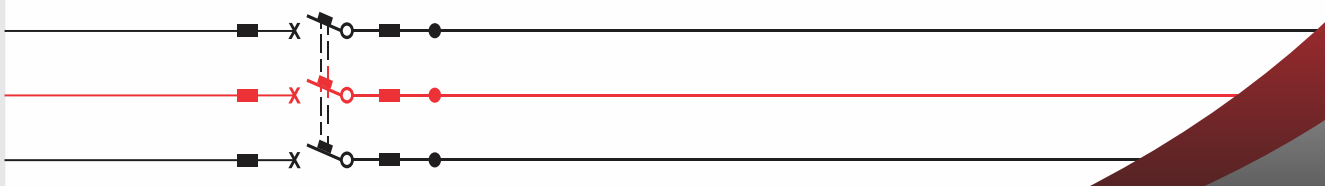
GWS

GREAT WALL SWITCHGEAR

CATALOGUE

2024/5

GAS INSULATED SWITCHGEAR UP TO 36 kV



MV GAS INSULATED SWITCHGEAR

ABOUT US

GWS | GREAT WALL SWITCHGEAR

GWS | GREAT WALL SWITCHGEAR Electric Technology Company Ltd, was founded in 2009, and is located in the Economic Development Zone of Yueqing.

It is a Technology Enterprise, specialising in the field of Medium Voltage Gas Insulated Switchgear. Our Company specialises in manufacturing of 6.6 - 36 kV SF6 fully insulated metal compact switchgear.

In our 10,000 square meters factory, We have fully automatic CNC flexible production line and welding robots, with factory test and diverse test conditions of all products. Our company possesses 2 international patents and 23 utility model patents and is ISO9001 certified.

With a production capacity of 2000 panels per year, over the past decade, We have supplied over 18,000 panels to the Chinese State Grid as well as International Markets.

AUTOMATED ARC WELDING BY:

KUKA

GWS, A VERSATILE SWITCHBOARD

Example of GWS Extensible in industry

GWS is a medium voltage gas insulated switchboard up to 36 kV, 630 A, 20 kA 3s, used in secondary distribution applications. It can be fitted with the following protection devices:

- Transformer protection by fuse (F function)
- Transformer and line protection by vacuum circuit-breaker (V function)

Its compactness, wide range of functions and ease of installation and extensibility, make it a versatile switchboard to fit many secondary distribution applications such as: public distribution, industry, infrastructure or renewables.

ELECTRICALLY INSULATED USING SF6 GAS

GWS | hermetically sealed stainless

The high voltage conductive parts of the GWS switchboard are placed in an insulating inert gas (Sulphur Hexafluoride - SF6) which is neither reactive nor toxic.

The gas is confined in a hermetically sealed stainless steel tank. GWS is insensitive to the outside environment and to any possible aggressions such as:

- Humidity
- Dust
- Pollution
- Dirt
- Harmful rodents.

The use of SF6 as an insulating gas, and the design of GWS, makes it one of the most compact MV switchboards on the market (for instance, a cubicle with 3 functional units is 1 meter wide).

SIMPLE OPERATION AND MAINTENANCE

GWS in the mast of a wind tower, can be installed through a narrow door thanks to its compact size

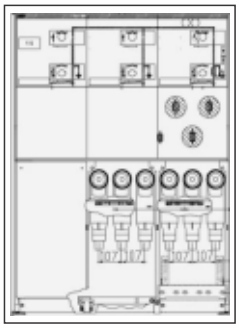
With a service life of 30 years for the main circuit without maintenance, the overall design of the range of GWS switchboards guarantees simple and reliable use:

- Simplified maintenance of the functional units and with continuity of service for the other units (LSC2 class)
- No gas filling is required on site at installation nor during the service life of GWS under normal operating conditions
- Long service life
- Interlocking to ensure the correct sequences of operations
- Can be used in substations with or without walk-in operation corridors
- Voltage presence indicator light

SAFETY AND INNOVATION

GWS has been designed for maximum safety of the operators and equipment in particular in case of internal arcing in the equipment:

- Safety valves at the rear yield and thus avoid gas overpressure
- An exhaust duct cools down and evacuates the gases towards the top (optional) and/or a deflector at the rear channels and cools the hot gases
- Front and lateral protection for the operator



MAIN FUNCTIONAL UNITS:

- **C** Cable incoming or outgoing feeder with switch-disconnector and earthing switch
- **F** Transformer protection with switch-disconnector fuse combination
- **V** Transformer/line protection with vacuum circuit-breaker
- **D** Direct incoming feeder without earthing switch
- **De** Direct incoming feeder with earthing switch
- **S** Bus coupler with switch-disconnector
- **I** Bus coupler with vacuum circuit breaker
- **M** Metering panel

non- extensible version

NON- EXTENSIBLE VERSION

This version can be easily integrated into a minisubstations thanks to its compact size and small footprint. Up to 6 functional units can be assembled in a single tank insulated by SF6 gas.

extensible version

EXTENSIBLE VERSION

The extensible version of GWS is used to enable the extension of a switchboard with additional functional unit.

- GWS: Double extensible version

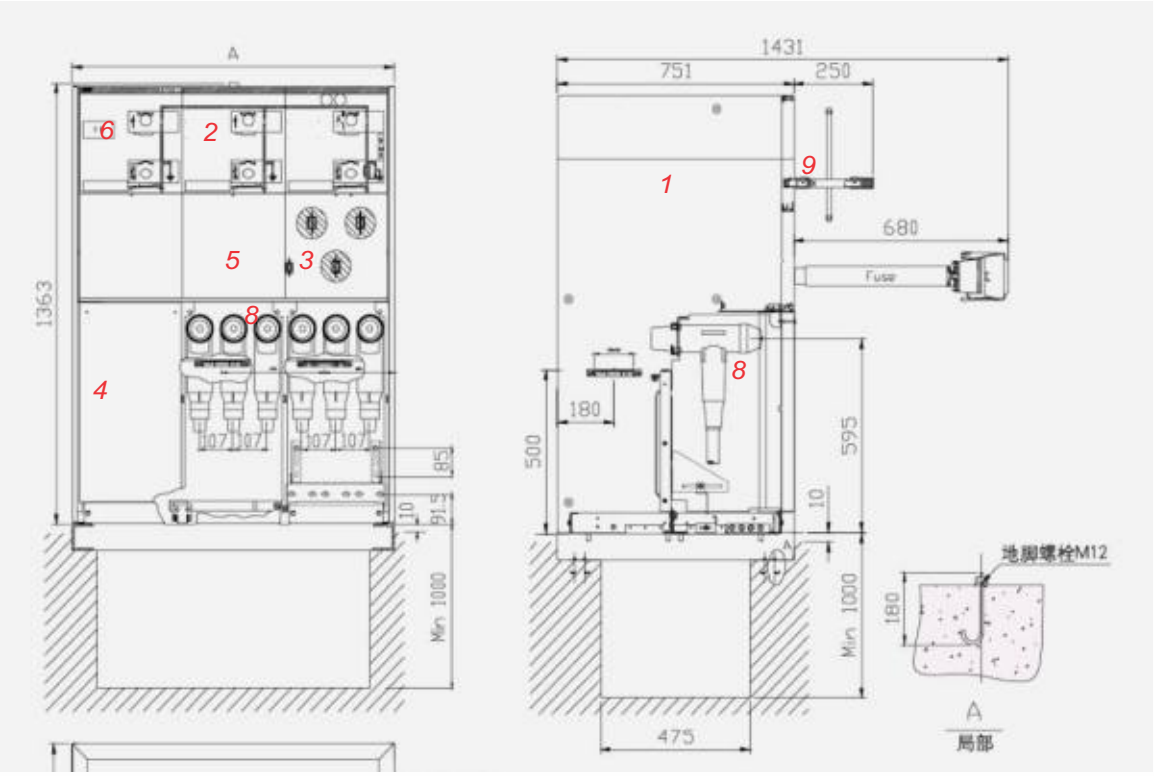
GWS switchboard can be extended on either or both left and right sides.

