Your safety first – at all times!

This is why our instruction manual begins with the following recommendations:

- Only install switchgear and/or switchboards in closed rooms suitable for electrical equipment.
- Ensure that installation, operation and maintenance are carried out by specialist electricians only.
- Fully comply with the legally recognized standards (IEC), the connection conditions of the local electrical utility and the applicable safety at work regulations.
- Observe the relevant information in the instruction manual for all actions involving switchgear and switchboards.
- **Danger!**
  
  Pay special attention to the hazard notes in the instruction manual marked with this warning symbol.
- Make sure that the specified data are not exceeded under switchgear or switchboard operating conditions.
- Keep the instruction manual accessible to all personnel involved in installation, operation and maintenance.
- The user’s personnel must act responsibly in all matters affecting safety at work and correct handling of the switchgear.

**WARNING**

Always follow the instruction manual and respect the rules of good engineering practice!

Hazardous voltage can cause electrical shocks and burns.

Disconnect power, then earth and short-circuit before proceeding with any work on this equipment.

If you have any further questions about this instruction manual, the members of our field organization will be pleased to provide the required information.

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1. Summary

1.1 General

This publication contains the information required for installation, putting into service, operation and maintenance of SecoGear air-insulated switchgear.

SecoGear is a three-phase, metal-clad, air-insulated switchgear and all the units are factory-assembled, type-tested and suitable for indoor applications of 24 kV. The units are designed as withdrawable modules and are fitted with a single busbar system. The withdrawable parts are equipped with circuit-breakers (SecoVac 24) and potential transformers.

Details of the technical design and configuration of individual switchgears, such as the technical data, detailed equipment lists for the individual panels and comprehensive circuit documentation etc., can be found in the relevant order documents.

For correct usage of the product, please read this manual carefully. It is always advisable to use the manual for all operations regarding installation, putting into service, operation and maintenance of SecoGear air-insulated switchgear to be carried out by specialized personnel.

1.2 Standards and specifications

SecoGear panels comply with the standards and specifications for factory-assembled, metal-clad and type tested high voltage switchgears to IEC publications 62271-200:2003. In addition, in accordance with IEC 60529, the switchgear panels have the following degrees of protection:

- IP 4X for the enclosure and IP 2X for the partitions.

All other corresponding IEC publications, national or local safety at work regulations and safety regulations for production materials must followed during erection and operation of these systems. Above and beyond this, the order-related data from GE must be taken into account.

1.3 Operating conditions

1.3.1 Normal operating conditions

The switchgears are fundamentally designed for the normal service conditions for indoor switchgears to IEC Publication 60694. The following limit values, among others, apply:

- Ambient temperature:
  - Maximum: + 40°C
  - 24h-Medium: +35°C
  - Minimum: -5°C

- Humidity
  - Highest average value measured over 24 hours
    Relative humidity 95 %
  - Highest average value measured over 1 month
    Relative humidity 90 %

The maximum site altitude is 1000 m above sea level.

1.3.2 Special operating conditions

Switchgears are suitable for operation in the climate of Withdrawable type according to IEC standard. Special operating conditions must be discussed with the manufacturer in advance.

For example:

- At site altitudes above 1000 m, the effects of the reduction in dielectric strength of the air on the insulation level must be taken into account.
- Increased ambient temperatures must be compensated for in the design of the busbars and branch conductors as well as for the withdrawable parts, otherwise the current carrying capacity will be limited. Heat dissipation in the switchgear panel can be assisted by fitting additional ventilation facilities.
Note on any special climatic operating conditions:
When switchgears are operated in areas with high humidity and/or major rapid temperature fluctuations, there is a risk of dew deposits which must remain an exception in normal operating conditions for indoor switchgear. Preventive action (e.g. fitting electric heaters) must be taken in consultation with the manufacturer to avoid this condensation phenomenon and any resulting corrosion or other adverse effects. The control of the heaters depends on the relevant project and details must be taken from the order documents.
2. Technical data

2.1 Main parameters for panels with circuit breakers

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage kV</td>
<td>24</td>
</tr>
<tr>
<td>Rated power frequency withstand voltage kV</td>
<td>50</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage kV</td>
<td>125</td>
</tr>
<tr>
<td>Rated frequency Hz</td>
<td>50</td>
</tr>
<tr>
<td>Rated current A</td>
<td>630/1250/1600/2000/2500</td>
</tr>
<tr>
<td>Rated short circuit breaking current KA</td>
<td>20/25</td>
</tr>
<tr>
<td>Rated short time withstand current(4s) A</td>
<td>20/25</td>
</tr>
<tr>
<td>Rated peak withstand current (1) kA</td>
<td>50/63</td>
</tr>
<tr>
<td>Rated short circuit connecting current KA</td>
<td>50/63</td>
</tr>
</tbody>
</table>

1) The short-circuit withstand capacity of the instrument transformers must be taken into account separately.

For individual switching device data, see the instruction manual for the relative switching device, as listed under 7.1.

2.2 Resistance to internal arc faults

The fault withstand capacity is as follows: 24 kV – 25 kA 1s

The switchgear units have been tested according to IEC 62271-200:2003 (appendix AA, class A, criteria 1 to 6). In individual cases, depending on the configuration of the switchgear panels and/or the switchroom conditions (e.g. low ceiling height), additional measures may be necessary to ensure compliance with criterion 5.

2.3 Dimensions and weights
Dimensions and weights of 24 kV units

<table>
<thead>
<tr>
<th>Dimension</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height A</td>
<td>2250</td>
</tr>
<tr>
<td>Width B</td>
<td>800</td>
</tr>
<tr>
<td>Depth C</td>
<td>1500</td>
</tr>
</tbody>
</table>

Weights of 24 kV panels (including withdrawable circuit-breaker parts):

<table>
<thead>
<tr>
<th>Rated current</th>
<th>Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1250</td>
<td>1000-1050</td>
</tr>
<tr>
<td>1600</td>
<td>1200</td>
</tr>
<tr>
<td>2000</td>
<td>1200</td>
</tr>
<tr>
<td>2500</td>
<td>1200</td>
</tr>
</tbody>
</table>

3. Panel design and equipment

3.1 Basic structure and variants (Figures 3/2 to 3/1)

SecoGear is equipped with withdrawable/fixed type SecoVac vacuum circuit breaker and can be configured for incoming/outgoing feeder, bus-tie and riser units. Each unit consist of three high voltage compartments i.e. (A) Main bus bar, (B) Circuit breaker, (C) Cable compartment and (D) Low voltage compartment for instruments and auxiliary circuits. Apart from this, there are variants for all operating needs. Pictures 3/2 shows examples of possible configurations of a panel including electrical equipment.

For busbar sectionalizing, two panels are necessary, the coupling panel with the withdrawable circuit-breaker part and a bus riser panel (optional with busbar metering and earthing). In equipment without busbar sectionalizing, a direct bar connection between the busbars will be established.

Further details about installation and switchgear equipment can be obtained from the documents of relevant order.

3.2 Enclosure and partitioning (Figure 3/1)

The enclosure and internal partitions of the panels are of 2 mm thick high quality Zinc-plated steel sheets. The three high voltage compartments (busbar compartment, circuit-breaker compartment and cable compartment) are equipped with top-mounted and secured pressure-relief flaps. These open in the case of overpressure due to an internal arc fault. The pressure-relief flaps are secured with steel screws on one longitudinal side and on the other longitudinal side with plastic screws. In the case of internal overpressure, the plastic screws are the point of rupture.

The front of the panel is closed off by pressure resistant doors which open to an angle of 130°.

Cable and circuit-breaker compartments have their own doors. The circuit-breaker compartments can be equipped with inspection windows made of security glass. Neighbouring panels are partitioned from one another by the side walls of each panel and, as a result of the design, the air cushion remains between these walls when the panels are jointed together.

The enclosure is completed above by top-mounted pressure-relief flaps which, according to the rated branch conductor current, are made of sheet steel or expanded metal and below by means of floor-covering 17, made of non magnetic material.

The switchgear can be equipped with the following systems:

- Fast recovery device: the auxiliary switches are mounted on the pressure sensors and operated by the sensor stroke pin (see chapter 3.6). Which trips the VCB without any delay during internal arc.

The necessary safety measures to counteract the effects of an internal arc fault must be ensured in relation to the ceiling height. In individual cases, this may require additional operator protection measures on the switchgear panels. These measures include:
1) Mounting a pressure-relief duct 50 on the top of the switchgear, with further channels leading out of the switchgear room in a form appropriate for the design of the building. The shock wave and arc discharge are channelled off in ducts (figure 5/8).

2) Mounting a pressure-relief duct with blow-out apertures located above the duct at the ends of the switchgear and pointing towards the centre of the switchgear (diverter duct). The shock wave and arc discharge then emerge in an extremely attenuated form and in a location which is not critical for the operating personnel.

The rear wall of the busbars of busbar compartment 84, intermediate wall 9, mounting plate 12 with shutters 12.1/1 2.2 and horizontal partition 20, form part of the internal partitioning.

The internal partitioning makes safe access to the circuit-breaker and cable compartments possible even when the busbars are live.

The low voltage compartment for the secondary equipment is completely protected from the high voltage area thanks to its steel-sheet casing.

On the end sides, cover plates ensure good appearance and are mechanically and thermally arc fault proof should such an event occur in the end panel.

Doors and rear walls as well as the cover plates are thoroughly cleaned and treated against corrosion before receiving a high quality double coating of paint. The finishing coat is in the standard RAL 7035 colour (special colours by agreement). Stoving completes the procedure and provides considerable insensitivity to impact and corrosion.

The circuit-breaker compartment and cable connection compartment doors are pressure resistant and can either be fitted with screws or manual closing systems. (central handle)

3.2.1 Ventilation of the panels (Figures 3/1, 6/15, 6/16)

Openings in the outer enclosure are needed for the purpose of ventilation in the case of certain rated currents in the busbars and branch bars.

For incoming air to the circuit-breaker compartment, the horizontal partition is provided with air-vents 20.2. IP4X degree of protection and safety in the case of any release of hot gas due to an arc fault are provided by flap 20.3 in the horizontal partition 20. For outgoing air, the pressure relief flaps 1.1 are made of expanded metal instead of flat steel sheets. The shape and size of the vents in expanded metal provide the IP4X degree of protection.

In cases of higher ambient temperature (>40°C) it may be necessary to install a fan in the horizontal partition. This is not standard. Please refer to figure 6/15 and 6/16.

