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**Medium Voltage Switchgear
and Switches**



→ **Medium Voltage Switchgear up to 24 kV, 630 A
SF₆-insulated, Modular Design**

Type: GAE, Series GAE630

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

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Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

General/Description

Benefits of SF₆-insulated, metal-encapsulated, modular switchgear assemblies

With the GAE630 series switchgear assemblies, Ormazabal Systems Division meets the international requirements of its customers for SF₆-insulated switchgear.

- ✓ Largely climate resistant
- ✓ Maintenance-free concept with SF₆-pressurised containers as a hermetically sealed pressure system
- ✓ Minimum space requirement
- ✓ Comprehensive personnel protection
- ✓ High level of functional reliability
- ✓ Great reliability of supply
- ✓ Great operator safety
- ✓ Great versatility due to availability of circuit-breaker, isolator and load-break switch sections
- ✓ Straightforward side-by-side fitting of sections by means of inner cone plug-in systems for the busbar connection
- ✓ Up to four-fold cable connection systems in circuit-breaker sections
- ✓ Conventional current transformers can be easily exchanged outside of the SF₆-pressurised container

Features

The GAE630 series switchgear assemblies are type-tested, factory-built, metal-encapsulated SF₆-insulated switchgear installations made up of sections. The panels can be easily combined to the switchgear series GAE1250.

The possibility of combining with GA series units is provided using the metering panel -1M1-.

Applications

The GAE system up to 630 A is eminently suitable for use in substations and switching stations, and also as load centres:

- In electricity supply company networks, substations, main distribution substations, distribution substations, user substations with metering on the electricity supply company's side and network protection
- In industrial networks with medium-voltage network infrastructure
 - Industrial substations with medium-voltage measurement for consumption monitoring of individual works, as well as network protection
- In buildings with medium-voltage network infrastructure, e.g. in railway stations, department stores, hospitals, barracks, law courts, administrative buildings, etc.
- In environmental projects with medium-voltage network infrastructure, e.g. in wind energy, biogas, sludge digestion, resource-recycling/-recovery plant, etc.



Combined customer-specific switchgear (front covers opened)

Type GA2K1LSF/10/ GAE630 -1M1-/8/ -1LSF-/5/ -1TS-/4/ -1KB-/4/

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

General/Description

Key to type references of panels

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

GAE630 x / x / x / x – x / x - x

- ① Family name: **Gas-insulated Expandable**
- ② Series: 630 A
- ③ Types of panel:
- | | |
|----------------------------|---|
| -1K-/3/ | = Cable panel |
| -1A1-/3/ | = Cable connection panel |
| -1KB-/4/ | = Cable panel with horizontal bushings |
| -1XL/3,2/ | = Bus sectionalizer panel to GE, GAE left-hand connection |
| 1XR-/3,2/ | = Bus sectionalizer panel to GE, GAE right-hand connection |
| -2K-/8/ | = 2*Cable panel |
| -3K-/10/ | = 3*Cable panel |
| -1TS-/4/ | = Transformer panel with stored-energy mechanism |
| -2TS-/8/ | = 2*Transformer panel with stored-energy mechanism |
| -1KG-/3/ | = Load-break switch bus sectionalizer panel |
| -1H1-/3/ | = Riser panel to 1KG, to 1LSFG |
| -1H2-/9/ | = Riser panel to 1LSVG |
| -1E1-/3/ | = Busbar earthing panel |
| -1LSF250(630)-/5/ | = Outgoing feeder panel with SF6-circuit breaker 250A/630A |
| -1LSF250(630)-/6/ | = Outgoing feeder panel with SF6-circuit breaker 250A/630A |
| -1LSFG250(630)-/5/ | = Bus sectionalizer panel with SF6-circuit breaker 250A/630A |
| -1LSFG250(630)-/6/ | = Bus sectionalizer panel with SF6-circuit breaker 250A/630A |
| -1LSV630-/5/ | = Outgoing feeder panel with vacuum circuit breaker 630A |
| -1LSVG630-/5/ | = Bus sectionalizer panel with vacuum circuit breaker 630A |
| 2K1TS-/10/ | = Expandable unit with transformer panel |
| 2K1LSF250(630)-/10/ | = Expandable unit with SF6-circuit breaker |
| -1M1-/9/ | = Metering panels |
| -1M2-/9/ | |
| -1M3-/4/ | |
| 1M4/9/ | |
| -1M5-/9/ | |
| -1M5ü-/9/ | |
- ④ Panel width:
- | | |
|-------|-----------|
| /3/ | = 350 mm |
| /3,2/ | = 320 mm |
| /4/ | = 400 mm |
| /5/ | = 500 mm |
| /6/ | = 600 mm |
| /8/ | = 800 mm |
| /9/ | = 850 mm |
| /10/ | = 960 mm |
| /12/ | = 1200 mm |
- ⑤ Rated voltage:
- | | |
|----|---------|
| 12 | = 12 kV |
| 24 | = 24 kV |
- ⑥ Rated busbar current: 630 = 630 A
- ⑦ Rated outgoer current:
- | | |
|-----|---------|
| 200 | = 200 A |
| 630 | = 630 A |
- ⑧ Rated short-time current:
- | | |
|----|---------|
| 16 | = 16 kA |
| 20 | = 20 kA |
- ⑨ Seconds of rated short-time current:
- | | |
|---|-------|
| 1 | = 1 s |
| 3 | = 3 s |

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

General/Description

The HV compartment

This is a gas-tight welded tank made from stainless steel, which houses all the live parts including the busbars. The incoming and outgoing power feeders, as well as the connections of the fuse compartments are led through cast resin bushings that are individually tested for adherence to the maximum admissible partial discharge values ($TE \leq 2 \text{ pC}$). Each HV compartment is equipped with a stainless steel bursting membrane that is specifically designed for the individual tank.

Drives

The sturdy drives, operated by spring or stored energy mechanism, are located above the HV compartment in panels with load-break switches and circuit-breakers, and in front of the HV compartment in panels with vacuum circuit-breakers. The spring operated drives of ring cable panels are maintenance free, the stored energy operated drives of transformer and circuit-breaker panels must be switched at least once after 15 years. But, due to the materials selected, there is no need for maintenance even here.

Cable connection compartments

These are generally provided, and are always in pressure-proof design. Arc-fault resistant compartments can also be supplied if required. They are separated from one panel to the next by sheet steel intermediate walls. Inspections or work can be carried out in this way although the cable connection zone of the neighbouring panel is live. The front covers can be interlocked against the corresponding earthing switch. The front cover can be opened only with the earthing switch switched On. An anti-reverse interlock system can also be provided for if required. This prevents the corresponding load-break switch from being switched onto a live busbar when the termination zone is open (front cover removed). The mechanism can be operated only with the front cover in place and the latch closed. The earthing switch at the cable outgoer is not incorporated in this interlock and is switchable even when the terminal zone is open (necessary for cable testing).

Deeper front covers are available for deeper double-cable connections (→ page 34).

Operation

The mechanisms must be operated via the external drive shafts that are included in the mimic diagram. They include operating lever, 1 × load-break switch, 1 × earthing switch. Conventional operability is ensured due to the clearly structured mimic diagram and the easy-to-operate rotary handles.

On the vacuum circuit-breakers, the spring-powered switching mechanism is charged using a handle during manual or emergency operation. Tripping of the switch takes place via push-buttons.

Busbars, 630 A

These are located in the HV compartment. The busbars of individual panels or blocks are linked with each other via special bushings that include screened silicone insulation and coupling pieces.

Cable retention brackets

These consist of galvanized pliable metal parts. Thanks to a special screwable design, they can be adjusted in height and depth enabling any of the cable terminations normally used for SF₆ systems to be applied and the cables to be fastened by means of cable clamps without difficulty.

Arc fault protection

The HV compartments and cable connection compartments comply with criteria 1 to 5 of VDE standard 0671 Part 200 / IEC 62271-200 Annex A "internal arc faults". This arc fault qualification IAC AFL is always present in the arc-fault resistant cable compartment systems.

The gases that emanate in the event of an arc fault are disposed of downwards into the cable well/cable duct in the standard version of the system.

In addition, there is a version where the panel floor is closed and pressure relief takes place via a rear absorber channel towards the top. The panel depth is thus increased to appr. 1150 mm.

By help of this rear absorber channel the pressure data within switchgear rooms will be reduced by appr. 60%.

Switchgear related pressure calculations can be enquired as part of services at the sales department of Ormazabal GmbH.

For details please see page 35.

LV control compartment / Relay compartment

LV control compartments / relay compartments are optionally available for all GAE630 unit and panel variants in the following heights:

300 mm, 600 mm, 900 mm.

Standard height for circuit breaker panels is 600 mm.

LV control compartments / relay compartments and the front covers are fitted customer-specifically. All current protection and control systems can be fitted.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

SF₆ the insulating and arc quenching medium

SF₆ the insulating and arc quenching medium

Sulphur hexafluoride (SF₆) gas has in recent years increasingly found its way also into medium-voltage load switching systems, having been previously successfully used mainly in circuit-breakers up to highest voltage levels.

This system change is taking place worldwide, since each of the previously used insulating and arc-quenching media, such as air, oil and solid materials, have their own more or less serious disadvantages:

- Air-insulated systems take up a great deal of space and, in extreme climatic or environmental conditions, require maintenance.
- Oil-insulated systems (as still predominantly used in English-speaking countries) although on the whole well protected against external influences, pose a considerable safety risk in the event of an internal fault.
- Solids-insulated systems (e.g. by cast resin), in the final analysis, are air-insulated devices and have the same maintenance problems, but much aggravated due to their compact construction.

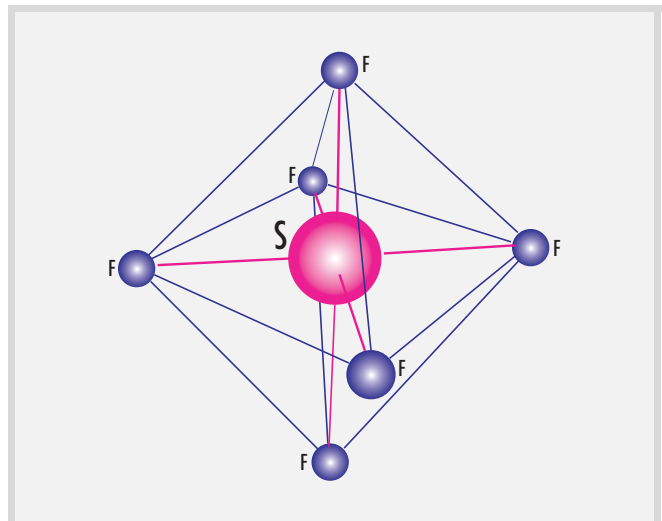
SF₆ as insulating medium has a high degree of dielectric strength thereby enabling the construction of **very compact systems** that furthermore are maintenance free since all the live electric assembly parts have to be encapsulated.

With the actuating mechanics also largely removed from environmental influences, the user therefore gets a product that will do long-term duty **without maintenance**.

SF₆ is a non-poisonous, inert, electronegative gas that is heavier than air. In addition to the high insulating capability already mentioned, it also has extremely effective arc-quenching properties. At the high temperatures arising in the circuit-breaking arc, SF₆ separates into its constituent parts. When it cools, these regenerate to restore the SF₆ gas. This regeneration process is supported by aluminium oxide (Al₂O₃) within the system. It means that the volume of gas originally introduced remains unchanged and suffices for the entire service life of the system or mechanism. An evaluation of the advantages and potential theoretical risks has shown that at present, there are no technically and ecologically worthwhile alternatives in sight.

The **high operational safety** of the system (external influences such as humidity, conductive dust etc., have no effect) virtually excludes arc faults. Should such a fault nevertheless occur, then the pressure release diaphragm (bursting membrane) comes into play.

There are detailed instructions for use of such a SF₆ system, issued by the German official Labour association. **SF₆ gas contained in the system shall be recycled and not released into the atmosphere. Ormazabal Systems Division will take care of the disposal for you, should you not wish to dispose of a system yourself. This offer will hold good even after the system has been in operation for 25 to 30 years for the costs then applicable.**



Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Technical data

Technical data

Switchgear panels (rated values)

			Rated voltage U_r			
			7.2 kV	12 kV	17.5 kV	24 kV ¹⁾
Rated insulation level						
Rated power-frequency withstand voltage, AC U_d	kV		20	28	38	50
Rated lightning impulse withstand voltage U_p	kV		60	75	95	125
Rated frequency f_r	Hz		50/60	50/60	50/60	50/60
Rated normal current I_r	For feeder circuits	A	630	630	630	630
	For busbars	A	630	630	630	630
Rated short-time current I_k	At $t_k = 1$ s	Up to kA	20	20	20	20
	At $t_k = 3$ s	Up to kA	20	20	20	20
Rated peak withstand current I_p	Up to kA		50	50	50	50
Ambient temperature T	Without secondary devices	°C	– 25 up to +40 (– 40 up to +40 on request) ²⁾			
	With secondary devices	°C	– 5 up to +40 (– 25 up to +40 on request) ^{2), 3)}			
	LSV panel	°C	– 5 up to +40 ^{3), 4)}			
	With reduced current ratings	°C	Above +40			
Relative humidity	%		Maximally 95			
Rated filling pressure of insulating gas at 20 °C and 101.3 kPa	kPa		130 (30 kPa overpressure)/-1LSF- = 150 (50 kPa)			
Insulating gas			SF ₆			
Rated density of insulating gas	kg/m ³		7.9			
Encapsulation of the HV compartment	IP		Hermetically welded tank, IP65			
Encapsulation of the fuse compartment	IP		Single-pole arcing-free encapsulation and 3-phase metal encapsulation, IP44			
Encapsulation of the drive housing, relay cabinet	IP		IP44/IP3XD			
Enclosure of the cable connection compartment	IP		IP44/IP3XD			
Internal arc test to VDE 0671. Part 200 resp. IEC 62271-200	kA		IAC AFL 20 kA, 1 s for HV compartments			
	kA		IAC AFL 20 kA, 1 s for cable connection compartments			
Colour of panel paint finish	RAL		7 035 (light grey)			
Operational availability			LSC 2A			
Partition class			PM			

1) Higher rated voltage (25 kV) on request.

2) When a pressure switch (optional) is being used, the operating conditions correspond to Class Minus 5. indoor installation.

3) Depending to the secondary technic.

4) Operation at lower temperatures on request.

Standards

The Type GAE switchgear installation complies with the following Standards and Regulations:

IEC 60265-1 (62271-103*)	/ VDE 0670 Part 301 (VDE 0671 Part 103*)
IEC 60282-1	/ VDE 0670 Part 4
IEC 62271-1 (IEC 60694**)	/ VDE 0670 Part 1000 (VDE 0671 Part 1*)
IEC 62271-100	/ VDE 0671 Part 100
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**)

* = future

** = up to now

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Technical data

Three-position load-break switches (rated values)

Cable panel 1K, Transformer out going panel 1TS				Rated voltage U_r					
				7.2 kV	12 kV	17.5 kV	24 kV ⁶⁾		
Rated normal current for	Ring cable feeder circuits	I_r	A	630	630	630	630		
	Transformer feeder circuits ¹⁾	I_r	A	200	200	200	200		
Rated short-time current	For systems with $t_k = 1$ s	I_k	kA	20	20	20	20		
	For systems with $t_k = 3$ s	I_k	kA	20	20	20	20		
Rated peak withstand current ²⁾		I_p	kA	50	50	50	50		
Rated short-circuit making current for	Transformer feeder circuits ³⁾	I_{ma}	kA	50	50	50	50		
	Ring cable feeder circuits	I_{ma}	kA	50	50	50	50		
Switching capacity for multi-purpose load-break switches to IEC 60265-1 and VDE 0670 Part 301									
Test sequence 1	Rated mainly active load-breaking current	At 20 operations	I_1	A	630	630	630	630	
		At 100 operations	I_1	A	630	630	630	630	
		At 5 %	I_1	A	31.5	31.5	31.5	31.5	
Test sequence 2a	Rated distribution line closed-loop current, $10 \times$	I_2	A	630	630	630	630		
Test sequence 4a	Rated cable-charging breaking current	I_{4a}	A	50	50	50	50		
Test sequence 5	Rated short-circuit making current	I_{ma}	kA	50	50	50	50		
–	Rated no-load transformer breaking current	I_3	A	4)	4)	4)	4)		
Switching capacity in the event of an earth fault									
Rated earth-fault disconnect current		I_{6a}	A	160	160	160	160		
Rated cable-charging breaking current in the event of an earth fault		I_{6b}	A	100	100	100	100		
Switching capacity to IEC 62271-105									
Rated transfer current		Device Type TS	$I_{transfer}$	A	1900	1900	1500	1500	
Rated transfer current		On request	Device Type LTS	$I_{transfer}$	A	2800	2800	–	–
Operations Ring cable panel 1K									
Rated mainly active load-breaking current		n		$100 \times$	$100 \times$	$100 \times$	$100 \times$		
Rated short-circuit making current 50 kA		n		$5 \times$	$5 \times$	$5 \times$	$5 \times$		
Mechanically admissible		n		$1000 \times^{5)}$	$1000 \times^{5)}$	$1000 \times^{5)}$	$1000 \times^{5)}$		
Class				E3/M1	E3/M1	E3/M1	E3/M1		

1) Dependent on HV fuse link size.

2) In the transformer feeder circuit, these values are limited by HV fuses.

3) Dependent on the HV fuse cut-off current.

4) Tested exemplary in accordance with the above Standard for 400 kVA and 1000 kVA transformers at 12 kV and 24 kV.

