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For your safety!

- Check that all the installation, putting into service and maintenance operations are carried out by qualified personnel with suitable knowledge of the apparatus.
- Make sure that all the installation, service and maintenance operations comply with the standards and laws so as to ensure that the installations are constructed in accordance with the rules of good workmanship and safety in the work place.
- Strictly comply with the instructions in this manual.
- Make sure that the rated performance of the apparatus is not exceeded during service.
- Pay special attention to the information in the manual highlighted by the following symbol:

![Warning symbol]

- Make sure that the personnel are provided with this manual and are aware of all the relevant information while operating on the apparatus.

Responsible behaviour safeguards your own and others' safety!
Please consult us if further details if required.

**Warning !**
To work in safe conditions, use the Personal Protective Equipment (PPE) required in your work station.

---

**Foreword**

The instructions in this manual refer to GSec switch-disconnectors. Please read the manual carefully to ensure that the product is used correctly. Besides this manual, it is always necessary to consult the latest technical documentation (circuit diagrams, connection diagrams, protection coordination studies, etc.), especially regarding any variants to the standard configurations required.

GSec switch-disconnectors must be built into medium voltage switchgear. Only use original spare parts conforming to the national and international regulations for maintenance operations. The manufacturer is responsible for compliance with such regulations.
### 1. Packing and transport

The packaging for GSec switch-disconnectors consists of a wooden pallet (L1200xD800xH700) and a twin-board cardboard box with polyethylene shells (PE) for protection. A plastic covering protects the switch-disconnector from dust during the period it remains in storage.

Up to three switch-disconnectors can be stacked on top of each other. The surface of the loading platform must be non-slip with a high coefficient of friction.

The platform must be fitted with frame members so as to prevent the units from shifting either longitudinally or cross-wise.

The units must be fastened to the structure of the vehicle with ropes to avoid damage and prevent them from tipping over when the transport vehicle is driven round bends or is sharply braked.

The vehicle must also be covered with a tarpaulin.

---

### 2. Checking on receipt

Unload the switch-disconnectors from the vehicle with the utmost care, as described in chap. 4. Immediately check the condition of the packaging as soon as the switch-disconnectors arrive. Make sure that the apparatus is undamaged and that the data on the nameplate on the outside of the packaging (see fig. 1) correspond to the information in the order confirmation and shipping note.

If damage or discrepancies are discovered, or the documents supplied with the goods fail to correspond, immediately inform ABB (either directly, or through your representative or supplier) and the haulage contractor that made the delivery.

The switch-disconnectors are supplied solely with the accessories specified at the time of order and validated in the order confirmation.
3. Storage

The switchgear must be stored in a dry, dust-free, non-corrosive place at a temperature between – 5 °C and 45 °C for the standard version and between – 40 °C e + 45 °C for the low temperature version. Please consult us if special requirements are involved.

4. Handling

- Make sure that the insulating parts of the switchgear are not damaged when the apparatus is handled.
- Before proceeding with any operation, always make sure that the springs of the operating mechanism are discharged and that the switchgear is on the ground.
- Keep the switchgear in the horizontal position when it is handled.

The switch-disconnectors will have been strapped to the wooden pallet. Cut the strap to unload the equipment. For handling purposes, the switch-disconnector can be lifted by a crane fitted with ropes and snap hooks conforming to the safety standards, to be fastened to the two anchor points provided. The switch-disconnector can also be shifted by hand. In this case, lift it by the operating mechanism part on one side and from the eyebolts (1) on the other side. Switch-disconnectors weigh approximately 75 kg.
## 5. Description

### 5.1. Performance and electrical characteristics

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>kV</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power frequency withstand voltage (50/60 Hz, 1 min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Line to line and line to earth</td>
<td>kV</td>
<td>28</td>
<td>38</td>
<td>50</td>
</tr>
<tr>
<td>- Between open contacts</td>
<td>kV</td>
<td>32</td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>Lightning impulse withstand voltage (BIL 1.2/50 µs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Line to line and line to earth</td>
<td>kVp</td>
<td>75</td>
<td>95</td>
<td>125</td>
</tr>
<tr>
<td>- Between open contacts</td>
<td>kVp</td>
<td>85</td>
<td>110</td>
<td>145</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>50-60</td>
<td>50-60</td>
<td>50-60</td>
</tr>
<tr>
<td>Rated current (40 °C)</td>
<td>A</td>
<td>800 (1)</td>
<td>800 (1)</td>
<td>630</td>
</tr>
<tr>
<td>Admissible rated short-time withstand current</td>
<td>kA</td>
<td>25 (2s) (2)</td>
<td>20 (3s) (2)(3)</td>
<td>16 (3s) - 20 (3s) (2)(3)</td>
</tr>
<tr>
<td>Making capacity (peak current)</td>
<td>kAp</td>
<td>62.5</td>
<td>52.5</td>
<td>40-52.5</td>
</tr>
</tbody>
</table>

### Mechanical and electrical performance

<table>
<thead>
<tr>
<th>Electrical endurance of the line contact</th>
<th>class</th>
<th>E3 - up to 5 makings and 100 rated current interruptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical endurance of the earth contact</td>
<td>class</td>
<td>E2 - up to 5 makings</td>
</tr>
<tr>
<td>Mechanical endurance of the line contact with operating mechanism</td>
<td>class</td>
<td>M2 – 5000 mechanical operations</td>
</tr>
<tr>
<td>1S – Single spring</td>
<td>class</td>
<td>M1 – 1000 mechanical operations</td>
</tr>
<tr>
<td>Mechanical endurance of the line contact with operating mechanism</td>
<td>class</td>
<td>M0 – 1000 mechanical operations</td>
</tr>
<tr>
<td>2S – Double spring</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Earthing switch type EF 230

- Admissible short-time withstand current (3 s): 2 kA
- Short-time peak current value (3s): 5 kAp
- Short-circuit rated making capacity: 5 kAp
- Number of short-circuit current makes: Class E2

### Earthing switches type ES230 16kA

- Admissible short-time withstand current (3 s): 16kA to 24kV
- Short-time peak current value (3s): 40kA to 24kV
- Short-circuit rated making capacity: 40kA to 24kV
- Number of short-circuit current makes: Class E2

