CATALOGUE

Switchgear & Substation



CNC ELECTRIC

About CNC

Our purpose is to **empower every connection** in the electrical ecosystem—uniting industries, partners, and communities for **sustainability**.

Our mission is to be your most trusted **electrical solution** provider.

Founded in 1988 with our first molded-case circuit breaker, CNC Electric became a corporate group by 1995 and now integrates R&D, manufacturing, trade, and service to supply reliable low-voltage systems, renewable-energy solutions, and transmission & distribution equipment in over 130 countries. Driven by trust, innovation, and smart manufacturing under international certifications, we empower industries and communities as your trusted partner in creating a smarter, greener electrical ecosystem.

Final Distribution

Power Distribution

Industrial Control

New Energy

Power Supply

Instruments & Meters

Electrical Accessories

Wall Switch

Power T&D

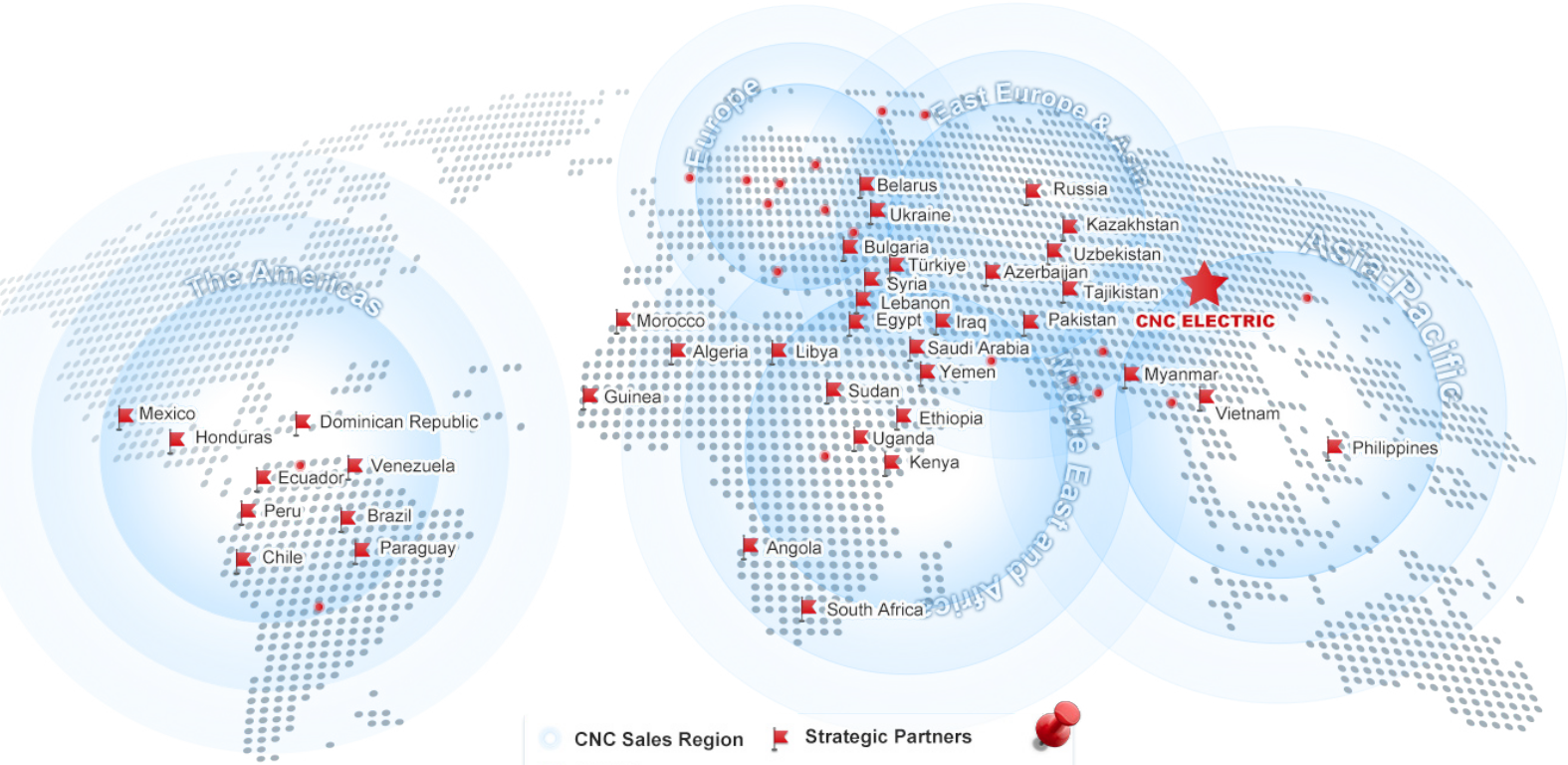


1988 Since

700+ Employees

2 Production Basis

130+ Serve Countries



CNC Sales Region Strategic Partners

CNC Stores

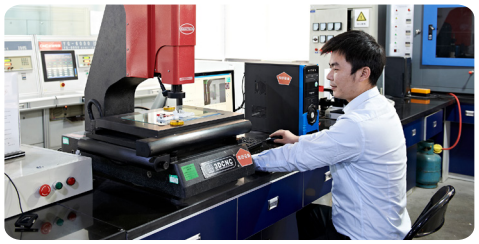


Land Area Covering

60,000m²

Manufacturing Capacity

MCB: 100,000 poles/day;
MCCB: 10,000 pcs/day;
ACB: 100 units/day;
Contactors: 10,000 units/day;





ISO9001*14001 & QC System

OHSAS1800

Project Case

Medium Voltage

Power Transformer

Switchgear & Substation

Russia Power Distribution Project






CNC Electric completed a customized power distribution project for a major Russian industrial facility—covering six workshops—in just 30 days. The service included installation supervision, commissioning, and a 5-year warranty.

Bulgaria Factory Electrical Project






Completed in 2024, this electrical upgrade for a Bulgarian factory established a reliable power distribution system, significantly enhancing both operational stability and energy efficiency.

Lagos Water Pump Control Project



To improve water supply efficiency and reduce energy consumption, the government of Lagos, Nigeria, upgraded its water pump control system. CNC Electric provided an integrated solution to support the city's sustainable infrastructure goals.

Russia Factory Electrical Infrastructure Project




Completed in 2023, this project provided a reliable and efficient electrical infrastructure for a new factory in Russia, ensuring long-term operational stability.

CNC ELECTRIC

Davao Cultural Landmark Auditorium Project



In September 2022, the Kingdom of Jesus Christ began constructing a 70,000-seat auditorium in Davao, Philippines. Set to be one of the world's largest enclosed venues, the project features an advanced electrical system—including transformers and switchgear—to ensure a reliable power supply.

Kiev Government Supplier List Inclusion Project





In 2022, CNC Electric was named a verified supplier for the Kiev government. By providing MCCBs, MCBs, and AC contactors for electrical switchgears, the company is actively supporting the modernization of Kiev's infrastructure.

Kazakhstan Real Estate Development Electrical Project





In 2021, a community development project in Kazakhstan required a robust electrical infrastructure to support new residential and commercial facilities. The project successfully installed high-capacity power transformers and advanced vacuum circuit breakers, ensuring reliable power distribution for the entire community.

AEON Towers Power Supply Project in Davao City



AEON Towers, a mixed-use development in Davao City, Philippines, utilized CNC Electric for its essential electrical infrastructure. The company supplied distribution transformers, power protection panels, and control devices to support the project's residential and commercial requirements.

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Medium Voltage Switchgear 15-185

KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type 15
KYN28-24 Metalclad AC Enclosed Switchgear, Withdrawable Type 26
KYN28-12 Metalclad AC Enclosed Switchgear, Withdrawable Type 32
XGN15-12,24,40.5 Air-insulated RMU (Fixed Type) 38
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HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear 61
YRM6-12 Gas-insulated Metal-enclosed Switchgear 76
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Prefabricated Substation



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Prefabricated Substation

YBM22-12/0.4 Outdoor Prefabricated Substation (EU)

- Rating:
  Rated voltage: HV equipment 7.2kV and 12kV, LV equipment 0.4 kV. Rated current: HV equipment 630A, LV equipment 100 - 2000A. Application: YBM22 series substation is a kind of compact power distribution device that integrates high and low voltage electrical equipment. It can be used in high - rise buildings, buildings in urban and rural areas, residential communities, high - tech development areas, small and medium size factories, mining areas, oil fields, temporary features sites, and other premises. It also can be used for acceptance and distribution of power in power distribution system of 6 - 15kV, 50Hz (60Hz), ring main power distribution system and double power supply or radiate terminal power distribution system.
- Feature:
  High integrity, small size, compact structure, safe and reliable operation, convenient maintenance, portable, etc. Compared with conventional civil engineering substation, in the same capacity, the prefabricated combined substation need only 1/10 - 1/15 floor area, so that the features expense is reduced.
- Standard: IEC1330

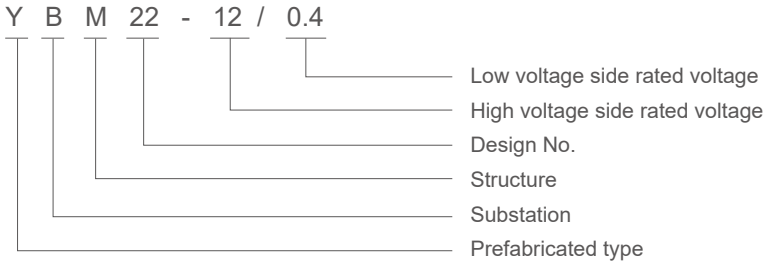
General





YBM22-12/0.4 Outdoor Prefabricated Substation (EU)

Type designation



Operating conditions

1. Ambient air temperature: -10°C~+40°C
2. Altitude: ≤1000m
3. Solar radiation: ≤1000W/m²
4. Ice cover: ≤20mm
5. Wind speed: ≤35m/s
6. Relative humidity: Daily average relative humidity≤95%. Monthly average relative humidity≤90%
7. Daily average relative water vapour pressure ≤2.2kPa. Monthly average relative water vapour pressure ≤1.8kPa
8. Earthquake intensity: ≤magnitude 8
9. Applicable in the places without corrosive and flammable gas

Note: Customized products are available

Features

1. The product is connected together by high voltage power distribution equipment, transformer and low voltage power distribution device. And divided into three functional compartments, that is High voltage compartment, Power transformer compartment and Low voltage compartment, have completely HV, LV function. high voltage side of a power supply system, can be arranged in a ring network power supply, end user power supply, dual power supply and other power supply, also can be provided with the high - voltage metering device to meet high voltage measurement. Transformer room can choose S9, SC and other series of low loss of oil immersed transformer or dry type transformer; low voltage chamber can be panel or cabinet mounted structure based on user requirement to form the power supply scheme required by user. These are power distribution, lighting distribution, Static Var Compensator, energy metering and energy improvement and other function, to meet different requirement of user. This makes Power management convenient for users and measure the quality of power supply.
2. The high voltage chamber with compact and reasonable structure, has a comprehensive anti - mis - operation interlock function. It can be equipped with a rail for power transformer when it is required by customer, it can make transformer in and out conveniently in power transformer compartment. Each room has the automatic lighting device, Meanwhile, all elements in high voltage and low voltage cabinet are reliable performance, convenient operation.
3. Adopt natural ventilation and the forced ventilation in two ways. There is ventilation channel for power transformer compartment and High, Low voltage compartment. The exhaust fan is provided with a temperature control device, it can automatic startup and shutdown according to the setting temperature. This ensures the normal operation of transformer.
4. The enclosure structure can prevent rain and dirt. The material adopt color steel plate and have anti - corrosion insulation function.

