



ORMAZABAL



**Medium voltage switchgear
and switching devices**



**Medium voltage switchgear up to 24 kV, 630 A
SF₆-insulated, extensible**

Type: GAE, Series GAE630

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

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Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

General/description

General/description

Advantages of the SF₆-insulated, metal-enclosed, modular switchgear

With the switchgear from the GAE630 series, Ormazabal fulfils the international requirements of their customers for SF₆-insulated switchgear.

- ✓ Extensive climatic independence
- ✓ Maintenance-free concept with SF₆-pressure tank as a sealed pressure system
- ✓ Minimal space required
- ✓ Comprehensive personnel protection
- ✓ High reliability
- ✓ High security of supply
- ✓ High level of operational safety
- ✓ Great variety through circuit-breaker and load-break switch panels
- ✓ Easy extensibility of the switch panel through inner cone plug-in systems for the busbar connections
- ✓ Up to four-fold cable connection system for circuit-breaker panels
- ✓ Conventional current transformer outside of the SF₆-pressure tank can be exchanged subsequently without problem

Features

The switchgear of the GAE630 series are type-tested, prefabricated metal-enclosed SF₆-insulated switchgear in panel construction. The single panels can be combined with the GAE1250 series.

A combinability with the GA block versions is given via the metering panel -1M1.

Application

The switchgear of the GAE630 series is exceptionally suited to transformer and switching stations, as well as to the main consumer points:

- In utility networks
transformer substations, hub substations, distribution substations, customer substation with utility-sided metering set and mains contactor,
- In industrial mains with MV mains infrastructure
– Industrial substation with MV measurement for measuring the load from individual businesses and mains contactor,
- In buildings with MS mains infrastructure, e. g. train stations, department stores, hospitals, barracks, court buildings, public administration buildings etc.,
- In environmental projects with MS mains, e. g. switchgear for wind energy, biofuel, sludge treatment, recycling/reusable material etc.



GAE630 Reference Rudolf-Harbig-Stadium, Dresden

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

General/description

Key to type references of the switchgear

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

GAE630 x / x / x - x / x - x

- | | | |
|---|---|--|
| ① Surname: | Gas insulated | Extensible |
| ② Series: | 630 | A |
| ③ Switch panel types: | -1K-/3/
-1A1-/4/
-1KB-/4/
-1XL/3,2/
1XR-/3,2/
-2K-/8/
-2KB-/8/
-3K-/10/
-3KB-/12/
-1TS-/4/
-2TS-/8/
-1KG-/4/
-1H1-/4/
-1H2-/8,5/
-1E-/4/
-1LSF250(630)-/6/
-1LSFG250(630)-/6/
-1LSV630-/5/
-1LSVG630-/5/
2K1TS-/10/
2K1LSF250(630)-/10/
-1M1-/8,5/
-1M2-/8,5/
-1M4/8,5/
-1M5-/8,5/
-1M5Ü-/8,5/
-1M6-/8,5/ | = cable panel
= cable connection panel
= cable panel with horizontal bushings
= Bus sectionaliser panel for GE, GAE left connection
= Bus sectionaliser panel for GE, GAE right connection
= 2*cable panel with diagonal bushing
= 2*cable panel with horizontal bushings
= 3*cable panel with diagonal bushing
= 3*cable panel with horizontal bushings
= Transformer outgoing panel with stored-energy mechanism
= 2*Transformer outgoing panel with stored-energy mechanism
= bus sectionalizer load-break switch panel
= Bus riser panel for 1KG, for 1LSFG
= Bus riser panel for 1LSVG
= Busbar earthing panel
= Branch circuit panel with SF ₆ circuit-breaker 250A/630A
= Bus sectionaliser panel with SF ₆ circuit-breaker 250A/630A
= Branch circuit panel with vacuum circuit-breaker 630A
= Bus sectionaliser panel with vacuum circuit-breaker 630A
= Extensible block with transformer outgoing panel
= Extensible block with SF ₆ circuit-breaker
= Metering panel |
| ④ Rated voltage: | 12 = 12 kV
24 = 24 kV | |
| ⑤ Rated value of the busbar: | 630 | = 630 A |
| ⑥ Rated current on the outgoing cable: | 200
630 | = 200 A
= 630 A |
| ⑦ Rated short-time withstand current: | 16
20 | = 16 kA
= 20 kA |
| ⑧ Rated short-time withstand current seconds: | 1
3 | = 1 s
= 3 s |

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

General/description

The HV compartment

is a gas-tight welded tank made of stainless steel, in which all active parts including busbars are located. The incoming and outgoing power feeders, as well as connection to the fuses occurs via cast resin bushings, that are individually tested for compliance with the maximum permissible partial discharged value (2 pC). Each HV compartment is equipped with a stainless steel bursting membrane, which is especially designed for each gastank.

Drive mechanisms

The robust spring-type or stored-energy mechanisms are located on the load-break and circuit-breaker panels above the HV compartment and on the switch panels with front vacuum circuit-breakers before the HV compartment. Whereas for the spring-type mechanism of the ring cable panel no check is necessary, the trigger function of the transformer and circuit-breaker panel should be checked once after 10 years. There is normally no need for any maintenance due to the chosen materials.

The mechanisms of the switch panel with vacuum circuit-breaker should be serviced at an interval of 10 years after commissioning.

Connection compartments

are present on all switch panels and are normally designed to be arc-proof. They are partitioned by steel sheet intermediate walls. Checks and work can be carried out, although the connection zone of the neighbouring panel is live. The front covers are interlocked against the associated earthing switch. The front cover should only be opened with earthing switches inserted. If required an anti-reverse interlock can also be considered. It prevents the associated load-break switch on applied voltage to the busbar from being switched with open connection zones (front cover removed). The switching device can first be used with the front cover installed and fastener closed. The earthing switch on the outgoing cable is not integrated into this interlock and can be switched with open connection zones (essential for cable testing).

For deeper double cable connection systems deep front covers and partially deep connection compartments are available (→ see drawing Page 11 ff.).

The operation

of the switchgear should be carried out on the drive shafts implemented and integrated into the mimic diagram. Included in this are switching levers, 1 × load or circuit breaker, 1 × earthing switch. Due to the clear mimic diagram and the simple rotary drives a conventional operability is permitted.

For vacuum circuit-breakers the switch panel is tensioned for manual or emergency operation using a crank handle. The trigger operation occurs via push-buttons.

Optionally all drive mechanisms can be equipped with motors.

Busbars

are located in the HV compartment. The busbars of single panels or switch panel blocks are connected to each other via special bushings, double sealing including screened silicone insulation and coupling parts.

The cable fixing irons

are comprised of galvanised folded sheet-metal parts. They are adjustable in height and depth thanks to a special screw construction, so that all common terminations used for SF₆ switchgear and the cables can be fixed without using further cable clamps.

Arc-fault proof

The HV and connection compartments comply with arc-fault protection requirements according to VDE 0671 Part 200 / IEC 62271-200 Appendix A "Arc-fault protection" criteria 1 to 5. The internal arc classification IAC AFL is always present.

Additionally, on request there is a version in which for closed panel bottoms the pressure relief for further pressure-reduction measures is lead upwards via a rear pressure absorber channel. As a result the panel depths increase in size (→ see overview drawings Page 11 ff.).

By means of this rear pressure absorber channel the pressure values in the interior of the switchgear room can be reduced by approx. 60%.

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

For the installation of the equipment see the respective information on page 32.

Low voltage compartment/relay niche

Low voltage compartments/relay niches are optionally available for all GAE630 panel and block versions in the following design heights:

300 mm, 600 mm, 900 mm.

The standard design height for circuit-breaker panels is 600 mm.

The mounting of the low voltage compartment or relay niche and the front cover occurs according to the order. All common protection and control systems can be used.

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Insulation and arc-deflecting extinguishing medium SF₆

Insulation and arc-deflecting extinguishing medium SF₆

In past years sulphur hexafluoride has found a way in (SF₆) even to medium-voltage switchgear systems in reinforced dimensions, having been previously successfully used mainly in circuit-breaker technology to the highest voltages.

The system transition is fulfilled worldwide, as the insulation and arc-deflecting extinguishing media air, oil and solid matter have significant disadvantages:

- Air-insulated switchgear take up a lot of space and require maintenance during extreme climate or environmental conditions.
- Oil-insulated switchgear (still overwhelmingly used in anglo-saxon countries) are admittedly more protected from external influences, but they carry a much higher safety risk in the event of internal faults.
- Solid matter insulated switchgear (e. g. casting resin) are actually air-insulated constructions, that due to their compact construction have significant maintenance problems.

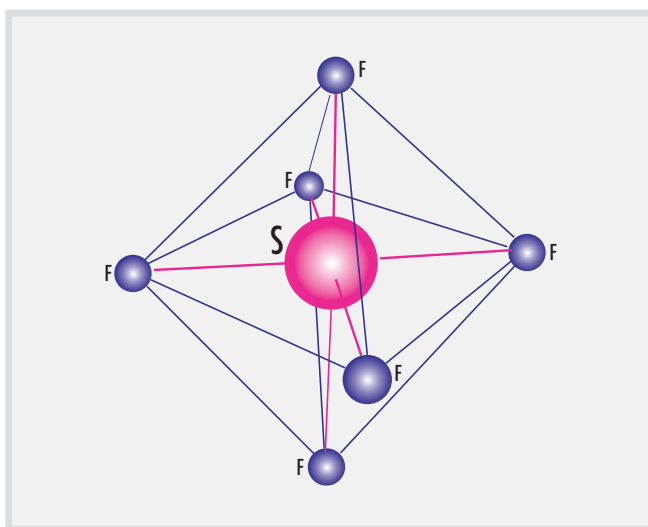
Due to its high electrical dielectric strength, the SF₆ insulating material enables the construction of **very small switchgear**, which are still **maintenance free**, as all active electrical assembly parts have to be enclosed.

If the actuating voltage is cancelled extensively due to effects of the weather, the user has a product that **with no maintenance** will perform its service long-term.

SF₆ is a non-toxic, inert and electronegative gas that is heavier than air, and apart from the already agreed insulation capacity, also has very good arc-deflecting properties. In the switching-off arc, SF₆ is dismantled into its components at high temperatures, which are then regenerated into SF₆ during cooling. The regeneration process is supported by the aluminium oxide (Al₂O₃) found in the switchgear. Through the regeneration the filled gas quantity remains unchanged and is sufficient for the entire operating time of the switchgear or switching device. A consideration of the advantages and potential theoretical risks shows that sensible technical and ecological alternatives are not currently available.

Due to the **high operational safety** of the switchgear (external influences such as humidity, conducting dusts etc are not effective) arc faults are almost impossible. Should such a fault occur, the pressure relief flap (bursting membrane) is activated.

The German official labour association provides details on how this can be avoided with an SF₆ switchgear. **The SF₆ gas in this equipment must be reused – if necessary after appropriate treatment – and must not be discharged into the atmosphere. If you do not wish to dispose of the switchgear yourself, Ormazabal offers you the return of the switchgear, offset against payment of the expenses. This offer is also valid when the switchgear has been in operation for 25 to 30 years.**



Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Technical data

Technical data

Switchgear and switch panel (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 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 branch circuits	A	630	630	630
	for busbars	A	630	630	630
Rated short-time withstand current I _k	with t _k = 1 s	to kA	20	20	20
	with t _k = 3 s	to kA	20	20	20
Rated peak withstand current I _p	to kA	50	50	50	50
Ambient temperature T	without secondary equipment	°C	-25 to +40 (-40 to +40 on request)		
	with secondary equipment	°C	-5 to +40 (-25 to +40 on request) ²⁾		
	LSV panels	°C	-5 to +40 ^{2),3)}		
	with red. Rated peak withstand currents	°C	over +40		
Relative humidity	%	maximum 95			
Rated filling pressure of insulating gas at 20 °C and 101.3 kPa	kPa	130 (30 kPa overpressure)/LSF panel 150 (50 kPa overpressure)			
Insulating gas		SF ₆			
Rated density of the insulating gas	kg/m ³	7.9 (9.1 for LSF panels)			
Enclosure of HV compartment	IP	hermetically welded tank, IP65			
Enclosure of the fuse compartment	IP	single pole arc-root free enclosure and 3-phase metal enclosure, IP44			
Enclosure of the drive housing, relay cabinet, connection compartment	IP	IP44/IP3XD			
Internal arc classification according to VDE 0671 part 200 or IEC 62271-200	kA	IAC AFL 20 kA, 1 s for HV compartment			
	kA	IAC AFL 20 kA, 1 s for connection compartment			
Coloration of equipment	RAL	7035 (light grey)			
Loss of service continuity category		LSC 2A			
Partition class		PM			

1) Increased nominal voltage (25 kV) optional.

2) Dependent on the secondary technology used.

3) Usage at lower temperatures on request.

Standards

The GAE type switchgear fulfils the applicable standards and regulations below.

IEC 60265-1	/ DIN EN 60265-1 (VDE 0670-301)	IEC 62271-100	/ DIN EN 62271-100 (VDE 0671-100)
IEC 60282-1	/ DIN EN 60282-1 (VDE 0670-4)	IEC 62271-102	/ DIN EN 62271-102 (VDE 0671-102)
IEC 60529	/ DIN EN 60529 (VDE 0470-1)	IEC 62271-105	/ DIN EN 62271-105 (VDE 0671-105)
IEC 61243-5	/ DIN EN 61243-5 (VDE 0682-415)	IEC 62271-200 [60298] ¹⁾	/ DIN EN 62271-200 (VDE 0671-200) [DIN EN 60298 (VDE 0670-6)] ¹⁾
IEC 62271-1 [60694] ¹⁾	/ DIN EN 62271-1 (VDE 0671-1) [DIN EN 60694 (VDE 0670-1000)] ¹⁾	IEC 62271-303	
		DIN EN ISO 9001	

BImSchV Federal Gazette 1996, part 1 no. 66 dated 20.12.1996

¹⁾ Former

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Technical data

Three-position load-break switch (rated values)

Cable panel K, Transformer panel 1TS				Rated voltage U _r				
				7.2 kV	12 kV	17.5 kV	24 kV ⁶⁾	
Rated normal current for	Ring cable branch circuits	I_r	A	630	630	630	630	
	Transformer branch circuits ¹⁾	I_r	A	200	200	200	200	
Rated short-time withstand current ²⁾	for switchgear with $t_k = 1$ s	I_k	kA	20	20	20	20	
	for switchgear 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 branch circuits ³⁾	I_{ma}	kA	50	50	50	50	
	Ring cable branch circuits	I_{ma}	kA	50	50	50	50	
Switching capacity for multi-purpose load-break switch according to IEC 60265-1 and VDE 0670 part 301								
Operating sequence check 1	Rated mainly active load-breaking current	with 20 switching operations	I_1	A	630	630	630	630
		with 100 switching operations	I_1	A	630	630	630	630
		at 5%	I_1	A	31,5	31,5	31,5	31,5
Operating sequence check 2a	Rated value ring breaking current, $10 \times$	I_2	A	630	630	630	630	
Operating sequence check 3	Rated no-load transformer breaking current	I_3	A	4)	4)	4)	4)	
Operating sequence check 4a	Rated cable-charging breaking current	I_{4a}	A	50	50	50	50	
Operating sequence check 5	Rated short-circuit making current	I_{ma}	kA	50	50	50	50	
Switching capacity under earth fault conditions								
Rated earth fault breaking current		I_{6a}	A	160	160	160	160	
Rated cable-charging breaking current under earth fault conditions		I_{6b}	A	100	100	100	100	
Switching capacity according to IEC 62271-105								
Rated transfer current	Device type TS	$I_{transfer}$	A	1900	1900	1500	1500	
Operating cycles ring cable panel 1K								
Rated mainly active load-breaking current		n		100 ×	100 ×	100 ×	100 ×	
Rated short-circuit making current		n		5 ×	5 ×	5 ×	5 ×	
Mechanically permissible		n		1000 × ⁵⁾	1000 × ⁵⁾	1000 × ⁵⁾	1000 × ⁵⁾	
Class				E3/M1	E3/M1	E3/M1	E3/M1	

1) Dependent on HRC-fuse cartridge.