### Earthing switches type ES230 21-25kA

- Admissible short-time withstand current (3 s): 25kA to 12kV, 21kA to 24kV
- Short-time peak current value (3s): 62.5 kA to 12 kV
- Short-circuit rated making capacity: 52.5 kA to 24 kV
- Number of short-circuit current makes: Class E2 line side
  Class E2 earth side

(1) 630A for GSec/T2
(2) 16kA (3s) for GSec/T2
(3) For 21kA (3s) please contact ABB
5.2. Types of switch-disconnectors and earthing switches

5.2.1. GSec/T1 and GSec/T2 switch-disconnectors

Key
1 Switch-disconnector
2 Lifting points
3 Switch-disconnector lever seat
4 Earthing switch lever seat
5 Switch-disconnector position signalling seat
6 Rating plate
7 Key locks
8 Voltage presence signalling lamps
9 Cable route of voltage presence signalling lamps
10 Terminal box of auxiliary circuits
11 Earthing circuit connection point
12 Main circuit connection point

Fig. 2
5.3. Overall dimensions

GSec/T1/T2 switch-disconnectors

Key
1. Upper contact
2. Upper contact
3. Low voltage enclosure
4. Housing of the operating mechanism
5. Enclosure

Door interlock.
10mm: Travel.
32mm: Dimension required for door lock.

Fig. 3
GSec/T2F switch-disconnectors

Key
1. Disconnector
2. Fuse crossbeam
3. Earthing switch
4. Earthing switch transmission rod
5. Switch-disconnector-Earthing switch lever seat
6. Terminal box for wiring auxiliary circuits
7. Switch-disconnector position signalling seat
8. Earthing switch position signalling seat
9. Rating plate
10. Key locks
11. Voltage presence signalling lamps
12. Cable route of voltage presence signalling lamps
13. Three post and/or capacitive insulators
14. Lifting points
15. Earthing circuit connection point
16. Main circuit connection point
17. Cable connection

Fig. 4
GSec/T2F switch-disconnectors

Key
1. Upper contact
2. Lower contact
3. Low voltage enclosure
4. Housing of the operating mechanism
5. Cover
6. Fuse release system

Door interlock.
10mm: Travel.
32mm: Dimension required for door lock.

Fuse connection

UniSec SFC 375 Cubicle

Fig. 5
GSec/IB switch-disconnectors

Key
1 Disconnector
2 Lifting points
3 Earthing switch
4 Earthing switch transmission rod
5 Switch-disconnector-Earthing switch lever seat
6 Switch-disconnector lever seat
7 Terminal box for wiring auxiliary circuits
8 Disconnector position signalling seat
9 Earthing switch position signalling seat
10 Rating plate
11 Key locks
12 Voltage presence signalling lamps
13 Cable route of voltage presence signalling lamps
14 Fixed contacts
15 Main circuit connection points

Fig. 6
**GSec/IB switch-disconnectors**

**Key**
1. Upper contact
2. Lower contact
3. Low voltage enclosure
4. Housing of the operating mechanism
5. Enclosure

**Door interlock.**
10mm: Travel.
32mm: Dimension required for door lock.

**Fastening points on plate require** 4 (four) \( \phi 5.2 \) holes

---

**Fig. 7**

**GSec/IB:**
- 24.06.20
- 24.06.16
- 17.08.20
- 12.08.25
5.4. Construction characteristics

5.4.1. Switch-disconnectors
GSec is a three-position switch-disconnector (line-open-grounded). The enclosure of the GSec switch-disconnector consists of two half-shells, the top part being made of resin and the bottom part in stainless steel. GSec apparatus is “sealed for life” in accordance with standard IEC 62271, i.e. gas tightness is guaranteed for over 30 years. Insulating bushings are fixed to the disconnector enclosure: three upper ones for connecting the busbars housed in the busbar compartment (upper) and three lower ones for the line compartment applications (cables and terminals, fuses, earthing switch and instrument transformers).

5.4.2 Protection classes
The GSec switch-disconnector is designed according to the following protection classes:

<table>
<thead>
<tr>
<th>SF6 enclosure:</th>
<th>IP65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front operating mechanism (with cover assembly 2RDA01777):</td>
<td>IP2X (excluding lever seats)</td>
</tr>
</tbody>
</table>

5.4.3. Main components

<table>
<thead>
<tr>
<th>IMS</th>
<th>Operating mechanism</th>
<th>Earthing switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSec/T1</td>
<td>1S</td>
<td>ST</td>
</tr>
<tr>
<td>GSec/T2</td>
<td>2S</td>
<td>ST</td>
</tr>
<tr>
<td>GSec/T2F</td>
<td>2S</td>
<td>ST2 - EF 230</td>
</tr>
<tr>
<td>GSec/IB</td>
<td>1S</td>
<td>ST1 - ES 230</td>
</tr>
</tbody>
</table>

Switch-disconnector
The switch-disconnector (fig. 8) is the three-position IMS type. Thus the moving contacts can set to three positions:
1) IMS closed
2) IMS and ST open
3) ST closed.

The following types of GSec apparatus can be supplied.

- **GSec/T1**: three-position switch-disconnector with manual operation once dead-center has been passed. It is normally used to make incoming/outgoing compartments.
- **GSec/T2**: three-position switch disconnector with manual and stored energy operating mechanism. It is normally used to make incoming/outgoing compartments and can be equipped with shunt opening release.
- **GSec/T2F**: three-position switch disconnector with manual and stored energy operating mechanism, fuse holder frame, tripping device in case of blown fuses, earthing switch on load side of fuse holder frame. It is normally used to make transformer protection compartments and can be equipped with shunt opening release.
- **GSec/IB**: three-position line-side isolator with manual operation once dead-center has been passed and spaced earthing switch, interlocked with the earthing switch of the IMS. It is normally used to make incoming/outgoing compartments with fixed circuit-breakers.

- Do not drill or weld the stainless steel enclosure of the apparatus.
- The copper connections must be assembled on the insulators using a torque wrench and 33 Nm tightening torque.