YBM22-12/0.4 Outdoor Prefabricated Substation (EU)

Technical data

Sheet 1

Item	Unit	H.V electrical equipment	Transformer	LV electrical equipment
Rated voltage	kV	10	10/0.4	0.4
Rated current	A	630	/	100 - 2500
Rated frequency	Hz	50	50	50
Rated capacity	kVA	/	100 - 1250	/
Rated thermal stability current	kA	20/4S	/	30/1S
Rated dynamic stability current (peak)	kA	50	/	63
Rated closing short - circuit current (peak)	kA	50	/	15 - 30
Rated breaking short circuit current	kA	31.5 (Fuse)	/	/
Rated breaking load current	A	630	/	/
1 min power frequency withstand voltage	kV	Between phases, to earth 42, to open contacts 48	35/28 (5min)	20/2.5
Lightning impulse withstand voltage	kV	Between phases, to earth 75, to open contacts 85	75	/
Shell protection class	/	IP23	IP23	IP23
Noise level	dB	/	/	/
Loops No.	/	/	2	4 - 30
Low voltage side max static var compensator	kvar	/	/	300

Overall and mounting overall and mounting dimensions (mm)

YBM series of prefabricated substation have type 1 (refer pic1-1, 1-2) and type 2 (refer to 1-3, 1-4), the Overall and mounting dimensions (mm) s refer to pic 2, pic 3.

YBM series of prefabricated substation plane layout

Picture 1



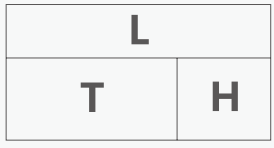
Pic 1-1



Pic 1-2



Pic 1-3



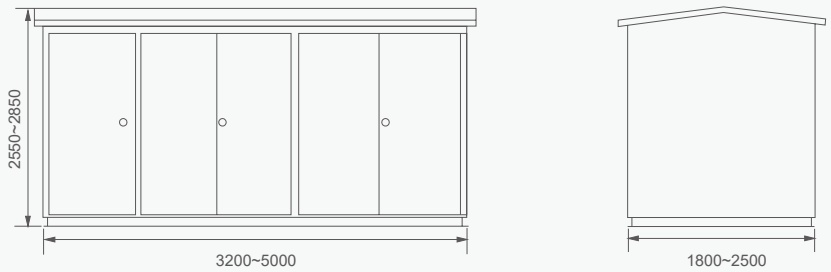
Pic 1-4

H-H.V chamber; T-Power transformer chamber; L-L.V chamber

YBM22-12/0.4 Outdoor Prefabricated Substation (EU)

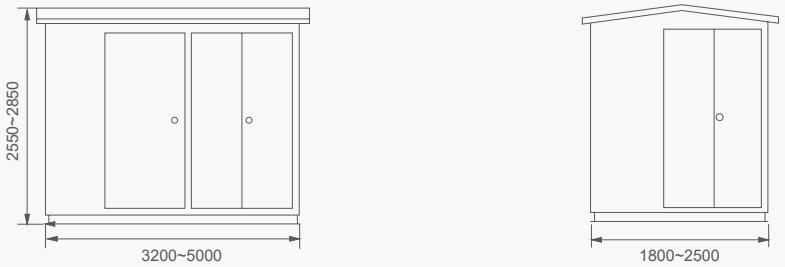
Type 1 layout

Picture 2

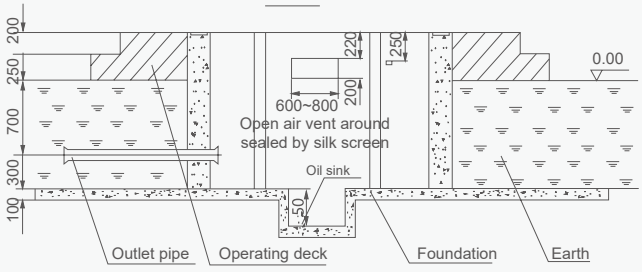


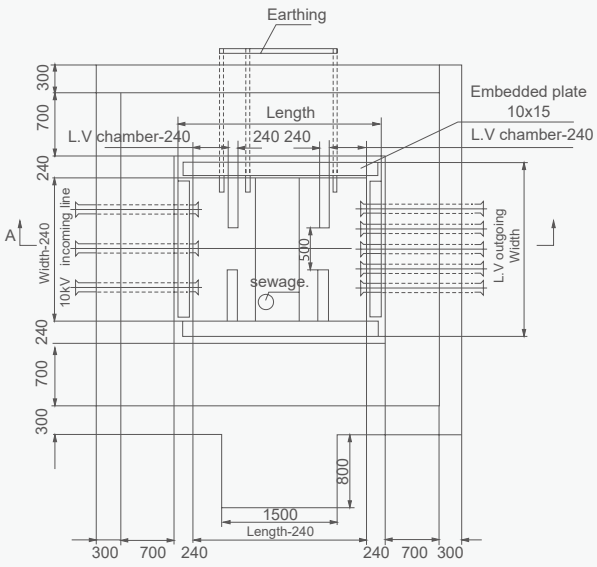
Type 2 layout

Picture 3



Foundation drawing

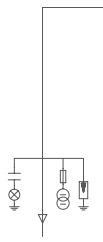
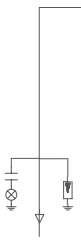
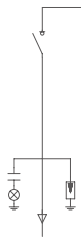
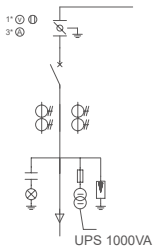
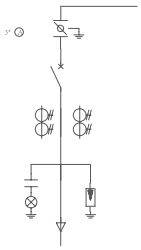
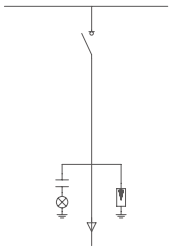


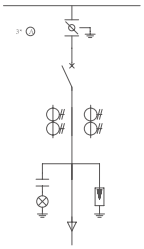
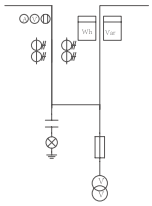
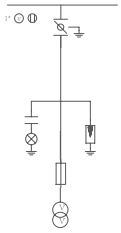
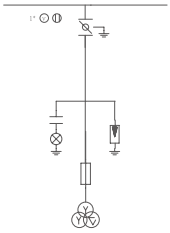
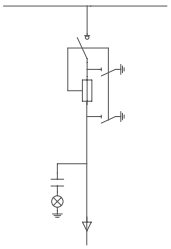
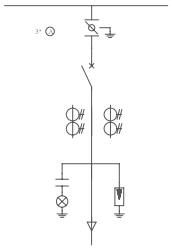


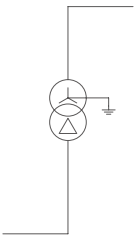
YBM22-12/0.4 Outdoor Prefabricated Substation (EU)

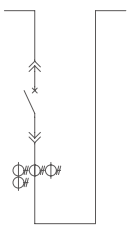
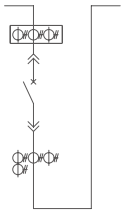
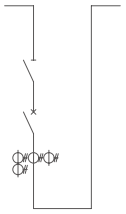
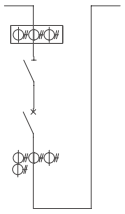
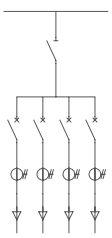
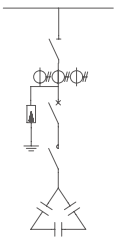
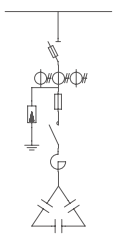
Main single line diagram

Medium Voltage Section

Incoming Scheme 1	Incoming Scheme 2	Incoming Scheme 3	Incoming Scheme 4	Incoming Scheme 5	Ring Main Scheme 1
					
Incoming Panel with VT	Incoming Panel	Incoming Load Break Switch Panel	Incoming Circuit Breaker Panel with VT	Incoming Circuit Breaker Panel	Ring Main Load Break Switch Panel

Ring Main Scheme 2	Metering Scheme 1	VT Cabinet Scheme 1	VT Cabinet Scheme 2	Outgoing Feeder Scheme 1	Outgoing Feeder Scheme 2
					
Ring Main Circuit Breaker Panel	Metering Panel	VT Panel	VT Panel	Outgoing LBS-Fuse Combination Panel	Outgoing Circuit Breaker Panel

