SF$_6$-insulated, extensible ring cable panel
Type GAE630 -1K-/3/ for accessible switchgear rooms
for rated voltages of up to 24 kV,
630 A rated current busbar
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1 General

1.1 Liability and warranty

All information and notes concerning operation and maintenance of the cable panel are provided under due consideration of our previous experience and to the best of our knowledge. This manual describes the standard cable panel.

All technical information and data contained in these operating instructions are up to date at the day of printing. We reserve the right for technical changes in the course of further development without changing these instructions.

We will not assume liability for damage or malfunctions resulting from operating errors, failure to observe these operating instructions or incorrect repairs.

Genuine spare parts from Ormazabal have been specially designed and tested for Ormazabal cable panels.

It is highly recommended to purchase spare parts and accessories only from Ormazabal. We would like to make explicitly clear, that any spare parts and accessories not supplied by us require the approval by Ormazabal.

The assembly and use of other products may have a negative effect on design specific characteristics of the cable panel and thereby impair the safety for man, cable panel or other property.

For damage resulting from the use of spare parts and accessories not approved by Ormazabal any liability by Ormazabal is excluded.

Any unauthorized conversions and changes to the cable panels are prohibited for safety reasons and cause the exclusion of any liability by Ormazabal for any damage resulting from this.

1.2 Service information

The customer service department of Ormazabal is always available for any technical information on Ormazabal cable panels.

Should you encounter any difficulties with our equipment, please contact the local manufacturing plant. The address of the local manufacturing branch can be found on the last page of these operating instructions.
2 Safety regulations

2.1 Intended use

The SF₆-insulated cable panel of the GAE630 type is a prefabricated, type approved, metal encapsulated interior switching panel for accessible switchgear rooms. As standard the cable panel can be extended with switchgear panels of the GAE630 type on both sides. The cable panel can be used with alternating current of up to 630 A (rated normal current) at rated operational voltages of up to 24 kV.

Cable panels are used for e. g.:
- Power grids
- industrial plants
- consumer’s installations
- wind turbine generators etc.

With the GAE630 cable panel:
- overhead lines and cables
- sectionalizers

are switched.

The cable panel must only be serviced and repaired by authorized persons, who have been instructed or trained accordingly.

These operating instructions must be carefully read and strictly observed before installing and commissioning the cable panel.

Each person involved in the installation, commissioning, operation, maintenance and repair of the unit must have read and understood these operating instructions, especially the chapter on safety regulations and any other notes on safety.

We recommend that the user/owner obtains written confirmation of compliance with this requirement.

Only the exact knowledge of these operating instructions helps to avoid operating errors and ensures trouble-free operation.

The general safety and accident prevention instruction issued by the legislator and possible regulations of the insurer, which may be different from country to country, must be strictly observed when operating and servicing the cable panel.

These operating instructions are part of the cable panel. When passing on the cable panel (relocation, selling or similar) the operating instructions must also be handed over.

2.2 Explanation of symbols and notes

Health and safety symbols
You will find these symbols with all health and safety instructions in these operating instructions in which reference is made to hazards for personnel.

Warning about risk of electric voltage
This special health and safety symbol warns against dangers due the risk of electric voltage.

Attention!
Cautionary instruction
In these operating instructions this note appears at all points which must be especially observed in order to comply with guidelines, instructions and the correct work sequence, thereby avoiding damage and destruction of the cable panel.
2.3 General health and safety instructions

The cable panels from Ormazabal are designed on the basis of the latest technical standard and under due consideration of all relevant safety instructions.

However, dangers for persons and property may arise from these cable panels if they are used incorrectly by untrained personnel or for purposes they are not intended for, if they are manipulated or if the safety regulations are disregarded. Each person involved in the installation, commissioning, operation or servicing of the cable panels must therefore have read and understood these instructions.

2.3.1 Operation

When operating the cable panel the responsibilities must be clearly specified and complied with, so that no unclear competences regarding safety will arise.

Before commissioning the cable panel and after service work or modifications the cable panel must be inspected by qualified personnel for a safe working condition.

Before starting operation all persons within the danger zone around the cable panel must be warned and asked to leave this area. There must not be any objects blocking the access to the controls.

The user must operate the cable panel only in perfect condition.

Any changes that degrade safety must be reported immediately to the supervisor.

Changes to the cable panel are only permitted in coordination with Ormazabal and under the supervision of expert personnel.

Specialist personnel are persons who, due to their professional training and experience, have sufficient knowledge in the field of electrical technology and are familiar with the applicable health and safety regulations (BGV A3), directives and the generally accepted technical rules and regulations (e. g. VDE-regulations, IEC standards, DIN-standards).

2.3.2 Safety features

Safety installations must not be modified, dismantled or made ineffective. Unprotected parts of the system can cause fatal injuries.

All safety installations, e. g. shrouds, must always be fully functional and correctly in place. Operation of this cable panel with faulty safety installations is not permitted.

2.3.3 Auxiliary device for operation, maintenance and repair

If any auxiliary devices (tools or similar) are required for operation, maintenance or repair of the cable panel, these must be in safe condition and should be used in a safe way.

Any unnecessary and endangering use of auxiliary devices of any kind on the cable panel is not permitted.

2.3.4 Statutory health and safety regulations

Apart from these notes on prevention of accidents and the notes attached to the cable panel the locally valid accident prevention instructions must also be observed.
3 Transport and installation

3.1 Safety notes for transport

1. Lifting tackle must only be used at points intended for this purpose.
2. Ropes, chains or other lifting tackle must be fitted with safety hooks.
3. Do not use any torn or worn ropes.
4. Ropes and chains must not be knotted.
5. Ropes and chains must not touch any sharp edges.
6. Use only ropes and chains of sufficient load bearing capacity. (For weight of GAE630 cable panel see chapter “Technical data”.)
7. Use only lifting gear of sufficient loading capacity. (For weight of GAE630 cable panel see chapter “Technical data”.)
8. Do not lift loads over persons.

3.2 Transport and unloading

The panel is delivered packed upright on a pallet. It is strapped to the pallet with tightening straps (Fig. 4).

For transportation or intermediate storage you should always use the original packaging and secure the cable panel with tightening straps (tightening belts), in the same way as for delivery.

When attaching the tightening straps make sure to attach these as shown in Fig. 4, as otherwise the cable connection compartment may be damaged.

During transport comply with the warning and safety notes on cable panel and packaging!

When unloading observe the notes on safety (see 3.1) and the applicable accident prevention instructions.