- Do not drill or weld the stainless steel enclosure of the apparatus.
- The copper connections must be assembled on the insulators using a torque wrench and 33 Nm tightening torque.
5.5. Operating mechanisms

**Operating mechanism 1S** is the "on exceeding dead-center type". It uses a single spring to open and close the switch-disconnector and to close the earthing switch/es. Operating speed is independent of the operator.

**Manual operating mechanism 2S** is the stored energy type. It uses two springs. The first closes the switch-disconnector at an operating speed independent of the operator. The second spring is loaded during the switch-disconnector closing stage and is designed to both open the switch-disconnector (in the manual mode using the dedicated pushbutton, or by fuse tripping or by means of the shunt opening release) and close the earthing switches at an operating speed independent of the operator.

Opening of the earthing switches takes place at operating speeds independent of the operator.
5.6. Earthing switches

There are three types of earthing switches:
- ST
- ES 230 with 1S operating mechanism
- EF 230 with 2S operating mechanism.

They can be integrated into the enclosure containing the switch-disconnector (fig. 9) or positioned on the load side of the fuses or circuit-breaker (figs. 13, 14 and 15).

**Earthing switch ST** is integrated into the enclosure of the switch-disconnector and has full making capacity.

**Earthing switch ES 230**, used in conjunction with the 1S operating mechanism, is positioned on the load side of the safety circuit-breaker, associated with the IMS, is interlocked by a transmission lever to earthing switch ST and has full making capacity.

**Earthing switch EF 230**, associated with operating mechanism 2S, is positioned on the load side of the fuses, is interlocked by a transmission lever and has a reduced making capacity of 5 kA.

---

**Earthing switch ES 230**

![Earthing switch ES 230](image)

**ES 230 (12-17.5-24kV 16kA)**

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ES 230-N Disconnector assembly</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Screw M8X20-8.8 ISO8678</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>M8 hex nut</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Earthing jaws</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>ES 230-N 25kA Additional 25kV kit</td>
<td>1</td>
</tr>
</tbody>
</table>

---

![Fig. 9a](image)

**ES 230 (12-25kA) (17.5-24kV 21kA)**

![Fig. 9b](image)
5.7. How to connect earthing switch ES 230

Comply with the following instructions when installing the earthing switch.

1. Place the operating mechanism in its seat on the panel.

2. Fix the operating mechanism in place with the screws.

3. Fix the switch lever to the operating mechanism as shown in fig. 12, using the dedicated clip.

---

**BOM Table**

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earthing switch EF230 / 375</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>ES Connection system</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Screw ISO678_M8X20-8.8/ZNBLC6</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>M8-Steel 6 flanged hex nut</td>
<td>4</td>
</tr>
</tbody>
</table>

---
1. Assemble the Base 375 Fuse on the right-hand side of the panel.

4. Turn the switch to the earthed position.

9. The force measured 80 mm from the end of the blade must be: $23 \pm 3$ N.

10. Adjust the ES connection system so as to obtain the necessary force and tighten the two nuts to the required torque value.

Note: When the slot is pointing upwards, it means that the switch is in the open position!
5.8. How to connect earthing switch EF 230

Comply with the following instructions when installing the earthing switch.

1. Assemble the fuse holder base on the right-hand side of the panel. There are two positions, depending on the length of the fuse chosen.

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>A0001 Q.ty</th>
<th>A0002 Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuse base</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Screw ISO8678_M8X20-8.8/ZNBLC6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>M8-Steel 6 flanged hex nut</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Fig. 16
2. Turn the shaft to the earthed position. Make sure that it is in the condition shown in figure 17.

3. Position the two PVC spacers as shown in figure 18 and fix the switch lever to the two rods with the relative screw.

4. Fix the switch to the panel with the relative screws, as shown in figures 20 - 21.
5.9. General information about SF₆ gas-insulated switching and isolating apparatus

In its pure state, SF₆ is an odourless, colourless, non-toxic gas with a density about six times higher than that of air. This is why, although it is free from any specific physiological effects, it can produce the same effects as lack of oxygen in places saturated with SF₆. The electric arc produced during the breaking phase of the line-side isolator decomposes a very small amount of SF₆. The decomposition products remain inside the enclosure. The probability of coming into contact with SF₆ is extremely low and even small quantities in the environment (1-3 ppm) are immediately evident owing to its unpleasant, pungent odour. Rooms must be ventilated before anyone enters them (see standard IEC 1634).

5.11. Interlocks

The operations must be performed with the normal actuating torque using the dedicated operating lever ($\leq 100$ Nm). If the operations are obstructed, do not force the mechanical interlocks but check that the operating sequence is correct.

Mechanical and electrical locks are used in the compartments. The mechanical locks include:
- prevention locks
- safety locks (padlocks/keys).

The electric locks feature microswitches that ensure continuity of service or make or break an electrical circuit.

5.11.1. Interlock between switch-disconnector and earthing switch.

This is a mechanical prevention lock, which stops the operating lever from being inserted into the corresponding lever seat if the conditions are not correct.

The earthing switch can only be closed if the switch-disconnector is open.

The switch-disconnector can only be closed if the earthing switch is open.

5.11.2. Interlock between the operating lever of the switch-disconnector and the motor

This is an electrical lock that prevents the motor from functioning when the operating lever is in the seat of the IMS. Insertion of the operating lever acts on a microswitch which cuts off the power supplied to the motor and prevents it from operating.

5.11.3. Interlock between the operating lever of the earthing switch and the motor

This is an electrical lock that prevents the motor from functioning when the blades of the earthing switch are closed or the operating lever is in the seat of the ST. A microswitch enables motor operation when the blades of the earthing switch are open and the operating lever is withdrawn from its seat.