3.3 Compartments in the panels

3.3.1 Busbar compartment (Figures 3/1, 5/12, 5/13 to 5/18)

The busbars 3 have a flat cross-section made of copper and are laid in sections from panel to panel.

Busbars and branch conductors are insulated by means of shrink-on sleeves. The bolt connections in busbar systems are covered by insulating covers 58.

By means of bushing plates 28 and busbar bushings 29, partitions can be created between panels. These partitions are necessary for higher rated short-time currents – see the following table.

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Rated short-time withstand current</th>
<th>Partitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 kV</td>
<td>25 kA</td>
<td>No</td>
</tr>
</tbody>
</table>

1) In these panels, busbar bushings 29 and bushing plates 28 need not be mounted - the dynamic strength of the busbar system is sufficient.

According to customer requirements, this separation into individual panels by means of busbar bushings 29 and bushing plates 28 can also be provided in switchgear panels. Top-mounted boxes with busbar earthing switches, or busbar voltage transformers can be placed above the units. For details, see chapter 5.5.
3.3.2 Circuit-breaker compartment (Figures 3/1, 5/11, 6/17)

The circuit-breaker compartment is isolated from all other compartments and equipped with shutter mechanism, racking mechanism, padlocking for shutter, auxiliary and control wiring socket.

Spout bushing on which tulip contacts from breaker gets connected are mounted on mounting bracket 12. The metal shutters 12.1/12.2, covering the insertion openings, are also included. The shutters are opened by means of actuating bars 13.16 of the withdrawable circuit-breaker part, using lever 38 when inserting into the service position, and are closed when the latter is removed. In the test/disconnected position of the withdrawable part, partitioning by separation is established in the main current circuit. Connection of the control wiring, required for test purposes, need not be interrupted when in the test/disconnected position.

In the test/disconnected position, the breaker remains completely inside the panel with the door closed. The ON/OFF pushbutton located on the circuit-breaker, and the mechanical indicators for ON/OFF and CHARGED/DISCHARGED can be observed through an inspection window. when circuit breaker is in service position.

The switching operations are carried out with the doors closed. Installation of an additional mechanical switching device for manual operation of the circuit-breaker in the service position is also possible.

The socket 10.1 for the control wiring is mounted fixed in the circuit-breaker compartment.

3.3.3 Withdrawable parts (Figures 3/1)

1. Withdrawable circuit-breaker parts

The withdrawable circuit-breaker forms a complete module consisting of the Vacuum circuit breakers type SecoVac the withdrawable assembly 13.15, isolated contact arm 4.2 with contact system 4.3 and control wiring plug 10.2.

The withdrawable assembly 13.15 and the circuit-breaker are coupled via a multi-pole control wiring plug connector 10.3.

The withdrawable assembly establishes the mechanical connection between the panel and the circuit-breaker. The fixed part is connected to the panel by forking, which is form coded on both sides. The moving part with the circuit-breaker is moved manually by means of a spindle, between the service or test/disconnected positions with the front doors closed. Service and test disconnected positions are set precisely by means of auxiliary switches, which register the final position reached and the angular position of the spindle.

The earthing connection between the withdrawable part and the panel is established by its rollers and travel rails 42, which are bolted onto the panel.

Withdrawable parts of the same design are interchangeable. In the case where the withdrawable parts have the same dimensions, but different circuit-breaker fittings, the control wiring plug coding prevents any erroneous connections between the withdrawable part and the panel. The coding is indicated in the order documents.

2. Other withdrawable parts

The withdrawable part can also be fitted with the following trucks:
– metering voltage transformers truck with fuses;
– earthing truck without making capacity (for main busbar system and power cables);
– earthing truck with making capacity (for main busbar system and power cables);
– power cable testing truck;
– isolation truck;
– isolation truck with fuses;
– shutters lifting truck.

3.3.4 Cable connection compartment (Figures 3/1, 5/9 to 5/11)

The cable compartment contains current transformers 7, fixed and withdrawable voltage transformers 8, and earthing switch 6, according to individual operating requirements in each case.

The cable compartment is constructed for installation of three current transformers. Should all three current transformers not be required, dummies will be installed in their place, using the same installation and connection procedures.

The voltage transformers mounted fixed are connected on the primary side with flexible, fully-insulated cables which are inserted into the transformers.
The removable voltage transformers are fitted with HRC fuses.

The ESW type earthing switch can be used with either a manual mechanism. Its switching position will be indicated both mechanically by indication on the shaft and electrically by means of the auxiliary switch.

In place of one cable termination surge arrestors can be connected mounted fixed on the panel.

**Cable connection:**
In the 800 mm wide panel, up to three parallel XLpe cables can be connected with single-core cable protection and push-on sealing ends with a maximum cross-section of 500 mm².

In the 1000 mm wide panel, up to six parallel plastic cables can be connected with single-core cable protection and push-on sealing ends with a maximum cross-section of 500 mm².

For more information regarding cable connection, see chapter 5.7.

3.3.5 Control cabinet (Figures 3/1, 5/11, 5/21)
The control cabinet is for all control and protection Requirements, suitable for both conventional or microprocessor control technology.

The height of the control cabinet is 580/705/1100 mm. For details, see chapter 2.3.

If the secondary devices are not intended for door installation, they are mounted on DIN RAILS. This enables any subsequent changes to the wiring. In the lower part of the control cabinet, there are three rows of DIN RAILS on the swiveling DIN RAIL holder and, below these, there is an easily accessible auxiliary switch for the control wiring plug.

Secondary wiring inside the panel is in a duct on the right side of the panel. The left side of the panel is for the external wiring. The ducts are covered with steel sheet metal 43.1, 43.2. There are holes for sliding in the ring conductors at the side of the control cabinet.

3.4 Interlock/protection against erroneous operation

3.4.1 Panel internal interlocking (Figure 3/1)
To prevent hazardous situations and erroneous operation, there is a series of interlocks to protect both personnel and equipment:

- The Vacuum circuit breaker can only be moved from the test/disconnected position (and back) when the circuit-breaker and earthing switch are off (i.e. the switch must be off beforehand.) In the intermediate position, the switch is mechanically interlocked. The electrical interlock can be provided with circuit breaker having electrical release.

- The circuit-breaker can only be switched on when the withdrawable part is in the test or service position. In the intermediate position, the switch is mechanically interlocked. When the circuit-breakers have an electrical release, the interlock is also electrical.

- In panels with digital control technology, prevention of malfunction of the switch can also be achieved by means of the control terminal.

- In the service or test positions, the circuit-breaker can only be switched off manually when no control voltage is applied and it cannot be closed (electromechanical interlock).

- Connecting and disconnecting the control wiring plug 10.2 is only possible in the test/disconnected position of the withdrawable part.

- The earthing switch 6 can only be switched on if the vacuum circuit breaker is in the test/disconnected position or outside of the panel (mechanical interlock 1).

- If the earthing switch is on, the vacuum circuit breaker part cannot be moved from the test/disconnected position to the service position (mechanical interlock).

- Optionally there can be interlocking on shutters to prevent opening them by hands. If it is applied then a shutter device needs to be ordered.

- Details of other possible interlocks, e.g. in connection with a locking magnet on the withdrawable part and/or earthing switch drive, can be obtained from the relevant order documents.
3.4.2 Doors interlocking

The panels can be equipped with the following door interlocks (all optional):

- The circuit-breaker cannot be racked-in if the apparatus compartment door is open.
- The circuit breaker compartment door cannot be opened if the circuit-breaker is in service or in an undefined position.
- The earthing switch cannot be operated if the cable compartment door is open.
- The cable compartment door cannot be opened if the earthing switch is open.

Note: When the interlocking for circuit breaker is used then is necessary to use OFF push button on door to provide emergency switching OFF.

3.4.3 Interlocks between panels (Figure 3/2-6, 3/2-7)

- The busbar earthing switch can only be closed when all the withdrawable parts in the relative bus-bar section are in the test/disconnected position (electromechanical 2) interlock).
- When the busbar earthing switch is closed, the vacuum circuit breaker in the earthed busbar section cannot be moved from the test/disconnected position to the service position (electromechanical interlock).

3.4.4 Locking devices (Figures 3/1, 6/13, 6/17)

- The shutters 12.1/12.2 can be secured independently of each other with padlocks when the withdrawable circuit-breaker has been removed.
- Access to the operating-shaft 14.1 of the earthing switch can be restricted with a padlock.
- Access to the circuit-breaker racking slot can be restricted with a padlock.
- Access to the circuit-breaker compartment and the cable compartment can be restricted with a padlock.
3.5 Cross sections of 24 kV panel variants

Figure 3/1: Example of SecoGear feeder unit
Figure 3/2-1: Feeder unit 24 kV, 1250 A, 25 kA

Figure 3/2-2: Feeder unit 24 kV, 2000 A, 25 kA with removable transformer

Figure 3/2-3: Feeder unit 24 kV, 1250 A, 25 kA, with top-mounted busbar voltage transformers

Figure 3/2-4: Feeder unit 24 kV, 1250 A, 25 kA, with top-mounted busbar earthing switch
Figure 3/2-5: Feeder unit - 24 kV, 2500 A, 25 kA

Figure 3/2-6: Bus tie - 24 kV, 2000 A, 25 kA - with earthing switch

Figure 3/2-7: Bus riser - 24 kV, 2000 A, 25 kA - with withdrawable voltage transformers

Figure 3/2-8: Busbar metering - 24 kV, with withdrawable voltage transformers
4. Dispatch and storage

4.1 Condition on delivery

At the time of dispatch, the SecoGear panels are factory-assembled, the withdrawable parts are in the service position and the doors are closed.

The factory-assembled panels are checked at the works for completeness in terms of the order and simultaneously subjected to routine testing (normally without AC voltage testing of the busbars) to IEC 62271-200:2003, and are therefore tested for correct structure and function.

The busbars are not assembled. The busbar material, fasteners and accessories are packed separately.

4.2 Packing

According to the kind of transport and country of destination, the panels packing may change it may remain unpacked or wrapped in foil and packed in seaworthy crates. A drying agent is provided to protect them against moisture:

- Panels with basic packing or without packing.
- Panels with seaworthy or similar packing (including packing for containerized shipments):
  - Sealed in polyethylene sheeting
  - Transport drying agent bags included
  - Moisture indicator included
- Observe the directions for use of the drying agent bags. The following applies:
  - Coloured indicator blue: contents dry
  - Coloured indicator pink: contents moist (relative humidity above 40%).

4.3 Transport (Figure 4/1)

The transport units normally comprise individual panels and, in exceptional cases, small groups of panels. The panels are each fitted with four lifting lugs.