2) In the transformer branch circuit these values are limited by the HRC-fuses.

3) Dependent on the let-through current of the HRC-fuse.

4) Generically checked according to the above-mentioned standard for 400 kVA and 1000 kVA transformers at 12 kV and 24 kV.

5) Higher values on request.

6) Increased nominal voltage (25 kV) optional.

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Technical data

Three-position disconnecter 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	Circuit-breaker panel	I_r	A	630	630	630	630
Rated short-time withstand current	for switchgear with $t_k = 1$ s	I_k	kA	20	20	20	20
	for switchgear with $t_k = 3$ s	I_k	kA	20	20	20	20
Rated peak withstand current		I_p	kA	50	50	50	50
Operating cycles – mechanically permissible		n		10000 ×	10000 ×	10000 ×	10000 ×
Class				M2	M2	M2	M2

1) Increased nominal voltage (25 kV) optional.

Three-position circuit-breaker with memory for "OFF" (rated values)

Switching capacity according to IEC 62271-100, operating sequence check I_{100a} not necessary Circuit-breaker panel LSF				Rated voltage U_r			
				7.2 kV	12 kV	17.5 kV	24 kV ¹⁾
Rated normal current of the branch circuit		I_r	A	250/630	250/630	250/630	250/630
Rated short-time withstand current	for switchgear with $t_{th} = 1$ s	I_k	kA	20	20	16	16
	for switchgear 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
Rated operating sequence		–		0 – 3 min – C0 – 3 min – C0			
Operating cycles with							
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 permissible		n		2000 ×	2000 ×	2000 ×	2000 ×
Class				M1, E2	M1, E2	M1, E2	M1, E2

1) Increased nominal voltage (25 kV) optional.

Earthing switch (rated values)

K, TS, LSF, LSV panels				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 (40 ³⁾	50 (40 ³⁾
Rated short-time withstand current		I_k	kA	20	20	20 (16 ³⁾	20 (16 ³⁾
Earthing function behind the HRC-fuse							
Rated short-circuit making current		I_{ma}	kA	6,3	6,3	6,3	6,3
Rated short-time withstand current		I_k	kA	2,5	2,5	2,5	2,5
Operating cycles							
Rated short-circuit making current 50 kA		n		5 ×	5 ×	5 ×	5 ×
Mechanically permissible		n		1000 × ¹⁾	1000 × ¹⁾	1000 × ¹⁾	1000 × ¹⁾
Class				E2	E2	E2	E2

1) Higher values on request

2) Increased nominal voltage (25 kV) optional.

3) LSF earthing switch

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Technical data

Vacuum circuit-breaker GNVL with memory for "ON" and "OFF"

				Rated voltage U _r			
				7.2 kV	12 kV	17.5 kV	24 kV ¹⁾
Rated normal current of the branch circuit		I_r	A	630	630	630	630
Rated short-time withstand current	for switchgear with $t_{th} = 1$ s	I_k	kA	20	20	20	20
	for switchgear with $t_{th} = 3$ s	I_k	kA	20	20	20	20
Rated peak withstand current		I_p	kA	50	50	50	50
Rated short-circuit making current		I_{ma}	kA	50	50	50	50
Rated short-circuit breaking current		I_{sc}	kA	20	20	16	16
Rated cable-charging breaking current		I_c	A	50	50	50	50
Rated line-charging breaking current		I_l		20	20	20	20
Direct current components			%	33	33	33	33
Rated transient recovery voltage		U_c					
	Peak value		kV	21	21	41	41
	Gradient		kV/ μ s	0,34	0,34	0,47	0,47
Pole factor				1,5	1,5	1,5	1,5
Mechanical operating cycles		n		10000 ×			
Class				E2/M2/C2	E2/M2/C2	E2/M2/C2	E2/M2/C2
Insulation medium				SF ₆			
Extinguishing agent				Vacuum			
Drive mechanism				Spring accumulator			
Number of poles				3			
Number of clearances between open contacts per pole				1			
Opening time			ms	45			
Closing time			ms	38			
Distance between pole centres			mm	150			
Temperature class			°C	-5 to +40 ²⁾			
Installation				Indoors			
Rated operating sequence				0 – 0,3 s – C0 – 15 s – C0			

1) Increased nominal voltage (25 kV) optional.

2) Usage at lower temperatures on request.

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

Delivery programme of single switch panels

Cable panel with load-break switch and vertical bushing-type arrangement type -1K-/3/ and horizontal bushing-type arrangement type -1KB-/4/

Variants

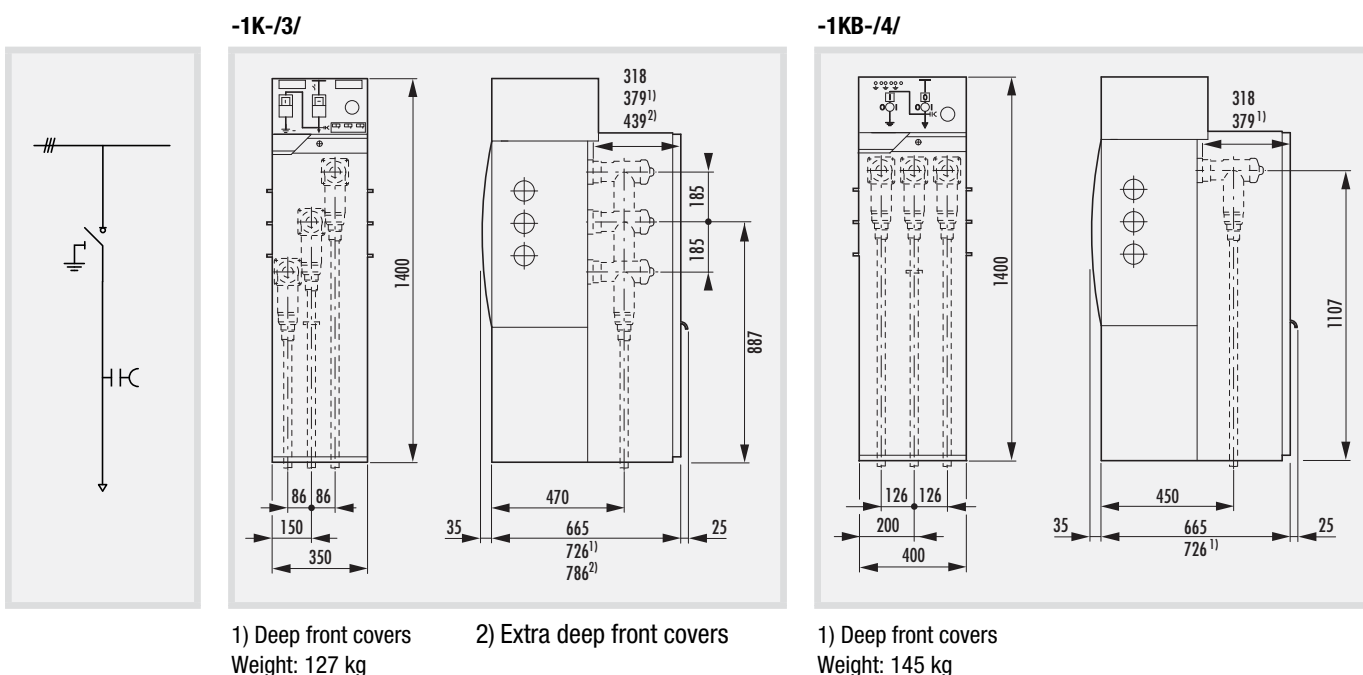
-1K-/3/12/630-630/... -1KB-/4/12/630-630/...
-1K-/3/24/630-630/... -1KB-/4/24/630-630/...

Basic features

- SF₆ three-position load-break earthing switch:
 - Comprising interlock,
 - manual operation,
 - load-break and earthing switch with spring-type mechanism – "ON" and "OFF"–,
- Three pole busbar under SF₆ in the SF₆ compartment,
- On both sides of the SF₆ gas tank, internal taper plug systems for external busbar links,
- Capacitive voltage tapping,
- Gas leakage indicator,
- Pressure relief in the arc in the cable cellar, open panel bottom,
- Lockable drive mechanisms,
- Simple outgoing bushing in vertical arrangement for maximum double cable connection over external cone plug XLPE 2 × 1 × 500 mm² (NKT CB, CC) (a connecting plug replaceable with lightning arrester).

Optionally

- Accessories for SF₆ three-position load-break earthing switch:
 - Auxiliary switch for load-break switch max. 4 NO, 4 NC,
 - auxiliary switch for earthing switch max. 3 NO, 3 NC,
 - motor drive for load-break switch – on request,
- Anti-reverse interlock for cable connection front covers,
- Relay and control compartment height 900 mm,
- Capacitive voltage indicator with integrated continuous three-phase indication and permanent self monitoring in relay front cover (→ Page 30),
- Short-circuit indicator (→ Page 34),
- SF₆ pressure monitoring:
 - Pressure switch with auxiliary contact,
 - Density monitor with auxiliary contact,
- Upwards pressure relief in cases of an arc over the rear pressure absorber channel, panel bottom closed, complete panel depth 1119 mm (→ Page 32), (only for -1KB-/4/), additional weight approx. 90 kg,
- Additional base 400 mm with pressure absorber channel (→ Page 32),
- Phase separation PS (→ Page 32),
- Deep front covers for deeper double cable connections (depth + 61 mm),
- Extra deep front covers for -1K-/3/ panel (Depth + 121 mm)
- Cable clamps,
- Arc-fault proof cable connection compartment,
- Relay and control compartment (→ Page 5).



Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

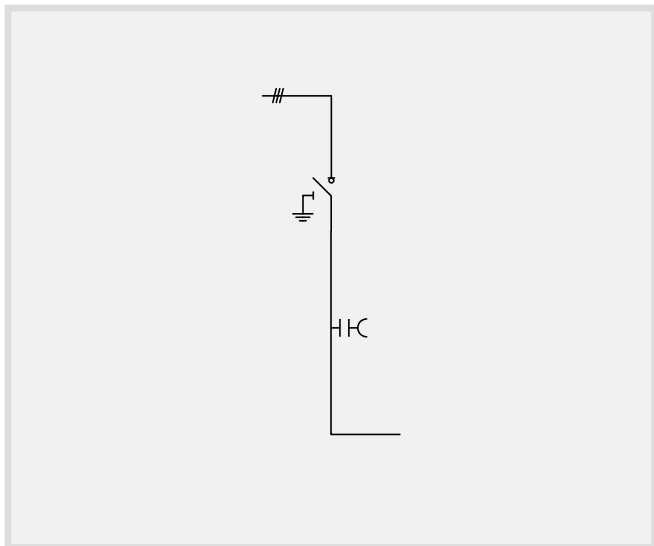
Bus sectionalizer load-break switch panel type -1KG-/4/

Variants

- 1KG-/4/12/630-630/...
- 1KG-/4/24/630-630/...

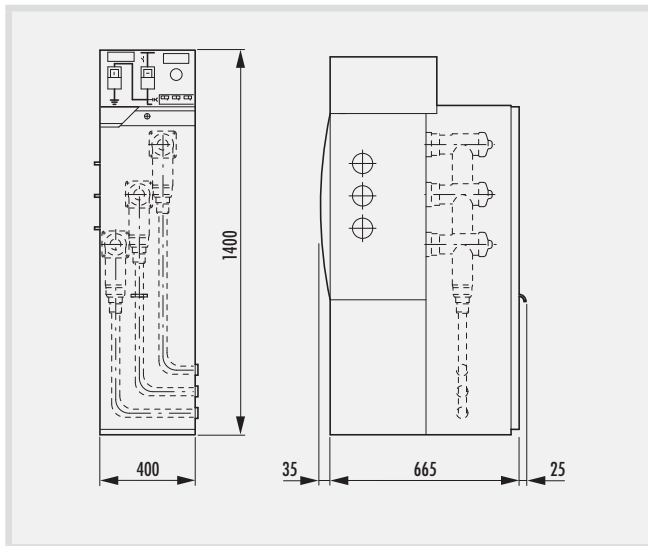
Basic features

- Three pole busbar for metering panel -1M1-
- Otherwise as Page 11.



Optional accessories

- Such as Page 11.



Weight: 145 kg

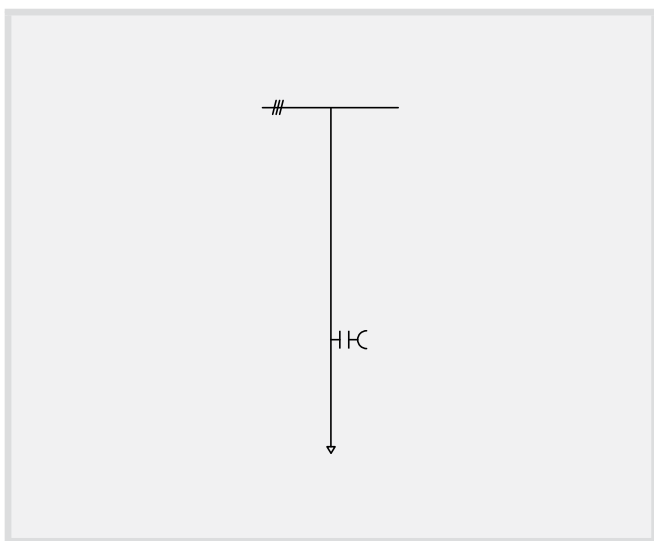
Cable connection panel type -1A1-/4/

Variants

- 1A1-/4/12/630-630/...
- 1A1-/4/24/630-630/...

Basic features

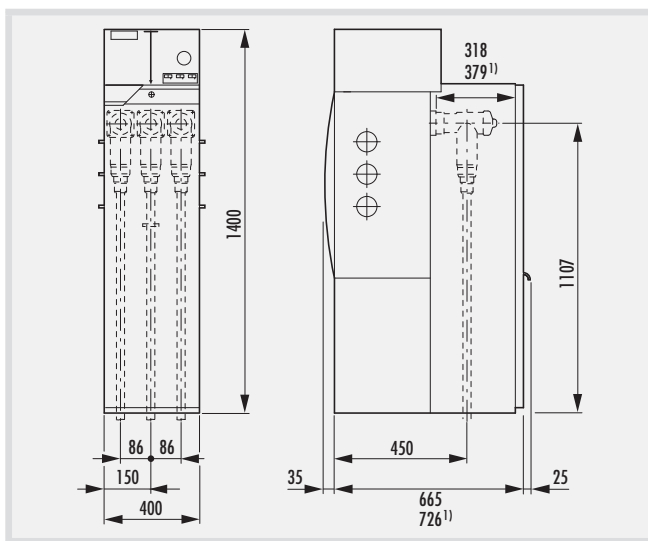
- Three pole busbar in the SF₆ compartment without switch.
- Otherwise as Page 11.



Optional accessories

- Such as Page 11 (except switching accessories).