5.10. Reference Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 447</td>
<td>Direction of movement of electrical apparatus actuators.</td>
</tr>
<tr>
<td>CEI 17-4</td>
<td>Isolators and earthing switches for voltages over 1 kV</td>
</tr>
<tr>
<td>IEC 129</td>
<td>Isolators and earthing switches for voltages over 1 kV</td>
</tr>
<tr>
<td>IEC EN 60529</td>
<td>Protection classes of enclosures. Classification.</td>
</tr>
<tr>
<td>IEC 529</td>
<td>Protection classes of enclosures. Classification.</td>
</tr>
<tr>
<td>CEI 17-9/1-2</td>
<td>Switch-disconnectors</td>
</tr>
<tr>
<td>IEC 265-1-2</td>
<td>Switch-disconnectors</td>
</tr>
<tr>
<td>IEC 1634</td>
<td>High voltage switchgear and controlgear.</td>
</tr>
<tr>
<td>IEC 11-35</td>
<td>Guideline to the execution of electrical substations for the final customer/user.</td>
</tr>
<tr>
<td>IEC 62271-1</td>
<td>High-voltage switchgear and controlgear - Part 1: common specification</td>
</tr>
<tr>
<td>IEC 62271-102</td>
<td>High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches.</td>
</tr>
<tr>
<td>IEC 62271-103</td>
<td>High-voltage switchgear and controlgear - Part 103: Switches for rated voltages above 1 kV up to and including 52 kV</td>
</tr>
</tbody>
</table>
### General information

The blades of the earthing switch are operated in the manual mode only, while operation of the switch-disconnector can be either manual or manual/motor-operated. In this latter case, the spring is loaded by a motor operated by pushbuttons on the panel front. Insertion of the operating lever cuts off the power supplied to the motor.

For the GSec/IB types, the earthing switches on the supply side and on the load side of the fuses and circuit-breaker, respectively, have a single operating seat since they are mechanically connected to each other.

---

#### WARNING

The lever of disconnectors equipped with motors must be removed from its operating seat before proceeding with opening/closing operations using pushbuttons.

#### NOTE

When using the operating lever, turn it approximately 85-90 degrees to set the disconnector to the line position and 170-180 degrees for earthing.

---

### 5.12. Switch-disconnector operating instructions

#### 5.12.1. Unit with single-spring operating mechanism

1. Switch-disconnector closing from “open” position

   - Once started, all the operations must be completed and the lever removed from its operating seat.
   - The operations must be performed with the normal actuating force using the dedicated operating lever (< 200 N). If the operations are obstructed, do not force the mechanical interlocks but check that the operating sequence is correct.
   - The locks are sized to withstand a maximum 400 N actuating force using the dedicated operating lever, without permanent deformation or breakage occurring.

---

**Fig. 22 - “Open” position**

**Fig. 23 - “Open” position with operating lever**

**Fig. 24 - “Closed” position**
2. Switch-disconnector opening from “closed” position

- Fit operating lever into upper hole.
- Turn lever counter-clockwise to “open” position.

3. Switching from “open” position to “earthed” position

- Fit operating lever into lower hole.
- Turn lever clockwise to “earthed” position.

4. Switch-disconnector opening from “earthed” position

- Close cable compartment door.

**NOTE**
The cable compartment door can only be opened when the switch-disconnector is in the “earthed” position.
b) Fit operating lever into lower hole.
c) Turn lever counter-clockwise to “open” position.

5.12.2. Unit with double-spring operating mechanism

NOTE
In the case of a motor-operated unit with double-spring operating mechanism, all remote controlled operations must be inhibited and disabled before any mechanical operations are performed. In the case of a motor-operated unit with double-spring operating mechanism, it is advisable to push the pushbutton upwards to free the operating shaft hole before performing mechanical operations with the lever on the switch-disconnector on the earth side. This facilitates the operation by slowing down the motor.

1) Switch-disconnector closing from “open” position
a) Push pushbutton upwards to free operating shaft hole (arrow).

b) Fit operating lever into upper hole.
c) Turn it clockwise.
The spring is now loaded.

d) Remove the operating lever.
e) Push pushbutton downwards to release pushbuttons (arrow).

f) Push pushbutton to the right (green “I”) to set unit to the “closed” position.

2. Switch-disconnector opening from “closed” position

a) Push pushbutton to the left (green “O”) to set unit to the “open” position.
3. Switching from “earthed” position to “open” position
   a) Fit operating lever into lower hole.
   b) Turn lever clockwise to “earthed” position.

4. Switch-disconnector opening from “earthed” position
   a) Close cable compartment door.
   b) “Earthed” position
   c) Fit operating lever into lower hole.
   d) Turn lever counter-clockwise to “open” position.

**NOTE**
The cable compartment door can only be opened when the switch-disconnector is in the “earthed” position.
5.12.3. No-load spring release procedure

NOTE
The no-load spring releasing operation is guaranteed for a limited number of times < 25.
If the springs are loaded and the disconnector is open, the operator can release the springs without changing the condition of the disconnector.

Operating sequence
In the case of a non-motor operated double-spring operating mechanism:
1. Release the springs by means of the opening button.

In the case of a motor operated double-spring operating mechanism with GSec CAD (printed circuit board):
1. Remove the protective enclosure from the operating mechanism.
2. Insert a screwdriver and push the lever downwards.
3. Release the springs.
4. Fit the protective enclosure back in place.

Motor operated with remote control switches:
1. Remove the protective enclosure from the operating mechanism.
2. Insert the tool (screwdriver) as indicated in the photo and inhibit the interlock.
3. Fit the operating lever into the seat.
4. Turn the operating lever clockwise to release the motor.
5. Remove the operating lever from the seat.
6. Release the springs by means of the opening button.

5.12.4. Operating units fitted with key interlocks
The units can be fitted with key interlocks. The key interlocks are available separately for both the line switch and earthing switch. Key locks can only be used in the following cases:
- The line circuit-breaker can set to the following 3 positions when the operating mechanism is the single-spring type:
  - “open-free” (1 key that locks the circuit-breaker in the “open” position)
  - “closed-free” (1 key that locks the circuit-breaker in the “closed” position)
  - combination of “open-free” and “closed-free” (2 keys).
- The line circuit-breaker can only set to the following position if the operating mechanism is the double-spring type:
  - “open-free” (1 key that only turns when the circuit-breaker is in the “open” position, with springs discharged).
- The earthing switch can set to the following 3 positions with both single- and double-spring operating mechanisms:
  - “open-free” (1 key that locks the circuit-breaker in the “open” position)
  - “earthed-free” (1 key that locks the circuit-breaker in the “earthed” position)
  - combination of “open-free” and “earthed-free” (2 keys).
An example of key interlocks is shown in figure 48. The unit with single-spring operating mechanism has 2 key interlocks for the line switch and 2 key interlocks for the earthing switch.