Transport panels upright. Take the high centre of gravity into account. Carry out loading operations only when it has been ensured that all precautionary measures to protect personnel and materials have been taken and use of one of the following equipment is recommended:

- Crane
- Fork-lift truck and/or
- Manual trolley jack.

Loading by crane:

- Check the weight of the panel before lifting.
- Fit lifting ropes of appropriate load capacity with spring catches (eyebolt diameter: 30 mm)
- Keep an angle of at least 60° from the horizontal for the ropes leading to the crane hook.
- **Hang the unit using ALL four eyebolts!**

4.4 Delivery

The responsibilities of the consignee when the switchgear arrives at site include, but are not limited to, the following:

- Checking the consignment for completeness and lack of any damage (e.g. also for moisture and its detrimental effects). In case of doubt, the packing must be opened and then properly resealed, putting in new drying agent bags, when intermediate storage is necessary.
- If any quantities are short, or defects or transport damage are noted, these must be:
  - documented on the respective shipping document.
  - notified to the relevant carrier or forwarding agent immediately in accordance with the relative liability regulations.

**Note:**
Always take photographs to document any major damage.
4.5 Intermediate storage

Optimum intermediate storage, where it is necessary, without any negative consequences depends on compliance with a number of minimum conditions for the panels and assembly materials.

1. Panels with basic packing or without packing:
   - A dry well-ventilated store room with a climate in accordance with IEC 60694.
   - The room temperature must not fall below –5 °C.
   - There must not be any other negative environmental influences.
   - Store the panels upright.
   - Do not stack panels.
   - Panels with basic packing:
     - Open the packing, at least partially.
   - Panels without packing:
     - Loosely cover with protective sheeting.
     - Ensure that there is sufficient air circulation.
   - Check regularly for any condensation until installation.

2. Panels with seaworthy or similar packing with internal protective sheeting:
   - Store the transport units:
     - protected from the weather,
     - in a dry place,
     - safe from any damage.
   - Check the packing for damage.
   - Check the drying agent (also see section 4.2):
     - on arrival of the consignment,
     - subsequently at regular intervals.
   - When the maximum storage period, starting from the date of packing, has been exceeded:
     - the protective function of the packing can no longer be guaranteed,
     - take suitable action if intermediate storage is to continue.

**Warning:**

Do not walk on the roof of the panels (rupture points in pressure relief devices!).

The pressure relief devices could be damaged!
5. Assembly of the switchgear at site

In order to obtain an optimum installation sequence and ensure high quality standards, site installation of the switchgear should only be carried out by specially trained and skilled personnel, or GE approved skilled personnel.

5.1 General site requirements

On commencement of installation on site, the switch-room must be completely finished, provided with lighting and the electricity supply, lockable, dry and with facilities for ventilation. All the necessary preparations, such as wall openings, ducts, etc., for laying the power and control cables up to the switchgear must already be complete. Where switchgear panels have top-mounted structures for earthing switches or instrument transformers, it must be ensured that the ceiling height is sufficient for the opening travel of the pressure relief plates.

The ceiling must be high enough for assembly of pressure relief duct and/or top mounted VT box and earthing switch box.

Compliance with the conditions for indoor switchgear according to IEC 60694, including the conditions for the “minus 5 indoor” temperature class must be ensured.

5.2 Foundations (Figures 5/1 to 5/5)

We distinguish following 3 basic installation methods of switchgear in the switch room:

Method A – installation on the base irons of “C” profile shape

It is recommended to install the switchgear on the base irons of “C” profile shape set into the concrete floor of switch room. In this case we recommend to use the special bolt blocks for the fastening of units (Supplied by GE on request).

Method B – installation on the leveled concrete floor

The installation directly on the leveled concrete floor makes much higher demands on the leveling of floor, which must, in this case, fulfill the same tolerances as the base irons during the installation method A. The fastening is carried out by means of anchoring bolts in the concrete floor.

Method C – installation on the raised false floor

In this case the fastening of units is carried out by welding of outside panels to the steel floor frame in the place where the frame exceeds the switchgear bottom, this means on the outside lateral walls of units row. This method of installation is not recommended if the seismic resistance is required.

Generally it is possible to recommend the following procedure of switchgear anchoring and namely for any from the cited methods of installation:

1) The switchgear panels are bolted together in the front and rear part into one unit

2) If the seismic resistance is not required, it is not necessary to attach each switchgear panel to the floor or frame, but it suffices to fix outside panels in each row of switchgear only.

3) If the seismic resistance is required, it is necessary to attach each switchgear panel to the floor or frame. To reach the seismic resistance the special fixing system is used. This system makes preferably use of steel floor frame with „C” profile shape but moreover with an addition special fixing element – please contact the manufacturer for details.

Further given structural data guideline makes possible a rough calculation of the space required and planning of the room design for a switchgear project.

When the final construction documents are compiled for the execution of building, the binding data supplied by GE for a particular case must always be taken into account!

Dimension chart of structural data (also see figures 5/1 to 5/5)

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>kV</th>
<th>24 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel width FT</td>
<td>mm</td>
<td>800</td>
</tr>
<tr>
<td>Aisle width G</td>
<td>mm</td>
<td>1500</td>
</tr>
<tr>
<td>Door width</td>
<td>mm</td>
<td>1000</td>
</tr>
<tr>
<td>Door height</td>
<td>mm</td>
<td>2525</td>
</tr>
<tr>
<td>Width</td>
<td>mm</td>
<td>1000</td>
</tr>
<tr>
<td>Length</td>
<td>mm</td>
<td>1800</td>
</tr>
<tr>
<td>Ceiling load</td>
<td>kg/m²</td>
<td>900</td>
</tr>
</tbody>
</table>

1) Pay attention to appropriate national standards.
2) Applies to low voltage compartments of standard height.
3) Approximate numbers depending on the type of panels.

5.2.1 Method of installation A – Installation of the base irons:
The general foundation drawing is given in the figures 5/1 according to parameters of units.

- The base irons of "C" profile shape can be supplied by GE manufacturer together with the switchgear. Their installation is usually carried out by site personnel and should, if possible, be performed under supervision of a GE specialist. The base irons must be installed in the slab before finishing the floor:
  - Rest the irons in the specified position on the concrete floor as shown in the relevant foundation drawing and mark out holes for drilling in the place of prepared holes. Then drill the holes for anchoring bolts i.e. for plugs 14 for fixing of base irons in the floor. Then put the plugs in holes and attach the base irons to the floor slightly with the bolts 13 without end tightening to make possible the required leveling.
  - Carefully level base irons both longitudinally and transversally over the entire length and to the correct height by putting under strips of suitable thickness using a leveling instrument.

Tolerances for laying the floor frame are:

- Evenness tolerance: ± 1 mm within a measuring length of 1 m
- Straightness tolerance: 1 mm per 1 m, but not more than 3 mm over entire length of frame.

- After leveling of base irons tighten the bolts 13. The adjusted position of base irons on the concrete floor must not be changed during this operation! Check again and if need be correct deviations.
- Weld Individual parts of base irons inside „C“ profile in the seams together so that the conductive connection is mutually reached. The connection strips must avoid the opening for power cables so that they do not obstruct the cables.
- Make necessary measures for perfect earthing of the base irons with galvanized steel strips of dimensions min. 30 x 4 mm. Two earthing connections are recommended for the panel row longer as approx. 5 panels.
- When the floor top covering is applied, carefully backfill the floor frame, leaving no gaps. The top edge of floor frame should be 2 mm above the finished floor surface; the tolerance of this value is in the limits of 0 to 5 mm. This facilitates erection and alignment of the switchgear panels. In some cases, this means that the material thickness of an additional floor covering to be fitted later must be taken into account separately.
- The base irons must not be subjected to any harmful impact or pressures, particularly during the installation phase.

If these conditions are not respected, problems during assembly of the switchgear and possibly with movement of the withdrawable parts, as well as opening a closing of the doors cannot be ruled out.

**Attachment of units to the base irons of „C“ shape (Figure 5/5-2)**

The switchgear is attached to the base irons by means of special bolt blocks, which can be supplied on request.

- Put individual units of switchgear in successive steps on correct leveled installed base irons and level them according to the relevant foundation drawings.
- Level the units and then bolt them together in the front and rear part.
- To attach to base irons insert special bolt blocks into fixing holes at the bottom of units and tighten.

**5.2.2 Method of installation B – Fixing with anchoring bolts to concrete floor (Figure 5/5-1):**

The general foundation drawing is given in the figures 5/3, 5/4 according to parameters of units.

- Clean carefully the installation area of switchgear
- On the slab, according to the relevant outline drawing take the minimum wall and obstacle clearances into account.
- Level the floor both longitudinally and transversally; evenness tolerance is: 1 mm within a measuring length of 1 m.
- Drill the floor at the foreseen fixing points, referring to the slab drilling drawings. To make the holes, use a hammer drill with the bit according to used steel plugs.
- Insert the plugs in the holes and on the traced perimeters of units put the individual panels creating switchgear.
- Level the units and then bolt them together in the front and rear part.
- Fix the units with bolts with special washers (The coupling material is supplied by request).
- In the case of metal floor use the attachment according to the figure (Figure 5/5-3 or 5/5-4)

To make the holes, use a drill with a suitable bit for the type of fixing to be made (through or threaded hole).

**5.2.3 Method of installation C – Fixing to a flouting floor – Figure 5/6:**
The general foundation drawing is given in the figure 5/6 according to parameters of units. In most cases the flouting floor is created by steel structure in which the welded steel frame is installed. It is used the frame produced from suitable steel profiles. GE does not supply this frame.
- Clean the installation area.
- After installation of frame make necessary measures for perfect earthing of frame with galvanized steel strips of dimensions min. 30 x 4 mm. Two earthing connections are recommended for the panel row longer as approx. 5 panels.
- Put units on the frame according to the relevant foundation drawings, taking the minimum wall and obstacle clearances into account.
- Level the units and then bolt them together in the front and rear part.
- Carry out the attachment by welding of outside panels to the steel floor frame in the place where the frame exceeds the switchgear bottom, this means on the outside lateral walls of units row. This method of installation is not recommended if the seismic resistance is required.
- In the case of metal floor use the attachment according to the figure (Figure 5/5-3 or 5/5-4) To make the holes, use a drill with a suitable bit for the type of fixing to be made (through or threaded hole).