-1A1-/4/



1) Deep front covers
Weight: 140 kg

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

Transformer outgoing panel with fuse load-break switch type -1TS-/4/

Variants

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

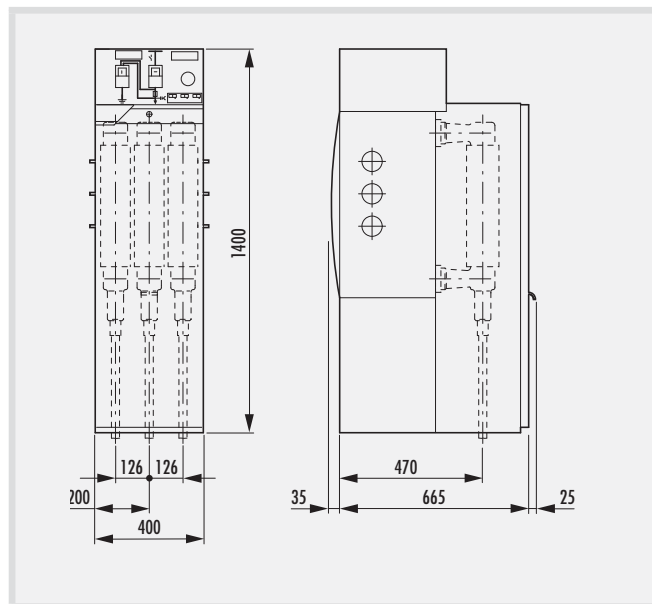
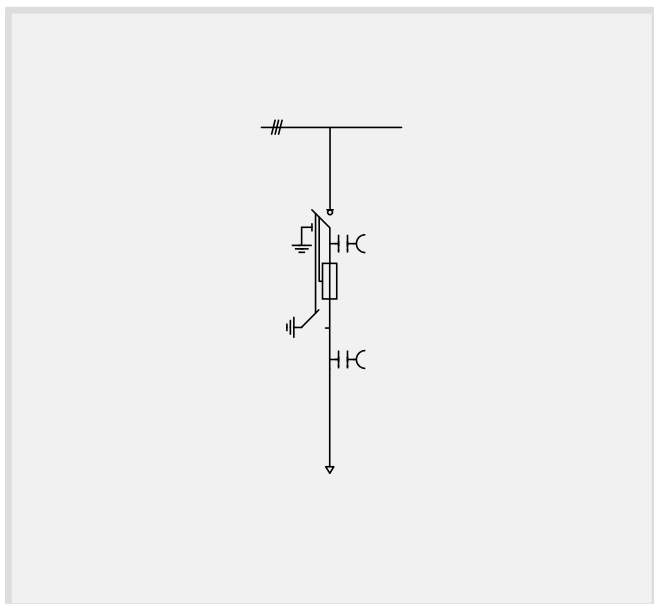
-1TS-/4/24/630-200/...

Basic features

- SF₆ three-position load-break earthing switch:
 - Comprising interlock,
 - Manual operation,
 - Load-break switch with spring-type mechanism –"ON" and stored-energy mechanism –"OFF",
 - Earthing switch with spring-type mechanism –"ON" and "OFF"–,
- Fuse tripping mechanism display,
- Three pole busbar under SF₆ in the SF₆ compartment,
- On both sides of the SF₆ gas tank, internal taper plug systems for external busbar links,
- Three pole fuse base enclosure,
- Earthing switch in SF₆ behind the HRC-fuse,
- Three pole sliding surface sealing end for transformer cable maximum XLPE 1 × 240 mm² Cu, 1 × 185 mm² Al,
- Capacitive voltage taps behind the fuse,
- Gas leakage indicator,
- Pressure relief in the arc in the cable cellar, open panel bottom,
- Lockable drive mechanisms,
- Arc-fault proof connection compartment.

Optionally

- Accessories for SF₆ three-position load-break earthing switch:
 - Auxiliary switch for load-break switch max. 4 NO, 4 NC,
 - Shunt trip release AC, DC,
 - Auxiliary switch for trip indication,
 - Motor drive for load-break switch,
 - Auxiliary switch for earthing switch max. 3 NO, 3 NC,
- Anti-reverse interlock for connecting front covers,
- Relay and control compartment height optional, 300/600/900 mm,
- Capacitive voltage taps additional before the fuse,
- Capacitive voltage indicator with integrated continuous three-phase indication and permanent self monitoring (→ Page 30),
- SF₆ pressure monitoring:
 - Pressure switch with auxiliary contact,
 - Density monitor with auxiliary contact,
- Upwards pressure relief in cases of an arc over the rear pressure absorber channel, panel bottom closed, complete panel depth 1119 mm (→ Page 32), additional weight approx. 90 kg,
- Additional base 400 mm with pressure absorber channel (→ Page 32),
- Phase separation PS (→ Page 32),
- Cable clamps.



Weight: 150 kg

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

Outgoing circuit-breaker panel with circuit-breaker on quenching coil basis type -1LSF-/6/

Variants

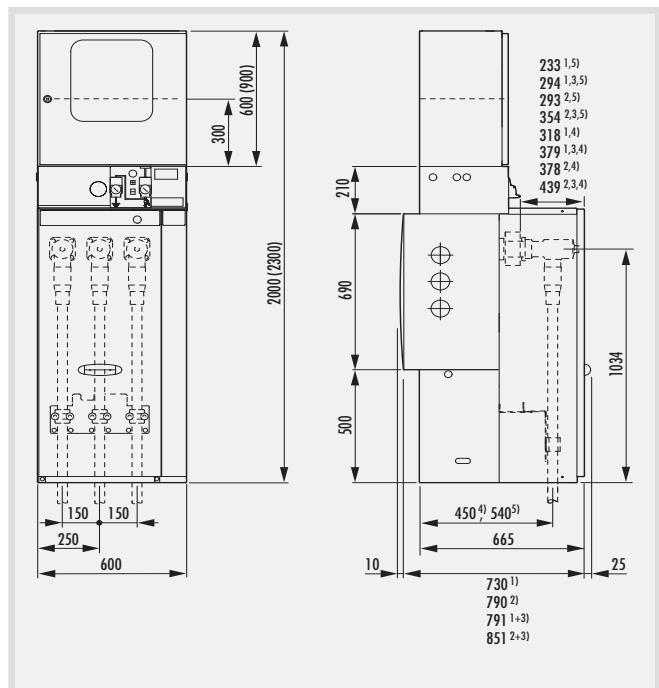
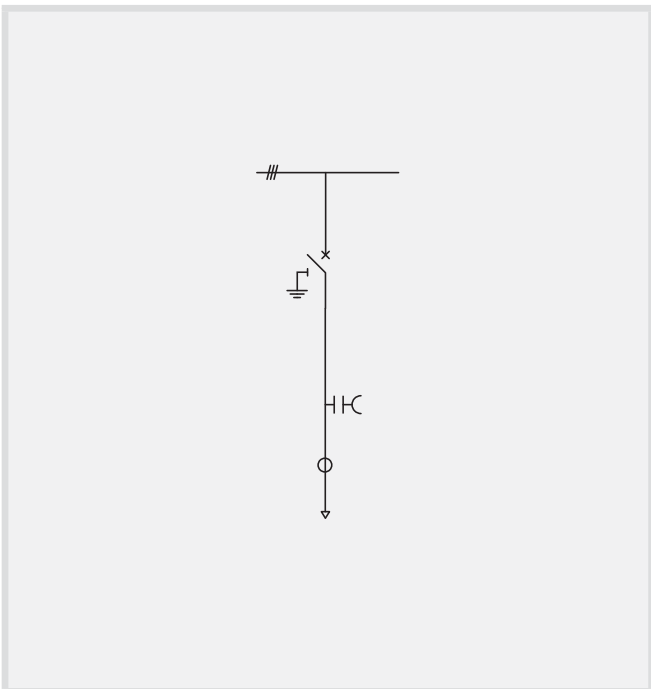
- 1LSF-/6/12/630-630/... -1LSF-/6/12/630-250/...
- 1LSF-/6/24/630-630/... -1LSF-/6/24/630-250/...

Basic features

- SF₆ three-position load-break and earthing switch
 - Comprising interlock,
 - Manual drive,
 - Circuit-breaker with spring-type mechanism –"ON" and stored-energy mechanism –"OFF",
 - Earthing switch with spring-type mechanism –"ON" and "OFF"–,
- Emergency manual "OFF" pressure switch,
- Three pole busbar under SF₆ in the SF₆ compartment,
- On both sides of the SF₆ gas tank, internal taper plug systems for external busbar links,
- Capacitive voltage tapping,
- Gas leakage indicator,
- Pressure relief in the arc in the cable cellar, open panel bottom,
- Lockable drive mechanisms,
- Arc-fault proof cable connection compartment,
- Simple outgoing bushing in vertical arrangement for maximum double cable connection over external cone plug $2 \times 1 \times 500 \text{ mm}^2$ (NKT CB, CC), (a connecting plug replaceable with lightning arrester),
- Arc-fault proof cable connection compartment.

Optionally

- Circuit-breaker
 - Motor drive for circuit-breaker,
 - Shunt trip release AC, DC,
 - Auxiliary switch max. 4 NO, 4 NC,
- Auxiliary switch for earthing switch max. 3 NO, 3 NC,
- Anti-reverse interlock for cable connection front covers,
- Relay and control compartment height optional, 300/600/900 mm,
- Ct-powered release for pulse or over auxiliary current release,
- Auxiliary current,
- Capacitive voltage indicator with integrated continuous three-phase indication and permanent self monitoring in relay front panel (→ Page 30),
- Short-circuit indicator in relay front panel (→ Page 34),
- SF₆ pressure monitoring:
 - Density monitor with auxiliary contact,
- Upwards pressure relief in cases of an arc over the rear pressure absorber channel, panel bottom closed, complete panel depth $1149 \text{ mm}^1(1209 \text{ mm}^2)$ (→ Page 32), additional weight approx. 90 kg,
- Deep front covers for deeper double cable connections (depth + 61 mm),
- Protection relay according to agreement,
- Three pole mains contactor- (and measuring current transformer, optionally calibrated) as toroidal core (glasses) transformer for the external cone bushing according to agreement.
- Assembly of relay compartment and front cover according to agreement,
- Cable clamps,
- Deep cable connection compartment (+ 60 mm).



- 1) Standard connection compartment.
 - 2) Deep connection compartment.
 - 3) Deep front cover.
 - 4) Short bushings.
 - 5) Long bushings.
- Weight: 255 kg

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

Bus sectionalizer circuit-breaker panel type -1LSFG-/6/

Variants

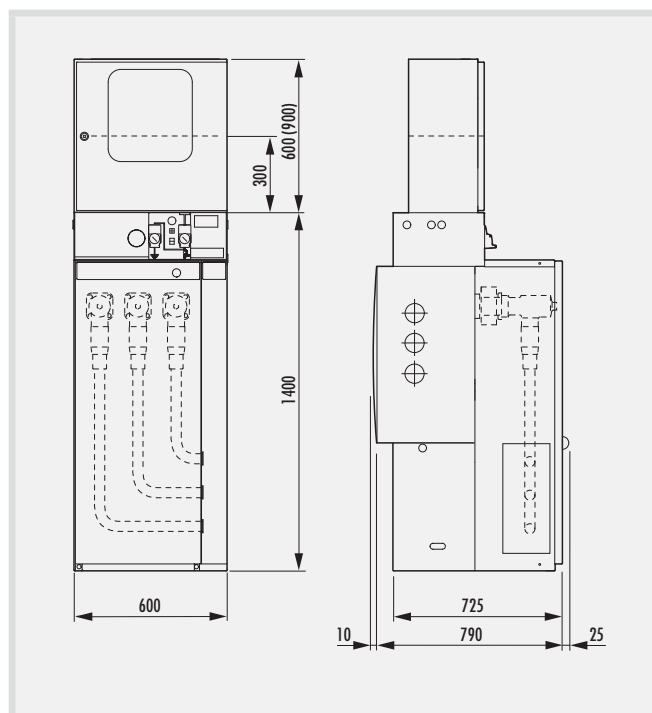
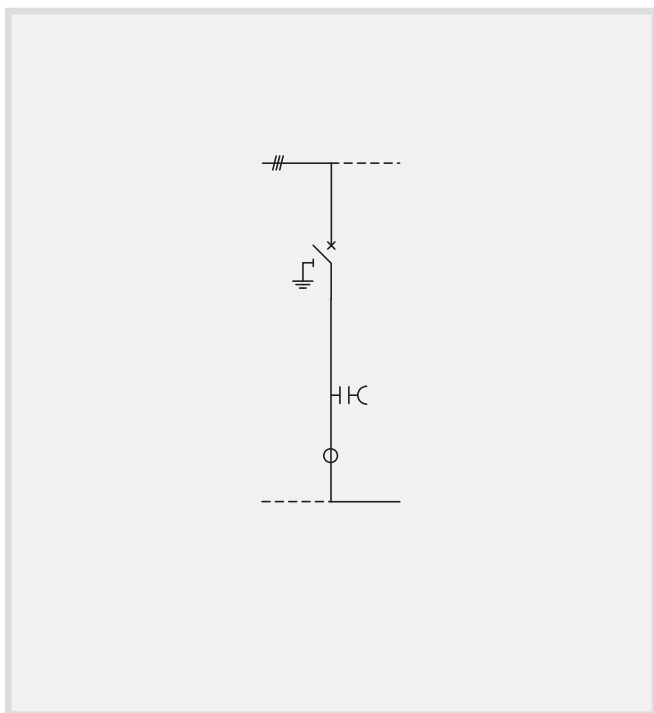
- 1LSFG-/6/12/630-630/20-...
- 1LSFG-/6/24/630-630/16-...

Basic features

- Three pole busbar for metering panel-1M1-/8,5/ (optionally to the left/to the right)
- Otherwise as Page 14.

Optional accessories

- Such as Page 14.



Weight: 255 kg



-1LSF-/6/ with opened cable front cover and relay cabinet cover

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

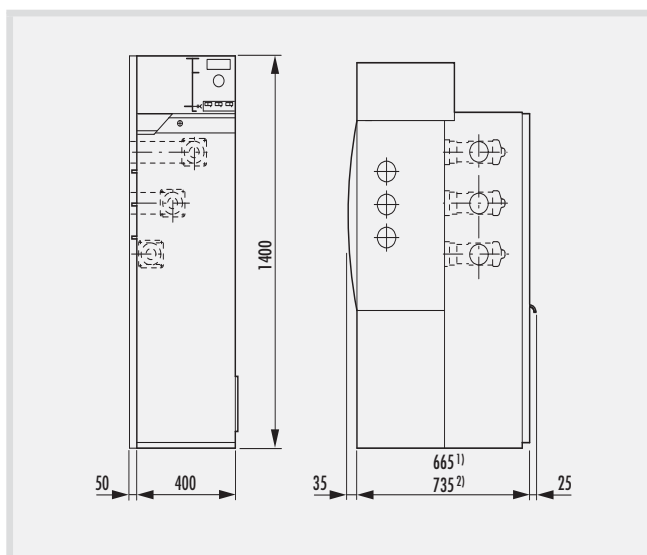
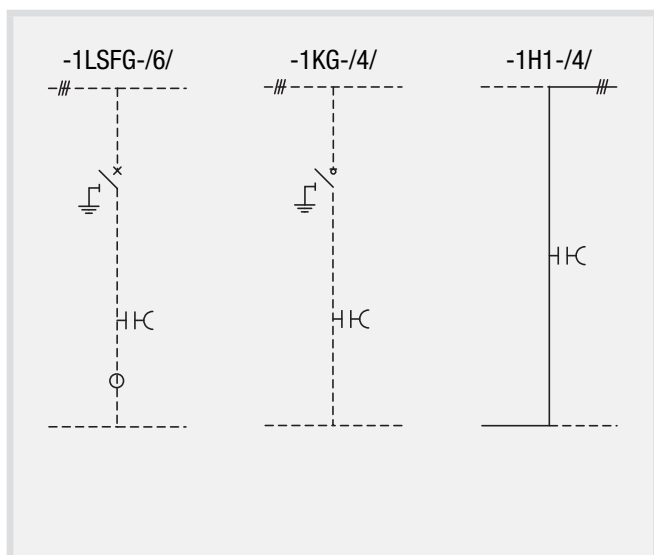
Bus riser panel type -1H1-/4/ in connection with -1KG-/4/ or -1LSFG-/6/

Basic features

- Three pole busbar in the SF₆ compartment,
- Capacitive voltage indicator in SS range,
- Intermediate frames 50 mm,
- Arc-fault proof connection compartment.