Unloading is only allowed to be performed by experienced persons who are fully familiar with the lifting gear. Observe the permissible hoisting weight of lifting tackle and lifting gear (forklift truck, crane).
3.3 Arrival and unpacking

Upon arrival check the cable panel immediately for any signs of transport damage:

- **Externally visible damage** must be confirmed by the driver on the freight documents. For actuarial reasons damages must be reported in writing to the delivering forwarding agent within a period of 3 days (!).
- **Hidden damage** can only be detected after removing the packaging material. Claims for transport damage found at a later date can only be accepted by us **within one week**.

Remove the tightening straps - the cable panel is now unsecured. Due to the design of the cable panel the centre of gravity is located in the middle of the unit.

⚠️ The cable panel may only be attached using the transport brackets provided. The transport bracket screw connections (Fig. 5) must be checked for tightness before lifting the Ring Main Unit (tightening torques see chapter 8, Table 2).

**Attention!**

When handling the cable panel in unsecured condition the unit may tip over!

This is of particular importance when transporting the cable panel to its final place of installation. It not allowed to use levers to transport the cable panel to its final position. This action could cause damage to the enclosure.

The cable panel must be transported with a 2-rope lifting tackle to avoid damage (Fig. 5).

When using lifting tackle, use tackle with 2 ropes with a rope length of at least 500 mm. Shorter rope lengths can lead to damage to the cable panel!

For particularly narrow transport passages (e.g. tower stations) the cable connection compartment can be disassembled. In such cases contact the customer service of Ormazabal.

After transporting the cable panel to the place of installation remove the transport brackets (Fig. 6) and close the fastening threads of the brackets with the hexagon screws.

For a possible later transport of the cable panel store the transport brackets in a suitable place.

In order to ensure a tight fit of the screws in case of a later installation of the transport brackets, the screws must be tightened with a torque according to chapter 8, Table 7.
Check the delivery for completeness.

The serial number on the delivery note must conform with the serial number mentioned on the rating plate (Fig. 7) of the cable panel.

### 3.4 Storage

In the factory the cable panel is packed ready for transport and storage. It is only to be stored in dry, clean rooms and is to be protected against excessive soiling. The environmental conditions must comply with IEC 6221-1 / DIN EN 62271-1 or VDE 0670 Part 1000, ambient temperature class “minus 5 indoor”.

![Fig. 7 Rating plate (example)](image-url)
3.5 Installation and assembly

For installation of the cable panel follow the illustrated installation plan. In order to assure secure standing of the cable panel use all fastening bores provided. The depths of the individual panel types in the GAE630 family vary. In order to ensure all possible block/panel combinations (excluding LSF panels) can be installed, the foundation projection must be drawn at a distance of 135 mm from the rear wall!

In the case of the installation of LSF panels, a minimum distance of 200 mm is necessary.

**Note!**

If it is assured that with any system extension no — GAE630 -1LSFx- panels — GAE630 metering panels with metal cooling stretch arrangement are installed, the distance from the wall can be reduced to 100 mm.

To simplify assembly of the modular switchgear GAE630, we recommend the following lateral wall distances for attaching from left to right:
- Distance from left wall at least 100 mm
- Right wall distance at least 300 mm.

In the case of installation from right to left, the distances from the side walls are reversed.

Reduced wall distances on request.

The area for the floor opening must not be reduced in size, so that, in case of an internal arc fault, the hot gases can be safely discharged.

A straight and level floor surface is a prerequisite for the stress-free installation of the cable panel. Pay attention to the information in DIN 43661. In particular the tolerance on the evenness (maximum 1 mm over a measured length of 1 m) and the tolerance on the straightness (maximum 1 mm per metre and maximum 2 mm over the entire length of the foundation rail) are to be observed.

**Note!**

To ease the assembly work on the installation of several GAE panels, we recommend the usage of a metal chassis.

The fastening material is not included in the items supplied.

To anchor the cable panel to a raised floor, we recommend the following fastening material:
- Hexagon screw M10 (minimum M8, strength class 5.6) DIN EN ISO 4017
- Washers DIN EN ISO 7093 (switch panel side)
- Washers DIN EN 7089/7090 (raisedfloor side) or tapered washers for anchoring to U-sections
- Spring lock ring DIN 127/DIN 128
- Hexagon nut M10 DIN EN ISO 4032

In the case of installation on concrete with a strength of \( \geq 25 \text{ N/mm}^2 \), we recommend the following fastening material:
- Fischer plastic dowels of type S12
- Wood screw DIN 571-10x80-St
- Washer DIN 125 A10

Remove front covers and cable fixing irons inside the cable connection compartment in order to gain access to the fastening bores (see chapter 5).
3.6 Planning of installation

3.6.1 Floor fastening measurements

Fig. 9 shows the floor fastening and floor opening measurements for a pressure relief into the cable cellar/cable trench.

3.6.2 Dimensions

Fig. 8 Cable panel GAE630-1K/-3/ (all dimensions are nominal dimensions [mm])
3.6.3 Possible installations

Installation possibility for cable panel in accessible switchgear rooms

**Attention!**

During installation make sure not to damage the bursting plate in the bottom of the gas tank (Fig. 10).

This diaphragm opens in case of an internal arc fault. The gases emerging must be discharged as shown in Fig. 10.

The cable trench must have a defined minimum cross-section. For the pressure relief of the cable trench the following rule of thumb must be applied:

- up to 3 panels: one metal cooling stretch arrangement (400 x 600 mm)
- from 4 panels: a second metal cooling stretch arrangement of the same size.

The metal cooling stretch arrangement must be arranged in a way that the cable trench is evenly divided.

In order to enhance the stability the rear wall of the cable panel can be fastened with two steel angles (not included in the scope of delivery). For this purpose use the screw connections from the transport device.

Please ask for our assistance in the planning and installation of the station.

The construction of the building and the switchgear room must withstand the expected mechanical loads and the internal pressure caused by a short-circuit arc. Appropriate calculations for these purposes are recommended. Switchgear related pressure calculations can be requested as part of the services provided by the sales department at Ormazabal GmbH.

Fig. 10
3.7 Installation of the supply line for the auxiliary and control circuits

The following installation work is necessary when laying the supply line for the auxiliary and control circuits:

**Note!**

For cable panels with fitted relay cabinet the cable leadin is effected through the roof or the side wall of the relay box. In this case the following assembly steps are not required.

⚠️ When working on the open drive of the cable panel the stored-energy drive must be in relieved condition. Never reach into the drive during the switching process. Accidental triggering of the drive can cause severe injury!