5.12.5. Cable testing

**CAUTION**
The following interventions can only be carried out by skilled personnel!

**WARNING**
Pay special attention to safety when performing the following interventions!

**NOTE**
During the cable test, the earthing switch will be open when the cable compartment door is open.

5.12.5.1. Cable testing position

a) Fit the operating lever into the earthing seat.

b) Turn lever clockwise to the “earthed” position.

c) Open cable compartment door.

d) Remove the cover of the operating mechanism compartment.

e) Push the locking plate into the upper position.

f) Fit the operating lever into the earthing seat.

g) Turn the lever counter-clockwise to the “open” position.

Cable testing can now be carried out.

After cable testing has terminated, work through the previously described operations in reverse order.
5.13. Putting into service

5.13.1. Preparatory operations

Before connection to the medium voltage network

The following operations must be carried out in preparation for putting into service:

– Check the general condition of the switchgear to make sure there are no defects or damage.
– Visually inspect the switching devices, isolating contacts, insulating parts, etc.
– Check the main earthing busbar connection to the earthing conductor of the installation (in compliance with the appropriate safety regulations).
– Check the paintwork for damage and touch up where necessary.
– Remove all residues of materials, foreign objects and tools from the switchgear.
– Clean the switchgear by rubbing down the insulating parts with a clean, dry, soft, non-fraying cloth. Remove any traces of greasy or sticky dirt with water and slightly alkaline detergent.
– All covers removed during the assembly and testing operations must be properly fitted back in place.
– Preparatory work for circuit-breakers:
  – Clean the insulating parts with a clean, dry cloth.
  – Check that the upper and lower terminals are clean and free from any deformation caused by shocks received during transport and storage.
  – If the HD4 circuit-breaker is equipped with a pressure measuring device, it is advisable to check the SF6 gas pressure.
– Switch on the auxiliary and operating voltage.
– Perform tests on the switching devices either manually or using electrical operating mechanisms while observing the relative position indicators.
– Check the efficiency of the mechanical and electrical interlocks without using force.
– Check the SF6 gas pressure of the GSec switch-disconnector and HD4 circuit-breaker (if available).
– Set the required values for the protection devices in the switchgear and make sure they operate properly using test equipment.
– Train local operators regarding the basic instructions for correct use of the switchgear.
– Check to make sure the apparatus is ready to operate and check the operating status of the electrical systems on the supply side and load side of the switchgear.

Other checkpoints

Depending on the allocation of responsibilities, it may also be necessary to check the following equipment in the vicinity of the switchgear:

– Power cables
– Auxiliary cables
– Auxiliary power source
– Remote control system
– Complete earthing system
– Equipment in the switchgear installation room
– Characteristics of the switchgear installation room
– Pressure resistance in the case of an internal arc fault
– Ventilation
– Temperature
– Humidity.

5.13.2. Start-up

Instructions

– Comply with all the relevant safety regulations.
– Make sure that the switch-disconnectors and circuit-breakers in the system are in the OPEN position.
– Remove any existing earthing and short-circuiting connections in the critical operating area.
– Energize the power supply feeders.
– Connect the switchgear step by step, observing the signals and indications.
– Where necessary, check that the conductors are in phase when there are several incoming feeder lines and switchgear sections.
– Take all the necessary measurements and check that all functions that depend on the high voltage supply are connected.
– Make sure that there are no anomalies of any kind.
6. Service and maintenance

6.1. General recommendations and precautions

**WARNING**

Pay attention to the following safety recommendations:

Preparing the switchgear for safe assembly

1. For each case, define safe working conditions with the utility safety officer.
2. Make sure that the national safety regulations are followed.
3. Make sure there is no voltage in the busbars and cable terminals and that the risk of reconnection has been eliminated in all units. Remote control must also be inhibited.
4. Set the switch (or combined switch-fuse unit) to the “open” position and then to the “earthed” position.
5. Make sure that the auxiliary circuits are also disconnected from all possible power supply sources (including instrument transformers).

**Tools required**

- Screwdriver
- Hand screwdrivers for 10 mm screws
- M10 (M8) torque wrench
- Size 5, 6 and 8 hex screw wrenches
- Vacuum cleaner
- Cleansing wipes
- Slightly alkaline detergent
- Do not use trichloroethane, carbon tetrachloride or any kind of alcohol, etc., for cleaning purposes.
- Clean water
- Silicone liquid
- In special cases, insulating surfaces can be covered by a thin layer of silicone liquid like DC200/100CS, or similar products.
- Test equipment.

**Checkpoints**

- Check that there are no visible signs of partial discharges or damage caused by them.
- There should be no visible signs of overheated connections.
- All components should perform perfectly and any faulty components must be replaced.

**Maintenance instructions**

Maintenance preserves trouble-free operation and ensures the switchgear remains functional for the longest possible time. It comprises the following closely related activities:

- Inspection: Determination of the effective conditions
- Servicing: Measures to preserve the specified conditions
- Repairs: Measures to restore the specified conditions.

The inspection and servicing intervals for some of the apparatuses/components (e.g., parts subject to wear) are determined by fixed criteria, such as switching frequency, length of service and number of short-circuit breaking operations. On the other hand, for other parts, the length of the intervals may depend, for example, on the different modes of operation in individual cases, the degree of loading and environmental factors (including pollution and corrosive atmosphere).

The intervals at which maintenance work must be carried out always depend on the operating conditions of the switchgear and, above all, on the operating mode, the number of rated and short-circuit switching operations, ambient temperature, pollution, etc.

The maintenance intervals and measures to be taken given in table 18 are recommended for GSec switchgear under normal service conditions. Three intervals per year are recommended for all maintenance measures in more demanding conditions (such as areas with high pollution levels). Switch-disconnector 1S and 2S operating mechanisms are maintenance-free and do not need any lubrication.