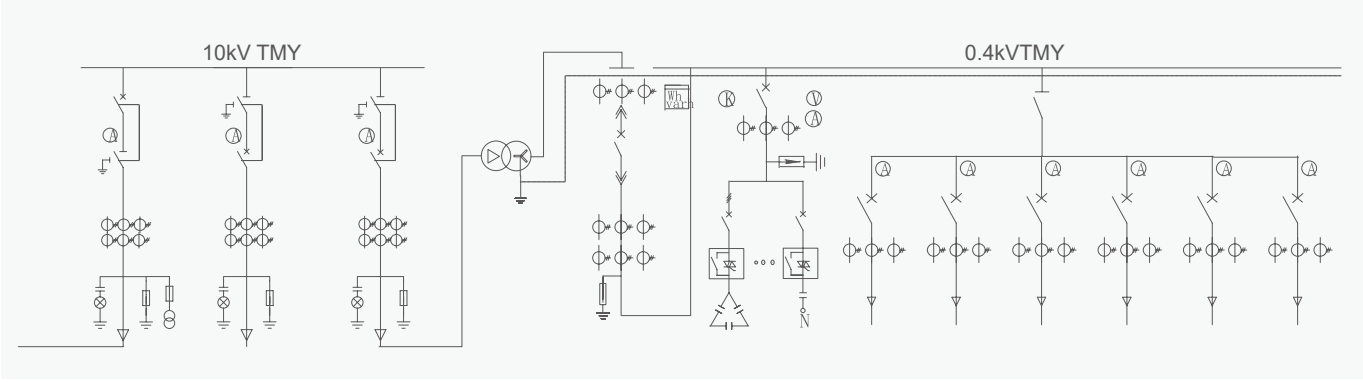
Transformer Section

Oil-Immersed / Dry-Type Transformer

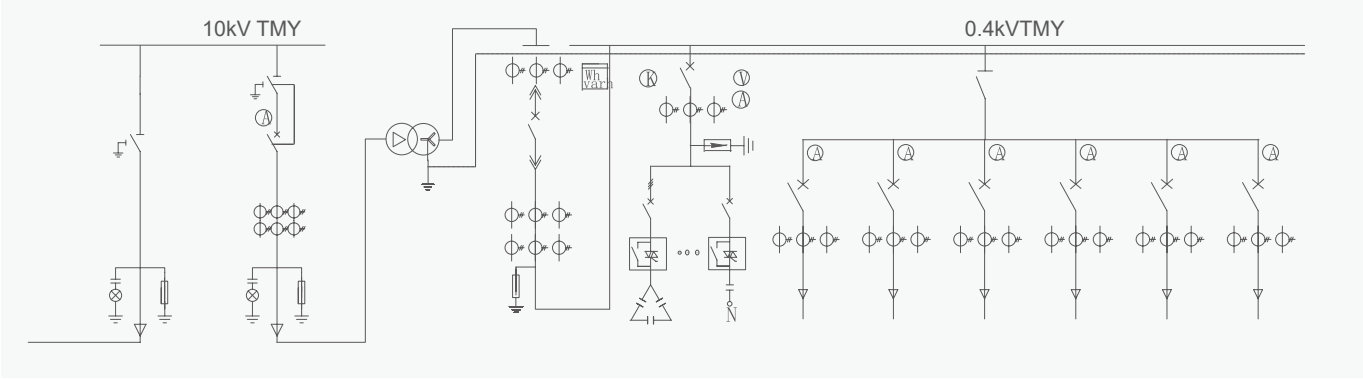
Low Voltage Section	Low Voltage Section	Low Voltage Section	Low Voltage Section	Low Voltage Section	Low Voltage Section	Low Voltage Section
						
Incoming Panel 1	Incoming Panel 2	Incoming Panel 3	Incoming Panel 4	Outgoing Feeder Panel	Capacitor Compensation Panel 1	Capacitor Compensation Panel 2

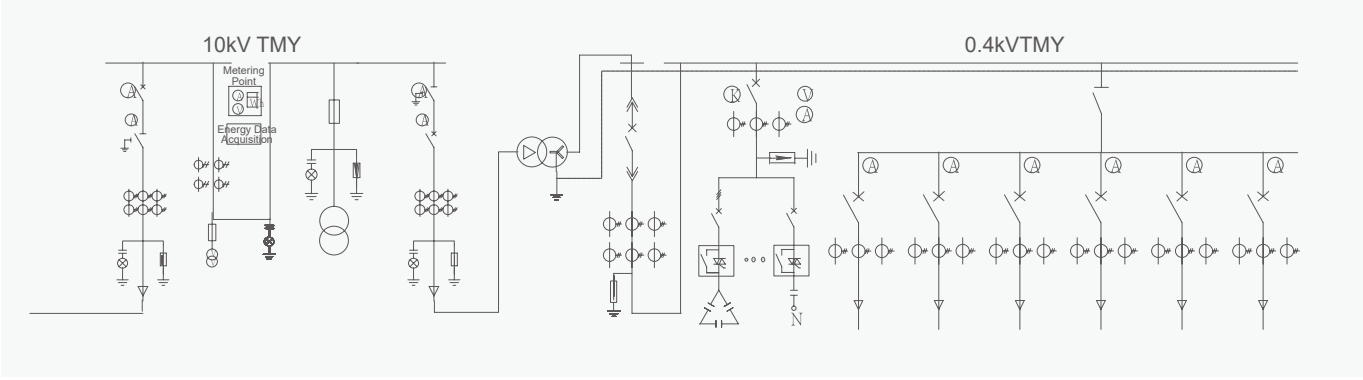
YBM22-12/0.4 Outdoor Prefabricated Substation (EU)

The typical scheme for example

Terminal low measurement







Please provide the following information when ordering

1. The type of prefabricated substation
2. The type and capacity of power transformer
3. High voltage and low voltage single line scheme
4. Electrical component models and parameters if have special requirement
5. Shell color
6. The spare parts, name, quantity and other requirements

Prefabricated Substation

YB27-12/0.4 Outdoor Prefabricated Substation (US)

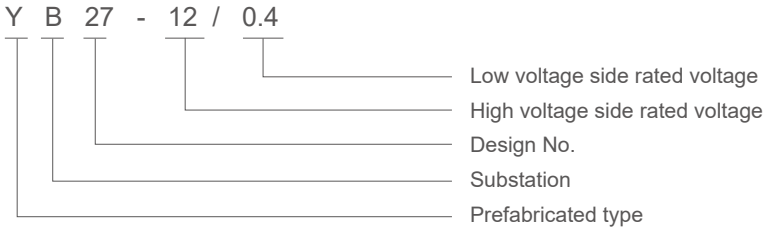
- Rating:
  Rated voltage : HV equipment10kV and 12kV, LV equipment 0.4 kV. Rated current :HV equipment 630A, LV equipment 1500A.
- Application:
  Yb27 series substation is an American type combined substation with function of high voltage control, protection, power transformation and distribution. Usually used in urban and rural power distribution system. The high voltage load switch and high voltage fuse of this product are installed in the oil of the transformer, with the two structures: in same case with the transformer and in different case with transformer. It can be used in high-rise buildings, building in urban and rural areas, residential communities, high-tech development areas, small and medium size factories, mining areas, oil fields, temporary features sites, and other premises.
- Standard: IEC1330

General



YB27-12/0.4 Outdoor Prefabricated Substation (US)

Type designation



Operating conditions

1. Ambient air temperature: -30°C~+40°C
2. Altitude: ≤1000m
3. Wind speed:34m/s ≤700pa
4. Relative humidity: Daily average relative humidity≤95%. Monthly average relative humidity≤95%.
5. Installation inclination:≤grade 8
6. Applicable in the places without corrosive and flammable gas.

Note: Customized products are available.

Features

1. Compact structure with small volume, the volume is 1/3-1/5 of European style substation in same capacity. It reduce the floor space efficiently.
2. Whole sealing and full insulated structure, no need insulation distance. This can protect personal safety
3. High voltage wiring can used both in looped network and terminal with high reliability and flexibility
4. The transformer is with excellence performance, low loss, low Noise, low temperature rise, high overload capacity, strong impact resistant ability and high anti-short circuit capacity.
5. connector. Both can equiped with all insulated ZnO lightning conductor.200A elbow connector can use with load plug and with the function of insulation switch.

Technical data

1. Rated voltage: 10kV/0.4Kk
2. High voltage side rated voltage: 10kV
3. High voltage side max voltage: 12kV
4. Low voltage side rated voltage: 0.4kV
5. Rated frequency: 50Hz
6. High voltage switch thermal stability capacity: 20kA/26
7. Low voltage main circuit breaker rated short circuit breaker capacity: 35kA
8. Low voltage output circuit breaker rated short circuit breaker capacity: 35kA
9. High voltage load switch transfer current: 1500A
10. Selection of neutral earthing bus

YB27-12/0.4 Outdoor Prefabricated Substation (US)

Technical data

Rated voltage (kV)	10			0.4
	Transformer	Switch to ground and interphase	Switch isolation between fracture	
Power frequency withstand voltage (kV)	35	42	48	2.5
The peak impact resistance (kV)	75	75	85	/

11. Noise level: 50dB
12. Box shell protection grade: Not less than IP3X

Overall and mounting dimensions (mm)

YB27-12/0.4 prefabricated substation standard type Overall and mounting dimensions (mm)

	Capacity (kVA)	A	B	C	D	E	F	H
Standard type	100 - 250	1900	1650	1250	650/800	600	1410/1560	1450
	315	1900	1650	1350	650/800	650	1460/1610	1450
	400 - 500	1900	1750	1450	650/800	650	1490/1640	1550
	630	1900	1750	1550	650/800	700	1580/1730	1550
	800	1900	1850	1550	650/800	700	1640/1790	1650
	1000	1900	1850	1650	650/800	700	1640/1790	1650

YB27-12/0.4 prefabricated substation extra-strength type Overall and mounting dimensions (mm)

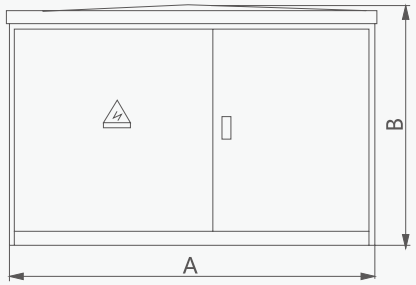
	Capacity (kVA)	A	B	C	D	E	F	H
Standard type	100 - 250	1900	1650	1250	650/800	600	1410/1560	1450
	315	1900	1650	1350	650/800	650	1460/1610	1450
	400 - 500	1900	1750	1450	650/800	650	1490/1640	1550
	630	1900	1750	1550	650/800	700	1580/1730	1550
	800	1900	1850	1550	650/800	700	1640/1790	1650
	1000	1900	1850	1650	650/800	700	1640/1790	1650

	Capacity (kVA)	A	B	C	D	E	F	H
Extra-Strength type	100 - 250	2400	1650	1250	800	600	1560	1450
	315	2400	1650	1350	800	650	1610	1450
	400 - 500	2400	1750	1450	800	650	1640	1550
	630	2400	1750	1550	800	700	1730	1550
	800	2400	1850	1550	800	700	1790	1650
	1000	2400	1850	1650	800	700	1790	1650

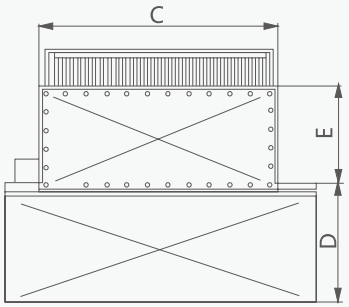
YB27-12/0.4 Outdoor Prefabricated Substation (US)

YB27-12/0.4 prefabricated substation comprehensiveness type Overall and mounting dimensions (mm)

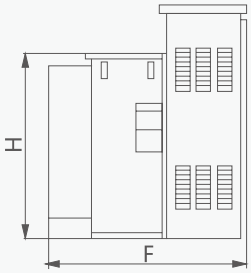
	Capacity (kVA)	A	B	C	D	E	F	H	N
Comprehensiveness type	100 - 250	2400	1750	1250	800	600	1750	950	550
	315	2400	1750	1350	800	650	1750	950	550
	400 - 500	2400	1850	1450	800	650	1750	950	550
	630	2400	1850	1550	800	650	1750	950	550
	800	2400	1950	1550	800	650	1750	950	550
	1000	2400	1950	1650	800	700	1750	950	550



