SF₆-insulated, extensible transformer outgoing panel
Type GAE630-1TS/-4/ for accessible switchgear rooms
for rated voltages of up to 24 kV
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13. Fastener
14. Tensioning lever
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16. Upper fuse holder
17. Front cover
18. Lower fuse holder
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20. Pedestal
21. Cable fixing iron
22. Strengthening plate for cable fixing irons (optional)
23. System earthing
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29. Side bushing (busbars)
30. Top panel screw connection
Assembly components for panel fitting

30  Top panel screw connection  
    (guide pin)  
31  Bushing with contact springs  
32  Contact bolt  
33  Double seal  
34  Bottom panel screw connection  
    (guide pin)
Fig. 3  Assembly components for the transformer outgoing panel if end panel in the overall switchgear

35  Sealing end side bushing
36  Clamping sheet
37  Busbar bushing (inside taper)
38  Contact springs
39  Single seal
40  Cover
41  Screw plug
42  Stiffening plate
43  Arc proofed protection sheet
1 General

1.1 Liability and warranty

All data and information on the operation and maintenance of the transformer outgoing panel are provided based on our past experience and to the best of our knowledge. These instructions describe the standard transformer outgoing panel.

All technical information and data contained in these operating instructions are up to date at the time of going to press. We reserve the right to make technical changes in the course of further development without the need to change these instructions.

No claims can therefore be raised on the basis of the information and descriptions in these instructions.

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

Ormazabal genuine spare parts have been specially designed and tested for Ormazabal transformer outgoing 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 installation and use of products from other manufacturers may have a negative effect on specific design characteristics of the transformer outgoing panel and degrade personal safety or place the transformer outgoing panel or other property at risk.

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 transformer outgoing panel are prohibited for safety reasons and cause the exclusion of any liability by Ormazabal for any resulting damage.

1.2 Service information

The customer service department of Ormazabal is always available for any technical information on Ormazabal transformer outgoing panel.

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 transformer outgoing panel of type GAE630 is a pre-fabricated, type-tested, metal-enclosed indoor switch panel for accessible switchgear rooms.

The transformer outgoing panel can as standard be extended on both sides with switchgear panels of type GAE.

The transformer outgoing panel can be used in the busbar line for alternating current up to 630 A (rated normal current) at a rated operational voltage of 24 kV.

The transformer outgoing (load-break switch with fuse base) is designed for a rated normal current up to 200 A (ahead of the fuse).

Transformer outgoing panels are used for e. g.:

- Power grids
- Industrial plants
- Consumer’s installations
- Wind turbine generators etc.

Transformers are switched using the GAE630 transformer outgoing panel.

The transformer outgoing panel is only allowed to be serviced and repaired by authorised personnel, who have been instructed or trained accordingly.

These operating instructions are to be read prior to the assembly and prior to the commissioning of the transformer outgoing panel.

All measures and notes mentioned in the operating instructions must be fully complied with during installation, commissioning and during operation.

Every 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 Ring Main Unit.

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

2.2 Explanation of symbols and notes

Observe these instructions and exercise extreme care in such cases. Hand out all notes on health and safety also to all persons who are involved in work on the equipment. Besides the notes in these operating instructions you must also comply with the generally valid safety and accident prevention instructions (e. g. DIN EN 50110, VDE 0105 Part 100, BGV A3).

Health and safety symbols

In these operating instructions you will meet these symbols with all notes on health and safety which highlight possible dangers for the health and life of persons.

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

Transformer outgoing panels from Ormazbab are designed to the latest technical standard and under due consideration of all relevant safety instructions.

However, dangers for persons and property may arise from these transformer outgoing 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. For this reason every person involved in the installation, commissioning, operation or maintenance of the transformer outgoing panel must have read and understood these instructions.

2.3.1 Operation

When operating the transformer outgoing panel the responsibilities must be clearly defined and observed, so that no unclear areas of responsibility in relation to safety arise.

Before commissioning the transformer outgoing panel and after maintenance work or modifications, it must be inspected by suitably qualified personnel to ensure it is in safe and correct working order.

Before commissioning, all personnel in the danger zone around the transformer outgoing 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 transformer outgoing panel only in correct working order.

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

Changes to the transformer outgoing panel must be strictly coordinated with Ormazbab and should only be performed under the supervision of specialist 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 the transformer outgoing panel with faulty safety features is not permissible.

2.3.3 Auxiliary device for operation, maintenance and repair

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

Any unnecessary or hazardous use of auxiliary devices of any kind on the transformer outgoing panel is not permissible.

2.3.4 Statutory health and safety regulations

Apart from these instructions on health and safety and those attached to the transformer outgoing panel, the locally applicable health and safety regulations are to be observed.
# 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. Only use ropes and chains of sufficient loading capacity (for weight of the GAE630 transformer outgoing panel see Table 1).
7. Only use lifting gear of sufficient loading capacity (for weight of the GAE630 transformer outgoing panel see Table 1).
8. Do not lift loads over persons.

## 3.2 Transport and unloading

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

For transportation or intermediate storage, please always use the original packaging and secure the transformer outgoing panel with straps 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.

Weight of the transformer outgoing panel

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight</th>
<th>Accessories</th>
<th>SF filling capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAE630 -1TS-/4/</td>
<td>approx. 140 kg</td>
<td>11 kg</td>
<td>0,78 kg</td>
</tr>
<tr>
<td>GAE630 -1TS-/4/ with</td>
<td>approx. 230 kg</td>
<td>11 kg</td>
<td>0,78 kg</td>
</tr>
<tr>
<td>pressure absorber channel</td>
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</tbody>
</table>

Table 1

During transport comply with the warning and safety notes on transformer outgoing 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 transformer outgoing panel immediately for any signs of transport damage:

- **Externally visible damage** must be confirmed by the driver on the freight documents. For insurance reasons, damage must be reported in writing to the delivering freight carrier 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 transformer outgoing panel is now unsecured. Due to its design, the centre of gravity of the transformer outgoing panel is in the area of the middle of the switchgear.

