per lubrication specification L5.
- Apply lubricant to the screws (5) per lubrication specification L1.
- Replace the end flange (3) with screws (5) and washers (6). Tighten to a torque of 60 Nm.



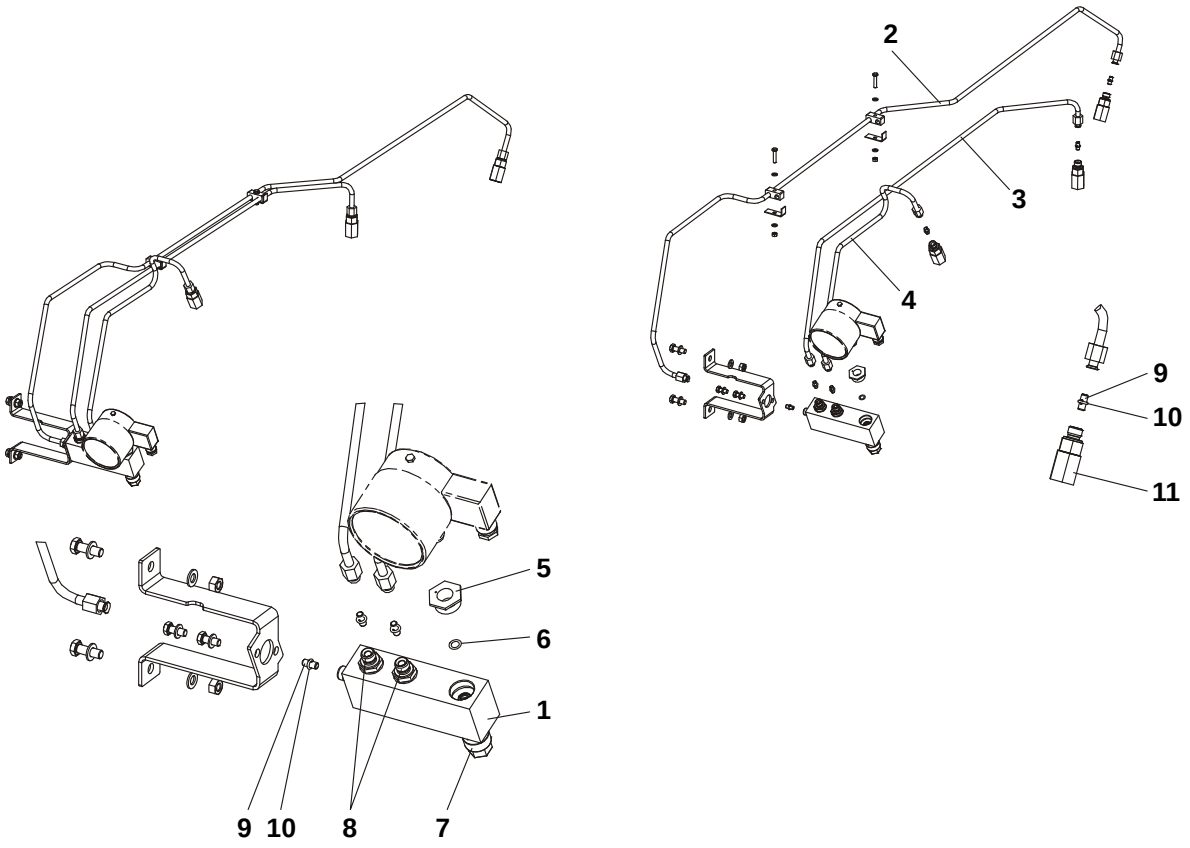

BA-HY-TROCKENBEUTEL

| | | |
|---|---|---|
| **1** | Desiccant | 1x |
| **2** | Spring clamp | 1x |
| **3** | End flange | 1x |
| **4** | O-ring, 253.37x6.99 | 1x |
| **5** | Hexagon screw, M12x40 A2-70 | 8x |
| **6** | Washer, 12 200 HV-A2 | 8x |

## 10.16 Gas Piping

### 10.16.1 Rigid Gas Piping

To recondition individual components of the gas piping, see the sections entitled ***"Replacing the Density Monitor" on Page 107*** and ***"Replacing the Rigid Gas Pipe" on Page 111***.

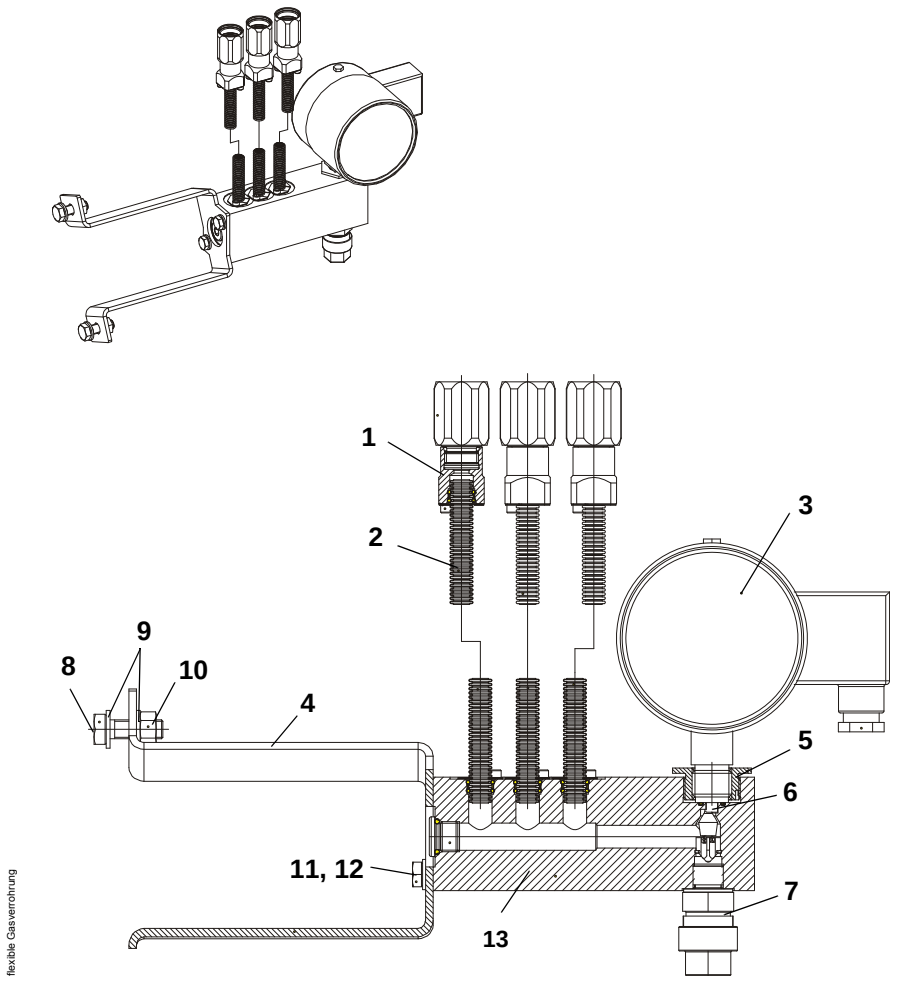



2032170

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | Filler block | 1x | | **7** | Supply connection (type Dilo DN8 coupling) | 1x |
| **2** | Gas pipe A | 1x | | **8** | Screw-in connector | 3x |
| **3** | Gas pipe B | 1x | | **9** | Insert | 6x |
| **4** | Gas pipe C | 1x | | **10** | O-ring, 7.30x2.40 | 6x |
| **5** | Threaded bushing | 1x | | **11** | Gas coupling | 3x |
| **6** | O-ring, 10.82x1.78 | 1x | | **-** | - | - |

### 10.16.2 FlexLink Gas Piping

To recondition individual components of the gas piping, see the sections entitled ***"Replacing the Density Monitor" on Page 107*** and ***"Replacing the Flexible Metal Hose of the Gas Piping" on Page 109***.




| | | |
|---|---|---|
| **1** | Gas coupling | 3x |
| **2** | Flexible metal hose with gas coupling | 3x |
| **3** | Density monitor | 1x |
| **4** | Bracket | 1x |
| **5** | Threaded bushing | 1x |
| **6** | O-ring 10,82x1,78 | 1x |
| **7** | Supply connection (Dilo DN8 coupling) | 1x |
| **8** | Hexagon bolt M10x30 A2-70 | 2x |
| **9** | Washer 10-200HV - A2 | 4x |
| **10** | Hexagon nut M10 | 2x |
| **11** | Hexagon screw M8x20 A2-70 | 2x |
| **12** | Washer M8 200HV A2 | 2x |
| **13** | Filler block | 1x |

## 10.17 Poles

**WARNING**

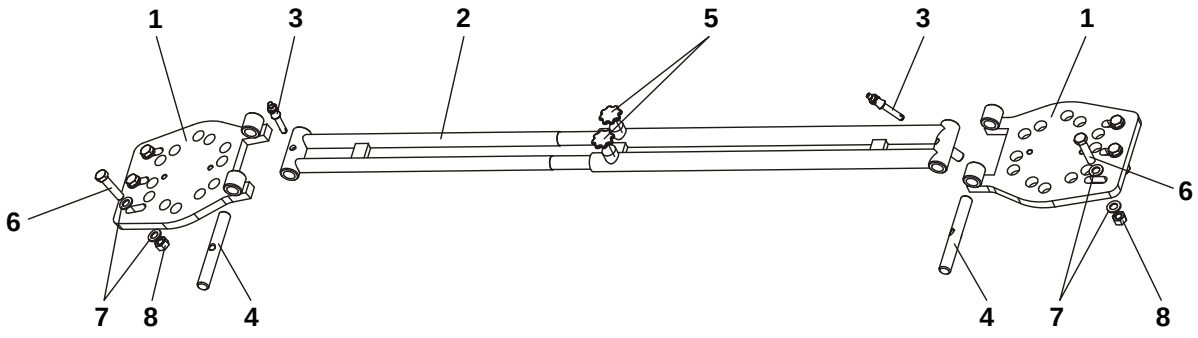
Lifting the poles without a lifting device (T108) will cause the pole to tip.

**CAUTION**

Unnecessary bending stress will damage the insulator.

**Therefore:**

- **Install the lifting device (T108) so that it is free from distortion.**




BA-HY-HEBEVORRICHTUNG-WERK-ZEUGE

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | Stop plate | 1x | | **5** | Knurled thumb screw | 2x |
| **2** | Telescope | 1x | | **6** | Hexagon bolt, M16x70 A2-70 | 6x |
| **3** | Ball catch pin | 2x | | **7** | Washer, 16 200 HV-A2 | 12x |
| **4** | Hinge pin (joint axis) | 2x | | **8** | Hexagon nut, M16 A2-70 | 6x |

Before the poles are lifted out of the pole mounts, make sure that the current transformer cables are disconnected from the terminal strip in the CT terminal box. The gas piping must also be disassembled and removed.

In addition, make sure that the lifting device (T108) is properly attached.

- First disengage and remove the ball catch pins (3). Then remove the hinge pins (4).
- Lay the stop plates (1) flat on the insulator terminal lugs (tabs). The open holes provide clearance for the inner conductor joints. Screw down the stop plates via the mounting holes of the high voltage terminal plates using three screws (6), six washers (7) and three nuts (8) each and tighten until finger-tight.
- Loosen the knurled thumb screws (5) of the telescope (2) and fix the telescope in position between the stop plates (1) using the hinge pins (4) and the ball catch pins (3).
- Tighten the knurled thumb screws (5).

- Finally, tighten the screwed joints of the stop plates (1) to a torque of 146 Nm.

Poles A and C are installed at an angle of 30°:

- Insert the lifting tackle through the openings in the telescope (1) and fasten it to the pole anchor points with two shackles

**CAUTION**

Take appropriate steps to prevent the edges of the current transformer from being damaged by the lifting tackle.

- Remove the pole's bolted joints, each consisting of three bolts (10), six washers (11) and three nuts (12).
- First bring the pole to an upright position in the pole mounts (9) and then lift it out of the pole mounts.

Pole B is installed in a vertical position:

- Insert the lifting tackle through the openings in the telescope (1) and fasten it to the pole anchor points with two shackles.

**CAUTION**

Take appropriate steps to prevent the edges of the current transformer from being damaged by the lifting tackle.

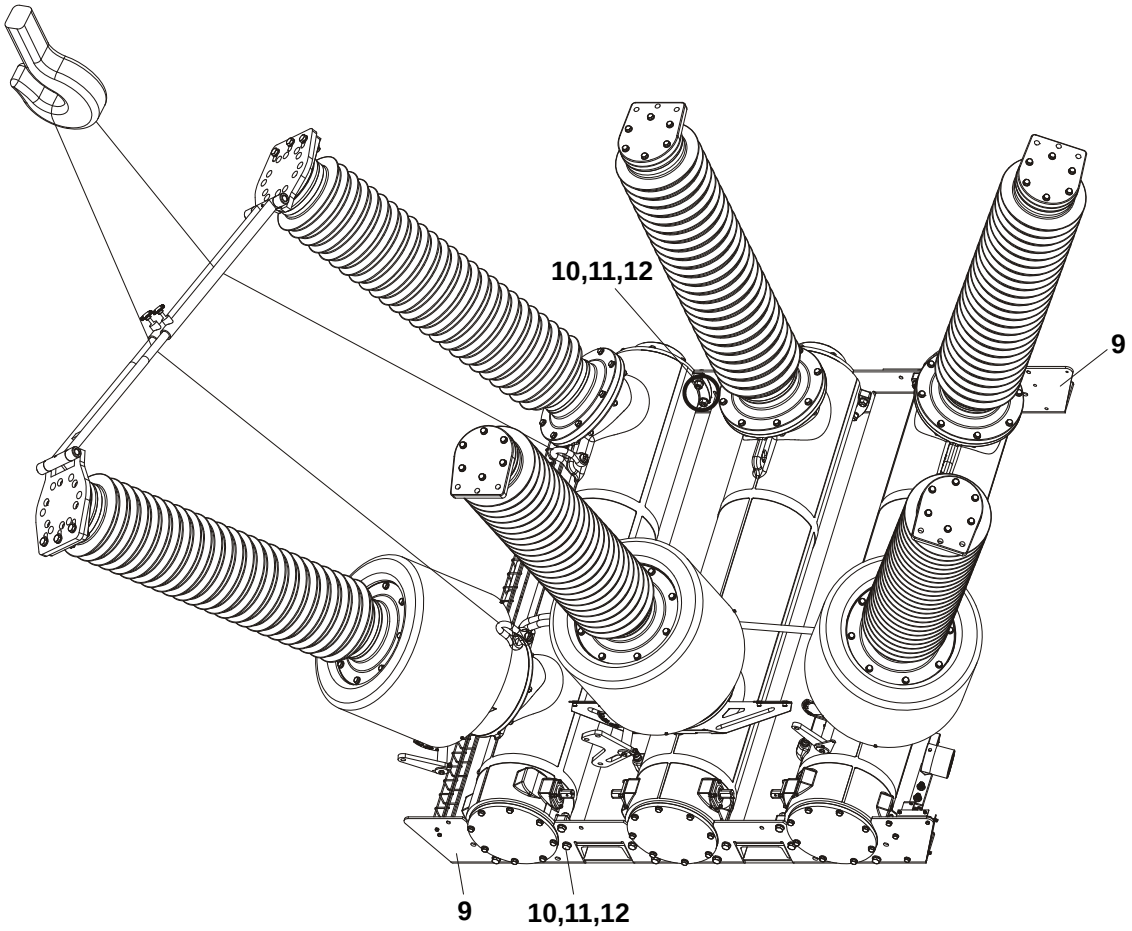
- Remove the pole's bolted joints, each consisting of four bolts (10), eight washers (11) and four nuts (12).
- Lift the pole out of the pole mounts.

Before setting the pole down on a suitable surface, the mounting brackets (T112) must be installed.