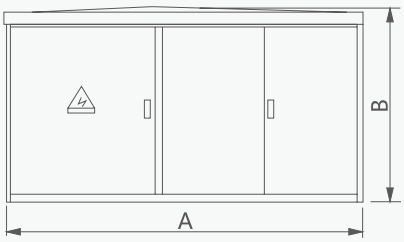
standard type /
comprehensiveness type bottom view



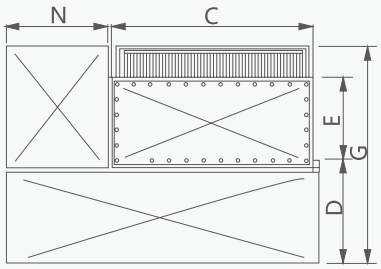
standard type /
Extra-Strength type top view



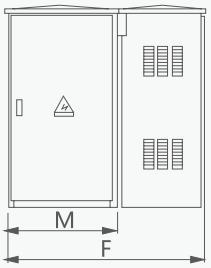
standard type /
Extra-Strength type side view



Extra-Strength type front view

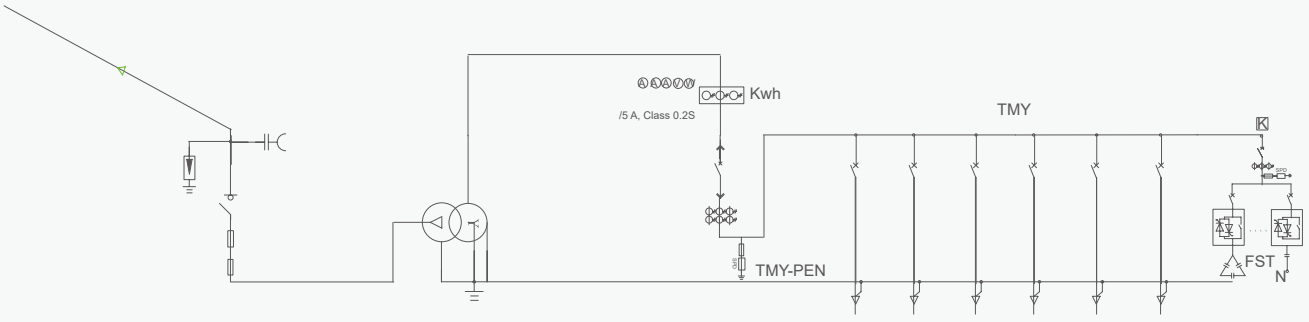


Comprehensiveness type top view



Comprehensiveness type side view

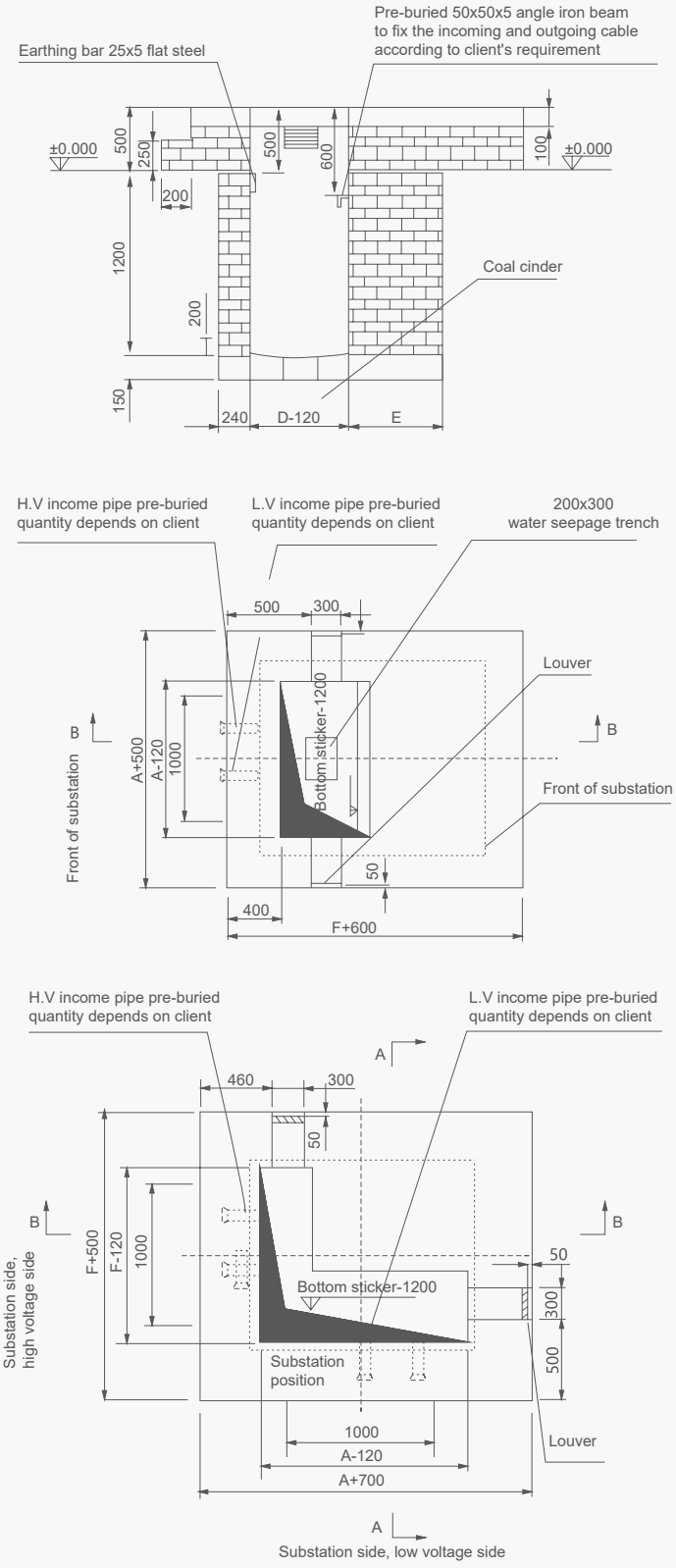
Electrical System Diagram



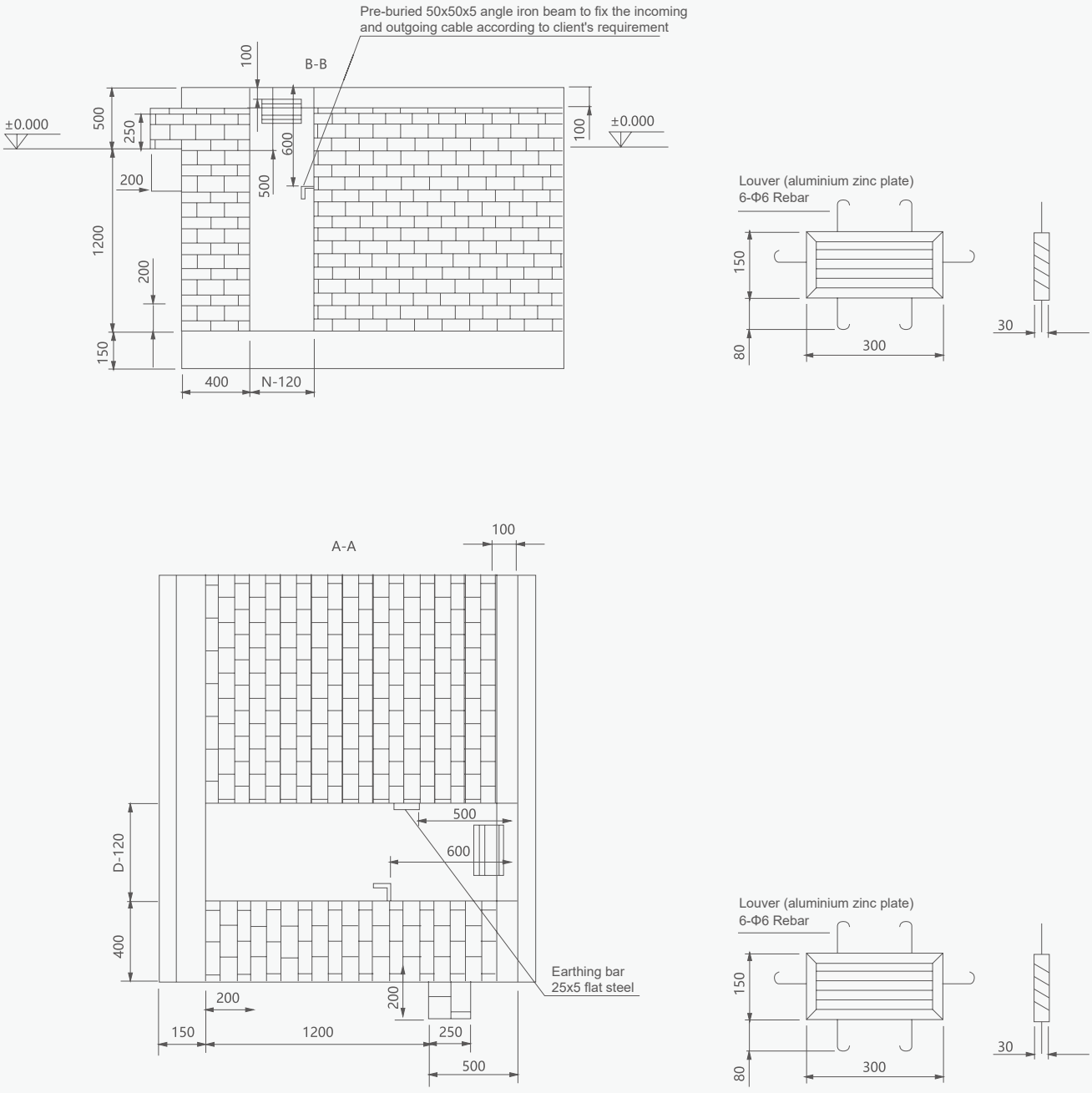
YB27-12/0.4 Outdoor Prefabricated Substation (US)

Foundation drawing

Standard type and extra-strength type



YB27-12/0.4 Outdoor Prefabricated Substation (US)



Medium Voltage Switchgear



CNC
ELECTRIC

Medium Voltage Switchgear

KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type

- KYN61-40.5 Air insulated metal clad movable switchgear is an indoor switchgear, assembly operating under the conditions of 50/60Hz three phase and rated 40.5kV AC voltage, which is applied to the transmission and distribution for generators, transformer substations and the industry and mine enterprises. It also can be used to control, protect and monitor electric circuits, and very useful for frequent operating conditions.
- Standard: IEC62271-200

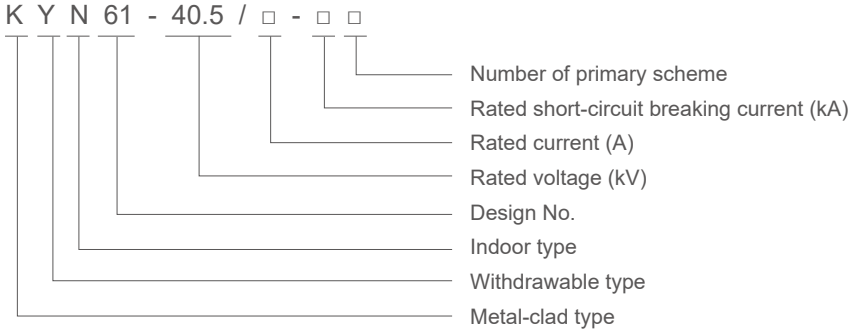
General





KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type

Type designation



Operating conditions

1. Ambient air temperature: -15°C~+40°C
2. Altitude: ≤1000m
3. Relative humidity : Daily average≤95%; Monthly average≤90%
4. Earthquake intensity:≤magnitude 8.
5. Applicable in the places without corrosive and flammable gas.

