Gas-Insulated Switchgear

Installation Instructions
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The only valid technical instructions are those which are supplied directly from the manufacturer with the delivery of the product.
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1 Regulations and provisions

1.1 Remarks on these instructions

This manual describes assembly of gas-insulated WI series medium-voltage switchgear.

These Instructions for Assembly are an integral part of the product and must be stored so that they are at any time readily accessible for and can be used by persons who are to work on the switchgear. If the switchgear is sold to new owners, they must receive this document along with the switchgear.

The following additional documents must be observed for this switchgear:
- Purchase contract with the agreements on the configuration of the switchgear and with the legal details
- Operating Manual for WI series
- the appropriate switchgear-specific circuit diagrams / documentation
- the Operating Manuals of the devices installed in the switchgear (e.g. IVIS, devices in low-voltage cabinet)
- the Instructions for Assembly of the manufacturer of the cable connection systems to be connected to the switchgear
- the Switchgear Configuration “WI”
- the assembly drawings supplied with the switchgear
- Use and handling of sulphur hexafluoride (SF6) in high-voltage switchgear (AGS 535051-01)

Since our products are constantly developed further, changes concerning images, technical data and standards are reserved.

All dimensions specified in this manual are in millimeters.

1.2 Terms and symbols used

This manual uses certain symbols which warn about dangers or provide important information which must be complied with to avoid danger to personnel and damage to equipment:

**Warning!** This symbol warns of dangerous electrical voltage. Contact with voltage may result in fatal injury!

**Warning!** This symbol is used for instructions non-compliance with which may result in serious injury, death or serious material damage.

**Important!** This symbol is used for information which is important to avoid damage.

1.3 Use in the line with the intended purpose

WI series gas-insulated medium-voltage switchgear units are exclusively intended for switching and distributing electrical power. They may only be used in the scope of the specified standards and the appropriate switchgear-specific technical data. Any other use constitutes improper use and may result in dangers and damage.

**Disclaimer of liability**

The manufacturer shall not be held responsible for damage which occurs if
- instructions in this manual are not complied with,
- the switchgear is not operated according to its intended use (see above),
- the switchgear is assembled, connected or operated improperly,
- accessories or spare parts are used which have not been approved by the manufacturer,
- the switchgear is modified without the manufacturer’s approval, or if inadmissible parts are attached.

No liability is accepted for parts provided by customers, e.g. current transformers.
1.4 Applied standards

WI series switchgear units are:
- metal-enclosed
- SF₆ insulated
- type-tested

<table>
<thead>
<tr>
<th>Designation</th>
<th>IEC standard</th>
<th>EN standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchgear</td>
<td>IEC 62271-1</td>
<td>EN 62271-1</td>
</tr>
<tr>
<td>Circuit-breaker</td>
<td>IEC 62271-100</td>
<td>EN 62271-100</td>
</tr>
<tr>
<td>Earthing switch</td>
<td>IEC 62271-102</td>
<td>EN 62271-102</td>
</tr>
<tr>
<td>Disconnector</td>
<td>IEC 62271-102</td>
<td>EN 62271-102</td>
</tr>
<tr>
<td>Current transformer</td>
<td>IEC 60044-1</td>
<td>EN 60044-1</td>
</tr>
<tr>
<td>Voltage transformer</td>
<td>IEC 60044-2</td>
<td>EN 60044-2</td>
</tr>
<tr>
<td>Voltage detection systems</td>
<td>IEC 61243-5</td>
<td>EN 61243-5</td>
</tr>
<tr>
<td>Protection against accidental contact, foreign objects and water</td>
<td>IEC 60529</td>
<td>EN 60529</td>
</tr>
<tr>
<td>Installation</td>
<td>IEC 61936-1</td>
<td>HD 637 S1</td>
</tr>
<tr>
<td>Operation of electrical equipment</td>
<td>–</td>
<td>EN 50110-1</td>
</tr>
</tbody>
</table>

Environmental and operating conditions

WI series switchgear units meet the following standards and regulations:

<table>
<thead>
<tr>
<th>Ambient conditions (acc. to IEC 62271-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature class</td>
</tr>
<tr>
<td>&quot;Minus 5 indoors&quot; 1)</td>
</tr>
<tr>
<td>Min./max. ambient temperature</td>
</tr>
<tr>
<td>Average value over 24 hours (max.)</td>
</tr>
<tr>
<td>Average rel. air humidity 24 h/1 month</td>
</tr>
<tr>
<td>Max. installation altitude above sea level</td>
</tr>
</tbody>
</table>

1) Other values on request

<table>
<thead>
<tr>
<th>Insulating gas (acc. to IEC 60376)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Rated pressure $p_a$ at 20 °C</td>
</tr>
</tbody>
</table>

2) See section 7

<table>
<thead>
<tr>
<th>Degree of protection against accidental contact and foreign objects (acc. IEC 60529)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main electric circuits</td>
</tr>
<tr>
<td>Drives</td>
</tr>
<tr>
<td>Low-voltage cabinet</td>
</tr>
</tbody>
</table>

3) optional: IP 52
1.5 Safety provisions

The work described in this manual may only be performed by staff of the Manufacturer’s Service Center, or by qualified staff who have been certified for assembly of the WI series.

Applicable standards and regulations:

Please comply with:

- the locally applicable health and safety, operating and work instructions
- Installation: IEC 61936-1 / HD 637 S1 ¹)
- Operation of electrical installations EN 50110-1 ¹)

¹) The respective national standards in the country of manufacture are to be considered.

Read these instructions carefully before you work on the switchgear, and perform the work as described. Only perform such work if you have understood the instructions. Do not perform any work on the switchgear which is not described here.