1. Unscrew the hexagon screws (2x) from the covering sheet.

2. Unscrew all Phillips head screws (6x) from the upper section of the front panel (Fig. 11/1).

3. Pull the front panel a few millimetres forward (Fig. 11/2).

4. Lift the covering sheet up from behind the front panel (Fig. 11/3).

5. Pull the covering sheet out of the clip-on clamps (Fig. 11/4).

**Note!**

Attaching further GAE630 panels and assembling end panels is effected using the assembly instructions "Panel screw connection for extensible GAE630 panels", order no. 12244002.

6. Use flexible plugs in the lateral openings of the drive mechanism housing for cable bushing protected against dust and moisture (see assembly instructions "Panel screw connection for extensible GAE630 panels", order no. 12244002).

**Attention!**

In the case of panels in a group, per opening **one plug is fitted for two adjacent side walls** for the drive mechanism housing.

7. For adaptation to the cable diameter use the separating lines on the plugs.

8. The covering sheet and front panel are fitted in the reverse order of removal in assembly steps 1 to 5.

As standard the cable panels are fitted with polystyrene caps on the side bushings to provide protection against soiling. The side wall sealing ends are to be fitted in accordance with the assembly instructions stated above.

In specific cases, cable panels can be already fitted with sealing ends in the side bushings from the factory. Check whether the sealing ends are fitted correctly to the side bushings and the bottom screw connection point is sealed with the screw plug (see Fig. 3). Please pay attention to the assembly instructions "Panel screw connection for extensible GAE630 panels", article no. 12244002.

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Fig. 11

Drive mechanism housing
Opening for cable bushing
Clip-on clamp
Covering sheet
Hexagon screw
Front panel

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3.8 Installation of the supply line for the auxiliary and control circuits with optional relay cabinet

There are openings for laying the supply line for the auxiliary and control circuits in the roof of the relay cabinet.

Flexible plugs are fitted in these openings, which provide a cable bushing protected against dust and moisture. For adaptation to the cable diameter use the separating lines on the plugs.

The supply line from a neighbouring panel on the left or right (loop cable) is laid through openings in the related side wall on the relay cabinet (Fig. 12).

If the relay cabinet on the neighbouring panel is fitted offset, the cable can be laid through the openings in the roof of the relay cabinet (Fig. 13).
3.8.1 Terminal connection diagrams for the individual extension groups

Fig. 14 shows the arrangement of auxiliary switches for the load-break switch and the earthing switch on the drive carrier.

Figures 16 to 18 show the connection diagrams for the individual extension groups.

Additional information of relevance for the wiring of the cable panel can be found in the enclosed circuitry documentation.
3.9 Earthing

The earthing of the cable panel must be performed in accordance with DIN VDE 0141. The cable panel is fitted with an earthing bus, which stretches the entire width of the panel (Fig. 18). As a measure to ensure an electrically conductive connection of the metal enclosure, earthing bus and enclosure are bolted with contact washers.

This makes sure that, in case of an earth fault or a double earth fault, the fault currents are safely discharged to the earth connection. The earthing bus is equipped with a screw joint (M12) for the connection of an earthing line to establish earthing of the unit.

In order to ease assembly of the earthing lead, the earthing terminals of the earthing bus and the cable fixing iron are fitted with insert nuts. On the cable fixing iron the cable lugs for the cable shields are fastened to the earthing terminals (M10). The cable fixing iron is designed with freely assignable earthing terminals.
4 Technical description

4.1 Description of the cable panel

The SF₆-insulated cable panel type GAE630 is characterized by the following features.

Primary switchgear and busbar are installed in a common gas tank. Sulphurhexafluoride (SF₆) is used as insulation and extinguishing medium. The cable panel can be used up to a rated voltage of 24 kV with a rated current of 630 A.

The cable panel is:
- metal-enclosed,
- almost low maintenance,
- suitable for severe climatic conditions,
- type-tested,
- extensible.

The cable panel complies with the specifications of the applicable standards and regulations as well as the statutory regulations. During manufacturing the cable panels are subjected to the quality guidelines of ISO 9001.

The load-break switch consists of the following core components:
- three-position switch / integrated switch-on resistant earthing switch
- Arc extinction by quenching coil
- maintenance-free spring drive
- no additional insulating distance generator required because the break distance is not bridged by the insulating substance
- SF₆ as insulating and quenching gas.

The system components, such as drive mechanism housing with drives, cable connection compartment and pedestal are attached to the gas tank in modular mode (see Fig. 1).

For an enhanced personnel protection the cable panel can be executed in an arc incident resistant design. In this case both the outside walls and the cover of the cable connection compartment and the front covers are reinforced.

The gas tank is reinforced with burn-out protection sheets as a protection against internal faults.

In case of an internal fault the pressure increase inside the gas tank is limited by the bursting plate (in the bottom of the gas tank). The burst protection, a clamped metal foil of low mass, opens at a gas overpressure of 200 kPa. The opening created by the pressed out metal foil controls the directed pressure relief of the hot gases into the compartment under the SF₆-gas tank and from there into the cable cellar or the cable trench (see Fig. 10).

The front cover provides a pressure-proof seal for the cable connection zone. It is plugged onto panhead rivets on the lateral field walls, then pushed vertically down and thereby locked in the cable connection compartment. Front covers can be additionally provided with inspection windows.

As standard the cable panel is equipped with various interlocking devices for safety reasons.

Switching interlock:
- An interlock against an unauthorized switching sequence between the actuating shafts of a panel

Front cover interlock:
- An interlock against unauthorized remove the frontcover during operation

Anti-reverse interlock (optional)
- An interlock against unauthorized switching-on of the load-break switch when the front cover is removed.

For more details refer to chapter 4.6.

All active parts are located in the gas tank filled with SF₆-insulating gas. The supply or discharge of energy is routed through cast resin bushings in accordance with DIN 47636 (see chapter "Technical data").

For cable connections technology commercial sets with taper, in accordance with DIN 47636, should be used.
4.2 Cable panel extension

The circuit-breaker panel GAE630 -1K- can be extended with panels/block modules from the GAE630 series on both sides. The design of the complete switchgear is oriented to the customer’s requirements. The busbars of the entire system are phase separated and arranged vertically above each other in the gas tank. The busbars of the panels to be attached are connected by means of contact bolts, which are inserted with double seals into the lateral bushings. The panels to be attached are laterally connected at two panel screw connection points.

When installing a switchgear without attaching, the lateral bushings must be secured with sealing ends to guarantee the dielectric strength of the switchgear. The screw plug is to be fitted in the bottom panel screw connection point. GAE630 panels can be delivered with pre-assembled sealing ends on the lateral bushings.

Fig. 19

The external side walls of the cable connection compartment in end panels must be secured with stiffening plate and arc proofed protection sheet.

Attention!