5.3 Assembly of the switchgear panels (Figures 3/1, 5/6 to 5/21)

Use screws of tensile class 8.8. The tightening torques for the busbar screw connections with dished washer are as follows:

<table>
<thead>
<tr>
<th>Thread</th>
<th>Without Lubricant</th>
<th>Oil or grease Lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>10.5</td>
<td>4.5</td>
</tr>
<tr>
<td>M8</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td>44.1</td>
<td>20</td>
</tr>
<tr>
<td>M12</td>
<td>74.6</td>
<td>40</td>
</tr>
<tr>
<td>M16</td>
<td>165</td>
<td>80</td>
</tr>
</tbody>
</table>

1) The rated tightening torques for fasteners without lubrication are based on a coefficient of friction for the thread of 0.14 (the actual values are subject to an unavoidable range, in part not inconsiderable).
2) Rated tightening torques for fasteners with lubrication in accordance with DIN 43 673 Standard.
3) Thread and head contact surface lubricated.

Any tightening torques that deviate from those in the general table (e.g. for contact systems or device terminals) must be taken into account as stated in the detailed technical documentation.

It is recommended that the threads and head contact surfaces of bolts should be lightly oiled or greased, so as to achieve a precise rated tightening torque.

The individual installation stages are as follows:
- Remove withdrawable parts 13 from the switchgear panels and store them with suitable protection.
- Dismantle lifting eyebolts 1.5.
- Transport the switchgear panels to the prepared installation point following the sequence shown on the switchgear plan.
- Remove vertical partitions 9 in front of the busbar compartments by releasing the fixing screws.
- Release the fixing screws and draw out horizontal partition 20 below the withdrawable part travel rails.
- Release and remove floor cover 17.
- Remove covers 43.2 and 43.3 from the vertical control wiring ducts at the front right and left of the panel.
- If any top-mounted enclosures with busbar earthing switches or instrument transformers have been removed for transport, bolt these in place in the specified position where the rear and middle pressure relief plates would otherwise be located on the switchgear panels, and make the internal connections again. (Figures 5/17 to 5/20).
- Fit and screw the separate mechanism enclosures for any top-mounted earthing switches in the specified position on the low voltage compartment with the front edge flush. Note the correct positions of the parts fitted on the hexagonal drive shaft supplied loose, and then remove the parts from the shaft, discarding the rubber ring at the front.
- Insert the drive shaft step by step at the front of the mechanism enclosure until it is completely fitted,
threading on the individual parts in the correct positions for the open position of the earthing switch.

Secure the setting rings. Adjust the mounting positions and operating moments of the auxiliary switches:

1. Adjust the positions of the auxiliary limit position switches in their slots in such a way that there is a run-on of 0.5 mm in the fully operated position before the plunger reaches the stop (for safety reasons).

2. The auxiliary limit position switch 78.4 for earthing switch ON must operate immediately after the dead centre position of the toggle spring mechanism is reached in the closing process and the automatic quick-closing process has started.

3. The auxiliary limit position switch 78.5 for earthing switch OFF must be operate during the opening movement of the slide (78.2) 1 mm before the tab of the slide makes contact with the armature of the de-energised locking magnet 78.6.

Fit and screw down the lids.

- Align the switchgear panels on the floor frame for correct positioning and vertical alignment (deviations of the panel edges from the vertical must not exceed 2 mm, especially at the front) and bolt the panels together. It is advisable to start from the centre when assembling switchgears with more than ten panels.

- When the switchgear has been properly assembled, fix the panels to the concrete floor using plugs, or weld or adequately bolt them to the foundation frame.

5.4 Installation of the busbars and bushings (Figures 3/1, 5/13 to 5/18)

Access to busbars is possible either from above after dismounting of the pressure relief plate 1.1 (fig. 3/1), or from the front of the circuit breaker compartment. After circuit breaker 13 has been withdrawn and horizontal partition 20 dismounted, partition 9 can be dismantled, which makes access to busbars from the circuit breaker compartment possible.

- Install bushings 29 (for switchgears with busbar barriers only).
- Clean the insulation on the busbar sections with a soft, dry cloth, and check for insulation damage.
- Remove greasy or adhesive dirt as described in section 7.3.
- Busbar connections:
  - The silver plated surfaces of the connections must be cleaned with a metal-free non-woven cleaning cloth and thinly and evenly coat with Isoflex Topas NB 52 grease.
  - The non-silver plated surfaces of the connections are either brushed with a wire brush, preserving the grease film, or cleaned with a metal-free non-woven cleaning cloth and evenly greased with a thin coat of Isoflex Topas NB 52.
- Prepare insulating covers 58 and lids 58.5 to suit the relevant busbar connections and thread them onto the busbar. (For insulated busbars only).
- Install the busbars panel by panel. Screw on the individual busbar elements one above the other (depending on the system layout) and in line with the flat branch conductor. Use the hexagonal socket head screws 163 provided. See the table above for the tightening torque. Use two dished washers for each screw.
- Bolt one holder 58.1 to each end of the busbars to support insulating cover 58. The screws for holder 58.1 must be tightened with a lower torque. (For insulated busbars only).
- Position insulating covers 58 and lids 58.5 over the relevant bolted joint, and slide the lid onto the cover until it clicks into place. (For insulated busbars only).

Note:
The connection of busbars is carried out with so called "stabilized connections". This means that quality of the copper busbar connections does not change depending on the operating time and therefore it is not necessary to inspect tightness of busbar connections regularly. But this is on condition that correct assembly is carried out as described above and especially that all connections are tightened with the prescribed torque according to the table in sect. 5.3.

We recommend only inspecting tightness of busbar connections during repairs - see sect. 7.4.1.
5.4.1 Busbars and bushings (Figures 5/13 to 5/18)
Busbars and branches are made of copper and both have a flat cross-section. Bushings for each phase have an electrode inside, which must be connected to the busbar. Busbars for 24 kV units are insulated by means of shrink sleeve and the connection points are covered by insulating covers.

Assembly procedure for bushings – main (upper) busbar system:

Insert bushing 29 for the lower busbar into bushing plate 28 from the right side, and the middle and upper one from the left side (see Fig. 5/13).

Lower bus-tie system:

Insert bushing 29 for the lower rear bus-tie into bushing plate 28.2 from the right side in contrast to the procedure for the other two bushings (see Fig. 5/14).

Important note:
Always check that there is good contact between the metal tube in the bushing and the busbar via contact spring 29.3. Ensure that the contact spring is in the correct position! (See Fig. 5/16).

5.5 Installation of the top-mounted boxes (Figures 5/18)

For transport reasons, attachments to the panels are not completed at our works. As far as possible however, they are pre-mounted.

5.5.1 Voltage transformer for busbar metering (Figures 5/18)

- Top-mounted box 79 with screw fixing material in the set of bags “Top-mounted box for metering” must be mounted on the busbar compartment.

Notes:
- In panels without busbar bushing plate 28, the partition between the busbar compartment and the top-mounted box is necessary. They are installed at the works in the top-mounted box.

- As far as equipment with busbar partitioning is concerned (i.e. with bushing plate 28), the space between the busbar compartment and the top-mounted box must remain open for purposes of pressure relief.

Connecting bars 2.2 with branch conductors 2 at the junction point must be screwed together according to figures 5/18. However, if necessary, the additional spacer plate 3.2 or 3.3 and threaded plate 3.4 or 3.8, as well as the screw fixing material from the “top-mounted box for metering” set of bags must be used.

- Insulating cover 58 must be brought into position as is described in section 5.4.

- Intermediate box 79.1, with the screw fixing material from the “top-mounted box for metering” set of bags must be mounted on the control cabinet. Conduction tube 79.2 must be positioned and inserted in reducer rings 79.3.

- Secondary circuits from the voltage transformers must be led to the terminal strips and connected according to the cable core markings and circuit diagram.
5.5.2 Earthing switch for busbar earthing (Figures 5/18, 5/19, 5/20)

- Top-mounted box 77 must be mounted on the busbar compartment using screw fixing material from the “top-mounted box for earthing” set of bags.
- Operating mechanism box 78 must be mounted on the control cabinet with screw fixing material from the “top-mounted box for earthing” set of bags.
- Pre-mounted single parts of hexagonal shaft 78.1 must be removed. Please pay attention to the sequence and angling of the parts!
- Hexagonal shaft from the operating mechanism box must be pushed through into the bevel gear of the earthing switch.
- Sequence and angles of the part must be restored!
- Connecting bars 2.2 with the branch conductors 2 at the junction point must be screwed together according to figure 5/18. However, if necessary, additional spacer plate 3.3 or 3.2 and threaded plate 3.4 or 3.8, as well as the screw fixing material from the “top-mounted box for earthing” set of bags must be used.
- Insulating cover 58 must be brought into position as described in section 5.4.

Note:
The auxiliary switches for the earthing switch are adjusted at the works. Problem-free operation is only guaranteed if the working elements on the hexagonal shaft are correctly mounted.

Because of final installation of the earthing switch and operating mechanism on site, it may be necessary to make precise adjustment of the auxiliary switches. In that case, the following is important:

- The auxiliary switch OFF 78.5 must be operated:
  - before slide 78.2 has uncovered half of the opening in front of the hexagonal shaft and
  - before the lower edge of the slide has touched the anchor of locking magnet 78.6.
- The auxiliary switch ON 78.4 must be operated
  - before the toggle spring of the earthing switch has reached its dead centre point.
- The push-rod of the auxiliary switch must still have about 0.5 mm to go to the end position in the operated position.

5.6 Pressure relief ducts (Figure 3/2-3, 5/2, 5/8)

- The pressure relief duct is supplied dismantled in single parts. The rear and front wall correspond, as far as length is concerned, with the appropriate panel width. They are joined together by means of the attachment strips.
- The screw fixing material is contained in the “pressure relief duct” set of bags. Rivet nuts are already provided in the metal sheets.

Note:
The rear pressure relief flap must be mounted according to figure 5/8.
Details regarding connection to the wall and a discharge grating for pressure relief outside the switchroom will be agreed on with the customer.

5.7 Cable connection

5.7.1 Power cables (Figures 5/9, 5/10)

The standard method for entry of power cables in the switchgear is shown in Fig. 5/9 and 5/10. The cables are conveyed from below through floor covering 17, which is divided at the cable entry point. The cables go through rubber reducer rings 17.2, which can be adapted to the required cable diameter in a range from 27 to 62 mm. Cables are fastened in the panel by means of cable clamps mounted on cable strips, which are part of the panel floor covering. The clamps make it possible to fasten cables with diameters between 35 and 54 mm.
Cable sealing ends are mounted on the cable cores according to the manufacturer's instructions. It is possible to use cable sealing ends of different manufactures (e.g. Pirelli, Raychem etc.), but it is necessary to keep the length of the cable ends, including cable sealing ends, which is given by the distance of cable connecting bars 23 from the panel floor covering. These bars have different versions, which differ in their number of parallel cables and the values of rated and short-circuit currents.