Important!

Operating reliability and useful life depend on correct operation.

Before performing work on the panel, make sure to comply with the following instructions:

Warning! Before starting work on the high-voltage components, de-energize the system, verify it for zero voltage and earth the system according to the applicable safety rules pursuant to EN 50110-1.

Warning! Before performing work on the drives, switch off the auxiliary voltage and prevent it from reclosing.

Warning! There is a risk of injury when working on the drive mechanism.

Release the circuit-breaker’s energy storing device by performing the corresponding:

- OFF-ON-OFF operating sequence.
- in case of a make-proof earthing switch, by the appropriate ON-operation.

Behaviour in case of incidents or accidents

The WI series switchgear panels feature pressure relief ports for the case of an internal arc fault to ensure operator safety.

In case of fire or of internal faults, toxic and caustic decomposition products may arise. Comply with the locally applicable health and safety provisions.

In case of injuries damage, take first-aid measures or cause them to be taken.

1.6 Disposal after the end of the useful life

A material and recycling data sheet can be provided on request for the disposal of series WI switchgear at the end of its service life.

Disposal is performed as a service by the manufacturer’s Service Center which is subject to a fee.

The operating equipment contains the fluorinated greenhouse gas Sulphur Hexafluoride (SF₆) mentioned in the Kyoto protocol with a global warming potential (GWP) of 22 200. SF₆ must be recovered and must not be released into the atmosphere. When using and handling SF₆, comply with the specifications in the standard IEC 62271 High-Voltage Switchgear and Controlgear – Part 303 Use and Handling of Sulphur Hexafluoride (SF₆).
2 Panel type overview

Fig. 2
1 Drive with front control panel
2 Tank with circuit breaker, disconnector and earthing switch
3 Busbar chamber
4 Supporting structure with cable connection area
5 Low voltage cabinet

Single busbar series WIA up to 38 kV
(40,5 kV, if \( I_{sc} \leq 31.5 \text{ kA} \))

Single busbar series WIA up to 52 kV / 55 kV
(40,5 kV, if \( I_{sc} \leq 40 \text{ kA} \))
Double busbar, series WIB up to 38 kV (40,5 kV, if $I_{sc} \leq 31.5$ kA)

Double busbar, series WIB up to 52 kV / 55 kV (40,5 kV, if $I_{sc} \leq 40$ kA)

Fig. 3
1 Drive with front control panel
2 Tank with circuit breaker, disconnector and earthing switch
3 Busbar chamber 1
4 Busbar chamber 2
5 Supporting structure with cable connection area
6 Low voltage cabinet
Shipping units

WI switchgear is delivered as individual panels. One transport unit consists of a maximum of three panels lying horizontally and secured to a pallet. Bus section couplers and bus couplers in 2 panel widths are delivered as preassembled units. The busbar compartment, the circuit-breaker compartment with three-position switch and the drives are mounted ready for connection. The busbar is assembled and the busbar compartments filled with insulating gas on site. The low-voltage cabinets are assembled in the factory or supplied as accessories, according to customer’s request.

Packaging

- If packed exclusively for truck transport, the panels are delivered on a pallet with PE protective film.
- For seaworthy transport, the units are packed in sealed aluminium film with desiccant and in a closed wooden case with tightly closed wooden base (also for container transport).
- In case of air transport, the panels are packaged in wooden crates with a protective PE film hood (dust protection) or in wooden crates, also with closed wooden bases, however without protective hoods (dust protection).

Transport

When transporting the panels, it must be ensured that the transport units do not slip or tilt (if necessary, nail down transport pallet on the loading surface).

Transport using a forklift truck:
The panel may only be transported on a pallet. The forks must be placed full-length under the transport unit.

Delivery

- Handle shipping units carefully when unloading and unpacking them.
- Shipping units must be unpacked immediately after receipt. Any damage occurred in transit must be recorded and reported immediately to the manufacturer.
- Check completeness of consignment based on the transport documents.
- The supplier must be notified in writing about any differences.

Storage

If the panels are not installed completely upon delivery, they can be stored temporarily.

- Re-use the original packaging to store parts which have been unpacked for inspection.
- Opened transport units must be protected against dust and contamination.
- The ambient conditions for storage must comply with the admissible operating conditions.
- Protect switchgear panels and accessories against condensation.

Warning!

Ensure that the storage area is level and can support the weight of the equipment!

Fig. 1

Transport unit
3 individual switchgear panels on a pallet protected by PE film
Weights
The weights are guide values for panels without packaging.

<table>
<thead>
<tr>
<th>Panels</th>
<th>One interrupter chamber per phase</th>
<th>Two interrupter chambers per phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WIA</td>
<td>WIB</td>
</tr>
<tr>
<td>Weight in [kg]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Branch-circuit panel</td>
<td>700</td>
<td>1075</td>
</tr>
<tr>
<td>Branch circuit panel with multiple cable</td>
<td>800</td>
<td>1175</td>
</tr>
<tr>
<td>connection tank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metering panel</td>
<td>700</td>
<td>1075</td>
</tr>
<tr>
<td>Bus coupler in one panel width</td>
<td>700</td>
<td>1075</td>
</tr>
<tr>
<td>Transport unit consisting of coupler and</td>
<td>1700</td>
<td>2450</td>
</tr>
<tr>
<td>busbar riser panel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Busbar unit without outgoing feeder (spare</td>
<td>210</td>
<td>420</td>
</tr>
<tr>
<td>panel)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional weights for attachment of busbar</td>
<td>+100</td>
<td>+200</td>
</tr>
<tr>
<td>compensation</td>
<td>+ 20</td>
<td>+ 40</td>
</tr>
<tr>
<td>busbar earthing switch</td>
<td>+ 20</td>
<td>+120</td>
</tr>
</tbody>
</table>