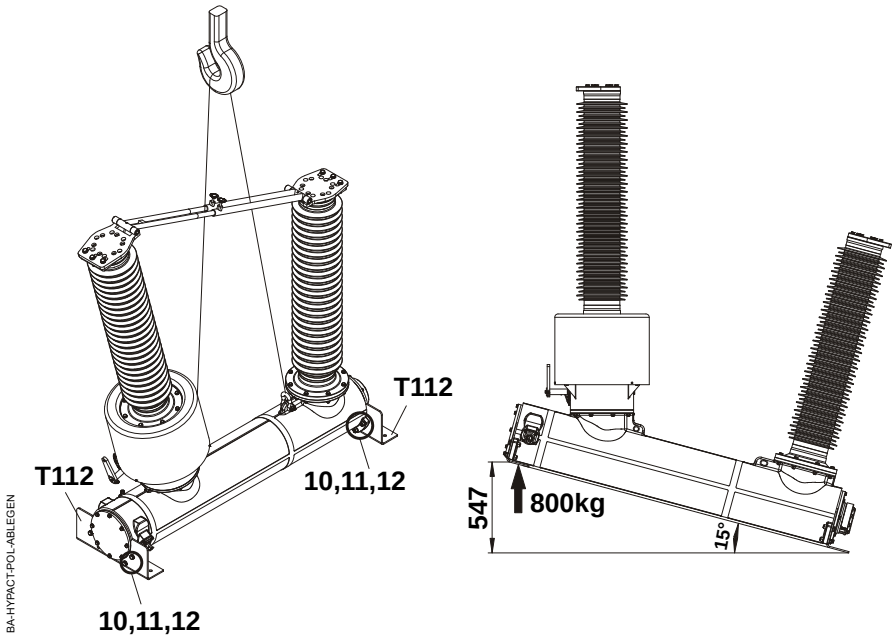
- Use the bolted joints of the respective pole for this purpose. Tighten to a torque of 146 Nm.

In order to then remove the front insulator and the combination disconnector-earthing switch, the pole must be positioned at an angle of 15°. For this purpose, a wooden support structure per the specifications given in the following diagram is required. It prevents the pole from sliding in the direction of the pressure relief device.

- Reverse the sequence to reassemble the components.
- Apply lubricant to the screws (10) per lubrication specification L1. Tighten to a torque of 146 Nm.
- Align the poles with one another via the shaft ends by using coupling shaft B/C (6) ***(see also picture on Page 121)***.




| | | |
|---|---|---|
| **9** | Pole mount | 2x |
| **10** | Hexagon bolt, M16x60 A2-70 | 20x |
| **11** | Washer, 16 200 HV-A2 | 40x |
| **12** | Hexagon nut, M16 A2-70 | 20x |




| | | |
|---|---|---|
| **10** | Hexagon bolt, M16x60 A2-70 | 20x |
| **11** | Washer, 16 200 HV-A2 | 40x |
| **12** | Hexagon nut, M16 A2-70 | 20x |
| **T112** | Mounting bracket | 2x |

# 11 End-of-Life Management

Environmentally compatible waste management is an integral part of the overall design of GE products. Eco-friendly waste handling in accordance with applicable regulations is guaranteed.

When it comes to waste management, recycling of materials is generally preferred to disposal.

Materials can be recycled as mixed scrap or - in cases where equipment is largely disassembled - as sorted scrap with a small residual amount of mixed scrap.

Sorted scrap is the preferred waste management option.

Switchgear has the following components:
- Ceramics / silicone
- Steel
- Aluminum
- Copper
- PTFE (polytetrafluoroethylene)
- Casting resin (some of which is fabric-reinforced)
- Rubber materials used as seals and gaskets
- Plastics in the operating mechanism (auxiliary switches, cable insulation, etc.)
- Hydraulic fluid
- Lubricants in small amounts

Waste management procedures must ensure that hydraulic fluids present in mechanism dampers are drained off. Compliance with regulations governing management of these wastes is required.

None of the oils and greases used in the switchgear contain PCBs (polychlorinated biphenyls).

No hazardous substances covered by the German regulations governing hazardous materials are present in the switchgear in as-delivered condition. For export purposes, compliance with local laws and regulations must be ensured.

The gas used for insulation and quenching is to be drawn off using suitable equipment and reused after reprocessing.

Solid decomposition products generated by operations may be present in the gas compartments. These products may constitute a health hazard if the gas compartments are opened.

Gaseous decomposition products are collected by filters. Compliance with the appropriate safety rules ***(see "Safety Precautions When Handling Used SF6" on Page 17)*** is required.

Your local GE Service will be happy to answer any questions you may have about waste management.

# A1 Description of the Equipment

## A1.1 Application

HYpacts are hybrid compact switchgear assemblies that are used for power distribution in high voltage systems. They are used in substations and are an important functional and safety feature in power operations. In the event of a system disturbance or line fault, their circuit breaker function interrupts the resulting short-circuit currents within a few milliseconds. Because of their integrated disconnectors and earthing switches (combination disconnector-earthing switches), HYpacts also disconnect any connected equipment. HYpact compact switchgear assemblies are usually operated by remote control.

## A1.2 Main Components

HYpact compact switchgear assemblies consist of the module and the support structure ***(see "Components Supplied" on Page 19)***.

The module consists of a circuit breaker, the combination disconnector-earthing switches, and the bushings for the three phases as well as other optional devices. Combining these elements in a common gas compartment gives the HYpact a compact design and high degree of reliability.
Measuring devices (toroidal core current transformers) can be installed below the bushings.

The supports are constructed of zinc-plated welded steel, on which the operating mechanisms are also mounted. The operating mechanisms for the circuit breakers consist of a self-supporting steel structure that is protected against corrosion. The door, floor, rear panel, removable side panels, and roof are constructed of aluminum sheet. The operating mechanisms for the combination disconnector-earthing switches have stainless sheet-steel housings.
The internal control system for the HYpact is located in a control cabinet mounted on the support structure or integrated into a circuit breaker operating mechanism.

### A1.3 Operation

The separate phases of the module are connected by $SF_6$ piping to form a common gas compartment. The movable contacts of the interrupter systems are connected by the insulating rods, torque shafts, levers and connecting rods to the operating mechanisms mounted on the support structure.

When current is interrupted by the circuit breaker, the transition from the closed position to the open position occurs within a few milliseconds. During this opening operation, the main contacts separate first. The arc that is formed between the arc contacts that then open is quenched by a gas flow within the interrupter unit. The main contacts, which have already opened, are not eroded by the arc.

In the third-generation $SF_6$ circuit breakers that are used in the HYpact modules, the required gas pressure is generated in a pressure chamber by the energy of the arc itself as a function of current. The operating mechanism only supplies the energy required for contact movement and mechanical auxiliary blow-out to ensure safe breaking of small currents.

During the closing operation, the arcing contacts are closed first and then the main contacts.

The closing spring in the operating mechanism is charged by an electric motor via a gear unit for the purpose of storing the required operating energy. The opening spring is also located in the operating mechanism and is charged during each closing movement. The spring energy store contains enough mechanical energy to execute the O-CO operation, even if the motor power supply should fail.
Electrical actuation of the closing and opening coils causes latches to be unlatched, which releases the energy of the springs for operating purposes. The spring energy is transferred to the contact system by connecting levers, linkages and shafts outside and inside the gas compartments.

The combination disconnector-earthing switches in the HYpact module permit isolation of any connected equipment.

Both the disconnectors and earthing switches in these disconnector and earthing switch combinations are available in different versions:

- Disconnector without commutation capability
- Disconnector with commutation capability
- Direct earthing switch
- Integral earthing switch

The different types of disconnectors and earthing switches can be combined in any desired configuration, either in a single disconnector-earthing switch combination or in different disconnector-earthing switch combinations within one HYpact. If necessary, the earthing function can be omitted.

With integral earthing, the existing closing capability of the circuit breaker is utilized to reduce the electrical load on the earthing switch. This means that while both the circuit breaker and the disconnector are in open position, the earthing switch is closed first at zero current and then the circuit breaker is closed again immediately thereafter by way of a positive operation. Any short-circuit currents that may occur therefore only impact the circuit breaker, which is designed to withstand them.
The operating mechanisms of the combination disconnector-earthing switches are electrically interlocked with the circuit breaker operating mechanisms in order to prevent non-permissible operations.

**DANGER**

The positive operation of the circuit breaker can be deactivated upon special request. In this case the circuit breaker must be closed by means of appropriate signals in order to guarantee earthing.

In the case of integral earthing in combination with another disconnector on the opposite side of the circuit breaker, it is important to make sure that earthing is only active when both the circuit breaker and the opposite disconnector are closed.

With direct earthing, earthing does not take place through the circuit breaker. This ensures that the direct earthing switch can be operated independently of the circuit breaker operating positions and any existing opposite disconnector-earthing switch combination.

In all cases, the mechanical mode of operation of the combination disconnector-earthing switch guarantees that the earthing switch is only closed when the associated disconnector is open.

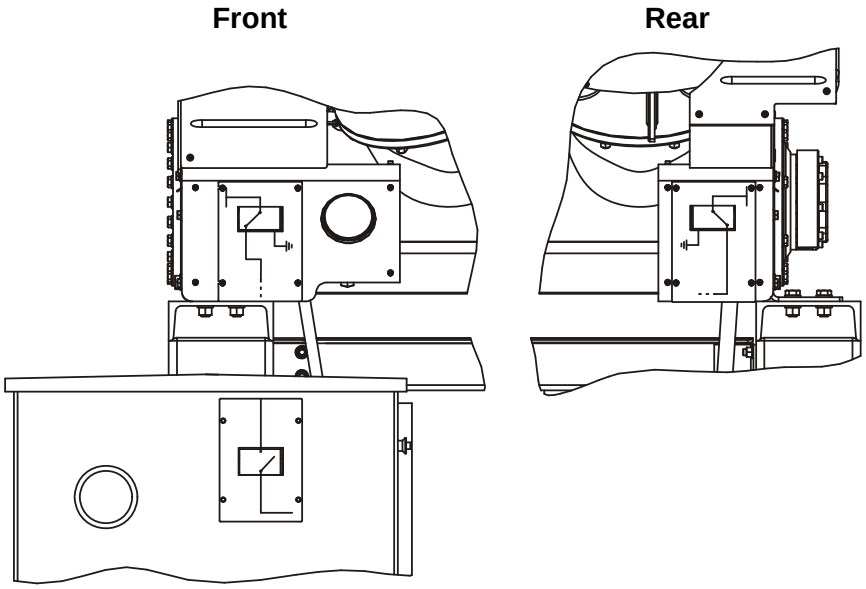
**DANGER**

Different designs of the combination disconnector-earthing switch result in different earthing possibilities and conditions that must be matched with the protective and control systems.

### A1.4 Combined Mechanical Position Indicator

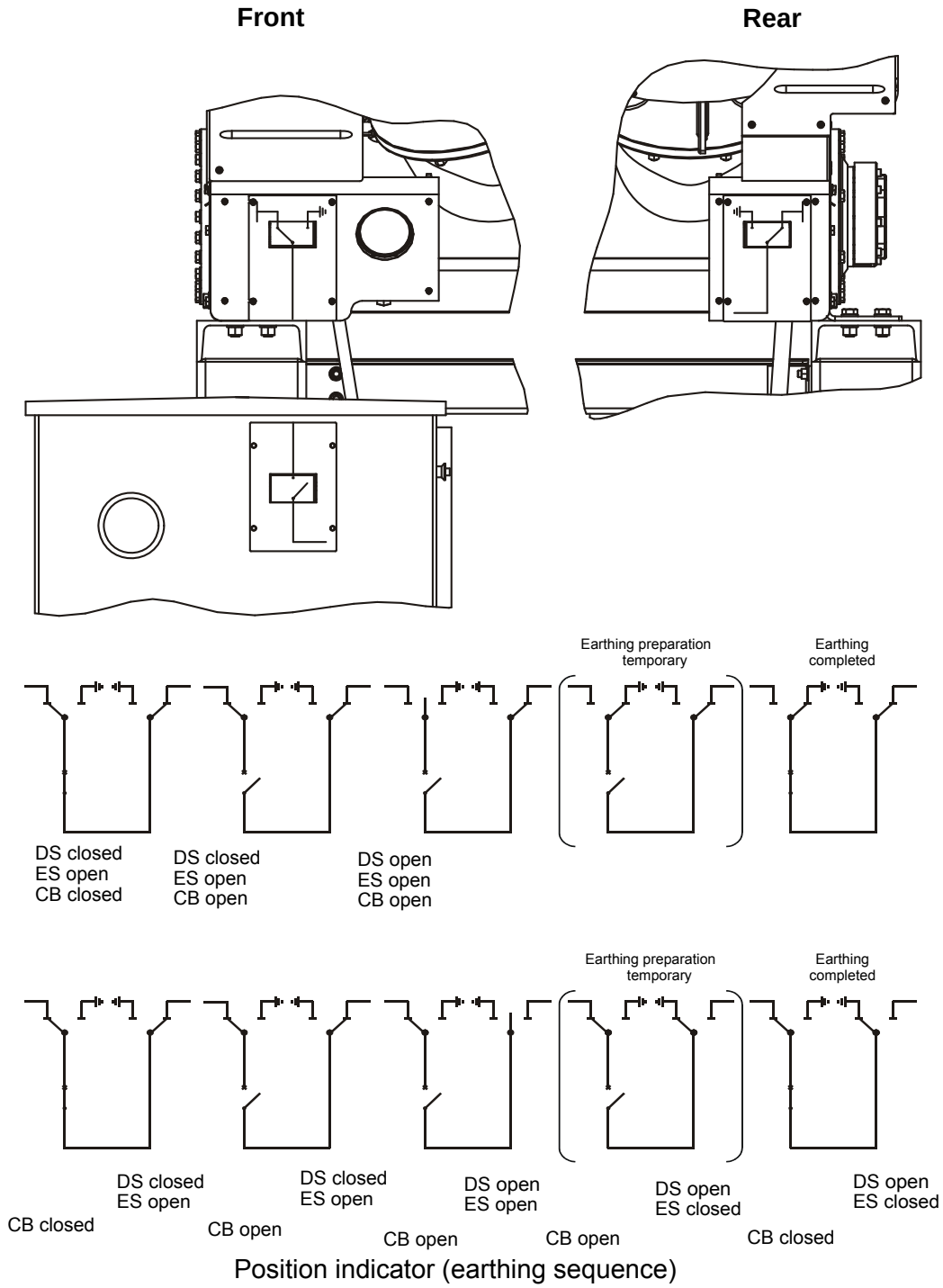
HYpact´s are equipped with a mechanical position indicator that shows the user the operating state at all times - especially in the event of power failure.

### A1.4.1 Direct Earthing



### A1.4.2 Integral Earthing

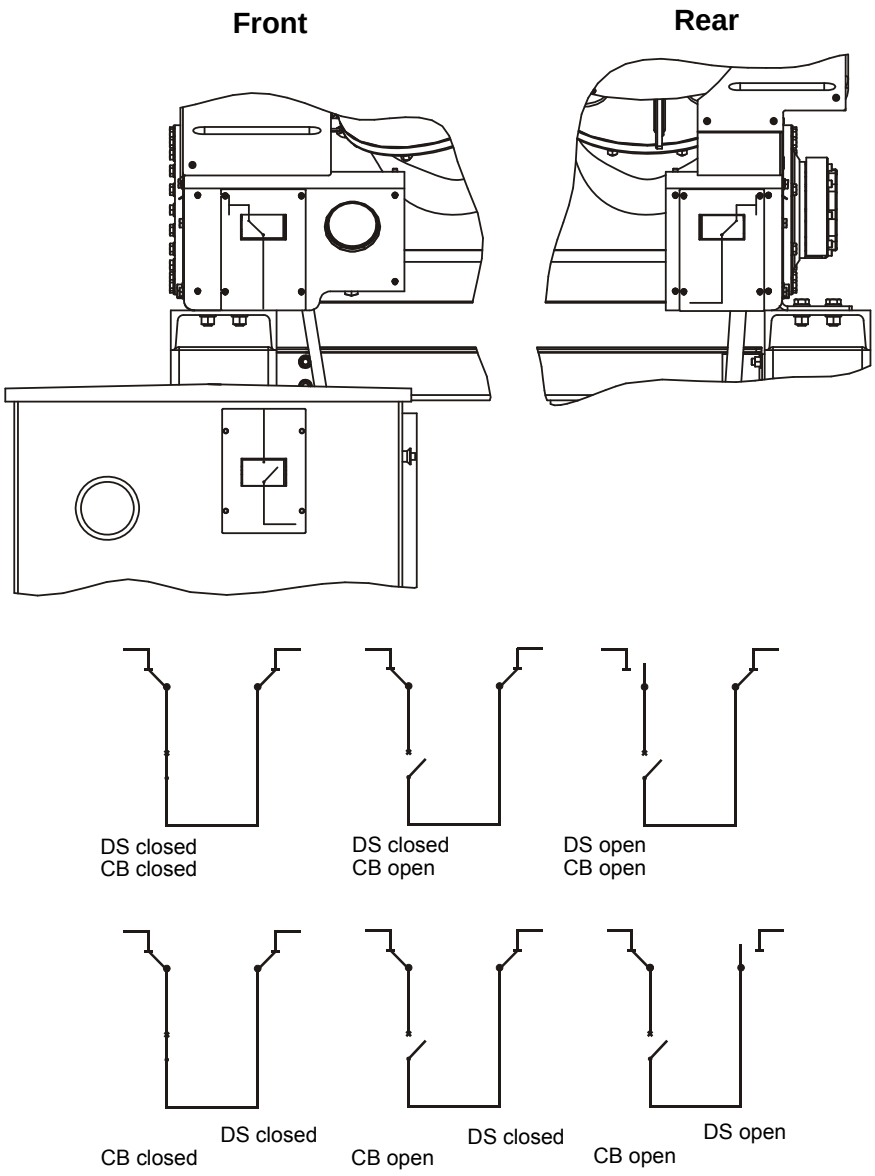
CB = circuit breaker
DS = disconnector
ES = earthing switch




Position indicator (earthing sequence)

### A1.4.3 Disconector with or without commutation capability

CB = circuit breaker
DS = disconnector




Position indicator

# A2 Tools and Auxiliary Equipment

## A2.1 Customer-Supplied Materials and Equipment for Installation and Commissioning

Customer-supplied materials and equipment are not included in the order or supplied by the manufacturer. They must be provided at the site by the customer.