- GWS: Single extensible version

GWS switchboard can only be extended on one of the sides

These versions offer the following advantages:

- A highly economic solution for secondary distribution applications
- Installation in very limited space locations such as through a narrow opening or hatch is possible
- The additional GWS extensible functional units can be arranged in any order you like
- A subsequent extension is possible through connecting device at the bushing level
- The flexibility and modularity of GWS extensible make GWS an ideal MV switchboard for applications in the industrial sector, or for those liable to change in time such as public distribution network.



1 Hermetically-sealed stainless steel tank filled with gas to insulate the main circuit

2 Operating mechanism compartment and mimic diagram

3 Fuse compartment

4 Cables compartment door

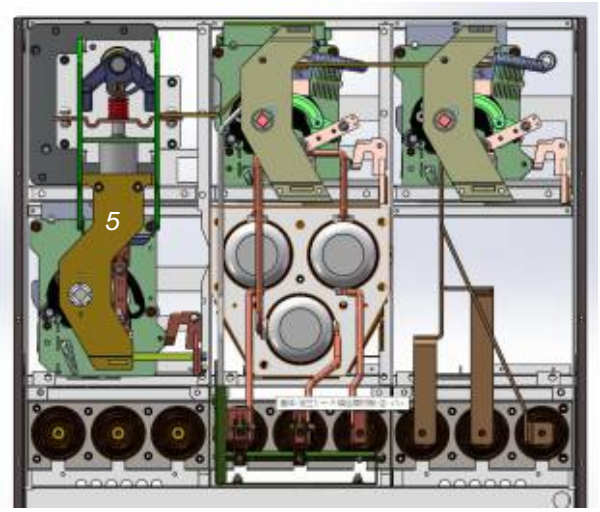
5 Vacuum circuit-breaker

6 Tank pressure manometer

7 Voltage presence detection system and low voltage part

8 Cable plug-in connections

9 3-position switch-disconnector



OPERATING CONDITIONS

- Temperature classification: –5°C indoors (option: –25°C).
- Ambient temperature: from –5°C to +40°C (option: –25°C) (option: up to +55°C for reduced service currents)
- Average value over 24 hours (max.): +35°C
- Typical maximum altitude for installation above sea level is 1,800 m. However, much higher altitudes are possible on request but with limitations when Metering or HV fuse-holders functions are requested.
- Type of insulating gas: sulphur hexafluoride (SF6)
- Rated pressure at +20°C: 0.4 Bar Abs
- Flood proof (option): successfully tested under water for 24 hours at 24 kV 50 Hz.

PROTECTION INDEX (IP)

- Main electrical circuits: IP67
- Fuse compartment: IP65 (option: IP67)
- Operating mechanisms: IP3X
- Cable connection compartment: IP2XC

PARTITION CLASS AND LOSS OF SERVICE CONTINUITY CATEGORY

- Partition Class: PM (1)
- Loss of Service Continuity Category: LSC2B for single functional unit (2)

INTERNAL ARC CLASSIFICATION

GWS is a pressurized sealed-unit system that complies with IEC 62271-1. Its tank is filled with SF6 gas that is used as an insulating and breaking medium. GWS internal arc classification as per IEC 62271-200 is detailed in the table below. In the unlikely event of gas overpressure, the gas is discharged via safety valves away from the operator.

(1) PM class according to IEC 62271-200 edition 2: metallic partitioning between compartments.
(2) Based on IEC62271-200 edition 2, GWS is classified as LSC2B.

The GWS switchboards comply with the standards

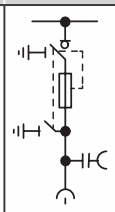
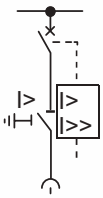
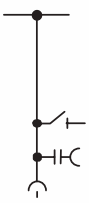
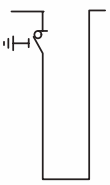
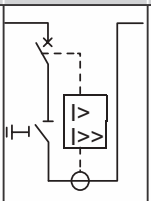
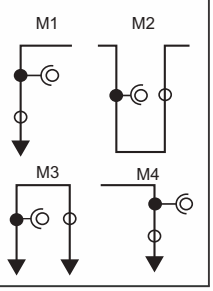
Description	IEC standard	IEC classes
Switchboard	IEC 62271-200 IEC 62271-1	
Behaviour in the event of internal faults	IEC 62271-200	
Earthing switch (in C, F, V, De, I)	IEC 62271-102	E2
Disconnector (in V, I)	IEC 62271-102	M1
General use switch (C)	IEC 62271-103	M1, E3, C2
Switch-disconnector fuse combination (F)	IEC 62271-105	M1, E3 (switch)
Circuit-breaker (in V, I)	IEC 62271-100	M1, M2, E2
Current transformer	IEC 61869-2	
Voltage transformer	IEC 61869-3	
Voltage presence indicators	IEC 62271-206	
Voltage detection systems	IEC 61243-5	
Protection against accidental contact, foreign bodies and ingress of water	IEC 60529	

IAC (internal arc classification):
The metal enclosed switchgear may have different types of accessibility on the various sides of its enclosure.
For identify purpose of different sides of the enclosure, the following code shall be used (according to IEC 62271-200 standard).
A: restricted access to authorized personnel only
F: access to the front side
L: access to the lateral side
R: access to the rear side.

LSC2A(Loss of service continuity):
this category defines the possibility to keep other compartments energized when opening a maincircuit compartment.

LSC2B:switchgear and controlgear of category LSC2 where the cable compartment is also intended to remain energized when any other accessible compartment of the corresponding functional unit is open.

MAIN FUNCTIONAL UNITS

Names	C	F	V	D	De	S	I	M
Functions	Cable incoming or outgoing feeder with switch-disconnector	Transformer protection with switch-disconnector fuse combination	Transformer/ line protection with vacuum circuit breaker	Direct incoming feeder without earthing switch	Direct incoming feeder with earthing switch	Busbar switch-disconnector	Busbar protection with vacuum circuit-breaker	Metering
SINGLE LINE DIAGRAMS								

C function
- The interrupting mechanisms are located in the sealed-for-life tank filled with gas
- The three-position switch is equipped with a spring-loaded closing mechanism for the switch-disconnector function and the earthing switch function

F function
- To make the replacement of HV fuses secure, earthing switches are placed both upstream and downstream from the fuses
- Both earthing switches are connected mechanically and are activated with a single operating mechanism
- The switch-disconnector is equipped with a spring-loaded mechanism for the closing operations and a stored energy mechanism for breaking operations which is mechanically pre-loaded
- When the striker pin trips on the blowing of one of the HV fuses, the switch disconnector is opened mechanically on all three phases
- An indicator on the front panel of the GWS visually signals the interruption due to a fuse blowing
- A push button for tripping the opening of the switch is available as an option.
- An opening by tripping coil is also possible
- The earthing function is operated with a separate spring mechanism

D function
- This function allows for the direct connection of a cable incoming feeder to the busbar of the GWS switchboard

De function
- This function, which is equipped with an earthing switch, allows for the direct earthing

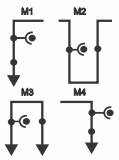
S function
- This function is used for the opening and disconnection of the busbar to separate the end-user from the energy provider

V function
- The CB function includes a vacuum circuit-breaker and a three-position disconnector switch
- Fast auto-reclosing operating cycle: O - 0.3 s - CO - 180 s - CO
- The earthing switch with making capacity is activated by a spring-loaded mechanism
- The vacuum circuit-breaker is equipped with a double-latch energy accumulation spring-loaded mechanism and can be pre-loaded manually or electrically for a complete OCO cycle
- An integrated protection relay is linked to the circuit-breaker
  - One of the following two autonomous relays can be integrated behind the front over with the current transformers fitted on cable plug-in connections: DPX-1 and WIC
  - Other non-autonomous relays can be used by fitting a low voltage cabinet with the current transformers fitted either to the withdrawable terminals or onto the outgoing feeder cables
- In option: metering with current transformers fitted to the cables in the cubicle's compartment
- When connected to an overhead line network, the CB function can protect from temporary line faults. It can also provide private network protection

I function
- The I function is used to protect the switchgear busbar (on the left or righthand side). Example of use: medium voltage metering switchboard
- This function uses the same vacuum circuit breaker and mechanism as the CB function

M function

GWS provides metering functional panel with conventional CTs and VTs, whose position can be switched between each other, it is a factory assembled, tested, air insulated and available in 4 versions:
- M1: M on left side of switchboard, top busbar connection, bottom cable in
- M2: Top busbar in/out
- M3: Bottom cable in/out
- M4: M on right side of switchboard, top busbar connection, bottom cable in