Optional accessories

- Upwards pressure relief in cases of an arc over the rear pressure absorber channel, panel bottom closed, complete depth approx. 1119 mm (→ Page 32), additional weight approx. 90 kg.



- 1) 1KG panel
- 2) 1LSFG panel
- 3) Weight: 145 kg

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

Busbar earthing panel type -1E-/4/

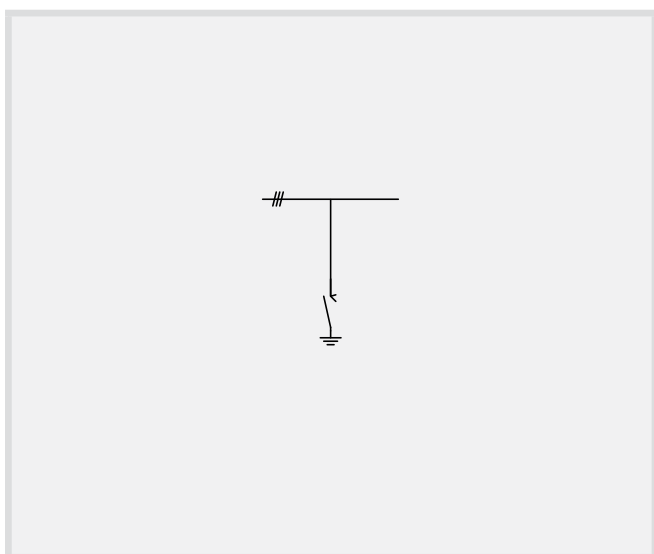
Variants

-1E-/4/12/630/...

-1E-/4/24/630/...

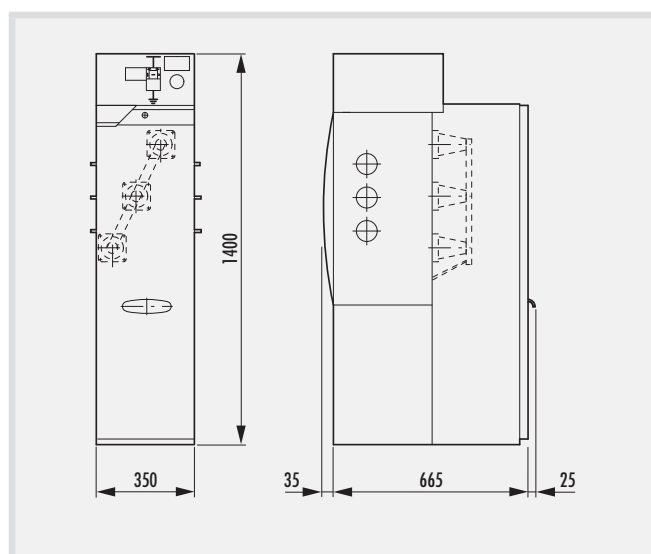
Basic features

- Three pole earthing switch for SS earthing. Earthing function as three-position switch,
- Three pole busbar in the SF₆ compartment,
- Spring-type mechanism for earthing switch,
- Lockable drive mechanism earthing switch,
- Arc-fault proof connection compartment.



Optional accessories

- Auxiliary switch for earthing switch max. 3NO, 3NC,
- Upwards pressure relief in cases of an arc over the rear pressure absorber channel, panel bottom closed, complete depth approx. 1119 mm (→ Page 32), additional weight approx. 90 kg,
- Electromagnetic interlock for earthing switch.



Weight: 148 kg

Bus riser panel -1H2-/8,5/ in connection with -1LSVG-/5/ panel

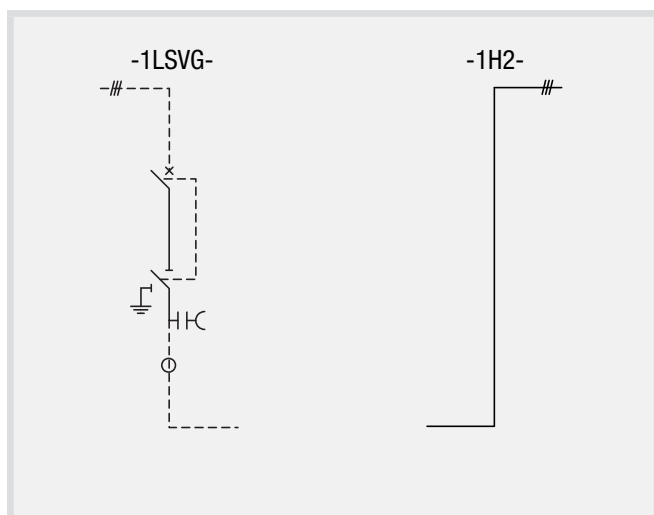
Variants

-1H2-/8,5/12/630/...

-1H2-/8,5/24/630/...

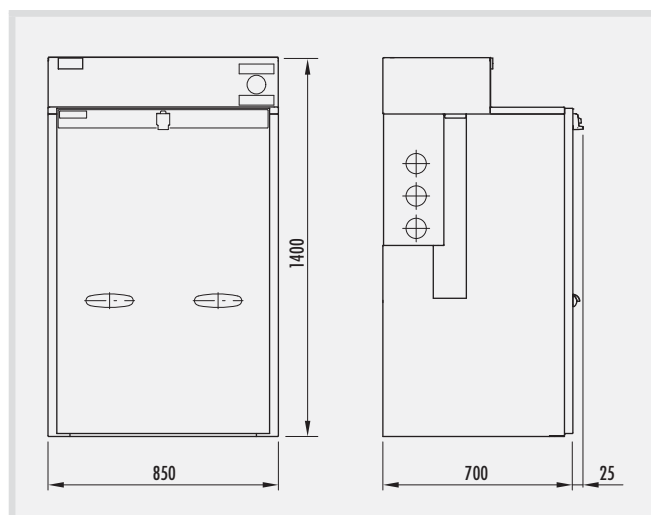
Basic features

- Three pole busbar,
- Arc-fault proof connection compartment.



Optional accessories

- Upwards pressure relief in cases of an arc over the rear pressure absorber channel, panel bottom closed, complete depth approx. 834 mm (→ Page 32), additional weight approx. 90 kg.



Weight: 270 kg

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

Outgoing circuit-breaker panel type -1LSV-/5/

Variants

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

-1LSV-/5/24/630-630/20-...

Basic features

- Vacuum circuit-breaker with spring-type mechanism –"ON" and "OFF"–,
 - Auxiliary switch 10 NO and 10 NC
 - Release – "ON", "OFF" – DC or AC,
 - Signalling switch for "closing spring tensioned",
 - Mechanical counter,
- SF₆ three-position circuit-breaker earthing switch:
 - Interlocked with circuit-breaker,
 - Manual operation,
 - Earthing switch with spring-type mechanism –"ON" and "OFF"–,
- Three pole busbar under SF₆ in the SF₆ compartment,
- On both sides of the SF₆ gas tank, internal taper plug systems for external busbar links,
- Capacitive voltage indicator in relay front cover,
- Gas leakage indicator,
- Pressure relief in the arc in the cable cellar, open panel bottom,
- Lockable drive mechanisms,
- Relay and control compartment (→ Page 5),
- Arc-fault proof cable connection compartment.

Optionally

- Accessories for vacuum circuit-breaker:
 - Motor drive,
 - Under-voltage release,
 - Fleeting contact for breaker tripping signal,
 - Anti-pumping relay,
 - Electric closing lock-out (blocking magnet),
 - Varistor module ≥ 60 V DC,
- Accessories for SF₆ three-position circuit-breaker and earthing switch:
 - Auxiliary switch for disconnecter max. 3 NO, 3 NC,
 - Auxiliary switch for earthing switch max. 3 NO, 3 NC,
- Anti-reverse interlock for cable connection front covers,
- Ct-powered release for pulse or over auxiliary current release,
- Capacitive voltage indicator with integrated continuous three-phase indication and permanent self monitoring in relay front cover (→ Page 30),
- Short-circuit indicator in relay front panel (→ Page 34),
- SF₆ pressure monitoring:
 - Pressure switch with auxiliary contact,
 - Density monitor with auxiliary contact,
- Upwards pressure relief in cases of an arc over the rear pressure absorber channel, panel bottom closed, complete depth 1150 mm (→ Page 32), additional weight approx. 90 kg,
- Additional base 400 mm with pressure absorber channel (→ Page 32),
- Protection relay according to agreement,
- One or three pole mains contactor- (and measuring current transformer, optionally calibrated) as toroidal core (glasses) transformer for the external cone bushing according to agreement,
- Assembly of relay compartment and front cover according to agreement,
- Cable clamps,
- Deep front cover for double cable connections (+ 116 mm).

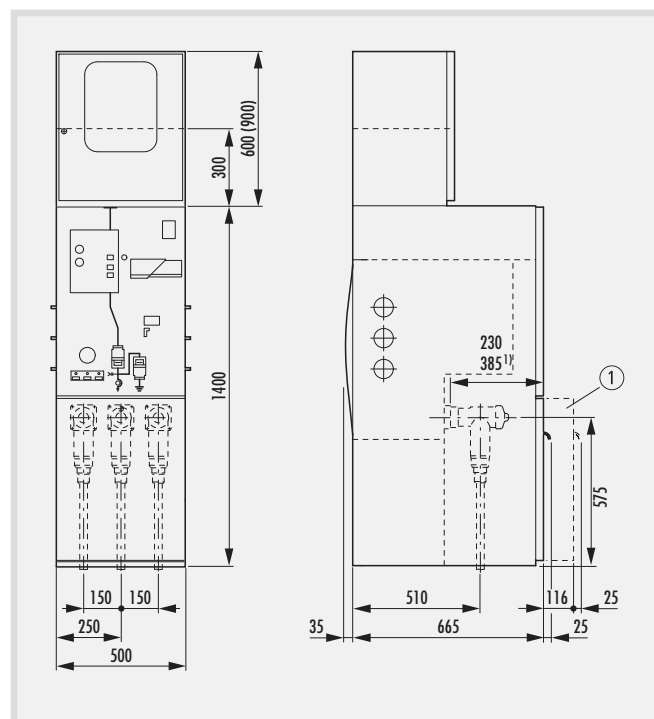
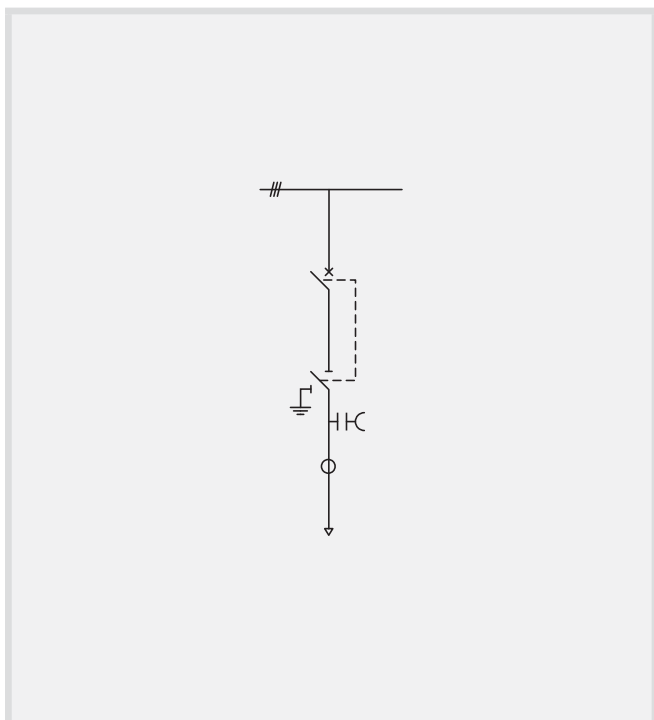


-1LSV-/5/ with opened cable front cover and relay cabinet cover

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

Outgoing circuit-breaker panel type -1LSV-/5/



- ① Front cover deeper
Possible for multipoint connection according to the type of plug-in connection required.

Weight: 330 kg

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

Variants

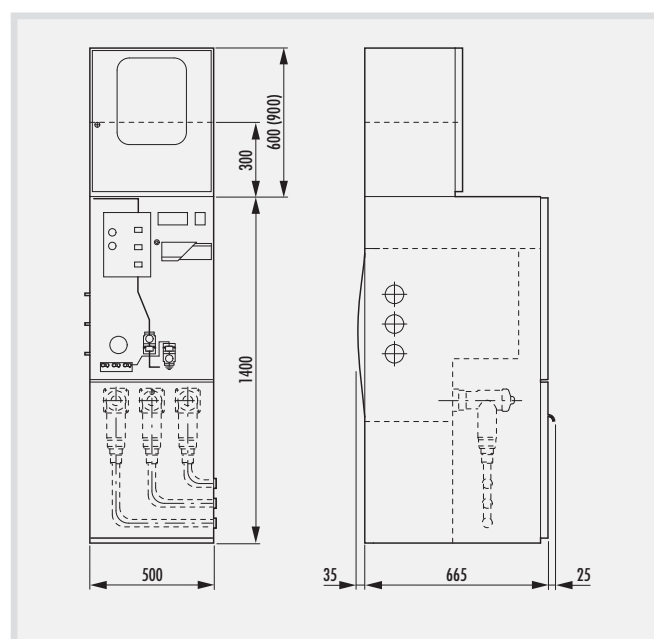
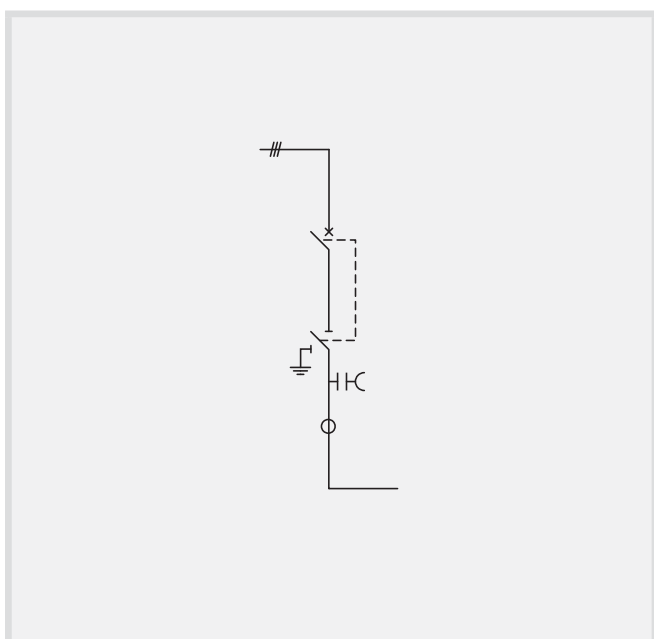
- 1LSVG-/5/12/630-630/20-...
- 1LSVG-/5/24/630-630/20-...

Basic features

- Three pole busbar for metering panel -1M1-/8,5/
- Otherwise as Page 18.

Optional accessories

- Such as Page 18.



Weight: 330 kg

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme of single switch panels

Metering panel type -1M...-/8,5/

Variants

-1M...-/8,5/12/630/...

-1M...-/8,5/24/630/...

Basic features

- Three pole busbar (SF₆ insulated or air or solid matter insulated),
- Narrow band support current or voltage transformer in accordance with DIN 42660 Part 8 or 9, IEC 600441, Ormazabal delivery or customer service,
- Arc-fault proof connection compartment,
- Insulating cover (only for 24 kV).