Note: Customized products are available.

Features

1. The cabinet is made of aluminum-zinc coated sheet processed by CNC equipment and assembled with bolts or rivets, with a fully modular structure.
2. This switchgear has various functions to prevent misoperations, including preventing loaded trolleys from moving, preventing live coupling and earthing switches, and preventing inadvertent entry into live compartments.
3. The switchgear is equipped with a ZNB5 vacuum circuit breaker with excellent performance and a handcart, and the main busbar is connected without the need for transitional transfer.
4. This switchgear is an advanced, stable performance, reasonable structure, easy-to-use, safe and reliable power distribution equipment

KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type

Technical data

Switchgear parameter

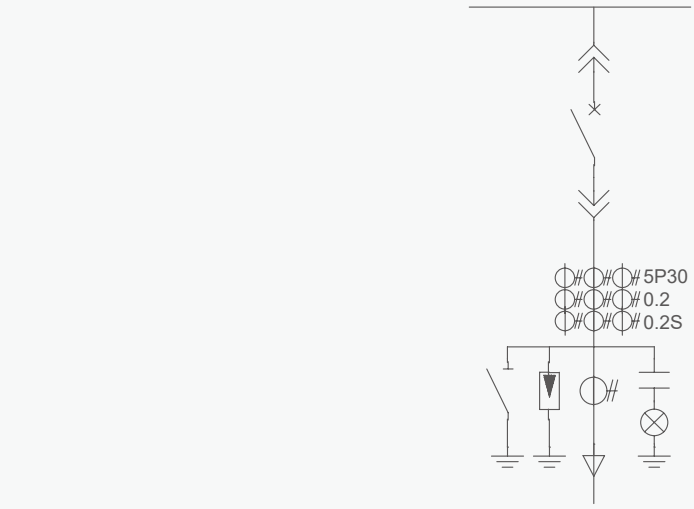
No.	Item		Unit	Value
1	Rated voltage		kV	40.5
2	Rated current		A	630/1250
3	Rated frequency		Hz	50/60
4	Power frequency withstand voltage in 1 min	Phase, Earthed	kV	95
		Isolating Fracture	kV	110
5	Lightning impulse withstand voltage (Peak)	Phase, Earthed	kV	185
		Isolating Fracture	kV	215
6	Rated current of the main busbar		A	630/1250
7	Rated current of the branch busbar		A	630/1250
8	Rated short-circuit breaking current		kA	20/25/31.5
9	Rated short-time withstand current		kA	20/25/31.5
10	Rated peak withstand current		kA	50/63/80
11	Rated short circuit making current		kA	50/63/80
12	Frequency withstand voltage in 1min of aux control loop		V	2000
13	Internal arc duration test (0.5s)		kA	31.5
14	Degress of protection		IP	IP4X(IP2X when the front door is opened)
15	Rated voltage of aux control loop		V	AC or DC 110/220

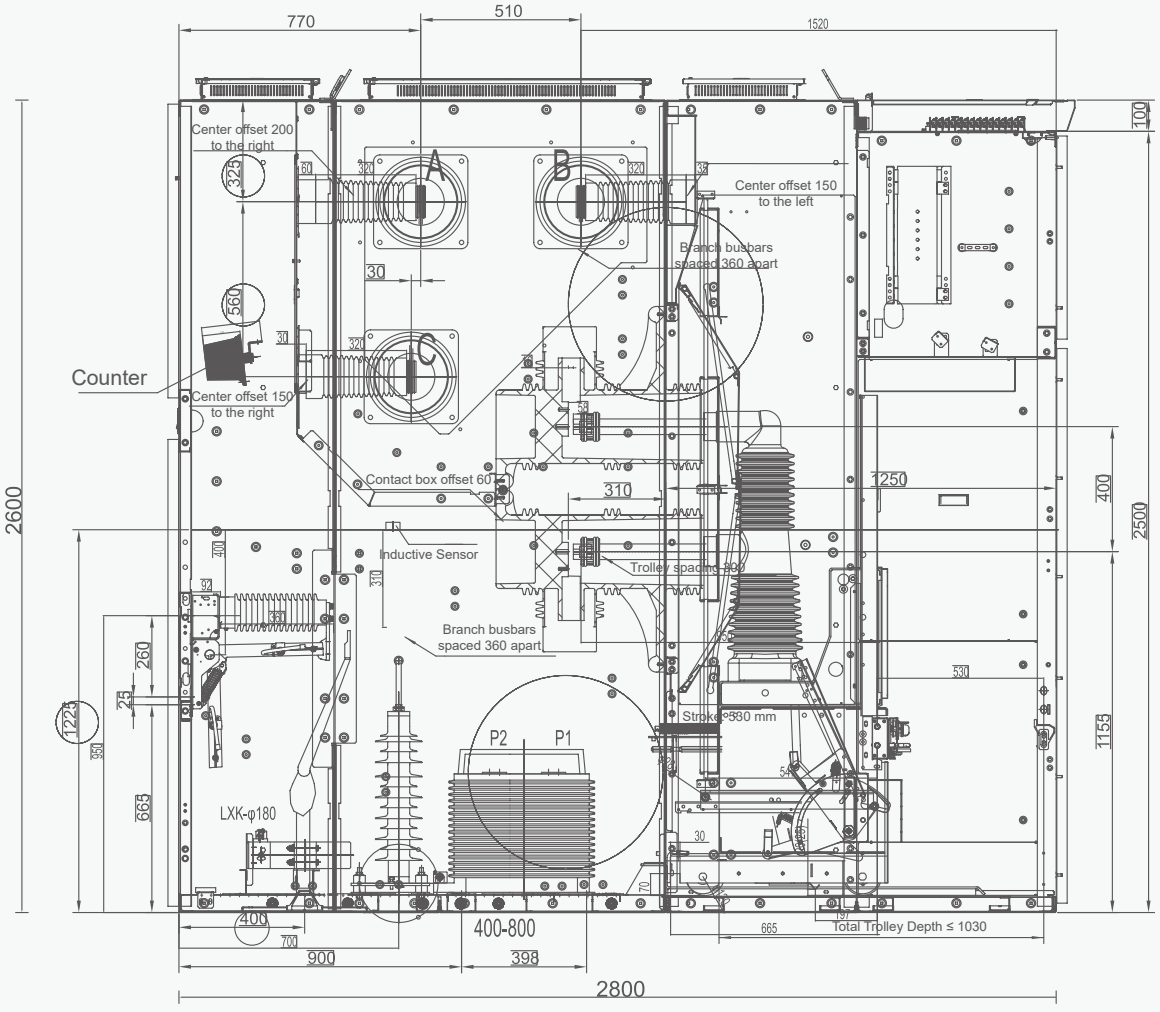
ZN85-40.5 parameter

No.	Item		Unit	Value		
1	Rated voltage		kV	40.5		
2	Rated insulation level	lightning impulse withstand voltage (full wave)	kV	185		
		1 min power frequency withstand voltage	kV	95		
3	Rated frequency		Hz	50		
4	Rated current		kA	630	630, 1250	1250
5	Rated short - circuit breaking current		kA	20	25	31.5
6	Rated short - circuit making current		kA	50	63	80
7	Rated withstands current (peak)		kA	50	63	80
8	Rated short - time withstand current		kA	20	25	31.5
9	Fixed breaking time		s	≤0.07		
10	Making time	Electro-magnetic mechanism	s	Electro - magnetic mechanism≤0.2		
		Spring mechanism	s	Spring mechanism≤0.10		
11	Rated operation sequence		/	Open - 0.3s - close open - 180s - close open		
12	Mechanical life		times	10000		

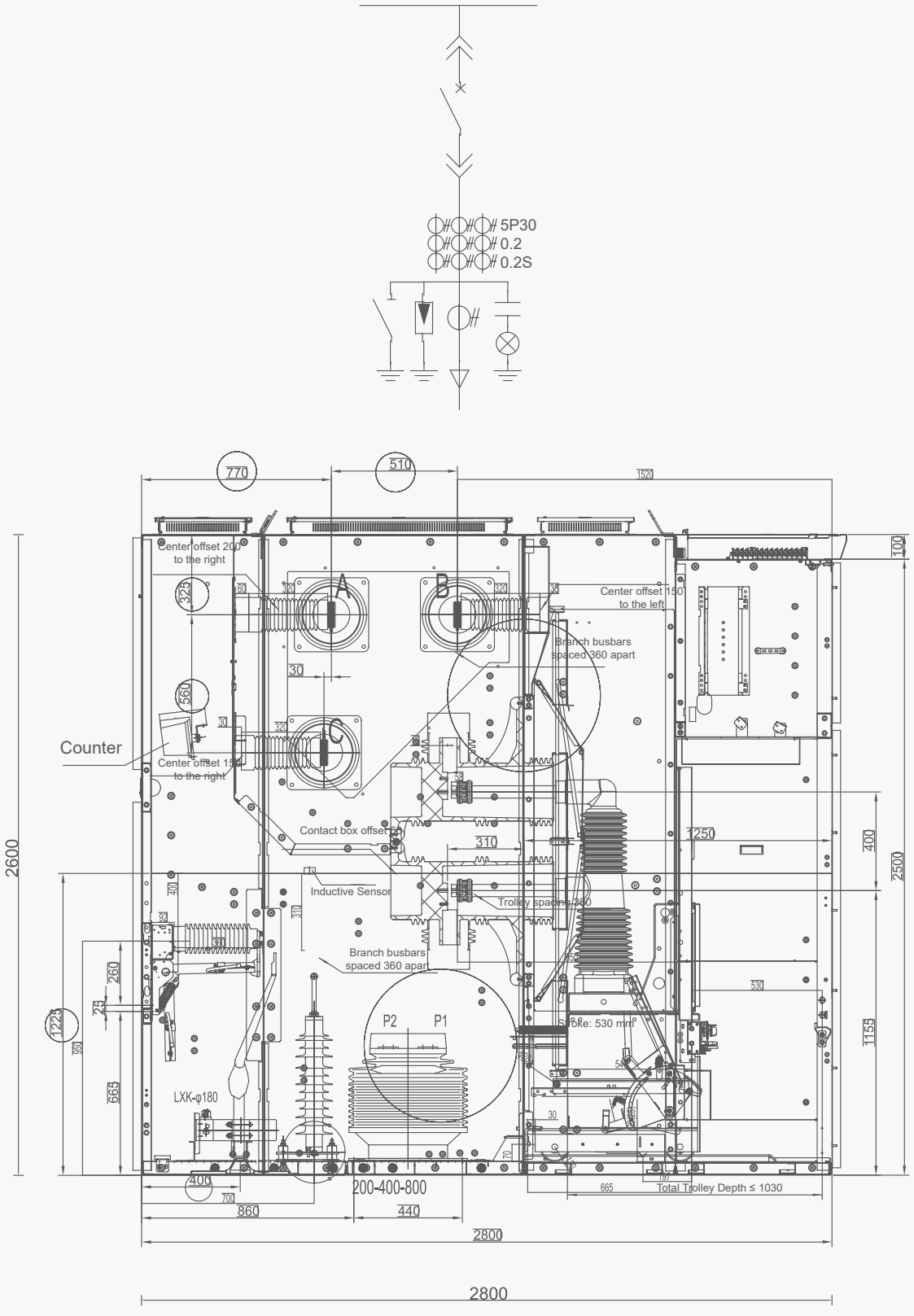
KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type