AVAILABLE CONFIGURATION

RANGE OF FUNCTION

Dimensions and weights of the GWS non-extensible

Function	Number of functional units	Height (mm)	Depth (mm)	Width (mm)	Approximative weight (kg)	
					1502 mm	1200 mm
CC	2	1502 / 1200	800	708	200	190
CF		1502 / 1200			200	190
CV		1502 / 1200			240	230
DeF		1502 / 1200			210	200
DeV		1502 / 1200			240	230
CCC	3	1502 / 1200	800	1048	320	305
CCF		1502 / 1200			330	315
CCV		1502 / 1200			360	345
CDeF		1502 / 1200			320	305
CDeV		1502 / 1200			360	345
DDeF		1502 / 1200			320	305
DDeV		1502 / 1200			350	335
CCCC	4	1502 / 1200	800	1388	440	420
CCCF		1502 / 1200			450	430
CCCV		1502 / 1200			480	460
CFCF		1502 / 1200			470	450
CVCV		1502 / 1200			530	510
CCCCC	5	1502 / 1200	800	1728	550	530
CCCCF		1502 / 1200			550	530
CCFCF		1502 / 1200			550	530
CFCFF		1502 / 1200		1728	570	550

Dimensions and weights of the GWS extensible

Function	Number of functional units	Height (mm)	Depth (mm)	Width[(1) (2)] (mm)	Approximative weight (kg)	
					1502 mm	1200 mm
C	1	1502 / 1200	800	368	135	130
D		1502 / 1200			125	120
De		1502 / 1200			135	130
F		1502 / 1200		368	160	155
V		1502 / 1200			190	185
I		1502 / 1200		500	250	245
S		1502 / 1200		500	200	195
M		1502 / 1200		750 / 900	(3)	(3)
CC	2	1502 / 1200	800	708	210	200
CF		1502 / 1200			210	200
CV		1502 / 1200			240	230
FF		1502 / 1200		708	310	300
VV		1502 / 1200			370	360
DeF		1502 / 1200		708	220	210
DeV		1502 / 1200			250	240
CCC	3	1502 / 1200	800	1048	330	315
CCF		1502 / 1200			340	325
CCV		1502 / 1200			370	355
CDeF		1502 / 1200			330	315
CDeV		1502 / 1200			360	345
DDeF		1502 / 1200			330	315
DDeV		1502 / 1200			360	345
CCCC	4	1502 / 1200	800	1388	450	430
CCCF		1502 / 1200			460	440
CCCV		1502 / 1200			490	470
CFCF		1502 / 1200			480	460
CVCV		1502 / 1200			540	520

(1) Add 14 mm for the busbar protective covers (right or left) at the extremity of the switchboard.
(2) It is impacted by CT and VT.

INTERLOCKING OF THE FUNCTIONAL UNITS

During the development of GWS switchboard, the accent was placed on personnel safety and the reliability of the operation.
An interlocking system prevents any incorrect use.
Thus, the operating levers can only be inserted if the service status permits it.
Access to the cables compartment and to the fuses is only possible if the appropriate outgoing feeder is connected to earth.
The switchboards are equipped in production series with the following interlocks：

Functional unit with switch-disconnector and earthing switch, switch-disconnector fuse combination (C, F and S functions)

Interrupting mechanism	Position	Interlock status… Switch-disconnector	Earthing switch	Cables compartment panel or fuses
Switch-disconnector	Closed	–	Locked	Locked
	Open	–	Unlocked	Locked, if earthing switch is open
Earthing switch (ES)	Closed	Locked	–	Unlocked
	Open	Unlocked	–	Locked
Cable or fuses compartment panel (S function not concerned)	Removed	Locked	Locked	–
	Fitted	■ Unlocked, if earthing switch is open ■ Locked, if earthing switch is closed	Unlocked	–

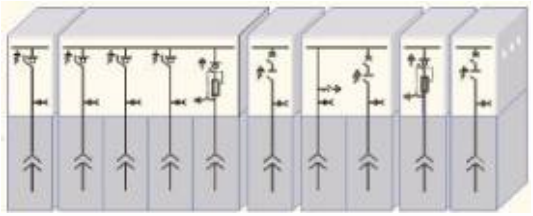
Option: switch-disconnector – locking of the cables compartment panel, for example, for the cable tests.

Functional unit with vacuum circuit-breaker, disconnector and earthing switch (V, and I function)

Interrupting mechanism	Position	Interlock status… Disconnector		Earthing switch		Circuit-breaker		Cable compartment panel (not I)
		Open	Closed	Open	Closed	Open	Closed	
Disconnector (Disc.)	Open	–	–	Unlocked	Unlocked	Unlocked	Unlocked	–
	Closed	–	–	Locked	–	Unlocked	Unlocked	–
Earthing switch (ES)	Open	Unlocked	Unlocked	–	–	Unlocked	Unlocked	Locked
	Closed	Locked	–	–	–	Unlocked	Unlocked	Unlocked
Circuit-breaker	Open	■ Unlocked if ES open ■ Locked if ES closed	Unlocked	■ Unlocked if DISC open ■ Locked if DISC closed	Unlocked	–	–	–
	Closed	Locked	Locked	■ Unlocked if DISC open ■ Locked if DISC closed	Unlocked	–	–	–

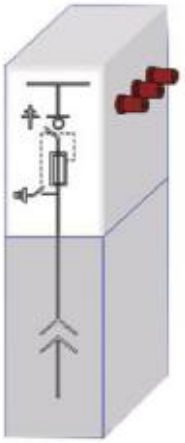
EXTENSIBILITY

EXTENSIBILITY OF GWS



- GWS offers extensible configurations for secondary distribution applications.
- The connection of each functional unit allows for multiple combinations depending on the installation requirements
- GWS extensible permits the connection of additional units on the left or right-hand side, thereby offering greater flexibility in the choice and positioning of the medium voltage switchboard functions
- The installation and in-line connection of GWS extensible does not require any handling of gas
- Maximum current: 630 A

ERECTION AND ASSEMBLY



The extension is a very simple process thanks to:

- The extension device used to connect the busbars of two cubicles.Variations in positioning are compensated by fixed, spherical contacts and mobile couplings that can be adjusted axially and radially
- Highly secure dielectric seals made with silicone insulating conical connectors adapted to the electrical voltage

The assembly of the insulating connectors is maintained by a mechanical force generated by:

- Integrated guiding pins for the correct alignment of the cubicles
- An assembly by bolts secured by mechanical stops

During the assembly of an extension cubicle, an additional space of at least 450 mm is necessary to allow for handling

CABLE COMPARTMENT

The cables connection compartment has been designed to accept connection systems that are:

- Completely insulated
- In metallic housing
- Partially insulated

Cable support mountings are adjustable horizontally and vertically to enable installation of various cable systems. The cable mountings are equipped with either round or long holes for standard cable terminals.
Additional support structures can be supplied (available only in the 1,432 mm height version) for the installation of two cables per phase cable plug-in connections or surge arresters.