**6.2. Maintenance intervals**

It is advisable to perform maintenance operations at the following intervals:

<table>
<thead>
<tr>
<th>Task performed</th>
<th>Time interval in years</th>
<th>According to section</th>
<th>According to number of switching operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection</td>
<td>5 (1)</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>5 (2)</td>
<td>6.4</td>
<td>(3)</td>
</tr>
</tbody>
</table>

(1) These intervals should be reduced in more complex operating conditions.
(2) Depending on the results of the inspections.
(3) GSec
  - Electrical endurance: 100 breaking operations at 630 A
  - Mechanical endurance: 5000 no-load operations
  - Circuit-breakers: see the manuals.
  - Earthing switch: 5 making operations – 1000 no-load operations

Table 18. Maintenance intervals

GSec switchgear must be completely replaced after the following intervals:

- 100 breaking operations at 630 A
- 5 short-circuit making operations in line
- 5000 mechanical operations for 1S operating mechanism in line
- 1000 mechanical operations for 2S operating mechanism in line
- 5 making operations
- 1000 mechanical operations (M0) on earth
6.3. Inspection

**General instructions**
Where necessary, the working area must be isolated and secured against accidental re-connection before the inspections are performed, in accordance with the “Safety regulations” specified by the IEC standards and corresponding national standards. Switchgear conditions must be monitored by regular inspections. Under normal operating conditions, inspections should be carried out once every five years by suitably trained professional electricians.

**Instructions**
Perform the following inspections:
- Visually check for dirt, corrosion and moisture.
- Check for effects of high temperature on the main circuits.
- Check for traces of partial discharges on insulating components.
- Check for traces of current leakage on insulating components.
- Visually check the surfaces of the contact systems
  - The contact areas must be cleaned if signs of overheating are visible (discoloured surface).
- Check the general condition and lubricate (Klüber NCA 52) the earthing switch contacts.
- Check the operating pressure of the GSec if the gas (SF6) monitoring device is available.

The inspection must also include checking correct mechanical/electrical operation of the following switching devices:
- 1S and 2S operating mechanisms;
- interlocking devices;
- protection devices;
- signalling devices;
- accessories and auxiliary devices (e.g. earthing switches).

Partial discharge must not occur on the surfaces of the equipment in the presence of operating voltage. This can, for example, be detected by characteristic noises, a clearly perceptible smell of ozone, or visible glowing in the dark.

6.4. Servicing

**Instructions**
If the need for servicing measures is established during the course of an inspection, proceed as follows:

1. Tighten all electrical connections to the correct torque value.
2. Clean all parts (disconnectors, release mechanisms, motors, etc.) with a vacuum cleaner and visually inspect them. Clean all surfaces in general:
   - Lightly settled dry dust deposits: clean with a soft dry cloth.
3. Perform an closing/opening operation on all switch-disconnectors, including the earthing switches.
4. Connect the auxiliary control voltage, but make sure that no remote signals can activate the components. Perform one electrical operation sequence on all motor-operated devices and tripping mechanisms.
5. Clean the insulating materials of the GSec switch-disconnector and busbars with a clean, soft, dry cloth. Remove all ingrained dirt, such as sticky or greasy stains, using a cloth and a mild alkaline detergent. Wipe with a damp cloth using clean water and thoroughly dry the surfaces. Clean inside the cable compartment in the same way (bottom of GSec switch-disconnector, instrument transformers, busbars and circuit-breaker).
6. If necessary, clean and grease (Klüber NCA 52) the earthing switch contactor, the blade and operating mechanism.

**NOTE**
Should partial discharges occur as a result of condensation, application of a thin layer of silicone over the affected surface is often effective as a temporary remedy. It is advisable to ask the ABB after-sales service department for advice regarding permanent solutions to this uncommon type of problem.

**NOTE**
Under abnormal operating conditions (including adverse climatic conditions) and/or particular environmental conditions (among which, heavy pollution and aggressive atmosphere), inspection at shorter intervals may be necessary.

**Repairs**
Appropriate servicing or repair measures must be taken if abnormal conditions are detected.
6.5. Replacing and installing new apparatus

6.5.1. Replacing tripped fuses

Troubleshooting and cleaning
The fuses cannot be regenerated. According to IEC Publication 60282-1, all three fuses must be replaced even if only one or two of them have blown. Exceptions are allowed when verifications have found that the fuses have not been subjected to any overcurrent. If the fused switch-disconnector units (T2F) are equipped with a fuse tripping mechanism, the switch-disconnector opens automatically by means of the striker pin/s of the fuse/s and the tripping mechanism.

Instructions
− Check that the colour of the fuse indicator is red and that the position indicator is in the “open” position.
− Turn the switch to the “earthed” position (see chapter 5.12. Switch-disconnector operating instructions.
− Open the door.
− The upper and lower fuse holders are earthed and the fuses can be removed and installed by hand.

Removing the fuses
a) Start from phase L1 (near the door).
b) Pull the fuse by its upper part until it has been released.

c) Lift the fuse upwards so that the lower part is also released.

d) Repeat this procedure for phases L2 and L3.
Installing the fuses

a) Start installation from phase L3 (the one furthest from the door).

b) The fuse striker pin must be facing upwards. First of all, insert the entire lower part of the fuse into the bottom fuse holder.

c) Push the upper part into the top fuse holder.

d) Turn the fuse until the arrow and technical data texts are no longer pointing towards the door.

e) Close the door.

f) Turn the switch-disconnector to the “open” position and then to the “closed” position (see chapter 5.12. Switch-disconnector operating instructions).
7. Accessories

7.1. VPIS voltage presence indicating systems

VPIS indicators are designed to indicate the presence of service voltage.

The energized state of the unit is signalled by a light that flashes with frequency of repetition of at least 1 Hz.

Operating temperature

The VPIS will operate reliably over a temperature range of –25 °C to +50 °C.

Phase comparison and testing of VPIS

Each phase of the integrated VPIS has a connection point on the front panel, which can be used to perform phase comparison and to test the voltage presence indicator. Product type DXN-HXQ-01 by Fujian Nanping Anda Electrical Manufacture Co. Ltd. is recommended for phase comparison.

Threshold values for voltage presence indication

The indication corresponding to “voltage present” appears when the effective line-to-earth voltage is between 45% and 100% of the rated voltage. The indication corresponding to “voltage present” does not appear when the effective line-to-earth voltage is less than 10% of the rated voltage.

Circuit diagram

![Circuit diagram](image)

NOTE

Under very bright lighting, it may be necessary to improve visibility by additional means.
7.2. Pressure monitoring devices

A device for monitoring the gas in the switch-disconnector can be installed on the front of the panel. The devices described below can be installed.