5) Higher values on request

6) Higher rated voltage (25 kV) on request

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Technical data

Three-position isolating switches in the current path (rated values)

Circuit-breaker panel 1LSV(G)				Rated voltage U_r			
				7.2 kV	12 kV	17.5 kV	24 kV ¹⁾
Rated normal current for	Circuit-breaker panel	I_r	A	630	630	630	630
Rated short-time current	For systems with $t_k = 1$ s	I_k	kA	20	20	20	20
	For systems with $t_k = 3$ s	I_k	kA	20	20	20	20
Rated peak withstand current		I_p	kA	50	50	50	50
Operations – mechanically admissible		n		3000 ×	3000 ×	3000 ×	3000 ×
Class				M2	M2	M2	M2

1) Higher rated voltage (25 kV) on request

Three-position SF₆ circuit-breaker with stored energy Off (rated values)

Outgoing panel with SF ₆ circuitbreaker 1LSF, Switching capability acc. to IEC 62271-100, test duty I_{100a} is not required				Rated voltage U_r			
				7.2 kV	12 kV	17.5 kV	24 kV ¹⁾
Rated normal current of the feeder circuits		I_r	A	250/630	250/630	250/630	250/630
Rated short-time current	For systems with $t_{th} = 1$ s	I_k	kA	20	20	16	16
	For systems with $t_{th} = 3$ s	I_k	kA	20	20	16	16
Rated peak withstand current		I_p	kA	50	50	40	40
Rated short-circuit making current		I_{ma}	kA	50	50	40	40
Rated short-circuit breaking current		I_{sc}	kA	20	20	16	16
Rated cable disconnection current		I_c	A	50	50	50	50
Rated switching sequence		–		0 – 3 min – C0 – 3 min – C0			
Operations at							
Rated short-circuit making current		n		5 ×	5 ×	5 ×	5 ×
Rated short-circuit breaking current		n		20 ×	20 ×	22 ×	22 ×
Rated normal current and mechanically admissible		n		2000 ×	2000 ×	2000 ×	2000 ×
Class				M1, E2	M1, E2	M1, E2	M1, E2

1) Higher rated voltage (25 kV) on request.

Earthing switch (rated values)

Panels K, TS, LSF				Rated voltage U_r			
				7.2 kV	12 kV	17.5 kV	24 kV ²⁾
Earthing function of the three-position switch							
Rated short-circuit making current		I_{ma}	kA	50	50	50	50
Rated short-time current		I_k	kA	20	20	20	20
Earthing function downstream of HV fuse							
Rated short-circuit making current		I_{ma}	kA	6.3	6.3	6.3	6.3
Rated short-time current		I_k	kA	2.5	2.5	2.5	2.5
Operations							
Rated short-circuit making current 50 kA		n		5 ×	5 ×	5 ×	5 ×
Mechanically admissible		n		1000 × ¹⁾	1000 × ¹⁾	1000 × ¹⁾	1000 × ¹⁾
Class				E2	E2	E2	E2

1) Higher values on request.

2) Higher rated voltage (25 kV) on request.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Technical data

GNVL vacuum circuit-breaker with pre-charged On and Off

				Rated voltage U_r			
				7.2 kV	12 kV	17.5 kV	24 kV ¹⁾
Rated normal current of the feeder circuits	I_r	A	630	630	630	630	
Rated short-time current	For systems with $t_{th} = 1$ s	I_k	kA	20	20	16	16
	For systems with $t_{th} = 3$ s	I_k	kA	20	20	16	16
Rated peak withstand current	I_p	kA	50	50	40	40	
Rated short-circuit making current	I_{ma}	kA	50	50	40	40	
Rated short-circuit breaking current	I_{sc}	kA	20	20	16	16	
Rated cable-charging breaking current	I_c	A	50	50	50	50	
DC component		%	33	33	33	33	
Rated transient recovery voltage	U_c						
	Peak value	kV	21	21	41	41	
	Rate of rise	kV/ μ s	0.34	0.34	0.47	0.47	
First-pole-to-clear factor			1.5	1.5	1.5	1.5	
Mechanical operations	n		10000 \times ³⁾				
Class			E1/M2/C2	E1/M2/C2	E1/M2/C2	E1/M2/C2	
Insulating medium			SF ₆				
Arc extinguishing medium			Vacuum				
Drive			Motor-spring operation				
Number of poles			3				
Number of breaks per pole			1				
Opening time		ms	45				
Closing time		ms	38				
Pole centres distance		mm	150				
Temperature class		°C	-5 to +40 ²⁾				
Installation			Indoor				
Rated switching sequence (optional)			0 – 0.3 s – C0 – 15 s – C0				

- 1) Higher rated voltage (25 kV) on request.
- 2) Operation at lower temperatures on request.
- 3) Higher values on request.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Range of individual panels

Cable panel with load-break switch and vertically arranged bushings Type -1K-/3/ and horizontal bushing position Type -1KB-/4/

Variants

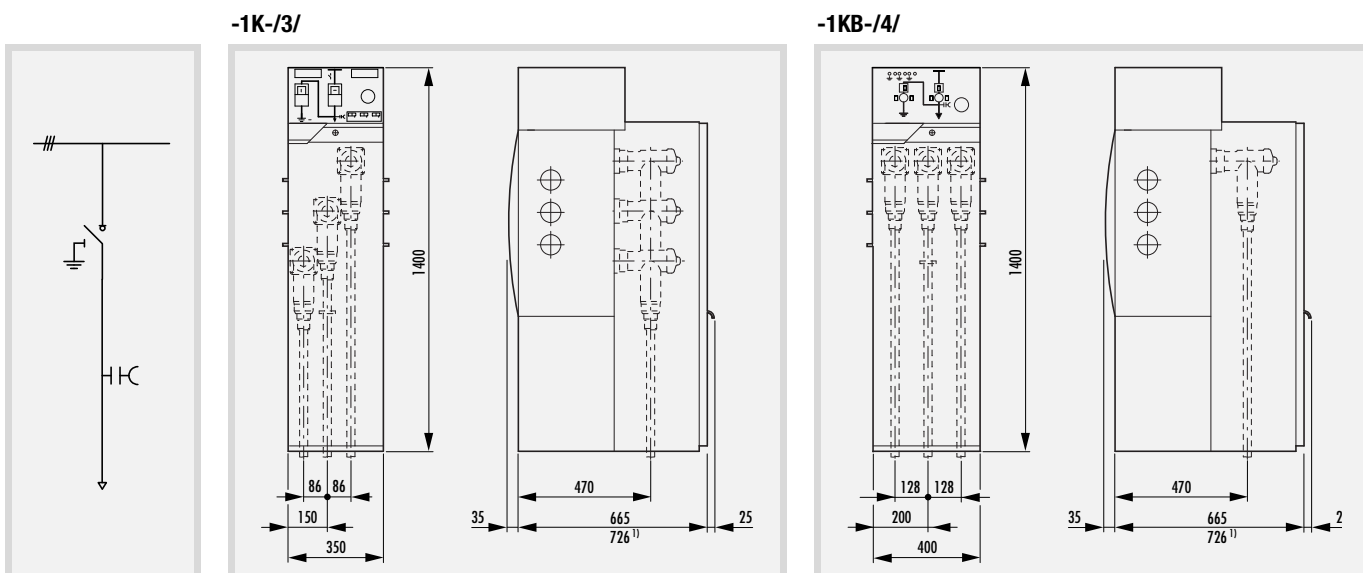
- 1K-/3/12/630-630/... -1KB-/4/12/630-630/...
 -1K-/3/24/630-630/... -1KB-/4/24/630-630/...

Standard equipment

- SF₆ three-position load-break and earthing switch:
 - Including interlock,
 - Manual operation,
 - Load-break and earthing switches with spring-operated – ON and OFF –,
- 3-pole SF₆-insulated busbar in the SF₆ compartment,
- On both sides of the SF₆-gas tank: inner cone plug-in systems for external busbar connection,
- Capacitive voltage indication ledges,
- Gas leakage indication
- Pressure relief in the event of arcing directed into the cable well, panel floor open,
- Lockable operators,
- Single set of cable connection bushings for maximally double cable connection via external cone plug XLPE 2 × 1 × 500 mm² (NKT CB, CC), (One connection plug replaceable for surge arrester).

Optional

- Accessories for SF₆ three-position isolating and earthing switch:
 - Auxiliary contact module for isolating switch, max. 3 NO, 3 NC,
 - Auxiliary contact module for earthing switch, max. 2 NO, 2 NC,
 - Motor operator for load-break switch, on request,
- Anti-reverse interlock for cable termination front covers,
- Relay and control compartment, height 900 mm,
- Capacitive voltage indication ledge with built-in three-phase continuous indication and permanent self monitoring in relay cabinet front cover (→ page 31),
- Short-circuit indicator (→ page 32),
- SF₆ pressure monitoring:
 - Pressure switch with auxiliary contact,
 - Density monitor with auxiliary contact,
- In the event of arcing, pressure relief via rear absorber channel towards the top, panel floor closed, overall panel depth approx. 1150 mm (→ page 35), (only for -1KB-/4/)
- Deep front covers for deeper double cable connection (depth + 61 mm),
- Extra deep front cover for -1K-/3/ (depth + 150 mm),
- Cable clamps,
- Arc-fault resistant cable termination compartments,
- Relay- and control compartment (→ page 5)



1) Deep front cover
Weight: 127 kg

1) Deep front cover
Weight: 130 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

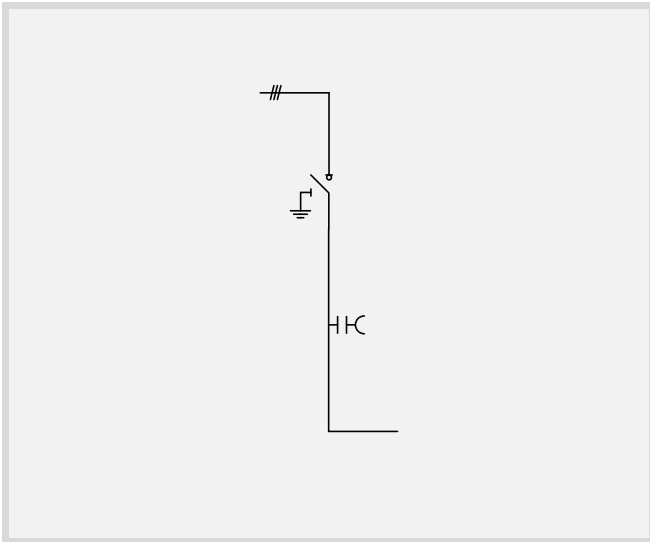
Bus-sectionalizer panel, Type -1KG-, with load-break switch

Variants

- 1KG-/3/12/630-630/...
- 1KG-/3/24/630-630/...

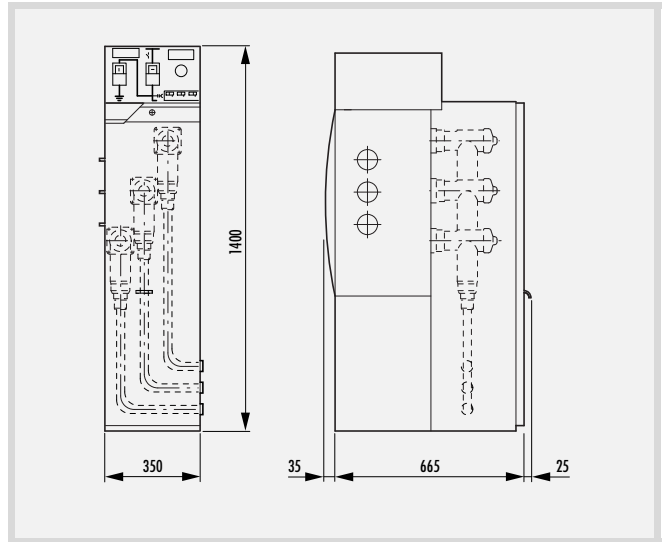
Standard equipment

- 3-phase busbar for metering panel -1M1-,
- Otherwise as page 11.



Accessories, optional

- As page 11.



Weight: 130 kg

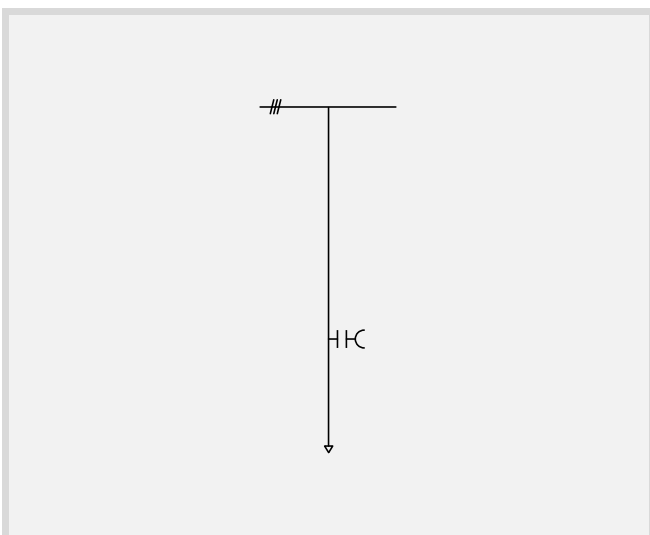
Cable connection panel Typ -1A1-

Variants

- 1A1-/3/12/630-630/...
- 1A1-/3/24/630-630/...

Standard equipment

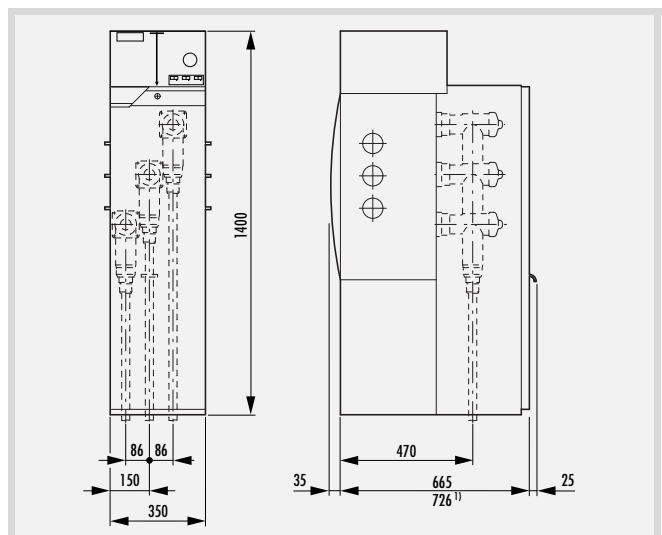
- 3-phase busbar in the SF₆ compartment without switch.
- Otherwise as page 11.



Accessories, optional

- As page 11 (except switch accessories).

-1A1-



1) Deep front cover
Weight: 127 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Transformer feeder panel with fused load-break switch Type -1TS-/4/

Variants

-1TS-/4/12/630-200/...

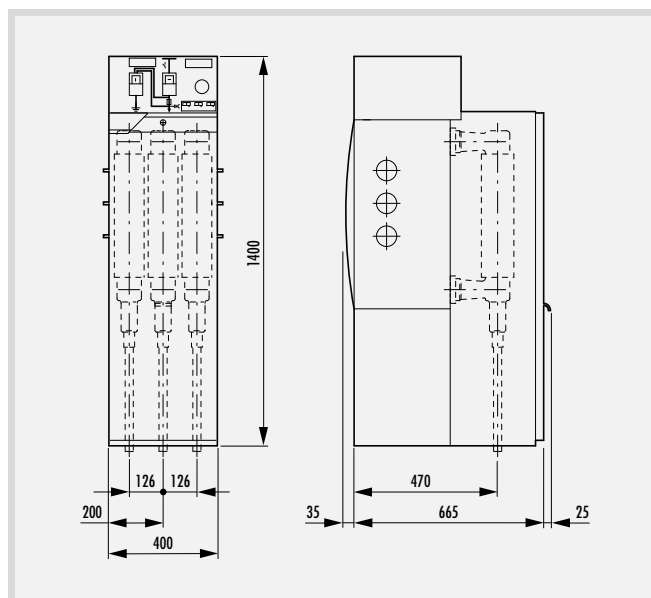
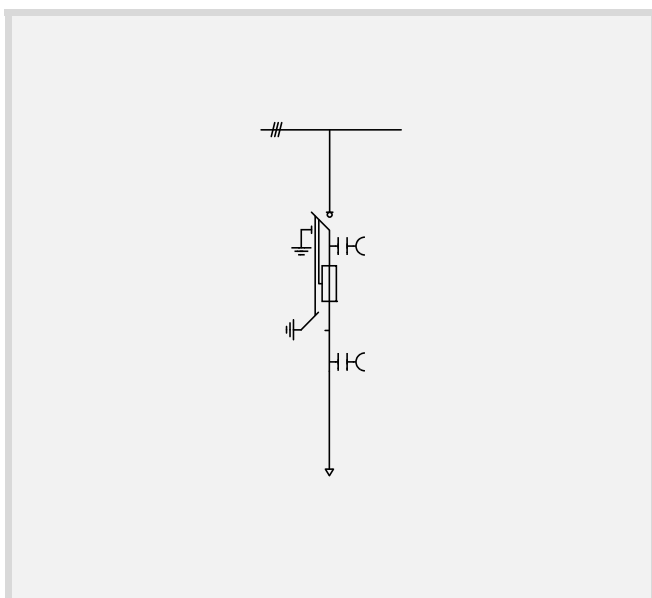
-1TS-/4/24/630-200/...

Standard equipment

- SF₆ three-position load-break and earthing switch:
 - Including interlock,
 - Manual operation,
 - Load-break switch with spring operated – ON, and stored energy operated – OFF,
 - Earthing switch with spring operated – ON and OFF –,
- Indication of tripped fuse,
- 3-pole SF₆-insulated busbar in the SF₆ compartment,
- On both sides of the SF₆-gas tank: inner cone plug-in systems for external busbar connection,
- 3-phase plug-on fuse arrangement,
- Earthing switch in SF₆ downstream of the HRC fuse,
- 3-pole slip-on type cable termination for transformer cables, maximally XLPE 1 × 240 mm²,
- Capacitive voltage indication ledges upstream and downstream of the fuse,
- Gas leakage indication,
- Pressure relief in the event of arcing directed into the cable well, panel floor open,
- Lockable operators,

Optional

- Accessories for SF₆ three-position load-break and earthing switch:
 - Auxiliary contact module for load-break switch, max. 3 NO, 3 NC,
 - Shunt trip release, AC, DC,
 - Auxiliary contact module trip indication,
 - Motor operator for load-break switch,
 - Auxiliary contact module for earthing switch, max. 2 NO, 2 NC,
- Anti-reverse interlock for front covers,
- Relay- and control compartment, height 900 mm,
- Capacitive voltage indication ledge with built-in three-phase continuous indication and permanent self monitoring (→ page 31),
- SF₆ pressure monitoring:
 - Pressure switch with auxiliary contact,
 - Density monitor with auxiliary contact,
- In the event of arcing, pressure relief via rear absorber channel towards the top, panel floor closed, overall panel depth approx. 1150 mm (→ page 35),
- Cable clamps,
- Arc-fault resistant terminal compartment,
- Relay- and control compartment (→ page 5).