Materials and equipment listed in sections A2.4 to A2.9 may be purchased from the GE Service Germany.

## A2.2 Materials

- Foundation including anchor bolts, nuts, and washers
- Earthing (grounding) conductors including terminals and fasteners
- Gas for filling
- Squared timbers and boards on which the module can rest before installation.

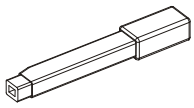
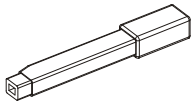
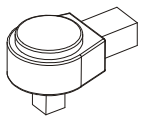
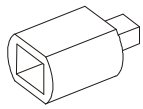
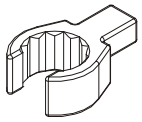
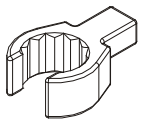
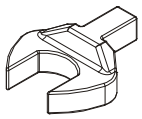
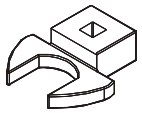
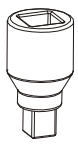
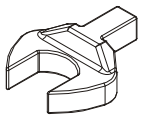
## A2.3 Hoisting and Climbing or Lifting Equipment

- Crane or forklift truck of sufficient lift height and load-carrying capacity
- Slings and lifting tackle of sufficient load-carrying capacity
- Ladders or lifting platforms.

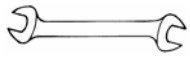
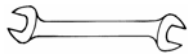
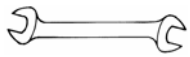
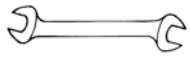
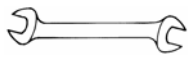
## A2.4 Tools, Test Equipment and Auxiliary Equipment

- Gas-filling device with pressure reducing valve and type DILO DN8 coupling
- $SF_6$ leak detector
- Multimeter
- Measuring device for determining operating times
- Measuring device for determining contact resistance
- Crowbar
- Assembly tools based on our tool recommendations
- Metal brush with stainless steel bristles
- Rubber mallet.

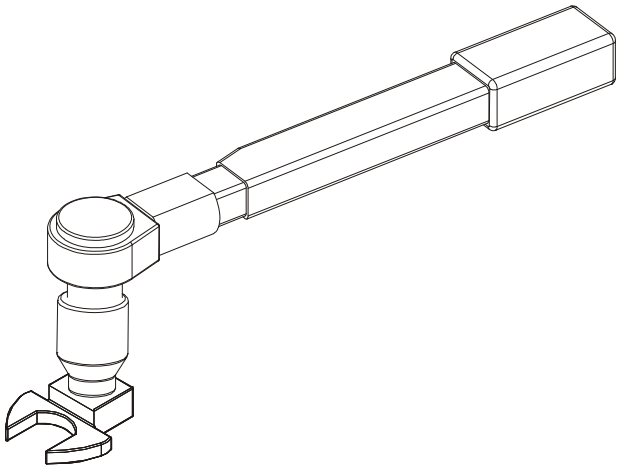
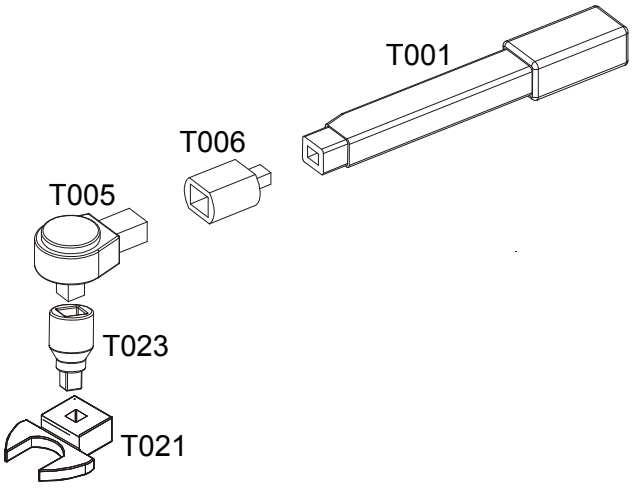
### A2.4.1 Tool Recommendations

| Tool | Description | Illustration |
|---|---|---|
| T001 | Torque wrench (spanner), 8-40Nm; 9x12mm seat; length ≤390mm |  |
| T003 | Torque wrench (spanner), 80-400Nm; 14x18mm seat |  |
| T005 | Ratchet adapter; can be used for ½" torque wrench; 14x18mm seat |  |
| T006 | Drive adapter; for use with 14x18mm heads in connection with 9x12mm torque wrench seat |  |
| T008 | Flare nut wrench, 19mm; head for torque wrench (spanner); 9x12mm seat |  |
| T009 | Flare nut wrench, 24mm; head for torque wrench (spanner); 9x12mm seat |  |
| T011 | Open-end wrench (open-ended spanner), 36mm; head for torque wrench (spanner); 14x18mm seat |  |
| T021 | Open-end wrench (open-ended spanner); head for SW27 torque wrench (spanner); 14x18mm seat |  |
| T023 | Adapter; 12.5 (½") inside; 10 (⅜") outside |  |
| T098 | Open-end wrench 22m, head for torque wrench, 14x18 mm seat |  |

**Double open-ended wrenches**

| Tool | Description | Illustration |
|---|---|---|
| T013 | Double open-ended wrench; 10x11mm |  |
| T014 | Double open-ended wrench; 12x13mm |  |
| T015 | Double open-ended wrench; 18x19mm |  |
| T016 | Double open-ended wrench; 22x24mm |  |
| T017 | Double open-ended wrench; 32x36mm |  |
| T018 | Double open-ended wrench; 36x41mm |  |
| T019 | Double open-ended wrench; 27x30mm |  |

**Tool Combinations**

| Tool | Illustration | Comment |
|---|---|---|
| WK001 | WK001 (combined)<br>  <br>WK001 (exploded view)<br>  | For tightening gas couplings to specific torque |

### A2.5 Greases for Installation, Commissioning and Maintenance

The following table describes how lubricating greases are to be used and applied. Each application is referred to in the text of the instruction manual by its abbreviation (e.g.: lubricated per L1).

| Abbre-viation | Name of Lubricating Grease | Function | Application |
|---|---|---|---|
| L1 | Molykote BR2plus | Lubrication of threaded connections | Apply a thin coating of grease to the external thread[1)] |
| L2 | Molykote BR2plus | Lubrication of sliding and bearing surfaces | Apply a thin coat of grease to the sliding or bearing surface[1)] |
| L3 | SF 1377 silicone grease | For protecting threaded surfaces from corrosion | Apply a thin coat of grease to the entire area being protected[1)] |
| L4 | SF 1377 silicone grease | Lubrication of threaded connections in gas piping | Apply a thin coating of grease to the external thread[1)] |
| L5 | SF1377 silicone grease plus alcohol | Lubrication of O-rings and O-ring contact surfaces | Clean the O-ring and O-ring mating surfaces with alcohol and apply a thin coat of grease with your fingers. To avoid introducing dirt, do not use brushes or rags[1)] |
| L6 | Molykote PG54 | Lubricating electrical contact surfaces in the pole units | Apply a thin coat of grease to the entire contact surfaces |
| L7 | Molykote PG54 | Lubricating sliding and bearing surfaces in the pole units | Apply a thin coat of grease to the contact surfaces |

[1)] The amounts required for installation and commissioning are supplied by the manufacturer and are included in the shipment.

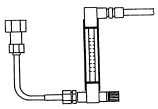
### A2.6 Locking Adhesives for Installation, Commissioning and Maintenance

The following table describes how locking adhesives are to be used and applied. Each application is referred in the text of the instruction manual by its abbreviation (e.g.: locked per S1).

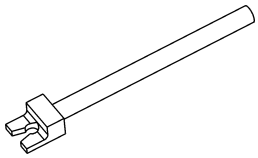
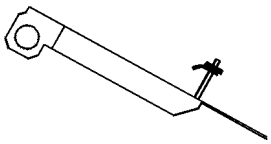
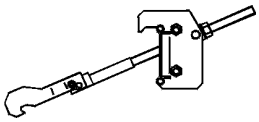
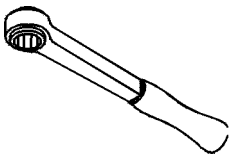
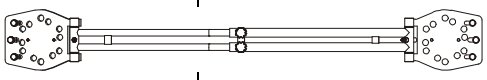
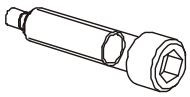
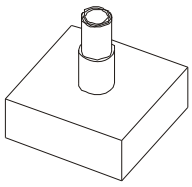
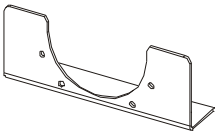
| Abbreviation | Name of Locking Adhesive | Function | Application |
|---|---|---|---|
| S1 | Loctite 243 | Medium strength threadlocker | Apply a light coating of locking adhesive to the first few threads only. The cure time is 30 minutes at room temperature. Low temperatures require a longer cure time[1)] |

[1)] The amounts required for installation and commissioning are supplied by the manufacturer and are included in the shipment.

### A2.7 Measuring Devices for Checking Gas Quality

| Tool | Description | Illustration |
|---|---|---|
| T200 | Dew point hygrometer |  |
| T201 | $SF_6$ analyzer, type AW |  |
| T202 | Acidity detector tube (10 each)<br>For use with T201 |  |
| T203 | $SF_6$ volume percentage measuring device |  |

## A2.8 Tools for Reconditioning

| Tool | Description | Illustration |
|---|---|---|
| T101 | Assembly tool for cotter pins |  |
| T103 | Blocking device:<br>device for blocking the closing latch |  |
| T104 | Slow operation device:<br>device for slow closing and opening operations |  |
| T105 | Ratchet box wrench (ring spanner) for M16:<br>standard tool for operating the slow operation device |  |
| T108 | Lifting device |  |
| T109 | Guide pin |  |
| T110 | Transport bolt M10 |  |
| T111 | Holding fixture for interrupter unit |  |
| T112 | Mounting bracket |  |

## A2.9 Auxiliary Materials and Supplies

| Description | Quantity |
|---|---|
| Molykote BR 2 plus grease | 0.20kg<br>0.40kg<br>0.80kg |
| SF 1377 silicone grease | 0.25kg<br>0.50kg |
| Molykote PG 54 grease | 1.00kg |
| Locking adhesive<br>Loctite 243 (blue) | 10cm³<br>250cm³ |
| Alcohol for cleaning | 5l |
| Scotch brand nonwoven material | 10mx100mm |

# A3 Replacement Parts and Accessories

Replacement parts and accessories for HYpacts can be purchased from the GE Service Germany.

The replacement parts have been broken down into several recommended groups based on many years of experience.

**Replacement Parts List "R" = Always Recommended**

| Description |
|---|
| Coil E/A FK3* |
| Contactor* |
| Auxiliary switch block |
| * Different variants or operating voltages; specify serial number of device |

**Replacement Parts List "U" = Useful for 5 HYpacts or More**

| Description |
|---|
| Motor for circuit breaker operating mechanism* |
| Cartridge heater for circuit breaker operating mechanism* |
| Cartridge heater for control cabinet* |
| Cartridge heater for transformer terminal box* |
| Auxiliary switch for circuit breaker operating mechanism |
| Motor protection switch for circuit breaker operating mechanism* |
| Time-delay relay 0.05s-60h 24-240V AC/DC for circuit breaker operating mechanism |
| Undervoltage release FK3 for circuit breaker operating mechanism* |
| * Different variants or operating voltages; specify serial number of device |

**Replacement Parts List "P" = Keep on hand if there are a large number of devices or to shorten repair time**

| Description |
|---|
| Circuit breaker interrupter system** |
| Drier bag |
| Gasket set** |
| Remote-local switch with or without open position** |
| **Specify serial number of device |

**Other Replacement Parts and Accessories**

| Description |
|---|
| Gas cylinder, 5kg |
| Gas cylinder, 10kg |
| Gas cylinder, 15kg |
| Gas cylinder, 20kg |
| Gas cylinder, 40kg |
| $SF_6$ gas refill set |
| Leak detector HI300 |
| Density monitor* |
| Socket outlet with earthing (grounding) contact |
| Lighting attachment, door contact** |
| Terminal UK 5 N 751 |
| Ground (earth) terminal UK5N/USLKG10 |
| Button temperature controller |
| Manual charging crank handle FK3 |
| Hand crank for disconnector-earthing switch type ME4 and ME1-3 |
| Saeka cleaning paste |
| Loctite 243 blue 250 ml |
| Molykote BR 2 grease, 400 g |
| Box of assorted HYpact parts & accessories |
| * Different variants or operating voltages; specify serial number of device |
| **Specify serial number of device |

## A3.1 Servicing Equipment

| Description |
|---|
| Service device with vacuum pump and cryoliquefier |
| Gas-filling cart with vacuum pump |
| Dew point hygrometer |
| $SF_6$ analyzer, type AW |
| - plus: Acidity detector tube (10 each) |
| $SF_6$ volume percentage measuring device |
| Actas measuring computer for operating time/displacement/ power consumption, Micro-Ohmmeter 600A |

# A4 Handling Used Sulfur Hexafluoride

Sulfur hexafluoride ($SF_6$) can become contaminated when used in electrical equipment. Contamination can result from leaks, incomplete evacuation, partial discharges, decomposition caused by electric arcs and mechanical erosion. Used $SF_6$ is a valuable recyclable material that must be reconditioned and re-used.

The guidelines for analyzing and reconditioning sulfur hexafluoride after removal from electrical equipment and the specifications for its re-use are defined in standard IEC 60480.

Standard IEC 62271-4 describes the use and handling of $SF_6$ in high voltage switchgear.