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

⚠️ **Attention!**

The transformer outgoing panel may tip if handled while is not secured!

Particular attention is to be paid to this issue when transporting the transformer outgoing panel to its place of installation. It is not allowed to use levers to transport the transformer outgoing panel to its final position. This action could cause damage to the enclosure.

To prevent damage, the transformer outgoing panel is to be moved using 2 ropes (Fig. 5).
After transporting the transformer outgoing panel to the place of installation remove the transport brackets (Fig. 6) and close the fastening threads for the brackets with the hexagon screws.

For a possible later transport of the transformer outgoing 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 8.

- 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 transformer outgoing panel.

### 3.4 Storage

The transformer outgoing panel is packed ready for transport and storage in the factory. 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 62271-1 / DIN EN 62271-1 and VDE 0670 Part 1000, ambient temperature class “minus 5 indoor”.

![Fig. 7 Rating plate](example)

<table>
<thead>
<tr>
<th></th>
<th>1 Serial number</th>
<th>2 Technical data</th>
<th>3 Standards applied</th>
<th>4 Document numbers of the corresponding operating instructions (German/English)</th>
<th>5 Type of unit</th>
<th>6 Manufacturing date: month/year</th>
</tr>
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<tbody>
<tr>
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3.5 Installation and assembly

For installation of the transformer outgoing panel follow the installation plan shown. In order to assure secure standing of the transformer outgoing panel use all fixing holes 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 certain that during a system extension no:
- GAE630 -LSFx- panels
- GAE630 metering panels with metal cooling stretch arrangements will be installed, the distance from the wall can be defined as 100 mm.

To ease the assembly of the modular switchgear GAE630, we recommend the following distances from side walls on installation from left to right:
- Distance from left wall at least 100 mm
- Distance from right wall at least 300 mm

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

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 flat, level floor is a required for the stress-free installation of the transformer outgoing 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 fixing material is not included in the items supplied.

To anchor the transformer outgoing panel to a raised floor, we recommend the following fixing 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 ISO 7089/7090 (raised floor 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 fixing 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 holes (see chapter 5).
3.6 Planning of installation

3.6.1 Base fixing dimensions

Fig. 8 shows the base fixing and floor opening dimensions for pressure relief only into the cable cellar/cable trench.

Fig. 9 shows the base fixing and floor opening dimensions for pressure relief via the rear pressure absorber channel.

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

Fig. 10 Transformer outgoing panel GAE630 -1TS/-4/ (all dimensions are nominal dimensions [mm])
3.6.3 Possible installations

Installation possibilities for transformer outgoing panels in accessible switchgear rooms.

**Attention!**

During installation make sure not to damage the burst protection in the bottom of the gas tank. This diaphragm opens in case of an internal arc fault. The gases emerging must be discharged as shown in Fig. 11.

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 back plate of the transformer outgoing panel can be fastened with two steel angles (not included in the scope of delivery). For this purpose use the screws 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.

Rear pressure absorber channels are available on request. In combination with metal absorbers these absorber channels allow an installation of the Ring Main Unit on closed panel base.

The pressure relief takes place towards the top on the back side. This version also meets the standard: internal arc classification IAC AFL 20 kA 1 s.
3.7 Laying the supply line for the auxiliary and control circuits

The following installation work is necessary to lay the supply line for the auxiliary and control circuits:

**Note!**

On transformer outgoing panels with a relay cabinet fitted, the cables are laid in the roof or in the side wall of the relay cabinet. In this case the following assembly steps are not required.

**Attention!**

When working on the open drive for the transformer panel the stored-energy drive must be in relieved condition. Never reach into the drive during a 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. 12/1).
3. Pull the front panel a few millimetres forward (Fig. 12/2).
4. Lift the covering sheet up from behind the front panel (Fig. 12/3).
5. Pull the covering sheet out of the clip-on clamps (Fig. 12/4).

**Note!**

Additional GAE630 panels are installed and end panels are fitted as per the related assembly instructions "Panel installation for extensible GAE630 panels", article no. 12244002.

6. For a cable bushing protected against dust and moisture, fit flexible plugs in the side openings on the drive mechanism housing (see assembly instructions "Panel installation for extensible GAE630 panels", article 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 transformer outgoing 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, transformer outgoing 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 installation for extensible GAE630 panels", article no. 12244002.
3.8 Laying 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. 13).

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. 14).
3.9 Terminal connection diagrams for the individual extension groups

Fig. 15 shows the arrangement of auxiliary switches for the load-break switch and the earthing switch on the drive carrier.

Figures 13 to 15 show the connection diagrams for the individual extension groups.

For additional relevant information on the wiring of the transformer outgoing panel, refer to the enclosed circuit documentation.

Fig. 15

Fig. 16

Fig. 17

Fig. 18
3.10 Connection of the power cables

Please proceed as follows to connect the power cables:

- Remove the front cover (see Chapter 5, "Operation").
- Dismantle the Z profile.
- Only on variants with bottom plates: Remove the front bottom plate and the rubber cable grommets. Push the rubber cable grommets onto the power cables to be connected.
- Route the power cables through the floor opening, cut to length, put in place and mount the male cable connector or cable adapter by following the instructions of the respective manufacturer.
- Only on variants with bottom plates: Insert the power cables with the rubber cable grommets into the cut-outs in the rear bottom plate.
- Connect power cables to the panel.
- Fix power cables to the cable fixing iron using the cable clamps so they are free of strain.
- Connect the earthing cables to the earthing terminals of the cable fixing iron.
- Only on variants with bottom plates: Re-fit the front bottom plate. During this process ensure the rubber cable grommet is correctly inserted between the bottom plates.
- Re-fit Z profile.