Temperature compensated pressure switch (Pressure regulator)

The device is self-powered and maintenance-free. The operator communicates with the device by means of two pushbuttons on the front.

Pushbutton 1: Check: shows whether the display is functioning correctly;
Pushbutton 2: Interrogates the monitoring device: the following information can be displayed:
- OK: correct operating pressure;
- Low: low pressure (minimum level for operation)
- Very low: insufficient pressure (operation cannot be performed). These indications can be displayed remotely by means of 2 contacts built into the device.

Pressure gauge

The device detects the measurement in temperature compensated zones and monitors the operating pressure of the gas in the switch-disconnector.

The pressure gauge has 2 reference zones:
- green: correct operating pressure;
- red: insufficient pressure (operation cannot be performed).

There is also a version with remote indications.
7.3. Door lock

The "door lock" is a specific interlock to be applied to the cable/circuit-breaker/fuse compartment door. It is supplied already installed and directly interlocked with the operating mechanism of the switch-disconnector. The mechanical interlock between the operating mechanism and door only allows the door to open when the earthing switch/es is/are closed (force interlock). Vice versa, it prevents the operating mechanism from being operated if the door is open (prevention interlock), thus creating a fundamental condition of safety for the operator.

**Key**

1. Interlock  
2. Screw  
3. Nut

**Fig. 62**
### 7.4. Key lock

Key locks for the various operating mechanism seats can be supplied on request. The following key combinations can be supplied for each open and closed position of every switch-disconnector, disconnector and earthing switch.

Application of key locks in the operating seats of the disconnector and earthing switch for GSec/T2F.

#### Fig. 63

#### Key

1. Circuit-breaker open/closed key lock
2. Disconnector and earthing switch key lock

---

### 7.5. Spare parts, additional materials and lubricants

#### 7.5.1. Spare parts

Available on request

A parts list for procurement of spare parts is available on request. This list includes moving parts and parts subject to wear. The serial number of the relative switchgear or switching device should always be indicated when ordering spare parts.

#### 7.5.2. Additional materials and lubricants

<table>
<thead>
<tr>
<th>Lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Klüber NCA 52</td>
</tr>
<tr>
<td>Problem</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>All unit types</strong></td>
</tr>
<tr>
<td>Switch-disconnector cannot be closed.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Switch-disconnector cannot be opened.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Switch-disconnector cannot be moved to the “earthed” position.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Switch-disconnector cannot be moved from the “open” to the “earthed”</td>
</tr>
<tr>
<td>position.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Cable compartment door will not open or close.</td>
</tr>
<tr>
<td><strong>Motor-operated switch-disconnector</strong></td>
</tr>
<tr>
<td>Switch-disconnector cannot be closed or opened.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Combined switch-fuse unit</strong></td>
</tr>
<tr>
<td>Combined switch-fuse unit will not close.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Combined switch-fuse unit is impossible to operate even though a fuse</td>
</tr>
<tr>
<td>has blown.</td>
</tr>
<tr>
<td><strong>Circuit-breaker unit</strong></td>
</tr>
<tr>
<td>The cable compartment door will not open.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>The circuit-breaker will not close.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Instrument transformers</strong></td>
</tr>
<tr>
<td>Secondary measurements from the current transformers are not possible.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Table 19 - Troubleshooting**
8. Recycling

8.1. General aspects

The instructions for recycling the UniSec product are given below. This includes the materials used for packaging and for the product. It also includes handling instructions for when the product is taken out of service.

The environmental regulations vary from country to country and are frequently changed. For this reason, it is advisable to contact local professionals for instructions about how to proceed when the product is taken out of service.

Information is also given about how to return the product after it has been taken out of service.

Dealing with waste requires permission in most countries and you must obtain authorization for your own company. ABB can provide more details, especially about SF$_6$ gas. Please contact us if you have any questions.

Information about local landfills can be obtained from the environmental agency. A product that is no longer in service can be dealt with in two different ways: It can be demolished by hand or crushed by mechanical means.

Information about suitable facilities can be obtained from the local environmental agency.

8.2. Materials

Product materials

Table 21 gives examples of the SDC 375 unit materials and how they can be recycled:

<table>
<thead>
<tr>
<th>Material</th>
<th>Recyclable</th>
<th>kg</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>Yes</td>
<td>106.5</td>
<td>69</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>Yes</td>
<td>5.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Copper</td>
<td>Yes</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Brass</td>
<td>Yes</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Aluminium</td>
<td>Yes</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Zinc</td>
<td>Yes</td>
<td>1.5</td>
<td>1</td>
</tr>
<tr>
<td>Plastic</td>
<td>Yes</td>
<td>4.6</td>
<td>3</td>
</tr>
<tr>
<td>SF6</td>
<td>Yes</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Total recyclables</td>
<td></td>
<td>132</td>
<td>87</td>
</tr>
<tr>
<td>Rubber</td>
<td>No</td>
<td>&lt;1</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Epoxy resin</td>
<td>No</td>
<td>18.5</td>
<td>12</td>
</tr>
<tr>
<td>Total non-recyclables</td>
<td></td>
<td>19</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 20. Product materials

Sulphur hexafluoride (SF$_6$)

SF$_6$ is a fluorinated greenhouse gas covered by the Kyoto Protocol, thus care must be taken not to cause emissions of SF$_6$. At the end of its life, this greenhouse gas must be recovered.

All operations must be carried out by skilled personnel with in-depth knowledge of SF$_6$ gas.

NOTE

All parts containing hazardous waste must be removed and sent to a facility authorized for their disposal.

NOTE

All operations must be carried out by skilled personnel with in-depth knowledge of SF$_6$ gas.