Optionally

- Front covers with or without left/right hinges,
- Fixed ball point for the connection of earthing and short-circuiting device D = 20 mm, M12,
- Fixed ball point for the connection of earthing and short-circuiting device D = 25 mm, M16,
- Assembly of NS control compartment and front cover according to agreement,
- Relay and control compartment (→ Page 5), optionally 300/600/900 mm
- Upwards pressure relief in cases of an arc over the rear pressure absorber channel, panel bottom closed, complete depth 964 mm (→ Page 32), additional weight approx. 90 Kg,
- Capacitive voltage display system (apart from 1M4, 1M5Ü).

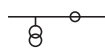
-1M1-/8,5/



Type: GAE-1M1-/8,5/12/

Type: GAE-1M1-/8,5/24/

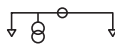
-1M2-/8,5/



Type: GAE-1M2-/8,5/12/

Type: GAE-1M2-/8,5/24/

1M4/8,5/



Type: GAE1M4-/8,5/12/

Type: GAE1M4-/8,5/24/

-1M5/8,5/

1M5-/8,5/



Type: GAE-1M5-/8,5/12/, GAE-1M5-/24/

Type: GAE1M5-/8,5/12/, GAE1M5-/24/

-1M5Ü/8,5/

1M5Ü-/8,5/



Type: GAE-1M5ü-/8,5/12/, GAE-1M5Ü-/24/

Type: GAE1M5Ü-/8,5/12/, GAE1M5Ü-/24/

-1M6-/8,5/



Type: GAE-1M6-/8,5/12/

Type: GAE-1M6-/8,5/24/

Weight of the metering panel approx. 400 kg



View with opened front cover

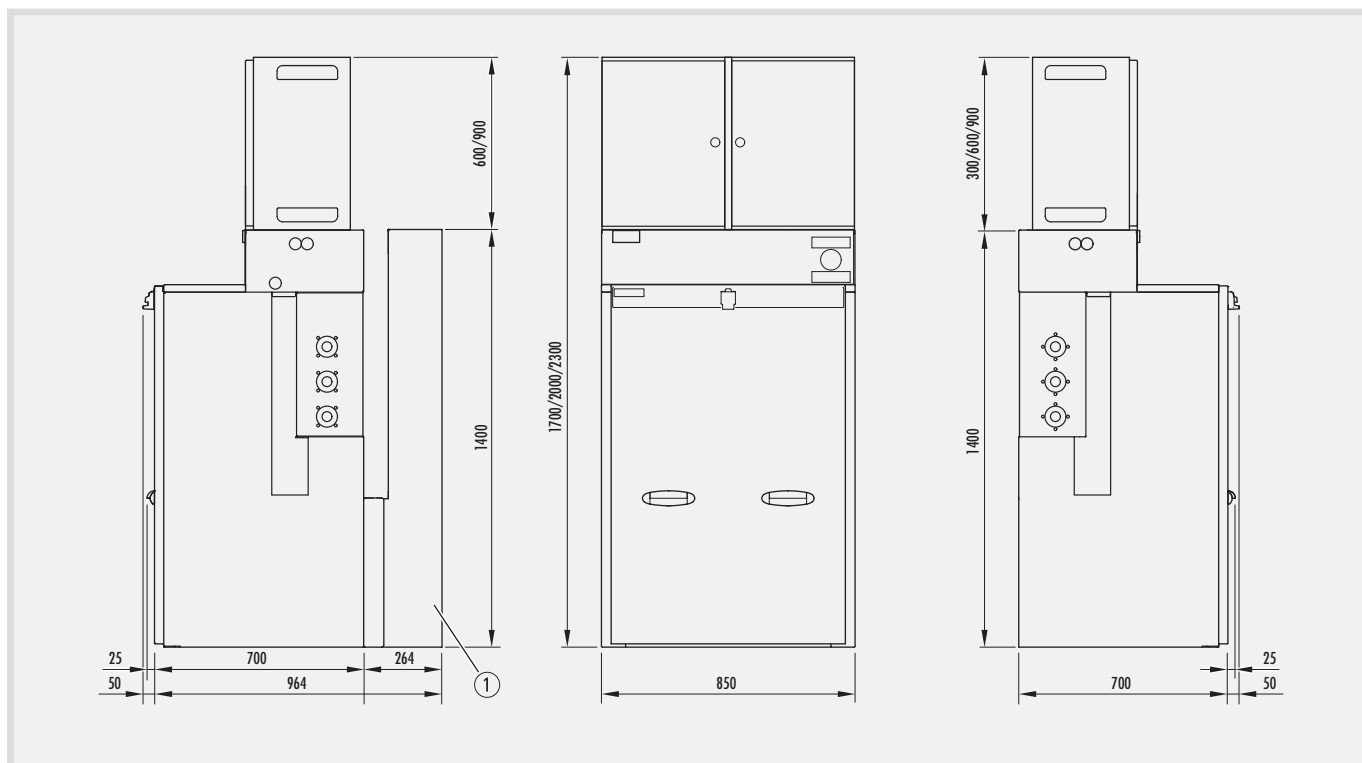


Front view, closed front cover

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

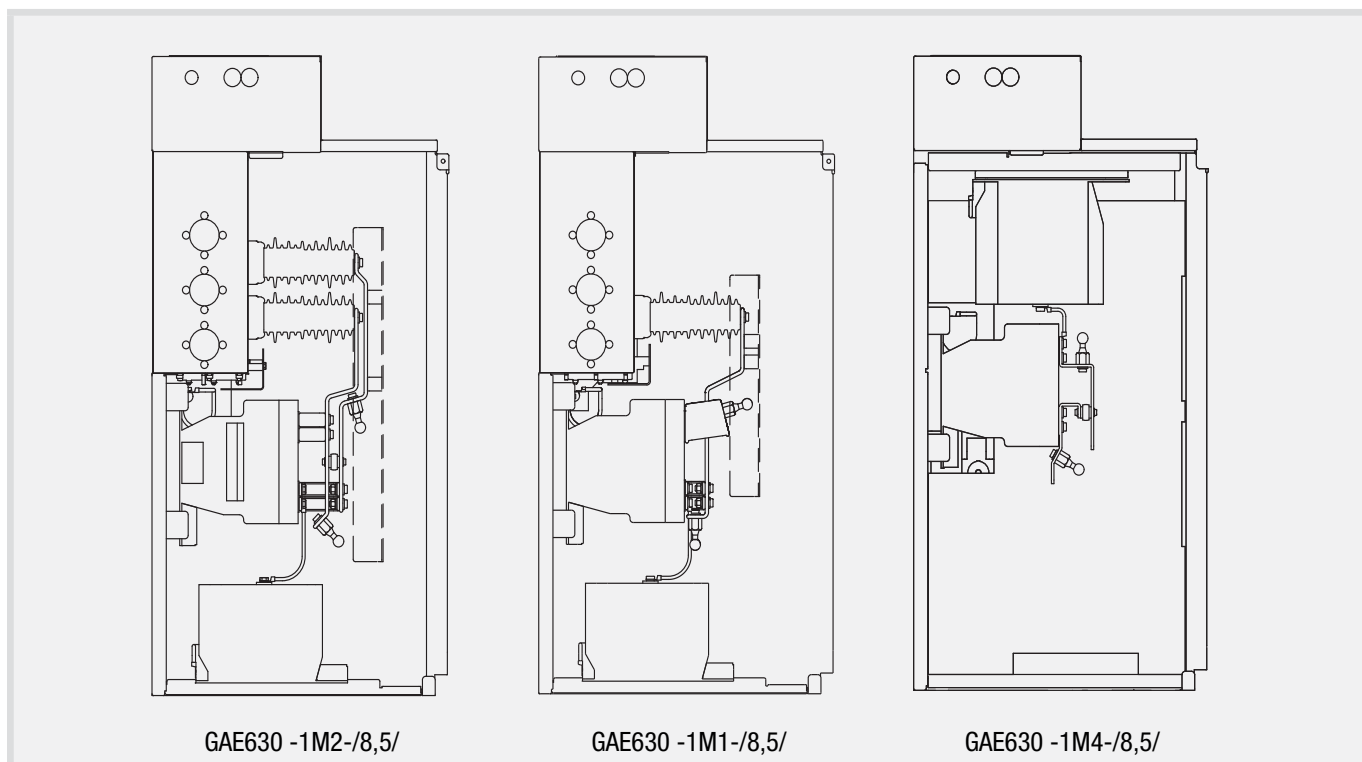
Delivery programme of single switch panels

View of example metering panel -1M ... -/8,5/



① Pressure absorber channel (optional) with minimum relay cabinet height 600 mm

Note: Relay cabinet (300/600/900 mm) optional in case of metering panel without pressure absorber channel



Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme for blocks

Delivery programme for blocks

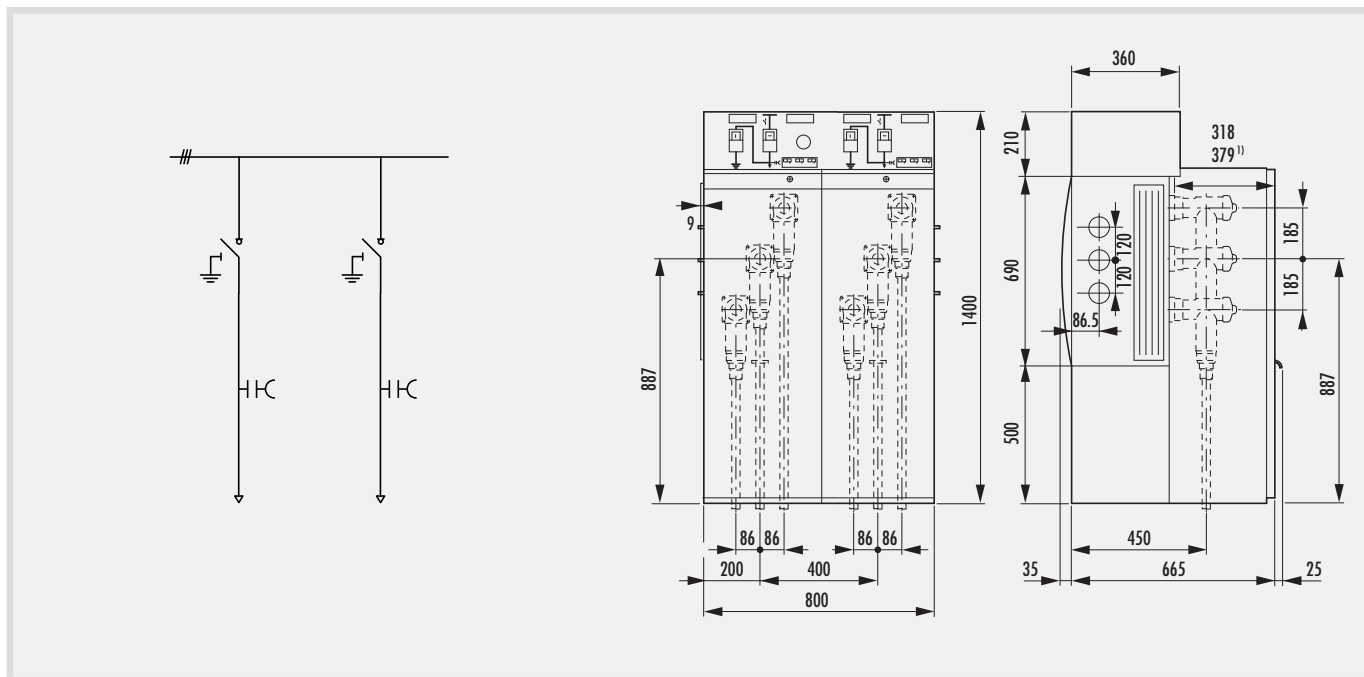
Ring cable panel block type -2K-/8/ with diagonal bushing-type arrangement

Basic features and optional accessories per panel, → Page 11,
ring cable panel type -1K-.

Variants

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

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



1) Deep front cover

Weight: 263 kg

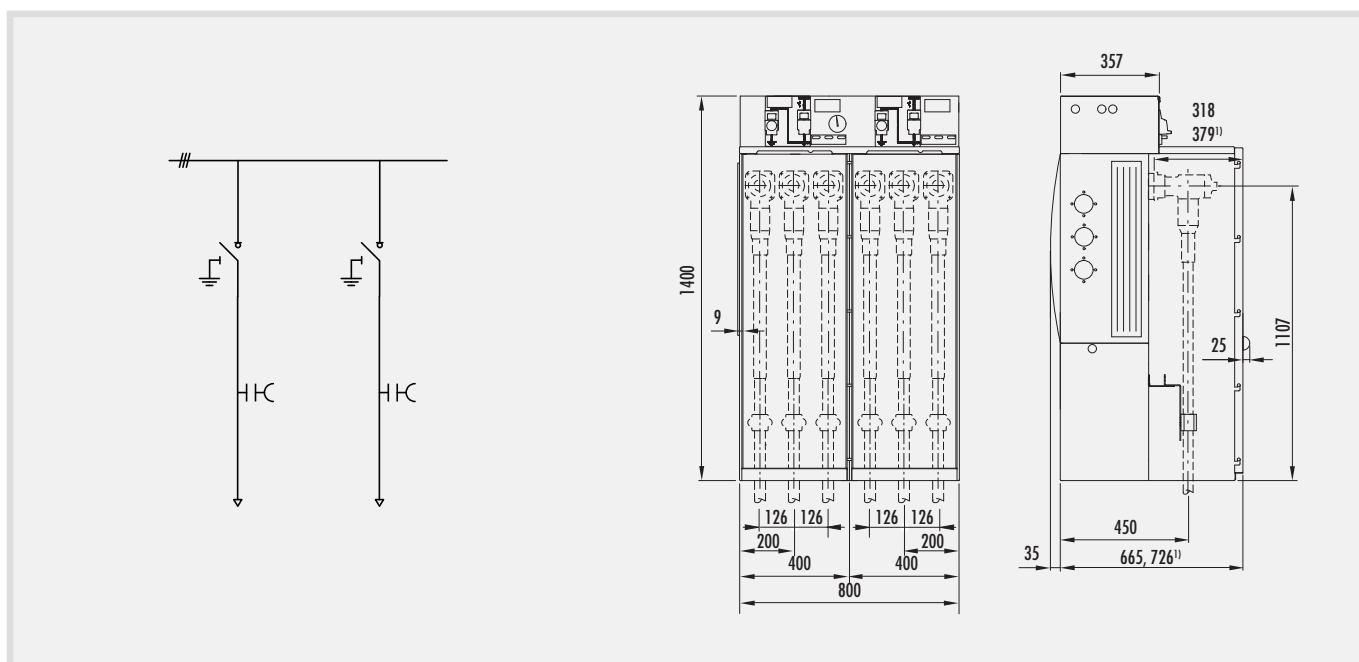
Ring cable panel block type -2KB-/8/ with horizontal bushing-type arrangement

Basic features and optional accessories per panel, → Page 11,
ring cable panel type -1K-.

Variants

-2KB-/8/12/630-630/...

-2KB-/8/24/630-630/...