Weight: 151 kg

Transformer panel, Type -1KS-

- As -1TS-/4/, without:
 - Stored-energy mechanism of load-break switch,
 - Fuse-tripping mechanism with display.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Outgoing feeder panel with SF₆ circuit-breaker based on arc quenching coil Type -1LSF-/6/

Variants

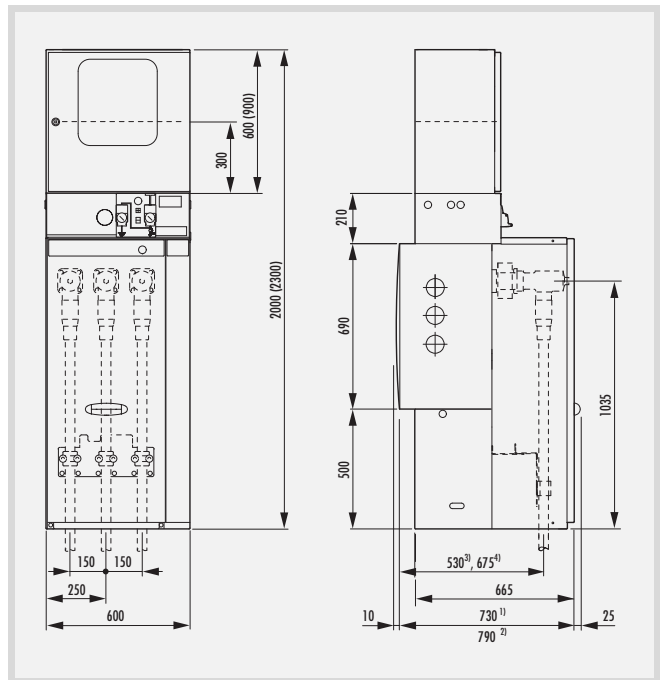
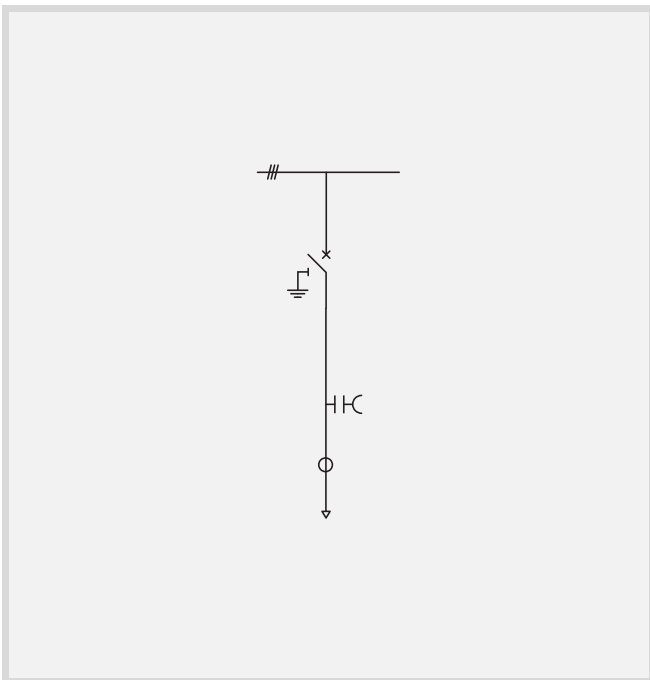
- 1LSF-/6/12/630-630/... -1LSF-/6/12/630-250/...
- 1LSF-/6/24/630-630/... -1LSF-/6/24/630-250/...

Standard equipment

- SF₆ three-position circuit-breaker and earthing switch:
 - Including interlock,
 - Handle,
 - Circuit-breaker with spring operated – ON, and stored energy operated – OFF,
 - Earthing switch with spring operated – ON and OFF –,
- Manual Emergency-Stop push-button,
- 3-pole SF₆ insulated busbar in the SF₆ compartment,
- On both sides of the SF₆ gas tank: inner cone plug-in systems for external busbar connections,
- Capacitive voltage indication ledges,
- Gas leakage indication,
- Pressure relief in the event of arcing directed into the cable well, panel floor open,
- Lockable operators,
- Single set of cable connection bushings for maximally double cable connection via external cone plug XLPE 2 × 1 × 500 mm² (NKT CB, CC), (One connection plug replaceable for surge arrester),
- Relay- and control compartment (→ page 5).

Optional

- Circuit-breaker
 - Motor operator for circuit-breaker,
 - Shunt trip release, AC, DC,
 - Auxiliary contacts: 3 NO and 3 NC,
- Auxiliary contact module for earthing switch, max. 2 NO, 2 NC,
- Anti-reverse interlock for cable termination front covers,
- Relay- and control compartment, height 900 mm,
- Current transformer trip release for pulsed release or via auxiliary current transformer,
- Auxiliary current transformer,
- Capacitive voltage indication ledge with built-in three-phase continuous indication and permanent self monitoring in relay cabinet front cover (→ page 31),
- Short-circuit indicator in relay cabinet front cover (→ page 32),
- SF₆ pressure monitoring:
 - Density monitor with auxiliary contact,
- In the event of arcing, pressure relief via rear absorber channel towards the top, panel floor closed, overall panel depth approx. 1150 mm (→ page 35),
- Deep front cover for deeper double cable connection (depth + 61 mm),
- Protective relay by agreement,
- 3-pole system protection current transformer (and measuring current transformer, optionally calibrated) as ring-core (spectacle core) transformer laid around the external cone bushing, by agreement,
- Layout of relay compartment and front panel, by agreement,
- Cable clamps,
- Arc-fault resistant cable termination compartments,
- Deep cable connection compartment (+ 80 mm).



- 1) Cable connection compartment standard.
 - 2) Cable connection compartment deep.
 - 3) Short bushings.
 - 4) Long bushings.
- Weight: 255 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Bus-sectionalizer panels, Type -1LSFG-/6/, with SF₆ circuit-breaker

Variants

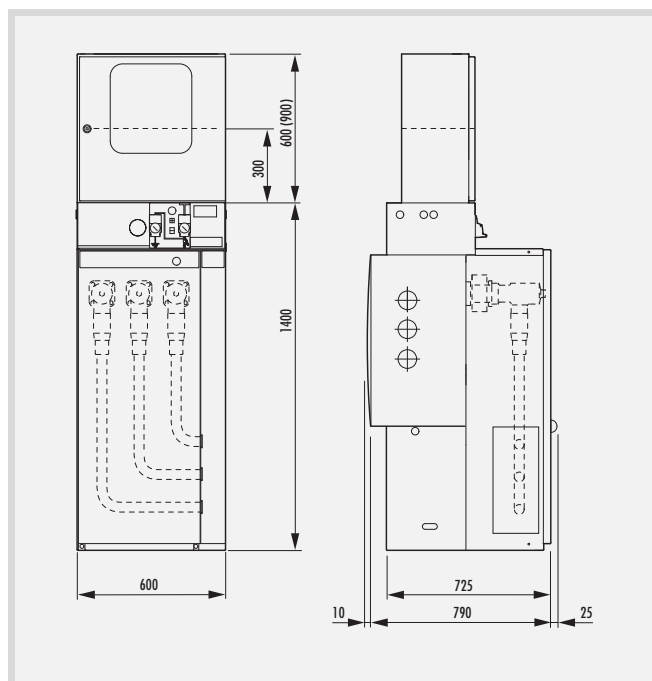
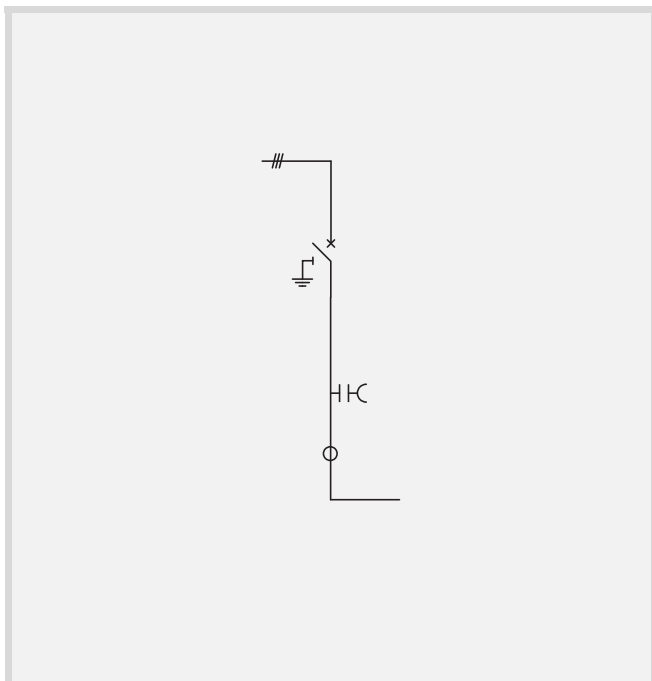
- 1LSFG-/6/12/630-630/20-...
- 1LSFG-/6/24/630-630/16-...

Standard equipment

- 3-phase busbar for metering panel -1M1-,
- Otherwise as page 14.

Accessories, optional

- As page 14.



Weight: 260 kg

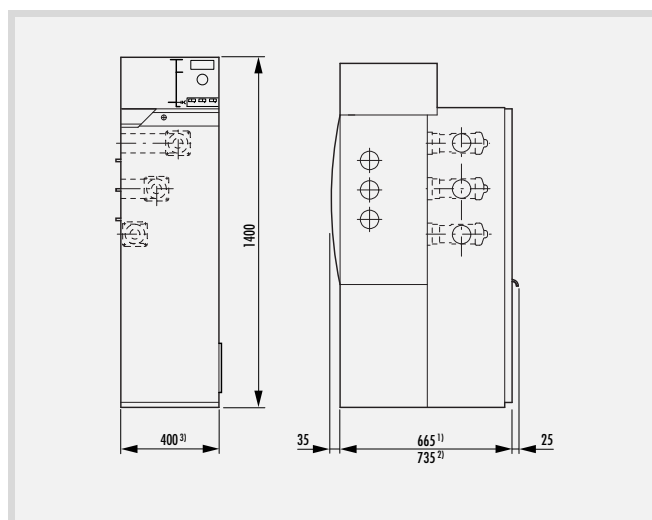
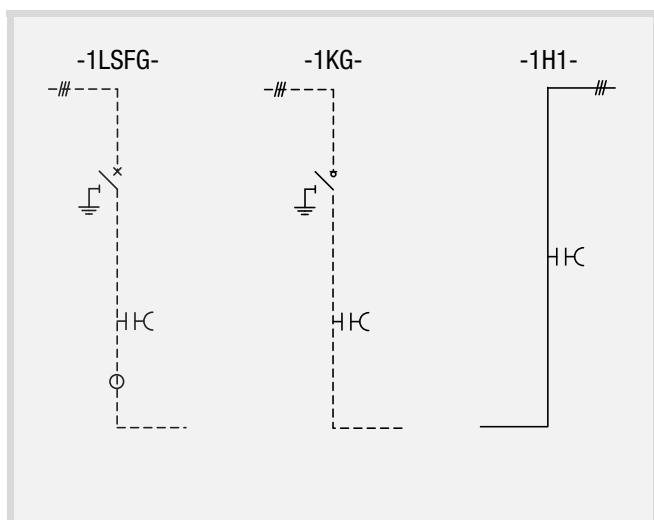
Bus riser panel, Type -1H1-/3/ in connection with -1KG-/3/ or -1LSFG-/6/

Standard equipment

- 3-phase busbar in the SF₆ compartment,
- Capacitive voltage indication ledge in the busbar area,
- Intermediate frame 50 mm.

Accessories, optional

- Arc-fault resistant cable compartment



- 1) 1KG panel.
 - 2) 1LSFG panel.
 - 3) incl. intermediate frame
- Weight: 130 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

SF₆ circuit-breaker panel, Type -1LSF-/5/ (availability on request)

Variants

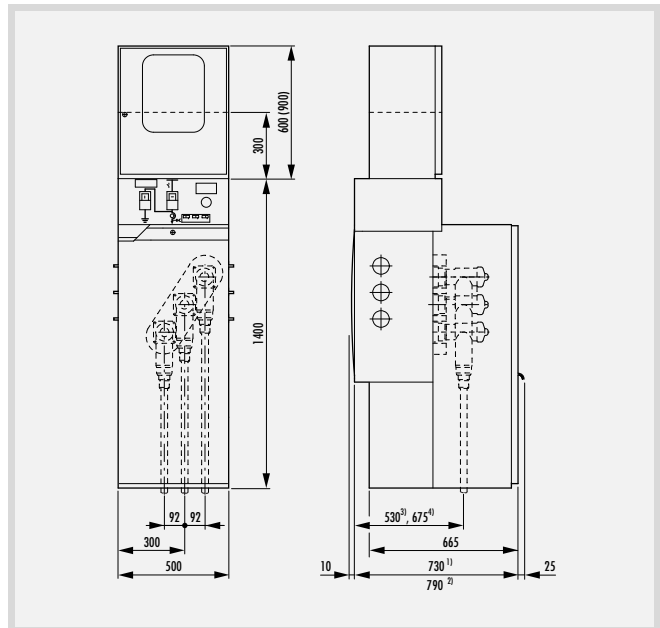
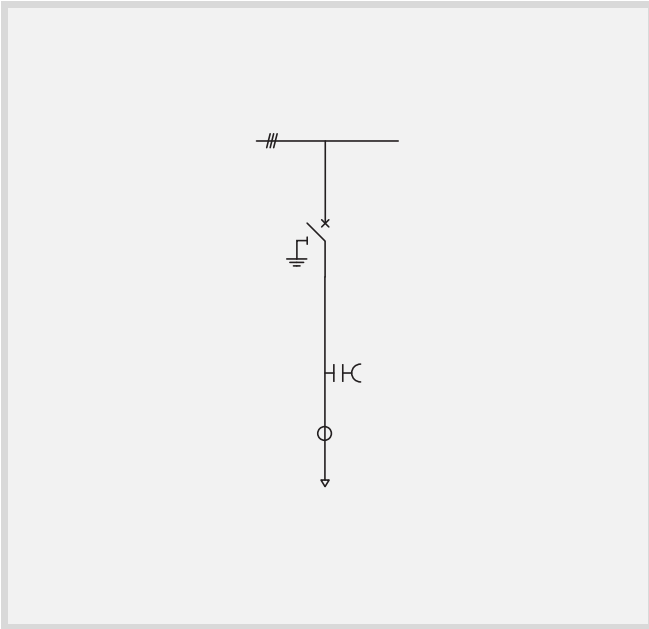
-1LSF-/5/12/630-630/20-... -1LSF-/5/12/630-250/20-...
 -1LSF-/5/24/630-630/16-... -1LSF-/5/24/630-250/16-...

Standard equipment

- As page 14.

Accessories, optional

- As page 14.



1) Cable connection compartment standard. 2) Cable connection compartment deep. 3) Short bushings. 4) Long bushings.

Weight: 255 kg

Bus-sectionalizer panels, Type -1LSFG-/5/, with SF₆ circuit-breaker (availability on request)

Variants

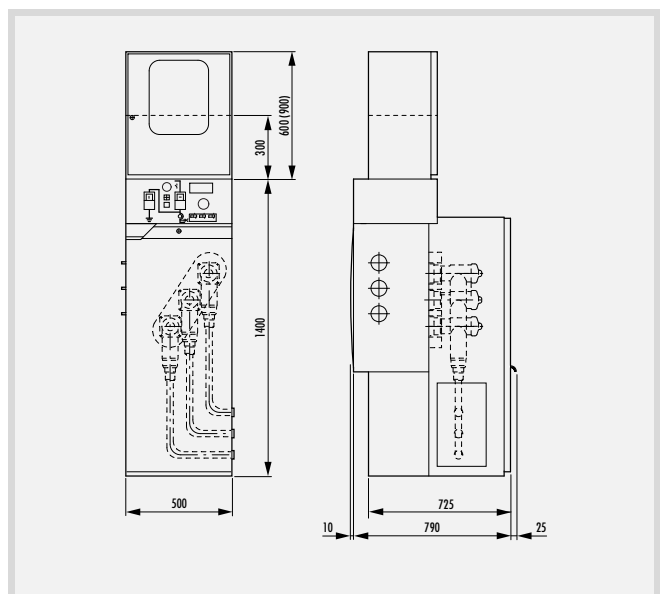
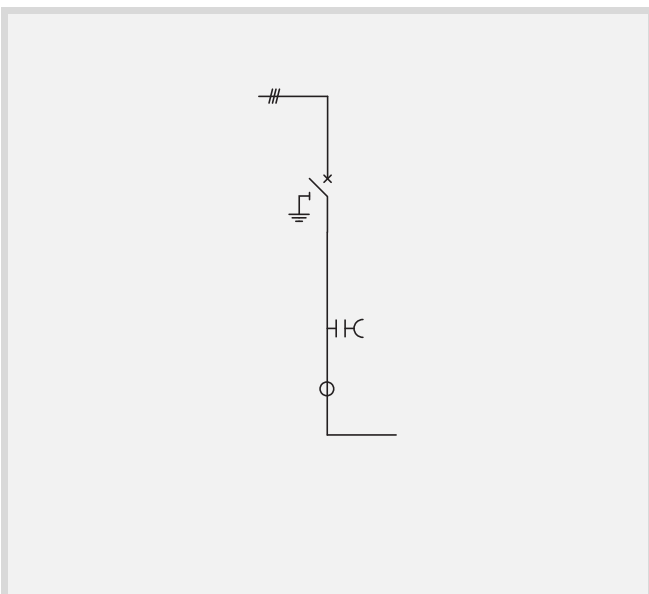
-1LSFG-/5/12/630-630/20-... -1LSFG-/5/12/630-250/20-...
 -1LSFG-/5/24/630-630/16-... -1LSFG-/5/24/630-250/16-...