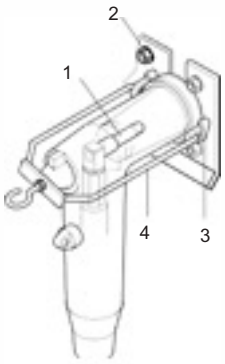
GWS switchboard is equipped with plug-in bushings:

C / F / V : plug-in bushing
NF EN 50181, with C type connection (Ir: 630 A; Ø M16 mm)

Bushing connector cones in accordance with NF-EN-50181

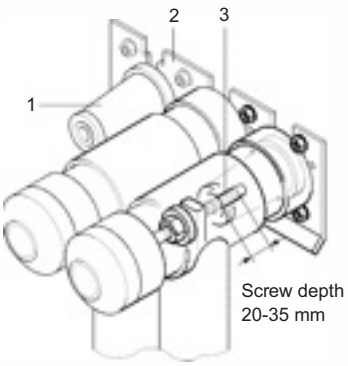
Switchboard function	D / De	C	F	V
Connector cone Type A (250 A)	–	–	■	–
Connector cone Type C (630 A)	■	■	□	■

Type A (250 A)



1 - Sliding contact pin
2 - Support plate
3 - Mounting flange
4 - Mounting device

Type C (630 A)

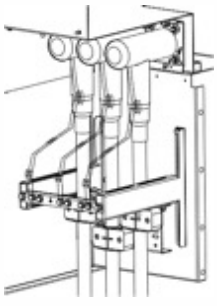


1 - Cross member - Male
2 - Support plate
3 - Screw contact

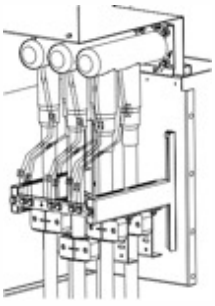
TYPE OF CONNECTION

GWS cable compartment is spacious and allows for various connections (cf. § Selection of cables):

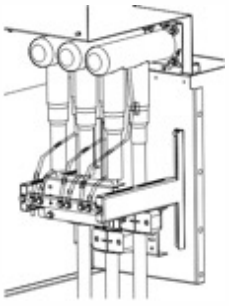
- Single cable per phase
- Two cables per phase
- Single cable per phase + surge arresters
- A triple cable per phase connection is also available (please consult us)
- No cable - bushing protected by insulating plug



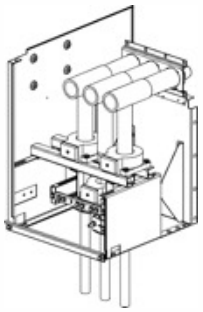
Single cable per phase connection



Two cables per phase (only available in the GWS 1,432 mm height version)



Cables & surge arresters (only available in the GWS 1,432 mm height version)



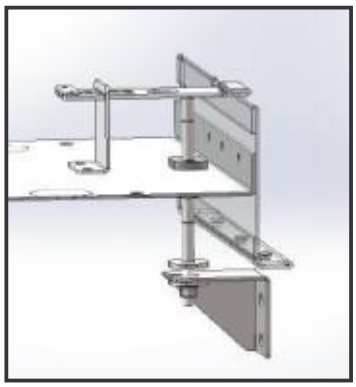
CB cable compartment with metering CT cores

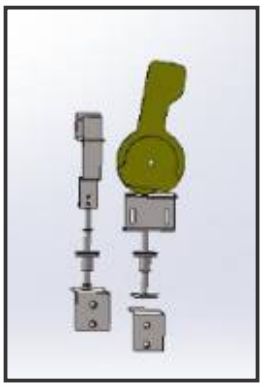
TOOL-FREE CABLE TESTING FACILITY

GWS provides optional integral cable testing facility which is independent of the cable boxes and accessible from the front of switchboard.
For operator safety, the cable testing procedures shall be carried out at the front and inside of the cable testing facility covers.

MECHANICAL INTERLOCK

For safety issue, mechanical interlock is used between earthing switch and the tool-free cable testing facility.
The metal covers for earthing bars are independently interlocked with the earth switch of the switching device that the cable test is being performed on. Once those metal covers have been opened, it's then possible to remove the earth bars to test cables.





FUSE COMPARTMENT

FUSE COMPARTMENT

The fuses are located within plugged and insulated fuse-holders. These fuse holders are integrated into the gas tank and offer the following advantages:

- The electrical field is placed in the SF6 gas
- The fuse-holder plugs are placed outside the electrical field which is contained in the tank filled with SF6 gas
- The fuse-holder is located in the tank and cannot be affected by outside elements
- The dielectric strength of the plug is thus not ensured by the compression of a seal but by an insulating distance.

Available option: watertight plugs.

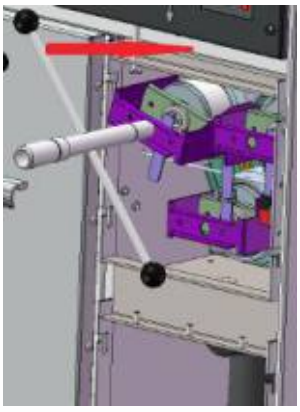
FUSE TRIPPING

The stored energy mechanism and the tripping striker open all three phases thanks to the switch-disconnector. If the striker on a single HV fuse is actuated, all three phases are disconnected.

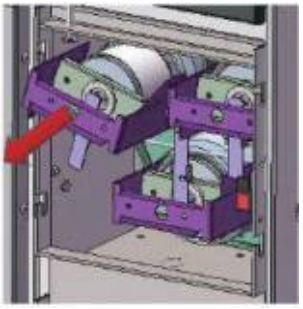
FUSE REPLACEMENT

The interlocking guarantees maximum safety for the personnel during the replacement of fuses. The fuse compartment panel can only be opened if it has been earthed correctly. Inversely, the earthing can only be removed once the fuse compartment panel is closed and locked.

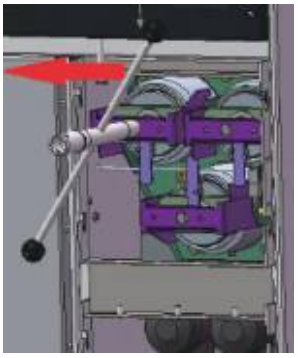
Two earthing switches with making capacity (both upstream and downstream from the fuses) allow the fuses to be replaced without using auxiliary equipment. The two earthing switches with making capacity are operated by a common spring loaded mechanism.



Openthe fuse canisters



Removal of the fuse



Close thefuse canisters

C. S. D. De FUNCTIONS

Characteristics of the C, S, D, De functions (switch-disconnector)								
Rated voltage		**kV**	**12**			**24**		
Rated frequency		Hz	50/60			50/60		
Rated lightning impulse withstand voltage								
Directly earthed		kV	95			125		
On the sectionalized distance		kV	110			145		
Rated power frequency withstand voltage								
On the sectionalized distance		kV	32			60		
Level of insulation for the SF6 pressure - Pre = 0.00 MPa								
Rated power frequency withstand voltage		kV	28			50		
Level of insulation of the sectionalized distance for the cable test								
Maximum AC feeder test voltage (30 min)		kV 0.1 Hz	18			35		
Rated current								
Busbar, S function		A	630			630		
Outgoing feeder		A	630			630		
Rated peak current		kA	40	50	63	40	50	
Rated short-circuit making capacity		kA	40	50	63	40	50	
Rated short-time current, main electrical circuit	1 s	kA	16	20	25	16	20	
	3 s	kA	16	20	–	16	20	
Rated short-time current of earthing circuit	1 s	kA	16	20	25	16	20	
	3 s	kA	16	20	–	16	20	
Rated network load and closed-loop breaking current		A	630			630		
Rated no-load cable-breaking current	C2	A	110A			110A		
Rated breaking current under earth fault conditions		A	30			30		
Rated no-load cable breaking current under earth fault conditions		A	17.3			17.3		
Number of operating cycles without inspection								
Mechanical: Load switch/ Earthing switch		M2/M1	5000/2000			5000/2000		
Electrical: Rated current		E3	100			100		
Short-circuit making Switch-disconnector		E3	5			5		
Earthing switch		E2	2			2		
Internal Arc Classification (IAC)								
		AFLR	20kA/1s					

(1) General use switch. The characteristics of the switch-disconnector are not applicable to the D and De functions.

F. FUNCTIONS

Characteristics of the F function (switch-disconnector fuse combination)								
Rated voltage		**kV**	**12**				**24**	
Rated frequency		Hz	50/60				50/60	
Rated peak current, main circuit (prospective current, limited by fuses)		**A**	**40**	**50**	**50**	**63**	**40**	**50**
Rated short-time current, downstream of fuse protection circuit	1 s	kA	1	1	5	5	1	5
Rated peak current, downstream of fuse protection circuit	3 s	kA	–	–	3	3	–	3
Rated short-circuit making current, downstream of fuse		kA	2.5	2.5	13	13	2.5	13
protection circuit		kA	2.5	2.5	13	13	2.5	13
Rated short-time current of earthing circuit	1 s	kA	16	20	20	25	16	20
	3 s	kA	16	20	20	–	16	20
Rated no-load cable-breaking current		A	60				60	
Rated breaking current under earth fault conditions		A	200				200	
Rated no-load cable breaking current under earth fault conditions		A	87				87	
Rated transfer current in accordance with IEC 62271-105		A	1500				1400	
Opening time in the case of fuse striker tripping T0	ms		34				34	
Number of operating cycles without inspection								
Mechanical: Load switch/ Earthing switch		M2/M1	5000/2000				5000/2000	
Electrical: Rated current		E2 (1)	10				10	
Short-circuit making Load switch		E3	5				5	
Earthing switch		E2	2				2	
Internal Arc Classification (IAC)								
AFLR			20kA/1s					

(1) E3 (100 x rated current) on request.