Fig. 19
3.11 Earthing

The transformer outgoing panel is to be earthed in accordance with the requirements of DIN VDE 0141. The transformer outgoing panel has an earthing bus that runs along the entire width of the panel (Fig. 20). 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.

In each panel area the earthing bar is equipped with a screw terminal (M12) for the connection of an earthing lead 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 irons 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.

Fig. 20
4 Technical description

4.1 Description of the transformer outgoing panel

The SF₆-insulated transformer outgoing panel type GAE630 is characterised by the following features.

Primary switchgear and busbar are installed in a common gas tank. Sulphur hexafluoride (SF₆) is used as an insulation and extinguishing medium. The transformer outgoing panel can be used in the busbar line up to a rated voltage of 24 kV with a rated normal current of 630 A.

The transformer outgoing (load-break switch with fuse base) is designed for a rated normal current up to 200 A (ahead of the fuse).

The transformer outgoing panel is:
- metal-enclosed,
- almost maintenance-free,
- suitable for severe climatic conditions,
- type-tested,
- extensible.

It complies with the specifications of the applicable standards and regulations as well as the statutory regulations. During manufacturing the transformer outgoing panels are subjected to the quality guidelines of ISO 9001.

The load-break switch with trip-free release consists of the following core components:
- three-position switch / integrated switch-on resistant earthing switch
- Arc extinction by quenching coil
- Maintenance-free stored-energy mechanism
- no additional insulating distance generator required because the break distance is not bridged by the insulating substance
- SF₆ as insulating and quenching gas.
- Tripping by HRC-fuse cartridge and tripping mechanism

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

The transformer outgoing panel can be arc-fault proof as an option for increased personnel protection. 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/cable trench or via a rear pressure absorber channel into the switchgear room (see Fig. 11).

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

For safety reasons the transformer outgoing panel is fitted with various interlocking facilities as standard.

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

Front cover interlock:
- An interlock against unauthorised removal of the front cover during operation

Anti-reverse interlock (optional)
- An interlock against unauthorised deactivation of the earthing switch after removing the front cover

For further details please refer to chapter 4.6.

All active parts are located in the gas tank filled with SF₆-insulating gas. The supply or provision of energy from/to the extended panels or block modules in the GAE630 series is undertaken with the aid of contact bolts via the side cast resin bushings. The discharge of energy is undertaken via cast resin bushings, with fuse base fitted, to the power transformer.

All control and indication elements of the transformer outgoing panel are clearly arranged on the front panel. Switch position indicators and actuating shafts are integrated in the mimic diagram. The front cover is fitted with padlocking facilities and panel nameplates as standard. The capacitive voltage detecting system is arranged on the right side of the front panel. On the front panel all symbols of relevance for the earthing circuit appear in red, whereas the symbols for the main current path are printed in black.

With the coloration of the front panel background all elements are clearly assigned to the respective switchgear panel.
4.2 Expansion of the transformer outgoing panel

The transformer outgoing panel of type GAE630-1TS- can be expanded on both sides with panels and block modules in the GAE630 series. The design of the overall switchgear depends on the customer’s requirements. The busbars for the overall switchgear are laid separated by phases, vertically one above the other in the gas tank. The connection of the busbars in the panels to be installed is undertaken using contact bolts that are fitted in the side bushings with double seals (Fig. 23). The panels to be installed are connected at the side using two two panel screw connections.

During the installation of an individual switch panel without grouping, the side bushings must be secured with sealing ends to maintain the dielectric strength of the switchgear. The screw plug is to be fitted in the bottom panel screw connection point.

The outer side walls for the cable connection compartment in end panels must be secured with a partition 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 installation for extensible GAE630 panels”, order no. 12244002.
4.3 Transformer outgoing panel version

The transformer outgoing panel of type GAE630 -1TS- is available in a 1400 mm high version for accessible switchgear rooms. Transformer outgoing panels with pressure absorber channel are available in the heights 2000 mm and 2300 mm.

Here the codes mean:

| T | Drive with trip-free release for tripping via HRC-fuse cartridge, Shunt release |
| S | HRC-fuse cartridge |
| - | On right/on left extensible |

The pedestal for the transformer outgoing 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. 11).

In the case of transformer outgoing panels with pressure absorber channel (incl. metal absorber) the pressure relief is into the switchgear room (see Fig. 11).

The transformer outgoing panel can be arc-fault proof as an option for increased personnel protection.

The transformer outgoing panel can be expanded with panels or block modules in the series GAE on both sides. The design of the extensibility to form complete switchgear is defined by the customer's requirement profile. The front cover is fitted with padlocking facilities as standard.

Optionally, the transformer outgoing panel may have a motor drive for remote switching on and off. For remote tripping the transformer outgoing panel can be optionally fitted with shunt release and tripping signal contacts.