Dimensions

<table>
<thead>
<tr>
<th>Panels</th>
<th>One interrupter chamber per phase (38 kV – type)</th>
<th>Two interrupter chambers per phase (52 kV / 55 kV – type)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WIA</td>
<td>WIB</td>
</tr>
<tr>
<td>Dimensions [mm]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel depth (valid for all variants)</td>
<td>1692 with low–voltage cabinet (standard)</td>
<td>1517 with terminal box</td>
</tr>
<tr>
<td>Branch-circuit panel</td>
<td>2100</td>
<td>2750</td>
</tr>
<tr>
<td>Width</td>
<td>2750</td>
<td>2750</td>
</tr>
<tr>
<td>Bus section coupler</td>
<td>2100</td>
<td>2750</td>
</tr>
<tr>
<td>Height: ( I_r \leq 2000 )</td>
<td>2100</td>
<td>2750</td>
</tr>
<tr>
<td>Width</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Bus coupler (in 2 panel widths)</td>
<td>-</td>
<td>2750</td>
</tr>
<tr>
<td>Height</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Width</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>Options:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage transformer on the upper busbar</td>
<td>Height</td>
<td>+ 475</td>
</tr>
<tr>
<td>Pressure relief on the upper busbar</td>
<td>Height</td>
<td>+ 45</td>
</tr>
<tr>
<td>Elevated panel supporting structure</td>
<td>Height</td>
<td>+ 300</td>
</tr>
<tr>
<td>Busbar compensation</td>
<td>Width</td>
<td>+ 200</td>
</tr>
<tr>
<td>Busbar earthing switch</td>
<td>Width</td>
<td>+ 145 (only at end of busbar)</td>
</tr>
<tr>
<td>Busbar cable connection</td>
<td>Width: Size 1-2</td>
<td>+ 200 (only at end of busbar)</td>
</tr>
</tbody>
</table>

for series WI switchgear units: width - height - depth
\( I_r \) = Rated current of switchgear
4 Installation of panels

4.1 Safety provisions

Installation and assembly of the switchgear panels must be performed by accordingly certified staff or the manufacturer’s Service Center.

**Warning!**

- Check technical data on rating plate.
- Check the supply voltage of the control and operating devices installed with reference to the switchgear-specific circuit diagrams.

**Warning!**

Pay attention to flooring ducts! Risk of accidents!

The WI series switchgear panels are delivered with the circuit breaker set to “OFF”, the energy storing device released and the earthing switch set to “ON”.

**Warning!**

Risk of injuries. During installation, assembly and connection, the energy storing device must not be charged.

**Important!**

Condensation, dirt and dust should be avoided during assembly.

4.2 Requirements regarding the switchgear room

Before installing the switchgear panels, make sure that the switchgear room is checked according to the switchgear documentation:

- Ducts for high-voltage and low-voltage cables
- Check position of spacer bars
- The load-bearing capacity of the fastening areas must correspond to the weight of the switchgear (perform a stress analysis of the building)
- Observe the minimum distance between the switchgear and the building wall
- Check spacer bar frame for dimensions and tolerances in position

Before the switchgear is positioned on its site of installation, check the fastening points for flatness. Any unevenness must not exceed ±1 mm/meter.

Fig. 4
Example: wall distances, ceiling ducts, spacer bars
4.3 Preparation for assembly

Erecting the switchgear panels

Warning!

Sufficient stability and evenness of the supporting area (floor) must be ensured.

1. Remove transport packaging (protective films).
2. Attach rope to the jack rings located on the circuit-breaker tank.

Warning!

The heavy-load jack rings (accessories) must be used to erect the panels or to transport them using a crane.

Important!

Make sure the rope is strong enough to bear the weight of the switchgear panel and to comply with the specific regulations applicable for hoisting equipment.

3. The panel on the opposite side, at the end of the supporting structure, must also be supported by the forks of the forklift truck.
4. Release the fasteners between the panel and the transport support frame.
5. Lift the panel carefully on both sides, then lower the supporting structure slowly to the floor. Erect panel completely using the crane.

6. Use yellow transport aids to move the panels (not included in scope of supply).
Assembly of the transport rollers

1. Insert transport rollers (3) into the carriers in the supporting structure and connect them using the securing pins (1) as shown in the drawing.

2. Lift panel using the setscrew (2).

Transport on rollers is only admissible on a completely level and horizontal floor.

Transverse movements on the spacer bar frame are only admissible over short distances (risk of tipping over).

Warning!
Risk of tipping over!
During transport, pay attention to the weight distribution. The center of gravity is at the gas tank level in the upper part of the switchgear panel.

Removal of transport securing device

Important!
The transport securing device must not be removed earlier than necessary, but just before the assembly in question is started.

- Remove cardboard transport covers from the busbar chamber (1) by unscrewing them.
- If necessary, remove transport securing device (2) in the supporting structure (depending on variant) only after installation of the panel.
4.4 Installation of the first switchgear panel

1. Place the panel on the spacer bars according to the switchgear-specific space assignment plan.

2. Lower the switchgear panel and discharge the transport rollers.

3. Align front edge according to the space assignment plan.

4. Align the panel.

   Check the busbar chambers for correct horizontal and vertical position.
   If applicable, lift the panel via the transport rollers and place shims in the direct vicinity of the fastening areas, until the horizontal position has been reached.

   **Important!**
   *The first panel is decisive for the location of the following panels, thus it is essential that measuring is effected with utmost precision!*

5. Remove the transport rollers.

6. Drill a thread M10 into the spacer bar frames in the 4 fastening areas. Screw down securing bolts (not included in scope of supply) only by hand, without using any tools.