To install GAE630 panels and block modules in a group and to fit end panels, please proceed in accordance with the assembly instructions "Panel screw connection for extensible GAE630 panels", order no. 12244002.
4.3 Cable panel versions

The cable panel is available as a 1400 mm high version for accessible switchgear rooms.

The markings on the panel designation have the following meanings:

- 1 = single panel
- K = cable panel with drive without trip-free release
- = extendable on the right or left side

The pedestal for the cable panel is closed at the rear as standard. In case of an arc fault the hot gases are discharged into the cable cellar or into the cable trench. The cable trench must have a pressure relief opening (see Fig. 10).

The cable panel can be extended by panels or block modules of the GAE630 series on both sides. The extendibility to a complete Ring Main Unit is determined by the job specification issued by the customer.

The front cover is fitted with padlocking facilities as standard.

The cable panel can optionally be fitted with a motor operator for remote switching on and off. If the cable panel is equipped with a motor drive, a relay cabinet for the installation of secondary equipment can be mounted on top of the drive housing.

The equipment of the relay cabinets is customized acc. to order and may differ from the following description:

- terminal strip,
- remote control relay for ON or OFF to control the load-break switches
- miniature circuit-breakers to protect motors and control circuit,
- the changeover switch for local remote control,
- the push-buttons to switch the load-break switch ON/OFF by the motor drive,
- the complete wiring to the electric components of the GAE630 panel, such as: motor, auxiliary contact, short-circuit indicator.

Fig. 22  GAE630 -1K-

- Motor drive is fitted as an option
4.4 Three-position switch

The load-break switch is designed as three-position switch. The switching positions ON-OFF-EARTHED can be switched with only one switching element (switching blade). Fig. 23 shows a schematic representation of the three-position switch.

The technical design of the three-position switch (blade switch) is simple and reliable. In each phase a pair of switch blades, vertically arranged above each other in the gas tank, which slides onto the contact elements, is effective.

Contact elements and switch blades are coated with a non-welding and wear-resistant material. This results in a long lifetime of the switch elements. The lifetime of the load-break switch depends on the extend and number of short circuit breaks (see chapter "Technical Data").

The fixed contact elements of the individual switchgear units are connected with the busbar. The switch blades are connected with the bushings. The unit earthing contact/switching shaft is tripped via the drive and transmits the rotary movement via the coupling rod to the switch blades.

For the load-break switch a quenching coil is used as an quenching facility. During the breaking action of the switch blade from switching position ON to OFF the quenching facility ensures that the arc generated when separating the contacts is cooled and interrupted. The interruption of current therefore takes place after a short quenching period.

The quenching coil is designed to meet the switching capacity of the load-break switch.

In OFF-position of the load-break switch the isolating distance is generated without bridging by insulating agent.

Fig. 23

1 Bushing
2 Gas tank
3 Switching blade
4 Coupling bar
5 Earthing contact/switching shaft unit
6 Contact element (main current path)
7 Quenching facility
8 Busbars
9 Switch position: ON
10 Switch position: OFF
11 Switch position: EARTHED
4.5 Drive mechanism

4.5.1 Cable panel drive

The cable panel drive switches the load-break switch and the earthing switch of the cable panel to ON and OFF position.

All parts of the drive mechanism susceptible to corrosion are galvanically zinc-coated.

For the cable panels a spring drive (cable panel drive) with a combined acting pressure spring is used. The drive is installed on a U-shaped drive carrier; the actuating shafts for load-break switch (right) and earthing switch (left) are mounted in plain bearings in the webs of the drive carrier. Between these two actuating shafts the pressure spring works on a pin guide, which is rotably mounted on each actuating shaft by two welded tongues. Both actuating shafts are hollow shafts with integrated blade inhibitors, which prevent swinging of the switch blade to the opposite contact of the three-position switch when switching off.

These interlocks are unlocked when the switching levers are inserted (against spring pressure) into the actuating shaft. The transfer of the rotary movement of the actuating shafts to the switching shaft vertically arranged in the gas tank is accomplished by toggle links. On the actuating shafts the toggle links are fastened to lugs with actuating cams and mounted so they can rotate by means of bolt connections.

The operating lever, which is horizontally mounted on the switching shaft, has the function of a counter bearing for the two toggle links. The dogs fastened with pins to the ends of the toggle links are of freewheeling design, so that they can decouple each other during the switching process. The operating lever controls the switch position indicator mounted to the drive carrier.

![Diagram of drive mechanism](image-url)
4.5.2 Motor drive (optional)

A motor drive system (Fig. 25) can optionally be retrofitted to all drive types - even subsequently. This complies with all standard direct and alternating voltages.

For details see “Motor drive system for SF₆-insulated switchgear systems of type GA/GAE
- Load-break switch panels K, TS
- Circuit-breaker panels LSF“, Article no. 12265423.

4.6 Panel interlocks

The switchgear panels are equipped with the following interlocks as standard.

Switching interlock
- between load-break switch and earthing switch

Front cover interlock
- between earthing switch and front cover

Anti-reverse interlock (optional)
- between fastener and load-break switch.

Switching interlock and front cover interlock are activated or deactivated during the switching process via lever and rod drives.
Switching interlock (Fig. 27)

The interlock between load-break switch and earthing switch is accomplished by the position indicator plate, whereby the downward extended plate tongue slides laterally into the horizontal recess in the actuating shaft (earthing/load-break switch). Hereby always the opposite plug-in opening for the switching lever (actuating shaft), which is switched to ON-position, is closed.

When the actuating shaft for earthing is switched to ON-position, the actuating shaft for the load-break switch of this panel is closed (and vice versa). When switching both actuating shafts to OFF-position, the plugging openings for both actuating shafts are open.

Front cover interlock (Fig. 26)

On the front cover interlock a bolt is inserted into a recess on the front cover. Controlled via the drive the pin is only retracted from the front cover when the earthing switch is switched to ON-position. The front cover can be removed.

Anti-reverse interlock (optional) (Fig. 27)

The anti-reverse interlock is switched on or off with the fastener key and the fastener in the front cover via a link drive. When closing/opening the front cover the anti-reverse interlock is activated/deactivated at the same time.

A sheet metal tongue (in front of the position indicator blade) turns sideways into the horizontal recess in the actuating shaft and closes the plugging opening for the switching lever. With the fastener opened on the cable panel the sheet metal tongue closes the actuating shaft for the load-break switch and prevents activation of the load-break switch after the front cover has been removed.

With the front panel removed only the earthing switch can be switched off in order to check the cables.