Standard equipment

- 3-phase busbar for metering panel -1M1-,
- Otherwise as page 14.

Accessories, optional

- As page 14 (except optional pressure relief channel).



Weight: 260 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Busbar earthing panel Type -1E-/3/

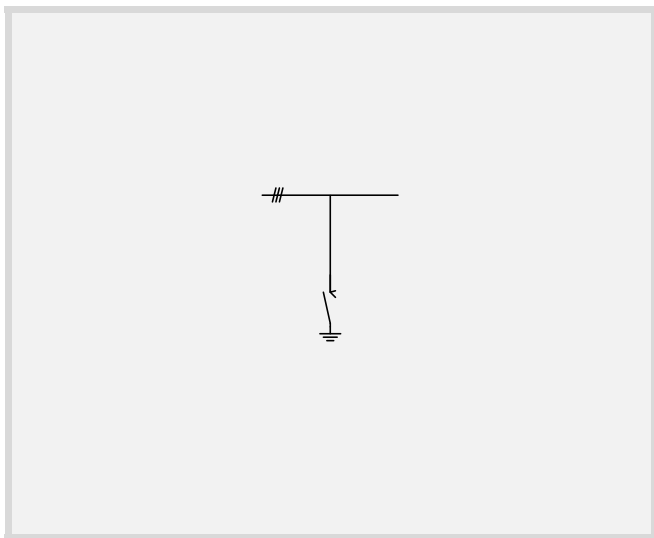
Variants

-1E-/3/12/630/...

-1E-/3/24/630/...

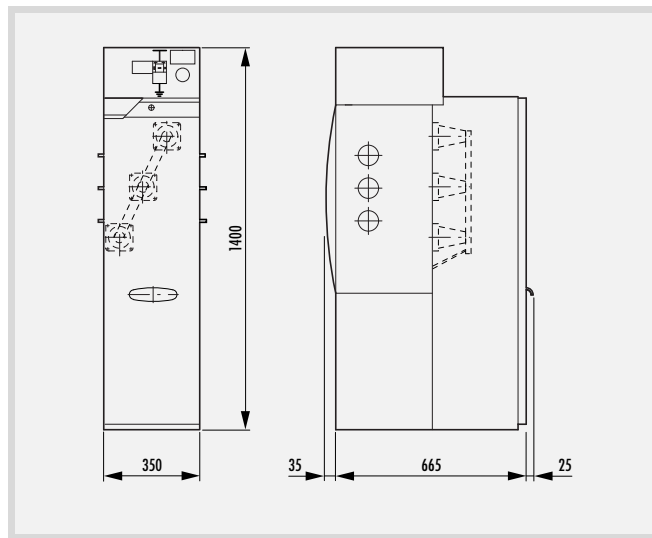
Standard equipment

- 3-phase earthing switch for busbar earthing. Earthing function as with three-position switches,
- 3-phase busbar in the SF₆ compartment,
- Spring operated drive for earthing switch,
- Padlocking facility for earthing switch actuator.



Accessories, optional

- Auxiliary contact for earthing switch, max. 2 NO, 2 NC,
- Arc-fault resistant cable compartment.



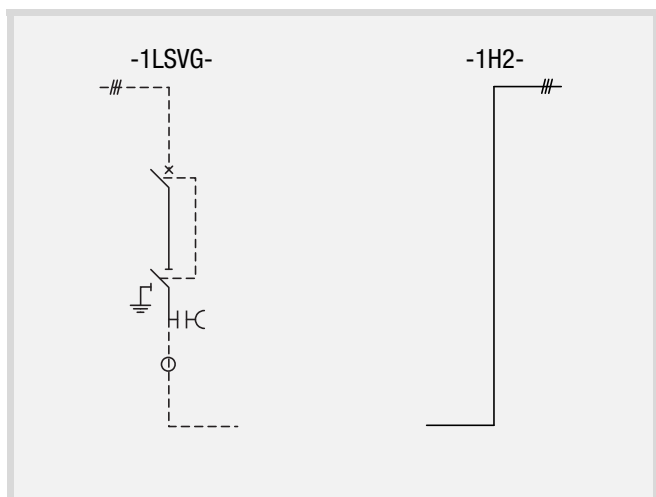
Weight: 125 kg

Bus riser panel -1H2-/9/in connection with -1LSVG-/5/ panel

Variants

-1H2-/9/12/630/...

-1H2-/9/24/630/...

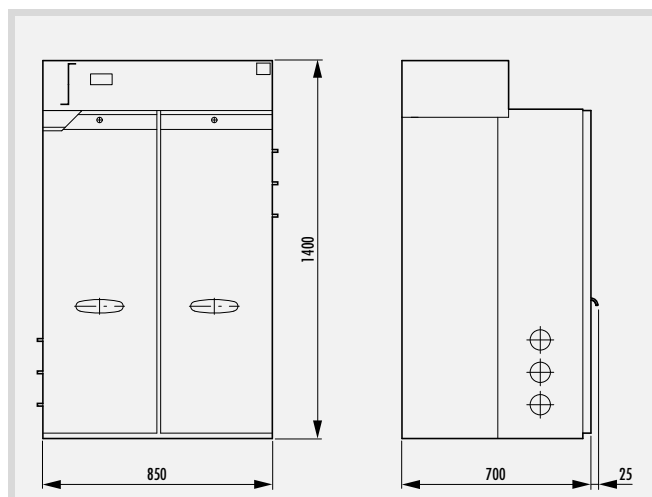


Standard equipment

- 3-phase busbar.

Accessories, optional

- Arc-fault resistant cable compartment.



Weight: 270 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Outgoing feeder panel with vacuum circuit-breaker Type -1LSV-/5/

Variants

-1LSV-/5/12/630-630/20-...

-1LSV-/5/24/630-630/16-...

Standard equipment

- Vacuum circuit-breaker with stored energy operated– ON and OFF –:
 - Motor operator,
 - Auxiliary contacts: 10 NO and 10 NC,
 - Tripping device – ON, OFF – DC or AC,
 - Signalling contact for “Starting sections charged”,
 - Mechanical counter,
- SF₆ three-position isolating and earthing switch:
 - interlocked with circuit-breaker,
 - Manual operation,
 - Earthing switch with spring operated– ON and OFF–,
- 3-pole SF₆ -insulated busbar in the SF₆ compartment,
- On both sides of the SF₆-gas tank: inner cone plug-in systems for external busbar connection,
- Capacitive voltage indication ledges in relay cabinet front cover,
- Gas leakage indication
- Pressure relief in the event of arcing directed into the cable well, panel floor open,
- Lockable operators,
- Relay- and control compartment (→ page 5).

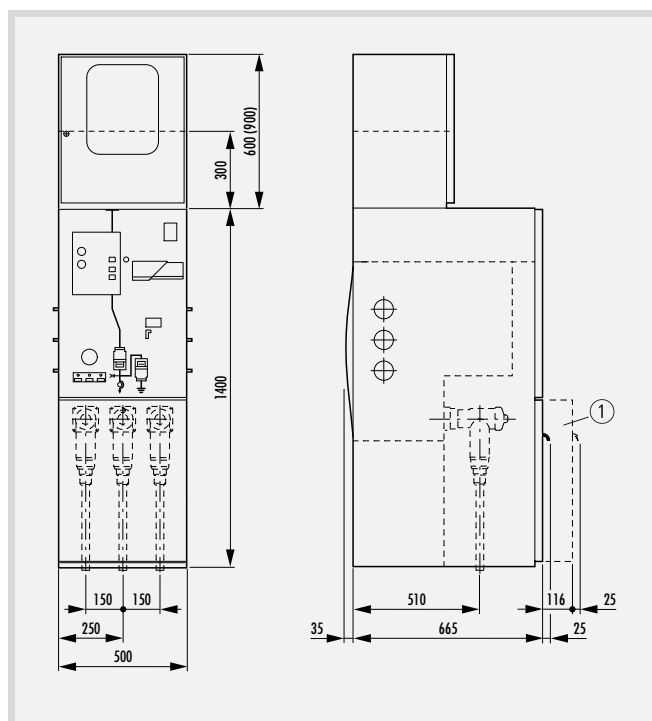
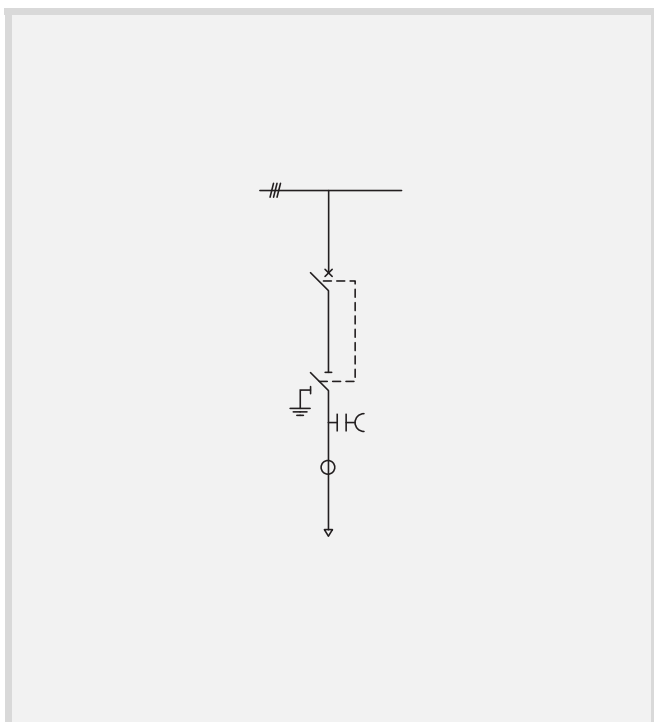
Optional

- Accessories for vacuum circuit-breakers:
 - Undervoltage trip block,
 - Fleeting contact for switch failure indication,
 - Pump blocking relay,
 - Electrical starting preventer (blocking magnet),
 - Varistor module ≥ 60 V DC,
- Accessories for SF₆ three-position isolating and earthing switch:
 - Auxiliary contact module for isolating switch, max. 3 NO, 3 NC,
 - Auxiliary contact module for earthing switch, max. 2 NO, 2 NC,
 - Motor operator for isolating switch – on request,
- Anti-reverse interlock for cable termination front covers,
- Current transformer trip release for pulsed release or via auxiliary current transformer,
- Capacitive voltage indication ledge with built-in three-phase continuous indication and permanent self monitoring in relay cabinet front cover (→ page 31),
- Short-circuit indicator in relay cabinet front cover (→ page 32),
- SF₆ pressure monitoring:
 - Pressure switch with auxiliary contact,
 - Density monitor with auxiliary contact,
- In the event of arcing, pressure relief via the rear absorber channel towards the top, panel floor closed, overall depth approx. 1150 mm (→ page 35),
- Protective relay by agreement,
- Single-pole or 3-pole system protection current transformer (and measuring current transformer, optionally calibrated) as ring-core (spectacle core) transformer laid around the external cone bushing, by agreement,
- Layout of relay compartment and front panel, by agreement,
- Cable clamps,
- Arc-fault resistant cable termination compartments,
- Deep front cover for double-cable connections (+ 116 mm).

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Outgoing feeder panel with vacuum circuit-breaker Type -1LSV-/5/



① Front cover may have to be fitted lower possibly for multiple cable connection, depending on the type of cable connections.

Weight: 325 kg

Bus sectionalizer panel with vacuum circuit-breaker Type -1LSVG-/5/

Variants

-1LSVG-/5/12/630-630/20-...

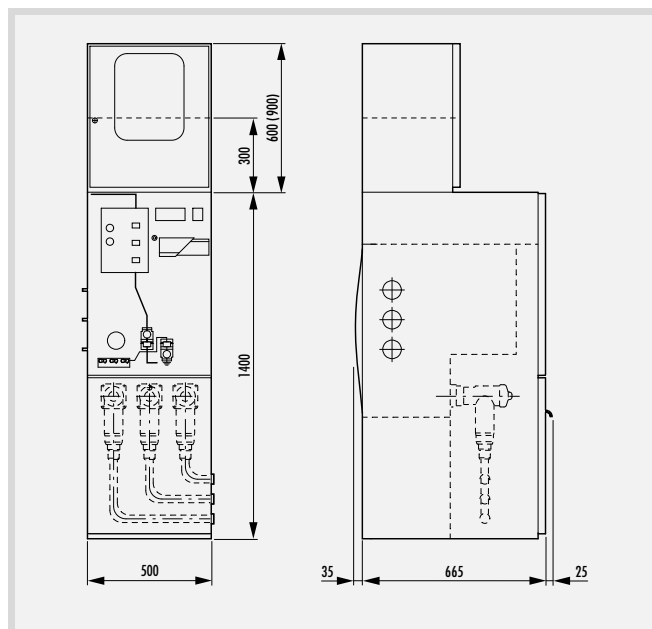
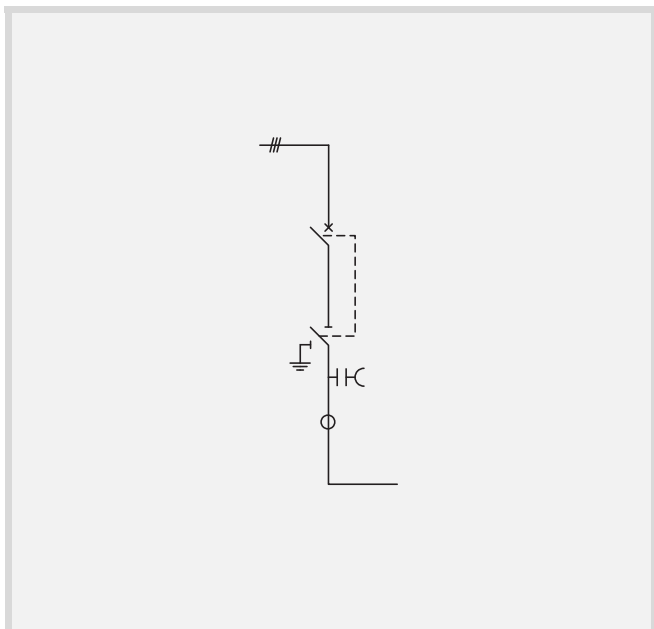
-1LSVG-/5/24/630-630/16-...

Standard equipment

- 3-phase busbar for metering panel -1M1-
- Otherwise as page 18.

Accessories, optional

- As page 18.



Weight: 330 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Metering panels Type -1M...-/.../

Variants

-1M...-/.../12/630/...



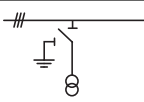
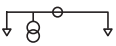



-1M...-/.../24/630/...

Standard equipment

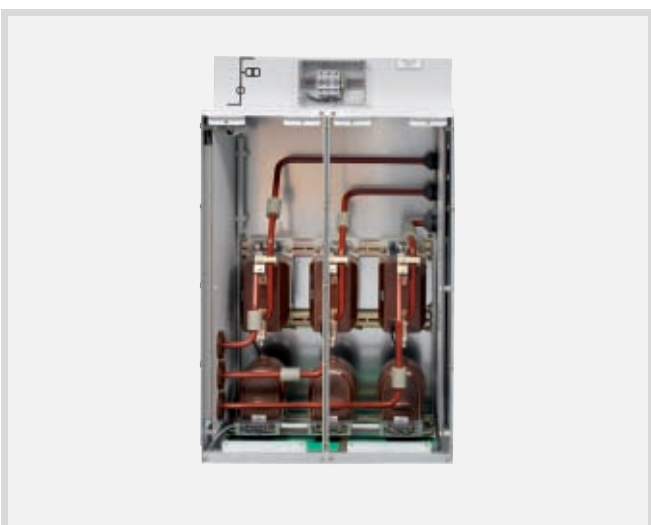
- 3-phase busbar,
- Compact insulators - current- and/or voltage transformers, DIN 42660 part 8 resp. 9, IEC 600441, supplied by Ormazabal, or supplied by electricity supply company.

Optional

- Locking facility for front covers, electricity supply company lock mechanism,
- Phase/earth bolt for connection of earthing and short-circuit kits D = 20 mm, M12,
- Phase/earth bolt for connection of earthing and short-circuit kits D = 25 mm, M16,
- Layout of LV control compartment and front panel, by agreement.
- Arc-fault resistant terminal compartments,
- Relay- and control compartment (→ page 5).