The bars are equipped with holes for M16 screws. If M12 screws are used for cable connections, special washers with the diameter for M12 screws are supplied. In all cases, the earthing of cable screens is carried out on the strip-holding cable clamps. The cable strip is connected to the earth potential.

It is also possible to place the removable arrangement of voltage transformers in the cable compartment. These can be fitted with HV fuses similar to those in the measuring panel. Three fixed mounted surge arresters can also be installed here. But in both these cases the number of parallel cables must be reduced – see the table.

Connection of cables in typical panels:

<table>
<thead>
<tr>
<th>Rated voltage (kV)</th>
<th>Panel width (mm)</th>
<th>Max. number of parallel cables in phase</th>
<th>Max. cross section of cables (mm²)</th>
<th>Range of cable clamp (mm)</th>
<th>Range of reducer ring (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>800</td>
<td>3</td>
<td>500</td>
<td>35 - 54</td>
<td>27 - 62</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) In the case where there are removable voltage transformers on the truck, or surge arresters are used, the number of parallel cables is reduced to a max. of 2 per phase.

2) In the case where there are removable voltage transformers on the truck, or surge arresters are used, the number of parallel cables is reduced to a max. of 4 per phase.

Connection of cables in the panel with switch-disconnector:

<table>
<thead>
<tr>
<th>Rated voltage (kV)</th>
<th>Panel width (mm)</th>
<th>Max. number of parallel cables in phase</th>
<th>Max. cross section of cables (mm²)</th>
<th>Range of cable clamp (mm)</th>
<th>Range of reducer ring (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>1000</td>
<td>1</td>
<td>240</td>
<td>35 - 54</td>
<td>27 - 62</td>
</tr>
</tbody>
</table>

Important notice:
Connection with single-core plastic insulated cables is presumed in the typical panels. In the case of any atypical cable connections or of special cables (e.g. three-core cables, cables with paper or special insulation etc.), an agreement must be reached between the customer and manufacturer.

Mounting procedure for power cables:
- Power cables must be inserted, cut to length and stripped.
- Reducer rings 17.2 must be adapted to the cable diameter and fitted onto the cable.
- Cable sealing ends 16 must be prepared and mounted on cable cores according to manufacturer’s instructions.
- Cable eyes must be connected to the prepared connections bars 23 with strain relief.
- Earthing of cables must be connected.
- Individual parts of the floor covering must be mounted.
- Reducer rings 17.2 must be moved down so that nuts in the rings fit into the corresponding recesses in the floor coverings. In this way, the cable passages are sealed.
- Cables must be fastened in the prepared cable clamps 21 (the maximum tightening torque applicable to the clamp screws is 9 ·2 Nm).
5.7.2 Control cables (Figures 3/1, 5/11)
The control cables are conveyed into the panel through the control wiring duct 1.2 on the left-hand panel side.
Mounting procedure:
- Insert the cables into the control wiring duct 1.2 on the left-hand side (Fig. 3/1). The duct is covered by covers 43.1, 43.2 (Fig. 5/11).
- Fasten the control cables at the top end of the duct, strip the insulation and convey cable control cores into the low voltage compartment D, after the terminal strip frame has been swung up (Fig. 5/21).
- Connect control cables to the terminal strip according to the circuit diagram.
- Make the control wiring connections to adjacent panels using bushing 24 (Fig. 5/6).

5.8 Earthing the switchgear (Figures 3/1, 5/10)
- Connect main earthing bar 19 with connections 19.1 provided in every panel.
- Protection wiring connection of the floor frame or the erected raised false floor respectively, should be made.
- Connect the earthing conductor coming from the earth electrode, preferably via a removable bolted connection for testing purposes, to the main earthing bar 19 of the switchgear.

5.9 Laying the ring circuits
The ring circuits are supplied rolled up in a bundle in the control cabinet or in the accessories. They are marked and fitted with ferrules or connectors at both ends. Openings are provided in the side walls of the control cabinet for these lines to be looped through from panel to panel.

5.10 Final erection work
- Check painted areas of the switchgear for possible damage, touching up where required (see also section 7.4.1).
- Check bolt connections and tighten where required, in particular all those carried out during on-site erection of the busbars and earthing system.
- After the lifting eyebolts have been removed, the Iₚ limiter auxiliary switch (if delivered) must be mounted and adjusted:
  - The auxiliary switch holder is fixed by means of screws 49.5 in the panel.
  - The auxiliary switch holder must be positioned horizontally.
  - The control pin of the auxiliary switch must be moved to the centre of the hole in the pressure relief flap.
  - If the auxiliary switch is mounted and adjusted according to the above instructions, checking during regular inspections is not necessary.
- Clean the switchgear thoroughly.
- Remove all foreign bodies from the panels.
- Correctly replace all coverings, etc. removed during erection and connection.
- In the enclosure, any remaining openings must be closed if they are no longer needed.
- Check the isolating contacts and interlocking mechanisms for smooth motion, and grease again with Isoflex Topas NB 52 where necessary (see section 7.4.1).
- Withdrawable circuit-breaker parts must be inserted and the control wirings connected.
- Panels doors must be properly closed.
5.11 Floor drawings

Fig. 5/1: SecoGear 24 kV
Guideline structural data for foundation frame on concrete floor It is not valid for the panel with switch-disconnector

C Panel depth with circuit breaker SecoVac 24 including combination with them is C = 1560 mm, in other cases C = 1520 mm – however always consider annotation 2)
G Width of operating aisle
FT Panel width
TB Door width = FT + 200 mm
TH Door height = panel height + 200 mm
1) Min. dimensions
2) Dimension must be verified in documentation of the relevant order
10 Door
11 Rear cover
12 Side end cover
13 Screw
14 Steel dowel
Figure 5/2: Example of 24 kV switchgear on foundation frame on concrete floor. Panel with pressure relief to the outside.

C Panel depth with circuit breaker including combination with them is C=1560 mm, in other cases C=1520 mm - however always consider annotation 2) 2)
Dimension must be verified according to documentation of the relevant order

Obr. 5/3-1: 24 kV – 800 mm wide units - anchoring bolt fixing system
Obr. 5/3-2: 24 kV – 800 mm wide units - base iron fixing system
Additional details for preparation of footprint – It is not valid for the panels with Switch-disconnector

Figure 5/5-1: anchoring bolts on concrete floor

Figure 5/5-2: base iron fixing system

Figure 5/5-3: through hole on metal structure

Figure 5/5-4: threaded hole on metal structure
Obr. 5/5-5: Guideline structural data for a raised false floor – SecoGear 24 kV

A Larger dimension is valid for the cubicle with circuit breaker including combination with them, in other cases smaller dimension is valid – however always consider annotation 2)

G Width of operating aisle
FT Panel width
TB Door width = FT + 200 mm
TH Door height = panel height + 200 mm
1) Min. dimensions
x) Max. dimensions
2) Dimension must be verified in documentation of the relevant order

---

10
20
20
20
20
20
80

A

20
80

FT

10

A

TB

TH

Section A-A

Example of profiles for foundation frame for a raised false floor

Section A-A

B

80

6

80

42

30

2,5

80

G
5.12 Photos assembly

Figure 5/6: For bolting the switchgear panels together, through holes are provided on the left-hand side and threaded bushes on the right-hand side, near the front and rear edges of the side walls, and through holes on both sides in the central part of the walls.

Figure 5/7: End panel of a switchboard with bolted-on cover plate.

Figure 5/8: Schematic diagram of the pressure relief duct. The components are assembled panel by panel and bolted together with overlaps at the panel joints.

50 pressure relief duct

1) If the switchgear is equipped with a pressure relief duct, the pressure relief flap for the cable connection compartment is fixed to the rear side of the panel and will open to the front (into the duct) in case of an arc fault.

Figure 5/8: Schematic diagram of the pressure relief duct. The components are assembled panel by panel and bolted together with overlaps at the panel joints.

50 pressure relief duct

1) If the switchgear is equipped with a pressure relief duct, the pressure relief flap for the cable connection compartment is fixed to the rear side of the panel and will open to the front (into the duct) in case of an arc fault.
Figure 5/9: View into the cable connection compartment, max. six parallel cables possible

1.8 Central catch
20 Horizontal partition, removable
43.1 Duct cover for external control cables

Figure 5/10 Partial view of the cable compartment, prepared

17 Floor cover, split
17.2 Reducer ring
19 Main earthing bar
19.1 Connecting link
19.2 Earthing connection pin
21 Cable clamp
39 Mounting rail, connected to earth

Figure 5/11: View into the high voltage area at the front

1.8 Central catch
20 Horizontal partition, removable
43.1 Duct cover for external control cables

Figure 5/12: View into the busbar compartment, shown without insulating covers

2 Branch conductor
3 Busbar
5 Tulip isolating contact
9 Partition, removable
5.13 Busbar junctions and partitioning drawings (24 kV)

Figure 5/13: Panels - 24 kV - Arrangement of the bushing plate and busbar bushings on the right-hand panel side wall with busbar barriers. View of the inside

2  Branch conductor
3  Busbar section
28  Bushing plate
29  Busbar bushing
29.1 Busbar support for single conductor
29.2 Busbar support for double conductor

Figure 5/14: Panels - 24 kV - Arrangement of the bushing plate and busbar bushings on the right-hand panel side wall in bus-tie panels. View of the inside

28.2 Bushing plate
29 Busbar bushing
29.1 Busbar support for single conductor
29.2 Busbar support for double conductor
Rated busbar current

1250 A  1250 A  1250 A

2500 A  2500 A  2500 A

Rated branch current

---

**Figure 5/15: Panels - 24 kV - Busbar junctions**

2 Branch conductor
3 Busbar section
3.4 M10 Bolt
58 Insulating cover

---

**Figure 5/16: Panels - 24 kV - detail of the busbar bushing, sectional view**

3 Busbar
29 Busbar bushing
29.2 Busbar support for double conductor
29.3 Contact spring
29.4 Metal tube

---

**Important note:**

The contact springs 29.3 must be inserted during the installation of busbars. These contact springs make the connection between the busbar 3 and the metal tube 29.4 and prevent damage caused by partial discharges inside the bushing on live busbars.

Always check that there is good contact between the metal tube 29.4 in the bushing and the busbars via the contact spring.
During assembly, cut out the insulating cover and lid to fit the cross section of the feeder bar or busbar.