Function of fastener:

- Turn the fastener clockwise to the end stop! The front cover is locked, the sheet metal tongue does not cover the plugging opening for the actuating shaft.
- Turn the fastener anticlockwise to the end stop! The front cover is unlocked, the sheet metal tongue covers the plug-in opening for the actuating shaft.
4.7 Gas tank

The power cables to the cable panel are connected to cast resin bushings with outer taper (acc. to DIN 47636 part 1 and 5), which are individually tested for compliance with the maximum permissible partial discharged values. Copper bars connect the three-position switch to the cable bushings. Three copper busbars are laid along the rear wall inside the gas tank with one outgoing per phase to the contact element for the three-position switch (Fig. 23). On the right hand side wall of the gas tank the copper busbars are bolted to the lateral bushings, by which the cable panel can be extended by another GAE-panel.

The guarantee for safe functioning of the sealed pressure system requires optimal mechanical processing of all mechanical components and an strict leak tightness of the tank. The gas tank is made of stainless steel. Bushings, sealing flange for actuating shaft and bursting plate are sealed towards the tank by means of sealing rings. The rotating stainless steel switching shaft of the three-position switch are sealed towards the tank by a double pair of radial seals.

After the evacuation process each cable panel is filled with dry SF\textsubscript{6}-gas, in accordance with IEC 60376. The addition of Al\textsubscript{2}O\textsubscript{3} absorbs smallest moisture quantities and permanently regenerates the SF\textsubscript{6}. The performance of a leak test according to IEC 62271-200 is proof that the permissible leak rate (10\textsuperscript{-7} mbar l/s) of the hermetically welded tank is not exceeded.

4.8 Gas leakage indicator

The gas pressure is indicated by a barometric cell type pressure gauge, connected to the tank via a non-return valve. The pressure gauge is corrosion-resistant against normal environmental influences.

The indication range (Fig. 28) is divided into two measuring ranges.

4.9 Pressure switch/density monitor (optional)

For remote monitoring the switchgear can optionally be equipped with a pressure switch or temperature-compensated density monitor, which works as a normally closed contact in the auxiliary circuit.

The bottom switching point of the pressure switch or temperature-compensated density monitor is 106 kPa abs.

If the pressure in the gas tank drops to 106 kPa abs., the pressure switch or temperature-compensated density monitor will report this pressure drop.

The bottom switching point of the pressure switch or temperature-compensated density monitor corresponds with the transition to the red measuring range on the scale of the gas leakage indicator.

The pressure switch or temperature-compensated density monitor is fastened to the non-return valve, together with the gas leakage indicator.

Before each switching process the gas leakage indicator and therefore the gas filling inside the tank must be checked.
4.10 Capacitive voltage detecting system

For the detection of the de-energized state a measuring bar (capacitive coupling part) is integrated in the front panel.

It is a HR-system acc. to VDE 0682, part 415 and IEC 61243-5.

The measuring bar consists of a plastic housing with all electronic components cast in.

Corrosion resistant sockets enable the connection of conventional display units. The coupling electrode in each bushing in series connection with the sub-capacitor has the function of a capacitive voltage divider.

The coupling part must be subjected a requalification test at regular intervals (approx. every 6 years). This test must be performed at the operational voltage using appropriate test units or adapters.

Captive shrouds protect the test sockets against dirt, dust and moisture (Fig. 29). Before the test these must be replaced by a suitable voltage tester (Table 1) (Fig. 30).

<table>
<thead>
<tr>
<th>Pfisterer</th>
<th>Type DSA-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horstmann</td>
<td>Type HO-ST-1</td>
</tr>
<tr>
<td>ELSIC</td>
<td>Type HO-SA</td>
</tr>
<tr>
<td>Jordan</td>
<td>Type DSP-HR</td>
</tr>
<tr>
<td>Dehn</td>
<td>Type DEHN cap/P-HR</td>
</tr>
</tbody>
</table>

Table 1

With a flashing indicator these units indicate that voltage is applied to the testing point of the bushing.

During every switch procedure (connection to or disconnection from the mains) the function of the capacitive voltage testing system must be checked, if a de-energized state is detected (see chapter 6.2). Always check all phases L1, L2, L3!
4.11 Short-circuit indicator (optional)

The cable panel can optionally be designed with short-circuit indicators. Two different designs can be installed.

**Short-circuit indicator mounted on the single-conductor cables (Fig. 31)**

These design types can vary.

- Short-circuit indicator with rotor system.
  In this case the rotary mounted rotor must be manually reset after it has tripped.

- Short-circuit indicator with liquid.
  The red particles whirled up after tripping remain suspended for 4–8 hours; after this time the indicator is clear again (automatic reset).

- Short-circuit indicator with fluid.
  (automatic reset) and micro-fleeting contact.
  The contact closes for the duration of the short-circuit and therefore makes possible remote signalling.

When installing the short-circuit indicators the earthing strand of the sealing end must be routed through the installation ring of the short-circuit indicator and connected to the earthing screw on the cable fixing iron.

For the use of these short-circuit indication systems the front covers are provided with inspection windows (optional).

**Short-circuit indicator for installation in front panel (Fig. 32).**

The indicator unit is integrated in a control panel plug-in housing acc. to DIN 43700 and is installed in the front panel of the cable panel next to the actuating shaft for the load-break switch for the assigned panel. In the factory three conversion sensors are mounted to the bushing, electrically connected to the indicator unit and tested.

The following types are used:

- **Short-circuit indicator type ALPHA M** (manual release).
  The indicator unit contains an electronic circuit with rotary knob generator and three rectangular flags, one for each phase in the panel. The indication is retained until it is manually reset by turning the rotary knob quickly in the counter clockwise direction. The function test on the short-circuit indicator is performed by turning the rotary knob quickly in the clockwise direction.

- **Short-circuit indicator ALPHA/E type** (automatic release).
  The indicator unit contains an electronic circuit, a test/reset button and three rectangular flags, one for each phase in the panel. The indication is maintained until it is automatically reset after two or four hours (factory setting). Premature resetting is possible by means of remote resetting or via the push button on the unit.
  The function test of the short-circuit indicator is performed by pressing the push-button.
  The energy for temporal resetting and function test is taken from a lithium cell (lifetime >15 years). The energy required for the excitation of the annunciators and for the remote contact is taken from the short-circuit current.

On customer request, other types of short-circuit indicators can also be fitted.
5 Operation

5.1 Switching accessories

The following accessories are needed to switch the cable panel (Fig. 33):

1 Switching lever for load-break switch (bare shaft)
   (optional for load-break switch and earthing switch (only in conjunction with 1-lever drive)).