-1M1-/9/		Type: GAE-1M1-12 Type: GAE-1M1-24	
-1M2-/9/		Type: GAE-1M2-12 Type: GAE-1M2-24	–
-1M3-/4/		Type: GAE-1M3-12 Type: GAE-M3-24	Standard equipment <ul style="list-style-type: none"> • SF₆-insulated three-position load-break, and earthing switch, • 3-phase busbar in the SF₆ compartment, • Padlocking facility for drives, • Three single-pole insulated voltage transformers 10 or 20/√3/0.1/√3/0.1/3 kV.
1M4/9/		Type: GAE1M4 12 Type: GAE1M4 24	–
-1M5/9/ 1M5-/9/		Type: GAE-1M5 12, GAE-1M5 24 Type: GAE1M5-12, GAE1M5-24	–
-1M5Ü/9/ 1M5Ü-/9/		Type: GAE-1M5Ü 12, GAE-1M5Ü 24 Type: GAE1M5Ü-12, GAE1M5Ü-24	–
-1M6-/9/		Type: GAE-1M6-12 Type: GAE-1M6-24	–

Weight of the metering panels approx. 490 kg

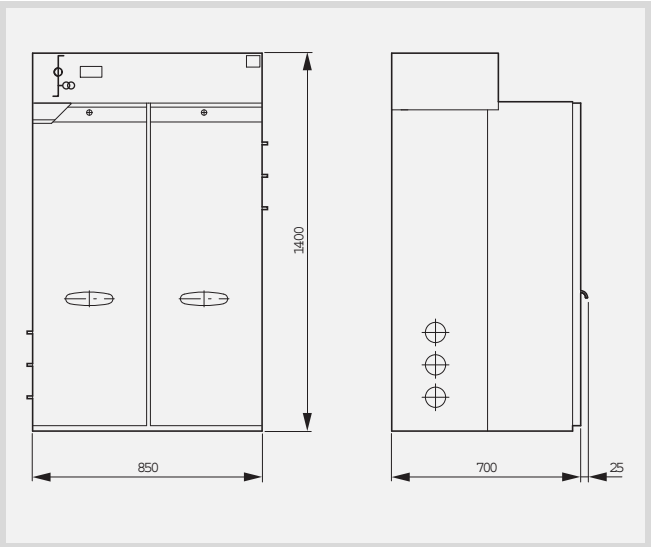


Metering panel 1M1-/9/

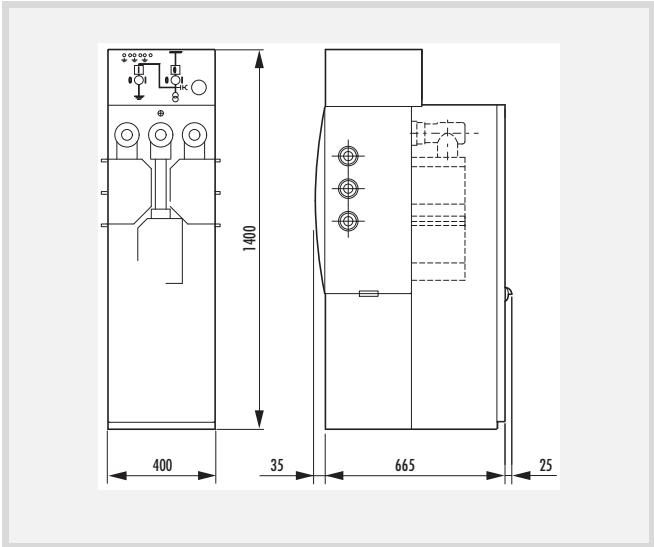
Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of individual panels

Examples of metering panel layouts



Metering panel Type GAE-1M1-/9/



Metering panel Type GAE-1M3-/4/

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of panel blocks available

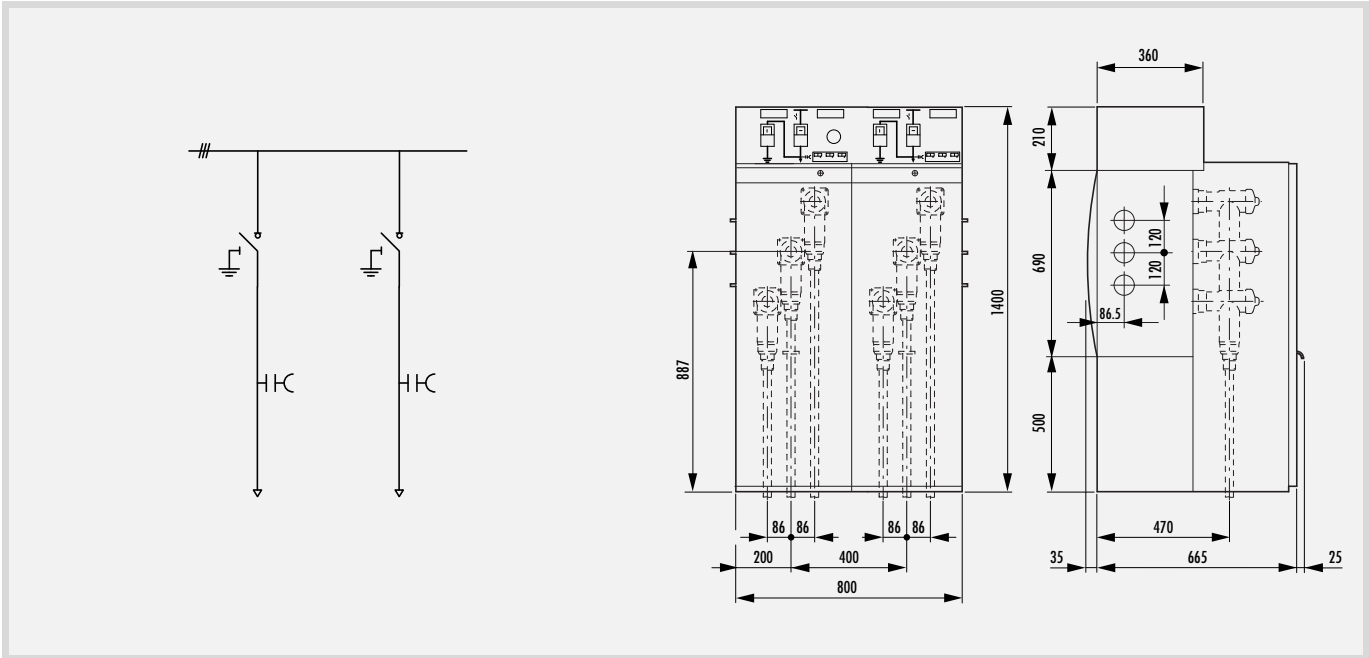
Range of panel blocks available

Ring cable panel, block Type -2K-/8/

Standard equipment and accessories, optional per panel,
→ page 11, Ring cable panel Type -1K-

Variants

- 2K-/8/12/630-630/...
- 2K-/8/24/630-630/...



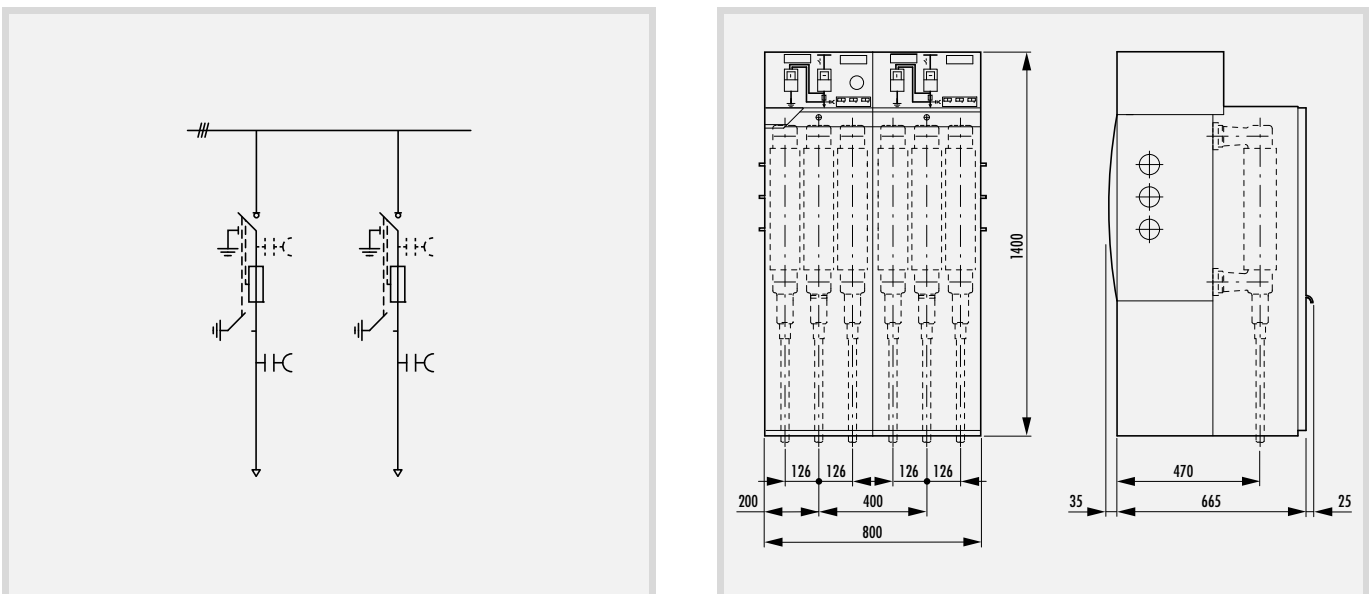
Weight: 263 kg

Transformer panel, block Type -2KS- or -2TS-/8/

Standard equipment and accessories, optional per panel,
→ page 13, Transformer panel Type -1KS- or -1TS-

Variants

- 2KS-/8/12/630-200/...
- 2KS-/8/24/630-200/...
- 2TS-/8/12/630-200/...
- 2TS-/8/24/630-200/...



Weight: 310 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

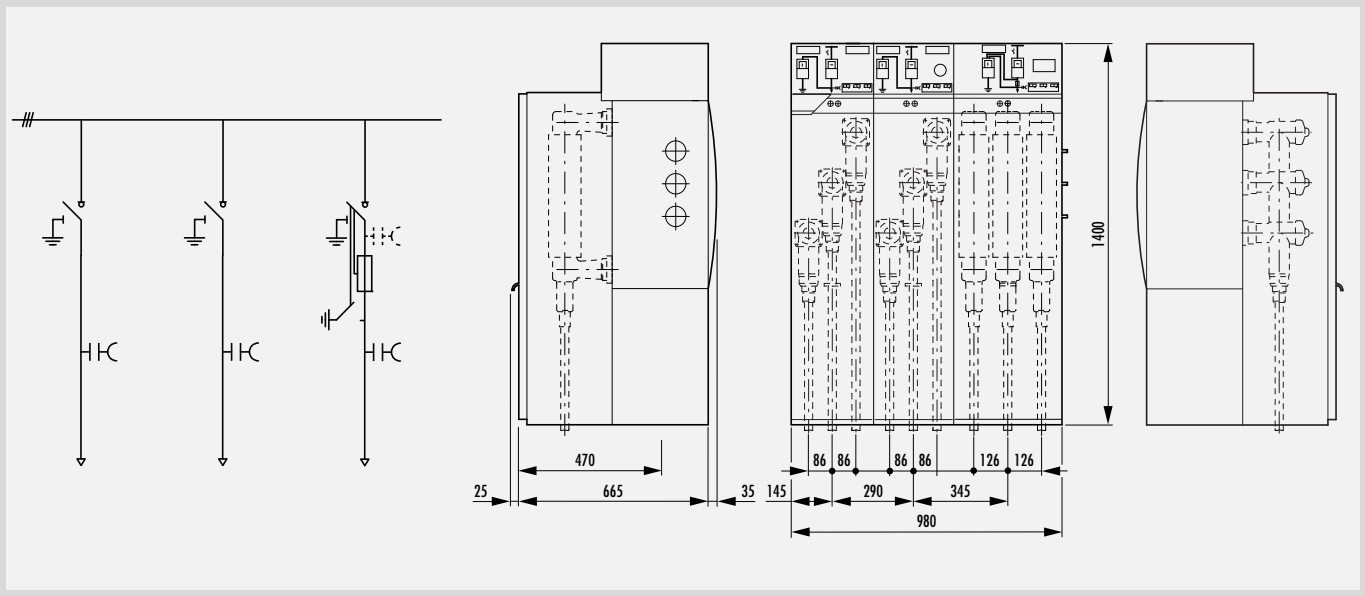
Range of panel blocks available

Ring cable panels, transformer panel, block Type 2K1KS- or 2K1TS-

Standard equipment and accessories, optional per panel, → page 11, Ring cable panel, Type -1K-, and → page 13 transformer panel, Type -1KS- or -1TS-.

Caution! Only expandable on the right.

- Variants**
- 2K1KS-/10/12/630-630/...
 - 2K1KS-/10/24/630-630/...
 - 2K1TS-/10/12/630-630/...
 - 2K1TS-/10/24/630-630/...

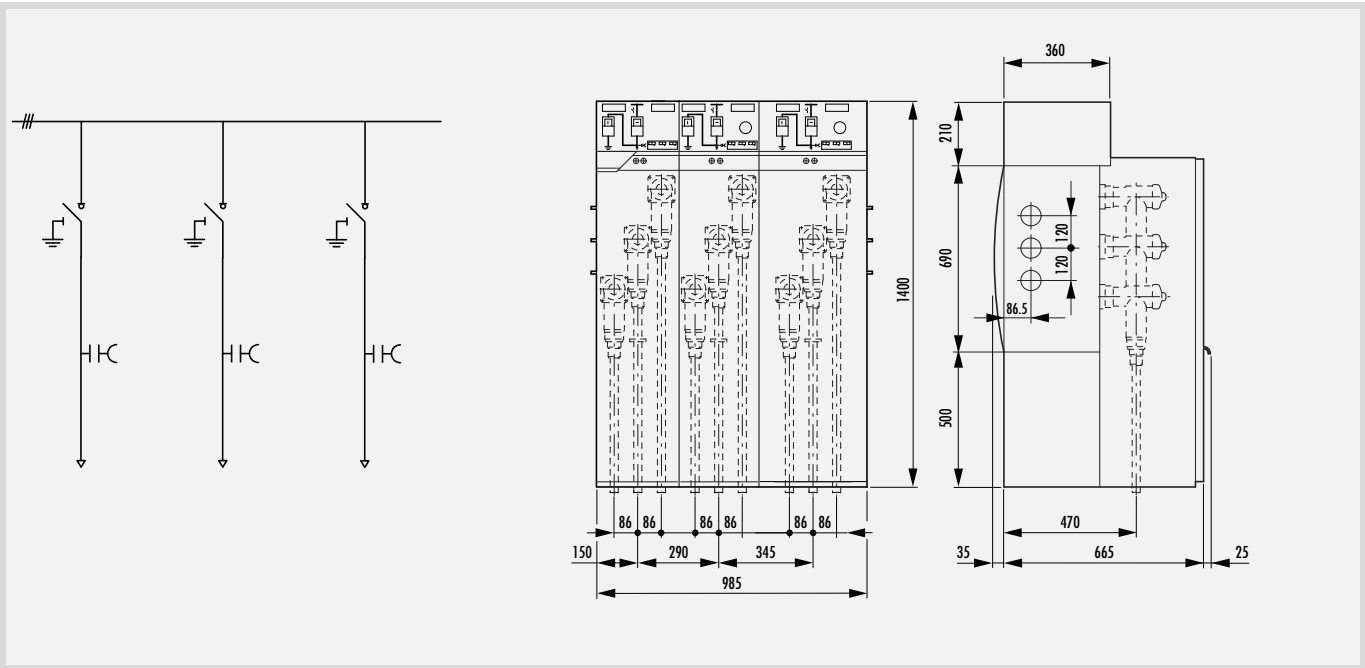


Weight: 298 kg

Ring cable panels, block Type -3K-/10/

Standard equipment and accessories, optional per panel, → page 11, Ring cable panel, Type -1K-

- Variants**
- 3K-/10/12/630-630/...
 - 3K-/10/24/630-630/...



Weight: 265 kg

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Range of panel blocks available

Ring cable panels with SF₆ circuit-breaker block, Type 2K1LSF250-/10/, Type 2K1LSF630-/10/

Standard equipment and accessories, optional per panel,
→ page 11, Ring cable panel, Type -1K-, and → page 14,
SF₆ circuit-breaker panel, Type -1LSF250- or -1LSF630-.

Caution! Only expandable on the right.

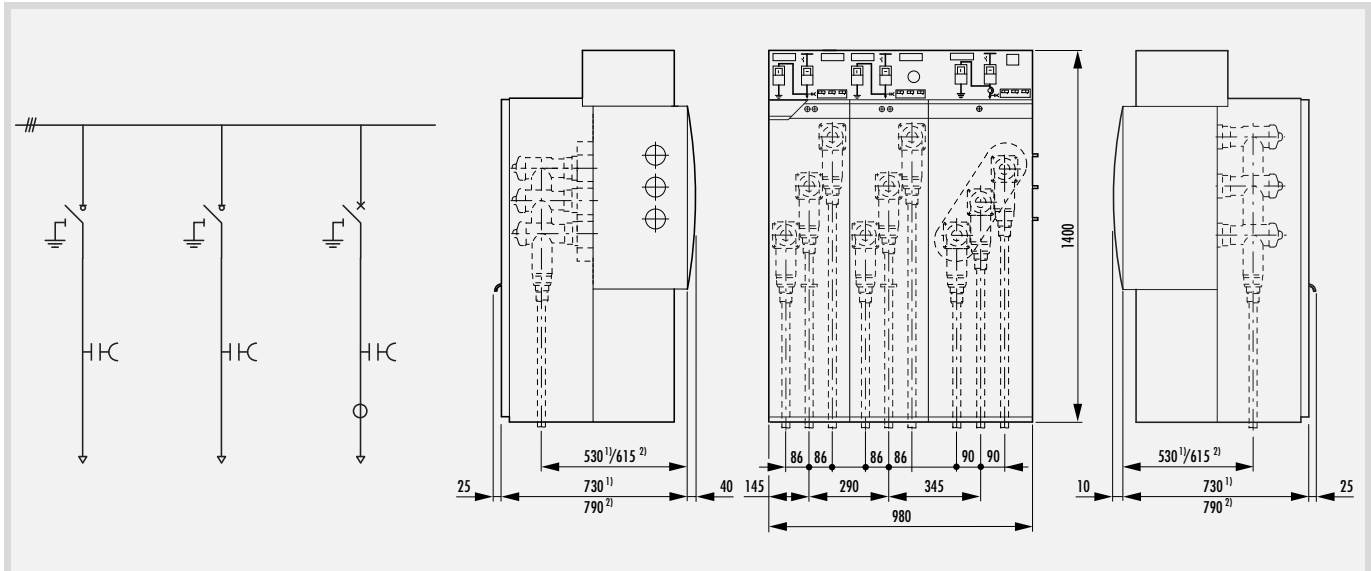
Variants

2K1LSF250-/12/630-250/20-...

2K1LSF630-/12/630-630/20-...

2K1LSF250-/24/630-250/16-...

2K1LSF630-/24/630-630/16-...



1) Cable connection compartment standard.

2) Cable connection compartment deep.