   **Important!**
   *Only after all switchgear panels have been installed and adjusted may they be screw-fastened to the spacer bars.*

4.5 Lining up panels

7. Place the second panel on the spacer bar next to the first panel according to the space assignment plan.

8. Screw-fasten 4 threaded pins M10 with a clearance of 32±1 mm into the busbar chamber (see Fig. 14).

   Fasten the 2 guide pins (not included in accessories) in the busbar chambers for assembly.

9. Coat the sealing surfaces on the busbar chambers and the seals (see Annex).

   Insert the packing ring on the busbar chamber.

10. Push switchgear panel close to the first panel using the transport rollers.

    The guide pins ensure that the busbar chambers are aligned correctly.

11. Screw-fasten the busbar chambers to each other (see Fig. 15).

    Tighten screw couplings cross-wise.

   **Important!**
   *Comply with the specified tightening torques (refer to Annex).*

12. Align panel (according to installation of the first panel).

   Remove the transport rollers.

   After having aligned and screw-fastened all panels to the busbar chambers (items 7-12), screw-fasten the panels to the spacer bars.

   (The securing bolts are not included in the scope of supply.) Make sure not to strain the panels in this process!
4.6 Busbar connections and busbar attachments

Busbar assembly

The busbar attachments are supplied with the switchgear accessories.

The busbars differ depending on the busbar rated current:
- Flat bars: \( \leq 1600 \) A
- Tubular bars: \( \leq 2500 \) A

The assembly procedure is identical for the different busbar systems:

**Preparation for assembly:**

Access to the busbar carriers' screw-fastening areas:
Before assembly, the lower mounting cover must be removed from the busbar chamber.
The screws and the cover must be kept in a safe place for re-use.

**Installing the busbars:**

1. Coat contact areas of the busbars, busbar carriers and the clamping piece (see Annex).
2. Pretreatment of the threads in the busbar carriers:
   - Degrease threads using a cleaning agent.
   - Coat at least two turns of the thread completely with a screw locking compound (e.g. Loctite, see Annex).

**Warning!**

*The contact surfaces must not be coated.*

3. Fasten busbars with clamping piece as shown in the diagram.

**Important!**

- Tightening torque: \( 10^{+2} \) Nm.

---

**Fig. 17**

1 Busbar carrier with contact carrier 1600 A
2 Flat busbars
3 Clamping piece
4 2 cup springs each
5 Socket-head capscrews M10 (4x)
6 Cup spring arrangement

**Fig. 18**

1 Busbar carrier 2500 A
2 Tubular busbar
3 Clamping piece
4 2 cup springs each
5 Socket-head capscrews M10 (4x)
6 Cup spring arrangement
End panel

In each end panel, one end shim is fastened to the busbar carrier together with the clamping piece and the busbar.

Proceed as described above for screw-fastening the busbars.

For the tubular busbars, round end covers are used. Assembly is performed analogously.

End panel with busbar earthing contact

Set earthing contacts:
1. First preadjust and tighten the earthing contacts.
2. Switch on earthing switch (see Operating Manual).

Warning! Risk of injury due to the spring mechanism of the earthing blades.

3. Align earthing contacts to the contact blades. Subsequently, tighten them applying the specified tightening torque.

Description of assembly

Important! Coating of contact surfaces and tightening torques: refer to Annex.

Phase L1:
The earthing contact is directly mounted to the busbar carrier together with the busbar. Proceed as described above for screw-fastening the busbars.

Phase L2 und L3:
The earthing contact and the busbar are screw-fastened to one another.

The busbar is fastened to the carrier according to the busbar screw-fastening procedure described above.
Transfer resistance measurement of busbar screw fastening

**Important!** *Comply with the manufacturer’s specifications regarding the ohmmeter.*

1. Connect the measuring device.
2. Measure transition resistance $R$ between the individual busbar sections with direct current.
3. The resistance values measured should be comparable. If one measurand exceeds the average of the other values by max. 20% or more, undo busbar screw fastening; clean contact surfaces carefully and repeat the mounting procedure.

Remounting the mounting cover

Before remounting the mounting cover to the busbar chambers, clean busbar compartments thoroughly to remove dust and impurities.

**Mounting cover without desiccant:**
1. Coat the sealing surfaces and seals (see Annex).
2. Insert a packing ring in the mounting cover.
3. Fasten mounting cover again to the busbar chamber.

**Important!** *Comply with the tightening torques specified in the Annex.*

**Mounting cover with desiccant:**

Mounting covers with desiccant are mounted in the end.
1. Coat the sealing surfaces and seals (see Annex).
2. Insert a packing ring in the mounting cover.
3. Check the outer desiccant bag for good condition. Use desiccant only if the bag is not damaged.
4. Remove the inner desiccant bag and place it in the desiccant cover.
5. Screw-fasten the desiccant container to the mounting cover.

Pay attention to the equipotential bonding connection! Metallic surfaces on the mounting flange and the desiccant container must be in contact (if necessary, expose metallic surfaces).

**Important!** *Comply with the tightening torques specified in the Annex.*

6. Fasten mounting cover again to the busbar chamber.

**Warning!** *The appropriate busbar compartment must be closed and evacuated within 90 minutes after the outer desiccant bag has been opened.*

7. Evacuate the gas compartments: refer to chapter 5.

---

**Fig. 21**
Measure transition resistance

**Fig. 22**
Mounting cover on the busbar chamber with desiccant attachment
1 Desiccant
2 Desiccant container
3 Expose metallic surface
4 Sealing surface
5 Packing ring
Type of insulating gas:
Sulphur hexafluoride SF₆ according to IEC 60376

After filling the busbar and circuit-breaker compartments, the indicators and settings of the pressure indicator must be checked.