Before used $SF_6$ is recycled, it must be analyzed and generally reconditioned in order to meet standard specifications. The reconditioning process removes the impurities. Reconditioning is handled by the $SF_6$ manufacturer. If the $SF_6$ is only slightly contaminated, it can also be treated on site using appropriate maintenance equipment (instructions are given in standard IEC 60480).

| | |
|---|---|
| **How do you ensure that used $SF_6$ will be handled correctly?** | By complying with the procedures defined in standards IEC 60480 and IEC 62271-4. |
| **What requirements must the operator meet?** | The operator must ensure that the procedures defined in standards IEC 60480 and IEC 62271-4 are followed and that the personnel assigned to carry out these procedures are qualified to handle used $SF_6$. Within the European Union, the assigned personnel must be qualified in accordance with EU Regulation 842/2006. |
| **How is used $SF_6$ handled?** | Used $SF_6$ is analyzed, reconditioned if necessary, and re-used. The relevant guidelines and specifications are defined in standard IEC 60480. |

# A5 Technical Description

## A5.1 Technical Data: HYpact

| Type | | HYpact 72,5 | HYpact 123 | HYpact 145 | HYpact 170 |
|---|---|---|---|---|---|
| Rated voltage | kV | 72,5 | 123 | 145 | 170 |
| Rated normal current | A | 2500 | | | |
| Rated frequency | Hz | 50/60 | | | 50 |
| Rated short-circuit breaking current | kA | 40 | | | |
| Rated short-circuit making current | kA | 104 | | | |
| Rated peak withstand current | kA | 104 | | | |
| Rated short-time withstand current | kA | 40 | | | |
| Rated duration of short circuit | s | 3 | | | |
| Rated power frequency withstand voltage, 1min | | | | | |
| - To ground | kV | 140 | 230 | 275 | 325 |
| - Across open switching device | kV | 160 | 265 | 315 | 375 |
| Rated lightning impulse withstand voltage | | | | | |
| - To ground | kV | 325 | 550 | 650 | 750 |
| - Across open switching device | kV | 375 | 630 | 750 | 860 |
| Rated mechanical terminal load | | | | | |
| - static | N | 1000-1250 | | | |
| - static and dynamic | N | 3000-5000 | | | |
| Temperature range* | °C | -30/ +40 | | | -25/ +40 |
| * further temperature ranges available on request<br>**other rated normal currents available on request | | | | | |

### A5.2 Technical Data: Spring Operating Mechanism

| | | |
|---|---|---|
| Type (see nameplate) | | FK 3-.. |
| Motor for charging the closing spring: | | |
| Rated voltage (preferred values) | | |
| - Direct voltage | V | 60/110/125/220/250 *) |
| - Alternating voltage | V | 120/230 *) |
| Allowable rated voltage deviation | | 85 to 110 % Vn |
| Power input | W | ≤1000 **) |
| Closing spring charging time | s | ≤ 15 |
| Shunt releases, closing and opening: | | |
| Rated supply voltage<br>(preferred values only with direct voltage) | V | 60/110/125/220/250 *) |
| Allowable rated supply voltage deviation | | |
| - Shunt closing release | | 85...110 % Un |
| - Shunt opening release | | 70...110 % Un |
| Power input for releases | | |
| - Shunt closing release | W | 340 |
| - Shunt opening release | W | 340 |
| Minimum pulse duration | ms | 10 |
| Auxiliary circuits: | | |
| Rated continuous load current | A | 10 |
| Auxiliary contact tripping capability | | |
| - At 230 V alternating voltage | A | 10 |
| - At 220 V direct voltage in an inductive circuit with a time constant of L/R = 20 ms | A | 2 |
| Anti-condensation heating: | | |
| Rated voltage (alternating voltage) | V | 120 or 230 *) |
| Power input | W | 80 |

*) Specify when ordering
**) The exact value is shown on the motor nameplate

### A5.3 Technical Data: Motor-Operated Mechanism of Disconnector-Earthing Switch

| Type | | ME4 | ME1-3 |
|---|---|---|---|
| Rated torque | Nm | 160 | 160 |
| Motor voltage | V dc | 48/60/110/220/240 *) | 48/60/110/220/240 *) |
| Control voltage | V dc | 48/60/110/220/240 *) | 48/60/110/220/240 *) |
| Heater rating | W | 80 | 17,8 / 19,7 / 17,9 |
| - Heater voltage | V ac | 120 / 230 *) | 110/127/220 *) |
| - Frequency with alternating current | Hz | 50 / 60 | 50 / 60 |
| Auxiliary switch | | nicht einstellbar | nicht einstellbar |
| - Rated contact current | A dc | 2 | 2 |
| - Contact rating per IEC 60694 | A / ms | 100A / 30ms | 100A / 30ms |
| *) Specify when ordering | | | |

# A6 Slow Operation for Maintenance Purposes (Circuit Breaker)

**Introduction**

These instructions describe the following manual operations:

- Executing a slow closing operation
- Executing a slow opening operation

Manual operations in accordance with these instructions are not necessary during installation work and during normal operation.

Slow closing or opening operations can be used for setting, adjusting and checking the circuit breaker, if necessary.

After improper manipulations or when there are problems with the circuit breaker, it may be necessary to close or open the circuit breaker slowly and discharge the closing spring manually in order to eliminate a problem or fault.

**Safety Precautions**

Stored-energy spring mechanisms have been designed according to the state of the art and are safe and reliable. Nonetheless, these devices can be hazardous if operated improperly.

The HYpact operator must therefore ensure that all personnel working on the equipment will meet the following requirements:

- Technical knowledge regarding local and national safety and accident prevention regulations, especially for high voltage systems and devices
- Knowledge of and compliance with the contents of this document
- Professional training in the area of circuit breakers and stored-energy spring mechanisms
- Compliance with the safety instructions displayed on the device
- Agreement to report immediately any changes that may compromise safety

**Requirements for Executing Manual Operations**

- The circuit breaker is in the open position.
- The HYpact is grounded (earthed) at both ends.
- The control voltage is turned off.

**Safety in General**

- Any manipulations of the equipment that do not conform to instructions may endanger both the individuals performing the manipulations and the spring mechanism.
- If manipulations are performed on the spring mechanism that are not in compliance with FK3 instructions, then the individual performing the manipulations is at risk of death or injury. The spring mechanism can also be damaged in the process


**Perform only manipulations that comply with these instructions.**

**Personal Safety When Performing Manipulations on the Operating Mechanism**

- After the control voltage is turned off, the closing spring is charged. Although the control voltage is interrupted, accidental operations are possible when performing manipulations on the operating mechanism.
- Touching moving parts poses a risk of injury.


**After control voltage has been interrupted, discharge the springs by executing opening, closing and opening operations using the manual releases.**

- Spring mechanisms with undervoltage releases open immediately as soon as the control voltage is interrupted.
- This can lead to injury when manipulations are being performed on the spring mechanism.


**Prevent unintentional or accidental opening operations by locking the undervoltage releases.**

- If the motor voltage is switched on, the motor will immediately begin to charge the closing spring.
- Touching moving and/or spring-charged parts poses a risk of injury.


**Keep parts of the body away from any moving or spring-charged parts when turning on the control voltage.**

**Product Safety**

- If the spring mechanism is operated without the circuit breaker, the total energy stored within the spring mechanism will be converted.
- The mechanism can be severely damaged as a result.

| | |
|---|---|
| CAUTION | **Only operate the spring mechanism when the circuit breaker is connected.** |

- If the gas pressure of the HYpact is below the minimum value for mechanical operation (visible on the warning plate or label inside the spring mechanism), then an unacceptably high level of energy is converted within the spring mechanism.
- This can damage both circuit breaker and spring mechanism.

| | |
|---|---|
| CAUTION | **Operate the spring mechanism only with a circuit breaker in which the gas pressure is above the minimum value for mechanical operation.** |

- Dust inside the spring mechanism can have an adverse effect on operation of moving parts such as latches, rollers, shafts and on the response of electrical devices.
- This can lead to malfunctions and result in damage to the spring mechanism.

| | |
|---|---|
| CAUTION | **Always keep the inside of the spring mechanism free of dust. Always close the cabinet door properly.** |

- The use of cleaning agents, rust-preventing grease or sprays may result in heavy gum formation (gumming).
- This can have a negative effect on the operation of the spring mechanism.
- Moisture inside the spring mechanism leads to water condensation and subsequent corrosion of steel parts.
- This may lead to malfunctions and result in damage to the spring mechanism.

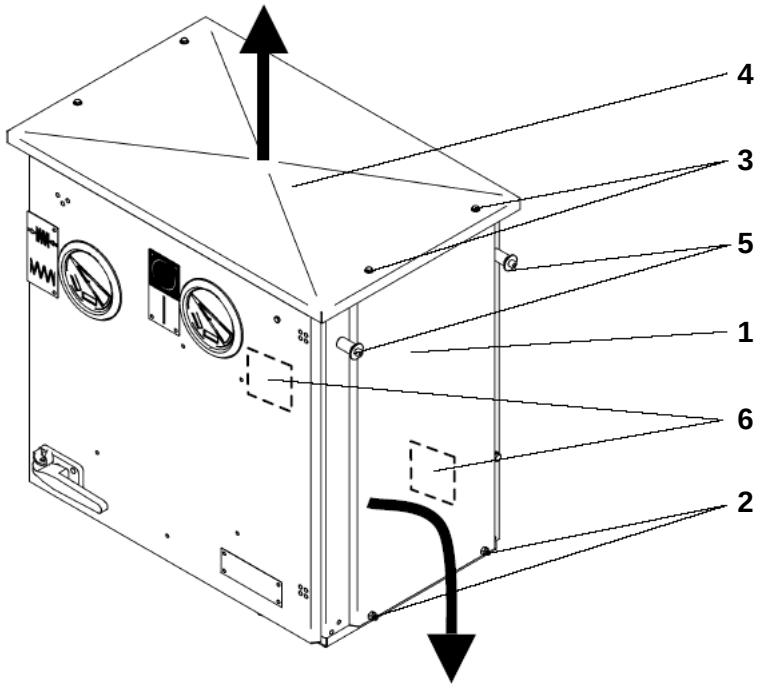
| | |
|---|---|
| CAUTION | **The heating unit (anticondensation heater) must always be in operation, regardless of HYpact location.** |

### Preparing the Spring Mechanism for Manual Operations

### Preparing the Cabinet

| If | Then |
|---|---|
| Cabinet is mounted horizontally; mounted on rear panel | • Remove the side panels(1)<br>• Remove the side panel lock nuts (2)<br>• Swing the side panel (1) out and down |

Horizontal mounting configuration shown



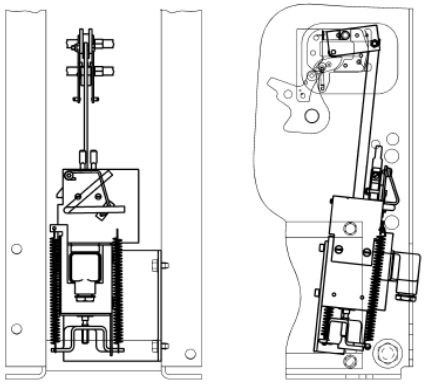
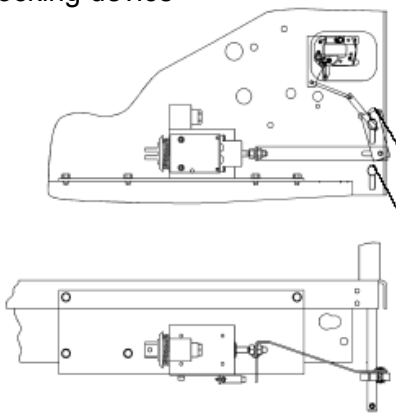
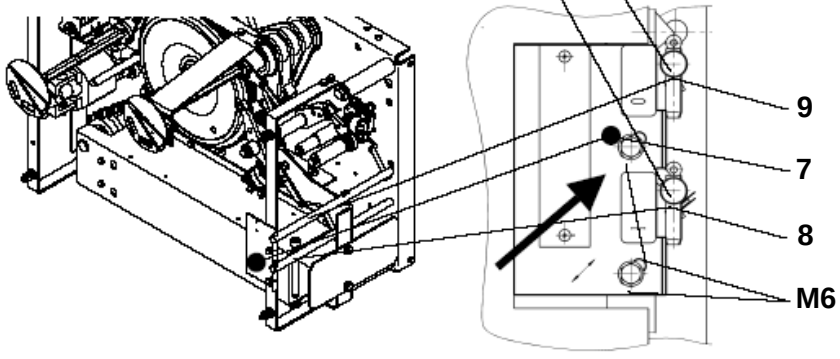

| | |
|---|---|
| **1** Side panel | **4** Roof |
| **2** Side panel lock nut | **5** Suspension pin |
| **3** Roof mounting screw | **6** Cover plate |

### Locking the Manual Releases

- The manual releases may be actuated unintentionally when manipulations are being performed on the spring mechanism.
- Manipulating the spring mechanism without locking the manual releases poses risk of injury.

**WARNING**

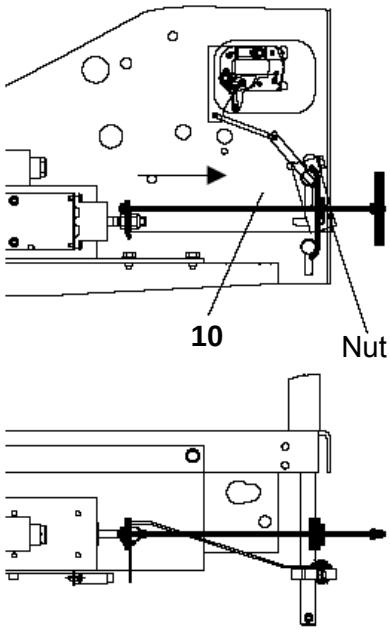
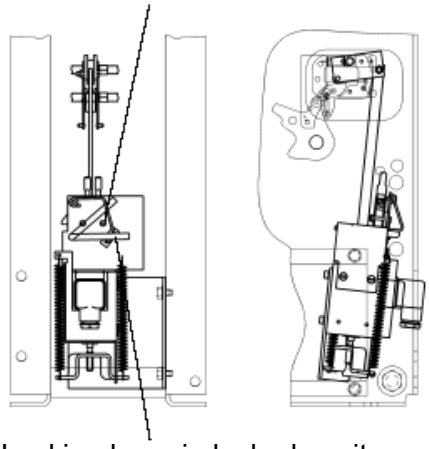
**Prevent inadvertent manual actuation of the spring mechanism by locking manual trip devices or releases.**

| If | Then |
|---|---|
| Spring mechanism has no undervoltage release | Manual releases are normally locked.<br>If this is not the case:<br>• Loosen the M6 screws.<br>• Slide manual release locking device (7) in the direction of the arrow until manual releases are locked.<br>• Retighten the M6 screws. Tighten to a torque of 7 Nm. |
| Spring mechanism has undervoltage release and integrated locking device  | |
| Spring mechanism has undervoltage release but no locking device  | The manual release locking device (7) is normally not installed in this model.<br>• Slide manual release locking device (7) in the direction of the arrow until manual releases are locked.<br>• Tighten the M6 screws. Tighten to a torque of 7 Nm. |
| Manual release locking device   | |

| | |
|---|---|
| **7** Manual release locking device | **9** Manual opening release |
| **8** Manual closing release | - |

**Locking the Undervoltage Release**

- If the spring mechanism is equipped with undervoltage releases and if slow closing or opening operations are necessary, then the undervoltage release must be locked.

| If | Then |
|---|---|
| Undervoltage release has no locking device<br>  <br><br>10 Locking device for undervoltage release | Insert hook of locking device (10) and pull out solenoid until it hits the stop;<br>• then hand-tighten the nut slightly. |
| Undervoltage release has integrated locking device<br>Locking lever in operation positon<br>  <br>Locking lever in locked positon | • Turn the locking lever from operation position to locked position |

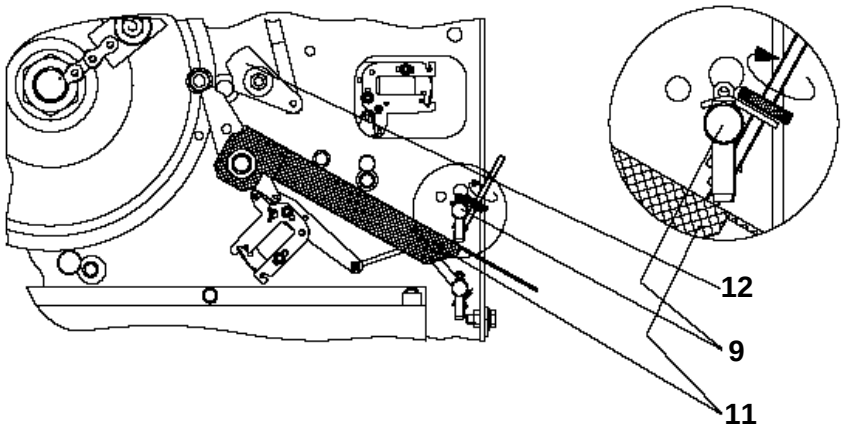
**Locking the Closing Latch if the Closing Spring is Charged**

- The closing latch may be actuated unintentionally when manipulations are being performed on the spring mechanism.
- Performing manipulations on the spring mechanism when the closing spring is charged and the closing latch is not locked poses a risk of injury.