Weight: 345 kg

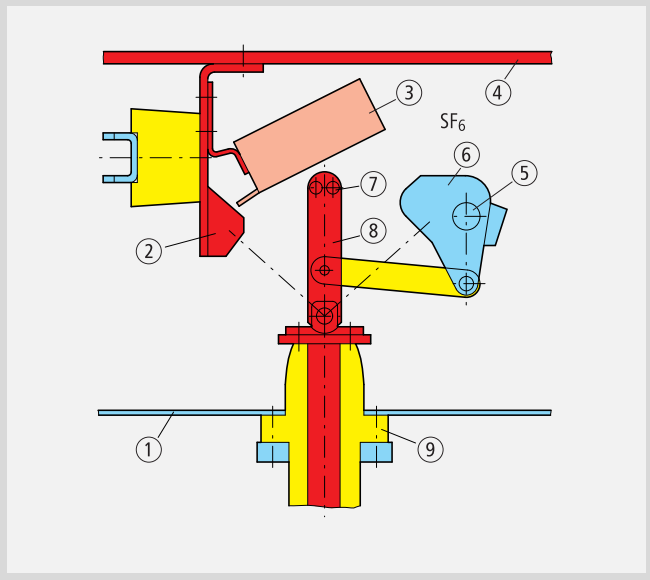


Block Type 2K1LSF250- with relay compartment, height 300 mm

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630
Switching systems

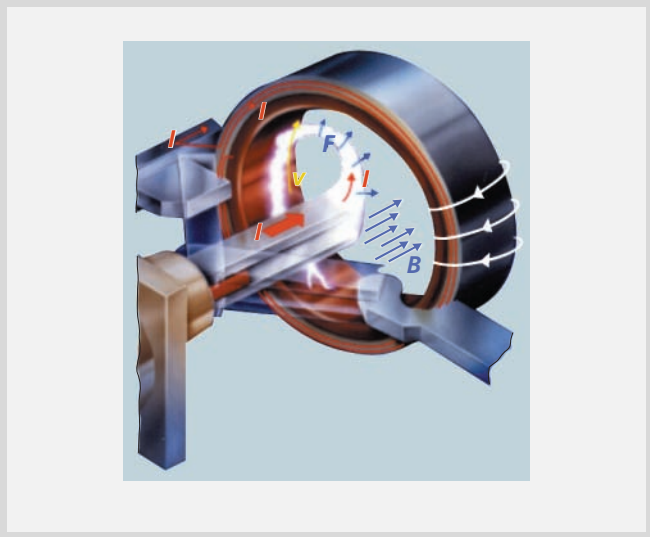
Switching systems

Three-position load-break switches
Three-position SF₆ circuit-breakers



- ① Front of gas tank
- ② Fixed contact On
- ③ Arc quenching coil
- ④ Busbar
- ⑤ Drive shaft
- ⑥ Earthing contact
- ⑦ Special contact rivets
- ⑧ Blade contact
- ⑨ Bushing

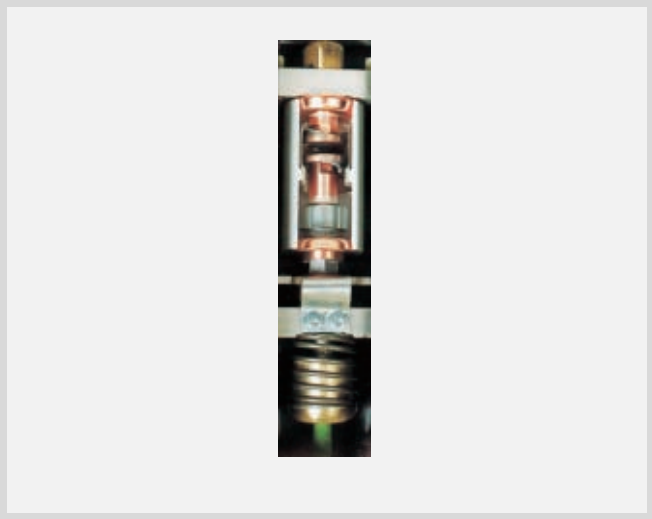
Function principle of the arc quenching coil



- I = Current
- B = Magnetic field produced by current I in the arc quenching coil
- F = Force exerted on the current-carrying switching arc
- v = Speed vector of the switching arc

The vacuum HV compartment

The vacuum HV compartment consists of axially arranged large-area contact bodies in an evacuated metal-ceramic enclosure. The contacting surfaces of the contact bodies are coated with a special contact material. Two solid copper dies one of which is movable, form the link with the circuit-breaker terminal parts. The vacuum-tight seal between the moving contact die and the vacuum container is made by metal concertina walls. The die is guided by a gliding bearing.



Vacuum switching with an axial magnetic field

On de-energization, an arc arises from the time of contact separation. After the quenching distance has been attained, the arc extinguishes as the current passes through zero. The arc causes local melting of the contact surfaces. The metal that evaporates during this process, is deposited mainly on the contact and only to a lesser extent on the screens surrounding the contacts. The arc interrupting current (normal chopping) of the vacuum HV compartments used, is less than 5 A and causes only moderate overvoltages. An axial magnetic field between the contacts in the vacuum HV compartment achieves that the metal vapour arc remains diffuse* even in the short-circuit current range. The thermal load on the contacts therefore, remains very small and contact burn is negligible.

* Arc is spread out rather than concentrated

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

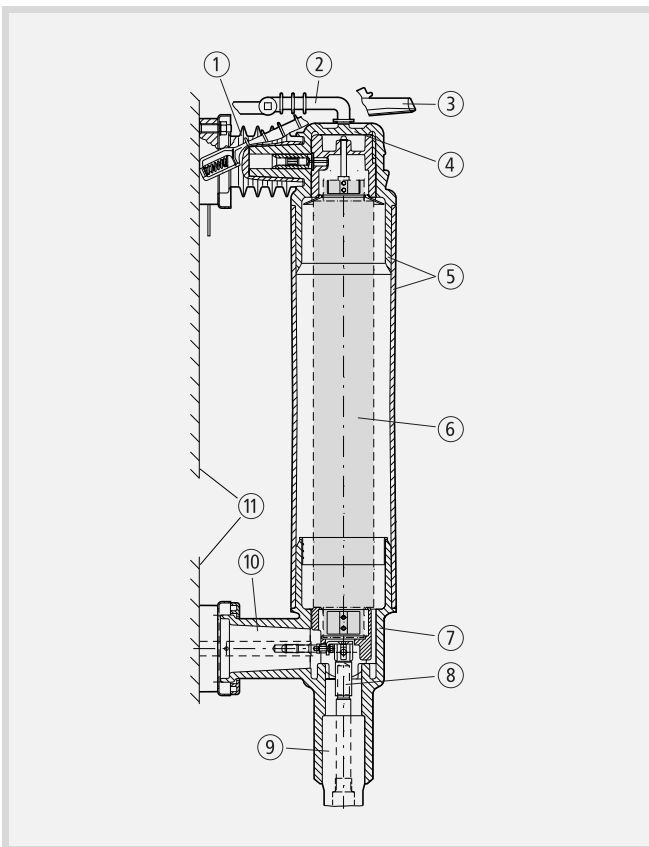
Fuse arrangement

Fuse arrangement

In the GAE system, the fuse arrangement is plug-fitted. All the fuse components are coupled to the contacts via cast-resin bushings from outside of the gas tank. The plug-in system consists of the upper and the lower fuse holder. The plug-in parts, made from silicone rubber, are designed to be track- as well as arc-root-proof. The lower fuse holder additionally functions as push-on type cable termination. Range of application: for Cu or Al cables from 25 up to 240 mm². The earthing switches in the SF₆ chamber enable the HV fuse cartridges to be earthed at both ends. The fuse arrangement is accessible only with earthing switches switched On. **The individual components of the plug-in system can be separated even after years of use since the plug-in surfaces are made of a special combination of materials which prevents sticking.** There is no need to lubricate these surfaces (interfaces). Fuse length: 442 mm; fuses of 292 mm length can be used with an extension adapter.

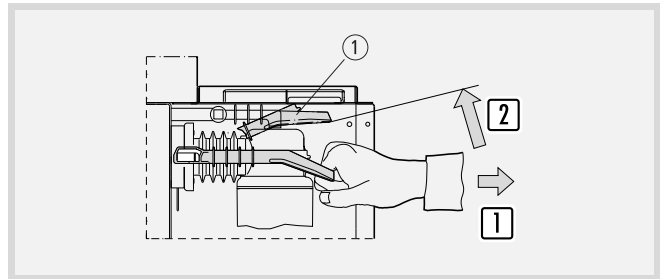
Fuse selection

Only HV back-up fuse links should be used acc. to actual fuse selection table No. 12254569 acc DIN 43625 up to 88 mm ø for protection of distribution transformers 6, 12 and 24 kV. Other types of fuse links only to be used after reconfirmation!



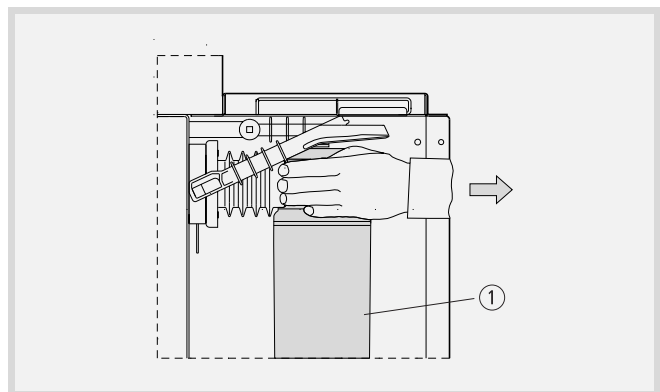
- | | |
|----------------------|-----------------------------|
| ① Upper bushing | ⑦ Lower fuse holder |
| ② Tripping linkage | ⑧ Cable lug |
| ③ Tensioning lever | ⑨ Stress cone |
| ④ Flexible diaphragm | ⑩ Lower bushing (2nd earth) |
| ⑤ Upper fuse holder | ⑪ Front gas tank |
| ⑥ HV fuse cartridge | |

Exchanging an HV fuse



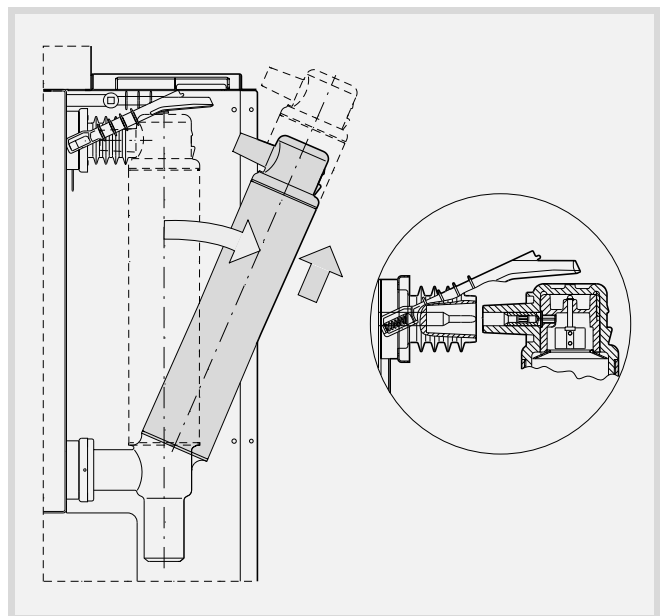
- ① Tensioning lever

Pull tensioning lever forward against the spring pressure, then swing it upwards, into the fuse compartment.



- ① Upper fuse holder

Grasp upper fuse holder and pull it straight out of the upper bushing.



Swing upper fuse holder forward, out of the fuse compartment, then pull it out towards the top, and replace the HV fuse link.

It is not necessary to grease the interface.

To insert a fuse, follow the sequence in reverse.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Front panel

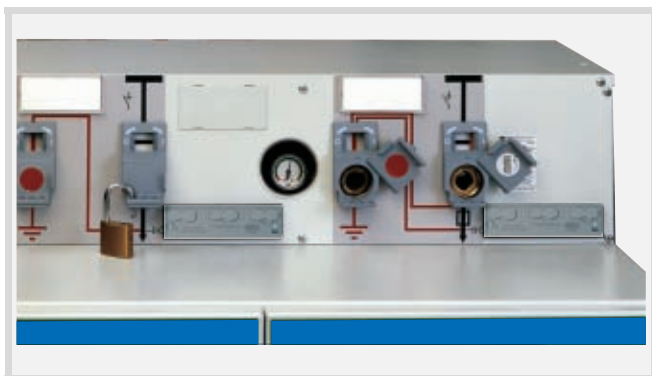
Front panel

Front panel with

- Mimic diagram
- Switch position indication
- Operator surface for the actuators
- Capacitive voltage indicators
- Gas leakage indication
- Short-circuit indicators
- Padlocking facility
- Drive sealed against dust, sand and insects
- Housing IP44



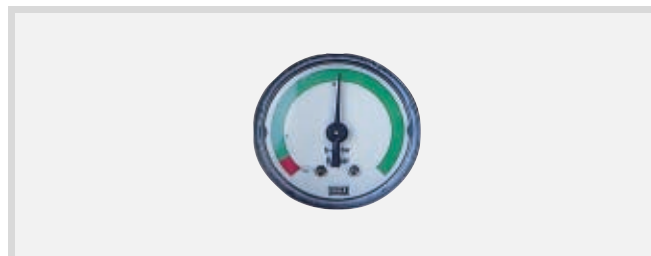
Padlocking facility



Switchgear assembled of individual panels. Consisting of panel Types 1M5-, -1TS-, -1K- and showing the facility to extend the busbars on the right-hand side, as well as busbar end covers.

Gas leakage indication

Each gas tank has a pressure display for verification of the SF₆ overpressure within, and allowing its functional safety to be inspected.



Meaning of the indication:

Green = Sufficient service pressure

Red = Insufficient service pressure

Pressure switch/density switch

Each gas tank can be fitted with a pressure switch resp. density switch (auxiliary contact) for remote monitoring. The lower switching point corresponds to the crossover point to the red measuring range on the gas leakage indication. The density switch can be optionally provided with auxiliary contacts for alarm and tripping function.

Phase sequence indication

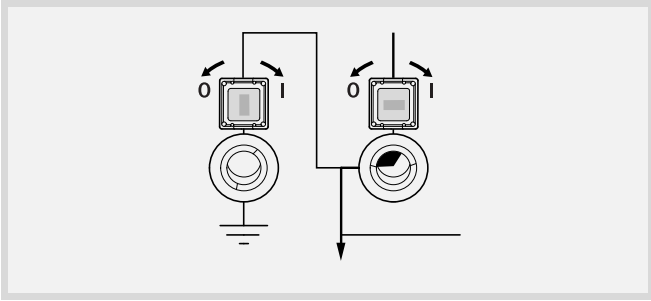


Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

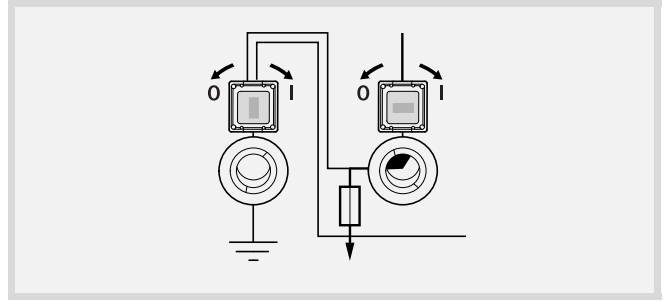
Interlocking function

Interlocking function

Operating lever cannot be inserted

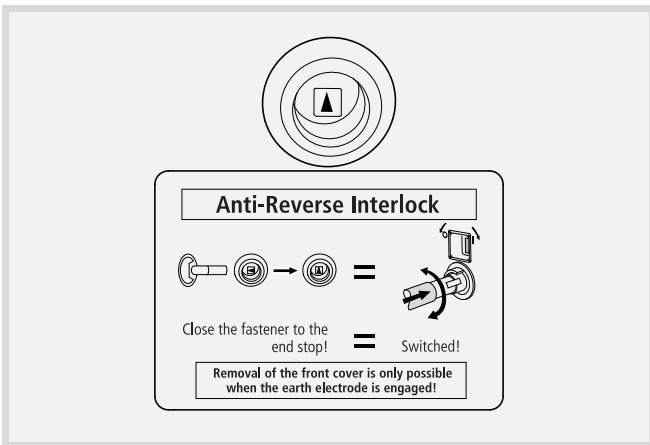


Ring cable panel:
Load-break switch blocked by switch interlocking.

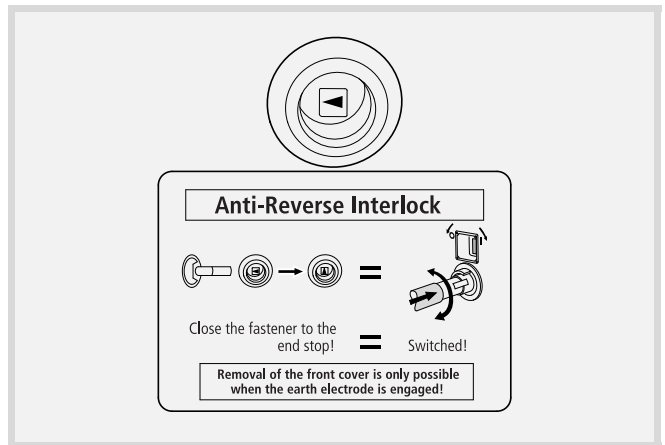


Transformer feeder panel:
Load-break switch blocked by switch interlocking.

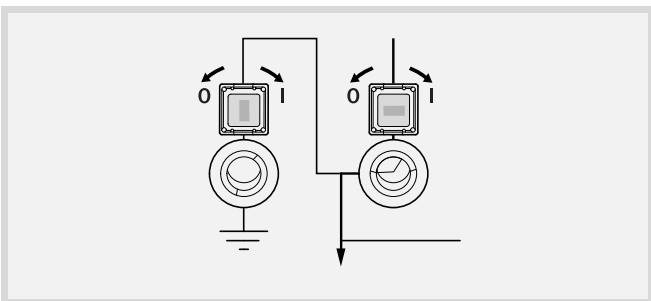
Anti-reverse interlock – Option –



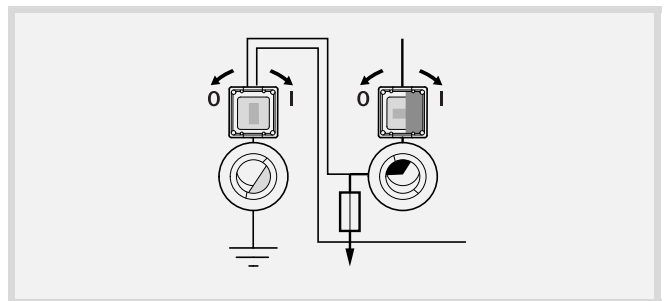
Fastener of the front cover is closed.
Switching processes not restricted.