If the transformer outgoing 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 electrical components of the GAE630 panel, such as: motor, auxiliary contact, shunt release, tripping signal contact, short-circuit indicator.
4.4 Three-position switch

The load-break switch is designed as a three-position switch. The switching positions ON-OFF-EARTHED can be switched with only one switching element (switching blade). Fig. 25 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 extent 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 a 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. 25](image-url)
4.5 Drive mechanism

4.5.1 General
Transformer outgoing panels have a spring drive with accumulator (transformer panel drive) as standard. The accumulator of this drive is activated by tripping of the fuse. The switch position indicator of the load-break switch shows the message TRIPPED for this drive.
The transformer panel drive switches the load-break switch as well as the earthing switch on the transformer outgoing panel to the ON and OFF switch position. The power accumulator of the transformer panel drive switches the load-break switch from switch position ON to OFF.
Tripping of the power accumulator is accomplished by an HRC-fuse cartridge, the switching lever or the shunt release. The function of the actuating shafts and their arrangement is shown in the mimic diagram on the front panel. All parts of the drive susceptible to corrosion are galvanically zinc coated.

4.5.2 Design and function
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 a pressure spring acts on a pin guide, which is mounted so it can rotate on each actuating shaft by two welded tongues. Both actuating shafts are hollow shafts.
The blade inhibitor for the earthing switch is integrated in the accumulator. On switch off it prevents the switching blade swinging to opposite contact on the three-position switch.

The accumulator is a freely rotating unit on the actuating shaft of the load-break switch. It consists mainly of tripping lever, accumulator tension spring and toggle link.
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.

Fig. 26

1 Earthing switch actuating shaft
2 Switch position indicator - slide
3 Tripping lever
4 Accumulator tension spring
5 Load-break switch actuating shaft
6 Blade inhibitor earthing switch
7 Tripping roller
8 Linkage for front cover interlock
9 Toggle link
10 Switching shaft
11 Operating lever
12 Drive carrier
13 Toggle link for earthing switch
14 Pressure spring for earthing switch
15 Pressure switch for load-break switch

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 drive 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 drive lever controls the switch position indicator mounted to the drive carrier.

While tensioning the pressure spring (left hand turn) the tripping roller, mounted so it can rotate on the pressure spring unit at the front face of the tripping lever, is locked. When turning the actuating shaft clockwise the pressure spring is relieved and the accumulator tensioning spring is tensioned. The accumulator is released by tripping of the fuse via an HRC-cartridge. During this process the tripping shaft coupled to the fuse tripping mechanism releases the tripping lever. With the help of a control cam the tripping lever presses the tripping roller out of its locked position on the accumulator.

A shunt release can be optionally coupled to this tripping shaft which, when energised, will relieve the accumulator in the same way as the fuse tripping mechanism. The accumulator is relieved, the load-break switch is switched to the OFF position. When switching off manually with the switching lever the triggering roller is forced out of its lock on the accumulator by means of another lever system. Transformer outgoing panels can optionally also be designed without fuse tripping mechanism. In this case the panel will be fitted with the drive for cable panels (cable panel drive).

Fig. 27

4.5.3 Motor drive (optional)

A motor drive system (Fig. 27) can optionally be added 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 earthing switch (Fig. 29)

Switching interlock and front cover interlock are activated or deactivated during the switching process via lever and rod drives.
Switching interlock (Fig. 29)
The interlock between load-break switch and earthing switch is accomplished by the position indicator plate; the downward extended plate tongue slides laterally into the horizontal recess in the actuating shaft (earthing/loadbreak switch).
During this process 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). If both actuating shafts are switched to the OFF-position, the plugin openings for both actuating shafts are open.

Front cover interlock (Fig. 28)
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. 29)
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 plate) turns sideways into the horizontal recess in the actuating shaft and closes the plug-in opening for the switching lever.
With the fastener opened on the transformer panel the sheet metal tongue closes the actuating shaft for the earthing switch and prevents deactivation of the earthing switch after the front cover has been removed.

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 gas tank is made of stainless steel. The side bushings for the panel/module expansion and the bushings for the fuse base are individually tested for compliance with the maximum permissible partial discharged values. The transformer outgoing panel is equipped with a top and a bottom bushing for each phase to which the fuse holder is fitted.

Copper busbars connect the three-position switch with the bushings in the upper fuse holder. The lower fuse holder is fixed to the bottom bushing, which has the function of a second earthing.

Three copper busbars are laid along the back plate inside the gas tank with one outgoing per phase to the contact element for the three-position switch (Fig. 25). On the right and left side wall of the gas tank, the copper busbars are bolted to the side bushings through which the transformer outgoing panel can be expanded with other GAE630 panels.

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. 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 in relation to the tank by a double pair of radial seals.

After the evacuation process each transformer outgoing panel is filled with dry SF₆ gas, in accordance with IEC 60376. The addition of Al₂O₃ absorbs very small quantities of moisture and permanently regenerates the SF₆. The performance of a leak test according to IEC 62271-200 is proof that the permissible leak rate (10⁻⁷ mbar l/s) of the hermetically welded tank is not exceeded.

4.8 Gas leakage indicator

The gas pressure is indicated by an aneroid diaphragm pressure gauge, which is connected to the tank via a check valve. The pressure gauge is corrosion-resistant against normal environmental influences. The indication range (Fig. 30) is divided into two measuring ranges.

![Fig. 30](image)

Red: Not ready for switching!
Green: Ready for switching

Before each switching process the gas leakage indicator and therefore the gas filling inside the tank must be checked.

4.9 Density switch/pressure switch (optional)

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

The bottom switching point of the density watchdog or pressure switch is 106 kPa abs. If the pressure in the gas tank drops to 106 kPa abs., the density switch or temperature compensated pressure switch will report this pressure drop.

The bottom switching point of the density switch/pressure switch corresponds with the transition to the red measuring range on the scale of the gas leakage indicator.

The temperature compensated density switch/pressure switch is fastened to the non-return valve, together with the gas leakage indicator.
4.10 Capacitive voltage detecting system

A voltage indication ledge (capacitive coupling element) is fitted to the front panel of each panel to determine if the panel is electrically isolated. It is an HR system in accordance with VDE 0682, part 415, draft 10.96. The voltage indication ledge consists of an insulated housing with all electronic assembly parts encapsulated. Corrosion-resistant sockets make it possible to connect commercially available meters.