NOTE

Consult the Service page of website www.abb.com/mediumvoltage for information about SF$_6$ gas and the relative management procedures.
**A. Tightening torques for steel screws and nuts/bolts**

### Nuts and bolts

<table>
<thead>
<tr>
<th>Type</th>
<th>Steel class 8.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4</td>
<td>3</td>
</tr>
<tr>
<td>M5</td>
<td>5</td>
</tr>
<tr>
<td>M6</td>
<td>9</td>
</tr>
<tr>
<td>M8</td>
<td>22</td>
</tr>
<tr>
<td>M10</td>
<td>45</td>
</tr>
<tr>
<td>M12</td>
<td>75</td>
</tr>
<tr>
<td>M16</td>
<td>185</td>
</tr>
</tbody>
</table>

### Hexagonal head bolts with flange

<table>
<thead>
<tr>
<th>Type</th>
<th>Steel class 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5</td>
<td>9</td>
</tr>
<tr>
<td>M6</td>
<td>16</td>
</tr>
<tr>
<td>M8</td>
<td>34</td>
</tr>
<tr>
<td>M10</td>
<td>58</td>
</tr>
<tr>
<td>M12</td>
<td>97</td>
</tr>
<tr>
<td>M16</td>
<td>215</td>
</tr>
</tbody>
</table>

### Cheese-head hex. socket screws

<table>
<thead>
<tr>
<th>Type</th>
<th>Max. tightening torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4</td>
<td>2</td>
</tr>
<tr>
<td>M5</td>
<td>4</td>
</tr>
<tr>
<td>M6</td>
<td>8</td>
</tr>
<tr>
<td>M8</td>
<td>12</td>
</tr>
<tr>
<td>M10</td>
<td>35</td>
</tr>
<tr>
<td>M12</td>
<td>50</td>
</tr>
<tr>
<td>M16</td>
<td>110</td>
</tr>
</tbody>
</table>

### Cheese-head Torx Fastite screw

<table>
<thead>
<tr>
<th>Type</th>
<th>Steel class 8.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>20</td>
</tr>
</tbody>
</table>

### Hex. socket-head and Torx round-head screws

<table>
<thead>
<tr>
<th>Type</th>
<th>Steel class 8.8</th>
<th>Steel class 10.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>M5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>M6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>M8</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>M10</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>M12</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

The values in the tables must be used unless the torque is specified in the table of joint types.
<table>
<thead>
<tr>
<th>Type of joint</th>
<th>Tightening torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M5</td>
</tr>
<tr>
<td>Bolts on the CT, TPU type</td>
<td>min. 2.8</td>
</tr>
<tr>
<td></td>
<td>nominal</td>
</tr>
<tr>
<td></td>
<td>max. 3.5</td>
</tr>
<tr>
<td>Bolts on electrical jaw contacts</td>
<td>min. 8</td>
</tr>
<tr>
<td></td>
<td>nominal</td>
</tr>
<tr>
<td></td>
<td>max. 10</td>
</tr>
<tr>
<td>Cable connection nut</td>
<td>min. 18</td>
</tr>
<tr>
<td></td>
<td>nominal</td>
</tr>
<tr>
<td></td>
<td>max. 22</td>
</tr>
<tr>
<td>Connections in busbar</td>
<td>min. 18</td>
</tr>
<tr>
<td></td>
<td>nominal</td>
</tr>
<tr>
<td></td>
<td>max. 22</td>
</tr>
<tr>
<td>Bolts on circuit-breaker</td>
<td>min.</td>
</tr>
<tr>
<td></td>
<td>nominal</td>
</tr>
<tr>
<td></td>
<td>max.</td>
</tr>
<tr>
<td>Type of joint</td>
<td>Tightening torque [Nm]</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------</td>
</tr>
<tr>
<td></td>
<td>M5</td>
</tr>
<tr>
<td>6  Bolts on the &quot;Mandolino&quot; CT</td>
<td>min.</td>
</tr>
<tr>
<td>7  Bolts on post insulator</td>
<td>min.</td>
</tr>
<tr>
<td>8  Bolts on connection and switching</td>
<td>min.</td>
</tr>
<tr>
<td>9  CT mounting bolts</td>
<td>min.</td>
</tr>
<tr>
<td>10 GSec and busbar HySec</td>
<td>min.</td>
</tr>
</tbody>
</table>
9. **Routine inspections**

- The routine inspections must be performed by our personnel or suitably qualified customer’s personnel with in-depth knowledge of the apparatus.
- Before proceeding with any operation, always make sure that the apparatus is in the open position with the springs discharged.

9.1. **General information**

During normal service, the switch-disconnectors are maintenance-free. Any interventions required basically depend on the severity of the service conditions, i.e. on various different factors such as the frequency of the operations, the interrupted current values, the relative power factor and the installation site. For precautionary reasons, an inspection schedule is given in the table in the following section, along with the frequency with which the apparatus must be checked. It is advisable to comply with the indications in the table for the first interventions. Optimal time limits for carrying out successive operations can be established on the basis of the results obtained during the routine inspections. It is advisable to record all the operations performed in detail on a maintenance card and service book, along with the date, description of the fault and reference data allowing the device to be identified, etc. Refer to article 10 of standard IEC EN 60694 if further details are required. Do not hesitate to call us if problems arise. It is always a good idea to inspect the apparatus (screw and bolt tightness - abnormal heating, etc.) a few months after it has been put into service. The following table gives the indicative frequencies with which inspections should be made.

9.1.1. **Inspection schedule**

<table>
<thead>
<tr>
<th>Part liable to inspection</th>
<th>Intervals</th>
<th>Operation required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perform a few mechanical closing and opening operations on the apparatus.</td>
<td>Make sure that the operating and transmission levers function correctly. The apparatus must operate regularly without stopping in intermediate positions and the applied torque must not exceed 100 Nm.</td>
</tr>
<tr>
<td>2</td>
<td>Visual examination of the insulating parts.</td>
<td>The insulating parts must be free from any built-up dust, dirt, cracks, traces of surface discharges or damage. Remove the dust and dirt with a vacuum cleaner and clean, dry cloths.</td>
</tr>
<tr>
<td>3</td>
<td>Auxiliary contacts and relays.</td>
<td>Make sure that operation and the signals are correct.</td>
</tr>
<tr>
<td>4</td>
<td>Auxiliary circuit conductors.</td>
<td>Check whether any of the wiring fasteners are slack or broken and make sure that the connections are well tightened.</td>
</tr>
<tr>
<td>5</td>
<td>Interlocks.</td>
<td>Make sure that the devices function correctly.</td>
</tr>
</tbody>
</table>
For more information please contact:

More product information: 
abb.com/mediumvoltage
Your contact center: 
abb.com/contactcenters
More service information: 
abb.com/service