Important! The Operating Manual for the WI series, section 7 “Insulating gas monitoring”, must be observed.

Fig. 24
1 Insulating gas monitoring of circuit-breaker compartment
2 Gas connector socket for busbar compartment
3 Temperature sensor for circuit-breaker compartment (only required for density controller)
4 Top gas connector socket for circuit-breaker compartment
5 Connecting line between insulating gas monitoring and compartment

Rated filling pressure (see also rating plate) and pickup values of insulating gas monitoring

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>[kV]</th>
<th>12/24</th>
<th>12/24/36</th>
<th>40.5</th>
<th>52/55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated nominal current</td>
<td>[A]</td>
<td>1600</td>
<td>2500</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td>Measuring device</td>
<td>Ambient temperature-compensated pressure gauge</td>
<td>Density controller</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated filling pressure pₑ</td>
<td>[MPa]</td>
<td>0.08</td>
<td>0.13</td>
<td>0.145</td>
<td>0.22</td>
</tr>
<tr>
<td>Pre-alarm in case of pressure drop</td>
<td>[MPa]</td>
<td>0.05</td>
<td>0.10</td>
<td>0.115</td>
<td>0.19</td>
</tr>
<tr>
<td>Main alarm in case of pressure drop</td>
<td>[MPa]</td>
<td>0.03</td>
<td>0.07</td>
<td>0.10</td>
<td>0.18</td>
</tr>
<tr>
<td>Main alarm in case of pressure increase</td>
<td>[MPa]</td>
<td>0.14</td>
<td>0.20</td>
<td>0.22</td>
<td>0.26</td>
</tr>
</tbody>
</table>

The pressure data refer to +20 °C and an atmospheric pressure of 101.3 kPa abs.
Workflow:

**Important!**

$\text{SF}_6$ must be recovered and must not be released into the atmosphere. When using and handling $\text{SF}_6$ comply with the specifications in the standard IEC 62271 High-Voltage Switchgear and Controlgear – Part 303 Use and Handling of Sulphur Hexafluoride ($\text{SF}_6$).

A) Evacuating the busbar compartment

Use a vacuum pump or service equipment with gauge for an absolute pressure of $\leq 1 \text{ kPa}$.

When evacuating gas-filled insulating gas compartments, make sure to use only service equipment for $\text{SF}_6$ insulating gas.

Connection to the vacuum pump should be made by short connecting hoses with a big inside diameter.

1. After removing the cap, connect vacuum pump to the gas connector socket for the busbar compartment (Fig. 24, item 2).
2. Evacuate the gas compartment to an absolute pressure of $\leq 1 \text{ kPa}$.
3. Disconnect the vacuum pump and mount the cap.

B) Filling the busbar compartment to the rated filling pressure

The circuit-breaker compartment has been filled by the factory to a gauge pressure of min. 0.030 MPa.

1. After removing the cap, connect the service equipment to the gas connector socket.
2. Fill the busbar compartment to the rated filling pressure.
3. Disconnect service equipment and mount cap again.

C) Filling the circuit-breaker compartment to the rated filling pressure

After filling the busbar and circuit-breaker compartments, the indicators and settings of the pressure indicator must be checked (see also Operating Manual).

D) Leakage test by means of leakage detector

A test for leakage is required whenever flange couplings exposed to insulating gas have been made on site.

1. Use a leakage detector. Observe the instructions of the leakage detector's manufacturer.
2. Check the flange couplings mounted during assembly by holding the leakage detector close to them. The flange coupling's tightness is ensured if the leakage detector does not react.

E) Dew point measurement of the insulating gas

(After approx. 48 hours)

1. Use a dew point measuring device. Observe the instructions of the manufacturer of the dew point measuring device.
2. Connect dew point measuring device to a filling valve. The measuring procedure is described in the operating instructions for the dew point measuring device. The dew point temperature must not exceed $-10 ^\circ\text{C}$.
3. Disconnect dew point measuring device. Screw-fasten cap on filling valve.

Fig. 25
Each of the busbar sections is monitored by a pressure gauge/density controller on the appropriate busbar section.
6.1 Earth continuity conductor

The connection bars incl. the screw couplings are supplied in the accessories.

1. Coat contact surfaces of the connecting points (refer to Annex).

2. Screw-fasten the connection bars of the earth continuity conductor to the earthing points of the panels.

**Important!**

Comply with the specified tightening torque (refer to Annex).

3. Connect earth continuity conductor of the switchgear to the earthing system of the switchgear building (not included in scope of supply).

6.2 Connecting external control lines

The switchgear-specific circuit diagram for connection of the external control lines must be complied with!

Wiring material is not included in the scope of supply.

1. Open low-voltage cabinet by means of the double-bit key.

2. Ring circuits are wired through the lateral rubber sleeves from panel to panel.

3. Route panel-related control lines in the cable duct through the opening in the floor of the low-voltage cabinet to the terminal strip.

Fig. 26
Attachment of end busbar ≤ 36 kV
1 Connecting bar
2 Screw coupling

Fig. 27
Attachment of end busbar (52 kV)
1 Connecting bar
2 Screw coupling

Fig. 28
Opening the swing frame
1 External control cables from adjacent panel
2 External control cables into cable duct
6.3 Attachment of cable support

The attachments are included in the switchgear accessories.

**Important!**
- Coat contact areas of earth transition
- Comply with the specified tightening torques (refer to Annex)

1. Screw-fasten cable support to the carrier in the panel supporting structure. Observe the assembly drawings supplied with the equipment.