The coupling electrode in each bushing connected in series 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. 31). It is opened by turning 90°.

The test must be undertaken using a suitable voltage tester (Table 2) (Fig. 32).

Table 2

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfisterer</td>
<td>Type DSA-2</td>
</tr>
<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 KSP-HR</td>
</tr>
</tbody>
</table>

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

In the standard version transformer outgoing panels are equipped with a voltage indication ledge for measurements after the fuse (bottom bushing) (Fig. 31). Transformer outgoing panels can be optionally equipped with an additional voltage indication ledge before the fuse (top bushing) (Fig. 69).

During each switching process (connection to or disconnection from the mains) the function of the capacitive voltage detecting system must be checked, if a de-energised state is detected (see chapter 6.2).

Always check all phases L1, L2, L3!

Fig. 31

Fig. 32
4.11 Fuse base

4.11.1 Design and function

The fuse base on the GAE630 transformer outgoing panel is designed as a plug-in system.

All components of the fuse base are coupled to the current path outside the gas tank via cast resin bushings. The plug-in system consists of the upper and lower fuse holders. The components inside the plugged enclosure are protected against water and dust. The plug parts made of silicon rubber are of track-proof and arc-root free design. In its functionality the lower fuse holder is additionally designed as a slide-on transformer cable sealing end.

The range of application for copper or aluminium cables reaches from 25 to 240 mm².

Each HRC-fuse cartridge is earthed on both sides by means of two earthing electrodes switching in SF₆. Changing of an HRC-fuse cartridge can therefore be performed without any risk, because the fuse base is only accessible with the earthing electrodes inserted. All plug-in surfaces (changing of a HRC-fuse cartridge) are made of special material pairs, which prevent inseparable bonding.

The individual components of the plug system can be easily separated, even after years.

The fuse base has been designed for HRC-fuse cartridges acc. to DIN 43625 with a pitch measurement of 442 mm and a maximum outside diameter of 88 mm. HRC-fuse cartridges with a pitch measurement of 292 mm can only be used in connection with an extension adapter (optional).

The fuse base on each transformer outgoing panel is designed as standard with a fuse tripping mechanism in combination with a stored-energy mechanism.
If one of the three HRC-fuse cartridges trips, all three phases on the panel are shut down. The striker pin of the HRC-fuse cartridge presses the flexible diaphragm of the upper fuse holder against the releasing lever of the fuse tripping mechanism, which then responds and causes a triple-phase shut-down of the transformer panel via the accumulator drive (transformer panel drive).

A red indicator with the inscription “TRIPPED” in the switch position indicator for the load-break switch indicates triggering of the drive (Fig. 34).

All components of the fuse base (except HRC-fuse cartridges and extension adapters) belong to the scope of delivery. For the assembly of the fuse base please follow the assembly instructions “Fuse Arrangement” (article no. 21015575).

4.11.2 Design of the HRC-fuse cartridges in accordance with the dissipation

All HRC-fuse cartridges acc. to DIN 43625 with a pitch measurement e = 442 mm (24 kV) can be used.

For HRC-fuse cartridges with the pitch dimension e = 292 mm (12 kV) an extension adapter must be used. The permissible dissipation of the standard Ormazabal fuse holder is max. 45 W. Higher values can lead to malfunctions.

In the special version (optional) the upper fuse holder can be equipped with a ventilation valve. The permissible dissipation is in this case max. 65 W.

Due to the very special operating conditions with wind turbine generators the fuse base with ventilation valve must be used.

Note!

The appropriate HRC-fuse cartridge must be selected by following the “HRC-fuse selection table”, article no. 12254569.
4.11.3 Replacement of HRC-fuse cartridges for switches with drive types KS or TS

**Note!**
Since the top and bottom bushings of the fuse base are earthed, the following steps of changing the fuse cartridge can be performed manually without any insulated tools.

If one of the three HRC-fuse cartridges of the transformer panel has tripped and the panel is fitted with a load-break switch of type TS a triplephase shut-down of the panel will occur.

Please remember: If fuse cartridges without thermal protection are used for partial areas, all HRC-fuse cartridges should be replaced, even if only one of the HRC-fuse cartridges has tripped, because the fusing conductors of the other HRC-fuse cartridges may already be damaged.

Before starting work the transformer must be protected against inverse voltage by disconnecting it from the mains and earthing:

- Test transformer outgoing panel is electrically isolated (see also chapter 6.2).
- Switch the earthing switch ON with the red earthing switch lever (see mimic diagram).
- Open the fastener of the front cover by turning the square key anti-clockwise.
- Remove the front cover by lifting it up and pulling it forward out of the side locks of the adapter housing (see also chapter 5.3).

**Fig. 34**
At the same time the switch position indicator in the shut down panel is tripped by the tripping technology. A red decal with the inscription "TRIPPED" informs the viewer that the panel has been switched off (Fig. 34).

When the earthing switch is engaged both the top and bottom contact caps on the HRC-fuse cartridge in the transformer panel are earthed.

**Fig. 35**
The tripped HRC-fuse cartridge can be recognised by the upwards expanded diaphragm at the upper fuse holder. Perform the following steps to replace the HRC-fuse cartridge:

Pull the tensioning lever (Fig. 35) forward against spring pressure, then lift it up into the attachment box. Due to the spring mechanism the tensioning lever remains in its end position.