Figure 5/17: Panels - 24 kV - Arrangement of the busbar and branch conductors at the busbar ends. In continuous busbars, the connections are similar, but without lid holder 58.1 and without spacer plate 3.5.

2 Branch conductor
3 Busbar section
3.5 Spacer plate
58 Insulating cover
58.1 Lid holder
58.5 Lid for insulating cover
(58.6) Washer ISO 7089
58.7 Washer 25 mm diameter
163 M10 hexagon socket head screw
164 M10 nut
165 10 mm spring washer
Figure 5/18: Panels 24 kV - Bolted busbar joint for top mounted box, shown for left-hand busbar end. In continuous busbars is the connection similarly, but without the lid holder 58.1 and without the spacer plate 3.5.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Branch conductor</td>
</tr>
<tr>
<td>2.2</td>
<td>Branch conductor to the top-mounted box</td>
</tr>
<tr>
<td>3</td>
<td>Busbar section</td>
</tr>
<tr>
<td>3.3</td>
<td>Spacer plate, 10 mm thick</td>
</tr>
<tr>
<td>3.4</td>
<td>Threaded plate</td>
</tr>
<tr>
<td>3.5</td>
<td>Spacer plate</td>
</tr>
<tr>
<td>58</td>
<td>Insulating cover</td>
</tr>
<tr>
<td>58.1</td>
<td>Lid holder</td>
</tr>
<tr>
<td>58.5</td>
<td>Lid for insulating cover</td>
</tr>
<tr>
<td>(58.6)</td>
<td>Washer 2 mm</td>
</tr>
<tr>
<td>58.7</td>
<td>Washer 3 mm</td>
</tr>
<tr>
<td>162</td>
<td>Cylinder screw</td>
</tr>
<tr>
<td>163</td>
<td>M10 hexagon socket head screw</td>
</tr>
<tr>
<td>165</td>
<td>10 mm spring washer</td>
</tr>
</tbody>
</table>
Figure 5/19: The earthing switch drive shaft is supplied loose when the top-mounted boxes are removed for transport purposes. View for the open position of the earthing switch with individual mechanism parts fitted in the positions for correct operation.

Figure 5/20: Operating mechanism area of top-mounted earthing switch in detail. Follow the sequence and arrangement of the parts on the drive shaft precisely when assembling. The figure shows the arrangement for the open position of the earthing switch.

78.4 Auxiliary limit position switch for earthing switch ON
78.5 Auxiliary limit position switch for earthing switch OFF
6. Operation of the switchgear

6.1 Commissioning

6.1.1 Preparatory work

In preparation for commissioning, the following work must be carried out prior to connection with the high voltage power supply:

- Check the general condition of the switchgear for any damage or defects.
- Visually inspect the switching devices, withdrawable parts, isolating contacts, insulating parts, etc.
- Check connection of the main earthing bar to the installation earthing conductor (following the appropriate safety regulations).
- Check the paintwork for damage and, where necessary, touch up as described in section 7.4.
- Remove all residues of materials, foreign bodies and tools from the switchgear.
- Clean the switchgear, rubbing down insulating parts with a soft, dry, clean, non-fraying cloth. Remove any greasy or sticky dirt as described in section 7.3.
- Correctly remount all covers etc. removed during assembly and testing procedures.
- Transport caps 13.9 on vacuum circuit-breakers - if still fitted - must be removed.
- Pole tube lids 13.10 on vacuum circuit-breakers may be fitted in certain systems and on certain circuit-breakers. Check that they are fitted correctly.
- Lifting eyebolts 13.13 on high current vacuum circuit-breakers must be removed if still fitted.
- Perform AC voltage testing of the main circuits according to IEC 62271-200:2003
where necessary. Pay special attention to voltage transformers and cables, etc. during this procedure. A testing and earthing module 142 can be used to make the connections (see section 6.3.2).

- Switch the auxiliary and control voltage on.
- Carry out testing operations on switching devices manually or by electrical control, and simultaneously observe the relative position indicators.
- Check mechanical and electrical interlocks for effectiveness, without using force.
- Set the protective devices in the switchgear to the required values and check their function with test equipment.
- In switchgear panels with an additional ventilation system for high current circuit-breakers (required for ambient temperature higher than > 40 °C and/or higher frequency - 60Hz - according to section 1.3 and figure 6/15 and 6/16), flap 20.3 must rest loosely against leaf spring 20.4 (with the centrifugal fan at a standstill, if fitted). This is not standard.

To check:
- Insert a suitable screwdriver through opening 20.5 in horizontal partition 20 and into bracket 20.6 on flap 20.3.
- Swing flap 20.3 upwards and allow it to rest loosely again on leaf spring 20.4.
- If the flap is in the locked position, use the screwdriver to press leaf spring 20.4 downwards by approx. 5 mm to release the lock before swinging the flap.
- If any centrifugal fans controlled in relation to primary current are fitted, also check that these function correctly.
- For any other matters regarding operation of the withdrawable circuit-breaker part and testing facilities for the withdrawable part, see section 7.5.
- Instruct local operators regarding the basic details of regular handling of the switchgear.
- Check readiness for operation and switching status of electrical systems upstream and downstream of the switchgear.

Depending on allocation of responsibilities, it may also be necessary to check the following equipment in areas adjacent to the switchgear:
- power cables
- auxiliary cables
- auxiliary power source
- remote control system
- complete earthing system
- switchroom equipment
- switchroom conditions

6.1.2 Start-up
- Comply with all relevant safety regulations.
- Ensure that the circuit-breakers in the system are in the OFF position.
- Remove any existing earthing and short circuiting connections in the critical switching area.
- Energize the feeder cables.
- Connect the switchgear step by step, observing the signals and indicators.
- Check that relative conductors are in phase, where necessary, when there are several incoming feeder cables and switchgear sections (also see section 6.3.2).
- Carry out all measurements and check all functions which depend on high voltage power supply being connected.
- Watch out for irregularities of any kind.

6.2 Switching operations

Carry out switching operations with the front doors closed!

6.2.1 Withdrawable apparatus (Figures 6/1, 6/5 to 6/12)

Manual insertion from the test/disconnected position to the service position:
- Connect control wiring plug 10.2
- Close the front door.
- Ensure that the apparatus is in the OFF position.
- Fit hand crank 121 on square spigot 18.1 of the spindle mechanism 18, after opening the
hole for them by turning slide 121.1.

- Turn the crank clockwise (approx. 30 at 24 kV) until the stop is reached and the Vacuum circuit breaker part is in the service position.
- Observe the position indicator.
- Remove hand crank 121.

It must be considered that the spring loaded pin head 18.2 will lie completely on the rear side of the panel door when the hand crank is moved from square spigot 18.1 of spindle mechanism 18. This ensures that the rear part of the pin head has been shifted onto the hexagonal cap of the spindle and prevents unintentional wrenching of the spindle during panel service. Wrenching may lead to the circuit-breaker blocking.

**Note:**
The Vacuum circuit breaker must not be stopped in any intermediate position in the travel range between the service and test/disconnected position!

Manual withdrawal from the service position into the test/disconnected position:

- Ensure that the apparatus is in the OFF position.
- Reverse the procedure described above for insertion into the service position.

**Important note:**

Insertion and withdrawal of circuit-breakers (and other withdrawable parts) must be gradual, in order to avoid any shocks which could deform the mechanical interlock. If the operations are prevented, do not force the interlocks and check that the operating sequence is correct. The force normally applicable to the insertion/withdrawing lever is 260 N. In any case, the maximum applicable force must never exceed 400 N. Please also refer to the technical documentation of the circuit-breakers for installation operations.

**Caution:** the insertion and withdrawal must always be carried out with the apparatus open!

Do not use force to move withdrawable parts with locking magnet Y0 or RL2 in the event of an auxiliary voltage drop. If this occurs, they are locked along the whole travel range between the service and test positions.

To remove the interlock, consult the technical documentation of the circuit-breakers.

**Withdrawal from the test/disconnected position onto the service truck:**

- Open the door of the circuit-breaker compartment.
- Release control wiring plug 10.2 and place it in the storage position on the withdrawable part.
- Position service truck 124 with guide pins 124.2 of the adjustable bench top at the correct height facing the panel front, and allow catch 124.3 to engage.
- Move sliding handles 13.11 inwards against the springs to release withdrawable part 13, draw the withdrawable part out onto the service truck and secure it in the catches on the truck.
- Press release lever 124.4 (at the front underneath the bench top) and release the service truck from the switchgear panel.
- Secure the position of the shutters with padlock 130 (Fig. 6/17).

**Insertion from the service truck into the test/disconnected position:**

- Carry out the procedure described above for withdrawal in reverse order.

**6.2.2 Circuit-breaker - SecoVac Charging the stored energy spring system:**

- On the circuit-breaker with charging motors, charging is carried out automatically. If the charging motor should fail, the charging procedure can be carried out or completed manually.
- On breakers with manual charging systems, either opens the door with the withdrawable part in the disconnected position, insert charging lever 128 into the recess and pump for approx. 25 strokes until the charged condition is indicated.
- Or breakers where the charging lever is integrated, take the lever and pump 10 times see fig. 6/4a.
- When the charged condition is reached, the charging mechanism is automatically disengaged, and any further strokes of the lever have no effect. See the fig. 6/4b.
Pumping is effective if the lever is moved in angle 90°.

---

**Opening and closing the circuit-breaker:**

- Opening and closing operations with the withdrawable part in the service position should only be performed with the door closed.
- Operate the local or remote electrical control.
- Observe the switch position indicator.

The switching operation counter 13.5 for the circuit-breaker automatically increases by one unit with each operating cycle.

An additional control mechanism fitted in the door of the circuit-breaker compartment enables mechanical operation of the circuit-breaker with the door closed and with the withdrawable part in either position (figures 6/8).

- Press the relative mechanical pushbutton, having previously turned knob 45.2 anti-clockwise to the stop if the withdrawable part is in the service position.
- Observe the switch position indicator.

---

### 6.2.3 Withdrawable metering parts

(Figures 3/2-2, 3/2-7, 3/2-8)

Handling of the withdrawable metering part in the metering panel is as described in section 6.2.1, without, however, the switching operations and interlocking functions.

Withdrawable metering parts in incoming and outgoing feeder panels are put into the cable compartment using a ramp. They reach their service position immediately and engage in the panel earthing by means of the two locking pins at the sides. The voltage transformers used correspond to the type used in the metering panel, and therefore HRC fuses can also be used along with the voltage transformers.