1) Deep front cover

Weight: 270 kg

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme for blocks

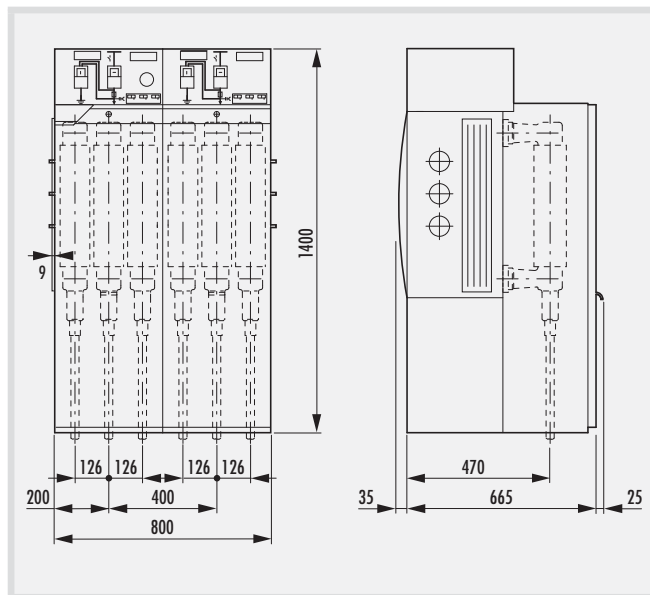
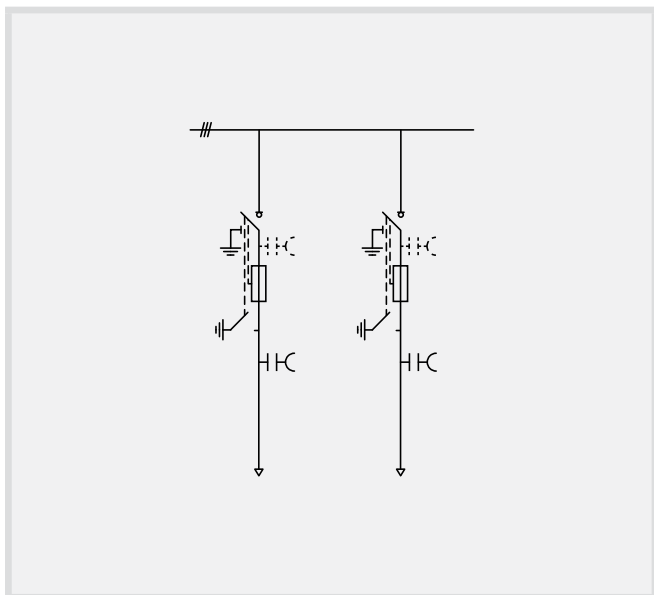
Transformer panel block type -2TS-/8/

Basic features and optional accessories per panel, → Page 13, transformer panel type -1TS-

Variants

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

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



Weight: 310 kg

Ring cable panel transformer panel block type -2K1TS-/10/

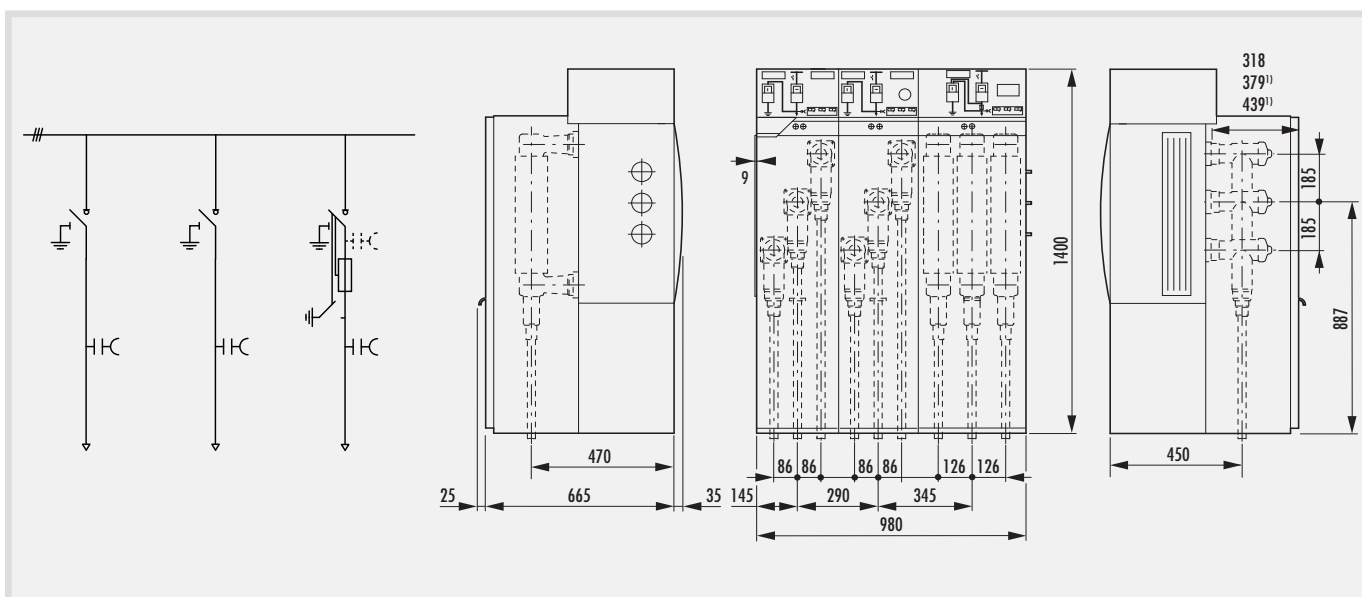
Basic features and optional accessories per panel, → Page 11, ring cable panel type -1K- and → Page 11, transformer panel type -1TS-

Variants

-2K1TS-/10/12/630-630/...

-2K1TS-/10/24/630-630/...

Attention! Only extensible to the right.



Weight: 298 kg

1) Deep front cover

2) Extra deep front cover (panel 1+2)

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme for blocks

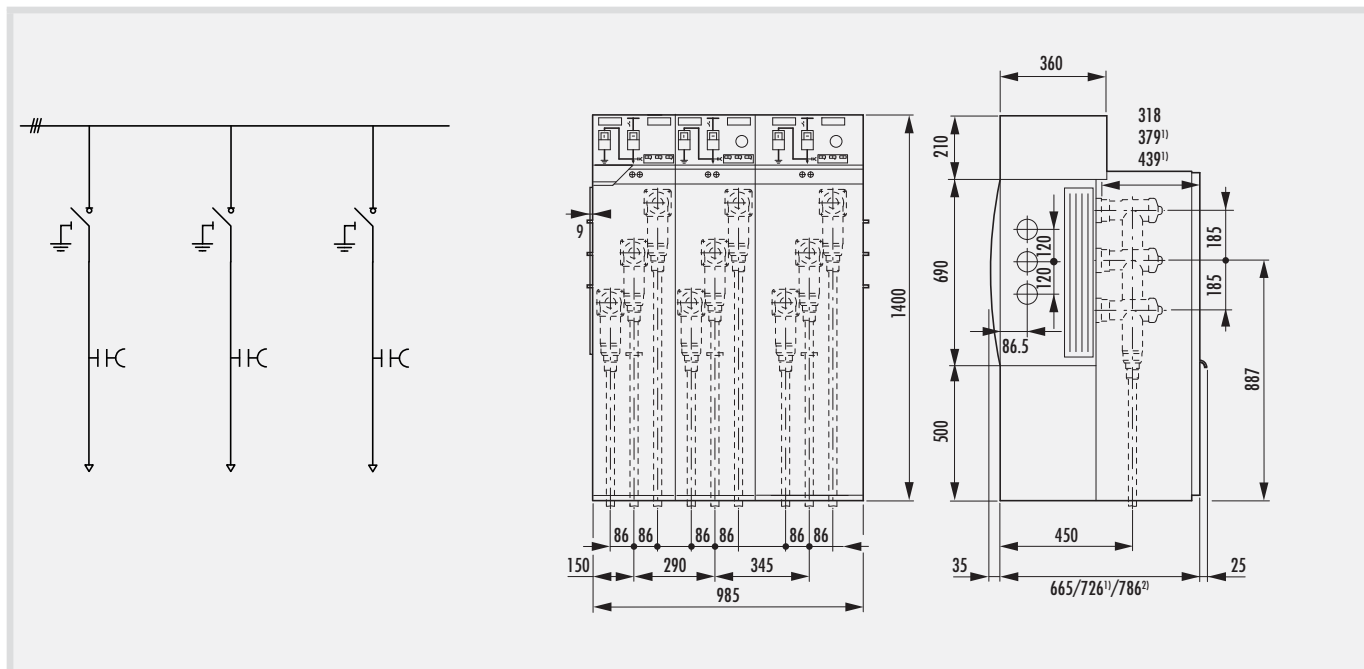
Ring cable panel block type -3K-/10/ with diagonal bushing-type arrangement

Basic features and optional accessories per panel, → Page 11,
ring cable panel type -1K-.

Variants

-3K-/10/12/630-630/...

-3K-/10/24/630-630/...



Weight: 300 kg

1) Deep front cover

2) Extra deep front cover (panel 1+2)

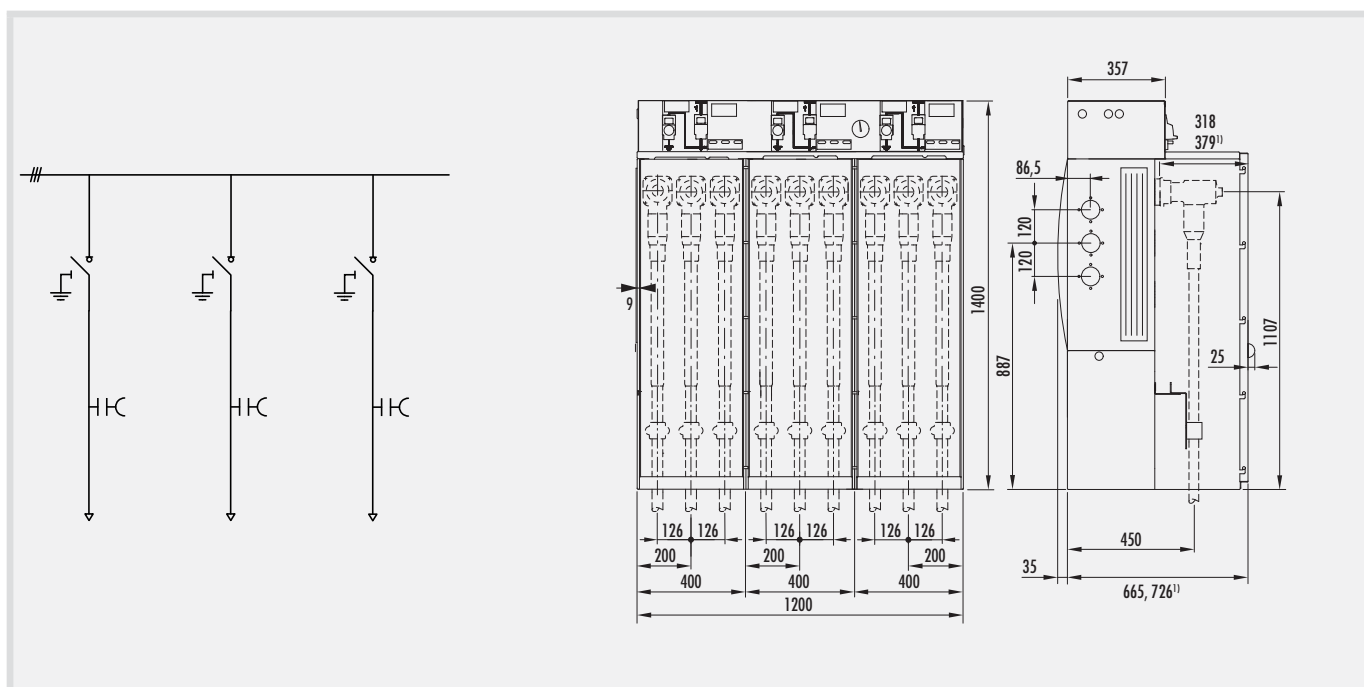
Ring cable panel block type -3KB-/13/ with horizontal bushing-type arrangement

Basic features and optional accessories per panel, → Page 11,
ring cable panel type -1K-.

Variants

-3KB-/12/630-630/...

-3KB-/24/630-630/...



1) Deep front cover

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Delivery programme for blocks

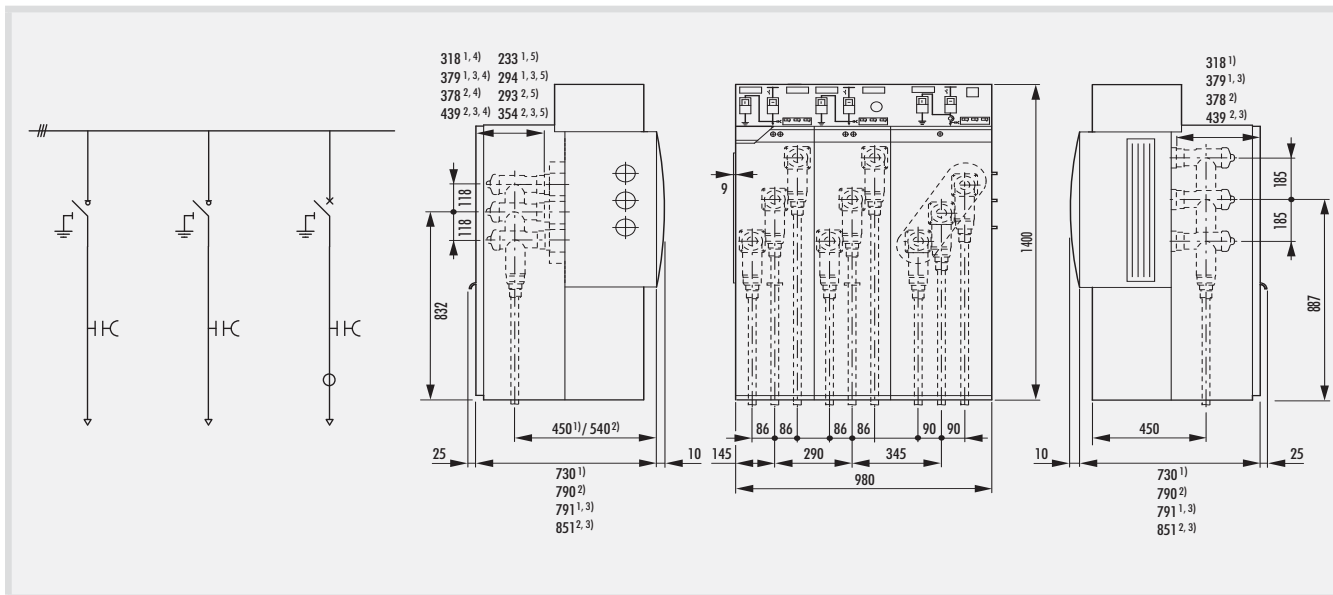
Ring cable panel circuit-breaker panel block type 2K1LSF250-/10/, type 2K1LSF630-/10/

basic features and optional accessories per panel, → Page 11,
ring cable panel type -1K- and load-breakerpanel
type -1LSF250- or -1LSF630- → Page 14.

Attention! Only extensible to the right.

Variants

- 2K1LSF250-/12/630-250/20-...
- 2K1LSF630-/12/630-630/20-...
- 2K1LSF250-/24/630-250/16-...
- 2K1LSF630-/24/630-630/16-...