**Fig. 36**
Grip the upper fuse holder (Fig. 36) and pull it straight out of the top bushing.
For easier handling the upper fuse holder may be pulled to an inclined position, because the contact element of the lower fuse holder is rotably mounted.

Pull the upper fuse holder upwards (Fig. 37) out of the lower fuse holder.

Lay the upper fuse holder on a clean base, as shown in Fig. 38. Remove all dirt with a lint-free cloth.

Pull the loosened HRC-fuse cartridge out of the lower fuse holder and insert the new HRC-fuse cartridge.

Fig. 37

In case of a burst HRC-fuse cartridge all coarse particles that have dropped into the lower fuse holder can be removed by hand, whereas the fine quenching sand particles can be removed by using e.g. a battery powered vacuum cleaner.

Attention!

The striker pin of the HRC-fuse cartridge must always point up (Fig. 39).

An incorrect installation position disables the fuse tripping mechanism.

Attention!

If HRC-fuse cartridges with a pitch measurement of \( e = 292 \text{ mm} \) are to be installed, the Ormazabal fuse adapter must be used. This extends the pitch measurement for the HRC-fuse cartridge to 442 mm (Fig. 38).

Attention!
Avoid any accumulation of dirt on the inserting taper and in the slideon area for the insulating tube of the upper fuse holder (Fig. 40).

The surfaces of the parts to be fitted must be free of any foreign particles! Guide the upper fuse holder over the HRC-fuse cartridge until the contact cap of the HRC-fuse cartridge has entered into the contact element of the upper fuse holder. For easier handling the HRC-fuse cartridge may be pulled forward to an inclined position (Fig. 40), because the contact element of the lower fuse holder has a rotating mounting.

**Check**

Once the end of the insulating tube of the upper fuse holder rests against the collar of the lower fuse holder (Fig. 40), the HRC-fuse cartridge has been properly inserted.

Swivel the taper of the upper fuse holder into the top bushing against the stop (Fig. 41).

**Attention!**

The use of force may cause damage!

Pull the tensioning lever against spring pressure forward and swing it down over the lock for the upper fuse holder.

Reinstall the front cover to the adapter housing in reverse order (to the previous description).

The transformer outgoing panel can be activated again.

For further information refer to the assembly instructions “Fuse Arrangement”, article no. 21015575.

**Note!**

Brief instructions for changing HRC-fuse cartridge are attached to the inside of the front cover on the transformer outgoing panel.

---

**Fig. 40**

**Fig. 41**
5 Operation

5.1 Switching accessories

To switch the transformer outgoing panel, the following accessories are required:

1 Switching lever for loadbreak 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 for switching the transformer outgoing panel have a torque reducing safety feature that avoids damage to the drives. If you try 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 inserted in the actuating shaft, because operation of the other actuating shaft will damage the switching interlock of the panel.
5.2 Padlocking facility

As standard the transformer outgoing panel is equipped with padlocking facilities (Fig. 43). 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.

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 position indicators and actuating shafts.

Fig. 43
5.3 As delivered state of the transformer outgoing panel

On delivery, the transformer outgoing panel is in the following switch position:

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

**Note!**

Front cover open

---

Fig. 44

Fastener closed (Anti-reverse interlock optional).

Fig. 45

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

Fig. 46

- Turn the fastener anti-clockwise with the fastener key to the end stop.

Fastener opened (Anti-reverse interlock optional).

Fig. 47

Earthing switch activated and locked by anti-reverse interlock (optional). Load-break switch deactivated and locked by switching interlock.

Fig. 48

Front cover interlock

The front cover can be removed as the pin for the front cover interlock is pulled out of the front cover (Fig. 48).

Fig. 49

Front covers

Remove front cover:
- Lift the front cover up against the stop (Fig. 49/1).
- Pull the front cover off to the front (Fig. 49/2).
5.4 Switching the transformer outgoing panel

Prior to switching the transformer outgoing panel, check the gas leakage indicator.

In case of a red indication the transformer outgoing 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. 52).

The switch positions of earthing and load-break switches can be read from the indicating device in the mimic diagram for the panel (Fig. 53).

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 load-break switch is closed by a locking plate.

Check the switch position of the transformer outgoing panel using the capacitive voltage detecting system (see chapter 6.2).
5.4.1 Switching on transformer outgoing panel

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

![Fig. 54](image1)

Note!

The "TRIPPED" side plate in the switch position indicator is only displayed if the transformer switch is switched off by a tripped HRC-fuse cartridge or the shunt release (option).

2 Switch off the earthing switch. Turn the switching lever (red shaft) anti-clockwise against the stop. (no pressure from counter spring).

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

4 Tensioning the load-break switch (see also Fig. 34).

Note!

There is no counter spring pressure on load-break switch. Insert the switching lever (bare shaft) and turn anti-clockwise.

5 Switch position after tensioning the closing spring. The tripped signal in the switch position indicator is no longer visible.
6 Switch the load-break switch on. Turn the switching lever (bare shaft) clockwise.

7 Switch position with activated load-break switch and deactivated earthing switch.
5.4.2 Switching off and earthing transformer outgoing panel

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

2. Switch off the load-break switch. Turn the switching lever (bare shaft) approx. 20...30 degrees to the left.

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. Turn the switching lever (red shaft) clockwise against the end stop (no spring pressure).

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

For commissioning the correct function of the transformer outgoing panel must be assured by checking 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, fuse base) 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).
– If a pressure gauge is installed check the reading on the gauge via the remote indicator when the voltage supply is switched on.

– After the installation of the transformer outgoing panel perform a function test on the switches.

In the case of the installation of a transformer outgoing panel as an end panel, make sure the sealing ends are correctly fitted to the side bushings and the bottom panel screw connection point is sealed with the screw plug. Please again pay attention to the assembly instructions “Panel installation for extensible GAE630 panels”, article no. 12244002.