---

### 6.2.4 Earthing switch - type ESW

(Figures 3/2, 3/1, 6/12, 6/13, 6/14, 6/19)

The earthing switch - has a snap closing mechanism which is independent of the rotation of the drive shaft. An earthing switch 6 allocated to a circuit-breaker is only enabled for switching when withdrawable part 13 is in the test/disconnected position or removed from the switchgear panel. Only turn earthing switches on when the doors are closed.

Manual opening and closing:

- Press slide 14.2 onto the operating lever recess socket downwards. (When the switch is closed, it is already in this position!)

---

**Caution!**

If the operation is prevented, do not force the interlock and check that the operation sequence is correct.

- Fit operating lever 122 onto hexagonal shaft 14.1, which is now released for operation.

**Note:**

Put operating lever 122 in pointed upwards or downwards on the hexagonal shaft so that there is sufficient room for movement of the operating lever even if space is limited at the sides.

- Turn the lever clockwise through approx. 180° until the stop is reached to close the earthing switch, or anticlockwise until the stop is reached to open the earthing switch.
- Observe the mechanical/electrical switch position indicator.
- Remove operating lever 122. Slide 14.2 remains open if the earthing switch is in the closed position.

Make sure that the operating lever is turned right up to the stop in the opening process, to ensure that the earthing switch is in its defined limit position. The manual operating mechanism can also be fitted with a locking magnet.

---

### 6.2.5 Busbar earthing switch

(Figures 3/2-4, 5/19, 5/20)

To earth the busbars, earthing switches are used, also of type ESW. Their operating mechanism is identical to that of the branch earthing switches (see section 6.2.5). The conditions for panel to panel interlocking of the busbar earthing switches are described in
section 3.4.2.

6.2.6 Earthing and short-circuiting with earthing module

- Isolate the area to be earthed and secure it against reconnection.
- Carefully follow all safety regulations.
- Remove the withdrawable circuit-breaker part from the relative switchgear panel.
- Secure the shutter in front of the live contact pins by means of the padlock. Screw on
  the earthing module 142 actuating bars 142.1 as follows:
  - To the top position for opening of bottom shutter.
  - To the bottom position for opening of top shutter.
- Further screw on the earthing module 142 insulating plate 142.5 with 3 removable
  bushings as follows:
  - Contact arms 142.2 in the bottom position for earthing of cable output feeder.
  - Contact arms 142.2 in the top position for earthing of busbars.
- Insert the earthing module 142 into the test/disconnected position and then move it into
  the service position with the hand crank 121 (for procedure - see sect. 6.2.1).
- Using a high voltage tester, check that contact pins 142.7 of the earthing module are
  definitely off-circuit.
- Withdraw the earthing module back into the test/disconnected position (see sect. 6.2.1).
- Mount a complete short circuit link 142.8 on the earthing module 142. Connect one end
  of earthing cable 133.1 under one of three screws M12, with which short circuit link
  142.8 is connected to contact pins 142.7. Connect the second end of this cable to the
  earthing terminal 19.3 in the panel.
- Insert the earthing module 142 with short-circuit link 142.8 mounted and earthing cable
  133.1 returned from the test/disconnected position into the service position in the panel
  with hand crank 121. For safety reasons, insert the module only with the circuit-breaker
  compartment door closed and with door catches 1.8 locked (see Fig. 5/11).
- Display earthing warning label on the switchgear panel door.
- Secure neighboring areas to prevent inadvertent contact with live parts (e.g. feeder
cables). The procedure for removing earthing is the same, only in reverse order

6.3 Service trucks

Instead of earthing, short-circuiting and testing with module 142 (see chapters 6.2.9, 6.3.1, 6.3.2),
it is possible to use the service trucks.

These trucks are divided into four different
types: Earthing truck without making capacity

These trucks carry out the same function as the earthing switches without making capacity.
Therefore they do not have any capacity to earth the live circuits under fault conditions. They
are used to ensure fixed additional earthing, as required by the plant service and maintenance
procedures, as at further guarantee for personnel. The use of these trucks foresees removal of
the switching device from the switchgear (circuit-breaker) and its replacement with the truck.
The units preset for use of earthing trucks are fitted with a key lock which, if activated, prevents
their racking-in.

This truck is available in two versions:

- main busbar system earthing;
- power cable earthing.

During the racking-in phase, the main busbar earthing truck only lifts the top shutter and earths
the contacts connected to the top branches (and therefore to the main busbar system) by
means of the switchgear structure.
During the racking-in phase, the power cable earthing truck only lifts the bottom shutter and earths the contacts connected to the bottom branches (and therefore to the power cables) by means of the switchgear structure.

These trucks can also be used in the bus-tie units. In this case, they earth the two sides of the main busbar system.

**Earthing truck with making capacity**

These trucks carry out the same function as the earthing switches with making capacity. They consist of circuit-breakers only fitted with top (main busbar earthing) or bottom (power cable earthing) terminals. The contacts without terminals are short-circuited by means of a copper bar and connected to earth by means of the apparatus truck. They keep all the characteristics of the circuit-breakers, such as full making capacity and opening of the live circuits under fault conditions. They are used to ensure extremely efficacious earthing on circuits stressed by a fault. They allow opening and closing operations to be carried out rapidly with remote electric control.

The use of these trucks foresees removal of the switching device from the switchgear (circuit-breaker) and its replacement with the truck. The units preset for use of earthing trucks are fitted with a key lock which, if activated, prevents their racking-in.

This truck is available in two versions:
- main busbar system earthing;
- power cable earthing.

During the racking-in phase, the main busbar earthing truck only lifts the top shutter and presets the contacts connected to the top branches (and therefore the main busbar system) for closing to earth by means of a control.

During the racking-in phase, the power cable earthing truck only lifts the bottom shutter and presets the contact connected to the bottom branches (and therefore to the power cables) for closing to earth by means of the control.

These trucks can also be used in bus-tie units. In this case, they earth the two sides of the main busbar system.

**Power cable test truck**

These trucks allow the insulation tests to be carried out on the power cables without accessing the feeder unit or disconnecting the cables from the switchgear.

The use of this trucks foresees removal of the switching device from the switchgear (circuit-breaker) and its replacement with the truck.

During the racking-in phase, the truck only lifts the bottom shutter and, by means of the connectors it is fitted with, allows connection of the test apparatus cables.

This truck can only be used in the incoming/outgoing units.

**Isolation truck**

The isolation truck allows the switchgear top and bottom contacts to be connected directly. Connection is made extremely safe by using the poles of the circuit-breakers to insulate the connection bars from the external environment. In the incoming/outgoing units, it connects the main busbar system to the power cables, whereas in the bus-tie units, to the two sides of the busbar system.

This truck is used in the SecoGear switchgears to make incoming/outgoing units without circuit-breakers in radial networks, to make cable connections between two switchgears placed in front of each other, and for constructing interconnection units and creating bus-tie-riser units with double insulation (in this case, both the units are made from bus-ties, the first fitted with a circuit-breaker and the other with an isolation truck).
Figure 6/1: Operation of the door screw

1.18 Door screw
145 Double bit screw

Figure 6/2: Operation of the door catch

1.17 Door catch
Before inserting the hand crank, it is necessary to open the hole for it - turn the slide by means of the key test/disconnected position and the service position, clockwise up to the stop to the service position and anti-clockwise for the test/disconnected position.

121 Hand crank
Figure 6/15: Fitting of horizontal partition 20 with additional ventilation for high current circuit-breakers, required due to increased ambient temperature (>40°C) and/or increased frequency (60 Hz) according to section 1.3. The internal flap is shown in the service position (open). Side view, but without the wind vane with micro-switch required with a fan. Not standard.

20 Horizontal partition, here fitted with the additional ventilation facilities for the circuit-breaker
20.3 Flap
20.4 Leaf spring
20.5 Inspection aperture
20.6 Bracket
20.7 Centrifugal fan

Figure 6/16: Horizontal partition with additional ventilation facilities. Checking unimpeded movement of the internal flap 20.3

20.5 Inspection opening
Figure 6/19: Operating accessories

- 31.28 Emergency manual operating lever (for switching off VM1 type circuit-breaker)
- 31.29 Auxiliary spring to secure the opening capacity (for VM1 type circuit-breaker)
- 90.8 Charging lever (for circuit-breaker)
- 121 Hand crank (for moving the withdrawable part inside the panel)
- 122 Operating lever (for earthing switch)
- 128 Charging lever (for circuit-breaker)
- 145 Double bit key (for using the central catch and screw type door catch)
- 147 Hand crank (for using the central catch or screw type door)
7. Maintenance

7.1 General

Maintenance serves to preserve trouble-free operation and achieve the longest possible working life of the switchgear. It comprises the following closely related activities:

**Inspection:** Determination of the actual condition

**Servicing:** Measures to preserve the specified condition

**Repair:** Measures to restore the specified condition

**Note:**
When carrying out all maintenance work, the regulations in the country of installation must be strictly complied with.

Maintenance work may only be performed in a careful manner by trained personnel familiar with the characteristics of the individual switchgear, in accordance with all relevant IEC safety regulations and those of other technical authorities, and with other overriding instructions. It is recommended that GE service personnel be called in to perform the servicing and repair work detailed below.

The inspection and servicing intervals for some of the equipment/components (e.g. parts subjects 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 also environmental influences (including pollution and aggressive air).

If necessary, further details can be taken from the technical documentation for the switchgear installation (including, for example, any special operating conditions agreed on).

### 7.1.1 Intervals for inspection, servicing and repairs

Time intervals for maintenance work to be carried out always depend on the operating conditions of the switchgear, and mainly on the mode of operation, the number of rated and short-circuit current switching operations, ambient temperature, pollution etc. We recommend carrying out the maintenance work at the following intervals:

<table>
<thead>
<tr>
<th>Activity performed</th>
<th>According to section</th>
<th>Time interval in years</th>
<th>According to number of switching operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection</td>
<td>7.2</td>
<td>4</td>
<td>1)</td>
</tr>
<tr>
<td>Servicing</td>
<td>7.3</td>
<td>4</td>
<td>2) According to results of inspection</td>
</tr>
<tr>
<td>Repair</td>
<td>7.4</td>
<td>As required</td>
<td>3) See the instruction manual of the circuit-breakers</td>
</tr>
</tbody>
</table>
Where necessary, the working area must be isolated and secured against reconnection in accordance with the Safety Regulations specified by IEC and appropriate national standards before inspection.

Correct condition of the switchgear should be monitored by regular inspections.

Under normal operating conditions, inspection should be carried out once every four years by specially trained professional electricians.