Characteristics

Characteristics of the V function (vacuum circuit-breaker)									
Rated voltage			**kV**		**12**			**24**	
Rated frequency			Hz		50/60			50/60	
Rated lightning impulse withstand voltage									
Directly earthed			kV		95			125	
On the sectionalized distance			kV		110			145	
Rated power frequency withstand voltage									
On the sectionalized distance			kV		32			60	
Level of insulation for the SF6 pressure - Pre = 0.00 MPa									
Rated power frequency withstand voltage			kV		28			50	
Level of insulation of the sectionalized distance for the cable test									
Maximum AC feeder test voltage (30 min)			kV	0.1 Hz	18			35	
Rated current									
Outgoing feeder			A		400 / 630			400 / 630	
Rated peak current			kA		42	52	65	42	52
Rated short-circuit making capacity			kA		42	52	65	42	52
Rated short-time current, main electrical circuit		1 s	kA		16	20	25	16	20
		3 s	kA		16	20	20	16	20
Rated short-time current of earthing circuit		1 s	kA		16	20	25	16	20
		3 s	kA		16	20	20	16	20
Rated short-circuit breaking current			kA		16	20	20	16	20
Percentage of the direct current component			%		20			20	
Rated operating sequence(1)					O -0.3s - CO - 180s - CO				
Rated no-load cable-breaking current			A		25			31.5	
Rated operating time									
Opening with tripping release			ms		18 to 60			18 to 60	
Breaking with tripping release			ms		18 to 50			18 to 50	
Arcing			ms		< 15			< 15	
Closing			ms		30			30	
Number of operating cycles without inspection									
Mechanical:	Vacuum circuit-breaker		M2		10000			10000	
	Disconnector/ Earthing switch		M1		2000			2000	
Electrical:	Short-circuit making	Disconnector	E2		5			5	
		Earthing switch	E2		5			5	
	Vacuum circuit-breaker		At E2 rated current		2000			2000	
		At rated short circuit breaking current			50			50	
Internal Arc Classification (IAC)									
AFL					20kA/1s				

(1) Spring-loaded current making and breaking mechanism with stored energy and motor.
(2) For the first cable test on a new unit. Later tests can be carried out at 67 kV.

L. FUNCTIONS

Characteristics of the I functions (bus coupler with vacuum circuit-breaker)									
Rated voltage			**kV**			**12**			**24**	
Rated frequency			Hz			50/60			50/60	
Rated lightning impulse withstand voltage										
Directly earthed			kV			95			125	
On the sectionalized distance			kV			110			145	
Rated power frequency withstand voltage										
On the sectionalized distance			kV			32			60	
Level of insulation for the SF6 pressure - Pre = 0.00 MPa										
Rated power frequency withstand voltage			kV			28			50	
Level of insulation of the sectionalized distance for the cable test										
Maximum AC feeder test voltage (30 min)			kV	0.1 Hz		18			35	
Rated current for continual service										
Busbar, I function			A			630			630	
Circuit-breaker			A			630			630	
Rated peak current			kA		40	50	63	40	50	
Rated short-circuit making capacity			kA		40	50	63	40	50	
Rated short-time current, main electrical circuit		1 s	kA		16	20	25	16	20	
		3 s	kA		16	20	–	16	20	
Rated short-time current of earthing circuit		1 s	kA		16	20	25	16	20	
		3 s	kA		16	20	–	16	20	
Rated short-circuit breaking current			kA		16	20	25	16	20	
Percentage of the direct current component			%		52			52		
Rated operating sequence(1)					O - 0.3s - CO - 180s - CO					
Rated no-load cable-breaking current			A		25			31.5		
Rated operating time										
Opening with tripping release			ms		18 to 60			18 to 60		
Breaking with tripping release			ms		18 to 50			18 to 50		
Arcing			ms		< 15			< 15		
Closing			ms		30			30		
Number of operating cycles without inspection										
Mechanical: Vacuum circuit-breaker			M2		10000			10000		
Disconnector/ Earthing switch			M1		2000			2000		
Electrical: Short-circuit making	Disconnector		E2		5			5		
	Earthing switch		E2		5			5		
Vacuum circuit-breaker			At rated current		2000			2000		
	At rated short circuit breaking current				50			50		
Internal Arc Classification (IAC)										
AFL					20kA/1s					

(1) Spring-loaded current making and breaking mechanism with stored energy and motor.
(2) For the first cable test on a new unit. Later tests can be carried out at 67 kV.

M. FUNCTIONS

Characteristics of the M1, M2, M3, M4 functions								
Rated voltage		**kV**		**12**			**24**	
Rated frequency		Hz		50/60			50/60	
Rated lightning impulse withstand voltage								
Directly earthed		kV		95			125	
On the sectionalized distance		kV		110			145	
Rated power frequency withstand voltage								
On the sectionalized distance		kV		32			60	
Rated current								
Outgoing feeder		A		400 / 630			400 / 630	
Rated peak current		kA		42	52	65	42	52
Rated short-time current, main electrical circuit	1 s	kA		16	20	25	16	20
	3 s	kA		16	20	20	16	20
Rated short-time current of earthing circuit	1 s	kA		16	20	25	16	20
	3 s	kA		16	20	20	16	20
Internal Arc Classification (IAC)								
AFL				20kA/1s				

MECHANISM OPERATING PRINCIPLES

Spring mechanism (C function)

It is a tumbler mechanism with a dead point passage. The energy is stored by tumbler mechanism.
- Manual: the opening or closing operation is manual and independent of the operator. The operation is performedwithout any duration or time constraint
- Motorized: the opening or closing operations are performed by a motor without duration or time constraint

Spring with energy storage (F function)

It is a tumbler mechanism for closing, with a latch-in feature for opening. The energy needed for opening is stored while closing.
- **Manual:** the operator manually closes the switch-disconnector in one single operation, and in the same time loads a spring for next opening. The mechanism is thus ready for a snap opening operation. Tripping can be performed with a coil, a fuse striker or a push-button
- **Motorized:** the closing operation is performed by a motor. The opening operating can be done with the motor or with a shutter release

Spring mechanism for DS/ES

It is a tumbler mechanism for closing operation.
The opening is manual and dependent of the operator, a spring is loaded and stores energy for next closing.
The closing is independent of the operator, the energy is released from the spring and closes the earthing switch in a snap operation.

Circuit-breaker mechanism (V function)

These operating mechanisms use the energy stored by springs to close and open the circuit-breaker on the V and I functions. There are two types:
- **Manual:** the operator manually operates to load the control mechanism's spring. The spring is held in place by a latch, freed manually by a mechanical button, causing:
  - the release of the spring
  - the closing of the CB
  - the arming of the trip spring, now held in place by a latch

It is thus possible to open the circuit-breaker by freeing the trip spring latch manually (mechanical button)
- or electrically (electro-magnet)

Note: with the circuit-breaker closed, it is possible to rearm the closing spring, which authorizes a rapid re-closure cycle
- **Motorized:** the closing spring is armed by a motor (arming time < 7 s). Opening and closure operations are carried out electrically (magnets)

Note: It is possible to manually arm, close and trip the circuit-breakers

Functions								
TYPE OF OPERATING MECHAN ISM		C	F	V	D	De	I	S
Switch-disconnector	Spring mechanism	■	–	■	–	–	■	■
	Spring with energy storage	□	■	–	–	–	–	□
Earthing switch	Spring mechanism for DS/ES		■	■	–	■	■	■
Circuit-breaker	Spring with energy storage	–	–	■	–	–	–	–
	Circuit - breaker mechanism	–	–	–	–	–	■	–
EQUIPMENT		C	F	V	D	De	I	S
Manual opening and closing		■	■	■	–	■	■	■
Mechanical position indicator		■	■	■	–	■	■	■
Motorization		□	□	□	–	–	□	□
Trip coil		□	□	□	–	–	■	–
2nd trip coil		–	–	□	–	–	□	–
Autonomous tripping device without any auxiliary source (striker)		–	–	–	–	–	□	–
Undervoltage tripping coil		–	–	□ (1)	–	–	□	–
Closing coil		–	–	–	–	–	□	–
Operating counter		–	–	□	–	–	■	–
AUXILIARY CONTACTS		C	F	V	D	De	I	S
Switch-disconnector position	Manual: 2 NO + 2 NC Motorized: 2 NO + 2 NC	□	□	□	–	–	□	□
Earthing switch position	1 NO and 1 NF Motorized: 2 NO + 2 NC	□	□	□	–	□	□	□
Fuse blown indicators	2 O/C inverters	–	□	–	–	–	–	–

Legend: ■ Standard □ Option

(1) The connection and wiring diagrams for the motorized mechanism, the magnetic tripping devices and auxiliary contacts are supplied in the event of an order.