2. Slip support brackets into sections of the adjustable cable supports and screw-fasten the cable securing section to them.

3. The number and setting of the cable securing sections depend on the cable connection type (single or multi-cable connection).

**Important!**
The cable securing sections are screwed down after introduction of the cable connectors and mounting the cable clips.

---

Fig. 29
Cable support attachment (shown: single cable connection)
1 Screw-fasten cable support to the carrier in the panel supporting structure
2 Adjustable cable supports
3 Cable securing section and support bracket

Fig. 30
Multiple tank with 4 connectors per phase
1 Cable support
2 Cable securing section
3 Low-voltage cabinet
4 Busbar tank
Inner cone-type appliance couplers (e.g. acc. to EN 50181) are standard equipment of the panels.

**Warning!**

Cable connectors, tools, accessories (cable clips, screws, spring washers etc.) are not included in the scope of supply.

Mount cable connectors according to the mounting instructions of the cable connector’s manufacturer. When mounting the cable connectors, comply with the specified tightening torques (see Annex).

**Warning!**

When shrink-fitting cable boxes, make sure that the cable connection area of the panel is not heated beyond the admissible service temperature.

We cannot accept any liability for consequential damage (charred cables of the capacitive indicator) which might result from shrink-fitting components in the cable connection compartment using an open flame.

Cable connectors for inner cone-type appliance coupler

1. Remove transport protective caps from the connector bushings (socket-contacts).
2. Mount cable connector according to the instructions of the cable connector manufacturer. Insert cable connector in inner cone-type appliance coupler (press down) and screw-fasten safely. Tighten screw couplings M8 with a torque of 15±3 Nm.

**Warning!**

After the cable connector has been inserted and screwed down, no cantilever loads or torsional forces must act on the inner cone-type appliance coupler (risk of damage to the inner cone-type appliance coupler).

3. If necessary, re-adjust cable support, align cables and fasten them to the cable support using cable clips.

Connect earthing cable

1. Coat contact surfaces of earth connection (cable’s Cu shield) with lubricant KL (refer to Annex).
2. Screw-fasten Cu shield of cable to cable support.
3. Close unused inner cone-type appliance couplers with surge-proof dummy plugs.

Connector shell with conductive contact surface with reference to switchgear’s metal enclosure:

If the metallic connector shell features a conductive surface in contact with the metal cladding of the switchgear (this applies to the Pfisterer brand, system CONNEX), the cable’s earth shield must not be connected to the connector shell (contacting). If for operational reasons it is not possible to provide an insulation between the cable’s earth shield and the connector shell, consult the manufacturer.
8 Special attachments

8.1 Conditions for assembly

Installation and assembly of the special attachments may only be performed by specifically trained staff, due to the technical requirements and the appropriate safety provisions involved.

Installation and assembly of the special attachments are performed by accordingly certified staff or, on request, by the manufacturer’s Service Center.

8.2 Compensator attachment

The heat produced during switchgear operation results in extension (depending on the normal current intensity).

The compensator attachments ensure a longitudinal compensation of the busbar system. Compensator attachments feature a panel width of 200 mm. They are required after 20 panels in case of single busbars, and after 10 panels in case of double busbars.

The attachments are included in the accessories.

Busbar connection

Specific tubular busbars must be mounted to the busbar carriers in the left-hand and right-hand adjacent panel of the compensator attachment. The busbar sections are connected, depending on the busbar rated current, by multicontact bands which are placed in the groove of the contact pin.

\[ I_r \leq 1250 \text{ A: } 1 \text{ contact band} \]
\[ I_r > 1250 \text{ A and } \leq 2500 \text{ A: } 2 \text{ contact bands} \]

Clearance between busbars on the multicontact connection. 15±2 mm. This ensures a length compensation of the busbar.

**Important!**

Comply with the specified coating of the contact surfaces and the tightening torques (refer to Annex).

**Warning!**

*After assembling the multicontact connection, the busbar sections must not be turned. Arrange their installation position previously, so that screwing down is possible without turning the busbars.*
8.3 Facings

Front-side facings of the panels and compensator attachments or lateral switchgear facings can be mounted on customer’s request.

The attachment variants depend on the switchgear-specific panel types and the local dimensions of the switchgear compartment.

The attachments are included in the accessories.

Fig. 35
Facings
1 End panel attachment
2 Cover attachment
3 Cover attachment for compensator
8.4 Current transformer in line with busbars

The attachments are included in the accessories.

8.5 Bus sectionalizer

Switchgear panels comprising a disconnector in line with the busbar are completely installed in the factory and delivered in ready-to-connect condition. The attachments for the busbar connections are included in the accessories.

Warning!  
Risk of tipping over!  
During transport, pay attention to weight distribution.  
The center of gravity is at the gas tank level in the upper part of the switchgear panel (see also section 4.3).

Fig. 36  
Current transformer in line with busbars

Fig. 37  
Disconnector in line with busbar  
Illustrated: double busbar
9 Replacement of transformers

9.1 Replacement of voltage transformers

Replacement of the voltage transformers in the cable outgoing feeder or, analogously, at the busbar.

**Warning!**

Observe the safety provisions in chapter 1.5.

**Warning!**

The isolating device for the voltage transformer must be in earthed position.

**Important!**

Please refer to the section “Disconnecting voltage transformers” in the Operating Manual of the WI series.
Disassembly of voltage transformers:

1. Release and identify transformer secondary cables.

2. Disconnect screw couplings of transformers (4 screws at the flange coupling and 2 screws at the fixing bracket).

3. Pull transformer carefully and in correct axial alignment out of the inner cone-type appliance coupler. The weight of the transformers must be taken into consideration! If necessary, support transformer using an elevating truck, or secure it by attaching a crane hook to the transformer's jack rings.