**WARNING**

**Prevent inadvertent manual actuation of the spring mechanism by locking the closing latch.**

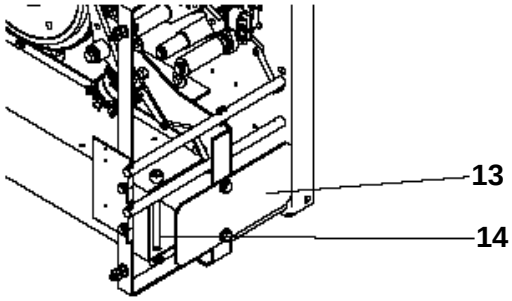
- Insert the locking device (11) for the closing latch (12) and fasten it to the shaft of the manual opening release (9).




| | |
|---|---|
| **9** Manual opening release | **11** Locking device for the closing latch (T103) |
| **12** Closing latch | - |

**Removing the Safety Plate**

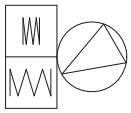
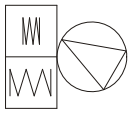
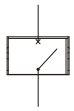
- Remove the safety plate (13).




| | |
|---|---|
| **13** Safety plate | **14** Self-locking bolt |

**Executing a Slow Closing Operation**
The spring mechanism is prepared for manual operations.

**Checking the Operating State of the Circuit Breaker and the Spring Mechanism**

| Position of Position Indicator | | |
|---|---|---|
|  |  |  |
| Spring position indicator shows closing spring is uncharged or charged | | Circuit breaker position indicator is in open position |

**Tools Required**

| |
|---|
| **7** Locking plate for manual[1)] |
| **10** Locking device for undervoltage release[1)] |
| **11** Locking device for the closing latch (T103) |
| **15** Slow operation device (T104) |
| **16** Closing spring release device |

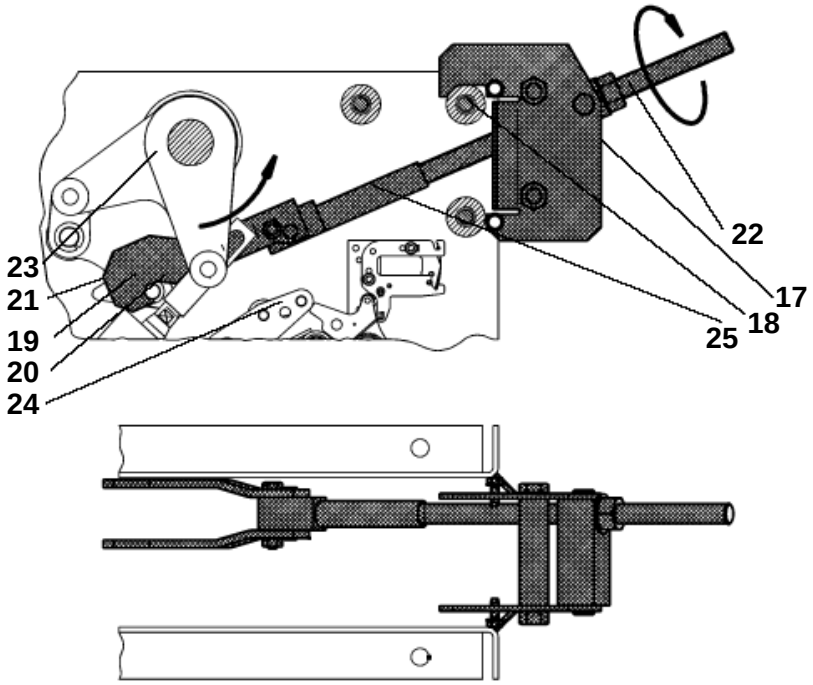
[1)] Only required for spring mechanisms equipped with an under-voltage release and no integrated locking device.

**Installing the Slow Operation Device**

- Place the support plate (17) of the slow operation device (15) on the upper right spacer sleeve (18) and prop the device against the mechanism housing.
- Attach the hook (19) of the slow operation device to the pin (20) of the support latch (21).

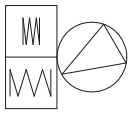
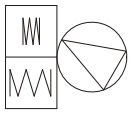
**Closing Manually**

- Turn the hexagon nut (22) clockwise until the support latch (21) of the roller follower (23) engages with the opening latch (24) by audibly snapping into place.
- During the slow closing operation, the opening spring in the mechanism is charged simultaneously. Overcharging is prevented by the stop sleeve (25).
- The circuit breaker position indicator is now in the closed position.




| | |
|---|---|
| **17** Support plate | **22** Hexagon nut |
| **18** Spacer sleeve | **23** Roller follower |
| **19** Hook | **24** Opening latch |
| **20** Pin | **25** Stop sleeve |
| **21** Support latch | - |

**Operating State after Slow Closing**

| Position of Position Indicator | | |
|---|---|---|
|  |  |  |
| Spring position indicator shows closing spring is uncharged or charged | | Circuit breaker position indicator is in closed position, opening spring is charged |

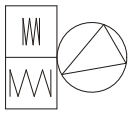
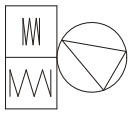
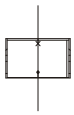
**Removing the Slow Operation Device**

- Turn the hexagon nut (22) counterclockwise until enough pressure is removed from the hook (19) that the slow operation device (15) can be removed.

**Executing a Slow Opening Operation**

The spring mechanism is prepared for manual operations.

**Checking the Operating State of the Circuit Breaker and the Spring Mechanism**

| Position of Position Indicator | | |
|---|---|---|
|  |  |  |
| Spring position indicator shows closing spring is uncharged or charged | | Circuit breaker position indicator is in closed position, opening spring is charged |

**Tools Required**

| |
|---|
| **7** Locking plate for manual release[1)] |
| **10** Locking device for undervoltage release[1)] |
| **11** Locking device for the closing latch (T103) |
| **15** Slow operation device (T104) |
| **16** Closing spring release device |

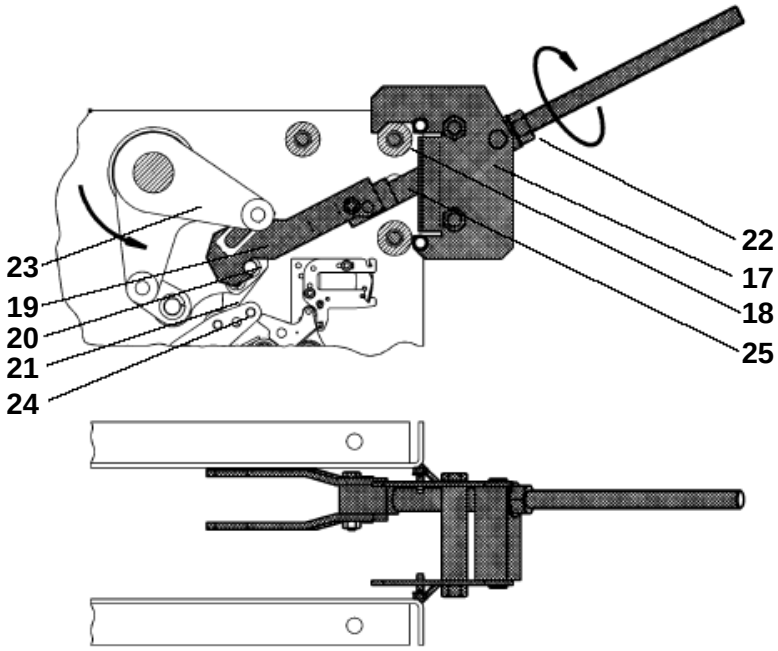
[1)] Only required for spring mechanisms equipped with an under-voltage release and no integrated locking device.

**Installing the Slow Operation Device**

- Place the support plate (17) of the slow operation device (15) on the upper right spacer sleeve (18) and prop the device against the mechanism housing.
- Attach the hook (19) of the slow operation device to the pin (20) of the support latch (24).

**Removing Pressure from the Opening Latch**

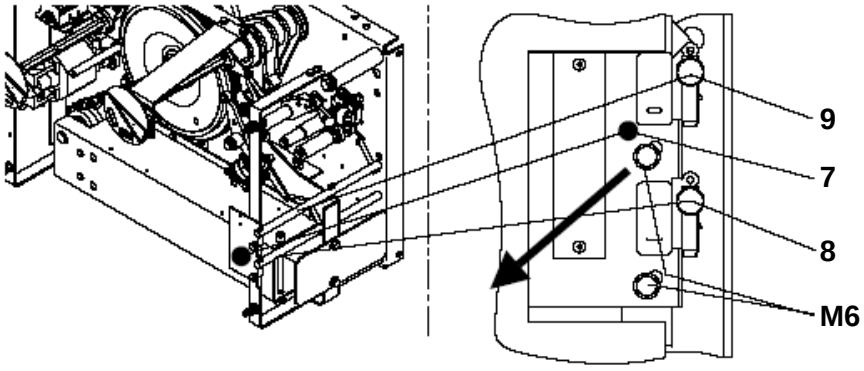
- Turn the hexagon nut (22) clockwise using the tool until the torque increases, i.e., until pressure is removed from the opening latch (24).




| | |
|---|---|
| **17** Support plate | **22** Hexagon nut |
| **18** Spacer sleeve | **23** Roller follower |
| **19** Hook | **24** Opening latch |
| **20** Pin | **25** Stop sleeve |
| **21** Support latch | - |

**Loosening the Manual Release Locking Device**

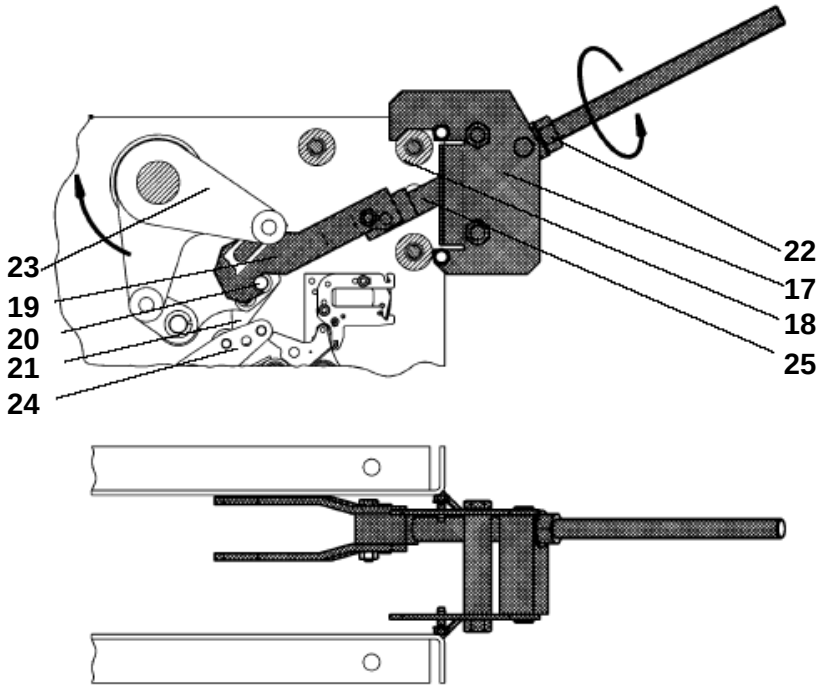
- Loosen the M6 screws.
- Slide the manual release locking device (7) in the direction of the arrow.
- Tighten the M6 screws. Tighten to a torque of 7 Nm.




| | |
|---|---|
| **7** Manual closing release | **9** Manual release locking device |
| **8** Manual opening release | - |

**Opening Manually**

- Release the opening latch (24) using the manual opening release (9).
- At the same time, turn the nut (22) counterclockwise until the support latch (21) of the roller follower (23) has passed the opening latch (24).
- Continue turning the nut (22) counterclockwise until the pressure is removed from the hook (19).
- At the end of this operation, the opening spring in the mechanism is discharged and the circuit breaker position indicator indicates that the circuit breaker is open.



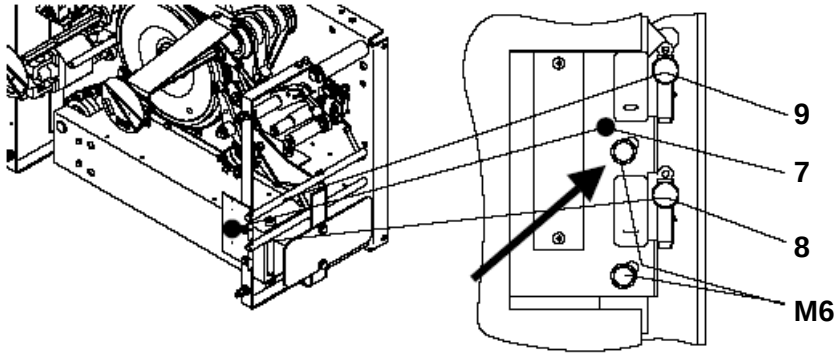

| | |
|---|---|
| **17** Support plate | **22** Hexagon nut |
| **18** Spacer sleeve | **23** Roller follower |
| **19** Hook | **24** Opening latch |
| **20** Pin | **25** Stop sleeve |
| **21** Support latch | - |

**Removing the Slow Operation Device**

- Turn the hexagon nut (22) counterclockwise until enough pressure is removed from the hook (19) that the slow operation device (15) can be removed.

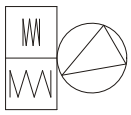
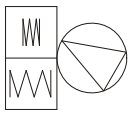
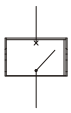
**Relocking the Manual Releases**

- Loosen the M6 screws.
- Slide the manual release locking device (7) in the direction of the arrow until manual releases (8) and (9) are locked.
- Retighten the M6 screws. Tighten to a torque of 7 Nm.




| | |
|---|---|
| **7** Manual closing release | **9** Manual release locking device |
| **8** Manual opening release | - |

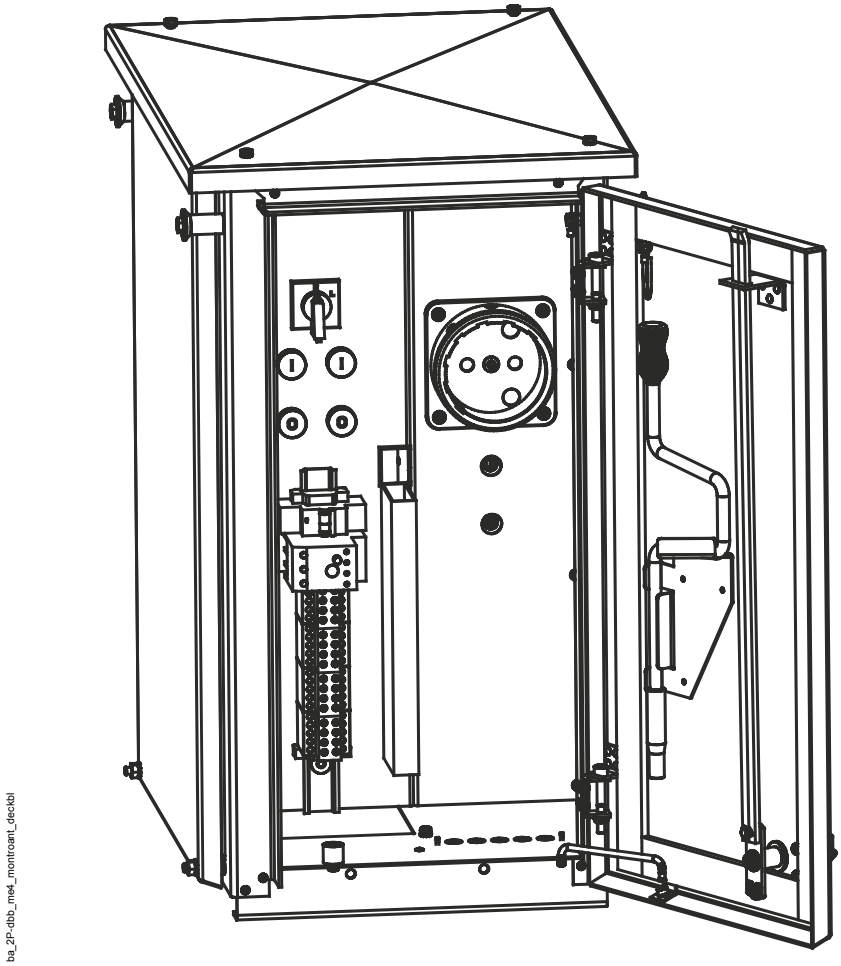
**Operating State of the Spring Mechanism after the Slow Opening Operation**

| Position of Position Indicator | | |
|---|---|---|
|  |  |  |
| Spring position indicator shows closing spring is uncharged or charged | | Circuit breaker position indicator is in open position, opening spring is discharged |

# A7 Motor-Operated Mechanism for Disconnector-Earthing Switch

| | |
|---|---|
| **CAUTION** | **“Type ME4 Motor-Operated Mechanism for Disconnector-Earthing-Switch” on page 189**<br>**“Type ME1-3 Motor-Operated Mechanism for Disconnector-Earthing Switch” on page 206** |

## A7.1 Type ME4 Motor-Operated Mechanism for Disconnector-Earthing-Switch



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### A7.1.1 General Information

#### A7.1.1.1 Information about the Instructions

The following instructions make it possible to operate the equipment safely and efficiently.
The instructions are an integral part of the device and must be kept in the immediate vicinity of the unit so that they are accessible to personnel at all times. Any individual operating or working on this device is required to read through the instructions carefully and understand them before beginning any type of operation. The basic requirement for safe work is compliance with all safety and operating instructions stated in this document. In addition, local accident prevention regulations and general safety requirements shall apply to the area in which the device is used. The illustrations in this document are for the purpose of basic understanding and may differ from the actual design of the device.