Characteristics

ELECTRICAL CHARACTERISTICS

ELECTRICAL CHARACTERISTICS OF THE C, F, DS/ES OPERATING MECHANISMS										
Reference standards		IEC								
Type of current		DC						AC		
Rated supply voltage	**V**	24	30	48	110	125	220	100/110	120/125	230
Frequency	Hz							50/60		
REARMING MOTOR										
Voltage range	% of Un	85 to 110						85 to 110		
Max. absorbed power		120 W						120 VA		
Starting current	A	12.1	4.7		4.1	2.5		6.9	6.8	3.7
earm time	s	< 6								
TRIP COIL										
Coil current	A	3	1		1	0.5		1	0.9	0.5
Undervoltage trip coil	**V**	24/60						230		
AUXILIARY CONTACTS										
Rated voltage	**V**	24	30	48	110	125	220	100/110	120/125	230
Rated current	A	10						10		
Short circuit current, 30 ms	A	100						100		
Breaking capacity (L/R ≤ 20 ms)	A	4	2		1	0.5				
Breaking capacity (U ≤ 230 Vac (resistive)	A							10		

ELECTRICAL CHARACTERISTICS OF THE CB OPERATING MECHANISMS				
Reference standards			IEC	
Type of current			DC	AC
Rated supply voltage		**V**	24 - 30 - 48 - 110 - 125 - 220	120 - 230
Frequency		Hz	–	50/60
REARMING MOTOR				
	Voltage range	% of Un	85 to 110	85 to 110
	Rearm time	s	< 6.5	< 6.5
TRIPPING DEVICE				
Tripping coil				
	Voltage range	% of Un	70 to 110	85 to 110
Undervoltage coil				
	Closing voltage range	% of Un	> 35	> 35
	Tripping voltage	% of Un	70 to 35	70 to 35
Autonomous tripping device without any auxiliary source (striker)				
			The low energy release type MITOP, trips at 200 µF / 12 V Trip energy ≤18 mJ	
Closing device				
	Voltage range	% of Un	85 to 110	85 to 110
AUXILIARY CONTACTS				
ated current		A	10	10
Breaking capacity 110 Vdc (L/R = 10 ms)		A	1	–
Breaking capacity 230 Vac Cos φ = 0.4		A	–	10
( ) Please consult us for current value				

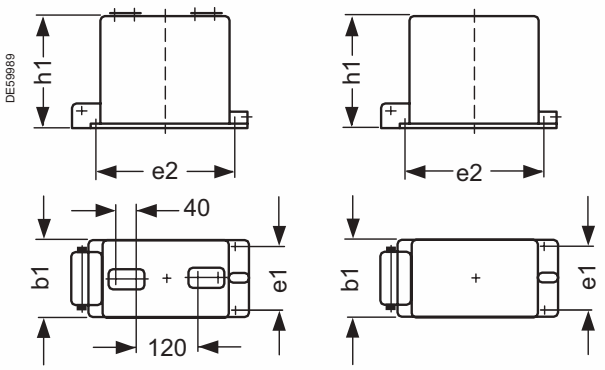
Characteristics of the current and voltage transformers

Current and voltage transformers in compliance with the DIN 42600 standard (narrow version) must be used in metering cubicles.

Remarks:

- Installation of current and voltage metering devices is possible with or without a selector switch
- Option: a voltage indicator can be added
- Pre-assembled cable connections can be purchased as an option.

Dimensions	Um (kV) 12 kV version	24 kV version
b1	148	178
e1	125	150
e2	270	280
h1	220	280



Current transformer (C)
(DIN 42600, Section 8)

Single phase voltage transformer (V)
(DIN 42600, Section 9)

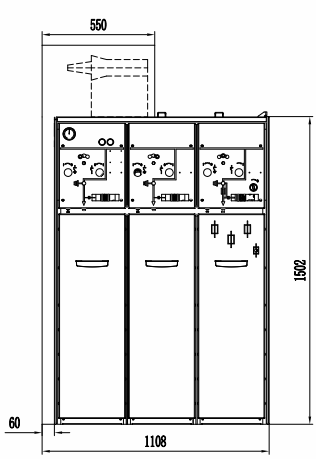
TOP VT SOLUTION

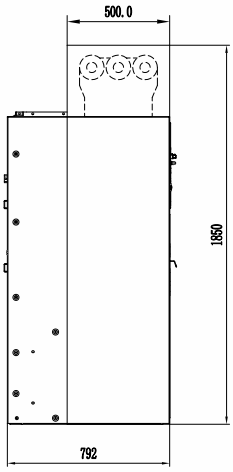
Ritz VT：MGZ12RSS

GWS provides integrated VT solution, which includes:

- A Ritz block VT (12/24 kV)
- Plug for VT (BBCA)
- Cable channel for connection
- VT box at panel top

For its dimension please see following drawings:





PROTECTION RELAYS

Overall Operation

The digital multi-functional protection relay is equipped with a high-performance microprocessor. This provides fully numerical processing of all functions in the device, from the acquisition of the measured values up to the output of commands to the circuit breakers.

Application Scope

Microcomputer Comprehensive Protection and Monitoring Device is a versatile devices designed for protection, control and monitoring of bus-bar feeders. For line protection, the device can be used in networks with grounded, low resistance grounded, isolated or compensated neutral point. It is suited for radial systems with single end infeed, for open or closed ring systems and for networks that are radial or looped, and for lines with double-end infeed. The device is equipped with motor protection for asynchronous machines of all sizes.
The device includes the functions that are necessary to protect and monitor circuit breaker positions and control the switchgear elements in single or double bus-bars providing universally applicable protection schemes. The devices also provide excellent backup facilities of differential protective schemes of lines, transformers, generators, motors, and bus-bars of all voltage levels.

Functions Overview

The relay features protective functions and additional functions. The hardware and firmware is tailored to these functions. Moreover, the command functions can be adjusted to the system conditions. The user can also enable or disable individual functions during configuration or modify how the functions interact.

- Protective Functions
- Control Functions
- Messages and Measured Values; Recording of Event and Fault Data
- Communication

Intellectual self-power relay

The intellectual protect device adopts high integrating micro processor with bus in the chip to process the signals from the current transformers, and then output the signals through digital logical operation control device. The device is with compact structure, airproof chassis, maintenance free design, sound anti-interference performance, and it specially suits for ring network system running in worse environment and with limited installation position.

- Low power consumption design technology is adopted for the whole machine, to ensure the protection functions can start quickly and is reliably at any condition.
- The structure of the device is simple and smart, easy and flexible to install, suiting for the compact installation conditions of ring network system.
- Power self-supply function (powered by current transformer) is available, which can avoid extra cost caused by installation of DC screen or UPS.
- Protection configuration is flexible and complete, and all protection functions can be switched on and off freely through control figures.
- Many kinds of IEC standard inverse time curves are available. The device has high current latch-up protection function and can be used together with various fuse protector, solving the problems commonly seen in power distribution system.
- LED display interface and multi-layer menu display is adopted, with sound human-machine interface.
- The large capacity nonvolatility memorizer of the device can record at least 200 times of historical events with complete content, and no data will lose even the power is off.
- The device has complete dynamic and static self-inspection function to in-service monitor the working conditions of various parts of the device, ensuring the reliability of the device.
- High precision components and working flows ensure the precision, reliability and longer service life of the device.
- The device provides RS-232 communication bus interface (back side terminal RS-485 communication bus interface is selectable) and provides open communication protocols to clients, so as to realize SCADA function.