Overall and Mounting Dimensions (mm)

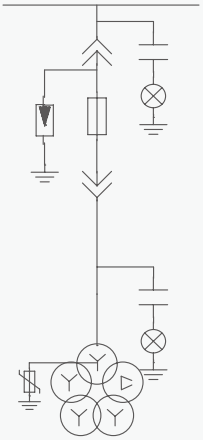


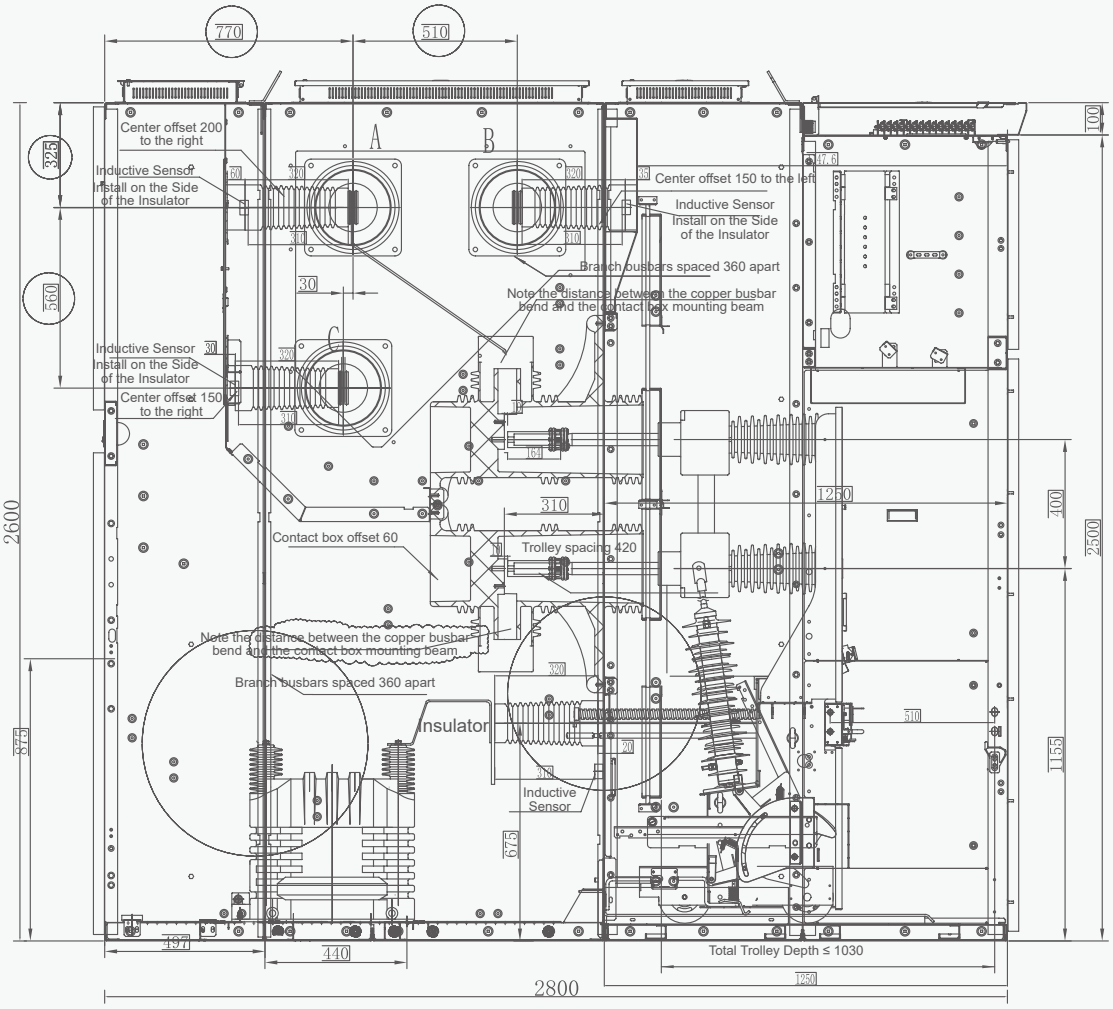


KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type

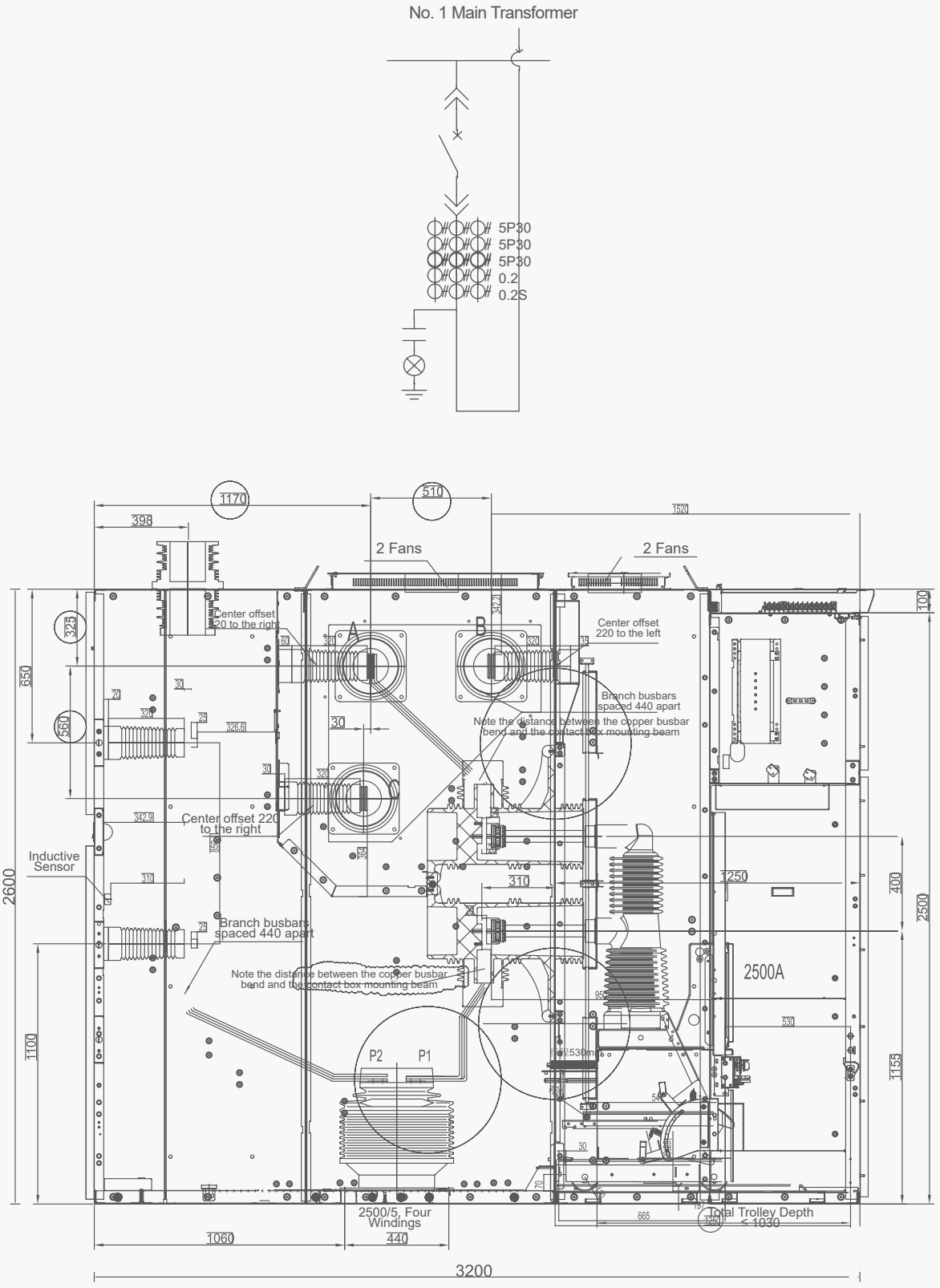


KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type

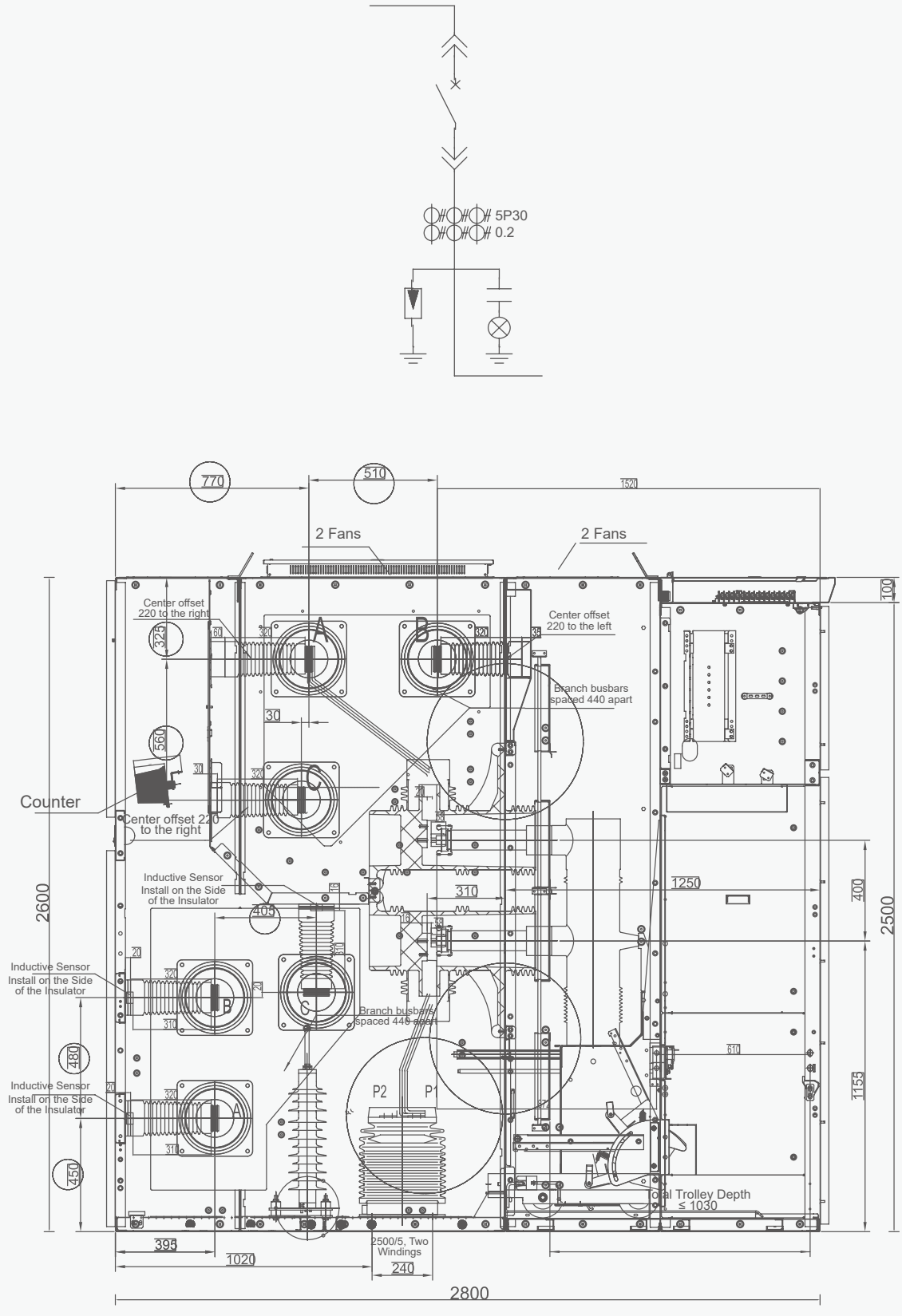