2 Switching lever for earthing switch (red shaft)
   (only in conjunction with 2-lever drive).

3 Key for front cover fastener
   (controls the anti-reverse interlock).

The switching levers used to switch the cable panel are fitted with a torque reducing safety feature, which avoids damage to the drives. When trying to continue a switching operation in a switch position (ON/OFF) by application of force, the knob of the switching lever will bend.

Attention!

Never leave the switching lever plugged in the actuating shaft since the switching interlock of the panel is damaged by switching the other actuating shaft.
5.2 Padlocking facility

The cable panel is fitted with padlocking facilities as standard (Fig. 34). The padlocking facility is opened by pressing the thumb against the locking resistance of the locking cover in clockwise direction. The padlocking facility stops in end position by means of an integrated stop, so that also the adjacent padlocking facility can be opened. The access to the actuating shafts can be secured with a maximum of three locks on each padlocking facility.

**Note!**

In the description of the switching operations in chapters 5.3 and 5.4 the padlocking facilities are not shown, for the purpose of a clearer representation of switch position indicators and actuating shafts.
5.3 Delivery condition of the cable panel

Upon delivery the cable panel is in the following switch position:

![Fig. 35](image1)

Fastener closed
(Anti-reverse interlock optional).

![Fig. 36](image2)

Earthing switch activated.
Load-break switch deactivated and locked by switching interlock.

![Fig. 37](image3)

Turn the fastener anti-clockwise with the fastener key to the end stop.
Fastener opened
(Anti-reverse interlock optional).

---

### Note!

For reasons of clarity the drawings in chapters 5.3 and 5.4 do not show any padlocking facilities.

---

5.3.1 Remove the front cover

Before removing the front cover the particular panel has to be switched off and earthed (see chapter 5.4.2).

![Fig. 38](image4)

Earthing switch activated.
Load-break switch deactivated.

![Fig. 39](image5)

Front cover interlock

In the switch position described the front cover is removable, because the pin of the front cover interlock (see chapter 4.6 "Panel interlocks") has been pulled out of the front cover (Fig. 39)

Remove the front cover:
- Lift the front cover up against the stop (Fig. 40/1).
- Pull the front cover off to the front (Fig. 40/2).

---

![Fig. 40](image6)

Front covers
5.4 Switching

Before switching the cable panel check the gas leakage indicator.

In case of a red indication the cable panel must not be switched! In such a case inform the customer service of Ormazabal.

Prior to switching the load-break switch, the front cover must be fitted. The fastener must be closed with the fastener key. For this purpose turn the fastener key clockwise to the end stop (Fig. 43).

The switch positions of earthing and load-break switches can be read from the indicating device in the mimic diagram for the cable panel (Fig. 44).

Note!

Load-break switches and associated earthing switches are mechanically locked with each other.

If the earthing switch is switched ON the plug-in opening on the switching shaft of the corresponding loadbreak switch is closed by a locking plate.

Check the circuit state of the cable panel by means of a capacitive voltage detecting system (see chapter 6.2).
5.4.1 Switching the cable panel on

1. Switch position with deactivated load-break switch and activated earthing switch.

2. Switch off the earthing switch. Hold the switching lever (red shaft) depressed to the end stop against spring pressure and turn it anti-clockwise.

3. Switch position with deactivated load-break switch and deactivated earthing switch.

4. Switch the load-break switch on. Hold the switching lever (bare shaft) depressed to the end stop against spring pressure and turn it clockwise.

5. Switch position with activated load-break switch and deactivated earthing switch.
5.4.2 Switching off and earthing a cable panel

1. Switch position with activated load-break switch and deactivated earthing switch.

2. Switch off the load-break switch. Hold the switching lever (bare shaft) depressed to the end stop against spring pressure and turn it anti-clockwise.

3. Switch position with deactivated load-break switch and deactivated earthing switch.

   Verify safe isolation from supply acc. to VDE 0105 part 100 (if earthing is required). Always check all phases L1, L2, L3!

4. Switch on the earthing switches. Hold the switching lever (red shaft) depressed to the end stop against spring pressure and turn it clockwise.

5. Switch position with deactivated load-break switch and activated earthing switch.
6 Commissioning

For commissioning the correct function of the cable panel must be assured by testing the following points:

- Please compare the data of rating plate, delivery note and order documents.

- Check the wiring of the secondary equipment by following the specifications in the circuit documentation provided for the respective equipment configuration.

- Check all screwed connections (cable connections, equipment joints, system earthing) for tight fit (torque) and proper fastening.

- Check the available operating pressure on the gas pressure gauge (the pointer must be in the green sector).

- In case of an installed gas leakage indicator check the reading on the indicator via the remote indicator when the voltage supply is switched on.

- Check the function of the switch after installing the cable panel.

\[ \text{!} \] When installing a cable panel as an end panel make sure that the sealing ends are correctly fitted to the lateral bushings and that the bottom screw connection point is closed with the screw plug. Please observe the assembly instructions "Panel screw connection for extendable GAE630-panels", order no. 12244002.

\[ \text{Note!} \] We recommend during commissioning on site, after completion of the assembly, to perform a power frequency voltage withstand test as per VDE 0671 part 200 / DIN EN 62271-200 section 7.105.

Comply with the following operating sequences.

\[ \text{Note!} \] The switch panel is delivered with front panels earthed (chapter 5.3).

6.1 Switching (manually by means of switching lever)

SWITCHING ON
- Switch off the earthing switch.
- Switch on the load-break switch.

SWITCHING OFF
- Switch off the load-break switch.
- Switch on earthing switch.
6.2 Verifying the safe isolation from supply

Before disconnecting an operating cable panel from and connecting a cable panel to the mains supply net the panel must be checked for a de-energized state with the capacity voltage testing system.

⚠️ Attention! Tests must always be performed in triple-phase mode!

When checking a cable panel the following steps must be performed:

– With the cable panel switched on, open the shrouds for the capacitive measurement points.

– Insert 3 voltage testers (see Table 1, chap. 4.10) into the measuring sockets of the cable panel (Fig. 55).

The voltage testers must flash.

– Switch the load-break switch to “OFF”.

– De-energise also the second cable end.

The voltage testers must no longer flash!

– Switch the earthing switch to “ON”.

The outgoing cable is now electrically isolated.

– Upon completion of the test remove the voltage testers and turn back the shrouds to close the capacitive measuring points.

Fig. 55
6.3 Phase comparison

On the insulated test sockets a phase comparison can obviously also be performed between two outgoings (e.g. manuf. Horstmann: type Orion Manuf. Pfisterer: type EPV Manuf. ELSIC: type HO-PV). The correct function of the phase comparison device must be checked in compliance with the instructions of the manufacturer (Fig. 56).