Fastener of the front cover is open.
Switching processes can take place only at the earthing switch in the ring cable panel.



Ring cable panel:
Load-break switch blocked by anti-reverse interlock. The switch interlock plate lies behind that of the anti-reverse interlock.
Earthing switch can be operated without restriction even with the front cover removed.



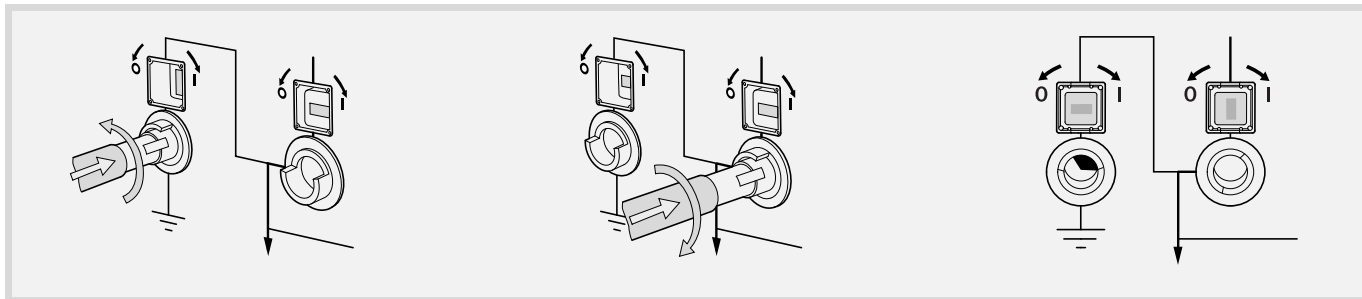
Transformer feeder panel:
Earthing switch blocked by anti-reverse interlock.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Switching processes in ring cable panels

Switching processes in ring cable panels

Earthing switch Off – load-break switch On

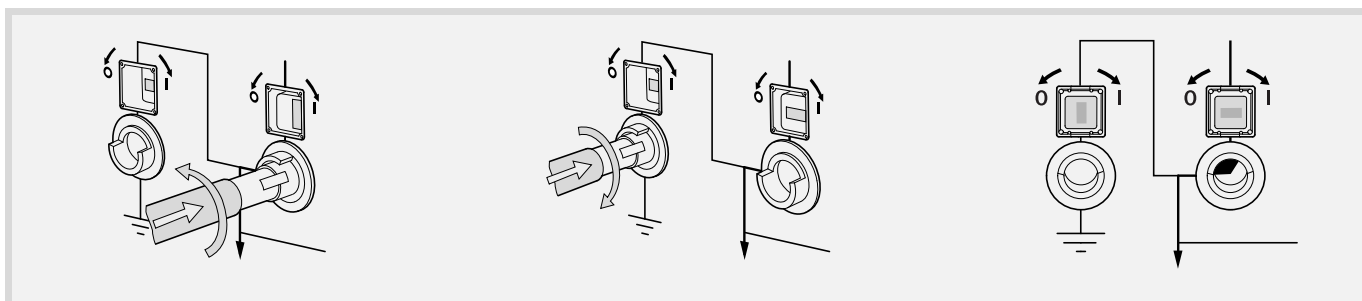


Switch Off the earthing switch.
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the left.

Switch On the load-break switch.
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the right.

Switch position with load-break switch On and earthing switch Off.

Load-break switch Off – Earthing switch On



Switch Off the load-break switch.
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the left.

Switch On the earthing switch.
Press the operating lever fully (up to the stop) against the spring pressure, hold and turn it to the right.

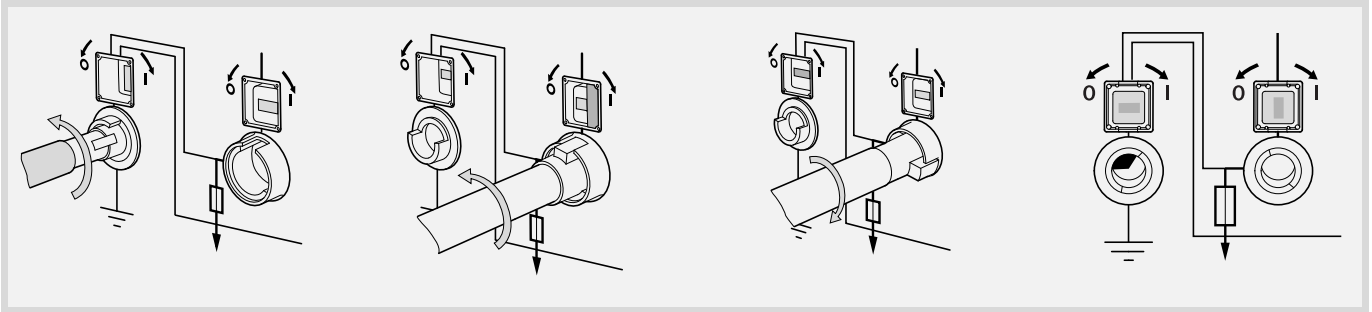
Switch position with load-break switch Off and earthing switch On.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Switching processes in transformer panels

Switching processes in transformer panels

Earthing switch Off – Transformer switch On



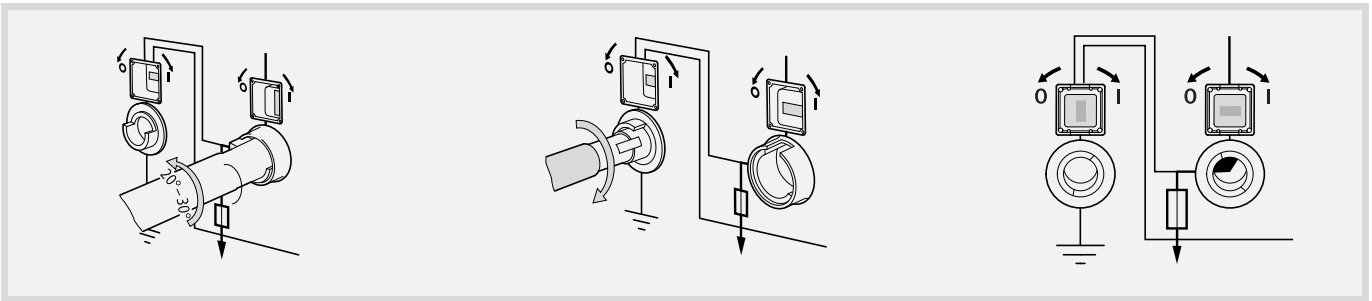
Switch Off the earthing switch.
Turn the operating lever fully
(up to the stop) to the left.

Charge the transformer switch
by turning the operating lever to
the left.

Switch On the transformer
switch.
Turn the operating lever to the
right.

Switch position with load-break
switch On and earthing switch
Off.

Transformer switch Off – Earthing switch On

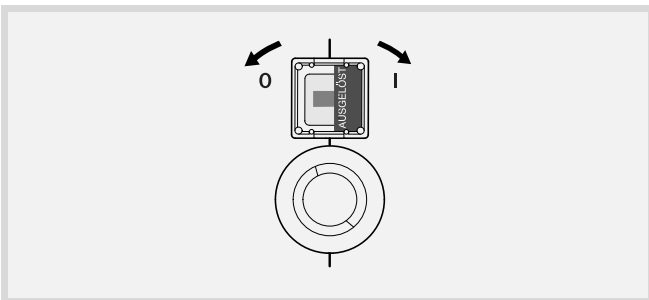


Switch Off the transformer switch.
Turn the operating lever
approx. 20 to 30° to the left.

Switch On the earthing switch.
Turn the operating lever fully (up to the
stop) to the right.

Switch position with transformer switch
Off and earthing switch On.

Transformer switch TRIPPED



The TRIPPED flag in the switch position indication shows only when the transformer switch has been de-energized via the HV fuse link having responded or via the shunt trip release (optional). The drive must be charged by turning it to the left, before the transformer switch can be switched On again.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Voltage indication and testing

Voltage indication and testing

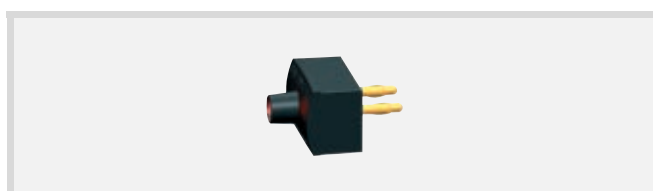
Each system is equipped with the necessary three-phase capacitive voltage indication ledges Type KSO for voltage testing to VDE 0682 Part 415 and IEC 61243-5 with HR system (other systems on request). This enables the absence of voltage in individual phases to be verified by inserting the voltage indication plugs into the corresponding pairs of sockets. Optionally, fixed-mounted capacitive indication lamps can be provided within indication ledges Type KSG. These are activated by removing the short-circuit bridges. The voltage indication ledge circuitry is designed for rated operational voltages of 10, 15 and 20 kV. The minimum and maximum values of the Standard for these voltage ranges are adhered to in the standard system. It is not necessary therefore, to adjust them again when changing the rated operational voltage within this range. Rated operational voltage 6 kV can be implemented in a special version. The live contact sockets are protected against accidental contact.

Voltage indication ledge in sealed version



Voltage indication plug

(Picture shows Horstmann device)

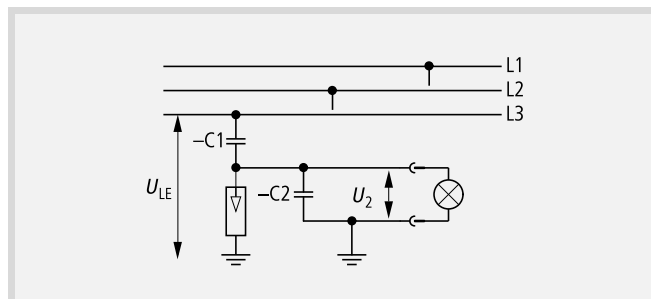


The following devices may be used:

Pfisterer	Type DSA-2
Horstmann	Type HO-ST-1
ELSIC	Type HO-SA
Jordan	Type DSP-HR
Dehn	Type DEHNcap/P-HR

Indication devices are also suitable for continuous duty.

Single-line diagram of a voltage indicator



Voltage indication via capacitive voltage divider, HR system. Voltage indication plugged in.

C_1 Capacitor integrated in the bushings.

C_2 Capacitance of the connecting cables and the voltage indication device to earth.

$U_{LE} = U_N/\sqrt{3}$ During rated operation in a three-phase system.

$U_2 = U_A$ = Voltage at the capacitive interface of the system or at the voltage indication device.

Phase sequence indication Interface tester

(Picture shows Horstmann device, Type ORION 3.0)



The following devices may be used:

Make	Phase sequence indication	Interface tester
Horstmann		H-OM measuring module with Fluke ammeter Type 87 or matrix Type Mx55 (II to IV)
Horstmann	Type: Orion	Type: Orion
ELSIC	Type: HO-PV	
Pfisterer	Type: EPV	Type: Euro test-HO
Jordan	–	Type: KSP-HR
Kries	Type: CAP-Phase	Type: CAP-Phase

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Short-circuit/earth-fault indicator

Short-circuit/earth-fault indicator

All ring cable panels can be equipped either with a 3-phase short-circuit or earth-fault indicator.

Manufacturer	Type
Horstmann	ALPHA M
	ALPHA E
	APLHA automatic
	DELTA M
	DELTA E
	EKA-3
	EKA 3/1
	GAMMA 4.0
	Opto
Kries	IKI-10V2SP
	IKI-20B1

Other types and products on demand.



Cable connection systems

T connection fittings

T connection fittings are to be used as the operator thinks fit. Connectable to bushings to DIN EN 50181 connection type C (630A) with external cone and bolt contact (M16).

With non-controlled systems, the manufacturer's mounting instructions are to be adhered to implicitly.

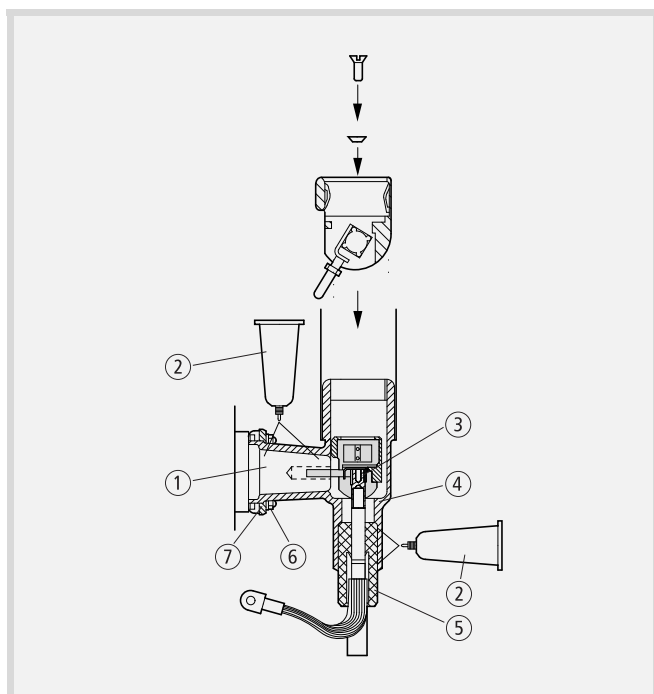
Mounting options for cable connection fittings:

	NKT/F&G type		ABB type		Tyco Electronics Raychem type		Euromold/Nexas type		Prysmian type	
	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV
XLPE- cable	CB12	CB24	SET12	SET24	RSTI	RSTI	K400TB	K400TB	FMCTs400	FMCTs400
	CC12	CC24	SEHDT13	SEHDT23	RICS...	RICS...	K400TB	K400TB	FMCTj400	FMCTj400
	CB36	CB36	SEHDT13.1	SEHDT23.1	–	–	AGT10/630	AGT20/630	–	–
	AB12	–	–	–	–	–	AGTL10/630	AGTL20/630	–	–
	AC12	–	–	–	–	–	–	–	–	–

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

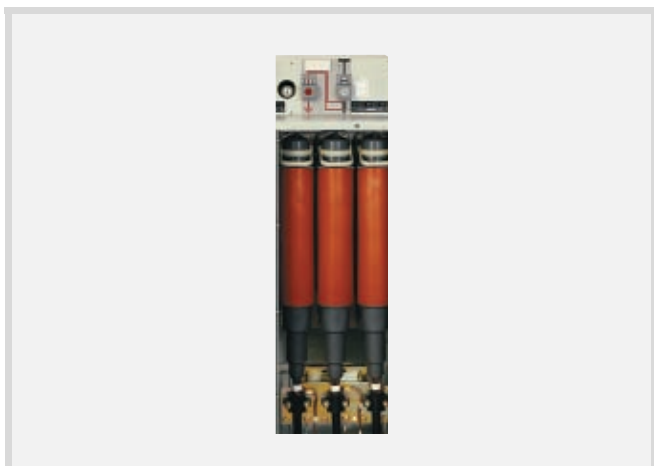
Cable connection systems

Cable connection for transformer panels



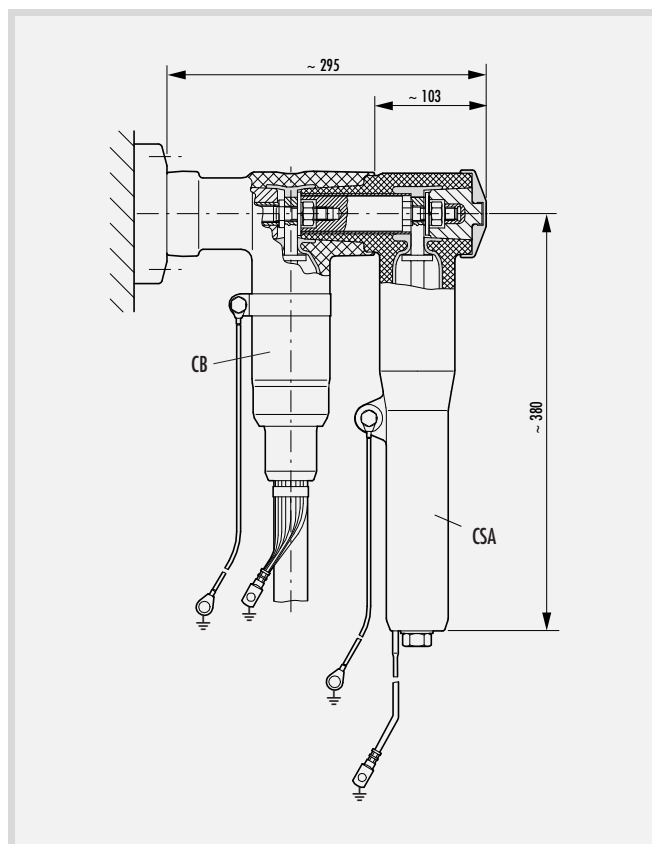
- ① Bushing cone (lower bushing)
- ② Assembling paste for fitting of termination
- ③ Cable lug
- ④ Lower fuse holder
- ⑤ Section control element
- ⑥ ISO nuts
- ⑦ Fixing flange

The lower fuse holder additionally functions as push-on transformer cable termination. Range of application: for Cu or Al cables from 25 to 240 mm²



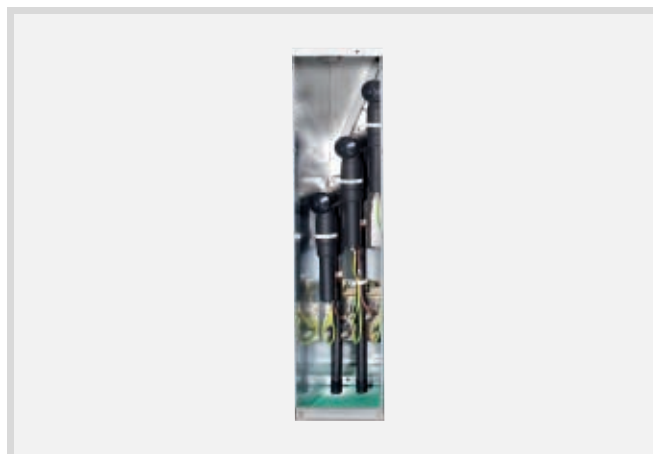
Transformer feeder panel, front cover open.
With fuse holders and transformer cable termination.