#### A7.1.1.2 Copyright Protection



#### A7.1.1.3 Limitation of Liability

All information and instructions in this document were compiled in accordance with applicable standards and regulations, the state of the art, and our knowledge and experience acquired over many years..
The manufacture is not liable for any damages resulting from the following causes:
- Non-compliance with the instructions
- Any use not in accordance with regulations or instructions
- Utilization of untrained personnel
- Unauthorized modifications
- Use of non-approved replacement parts

The actual scope of supply (equipment supplied by the manufacturer) may differ from the explanations and descriptions contained herein due to utilization of additional order options or as the result of the latest technical changes. The obligations agreed upon in the supply agreement, the General Terms and Conditions, the manufacturer's terms of delivery and the legal regulations applicable at the time the contract was signed shall apply.
We reserve the right to make technical changes within the scope of improvement of performance characteristics and further development.

The warranty conditions are included in the manufacturer's General Terms and Conditions.

### A7.1.2 Safety instructions

This section gives an overview of all important safety aspects essential for optimum protection of personnel and for safe and trouble-free operation.

Non-compliance with the instructions and safety information presented in this document may expose personnel and materials to significant danger.

---

**CAUTION**

**WARNING**
Proper product handling and use in accordance with regulations and standards is essential for product safety.

---


**WARNING**
**Danger for Unauthorized Individuals**
Unauthorized individuals who do not meet the requirements described in this document are not familiar with the dangers in the work area.
**Therefore:**
- Keep unauthorized persons away from the work area.
- In case of doubt, address these individuals and show them the way out of the work area.
- Interrupt work as long as unauthorized individuals are in the work area.

---

**NOTE REGARDING ENTIRE SYSTEM**
Contains fluorinated greenhouse gases covered by the Kyoto Protocol.

---

### A7.1.3 Personnel

Qualified personnel shall have the professional training and experience appropriate for the work being performed. Qualified personnel shall be familiar with all relevant regulations in order to safely complete the work to be performed and shall be able to recognize potential dangers and risks.

Only professional personnel who can be expected to perform the work reliably may work on and with the product. No procedure or operation that might compromise the safety of individuals, the environment or the product shall be carried out..


**WARNING**
The lack of appropriate professional qualifications poses a risk of injury.

Improper handling can lead to significant personal injury and/or property damage.

All activities must only be carried out by personnel who are professionally qualified to do so.

**Note**
Always be prepared for accidents or fire.

- The first aid equipment (first aid kit, blankets, etc.) must be easily accessible at all times.
- All personnel must be familiar with the accident reporting, first aid and rescue equipment .
- Access roads and lanes for emergency vehicles must always be kept clear.
- See "First Aid Measures" for accident procedures.

### A7.1.4 Overview

#### A7.1.4.1 Applications

The ME4 mechanism was developed to drive the following applications:

- Combination disconnector-earthing switch
- Disconnector
- Earthing switch

#### A7.1.4.2 Design

The ME4 mechanism has a housing 72.01 that protects the gear-box and electrical components against environmental influences and has a maximum protection rating of IP55. **(Figure 11)**

The operation mode of the device can be set using the operating mode selector 72.03 and locked by means of a padlock.

The mechanism can be operated by means of a hand crank 72.02 if the operating mode selector is set accordingly.

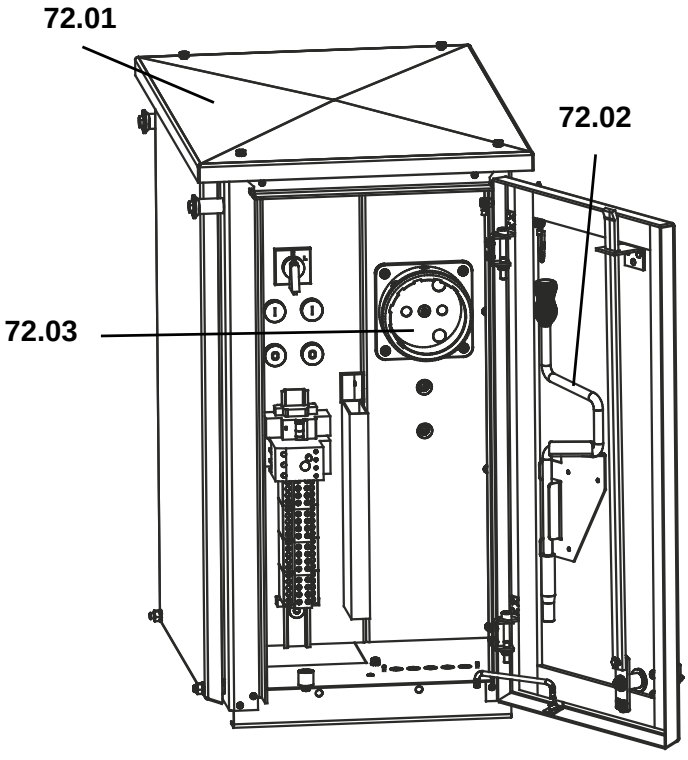


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**Figure 11**

| | |
|---|---|
| **72.01** | Housing |
| **72.02** | Hand crank |
| **72.03** | Operating mode selector |

### A7.1.5 Operating Mode Selector

#### A7.1.5.1 Design

The operating mode is set using the operating mode selector 72.03 by turning the selector drum 72.12 **(Figure 12 and Figure 13)**.

The operating mode is displayed in the windows 72.14 **(Figure 13)**.

The operating mode can be locked if the coding based on inserts 72.15 allows the frame 72.13 and selector drum 72.12 to be locked by means of the padlock 72.16.

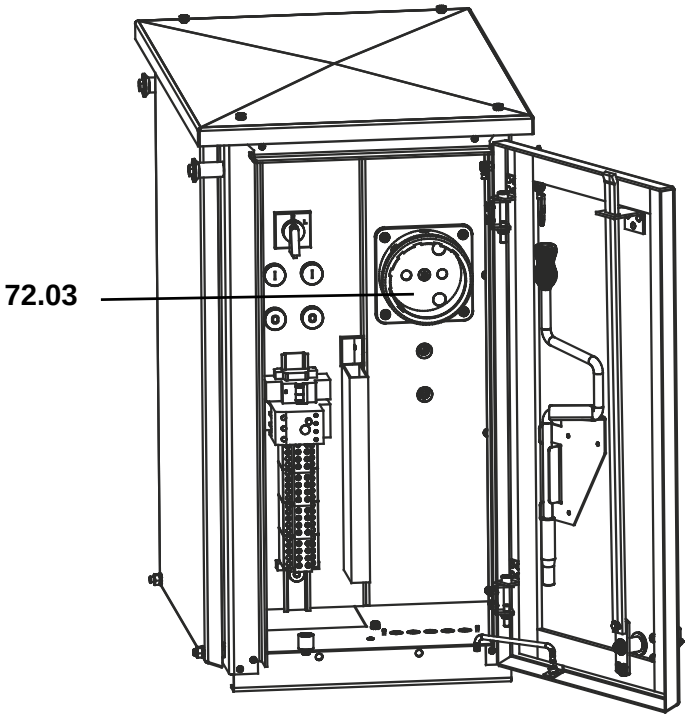



**Figure 12**

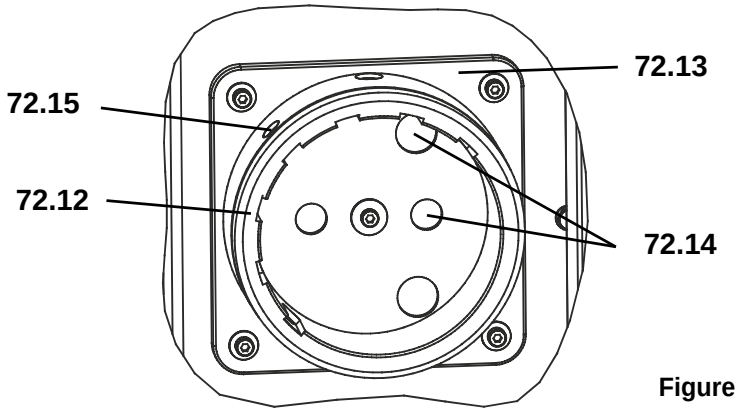



**Figure 13**

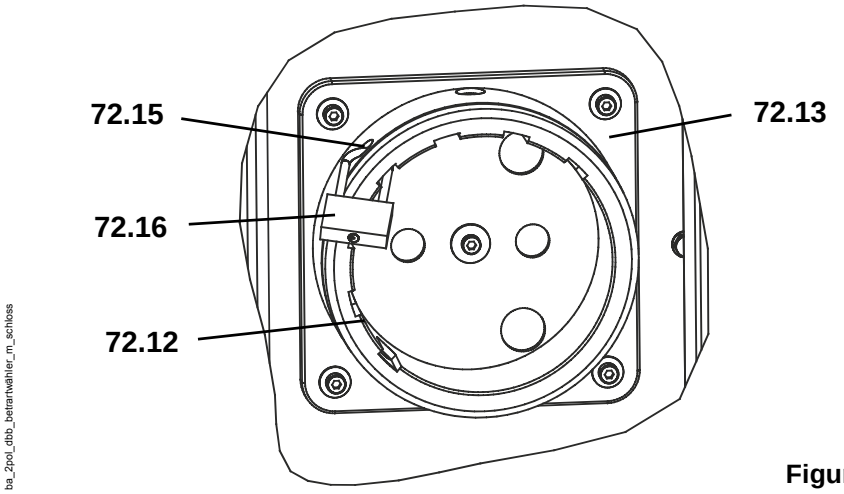



**Figure 14**

| | |
|---|---|
| **72.03** | Operating mode selector |
| **72.12** | Selector drum |
| **72.13** | Frame |
| **72.14** | Windows |
| **72.15** | Insert |
| **72.16** | Padlock |

#### A7.1.5.2 Operating Mode ON

In operating mode ON 72.17 **(Figure 15)** the drive mechanism is operated by the control system.

Manual operation is not possible in operating mode ON 72.17.
On 72.17 is generally the operating mode after the switchgear assembly has been commissioned or started up.

#### A7.1.5.3 Manual Operating Mode

In manual operating mode 72.18 **(Figure 15)** the drive mechanism is operated locally by a hand crank.

Electrical operation is not possible in the manual operating mode 72.18.

In the case of combination disconnector-earthing switch modules, only one application (disconnector or earthing switch) can be operated manually at the same time.

Switching from manual disconnector operation to manual earthing switch operation can only be done in the application's OPEN position by using the selector drum 72.12.
- Disconnector OPEN
- Earthing switch OPEN

The manual operating mode 72.18 is generally only used during startup and under certain conditions when inspecting the switchgear assembly.

#### A7.1.5.4 Operating Mode OFF

In operating mode OFF 72.19 **(Figure 15)** the device is turned off.

Neither manual or electrical operation is possible in operating mode OFF 72.19.

Operating mode OFF 72.19 can only be used in the application's final positions.
- Disconnector CLOSED
- Disconnector OPEN
- Earthing switch OPEN
- Earthing switch CLOSED

The operating mode OFF 72.19 is generally set during switchgear inspections if the device being driven is not to be operated at all.

### A7.1.5.5 Symbols

There are three possible operating modes **(Figure 15)**:

- ON 72.17
- Manual 72.18
- OFF 72.19

In combination disconnector-earthing switches the selected application is also displayed in operating modes ON 72.17 and Manual 72.18 **(Figure 16)**:

- Disconnector 72.20
- Earthing switch 72.21
- Combination disconnector-earthing switch 72.22 (DEd)
- Combination disconnector-earthing switch 72.23 (DEi)

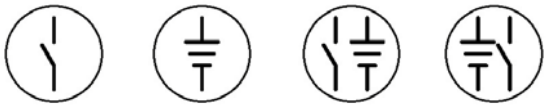
In operating mode Manual 72.18 the hand crank's direction of rotation is also displayed **(Figure 17)**:

- Hand crank direction of rotation 72.24
(Crank clockwise to close the application)
- Hand crank direction of rotation 72.25
(Crank counterclockwise to close the application)

**Operating Modes**

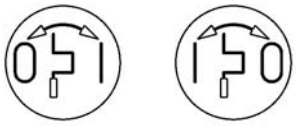
**72.17** **72.18** **72.19** **Figure 15**

**Applications**



**72.20** **72.21** **72.22** **72.23** **Figure 16**

**Directions of rotation**



**72.24** **72.25** **Figure 17**

| | |
|---|---|
| **72.17** | ON |
| **72.18** | Manual |
| **72.19** | OFF |
| **72.20** | Disconnector |
| **72.21** | Earthing switch |
| **72.22** | Combination disconnector-earthing switch<br>Direct disconnector-earthing switch, DEd) |
| **72.23** | Combination disconnector-earthing switch<br>Indirect disconnector-earthing switch, DEi) |
| **72.24** | Hand crank direction of rotation |
| **72.25** | Hand crank direction of rotation |

**Note**

- From this page to the end of section A7.1 please keep in mind that the position of the operating mode selector is a function of the mounting position of the ME4 operating mechanism.

The symbol in the operating mode window 72.26 of the selector drum
72.12 shows the selected operating mode **(Figure 18, Figure 19, Figure 20)**.

The symbol in the application window 72.27 of the selector drum 72.12 shows the respective application if the application is a combination disconnector-earthing switch **(Figure 18, Figure 19, Figure 20)**.

The symbols in the hand crank windows 72.28 of the selector drum 72.12 give the direction of rotation of the hand crank in the Manual operating mode 72.18 an **(Figure 18, Figure 19, Figure 20)**.

**Example ON**

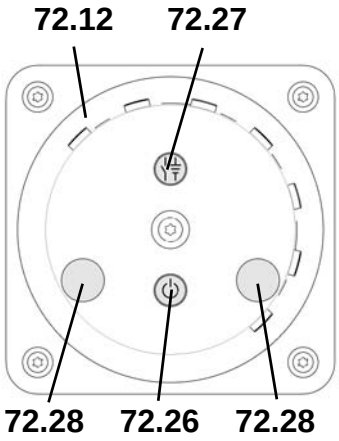



**Figure 18**

**Example Manual**

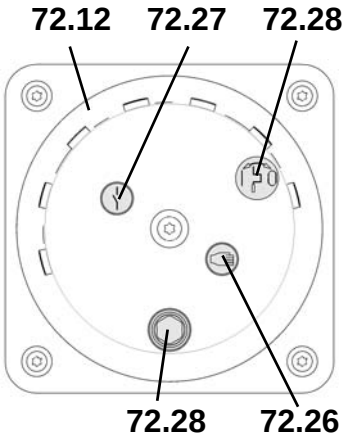



**Figure 19**

| | |
|---|---|
| **72.12** | Selector drum |
| **72.26** | Operating mode window |
| **72.27** | Application window |
| **72.28** | Hand crank window |

The symbols for operating mode OFF 72.19 are displayed in the operating mode window 72.26 and the application window 72.27 **(Figure 20)** if the application is a combination disconnector-earthing switch.

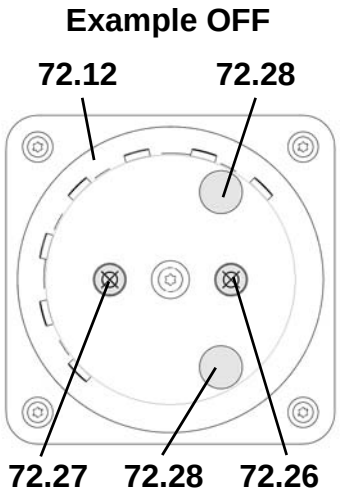



**Figure 20**

| | |
|---|---|
| **72.12** | Selector drum |
| **72.26** | Operating mode window |
| **72.27** | Application window |
| **72.28** | Hand crank window |

### A7.1.5.6 Operation

The operating mode is set by turning the selector drum 72.12 slightly **(Figure 21)**. The selector drum 72.12 engages every 30°.
If the locking hole 72.29 is closed **(Figure 22)**, the selector drum 72.12 cannot be locked by the padlock 72.16 to prevent resetting.