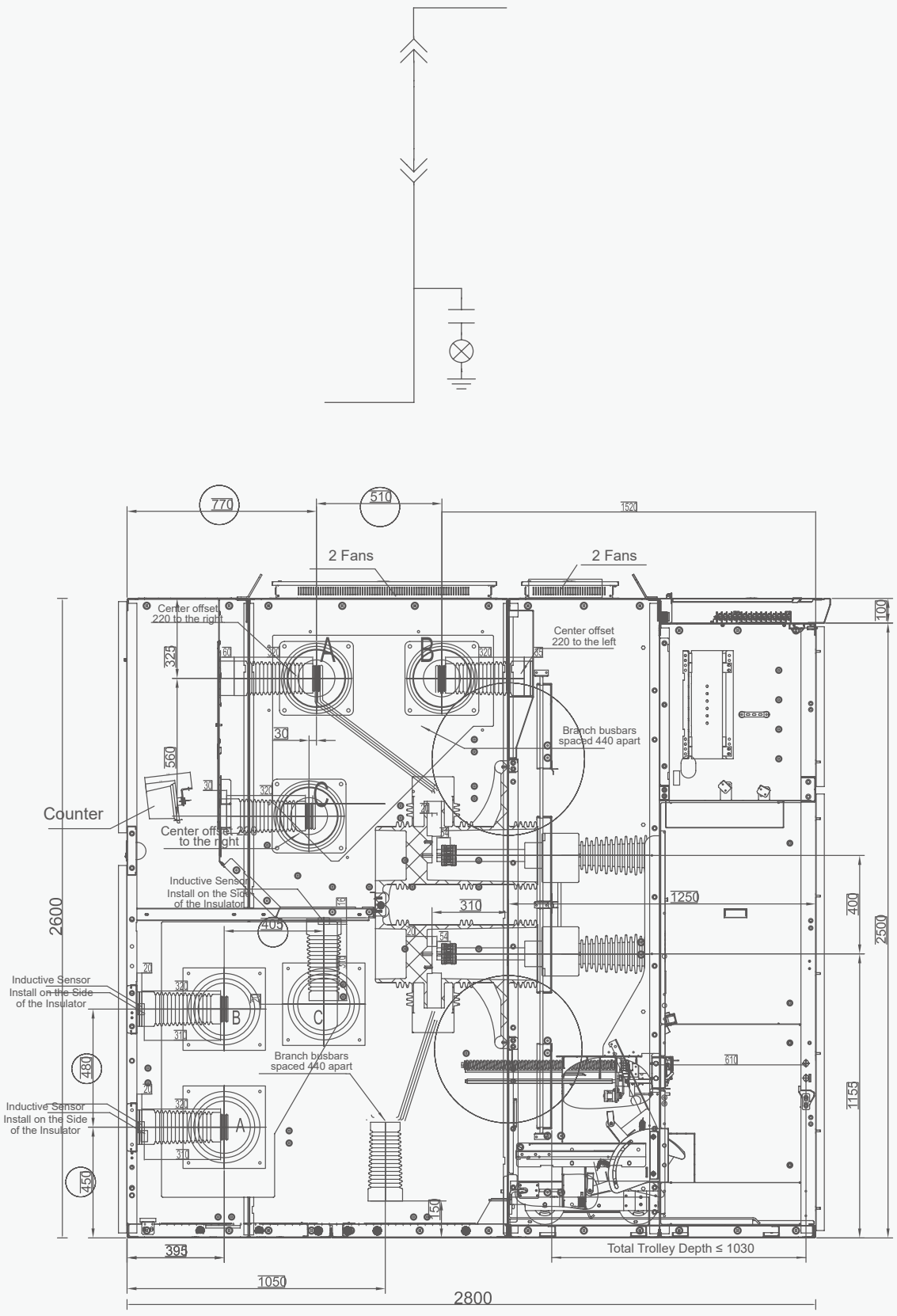
KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type



KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type

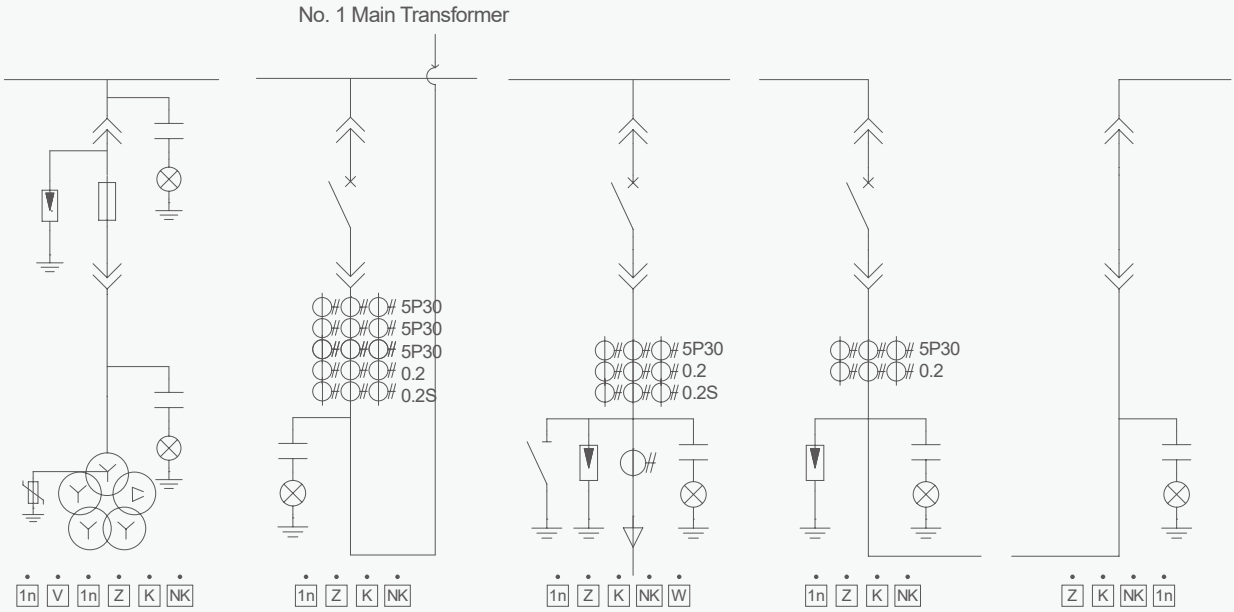


KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type



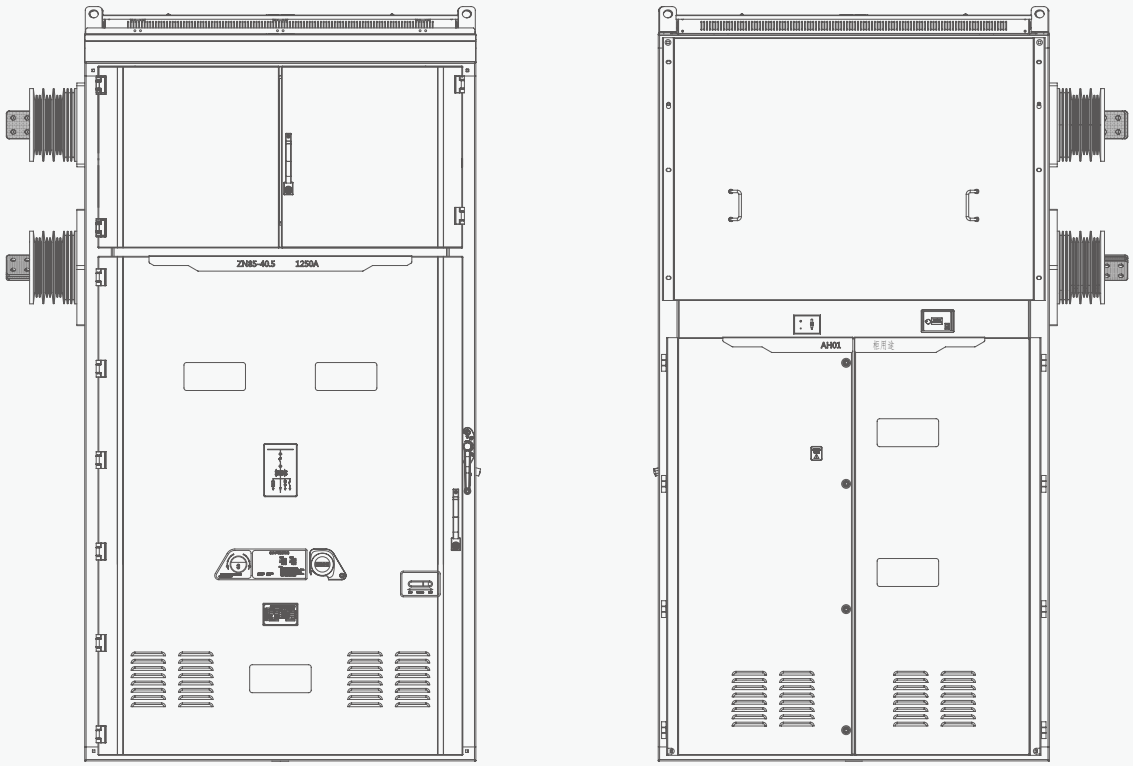
KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type