Lightning arrester at the T cable connector



The following combinations of T cable connectors with lightning arresters may be used:

- Messrs. NKT:
Type CB T plug with lightning arrester: CSA
- Messrs. ABB:
Type SEHDT T plug with lightning arrester: MUT
- Messrs. Raychem:
Cable terminations: IXSU, SMOE, UHGK, IDST with RICS adapter with RDA lightning arrester (picture shows combination from Messrs. NKT)

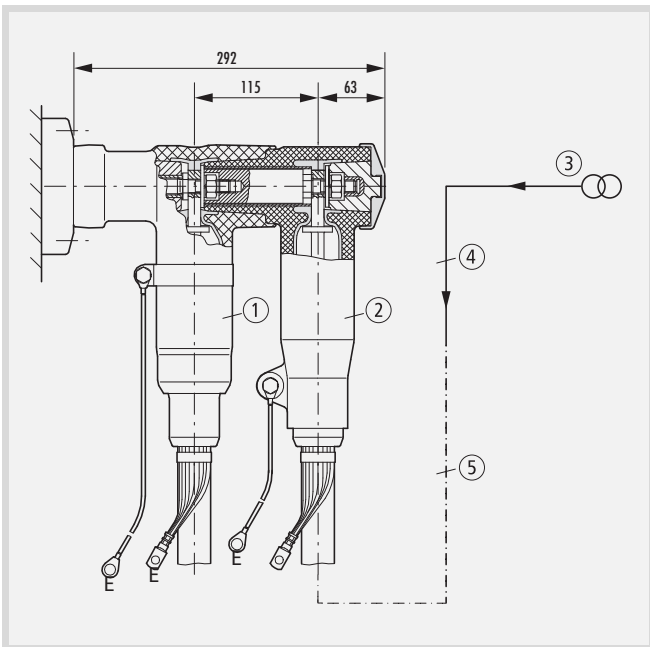


Ring cable panel, front cover open.
With lightning arrester in phase L1.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Cable connection systems

Voltage transformer – inductive – at the panel connection



Single-line diagram

- ① Cable connection Type: CB12 or 24-630
- ② Cable connection Type: CC12 or 24-630
- ③ Metal-encapsulated voltage transformer
- ④ Cable connection with metal encapsulation
- ⑤ Cable length as required

Where the voltage at the panel connection has to be monitored for protection or measuring purposes, a metal-encapsulated voltage transformer set can be connected via a double cable. The transformer set is protected against accidental contact and can therefore be fitted, for example, into an under-floor cavity. Transformers e.g. from Messrs. AEG Kondensatoren und Wandler GmbH or from Messrs. Ritz.

Primary contacts with external cone for cable plug-in parts to DIN EN 181.

Power ratings: Class 0.2/30 VA, Class 0.5 100 VA, Class 1/200 VA.

Double-cable connection

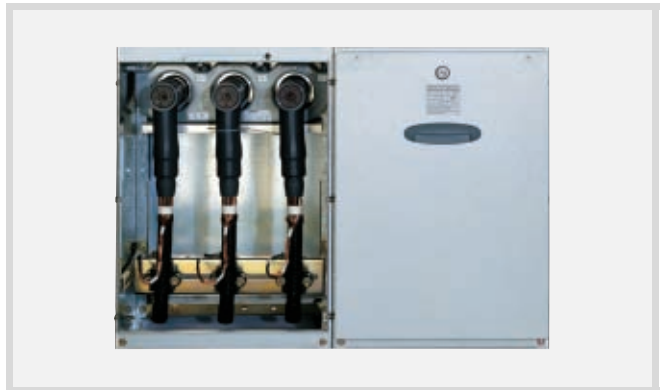


Double cables equipped with the abovementioned cable connection types can be connected to the standard system version without modification (maximum mounting depth 318 mm).

In this case, the compact double cable connections CB / CC type NKT in the panels A, K and LSF must be fitted with regular front covers.

Deeper double-cable connections require a deep front cover (→ page 5).

Cable connection vacuum circuit breaker



Cable connection in a circuit-breaker feeder panel, Type -1LSV630- with three-core current transformers around the bushings. Front of the left-hand panel is open.

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Installation possibilities in switchgear rooms

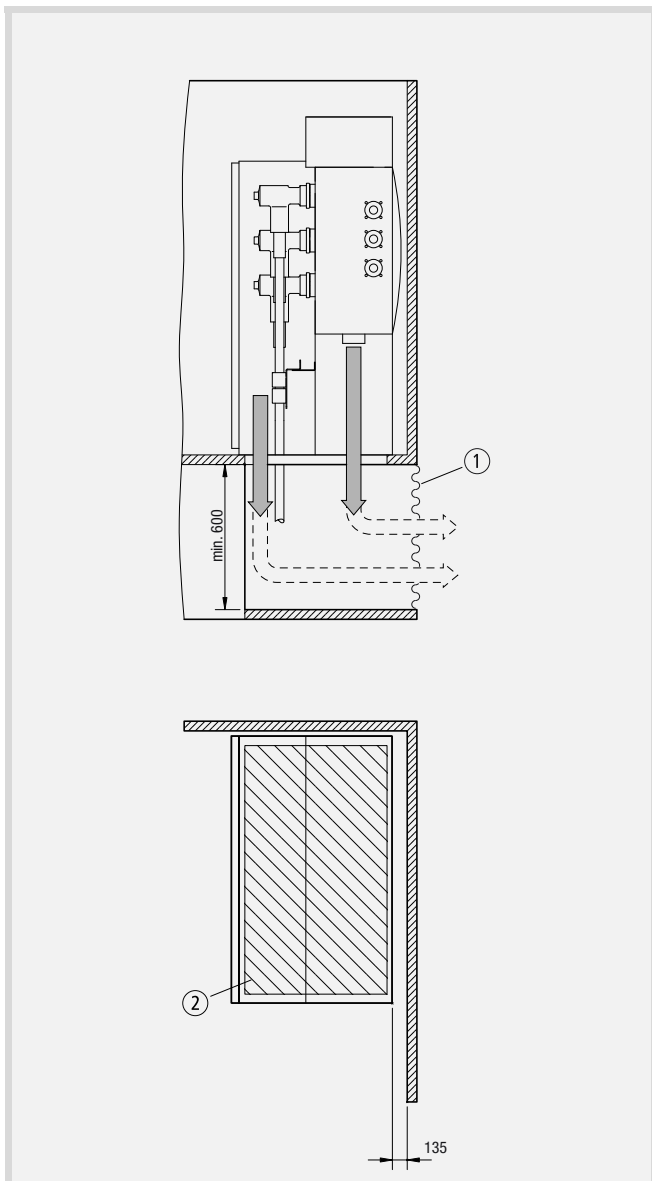
Installation possibilities in switchgear rooms

Installation possibilities for modular switchgear series GAE630.

In accessible and non-accessible switchgear rooms

Installation GAE630

- Bottom open



Pressure relief only into cable cellar/cable trench.

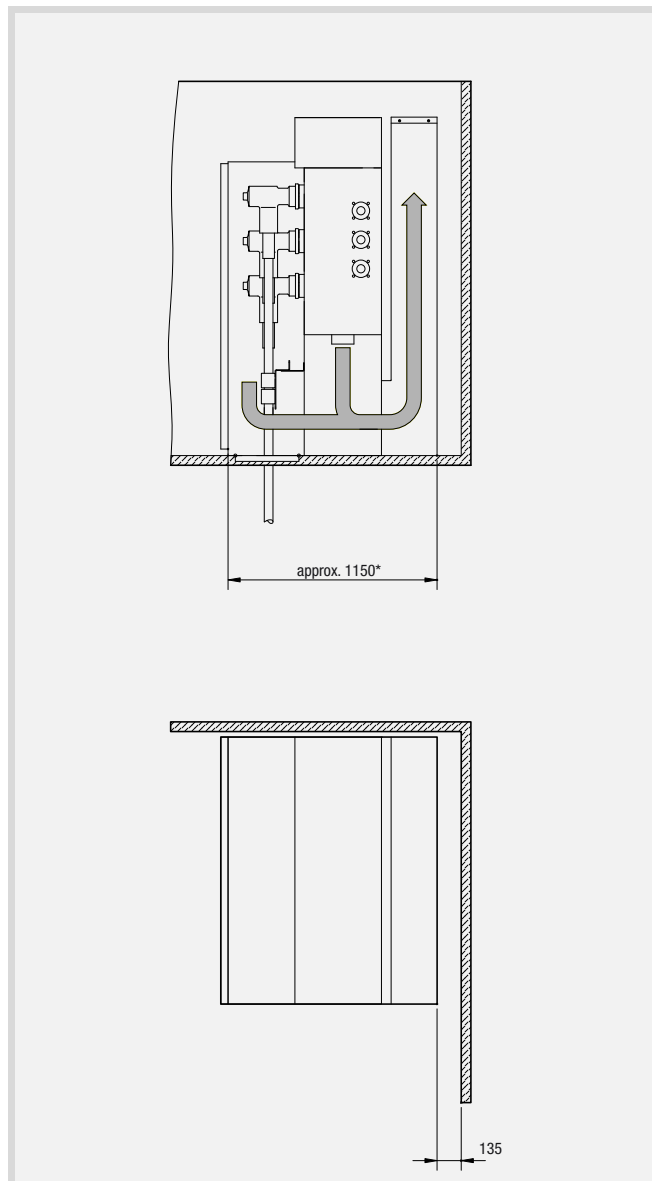
- ① Metal cooling stretch arrangement to cool down gases hot generated in case of an internal arc fault.
- ② Cable trench/cable cellar

For details see relevant operating instructions for GAE630 systems.

Switchgear related pressure calculations can be enquired as part of services at the sales department of Ormazabal GmbH.

Installation GAE630

- Bottom closed



Pressure relief via rear absorber channel towards the top.
(Availability on request)

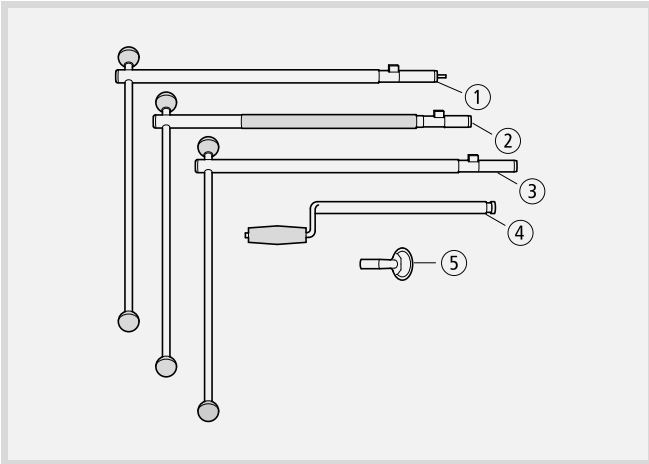
* 915 mm for blocks

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Panel accessories

Panel accessories

Operating levers

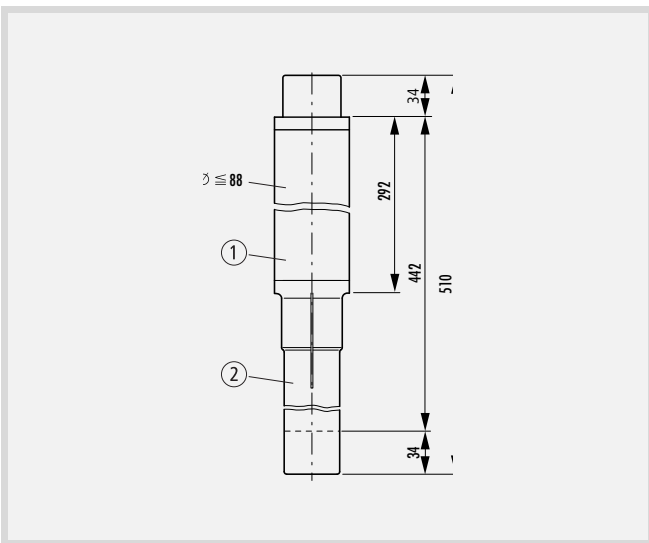


Operating levers, keys for fasteners

- ① Operating lever (optional) for the load-break switch actuating shaft with motor operator (for manual switching e.g. in case of loss of supply voltage).
- ② Operating lever for the earthing switch (optional red shaft).
- ③ Operating lever for the load-break switch (optional plain shaft).
- ④ Charging handle for vacuum circuit-breakers
- ⑤ Key for the fastener on the front cover (controls the anti-reverse interlock).

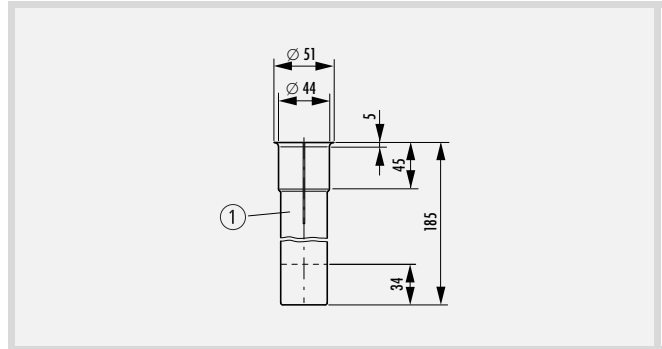
Fuse adapter

The transformer feeder panels are designed for fuses with dimension $e = 442$ mm. An adapter is available to allow fuses with dimension $e = 292$ to be used also.



Fuse link with adapter

- ① Fuse link
- ② Adapter



Fuse adapter

- ① Adapter

Connections

Busbar connection with double sealing



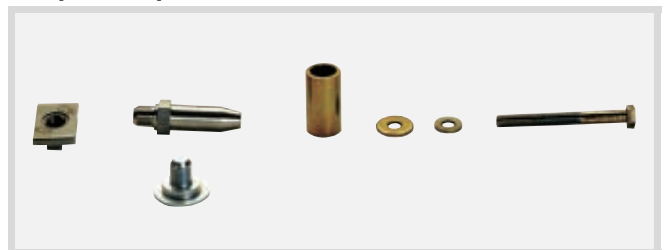
Shown: 1 phase

Busbar end cover with single sealing



Shown: 1 phase

Components: panel connection



Shown: 1 set

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Cable clamps

Cable clamps

Size I

Clamping range 26 to 38 mm for cables, i. e.

- 12 kV: $35 \text{ mm}^2 \leq 240 \text{ mm}^2$
- 24 kV: $25 \text{ mm}^2 \leq 185 \text{ mm}^2$

Size II

Clamping range 36 to 52 mm for cables, i. e.

- 12 kV: $\geq 300 \text{ mm}^2$
- 24 kV: $\geq 240 \text{ mm}^2$

Real cable diameter have to be compared with the clamping range.

Quality

To the able to ensure and verify quality, Ormazabal Systems Division (F&G) has installed a comprehensive Quality Management System.

The system complies with ISO 9001:2000 as well as ISO 14001:1996.

Routine testing of panels and systems as a matter of course includes the various tests to VDE 0670 as well as the testing of customer-specific device configurations.

For example:

- Function tests of devices,
- Rated AC withstand voltage test 1 min,
- Testing of all auxiliary devices such as auxiliary contacts, shunt trip releases, remote operators, protective mechanisms (relays), measuring instruments,
- Function testing of the capacitive measuring device,
- Function testing of short-circuit indicators (where present).

Medium-Voltage Switchgear up to 24 kV, SF₆-insulated, Modular Design, Type GAE, Series GAE630

Protection technology

Protection technology

All commercially available protection relays can be installed in the type GAE630 switchgear for the LSV circuit breaker panels and LSF circuit breaker panels.

The variants cover all commercially available transformer-operated protection relays resp. combined protection and control systems.

Low energy trips 0.5 VA and 0.1 VA are available for the transformer-operated relays.

In this context special relay-transformer combinations are tested.

Transformer supplied:

Common protocols and interfaces, e.g. Profibus DP, Modbus, IEC 60870-5-103, IEC 60870-5-101 and IEC 61850 can be provided with related relays.

Installation is in low-voltage compartment / relay niche.

Optionally, the protection relay can also be installed in the related cover.

It is also possible to configure the parameters for the protection relay in accordance with customer requirements.

A few commercially available protection relays as examples:



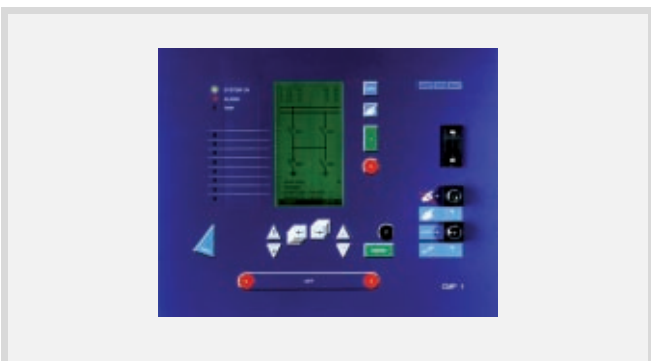
SEG type WIC

- SEG type WIC
- SEG WIP
- Siemens type 7SJ45
- Areva type P114S



Siemens type 7SJ45

Supplied with external power:



SEG Typ CSP/CMP

- SEG type CSP/CMP
- Siemens type 7SJ63
- ABB type REF542plus
- Areva type P139



ABB type REF542plus

Notice

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■ SF₆-insulated switchgear

- type GA
- type GAE
- type CPG.0
- type CPG.1

■ Air-insulated switchgear

- type EA
- type AMC

■ Air-insulated switches

- type NVL
- type KL(F), T, DES