Fig. 56
6.4 Cable test

The cable test is performed on the appropriately equipped cable set.

Fig. 57 shows a plug-in cable adapter of the AWK 10 type with assembled testing adapter of the PAM 400 type.

Fig. 58 shows a male cable connector of type AWKS with assembled testing adapter of type PAK 630.

For the execution of a cable test the following steps must be performed:

– Open the plugs for the capacitive measuring points by turning.
– Insert 3 voltage testers into the measuring sockets.

The voltage testers must flash.

– Switch the switch for the cable panel to be tested/measured to “OFF”.
– Isolate also the second cable end.

The voltage testers must no longer flash!

– Switch the earthing switch for the switchgear panel to be tested/measured to “ON”.
– Remove the front cover.
– Unscrew the threaded insert from the male cable adapter.
– Screw the test adapter onto the threaded pin of the male cable adapter (observe the tightening torque).
– Switch the earthing switch to “OFF”.
– Perform measurement/test. The panel can be tested with a maximum direct voltage of $8 \times U_0 = 96 \text{ kV}$, whereby the busbars may be applied to a rated voltage of maximum 24 kV!

After completion of the cable test:

– Switch the earthing switch to “ON”.
– Unscrew the testing adapter.
– Screw in the threaded insert from the male cable adapter (observe tightening torque).
– Insert the front cover.

The cable panel can be activated.
7 Maintenance

Maintenance and repair work as well as subsequent modifications must only be performed by skilled personnel and in compliance with the operating instructions, the accident prevention instructions and the regulations of the liability associations.

7.1 Inspection

Depending on the operating and local conditions an inspection of the cable panel should be performed every 4 years in order to check the condition of the cable panel.

In case of operation under severe environmental conditions (temperature, dirt, gases) shorter inspection intervals may be necessary. The operating pressure of the SF₆-gas tank should thereby be checked for pressure losses. As long as the pointer in the gas leakage indicator is in the green sector the pressure is sufficient.

The cable panel should be subjected to a general visual examination. Check the cable panel for any peculiarities such as dirt deposits or changes caused by other environmental influences.

7.2 Maintenance

The drives and the switches themselves are maintenance free.

The gas tank is welded gas-tight and all components inside are maintenance-free.

The SF₆ gas is resistant to ageing and is not consumed during the switching operations.

Under normal conditions the SF₆ gas does not need to be refilled during the lifetime of the panel.

7.3 Cleaning

Before starting cleaning work the cable panel must be switched.

As a measure to avoid impermissible switching processes the voltage supply must be switched off.

– Switch earthing switch to ON position.
– Open the fasteners and remove the front covers (if required).

Carefully clean off all dirt, especially from the surfaces of insulating materials. Clean off strongly adhering soiling, e. g. greasy soiling, using a lint-free cloth soaked in a household cleaning agent, then wipe off with clean water and dry.

Do not use any aggressive solvents!

7.4 Return of switchgear

For Ormazabal switchgear a 30-year operating time is assumed. The "sealed pressure system" acc. to IEC does not require refilling of the SF₆ gas over the entire operating time.

Due to the high reliability of the switchgear arc faults are almost completely ruled out. The handling and implementation of safety measures for switchgear, that has failed or has been taken out of operation because of such incidents, is described in the brochure "SF₆-systems", issued by the German official labour association for precision engineering and electrical engineering.

In 1993 the plant in Krefeld was certified acc. to DIN EN ISO 9001 for its quality system and in 1998 acc. to DIN EN ISO 14001 for its environment management system. As a competent partner Ormazabal offers you the return of your switchgear after the expiration of the above mentioned operating time. The costs involved depend on the legal requirements applicable at the time of return.

This switchgear contains the fluorinated greenhouse gas SF₆ covered by the Kyoto Protocol and with a global warming potential (GWP) 22200. SF₆ shall be recovered and not released into the atmosphere.

For further information on use and handling of SF₆ please refer to IEC 62271-303: High-voltage switchgear and controlgear – Part 303 Use and handling of sulphur hexafluoride (SF₆).

All other materials of this switchgear should also be recycled.
# 8 Technical data

## 8.1 General data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated filling pressure of insulating gas at 20 °C and 101.3 kPa</td>
<td>130 kPa (30 kPa overpressure)</td>
</tr>
<tr>
<td>Insulating gas</td>
<td>SF₆</td>
</tr>
<tr>
<td>SF₆-filling capacity at 20 °C and 101.3 kPa</td>
<td>0.61 kg</td>
</tr>
<tr>
<td>Rated density of insulating gas</td>
<td>7.9 kg/m³</td>
</tr>
<tr>
<td>Ambient temperature without secondary equipment</td>
<td>–25 to +40 °C (– 40 to + 40 °C on request)</td>
</tr>
<tr>
<td>Ambient temperature with secondary equipment ¹</td>
<td>–5 to +40 °C (–25 to + 40 °C on request)</td>
</tr>
<tr>
<td>Ambient temperature with reduced rated currents</td>
<td>over +40 °C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>maximum 95 % (indoor conditions)</td>
</tr>
<tr>
<td>Enclosure of HV compartment</td>
<td>sealed pressure system</td>
</tr>
<tr>
<td>Enclosure of HV compartment</td>
<td>in accordance with IEC, IP65/IP4X</td>
</tr>
<tr>
<td>Enclosure of the drive housing</td>
<td>IP44</td>
</tr>
<tr>
<td>Enclosure of cable connection compartment</td>
<td>IP44</td>
</tr>
<tr>
<td>Internal arc classification according to VDE 0671 part 200 or IEC 62271-200</td>
<td>IAC AFL 20 kA 1 s for HV compartment and connection compartment</td>
</tr>
<tr>
<td>Coloration of equipment</td>
<td>RAL 7035 (light grey)</td>
</tr>
<tr>
<td>Loss of service continuity category</td>
<td>LSC 2A</td>
</tr>
<tr>
<td>Partition class</td>
<td>PM</td>
</tr>
<tr>
<td>Weight</td>
<td>127 kg</td>
</tr>
</tbody>
</table>