- 1) Standard connection compartment
 - 2) Deep connection compartment
- Weight: 355 kg

- 3) Deep front cover
- 4) Short bushing LSF panel
- 5) Long bushing LSF panel



Block type 2K1LSF250-/10/ with relay and control compartment, height 300 mm

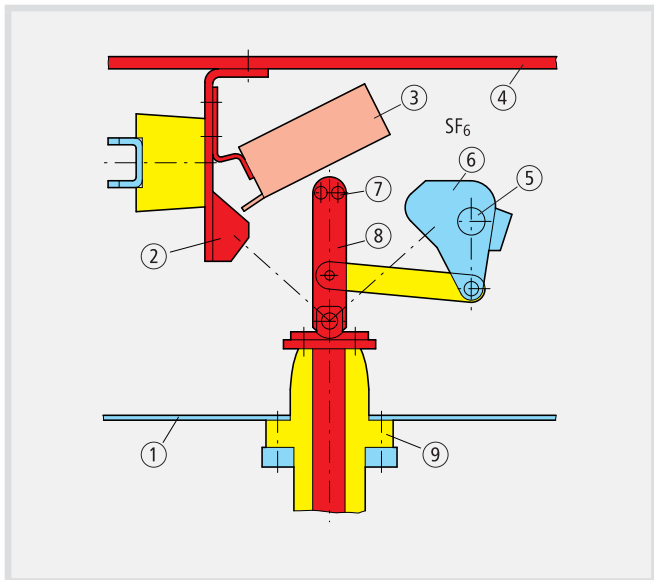
Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Switching systems

Switching systems

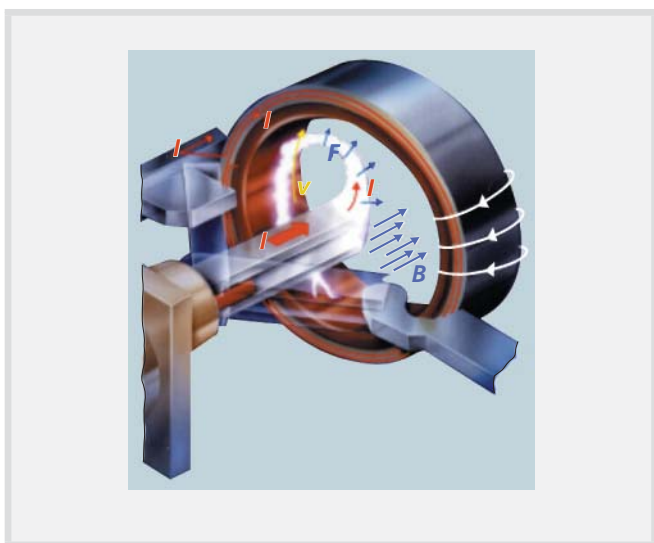
Three-position load-break switch

Three-position circuit-breaker



- ① Front gas tank
- ② Firm contact ON
- ③ Quenching coil
- ④ Busbar
- ⑤ Drive shaft
- ⑥ Earthing contact
- ⑦ Special contact rivets
- ⑧ Switching blade
- ⑨ Bushing

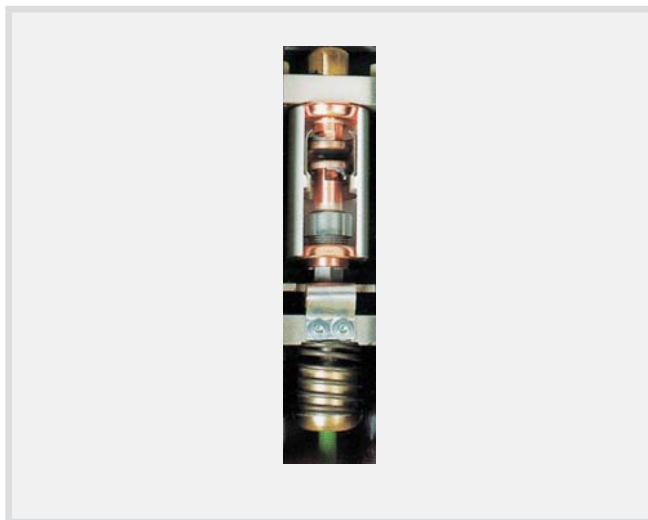
Function principle of the quenching coil



- I = Current
- B = from the current I in the magnetic field generated by the quenching coil
- F = Force on the current-carrying switching arcs
- v = Velocity vector of the switching arcs

Vacuum contact chambers

The vacuum contact chambers are comprised of the axial large area, contact bodies in an evacuated metal, ceramic compartment. The contact bodies protected against accidental contact are coated with a special contact material. Two massive copper seals, one of which can be moved, form the connection to the connection parts of the circuit-breaker. The vacuum seal between the contact stamp and the vacuum vessel overtakes a flexible metal bellows seal. The use of the stamp occurs via a sleeve bearing.



Switching in the vacuum for axial magnetic fields

When switching off, an arc occurs in the vacuum contact chamber from the moment the contacts are separated. Once the quenching distance is reached, the arc is quenched on the zero crossing of the current. The arc causes a local fusing of the contact surfaces. The evaporating metal thereby mainly deposits on the contacts, and to a lesser degree on the screens surrounding the contacts. The chopping current (normal chopping) of the installed vacuum contact chambers is less than 5 A and implies only minor overvoltages. An axial magnetic field between the contacts in the vacuum contact chamber keeps the metal vapour arc diffuse*, also in the range of short-circuit currents. The thermal damage to the contacts is thus very slight and the contact burn-up is negligibly low.

* arc form dispersing

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Front cover

Front cover

Front cover with

- Mimic diagram
- Switch position indicator
- Operating surface for switchgear
- Voltage indicating systems
- Gas leakage indicator
- Short-circuit indicators
- Lockable drives
- Drive mechanism seal for dust, sand, insects
- Enclosure IP44

Cable panel 1K



Transformer panel 1TS

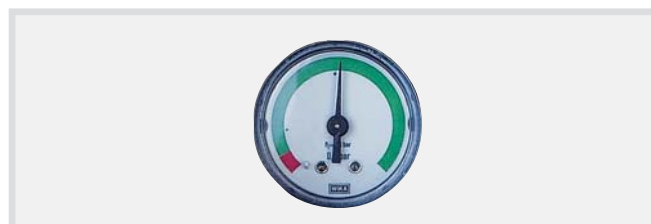


Circuit-breaker panel 1LSV



Gas leakage indicator

To control the functional safety, each gastank unit is equipped with a pressure indicator, which detects SF₆ overpressure in the tank.



The display indicates:

- Green = service pressure correct
- Red = service pressure not correct.

Pressure switch/density monitor

For remote monitoring each container unit can be equipped with a pressure switch or density monitor (auxiliary contact). The bottom switching point corresponds to the transition to the red measuring range on the gas leakage indicator. The density monitor can optionally be equipped with alarm and auxiliary release switches.

Lockable drives



Phase comparison



Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Cable connection zones

Cable connection zones

T-connection kits

T-connection kits are to be used at the discretion of the operator in cable/connection panels or circuit-breaker panels. To be connected to bushings acc. to DIN EN 50181 connection type C (630 A) with outside taper and screw contact (M16).

On uncontrolled systems the installation instructions of the manufacturer must be strictly observed.

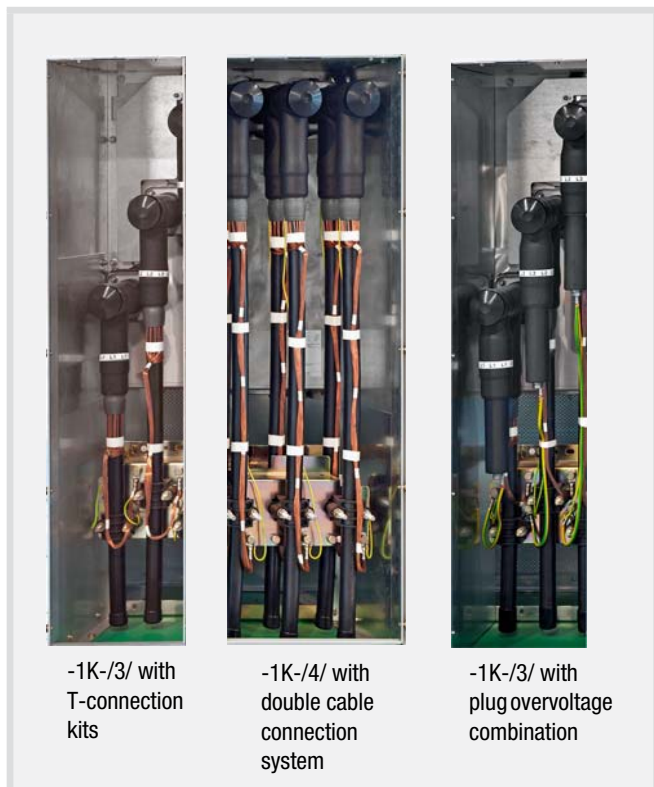
Installation possibilities for cable connection kits:

NKT type		Südkabel type		Tyco Electronics type		Euromold/Nexas-Type		Prysmian type		Cellpack	
10 kV	20 kV	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV	10 kV	20 kV
CB12	CB24	SET12	SET24	RSTI	RSTI	K400TB	K400TB	FMCTs400	FMCTs400	CTS 24 kV	CTS 24 kV
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	–	–	–	–	–	484TB/G	K484TB/G	–	–		

Note!

Depending on the mounting depth of the cable connection compartments, deep front covers or deep cable connection compartments may be necessary. Further connection possibilities on request. Possible mounting depths, see 11-25.

Cable connection cable/connection panels type K, A, LSF

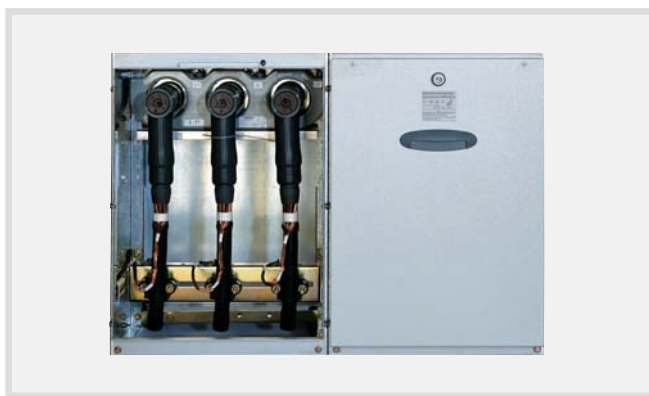


T-connection kits, double cable and plug overvoltage combinations cannot be connected in standard system layouts. As such compact cable connection systems are to be used (maximum standard mounting depth of 318 mm).

Exception: LSF panel with longer bushing (→ Page 14, 25).

Deeper cable connection systems require a correspondingly deeper front cover or cable connection compartment (see drawings pages 11-25).

Cable connection vacuum circuit-breaker panel 1LSV



-1LSV-/5/

Cable connection in the outgoing circuit-breaker panel type -1LSV-/5/ with bushing current transformer. Left front cover panel opened.

Standard mounting depth 230 mm

Deeper cable connection systems require a correspondingly deeper front cover (→ Page 19).

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

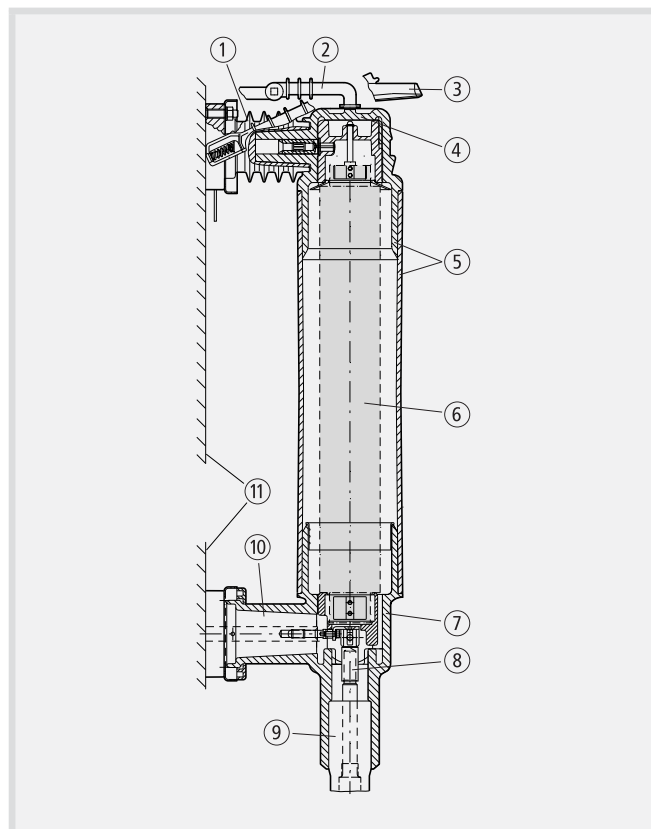
Fuse base, fuses selection, transformer cable connection

Fuse base, fuses selection, transformer cable connection

The fuse base on the GAE unit is designed as a plug-in system. All components are coupled to the current paths outside the gas tank via cast resin bushings. The plug-in system consists of the upper and lower fuse holder. 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 cable termination. Application range for Cu cable from 25 to 240 mm², for Al cable from 25 to 185 mm². Through the earthing switch located in the SF₆ container the HRC-fuse cartridges can be earthed on both sides. The fuse base is only accessible with the earthing switches inserted. Actual dimension of fuse: 442 mm, with extension adapter fuses with an actual dimension of 292 mm can also be installed.

Fuse selection

Only HRC back-up fuses corresponding to current selection table no. 12248573 are used in accordance with DIN 43625 to 88 mm $\alpha \cdot v \delta$, for the protection of distributor transformers 6/10/15/20 kV. Other HRC-fuses can only be used after consultation!



- | | |
|----------------------|---|
| 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
(2. Earthing switch) |
| ⑤ Upper fuse holder | ⑪ Front gas tank |
| ⑥ HRC-fuse cartridge | |



Transformer outgoing panel, front cover opened.
With fuse holders and transformer cable sealing end.

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Voltage indication and testing

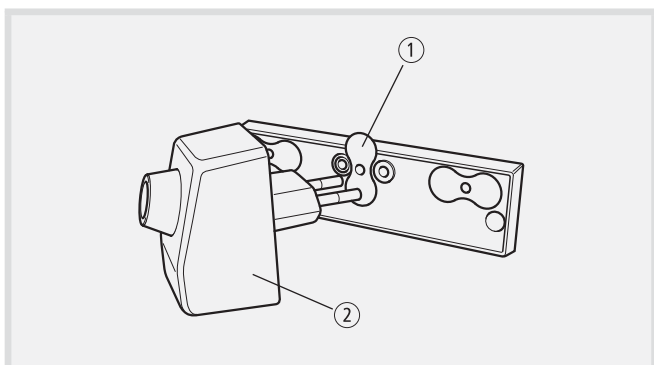
Voltage indication and testing

To check for electrical isolation or to perform a voltage test in accordance with VDE 0682 Part 415 and IEC 61243-5, each switch panel can be equipped with the following voltage indicating systems:

1. Standard VDS voltage indication ledge type KSO

The KSO voltage indication ledge is integrated in the drive front cover and is an HR voltage indicating system (VDS). The phased check for electrical isolation is made possible by inserting the voltage indicating system device into the corresponding socket pair. The wiring of the voltage indication ledge is designed for **rated operational voltage 10.15 and 20 kV**. The minimum and highest values of the standard are maintained in the standard line for these voltage ranges.

A new alignment for modification to the rated operational voltage in this range is not necessary. The rated operational voltage 6 kV is feasible in a special solution. Live contact sleeves are protected against accidental contact.



- ① Pivoting shroud
- ② Voltage tester

The test can be performed using a suitable voltage tester.