Keep to the switching sequence given below.

### Note!

The switchgear panel is delivered with closed front covers in the earthed switch position (see chapter 5.3).

### 6.1 Switching (manually by means of control lever)

#### SWITCHING ON

– Switch off the earthing switch.
– Tensioning the load-break switch (trip-free release).
– Switch on the load-break switch.

#### SWITCHING OFF

– Switch off the load-break switch.
– Switch on earthing switch.

#### Switching the transformer outgoing panel via the shunt release (option)

– Activate the transformer outgoing panel with the switching levers.
– For switching tests of the shunt release activate the voltage supply.
– Actuate the push button or the respective control transmitter on the remote trip until the transformer panel is switched off and the position indicator shows “TRIPPED”.

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6.2 Verifying the safe isolation from supply

Before disconnecting a transformer outgoing panel in operation from the mains and prior to connecting a transformer outgoing panel to the mains, the panel must be checked for electrical isolation using the capacitive voltage detecting system.

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

When checking the transformer outgoing panel the following steps must be performed:

- With the transformer outgoing panel switched on, open the shrouds for the capacitive measuring points by turning.
- Plug 3 voltage testers (see Table 2, chapter 4.10) into the measuring sockets (Fig. 67). In case of transformer panels of panel version with top and bottom measuring bar, plug 6 voltage testers into the measuring sockets (Fig. 69). The voltage testers must flash.
- Switch the load-break switch for the transformer panel to “OFF”.
- Also electrically isolate the low voltage side transformer supply. The voltage testers must no longer flash.
- Switch the earthing switch to “ON”. The fuse base is now safely isolated (before and after the fuse).
- Upon completion of the test, remove the voltage testers and close the measuring sockets by turning the shrouds.

Fig. 68 shows a transformer outgoing panel with a voltage indication ledge before the fuse (M2) (top bushing, optional) and after the fuse (M1) (bottom bushing) with voltage testers fitted.
6.3 Phase comparison

On the insulated test sockets a phase comparison can obviously also be performed between two outgoing circuits (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. 69).
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 transformer outgoing panel should be performed every 4 years in order to check the condition of the unit.

Test activation of the transformer outgoing panel with tripfree release (if present) should be performed approx. every 10 years. The function of the fuse tripping mechanism is checked by raising the fuse tripping mechanism (Fig. 70) a few millimetres in the direction of the cable connection compartment.

![Fig. 70](image)

The tripping shaft mechanically releases the TRIPPED message, which is displayed in the switch position indicator of the transformer load-break switch. The function of the shunt release (optional) shall also be checked by tripping (electrically).

On transformer outgoing panels equipped with anti-reverse interlock the function test of the fuse tripping mechanism must be performed with a test fuse with time delay. The antireverse interlock (optional) shall also be checked by tripping (electrically).

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 be checked for pressure loss during this process. As long as the pointer in the gas leakage indicator is in the green sector the pressure is sufficient.

The transformer outgoing panel should be subjected to a general visual inspection. Check the transformer outgoing panel for anything unusual such as soiling or changes caused by other environmental effects.

7.2 Maintenance

The drive and the switches 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 filling does not need to be replaced during the lifetime of the transformer outgoing panel.
7.3 Cleaning

**Attention!**
Before starting cleaning work the transformer outgoing panel must be isolated.

To avoid unintended switching operations, the supply voltage is to be shut down.

– Switch earthing switch to ON position.

– Open fastener and remove front cover (if necessary).

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

**Attention!**
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 SF$_6$ 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 SF$_6$-systems, issued by the liability 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 SF$_6$ covered by the Kyoto Protocol and with a global warming potential (GWP) 22200. SF$_6$ shall be recovered and not released into the atmosphere. For further information on use and handling of SF$_6$ please refer to IEC 62271-303: High-voltage switchgear and controlgear – Part 303 Use and handling of sulphur hexafluoride (SF$_6$).

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

8.1 General data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal filling pressure of the 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>Nominal density of the insulating gas</td>
<td>7.9 kg/m³</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td></td>
</tr>
<tr>
<td>without secondary equipment</td>
<td>–25 to +40 °C (–40 bis +40 °C on request)</td>
</tr>
<tr>
<td>with secondary equipment</td>
<td>–5 to +40 °C (–25 to +40 °C on request)</td>
</tr>
<tr>
<td>with reduced rated currents</td>
<td>above +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 in accordance with IEC, IP65/IP4X</td>
</tr>
<tr>
<td>Enclosure of the fuse compartment</td>
<td>single pole arc-root free encapsulation and 3-phase metal-enclosure, IP44</td>
</tr>
<tr>
<td>Enclosure of the drive housing</td>
<td>IP44</td>
</tr>
<tr>
<td>Internal arc classification according to VDE 0671 part 200 or IEC 62271-200 respectively</td>
<td>IAC AFL 20 kA 1 s for HV compartment and adapter housing</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>approx. 140 kg (approx. 230 kg with pressure absorber channel)</td>
</tr>
</tbody>
</table>