Mounting the voltage transformers:

Important!

Observe the instructions for assembly of the voltage transformers.

Important!

Contact and sealing surfaces must be cleaned before assembly to remove grease and silicone.

1. Clean and grease contact surfaces on the transformer connector and in the inner cone-type appliance coupler (see Annex).

2. Carefully clean the joining areas of the transformer connector and in the inner cone-type appliance coupler, and apply a uniform film of special paste.

3. Slip voltage transformer into the inner cone-type appliance coupler while observing correct axial alignment, and screw-fasten it by means of the 4 securing bolts. Screw-fasten the voltage transformer to the fixing bracket. Comply with the specified tightening torques (refer to Annex)!

4. Connect the transformer's secondary lines. Comply with the marking!
9.2 Replacement of the current transformers

The safety provisions must be complied with!

**Warning!** When working at the switchgear, disconnect the appropriate switchgear section from the power supply, as otherwise operator safety according to IEC 62271-200 is restricted.

Earth the cable outgoing feeder, check for zero voltage and ensure that earthing is not damaged.

**Warning!** The safety provisions acc. to section 1.5 must be complied with.

Refer to the instructions for assembly.

**Important!** Refer to the instructions for assembly of the cable connector manufacturer.

**Important!** Refer to the technical instruction for the “Use and handling of insulating gas” for the WI series.

Disassembly of the toroidal-core current transformer:

1. Remove cable connector with connecting cable.
2. Evacuate insulating gas of circuit-breaker cladded compartment, then fill with air to atmospheric pressure.
3. Disconnect the transformer lines in the low-voltage cabinet.
4. Remove container (10) of the inner cone-type socket.
   - Unscrew earthing jumper (8).
   - If necessary, disconnect the connector of the capacitive decoupling (11).
   - Disconnect the 4 supporting segments (9) and carefully remove the container by pulling it down.

The connector socket with the circular conductor is pulled out of the multicontact connection of the main current circuit. Take the weights into account!

5. Unscrew the protective cover (6).
6. Disconnect the screw coupling (5) between the fixing bracket (4) and the retaining plate (3) and remove the package from the toroidal-core current transformer and the retaining plate.

The toroidal-core current transformers (1) can be completed or replaced once the fastener (2) has been released.

Assembly of the toroidal-core current transformer:

For assembly, reverse disassembly procedure analogously.

**Important!** Please observe the following instructions:

- Replace seals and multicontact bands.
- Coating of contact surfaces of multicontact connection and earthing jumper (see Annex).
- Coating of sealing surfaces (refer to Annex).
- Tightening torques of the screw couplings (refer to Annex).

Subsequently, connect the transformer lines in the low-voltage cabinet and mount cable connection again.

If necessary, replace desiccant in the open circuit-breaker compartment. Evacuate the circuit-breaker compartment and fill it with insulating gas acc. to section 5.

If toroidal-core current transformers of multiple connectors must be replaced, proceed in principle in analogy to the above description. It may be necessary to disconnect additionally the conductor bar screw couplings in the multiple tank with the circular conductors. Replacement of the toroidal-core current transformers is performed on request by the manufacturer’s Service Center.
Final steps / commissioning

Final steps

Warning! The high-voltage supply must not be connected. All active parts must be earthed.

Clean and check assembly

- Clean the switchgear, removing contamination due to assembly work.
- Remove all the attached information tags, cards, brochures and instructions no longer needed.
- Check the tightening torques of all screw couplings and connections established on the site of installation:
  - Cable fitting on the appliance couplers
  - Surge-proof caps on appliance couplers
  - Earth conductor
  - Panel screw couplings
  - Special attachments
- Check the connected cables for phase coincidence with the appliance couplers.

Damaged paint

The panels are powder-coated. Minor damage to the paint can be repaired using commercially available paint (standard colour RAL 7044 or corresponding colour).

Verify:

- Check the switchgear for damage which might be due to transport or assembly work.
- Data on rating plate versus the required ratings.
- Filling pressure, according to rating plate, on the gas compartment monitoring system.

Commissioning

Check switching functions / interlocks:

Important! The series WI Operating Manual must be observed.

- Perform manual switching trials on the individual switching devices.
- Check switch position indicators.

Important!

While the power supply is not available, blocking coils (locking the interrogating levers and circuit-breaker push-buttons, depending on design), are in “locked” position. One undervoltage release (optional) is released.

1. Check rated supply voltage of control and operating devices.
2. Check wiring laid on site.
3. Apply supply voltage.

Important!

The energy-storing device of the circuit breaker drive is charged automatically as soon as the supply voltage is applied.

4. Check electrical functions of control and operating devices.
   - Motor drives for disconnector and earthing switches
   - Closing and opening releases for circuit-breaker

Check switch position indicators and interlocks (see Operating Manual, section 5).
11.1 Instructions for assembly

Cleaning products, lubricant KL, SF₆ multi-purpose lubricant MS and screw locking compound Loctite® appear in the Table “Auxiliary products” on the following page.

How to treat sealing surfaces and seals

Important!
Sealing surfaces, once coated with SF₆ multi-purpose lubricant MS, should not be touched, if possible. Any contamination may impair function.

1. Sealing surfaces, seals (O rings) and grooves for O rings must be cleaned and degreased with particular care using a cleaning agent and a lint-free cloth.

2. Check visually.

3. Immediately afterwards, apply SF₆ multi-purpose lubricant using a piece of leather which is exclusively reserved for this application; then keep the piece of leather in a place where it is protected against soiling.