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

Measuring devices for phase comparison or interface testing

In connection with the voltage indicating systems, for the phase comparison or interface testing the use of the following measuring devices is possible:

Brand	Phase comparison	Interface testing
Horstmann	–	Measuring module HO-M with ammeter device Fluketype 87 or Matrix type Mx55 (II to IV)
Horstmann	Type: ORION 3.0	Type: ORION 3.0
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, extensible, GAE type, GAE630 series

Voltage indication and testing

2. Integrated voltage indicating system IVDS

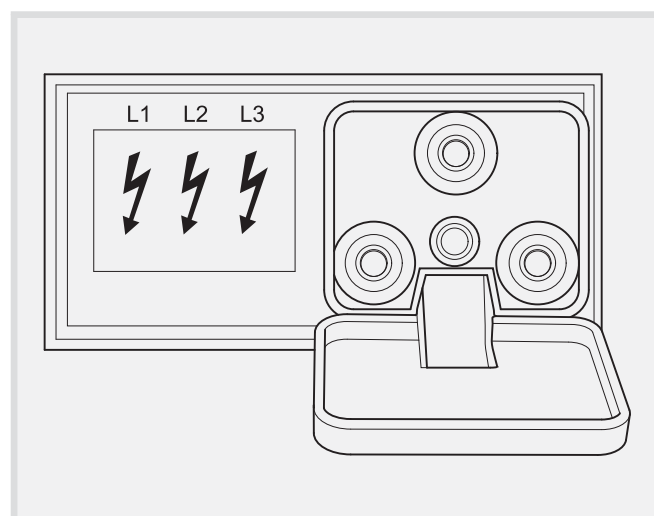
System CAPDIS, Co. Kries:

System	Features
CAPDIS-S1+	Integrated three-phase LCD continuous display, self monitoring
CAPDIS-S2+	Integrated three-phase LCD continuous display, self monitoring, auxiliary relay

CAPDIS is a capacitive voltage indicator with three-phase continuous display and permanent self monitoring.

This device indicates that voltage is present at the capacitive insulating support test point using the display of warning signs on the integrated Display.

In addition, the device has an integrated three-phase measuring point. This device is calibrated in accordance with LR requirements as per VDE 0682 Part 415 and IEC 61243-5 and is suitable for phase testing using an LR phase comparator. A captive shroud protects the test sockets against dirt, dust and moisture.



3. Integrated voltage detecting system IVDS

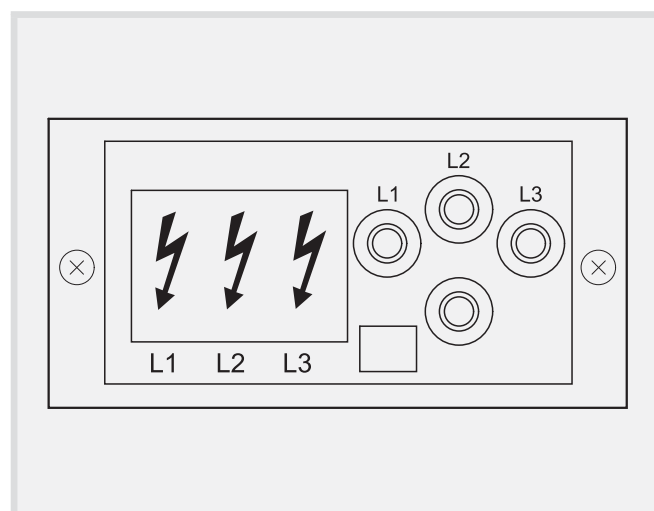
System WEGA, Co. Horstmann

System	Features
WEGA 1.2	Integrated three-phase LCD continuous display, self monitoring
WEGA 2.2	Integrated three-phase LCD continuous display, self monitoring, auxiliary relay

The integrated voltage detecting system WEGA complies with the requirements for capacitive voltage detecting systems of VDE 0682-415 (IEC 61243-5). It is a three-phase testing system, with which the voltage condition of a medium voltage line is displayed.

On the front plate are the LCD display, the display test button and the three-phase LRM interface. A shroud that is secured against loss protects the sleeves from dust and corrosion. On the rear side are connections for the measuring signals and auxiliary voltage.

For the display of arrows and point symbols in the Display, no auxiliary power is required, it is fed from the measuring signal. Even when the auxiliary voltage fails these display functions remain active. For the additional functions (relay control, display lighting and active zero readout) an auxiliary voltage is necessary.

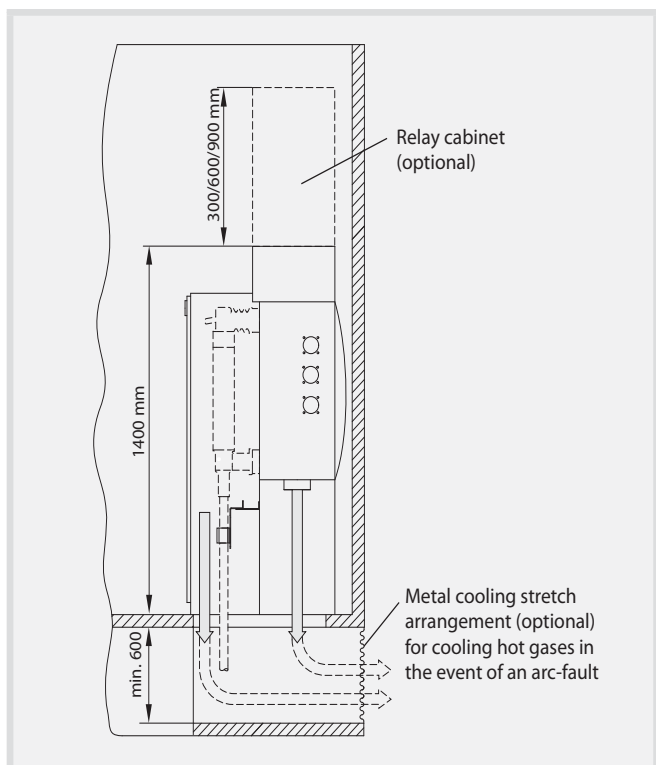


Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Possible installations in accessible and non-accessible switchgear rooms

Possible installations in accessible and non-accessible switchgear rooms

- Panel bottom open
- Pressure relief into the cable trench/raised floor



Please see the corresponding operating instructions for GAE630 switchgear for further details. Detailed installation plans on request.

Minimal switchgear height GAE630 with pressure absorber channel

- GAE630 single panels: Switchgear height 2,000 mm with 600 mm relay room or cover
- GAE630 2-panel/3-panel blocks without further single panels: Switchgear height 1,400 mm

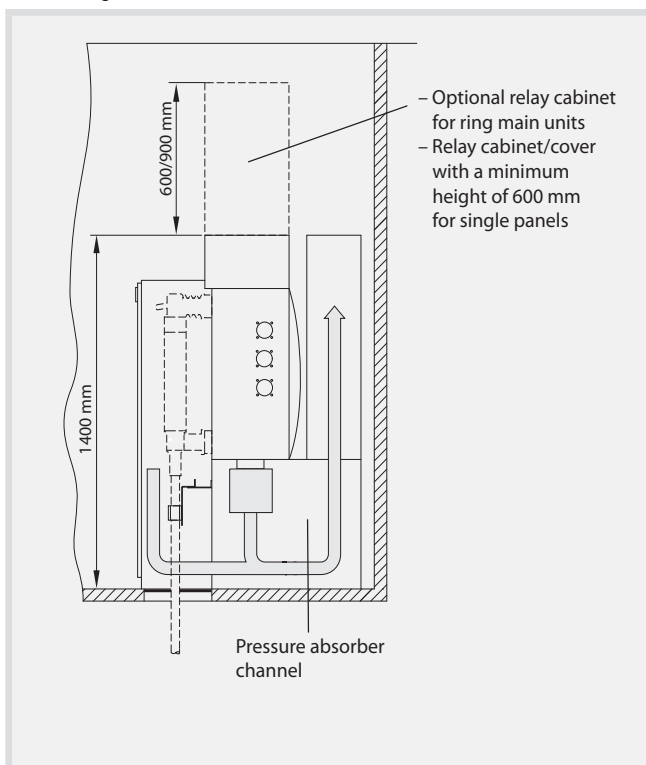
The construction of the building and the switchgear room must withstand the expected mechanical loads and the internal pressure caused by a short-circuit arc. Appropriate calculations for these purposes are recommended.

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

Phase separation option

The phase separation PS in the cable connection compartments of the SF₆-insulated switchgear of types GA and GAE is an option for increasing personal and switchgear protection as well as network availability.

- Panel bottom closed
- Pressure relief via rear pressure absorber channel into the switchgear room



As such the front covers of cable panel type K and circuit-breaker panel type LSF are provided on the inner side with phase isolating plates. They form according to the installation of the front cover one-phase metal partitioning between the screened cable connection compartments.

As a result the effects of a potential arc fault in the cable connection zone are considerably reduced. For earth fault compensated networks, the fault current will be limited to a one-phase earth fault current. Front covers with phase separation can be exchanged subsequently. Details on request.

Additional base option

For special installation conditions such as in switchgear rooms without raised floors or tower substations, Ormazabal offers an optional 400 mm additional base with rear pressure absorber channel.

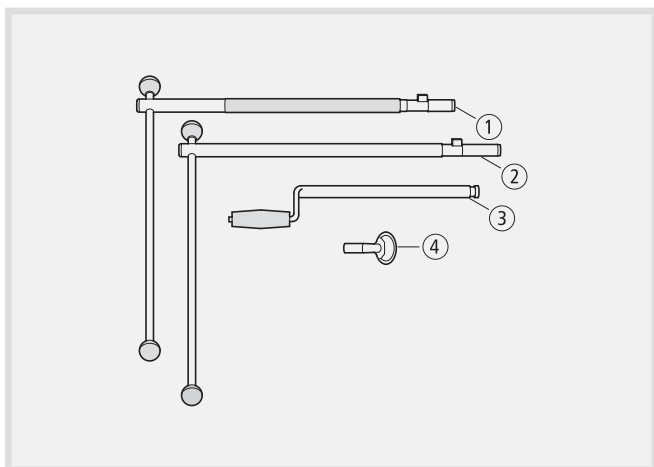
The medium-voltage cables can be fitted from behind or from the side via pressure-proof cable glands in the additional base, depending on the version. The additional bases can be delivered with diverse GAE panel combinations. Details on request.

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Switchgear accessories

Switchgear accessories

Switching lever

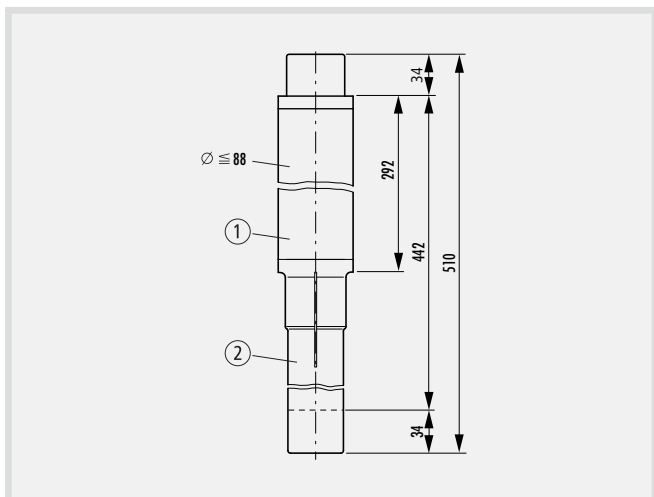


Switching lever, crank handle, fastener key

- ① Switching lever for earthing switch (red shaft).
- ② Switching lever for load-break switch or circuit-breaker (bare shaft).
- ③ Crank handle for vacuum circuit-breaker.
- ④ Key for front cover fastener (controls the anti-reverse interlock).

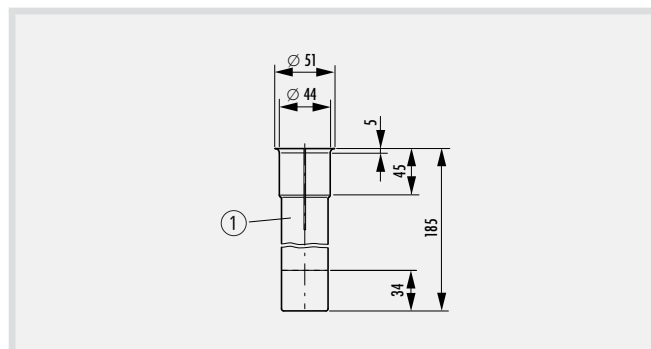
Fuse adapter

The transformer outgoing panels are designed for fuses with the dimension "e" = 442 mm. To be able to install fuses with the dimension "e" = 292 mm also, there is the adapter.



Fuse cartridge with adapter

- ① Fuse cartridge 12 kV "e" = 292 mm
- ② Adapter



Fuse adapter

- ① Adapter

Connections and screw connections

Busbar link with double sealing



Display: 1 Phase

Busbar connection with single sealing



Display: 1 Phase

Part: Panel screw connection



Display: 1 Set

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Protection technology

In the switchgear type GAE630 all commercially available protection relays can be installed for the switchgear LSV as well as for the circuit-breaker panel LSF.

The variation goes from transformer current protection relays to combined protection and control systems.

For transformer current relays low energy triggers 0.5 VA and 0.1 VA are available.

In this attachment special relay-transformer combinations are tested.

Market protocols or interfaces such as Profibus DP, Modbus, IEC 60870-5-103, IEC 60870-5-101 and IEC 61850 can be guaranteed with the corresponding relays.

Installation occurs in the low voltage compartment / relay niche.

Optionally the protection relays can also be installed in the corresponding cover.

As an auxiliary service, a parameter setting of the protection relays according to the requirements of the customer is possible.

Some commercially available protection relays are listed as examples:

Ct-powered release:

- SEG type WIC
- SEG type WIP
- SEG type WIZ
- SEG type WIM
- Siemens type 7SJ45
- Areva type P114S
- Areva type P115

External voltage supply:

- SEG type CSP/CMP
- Siemens type 7SJ46
- Siemens type 7SJ63
- Siemens type 7SJ80
- ABB type REF542plus
- Areva type P122
- Areva type P130

Short-circuit/earth fault indicator

All cable branch panels can optionally be mounted with a three-pole short-circuit or earth fault indicator.

Manufacturer	Type	short-circuit indicator	Short and earth fault indicator	Earth fault indicator
Horstmann	ALPHA M	X		
	ALPHA E	X		
	DELTA M		X	
	DELTA E		X	
	OPTO F 3.0	X		
	OPTO F+E 3.0		X	
	SIGMA	X		
	SIGMA F+E 3		X	
	SIGMA PLUS		X	
	COMPASS A		X	
	COMPASS B		X	
	COMPASS C			X
	EKA 3			X
	EKA 3/1			X
Earth Zero			X	
Kries	IKI-20Bx		X	
	IKI-20a		X	
	IKI-EDI-I2			X

Other types and manufacturers on request.

Medium-voltage switchgear up to 24 kV, SF₆-insulated, extensible, GAE type, GAE630 series

Cable clamps

Cable clamps

Size I

Clamping area 26 to 38 mm for cables, e. g.

- 12 kV: 35 mm² ≤ 240 mm²
- 24 kV: 25 mm² ≤ 185 mm²

Size II

Clamping area 36 to 52 mm for cables, e. g.

- 12 kV: ≥ 300 mm²
- 24 kV: ≥ 240 mm²

The precise cable diameter should be matched to the clamping area.

Quality

To guarantee and verify the quality, Ormazabal has implemented a comprehensive quality management system.

The system conforms to ISO 9001: 2000 and ISO 14001: 1996.

The switch panel or switchgear product test is naturally included in the different tests in accordance with VDE 0670/IEC 62271 as well as the testing of customer-specific devices.

For example:

- Functional tests of the devices,
- Rated short-duration power frequency withstand voltage test 1 min,
- Test of all auxiliary devices such as auxiliary switches, shunt trip release remote control drives, protective devices (relays), measuring tools,
- Functional test of capacitive measuring device,
- Functional test of the short-circuit indicator (if present).



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- SF₆-insulated switchgear
- Air-insulated switchgear
- Air-insulated switching devices