¹) dependent on the secondary technology used

## 8.2 Cable panel

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Switch</th>
<th>Earthing electrode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency</td>
<td>fᵣ</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>Uᵣ</td>
<td>12/24 kV</td>
</tr>
<tr>
<td>Rated operating current</td>
<td>Iᵣ</td>
<td>630 A</td>
</tr>
<tr>
<td>Rated short-time power-frequency withstand voltage 1 min</td>
<td>Uₚ</td>
<td>50 kV</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>Uₚₑ</td>
<td>125 kV</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage of the air gap</td>
<td>Uₚₑ</td>
<td>145 kV</td>
</tr>
<tr>
<td>Rated mainly active load breaking current</td>
<td>Iₘₐₜ</td>
<td>630 A</td>
</tr>
<tr>
<td>Rated cable-charging breaking current</td>
<td>Iₘₜₐₕ</td>
<td>50 A</td>
</tr>
<tr>
<td>Rated earth fault breaking current</td>
<td>Iₘₜₐₕ</td>
<td>160 A</td>
</tr>
<tr>
<td>Rated cable and line-charging breaking current under earth fault conditions</td>
<td>Iₘₜₐₕ</td>
<td>100 A</td>
</tr>
<tr>
<td>Rated peak withstand current</td>
<td>Iₚ</td>
<td>50 kA</td>
</tr>
<tr>
<td>Rated short-time withstand current 1 s (optional 3 s)</td>
<td>Iₖ</td>
<td>20 kA</td>
</tr>
<tr>
<td>Rated short-circuit making current</td>
<td>Iₘₐₜ</td>
<td>50 kA</td>
</tr>
<tr>
<td>Number of switching events at Rated mainly active load breaking current</td>
<td>n</td>
<td>100</td>
</tr>
<tr>
<td>Number of switching events at Rated short-circuit making current</td>
<td>n</td>
<td>5</td>
</tr>
<tr>
<td>Number of mechanical switching cycles</td>
<td>n</td>
<td>1000</td>
</tr>
<tr>
<td>Class</td>
<td>-</td>
<td>E3 M1</td>
</tr>
<tr>
<td>Class</td>
<td>-</td>
<td>E2</td>
</tr>
</tbody>
</table>

Table 2

Table 3
8.3 Pressure switch/density monitor

8.3.1 Pressure switch 1) (optional)

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>60-400 hPa</td>
</tr>
<tr>
<td>Lower switch point</td>
<td>60 hPa</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>20-30 hPa</td>
</tr>
<tr>
<td>Make-break capacity</td>
<td>250 V / 1 A</td>
</tr>
</tbody>
</table>

Table 4

1) when using the pressure switch (optional) the operating conditions comply with class minus 5 indoor

8.3.2 Density monitor GMD1 (optional)

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>0-1000 hPa</td>
</tr>
<tr>
<td>Lower switch point</td>
<td>60 hPa</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>50 hPa</td>
</tr>
<tr>
<td>Make-break capacity</td>
<td>250 V / 5 A</td>
</tr>
</tbody>
</table>

Table 5

1) further tripping data on request

8.4 T-connection kits

T-connection kits are to be used on the discretion of the operator. To be connected to bushings acc. to DIN EN 50181 connection type C (630 A) with outside taper and screw contact (M16). On uncontrolled systems the installation instructions of the manufacturer must be strictly observed.

Installation possibilities for cable connection kits:

<table>
<thead>
<tr>
<th>NKT</th>
<th>Südkabel</th>
<th>tyco Electronics</th>
<th>Euromold/Nexans</th>
<th>Prysmian</th>
<th>Cellpack</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 kV</td>
<td>10 kV</td>
<td>10 kV</td>
<td>10 kV</td>
<td>10 kV</td>
<td>10 kV</td>
</tr>
<tr>
<td>XLPE-Cable</td>
<td>CB12</td>
<td>CB24</td>
<td>SET12</td>
<td>SET24</td>
<td>RSTI</td>
</tr>
<tr>
<td>CC12</td>
<td>CC24</td>
<td>SEHDT13</td>
<td>SEHDT23</td>
<td>RICS...</td>
<td>RICS...</td>
</tr>
<tr>
<td>CB36</td>
<td>CB36</td>
<td>SEHDT13.1</td>
<td>SEHDT23.1</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>AB12</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>AC12</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Table 6

8.5 Tightening torques

<table>
<thead>
<tr>
<th>Thread nominal diameter</th>
<th>Screw joints</th>
<th>Welded stud</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strength class 8.8</td>
<td></td>
</tr>
<tr>
<td>M5</td>
<td>6 Nm</td>
<td>-</td>
</tr>
<tr>
<td>M6</td>
<td>10 Nm</td>
<td>5.9 Nm</td>
</tr>
<tr>
<td>M8</td>
<td>25 Nm</td>
<td>14.7 / -0.2 Nm</td>
</tr>
<tr>
<td>M10</td>
<td>49 Nm</td>
<td>-</td>
</tr>
<tr>
<td>M12</td>
<td>86 Nm</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 7

Note!

The table values do not apply for tightening torques specially mentioned in the documents!
8.6 Switching forces with manual operation

<table>
<thead>
<tr>
<th>Drive type</th>
<th>Switch position</th>
<th>Torque</th>
<th>Force to be applied (manual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable panel drive earthing switch</td>
<td>Making / breaking</td>
<td>55 Nm</td>
<td>130 N</td>
</tr>
<tr>
<td>Cable panel drive load-break switch</td>
<td>Making / breaking</td>
<td>55 Nm</td>
<td>130 N</td>
</tr>
</tbody>
</table>

Table 8

8.7 Materials

Materials used in the cable panel:

<table>
<thead>
<tr>
<th>Metals</th>
<th>Steel, copper, aluminium, zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic materials</td>
<td>PC, PA, EPDM, NBR, EP, POM, Q, PPS (PF/MF, PBT, GFK-optional)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Aluminium oxide, lubricants, SF₆ gas</td>
</tr>
</tbody>
</table>

Table 9

8.8 Cable panel, mechanical switching operations

Fig. 59
8.9 Regulations and standards

8.9.1 Test specifications

The cable panel complies with the following VDE standards and/or IEC publications.

IEC 60265-1 (62271-103) / VDE 0670 Part 301 (VDE 0671 Part 103)
IEC 60529 / VDE 0470 part 1
IEC 61243-5 / VDE 0682 Part 415
IEC 62271-1 (60694) / VDE 0670 Part 1000 (VDE 0671 Part 1)
IEC 62271-102 / VDE 0671 part 102
IEC 62271-200 (60298) / VDE 0671 part 200 (VDE 0670 part 6)
IEC 62271-303 / VDE 0671 part 303

DIN EN ISO 9001

BlmSchV Federal Gazette 1996, part 1 no. 66 dated 20/12/1996

1) Future
2) Former

8.9.2 Female connector (bushing)

Design of terminal components acc. to DIN EN 50181 connection type C (630 A) with external taper and screw contact M16.
9 Accessories

Assembly kit end panel  Order no. 12238777
Assembly kit panel screw connection  Order no. 12238780
Extension kit end panel  Order no. 12238779