Under abnormal operating conditions (including adverse climatic conditions) and/or special environmental stresses (heavy pollution and aggressive atmosphere, among others), inspection may be necessary at shorter intervals.

Inspection is primarily to carry out a visual check for grime, corrosion and moisture:
- Effects of high temperature on the main circuits,
- Traces of partial discharge on the insulating material parts,
- Traces of leakage current on the insulating material parts,
- Surfaces of the contact systems.

However, inspection must also to include correct mechanical/electrical operation of the following parts: switching devices, actuating, interlocking, protection and signalling devices.

Special conditions:

On panels with additional ventilation devices due to increased ambient temperature (see also section 1.3):

1. Check flap 20.3 for correct operation. (Also see section 6.1.1 and figures 6/15 and 6/16.)
2. The centrifugal fan (if fitted) does not require any special maintenance. Its working life - depending on the service conditions, and one significant parameter being the room temperature - is approx. between 20,000 and 30,000 operating hours.

Checking readiness for operation can be carried out as follows:

a) Load-dependent functional test with controllable primary current supply of the relative instrument transformer. On current rise:
   1. to approx. 70% of the rated instrument transformer current, the fan must start;
   2. to 80 % of the rated instrument transformer current, the fan must have reached the required minimum air flow. Corresponding monitoring/signalling by the wind vane with microswitch.

b) Basic checking with temporary operation of the centrifugal fan with an external power supply of 220 V AC.

c) In both cases, check for unimpeded normal running of the fan and listen for any unusual bearing noise. Remove any dirt on the fan rotor.

d) Check unimpeded operation of the wind vane and microswitch by starting the fan several times.

e) The wiring to removable horizontal partition 20 can be disconnected behind the right-hand side duct cover. Follow the circuit diagram and carefully reconnect the wiring again on completion.

Caution: instrument transformer circuit.

With regard to the switching devices, their separate Instruction manual should be followed.

Check all switchgear accessories and auxiliary devices (e.g. storage batteries).

No partial discharge must occur on the surfaces of equipment at operating voltage. This can, for example, be detected by characteristic noises, a clearly perceptible smell of ozone, or visible glowing in the dark.

Visually checking the contact system. We recommend to turn the contact system alternately in order to clean the inner contact points of the contact system.

The contact points should be cleaned if signs of overheating (discoloured surface) are visible (see section 7.4).

If any irregular conditions are detected, then relative repair measures must be taken.

7.3 Servicing

If, during the course of an inspection in accordance with section 7.2, the need for cleaning measures has been established, proceed as follows:

- Where necessary, the working area must be switched off and secured against reconnection in accordance with the Safety Regulations specified by IEC and appropriate national standards before cleaning.
Clean the surfaces in general:
- Weakly adhering dry dust deposits: with a soft dry cloth.
- More strongly adherent grime: with mildly alkaline household cleanser or with ETHANOL F 25 M.

Clean insulating surfaces and conductive components with ETHANOL F 25 M.

Wipe down after cleaning, using clean water, and dry properly.

Should partial discharges occur as a result of condensation, application of a thin silicone film on the surface concerned is often effective as a temporary remedy. It is advisable to ask the GE after-sales service department for advice regarding permanent solutions to this type of unusual problem.

7.4 Repair

7.4.1 Switchgear in general

Repair of surface damage:
- Carry out repair work immediately after a defect has been discovered.
- Completely remove all rust from damaged paintwork areas on steel sheet and other steel parts by mechanical means, e.g. with a wire brush.
- Lightly grind the surrounding paint coat and carefully degrease the entire area. Then immediately apply an anti-rust primer and, after an appropriate hardening time, apply the top coat. Only use suitable and compatible paint products.
- Apply the top coat in standard RAL 7035 colour, or the relevant special colour.
- Carefully remove any white rust on aluminium/zinc surfaces with a wire brush or cleaning pad, e.g. Scotch-Brite, and clean loosely adhering particles with a dry, non-fraying cloth. Next treat the cleaned parts with zinc spray or zinc powder paint and, finally, treat with aluminium spray for colour matching.
- Carefully remove any white rust from passivated operating parts and rust formation on phosphatised parts with a wire brush or metal-free cleaning pad, e.g. Scotch-Brite, and clean with a dry cloth. Then grease evenly (with Isoflex Topas NB 52).

Switchgear in general:
- Follow the maintenance instructions in the manuals for individual equipment components.
- Check that the bolt connections at the contact points in the busbar system and the earth connections are tight, and that the contact system functions correctly.
- Where necessary, grease slide plates and bearings in the panel again or thoroughly clean them. Then grease them again with Isoflex NB 52 lubricant.
- Top up grease on contact areas in the contact system when corroded or otherwise as necessary, or, when lubrication is inadequate or missing, thoroughly clean the areas concerned and grease them again with Isoflex Topas NB 52 lubricant.
- Remove the contact system for thorough cleaning as described below (Figures 7/1): - Slide in the two inner ring tension springs 4.4 facing the breaker pole to a position beside the other two outer ring tension springs, thus releasing contact system 4.3, and remove the contact system - The contact pin of the contact system and the slot on the contact arm must be cleaned and greased. Fit contact system back to front on the thin end of arbor 127 and slide it forwards onto the thicker part of the shank.
- Fit arbor 127 onto the relative contact arm 4.2, slide the contact system 4.3 over onto the contact arm, and withdraw the arbor.
- Check that all contact fingers and ring tension springs have a perfect fit.

Note:
The set installation position of contact arms 4.2 must not be changed by undue use of force

Replacement of the contact pins when the surface is damaged:

After any required replacement of contact pins 4.1, the latter should be retightened using the socket head bolts.

<table>
<thead>
<tr>
<th>Thread</th>
<th>Rated tightening torque ungreased</th>
</tr>
</thead>
<tbody>
<tr>
<td>M10</td>
<td>46 Nm</td>
</tr>
<tr>
<td>M20</td>
<td>250 Nm</td>
</tr>
</tbody>
</table>
7.4.2 Replacement of complex functional groups (Figures 3/1)

Precise matching of functions for control, interlocking and signaling only permits replacement of individual components to a limited extent.

The following assemblies are prefabricated and tested at the works, maintaining high quality standards. In the case of faults, they must therefore be completely replaced.

1. Withdrawable assembly:

- Disconnect plug connector 10.3.
- Remove interlock rod 13.91 with pin 13.27 from the withdrawable assembly.
- Remove the circuit-breaker from the withdrawable assembly (4 x M12 bolts).
- Mount the circuit-breaker on a new withdrawable assembly in the reverse order, using new circlips and special pliers for pin 13.27.
- Check the setting of interlocking rod 13.91.
  - Turn spindle 18 anti-clockwise to the stop for the disconnected position:
    - The distance between lever 13.26 and cam 13.25 must be 2~1 mm.
    - The distance between roller 13.24 and angle lever 13.92 must be 0.5 mm.
  - Turn spindle 18 clockwise to the stop for the service position:
    - The distance between lever 13.26 and cam 13.25 must be 2~1 mm.
    - The distance between roller 13.24 and angle lever 13.92 must be 0.5 mm.
  - Loosen bolts 13.91.2 or 13.92.1 for any necessary adjustment.

Note:
The auxiliary switches of the interchangeable groups are adjusted at the works.

When final installation of the earthing switch and operator takes place on site, it may be necessary to carry out further precise adjustment of the auxiliary switch. In this case, the following should be taken into account:

- There must be a run-on of 0.5 mm in the fully operated position before the plunger reaches the stop (for safety reasons).
- Auxiliary limit switch 11.4 for earthing switch ON must be operated immediately after the dead centre position of the toggle spring mechanism has been reached in the closing process and the automatic quick-closing process has started.
- Auxiliary limit switch 11.3 for earthing switch OFF must be operated on earthing switches with manual mechanisms during the opening movement of slide 14.2 before half of the hexagonal shaft has become visible, or 1 mm before the tab of the slide makes contact with the armature of the de-energised locking magnet.
7.5 Spare parts, auxiliary materials, lubricants

7.5.1 Spare parts
A spare parts list is available on request for procurement of spare parts. It basically includes moving parts and parts subject to wear. When parts are required, the serial number of the relative switchgear or switching device should always be quoted.

7.5.2 Auxiliary materials, lubricants

Lubricant:
- Isoflex Topas NB 52

Halogen-free cleansers:
- ETHANOL F 25 M (for general cleaning)

Touch-up paint:
Standard colour RAL 7032

Figure 7/1: Fit the contact system back-to-front on the thin end of the arbor and slide it onto the thicker shank area

Figure 7/2: Slide the contact system over from the arbor onto the isolating contact arm and allow it to engage there

127.1 127 4.3 4.2 4.6 127 4.3 4.4 127.1 Journal 4.2 Contact arm 4.3 Contact system 4.4 Internal tension spring 4.5 Hexagon socket head screw 127 Arbor
8. Product quality and environmental protection

The SecoGear type panels are produced in compliance with the requirements of international standards for the quality management system and environmental management system. In these fields, the excellent level is proved by quality certificates according to ISO 9001 and by the EMS according to ISO 14 001.

End of life of product

GE company is committed to complying with the relevant legal and other requirements for environment protection according to the ISO 14 001 standard.

The duty of company is to facilitate subsequent recycling or disposal at the end of product life.

During disposal of the product, it is always necessary to act in accordance with local legal requirements in force.

We the following methods of disposal:

Disposal can either be carried out thermally in an incineration plant or by storing on a waste site.

<table>
<thead>
<tr>
<th>RAW MATERIAL</th>
<th>RECOMMENDED METHOD OF DISPOSAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal material (Fe, Cu, Al, Ag, Zn, W, others)</td>
<td>Separation and recycling</td>
</tr>
<tr>
<td>Thermo plastics</td>
<td>Recycling or disposal</td>
</tr>
<tr>
<td>Epoxy resin</td>
<td>Separation of metal material and the disposal of rest</td>
</tr>
<tr>
<td>Rubber</td>
<td>Disposal</td>
</tr>
<tr>
<td>Oil as dielectric (transformer oil)</td>
<td>Draining from equipment and further recycling or disposal</td>
</tr>
<tr>
<td>SF6 gas</td>
<td>Discharging from equipment and further recycling or disposal</td>
</tr>
<tr>
<td>Packing material – wood</td>
<td>Recycling or disposal</td>
</tr>
<tr>
<td>Packing material – foil</td>
<td>Recycling or disposal</td>
</tr>
</tbody>
</table>
The data and illustrations are not binding. We reserve the right to make changes in the course of technical development of the product.