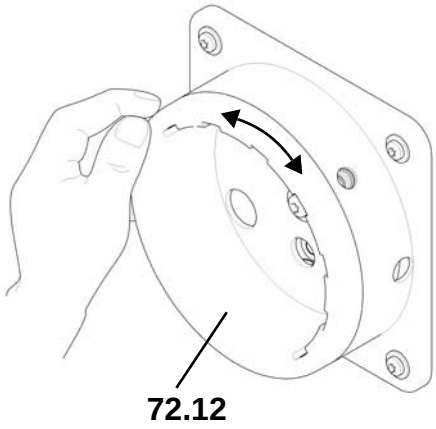



**Figure 21**

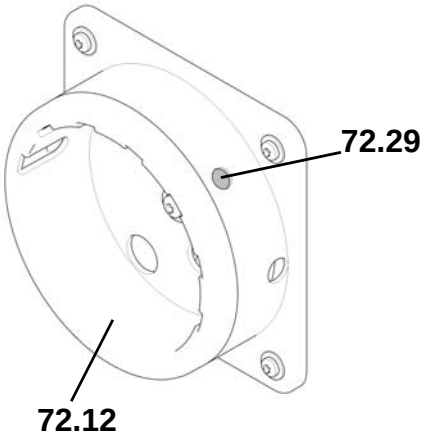



**Figure 22**

| | |
|---|---|
| **72.12** | Selector drum |
| **72.29** | Locking hole |

If the locking hole 72.29 is open **(Figure 23)**, the selector drum 72.12 can be locked by the padlock 72.16 to prevent resetting **(figure 24).**

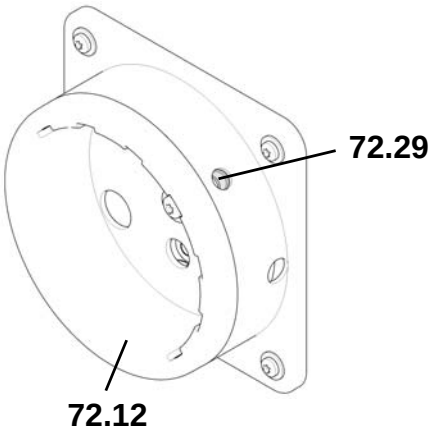



**Figure 23**

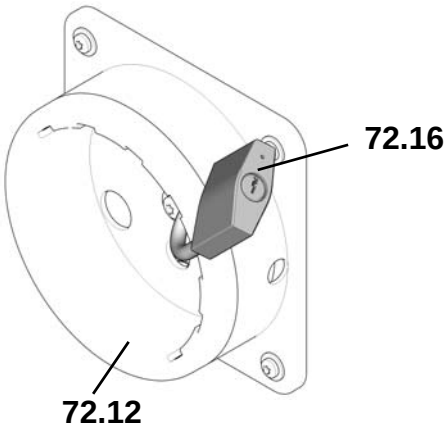



**Figure 24**

| | |
|---|---|
| **72.12** | Selector drum |
| **72.16** | Padlock |
| **72.29** | Locking hole |

In the MANUAL operating mode the mechanism can be operated by the hand crank 72.30 **(Figure 25, Figure 26)**.
The hand crank 72.30 must be inserted for this purpose into the hand crank hole 72.28 **(Figure 25, Figure 26)**.
The application is driven by turning the hand crank.

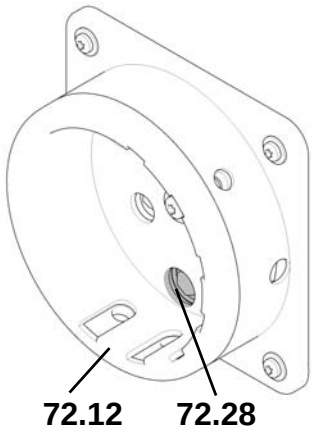



**Figure 25**

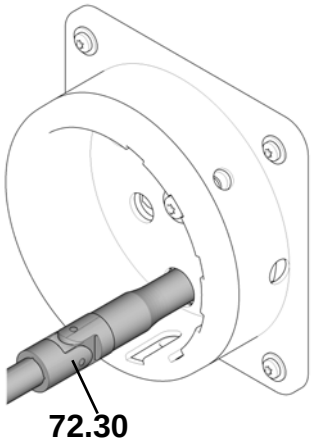



**Figure 26**

| | |
|---|---|
| **72.12** | Selector drum |
| **72.28** | Hand crank hole |
| **72.30** | Hand crank |

**Note**

The adjustable operating modes may vary depending on the application and the actual model..

The uniform indexing of the selector drum may mean that no operating mode symbols are displayed in one or more positions of the selector drum.

The mechanism cannot be operated either electrically or manually in these positions.


**WARNING**

The general safety rules for high voltage and for the specific application shall be strictly observed.

### A7.1.6 Replacement Parts

**Note**
The operating mechanism was designed as a maintenance-free component and can only be replaced in its entirety as a single component.

The operating mechanism may only be replaced by professionally trained personnel.

### A7.1.7 Disposal

After the component or system has reached the end of its useful life, the system must be disassembled and disposed of using an environmentally acceptable method.

**Note**
Additional information on disposal can be found in the disposal regulations relating to substation or switchgear systems.

If no return or disposal arrangement has been agreed upon, disassembled parts shall be taken to appropriate recycling facilities.

.

**Note**
Environmental damage may result from incorrect disposal.

Electrical scrap, electronic components, lubricants other consumables are subject to hazardous waste treatment and may only be disposed of by licensed professional companies.

Disassembly may only be carried out by professionally trained personnel.

### A7.1.8 User Evaluation

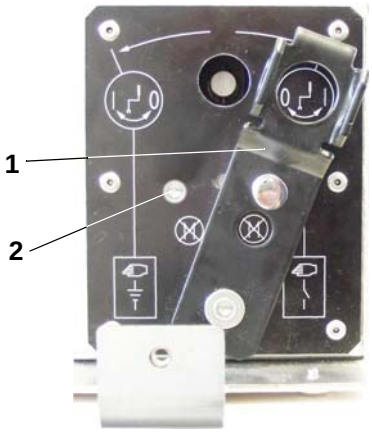
We have compiled this document based on the best state of knowledge. If you as a user need more information or have comments or additions regarding the structure or content of this document, please let us know.

We are grateful for any feedback so that we can ensure that our documents are always technically correct and practical.

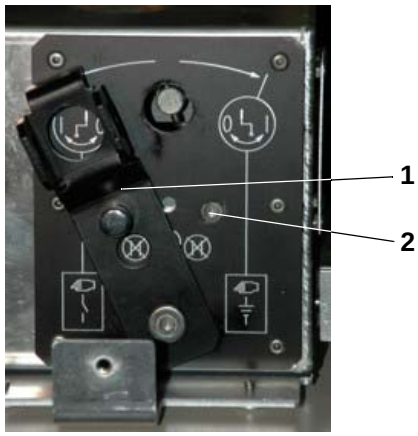
## A7.2 Type ME1-3 Motor-Operated Mechanism for Disconnector-Earthing Switch

### A7.2.1 Disconnector without commutation capability

- The blocking pin (2) prevents the mode selector lever (1) from being moved mechanically to the “Earthing switch manual” position.




Direct earthing

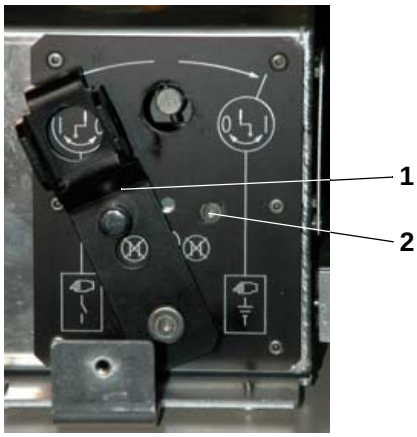



Integral earthing

| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Blocking pin | - |

### A7.2.2 Disconnector with commutation capability

- The blocking pin (2) prevents the mode selector lever (1) from being moved mechanically to the “Earthing switch manual” position.




Integral earthing

| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Blocking pin | - |

### A7.2.3 Direct Earthing

**Manual Operation**

- The ME1-3 motor-operated mechanism can be operated with the hand crank in the event of a control voltage failure or during maintenance operations. To do so, turn the mode selector lever (1) to the "Disconnector manual" or "Earthing switch manual" position.
- Insert the hand crank into the crank hole so that it engages with the manual operation shaft.
- The position selected for the mode selector lever (1) defines the position of the locking lever so that the locking disk only permits the pre-selected operation sequence ("Disconnector closed - Disconnector open" or "Earthing switch closed - Earthing switch open"). In order to carry out both operations, the hand crank must be removed and the mode selector lever (1) reset.

**Blocking**

Mechanical blocking is provided for the following positions:

- Disconnector closed / Earthing switch open
- Disconnector open / Earthing switch open
- Earthing switch closed / Disconnector open

- To block the mechanism, move the mode selector lever (1) to the desired position and insert the crank hole bolt (2) into the crank hole so that it engages with the manual operating shaft (3) and lock it with the padlock (4). The crank hole bolt (2) has a locking and sealing function.

**CAUTION**

The locking and sealing function is only guaranteed when the crank hole bolt is inserted and locked with the padlock.

- When the ME1-3 motor-operated mechanism is blocked, the control and motor circuits are interrupted by the mode selector limit switch.

**Operation**

**Types of use**

Remote-controlled, electrical or manual operation of the combination disconnector-earthing switch

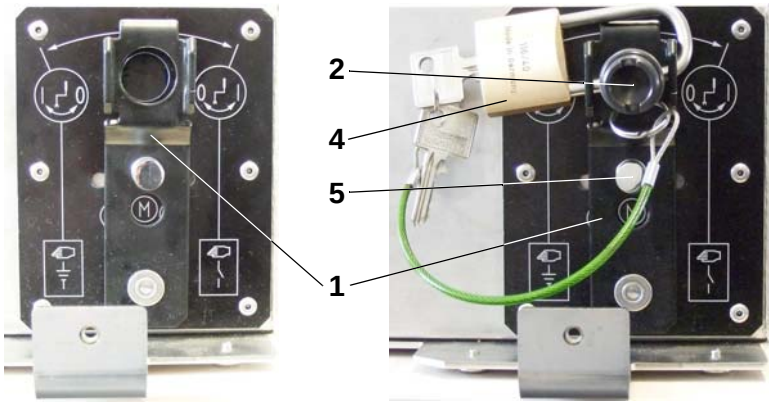
Mechanical blocking is provided for the following positions:

- Disconnector closed / Earthing switch open
- Disconnector open / Earthing switch open
- Earthing switch closed / Disconnector open

**Operation**

**Remote control as standard operation**

- The mode selector lever (1) is in the remote control position.
- The locking pin (5) is engaged.
- The crank hole bolt (2) is locked with the padlock (4).

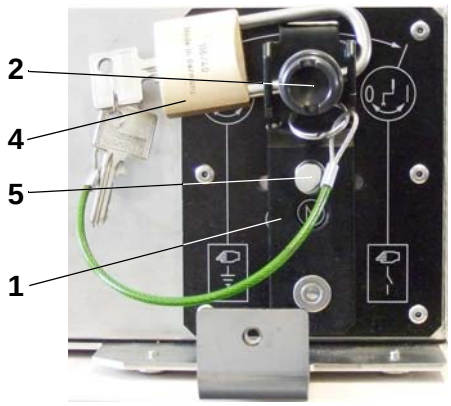



| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

- When the mode selector lever (1) is in this position, electrical remote control is activated, and mechanical blocking and manual operation are not possible.

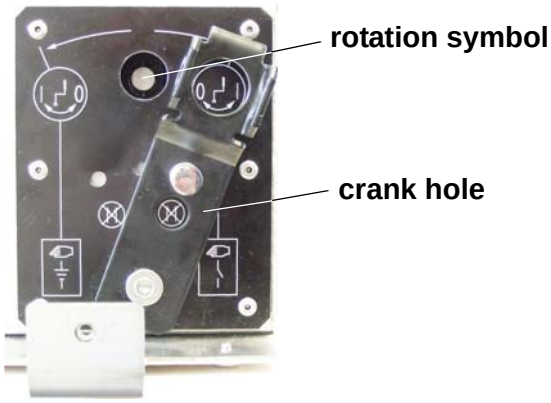
**Manual operation of the disconnector**

- The disconnector position indicator is in the "Disconnector open" position, the "Disconnector closed" position or in an intermediate position. The latter is only possible when there is an incomplete electrical operation and is normally displayed as a fault by the control system (watchdog timer).
  The mode selector lever (1) is in the remote control position.




| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

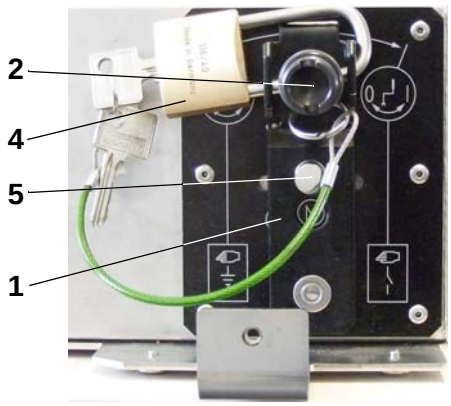
- Remove the padlock (4) and the crank hole bolt (2).
- Lift and turn the locking pin (5), move the mode selector lever (1) clockwise until it hits the stop, turn and release the locking pin (5), and then move the mode selector lever (1) back until the locking pin (1) engages.
- The mode selector lever (1) is now in the "Disconnector manual" position.




- Insert the hand crank into the crank hole in the housing and switch the combination disconnector-earthing switch to the desired position as shown by the rotation symbol.
- The final position is reached as soon as the hand crank (with torque control) is stopped by the position limiter (14 to 18 revolutions). To take pressure off the position limiter, turn the hand crank back 1 revolution maximum.
- Remove the hand crank. Lift and turn the locking pin (5), move the mode selector lever (1) counterclockwise to the remote control position, turn and release the locking pin (5), and move the mode selector lever (1) until the locking pin (5) engages. Insert the crank hole bolt (2) and lock it with the padlock (4).
- The ME1-3 motor-operated mechanism can now be operated again by remote control.

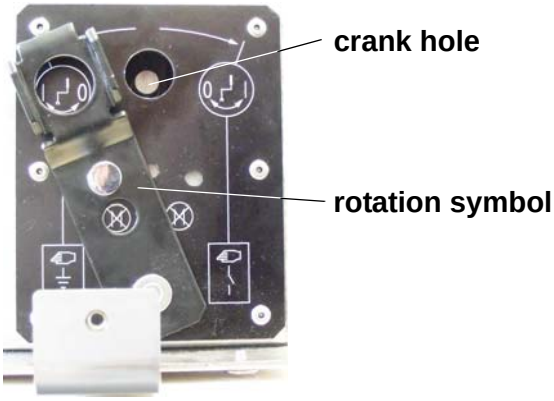
**Manual operation of the earthing switch**

- The earthing switch position indicator is in the "Earthing switch open" position, the "Earthing switch closed" position or in an intermediate position. The latter is only possible when there is an incomplete electrical operation and is normally displayed as a fault by the control system (watchdog timer).
  The mode selector lever (1) is in the remote control position.



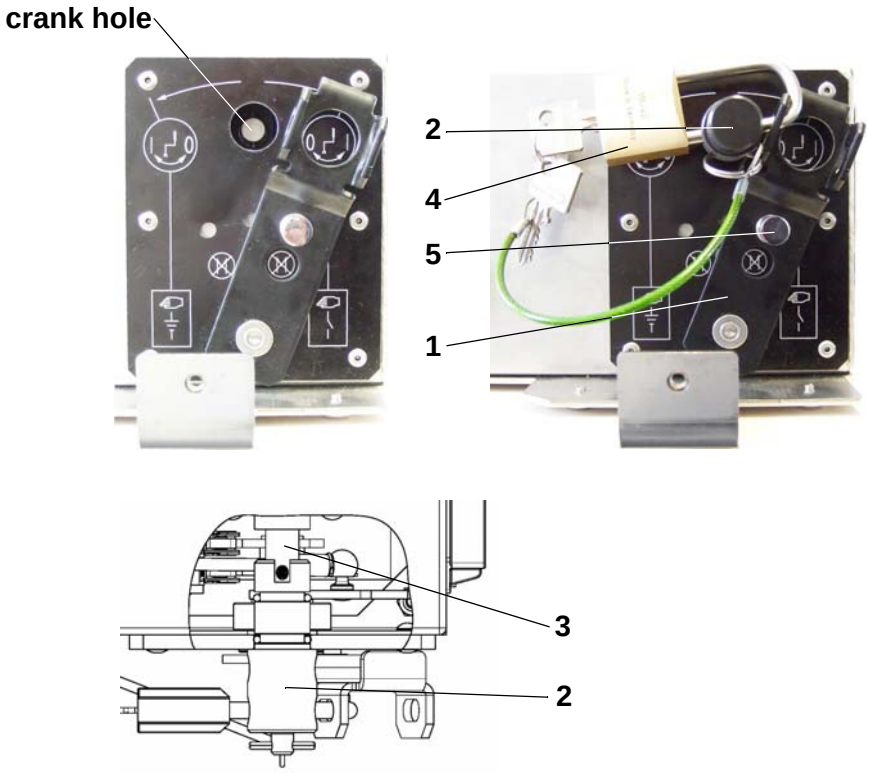

| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

- Remove the padlock (4) and the crank hole bolt (2).
- Lift and turn the locking pin (5), move the mode selector lever (1) counterclockwise until it hits the stop, turn and release the locking pin (5), and then move the mode selector lever (1) back until the locking pin (5) engages.
  The mode selector lever (1) is now in the "Earthing switch manual" position.