How to treat the contact surfaces:

Important!
Different lubricants must not be mixed on any account! Contact areas coated with lubricant KL should not be touched, if possible.

Contact surfaces must be subjected to preliminary treatment before screw-fastening.

1. Clean
   - using a lint-free cloth,
   - in case of serious contamination: using cleaning agent.

2. Polish to achieve a bright surface:

<table>
<thead>
<tr>
<th>Material of contact surfaces</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper, silver-plated</td>
<td>none</td>
</tr>
<tr>
<td>Copper</td>
<td>A</td>
</tr>
<tr>
<td>Aluminium, silver-plated</td>
<td>none</td>
</tr>
<tr>
<td>Aluminium</td>
<td>B</td>
</tr>
<tr>
<td>Steel</td>
<td>C</td>
</tr>
<tr>
<td>Sheet metal, galvanized</td>
<td>none</td>
</tr>
</tbody>
</table>

   (A) - using emery cloth (grain size 100 or finer)
   - or using a steel brush which is only used for copper

   (B) - using emery cloth (grain size 100 or finer)
   - or using a steel brush which is only used for aluminium

   (C) - using emery cloth (grain size 100 or finer) or
   - using a steel brush which is only used for steel.

3. Immediately after cleaning the material metallically bright, coat it with lubricant KL so that the space between the contact surfaces is completely filled once the screws have been fastened.

Locking of screws using LOCTITE®

1. Preparation of the threaded areas
   - Clean and degrease the threaded areas using a cleaning agent.

2. Apply adhesive
   - Coat the entire circumference of 2 or 3 threads in the area to be glued with liquid screw locking compound.
   - Maximum time for positioning: 60 s.

Note:
- In case the thread reach exceeds 1.2 x the screw diameter and in case of blind hole threads, only wet the nut’s thread.
11.2 Auxiliary products

**Warning!**

Risk of injury if the auxiliary products are handled improperly. Comply with the safety data sheets of the auxiliary products.

<table>
<thead>
<tr>
<th>Auxiliary products</th>
<th>Item no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning agent:</td>
<td>S 009 002</td>
</tr>
<tr>
<td>Surfaces in gas tanks</td>
<td>S 008 152</td>
</tr>
<tr>
<td>outside of the gas tanks</td>
<td>S 008 152</td>
</tr>
<tr>
<td>Lubricant KL;</td>
<td>ST 312-111-835</td>
</tr>
<tr>
<td>0.5 kg can</td>
<td>S 008 134</td>
</tr>
<tr>
<td>SF6 multi-purpose lubricant MS;</td>
<td>S 008 134</td>
</tr>
<tr>
<td>0.75 kg can</td>
<td>S 008 329</td>
</tr>
<tr>
<td>Screw locking compound Loctite®</td>
<td>S 008 329</td>
</tr>
<tr>
<td>Transport rollers</td>
<td>AGS 660 522-01</td>
</tr>
<tr>
<td>Transport aids (optional)</td>
<td>S 880 061</td>
</tr>
<tr>
<td>Touch-up pen RAL 7044</td>
<td>S 009 561</td>
</tr>
<tr>
<td>silk-grey, 50 ml</td>
<td>S 009 562</td>
</tr>
<tr>
<td>Touch-up pen, special paint</td>
<td>S 009 562</td>
</tr>
<tr>
<td>(specify colour shade)</td>
<td>S 009 562</td>
</tr>
</tbody>
</table>

The auxiliary products are available from the manufacturer.

The use of other auxiliary products is not admissible.

11.3 Screw couplings

The following elements must be used for all screw couplings:
- Screws and bolts: Grade ≥ 8.8,
- Nuts: Grade 8.

<table>
<thead>
<tr>
<th>Thread size</th>
<th>Tightening torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>min. 7 max. 9</td>
</tr>
<tr>
<td>M8</td>
<td>min. 16 max. 24</td>
</tr>
<tr>
<td>M10</td>
<td>min. 36 max. 44</td>
</tr>
<tr>
<td>M12</td>
<td>min. 63 max. 77</td>
</tr>
</tbody>
</table>

Table 1: Hex. bolts and socket-head cap screws (except slotted screws) and nuts (except self-locking nuts).

<table>
<thead>
<tr>
<th>Thread size</th>
<th>Tightening torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>min. 12.5 max. 15.5</td>
</tr>
<tr>
<td>M8</td>
<td>min. 32 max. 40</td>
</tr>
<tr>
<td>M10</td>
<td>min. 65 max. 79</td>
</tr>
<tr>
<td>M12</td>
<td>min. 90 max. 110</td>
</tr>
</tbody>
</table>

Table 2: Self-locking bolts and nuts.

<table>
<thead>
<tr>
<th>Thread size</th>
<th>Tightening torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>min. 5 max. 7.5</td>
</tr>
<tr>
<td>M8</td>
<td>min. 12 max. 18</td>
</tr>
<tr>
<td>M10</td>
<td>min. 24 max. 38</td>
</tr>
<tr>
<td>M12</td>
<td>min. 36 max. 54</td>
</tr>
</tbody>
</table>

Table 3: Screw coupling with casting nuts in cast resin parts.

<table>
<thead>
<tr>
<th>Thread size</th>
<th>Tightening torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>min. 5.5 max. 7.5</td>
</tr>
<tr>
<td>M8</td>
<td>min. 15 max. 19</td>
</tr>
<tr>
<td>M10</td>
<td>min. 30 max. 40</td>
</tr>
<tr>
<td>M12</td>
<td>min. 60 max. 76</td>
</tr>
</tbody>
</table>

Table 4: Screw coupling for current transfer, conductor material: copper.

Exception: Busbar fastening in section 4.6