Protection relay:
STROM, ST260E

Protection relay:
Kries, IKI-35

FAULT PASSAGE INDICATORS

Fault passage indicator

Fault passage indicators

To improve your power availability and manage your network load, GWS can be fitted with a variety of fault passage indicators integrated in GWS Low Voltage front panel.

Main characteristics of fault passage indicators:

It provides a high visibility flashing led and gives detailed information via the digital display. An outdoor lamp on option can give the fault passage indication without entering the substation.

Overcurrent detection

- Automatic mode for automatic adjustment-free calibration of detection thresholds
- Manual mode possible to perform special override settings
- Fault acknowledged time

Earth fault detection

Principle: the detector checks on the 3 phases the current variations (di/dt).
A time delay of 70 s is applied for fault confirmation by the upstream protective device.

- Automatic mode for automatic, adjustment-free calibration of detection thresholds
- Manual mode possible to perform special override settings
- Inrush function: to prevent unwanted detection in the event of load switch-on Incorporates a 3 s time delay for fault filtering at network power up

Fault indication

- Signalling

  As soon as a fault is confirmed, the indication device is activated.

- Fault indication via a red LED on the front panel
- Indication of the faulty phase (earth fault) on LCD display
- Optional remoting of indication to external flashing lamp
- Activation of a contact for retransmission to the SCADA system
- Indication reset
- Automatic reset upon load current recovery
- Manual reset via front panel button
- Reset via external Reset input
- Reset by time delay:
- Communication
- It provides Modbus communication whilst also acting as a Voltage Detector

Fault indicator: Kries, IKI-20

To accompany the rise of distributed power generation on distribution networks, GWS can be equipped with directional fault indicators.

VOLTAGE INDICATOR & RELAY

VDS. VPIS. IVIS. Vd23. LPVT

Voltage detection systems

The absence, or presence, of voltage at outgoing feeders level can be checked using 3 types of device:

- VDS-HR
- VDS-LR
- VPIS

Voltage indicators and any connectors for warning lights can be found to the top of the TGS front panel.

VDSHR and its removable luminous indicator

VPIS : voltage presence indicating system

Description:

- The VPIS is a self-powered voltage presence indicating system, in compliance with the IEC 62271-206 standard
- Connectors on the front panel allow the use of a phase comparator
- Extended lifetime of LEDs on the front panel
- Compatibility with existing MV network devices for replacement. VPIS-V0
- VPIS can be fitted with a voltage output cable to interface with passage indicator range or VD23 voltage detection relay, and in particular for power source changeover.

VPIS,Voltage Presence Indicating System

IVIS : voltage detection system

TGS can be fitted with the VDS-LR IVIS device:

- The integrated IVIS system (Integrated Voltage Detection System) checks for the absence of a voltage
- Flashing arrow symbols light up on the indicators in case of the presence of a voltage within defined threshold response limits

The IVIS is equipped with a self-test in order to avoid any electrical tests. The IVIS system also provides a phase comparison function.

It is equipped with integrated electronics, protected against bad weather conditions and requires no maintenance. It is auto-supplied. An auxiliary contact is available for remote monitoring (optional).

VPIS-V0

CAPDIS-S1/2+R4.5: fail-safe integrated voltage detecting system

Kries VDS provides integrated continuous three-phase voltage indication in high voltage equipment according to IEC61243-5.

It's composed with following features:

- **Inherent safety,**it includes a self test which offers inherent safety; no external test device is required.
- **No battery & maintenance free**, for voltage detecting and self test, no external power supply or battery is required.
- **Relay and LED outputs,**for remote monitoring of voltage condition, two relay contacts are integrated. The relays are driven by auxiliary voltage. Two LEDs show the actual relay state.

VDS:Kries, CAPDIS-S1/2+R4.5

LPVT options

TGS can now be specified with compact high accuracy Low Power Voltage Transformers (LPVT). These innovative sensors are ideal for the new generation of electronic protection devices and are the only way to measure energy in secondary MV loops.

- Up to Class 0.5 accuracy levels for metering
- Linear wide spectrum voltage range with no ferro resonance characteristics.
- Low power consumption and reduced size - ideal for new or retrofit solutions

Selection of HV fuses

Types of HV fuse

To protect distribution transformers, we recommend that you use HV fuses that have an integrated thermal striker, which is activated at a certain temperature threshold, in compliance with the selection tables. The fuse with thermal striker operates:

- In case of overcurrent
- In case of accidental damage.

It then switches off the switch-disconnector which avoids a thermal overload in the fuse holder.

Necessary data when placing an order

The following data must be specified:

- Transformer power
- Transformer service voltage

Rated current of suitable HV fuses is then given by the selection tables. If not applicable, please consult us

Technical characteristics

The fuses meet the following standards:

- Protection of the distribution transformers in compliance with the IEC 60787standard
- Fuses in compliance with the IEC 60282-1 standard
- Specifications of the IEC 62271-105 standard
- Maximum ambient temperature for the switchboards: 40°C in accordance with standards IEC 62271-1. Temperature must be considered when calculating fuse power losses. For higher temperature conditions, please consult us
- HV fuses can bear 1.3 times the transformer's rated current for a minimum of ten hours
- The interruption is made at 1.5 times the transformer's rated current for two hours

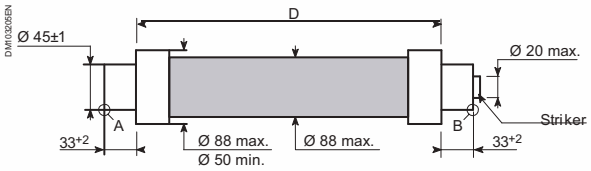
Spare fuses

Spare fuses must meet the following requirements:

- Dimensions in compliance with technical data sheet 1 (type 1, line 1), IEC 60282-1 publication, radius A and B < 3 mm
- "Medium" type of striker with a maximum initial tripping force of 80 N
- When using spare fuses without tripping with a thermal limitation integrated striker, the following requirements must be fulfilled
  - in case of overcurrents, the interruption must be carried out by LV fuses
  - if the switchboard is installed in an exposed area, in which the fuse links may be submitted to damage due to transient events (e.g. lightning), all the fuses must be replaced in accordance with the appropriate maintenance intervals

If these requirements are not fulfilled, only the backup HV fuses with integrated tripping of the striker and thermal limitation must be used in the GWS switchboard to protect from a thermal overload.

HV FUSE



VOLTAGE	D (mm)
Up to 12 kV	292
(with adaptor to extend to 442 mm)	
Up to 12 kV	442
17.5 kV	442

FUSES

Selection of HV fuses

HV FUSES SELECTION TABLE

Fuse type as per IEC		POWER OF TRANSFORMER (KVA)																		
		25	50	63	80	100	125	160	200	250	315	400	400	500	630	800	1000	1250	1500	1600
Fuse rated voltage (kV)	Transformer service voltage (kV)	Uk = 4%											Uk = 6%							
		Rated current for fuses (A)																		
7.2	3	10	25	25	31.5	40	50	50	80	100	100(2)	–	–	–	–	–	–	–	–	–
7.2	3.3	10	25	25	31.5	40	40	50	63	80	100(2)	–	–	–	–	–	–	–	–	–
7.2	5.5	6.3	16	16	20	25	31.5	31.5	40	50	63	80	80(1)	100 (1)(2)	–	–	–	–	–	–
7.2	6	6.3	10	16	20	25	25	40	40	50	63	80	63	80(1)	100 (1)(2)	–	–	–	–	–
7.2	6.6	6.3	10	16	16	25	25	31.5	40	50	63	63	63(1)	80(1)	80(2)	–	–	–	–	–
12	10	–	–	10	10	16	20	25	25	31.5	40	50	40	50	63(2)	80 (1)(2)	–	–	–	–
12	11	–	6.3	10	10	16	16	25	25	31.5	40	40	40	63(1)	63(1)	80 (1)(2)	–	–	–	–
24	13.8	4	6.3	6.3	10	10	16	16	20	25	31.5	31.5	31.5	40	50 (1)(2)	63 (1)(2)	–	–	–	–
24	15	4	6.3	6.3	10	10	16	20	20	25	31.5	31.5	31.5	40(1)	50 (1)(2)	63 (1)(2)	–	–	–	–
24	20	–	–	6.3	6.3	10(1)	10	16	16	20	25	25	25	31.5(1)	40(1)	40 (1)(2)	63 (1)(2)	–	–	–
24	22	–	–	6.3	6.3	6.3	10	10	16	16	25	25	25(1)	31.5(1)	40(1)	40(2)	50 (1)(2)	63 (1)(2)	–	–

(1) With mechanical time-delay device 70 ms.
(2) Without transformer overload.