- Insert the hand crank into the crank hole and switch the combination disconnector-earthing switch to the desired position as shown by the rotation symbol.
- The final position is reached as soon as the hand crank (with torque control) is stopped by the position limiter (14 to 18 revolutions). To take pressure off the position limiter, turn the hand crank back 1 revolution maximum.
- Remove the hand crank. Lift and turn the locking pin (5), move the mode selector lever (1) clockwise to the remote control position, turn and release the locking pin (5), and move the mode selector lever (1) until the locking pin (5) engages. Insert the crank hole bolt (2) and lock it with the padlock (4).
- The ME1-3 motor-operated mechanism can now be operated again by remote control.

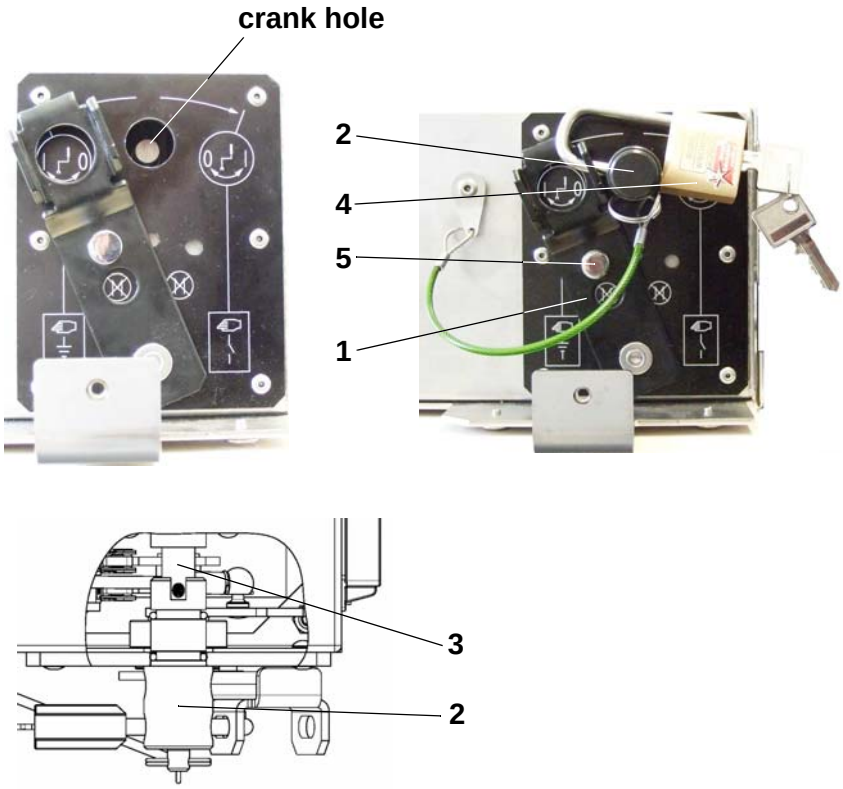
**Blocking in the "Disconnector manual" position**




| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **3** | Manual operation shaft | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

- Lift and turn the locking pin (5), move the mode selector lever (1) clockwise until it hits the stop, turn and release the locking pin (5), and then move the mode selector lever (1) back until the locking pin (5) engages.
- Insert the crank hole bolt (2) in the crank hole and engage it by turning the manual operation shaft (3). Lock the crank hole bolt (2) and mode selector lever (1) with the padlock (4). To do so, turn the crank hole bolt (2) with the connected manual operation shaft (3) so that the padlock (4) can be inserted.

**Blocking in the "Earthing switch manual" position**




| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **3** | Manual operation shaft | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

- Lift and turn the locking pin (5), move the mode selector lever (1) counterclockwise until it hits the stop, turn and release the locking pin (5), and then move the mode selector lever (1) back until the locking pin (5) engages.

Insert the crank hole bolt (2) in the crank hole and engage it by turning the manual operation shaft (3). Lock the crank hole bolt (2) and the mode selector lever (1) with the padlock (4). To do so, turn the crank hole bolt (2) with the connected manual operation shaft (3) so that the padlock (4) can be inserted.

### A7.2.4 Integral Earthing

**Manual Operation**

- The ME1-3 motor-operated mechanism can be operated with the hand crank in the event of a control voltage failure or during maintenance operations. To do so, turn the mode selector lever (1) to the "Disconnector manual" or "Earthing switch manual" position.
- Insert the hand crank into the crank hole so that it engages with the manual operation shaft.
- The position selected for the mode selector lever (1) defines the position of the locking lever so that the locking disk only permits the pre-selected operation sequence ("Disconnector closed - Disconnector open" or "Earthing switch closed - Earthing switch open"). In order to carry out both operations, the hand crank must be removed and the mode selector lever (1) reset.

**Blocking**

Mechanical blocking is provided for the following positions:

- Disconnector closed / Earthing switch open
- Disconnector open / Earthing switch open
- Earthing switch closed / Disconnector open

- To block the mechanism, move the mode selector lever (1) to the desired position and insert the crank hole bolt (2) into the crank hole so that it engages with the manual operating shaft (3) and lock it with the padlock (4). The crank hole bolt (2) has a locking and sealing function.

**CAUTION**

The locking and sealing function is only guaranteed when the crank hole bolt is inserted and locked with the padlock.

- When the ME1-3 motor-operated mechanism is blocked, the control and motor circuits are interrupted by the mode selector limit switch.

**Operation**

**Types of use**

Remote-controlled, electrical or manual operation of the combination disconnector-earthing switch

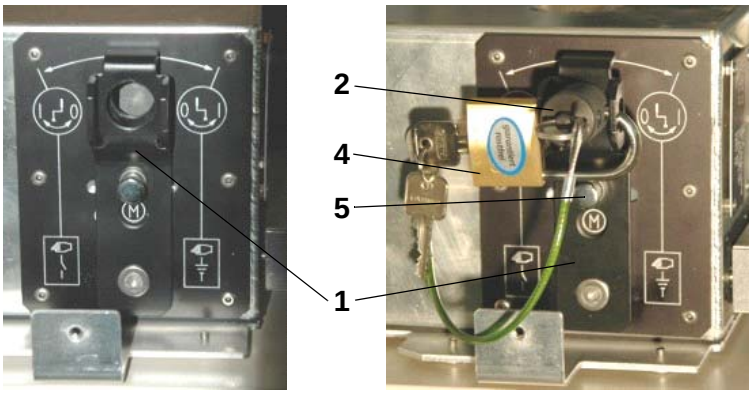
Mechanical blocking is provided for the following positions:

- Disconnector closed / Earthing switch open
- Disconnector open / Earthing switch open
- Earthing switch closed / Disconnector open

**Operation**

**Remote control as standard operation**

- The mode selector lever (1) is in the remote control position.
- The locking pin (5) is engaged.
- The crank hole bolt (2) is locked with the padlock (4).

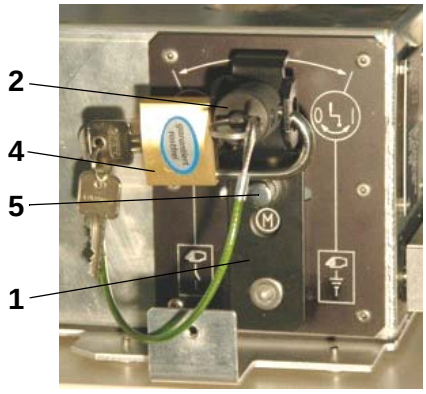



| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

- When the mode selector lever (1) is in this position, electrical remote control is activated, and mechanical blocking and manual operation are not possible.

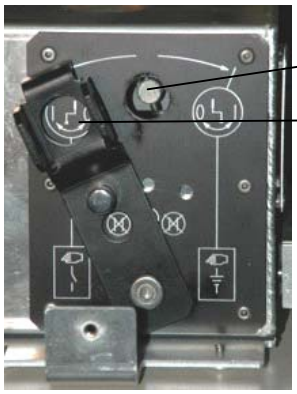
**Manual operation of the disconnector**

- The disconnector position indicator is in the "Disconnector open" position, the "Disconnector closed" position or in an intermediate position. The latter is only possible when there is an incomplete electrical operation and is normally displayed as a fault by the control system (watchdog timer).
  The mode selector lever (1) is in the remote control position.




| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

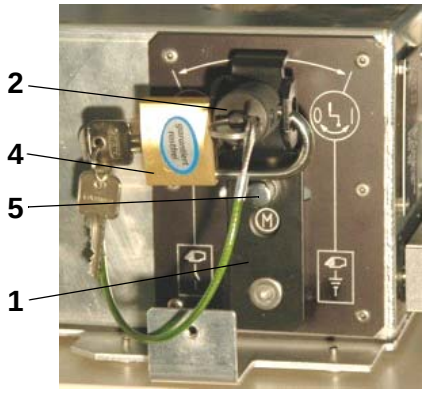
- Remove the padlock (4) and the crank hole bolt (2).
- Lift and turn the locking pin (5), move the mode selector lever (1) counterclockwise until it hits the stop, turn and release the locking pin (5), and then move the mode selector lever (1) back until the locking pin (1) engages.
- The mode selector lever (1) is now in the "Disconnector manual" position.




- Insert the hand crank into the crank hole in the housing and switch the combination disconnector-earthing switch to the desired position as shown by the rotation symbol.
- The final position is reached as soon as the hand crank (with torque control) is stopped by the position limiter (14 to 18 revolutions). To take pressure off the position limiter, turn the hand crank back 1 revolution maximum.
- Remove the hand crank. Lift and turn the locking pin (5), move the mode selector lever (1) clockwise to the remote control position, turn and release the locking pin (5), and move the mode selector lever (1) until the locking pin (5) engages. Insert the crank hole bolt (2) and lock it with the padlock (4).
- The ME1-3 motor-operated mechanism can now be operated again by remote control.

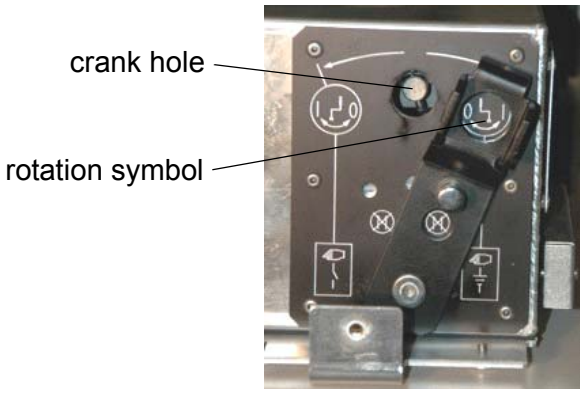
**Manual operation of the earthing switch**

- The earthing switch position indicator is in the "Earthing switch open" position, the "Earthing switch closed" position or in an intermediate position. The latter is only possible when there is an incomplete electrical operation and is normally displayed as a fault by the control system (watchdog timer).
  The mode selector lever (1) is in the remote control position.



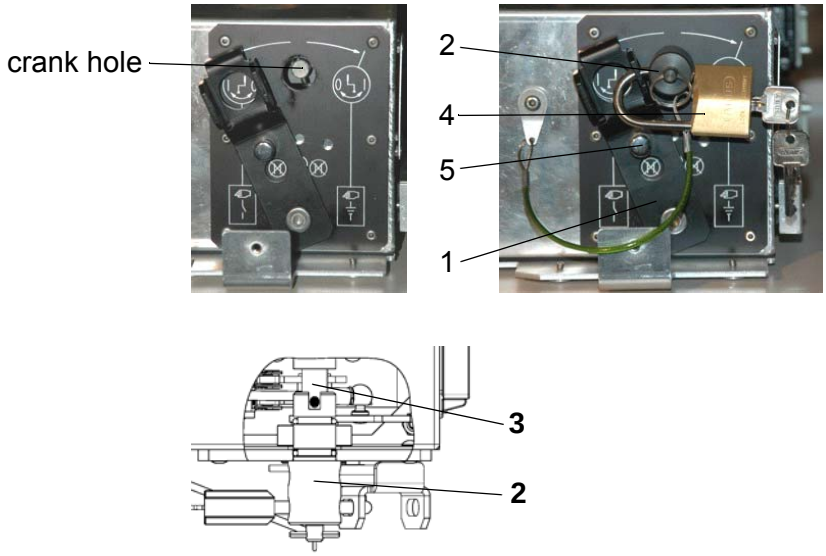

| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

- Remove the padlock (4) and the crank hole bolt (2).
- Lift and turn the locking pin (5), move the mode selector lever (1) clockwise until it hits the stop, turn and release the locking pin (5), and then move the mode selector lever (1) back until the locking pin (5) engages.
  The mode selector lever (1) is now in the "Earthing switch manual" position.




- Insert the hand crank into the crank hole and switch the combination disconnector-earthing switch to the desired position as shown by the rotation symbol.
- The final position is reached as soon as the hand crank (with torque control) is stopped by the position limiter (14 to 18 revolutions). To take pressure off the position limiter, turn the hand crank back 1 revolution maximum.
- Remove the hand crank. Lift and turn the locking pin (5), move the mode selector lever (1) counterclockwise to the remote control position, turn and release the locking pin (5), and move the mode selector lever (1) until the locking pin (5) engages. Insert the crank hole bolt (2) and lock it with the padlock (4).
- The ME1-3 motor-operated mechanism can now be operated again by remote control.

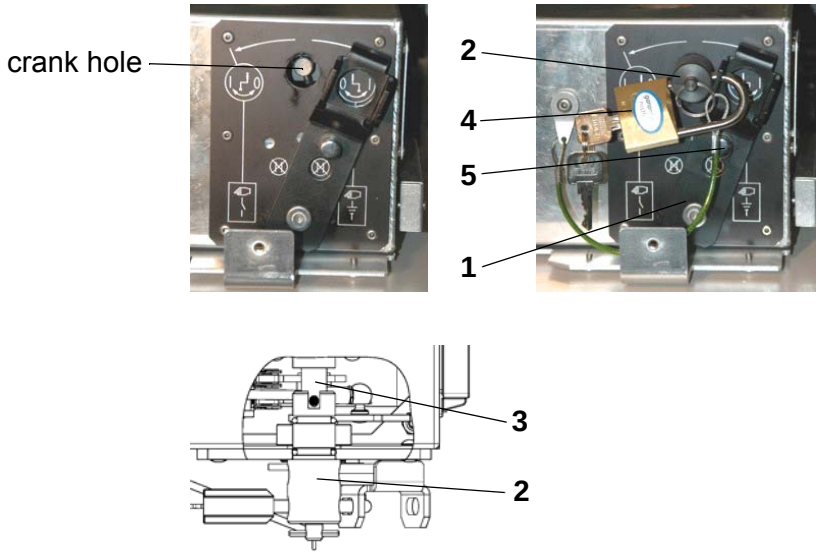
### Blocking in the "Disconnector manual" position




| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **3** | Manual operation shaft | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

- Lift and turn the locking pin (5), move the mode selector lever (1) counterclockwise until it hits the stop, turn and release the locking pin (5), and then move the mode selector lever (1) back until the locking pin (5) engages.
- Insert the crank hole bolt (2) in the crank hole and engage it by turning the manual operation shaft (3). Lock the crank hole bolt (2) and mode selector lever (1) with the padlock (4). To do so, turn the crank hole bolt (2) with the connected manual operation shaft (3) so that the padlock (4) can be inserted.

**Blocking in the "Earthing switch manual" position**




| | | |
|---|---|---|
| **1** | Mode selector lever | - |
| **2** | Crank hole bolt | - |
| **3** | Manual operation shaft | - |
| **4** | Padlock | - |
| **5** | Locking pin | - |

- Lift and turn the locking pin (5), move the mode selector lever (1) clockwise until it hits the stop, turn and release the locking pin (5), and then move the mode selector lever (1) back until the locking pin (5) engages.
- Insert the crank hole bolt (2) in the crank hole and engage it by turning the manual operation shaft (3). Lock the crank hole bolt (2) and the mode selector lever (1) with the padlock (4). To do so, turn the crank hole bolt (2) with the connected manual operation shaft (3) so that the padlock (4) can be inserted.