Table 3

1) Depending on secondary technology used
8.2 Transformer outgoing panel

<table>
<thead>
<tr>
<th>Transformer outgoing panel TS</th>
<th>Switch</th>
<th>Earthing electrode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before the fuse</td>
<td>after the fuse</td>
</tr>
<tr>
<td>Rated frequency ( f_r )</td>
<td>50/60 Hz</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Rated voltage ( U_r )</td>
<td>12/24 kV</td>
<td>12/24 kV</td>
</tr>
<tr>
<td>Rated operating current ( I_r )</td>
<td>200 A</td>
<td>-</td>
</tr>
<tr>
<td>Rated short-time power-frequency withstand voltage 1 min ( U_d )</td>
<td>50 kV</td>
<td>50 kV</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage ( U_w )</td>
<td>125 kV</td>
<td>125 kV</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage of the air gap ( U_p )</td>
<td>145 kV</td>
<td>-</td>
</tr>
<tr>
<td>Rated mainly active load breaking current ( I_l )</td>
<td>200 A</td>
<td>-</td>
</tr>
<tr>
<td>Rated cable-breaking breaking current ( I_{4a} )</td>
<td>50 A</td>
<td>-</td>
</tr>
<tr>
<td>Rated no-load transformer breaking current ( I_3 )</td>
<td>16 A</td>
<td>-</td>
</tr>
<tr>
<td>Rated earth fault breaking current ( I_{6a} )</td>
<td>160 A</td>
<td>-</td>
</tr>
<tr>
<td>Rated cable and line-breaking breaking current under earth fault conditions ( I_{6b} )</td>
<td>100 A</td>
<td>-</td>
</tr>
<tr>
<td>Rated peak withstand current ( I_p )</td>
<td>6.3 kA</td>
<td>-</td>
</tr>
<tr>
<td>Rated short-time withstand current 1 s (optional 3 s) ( I_{k} )</td>
<td>2.5 kA</td>
<td>-</td>
</tr>
<tr>
<td>Rated short-circuit making current ( I_{ma} )</td>
<td>50 kA</td>
<td>50 kA</td>
</tr>
<tr>
<td>Largest rated current with fuse ( I_{n, max} )</td>
<td>100 A</td>
<td>-</td>
</tr>
<tr>
<td>HRC-fuse cartridges (manuf. SIBA) Type ( I_{4s} )</td>
<td>3002213</td>
<td>-</td>
</tr>
<tr>
<td>Fuse striking pin Type ( T_0 )</td>
<td>medium</td>
<td>-</td>
</tr>
<tr>
<td>Rated take-over current ( I_{4} )</td>
<td>1900/1500 A</td>
<td>-</td>
</tr>
<tr>
<td>Switch opening time in case of striking pin actuation ( T_{0} )</td>
<td>54 ms</td>
<td>-</td>
</tr>
<tr>
<td>Number of switching events at rated mains load breaking current ( n )</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Number of switching events at Rated short-circuit making current ( n )</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Number of mechanical switching cycles ( n )</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Class</td>
<td>-</td>
<td>E3 M1</td>
</tr>
</tbody>
</table>

Table 4

1) These values are limited by the HRC-fuses

8.3 Shunt release

Electromagnet shunt release (optional)

<table>
<thead>
<tr>
<th>Nominal voltage (V)</th>
<th>Nominal power (W/VA)</th>
<th>ED %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>225</td>
<td>5</td>
</tr>
<tr>
<td>48</td>
<td>265</td>
<td>5</td>
</tr>
<tr>
<td>60</td>
<td>250</td>
<td>5</td>
</tr>
<tr>
<td>110</td>
<td>272</td>
<td>5</td>
</tr>
<tr>
<td>230</td>
<td>258</td>
<td>5</td>
</tr>
<tr>
<td>Alternating current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>652</td>
<td>5</td>
</tr>
<tr>
<td>230</td>
<td>608</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 5

8.4 Pressure switch/density watchdog

8.4.1 Pressure switch\(^1\) (optional)

<table>
<thead>
<tr>
<th>Pressure range</th>
<th>Lower switch point Hysteresis Make-break capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 - 400 hPa</td>
<td>60 hPa</td>
</tr>
<tr>
<td>20 - 30 hPa</td>
<td>50 hPa</td>
</tr>
<tr>
<td>250 V / T A</td>
<td>250 V / 5 A (^1)</td>
</tr>
</tbody>
</table>

Table 6

1) When using the pressure switch (optional) the comply with class minus 5 indoor

8.4.2 Density watchdog GMD1 (optional)

<table>
<thead>
<tr>
<th>Pressure range</th>
<th>Lower switch point</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 1000 hPa</td>
<td>60 hPa</td>
</tr>
</tbody>
</table>

Table 7

1) Further tripping data on request
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>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 8

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 (Nm)</th>
<th>Force to be applied (N) (manual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformer panel drive earthing switch</td>
<td>Making / breaking</td>
<td>60</td>
<td>140</td>
</tr>
<tr>
<td>Transformer panel drive load-break switch</td>
<td>Tensioning</td>
<td>75</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>Making</td>
<td>45</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Breaking</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 9

8.7 Materials

Materials used in the transformer outgoing 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-optimal)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Aluminium oxide, lubricants, SF$_6$-gas</td>
</tr>
</tbody>
</table>

Table 10

8.8 Regulations and standards

8.8.1 Test specifications

The transformer outgoing panel complies with the requirements of the following VDE standards and IEC publications:

| IEC 60265-1 (62271-103) | / VDE 0670 part 301 (VDE 0671 part 103) |
| IEC 60262-1              | / VDE 0670 part 4                     |
| IEC 60694 (62271-part 1) | / VDE 0670 part 1000 (VDE 0671 part 1) |
| IEC 62271-102            | / VDE 0671 part 102                   |
| IEC 62271-105            | / VDE 0671 part 105                   |
| IEC 62271-200 (60298)    | / VDE 0671 part 200 (VDE 0670 part 6) |
| IEC 62271-303            | / VDE 0671 part 303                   |


1) Future

2) Former

9 Accessories

- Assembly kit end panel Article no. 12238777
- Assembly kit panel screw connection Article no. 12238780
- Additional kit end panel Article no. 12238779