HV FUSES SELECTION TABLE

Fuse type as per DINVDE		POWER OF TRANSFORMER (KVA)																		
		25	50	63	80	100	125	160	200	250	315	400	500	630	630	800	1000	1250	1500	1600	2000
Fuse rated voltage (kV)	Transformer service voltage (kV)	Uk = 4%											Uk = 6%								
		Rated current for fuses (A)																			
7.2	6	6.3	10	16	20	25	25	40	40	50	63	80	100	100(2)	100 (1)(2)	–	–	–	–	–	–
12	10	–	–	10	10	16	20	25	25	31.5	40	50	63	80	63(2)	80 (1)(2)	–	–	–	–	–
24	15	4	6.3	6.3	10	10	16	20	20	25	31.5	31.5	50	63	50 (1)(2)	63 (1)(2)	–	–	–	–	–
24	20	–	–	6.3	6.3	10(1)	10	16	16	20	25	25	40	40	40(1)	40 (1)(2)	63 (1)(2)	–	–	–	–

(1) With mechanical time-delay device 70 ms.
(2) Without transformer overload

HV fuses selection table

Fuse type as per DINVDE		POWER OF TRANSFORMER (KVA)																			
		25	50	63	80	100	125	160	200	250	315	400	500	630	630	800	1000	1250	1500	1600	2000
Rated voltage (kV)	Service voltage (kV)	Uk = 4%											Uk = 6%								
		Rated current for fuses (A)																			
7.2	6	–	–	–	–	25	–	40	–	50	63	80	100	125	100	125	160(1)	–	–	–	–
12	10	–	–	–	–	16	–	25	–	32	40	50	63	80	63	80	100	100	–	160(1)	160 (1)
17.5	15	–	–	–	–	16	–	20	–	32	32	40	50	63(1)	50	63(1)	63(1)	80(1)	–	–	–
24	20	–	–	–	–	10	–	16	–	20	25	32	40	40	40	40	50	80(3)	–	100 (1)(3)	125 (1) (3)

(1) With mechanical time-delay device.
(3) Specific SSK type fuses.
Other HV fuses also available with GWS such as Ferraz fuses or Jean Müller IKUS type fuses.

Manometer

- The interrupting mechanisms are installed in stainless steel tanks filled with gas. During the service life of the switchboard, the addition of SF6 gas is not necessary
- The gas pressure in the hermetically sealed tank is indicated, as an option, by a relative or absolute pressure manometer for uses at high altitude
- An auxiliary contact can be fitted to the manometers (optional)

Accessories

Standard accessories supplied with TGS switchboard are:

- A set of operating levers (longer lever is optional)
- A set of keys to lock fuse compartment
- A hardcopy of operation manual

Ask for details of other supplies. Only TGOOD accessories are authorised for use with TGS.

Halogen Qualitative Leak Detector

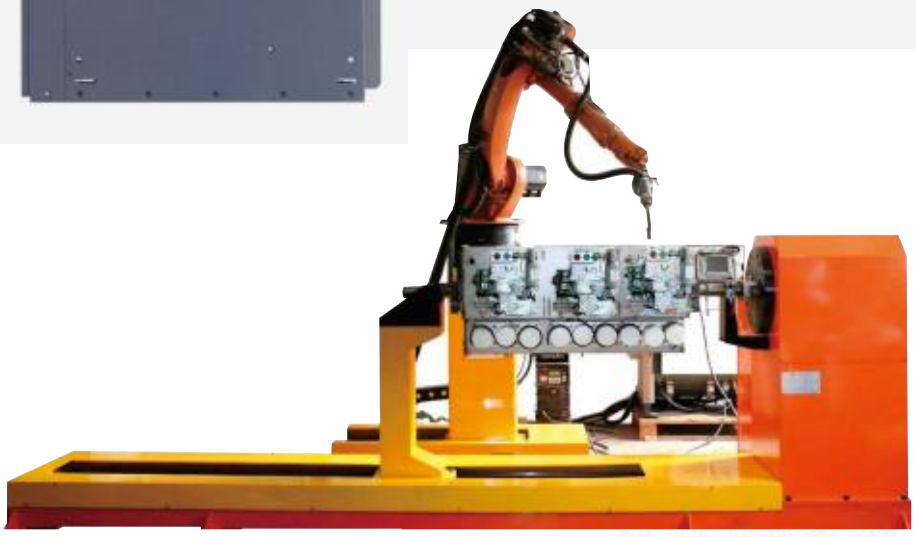
XP-1A detector is as an optional accessory for detecting the leakage of SF6 gas.

Relative pressure gauge

Halogen Qualitative Leak Detector

Operating lever

PRODUCTS & UNIT HOUSING

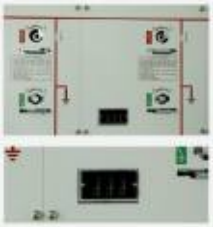


AUTOMATED ARC WELDING BY: KUKA

ACCESSORIES & PARTS

MOTORIZED CIRCUIT BREAKER MECHANISM

LV CONTROL PANEL



FACE PLATE AND VPIS

GAS PRESSURE GAUGE (MANOMETER)

MOTORIZED CIRCUIT BREAKER MECHANISM

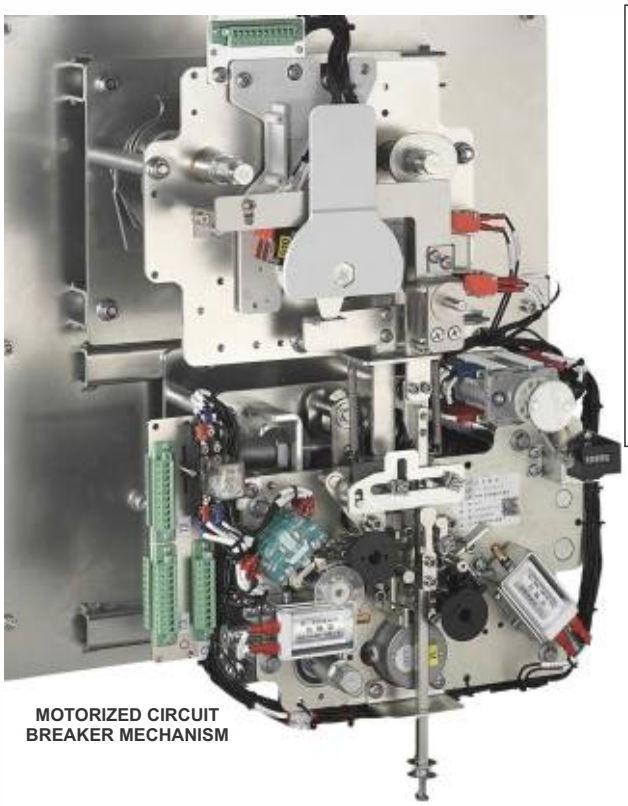
TOP EXTENSION BUSBAR

CABLE COMPARTMENT

SINGLE EXTENSIBLE UNITS

CIRCUIT BREAKER WITH 3 POSITION SWITCH

COPPER BUSBAR



MOTORIZED CIRCUIT BREAKER MECHANISM

3 PHASE PROTECTION CT

SINGLE PHASE PROTECTION CT

MOTORIZED ISOLATOR

GWS GREAT WALL SWITCHGEAR

ACCESSORIES & PARTS

CVC NON-EXTENSIBLE
RMU

CABLE COMPARTMENT
ACCESSORIES

EARTH SWITCH

CABLE COMPARTMENT
ACCESSORIES

3 POSITION SWITCH

CABLE COMPARTMENT
ACCESSORIES

CABLE COMPARTMENT
ACCESSORIES

CABLE COMPARTMENT ACCESSORIES

PRODUCTION PHOTOS