Single line diagram



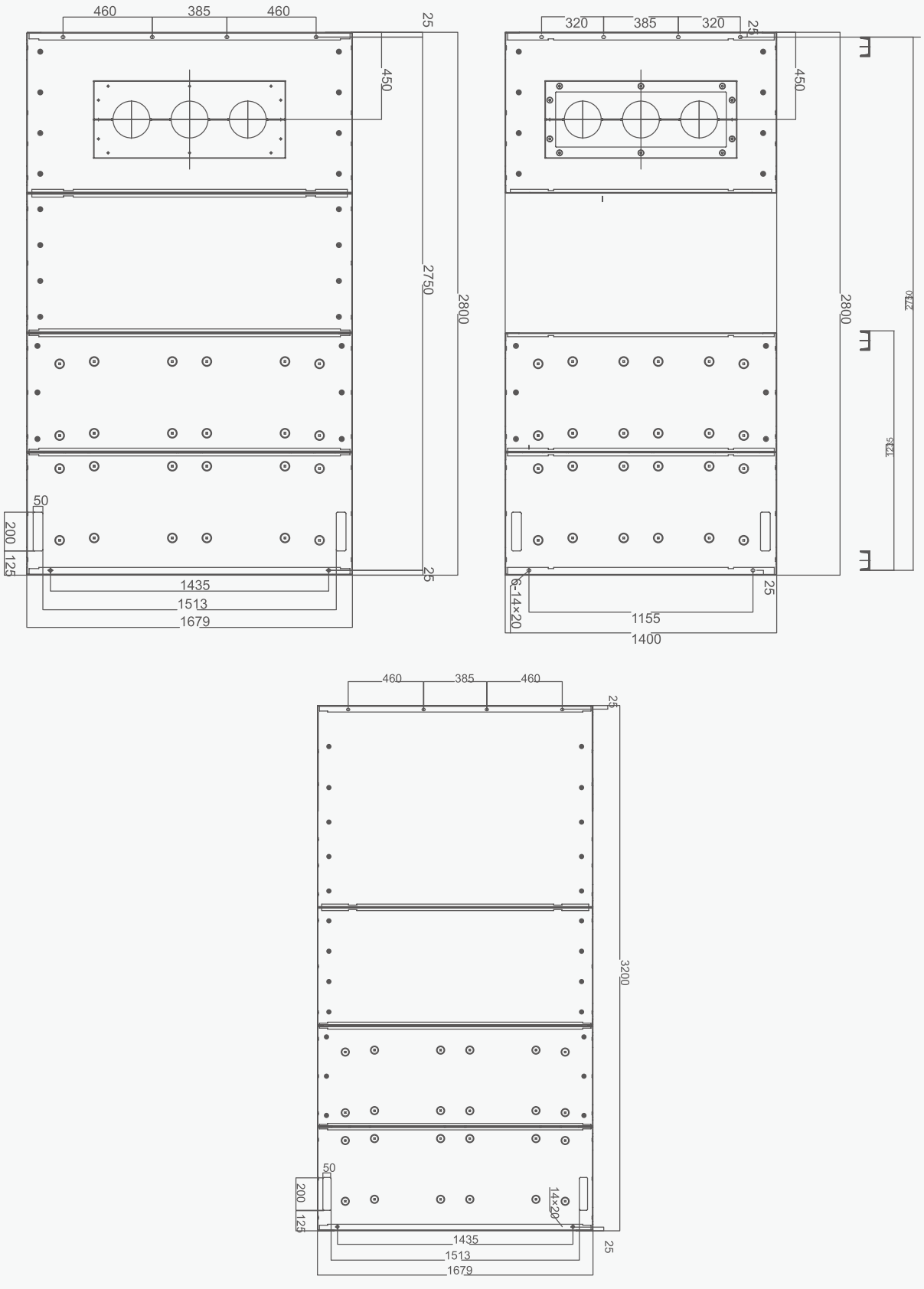
Busbar PT Panel	Main Transformer Incoming Panel	Outgoing Panel	Bus Sectionalizing Panel	Bus Coupler Panel
KYN61-40.5	KYN61-40.5	KYN61-40.5	KYN61-40.5	KYN61-40.5
1400*2800*2600	1680*3200*2600	1400*2800*2600	1680*2800*2600	1680*2800*2600

Cabinet illustration



The cabinet illustration is for reference only. The actual product shall prevail.

KYN61-40.5 Metalclad AC Enclosed Switchgear, Withdrawable Type



Medium Voltage Switchgear

KYN28-24 Metalclad AC Enclosed Switchgear, Withdrawable Type

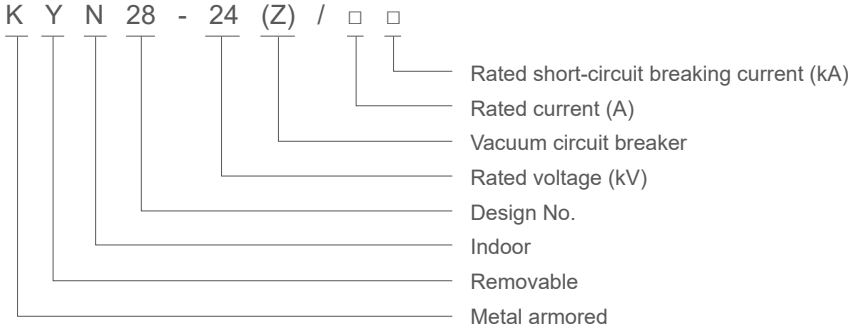
- KYN28-24 Metalclad AC Enclosed Switchgear, Withdrawable Type (hereinafter referred to as switchgear), suitable for indoor three-phase 50/60Hz, rated voltage 24kV power system, mainly used in power plants, substations, industrial and mining enterprises and high-rise buildings. It is used to receive and distribute electric energy and to control, protect and monitor circuits.
- Standard: IEC62271-200

General



KYN28-24 Metalclad AC Enclosed Switchgear, Withdrawable Type

Type designation



Operating conditions

1. +15°C~+40°C. And the average value measured within 24 hours shall not exceed 35°C
2. The average monthly relative humidity shall not exceed 90%
3. The average monthly water vapor pressure shall not exceed 1.8kPa;
4. Altitude: ≤1000m.
5. There is no obvious dust or smoke in the surrounding air: pollution caused by corrosive or combustible gases, vapors, or salt mist;
6. Vibration or ground motion from outside the switchgear and control equipment can be ignored;
7. The amplitude of electromagnetic interference induced in the secondary system shall not exceed 1.6kV

Features

1. The cabinet is made of aluminum-zinc coated sheet processed by CNC equipment and assembled with bolts or rivets, with a fully modular structure.
2. This switchgear has various functions to prevent misoperations, including preventing loaded trolleys from moving, preventing live coupling and earthing switches, and preventing inadvertent entry into live compartments. The switchgear is equipped with high-quality VS1 series center-mounted AC high-voltage vacuum circuit breaker and fixed-sealed vacuum circuit breaker. The busbar adopts heat-shrinkable insulation material as the insulation means, optimized electrode shape, and compact cabinet structure. This switchgear is an advanced, stable performance, reasonable structure, easy-to-use, safe and reliable power distribution equipment.

KYN28-24 Metalclad AC Enclosed Switchgear, Withdrawable Type

Technical data

Item		Unit	Data			
Rated voltage		kV	24			
Rated frequency of circuit breaker		Hz	50/60			
Rated insulation level	Lightning impulse withstand voltage (peak)	kV	Phase - to - phase, phase - to - ground	60	Isolating fracture	79
	1min power frequency withstand voltage (effective value)	kV	Phase - to - phase, phase - to - ground	125	Isolating fracture	145
	Auxiliary control circuit power frequency withstand voltage	V	2000			
Rated current of circuit breaker		A	630, 1250			
Rated short-circuit breaking current		kA	20		31.5	
Rated short-circuit closing current (peak)		kA	50		80	
Rated short-time withstand current		kA	20		31.5	
Rated peak withstand current		kA	50		80	
Auxiliary control circuit rated voltage		V	AC or DC 110/220			
Protection degree		/	IP4X (IP2X when the front door is opened)			
Overall and mounting dimensions (mm) s (widthdepthheight)		mm	800×1810×2380		1000×1810×2380	
Weight		kg	840 - 1140			

Note:The depth of the overhead incoming and outgoing cabinet is 2360mm

VS1-24 Technical data

Item		Unit	Data	
Rated voltage		kV	24	
Rated insulation level	Lightning impulse withstand voltage (peak)	kV	60	
	1min power frequency withstand voltage (effective value)	kV	125	
Rated frequency of circuit breaker		Hz	50/60	
Rated current of circuit breaker		A	630, 1250	1250
Rated short - circuit breaking current		kA	20	31.5
Rated short - circuit closing current (peak)		kA	50	80
Rated short - time withstand current		kA	20	31.5
Rated peak withstand current		kA	50	80
Rated single capacitor bank breaking current		A	630	
Rated back to back capacitor bank breaking current		A	400	
Rated short - circuit breaking current breaking times		Times	50	
Mechanical life		Times	20000	
Rated operating sequence			O - 0.3s - CO - 180s - CO	

KYN28-24 Metalclad AC Enclosed Switchgear, Withdrawable Type

VS1-24 Technical data

Item		Unit	Data
Rated voltage	closing and tripping coil	V	AC220, AC110, DC220, DC110
	opening and tripping coil		AC220, AC110, DC220, DC110
Working current	closing and tripping coil	A	AC220 or DC220 : 1.1A
	opening and tripping coil		AC110 or DC110 : 3.1A
Energy storage motor power		W	80, 100
Energy storage motor rated voltage		V	AC220, AC110, DC220, DC110
Energy storage time		S	≤10

Structure and working principle

The KYN28-24 switchgear consists of two main parts: a cabinet body and a removable component (commonly known as a handcart).

The cabinet is divided into multiple functional compartments using metal partitions, such as busbar compartment, circuit breaker compartment, cable compartment, and relay instrument compartment.

The movable components of the switchgear can be equipped with vacuum circuit breaker handcart, voltage transformer handcart, lightning arrester handcart, isolation handcart, and fuse handcart.

A. busbar room B. Circuit breaker handcart room C. Cable room D. Relay instrument room

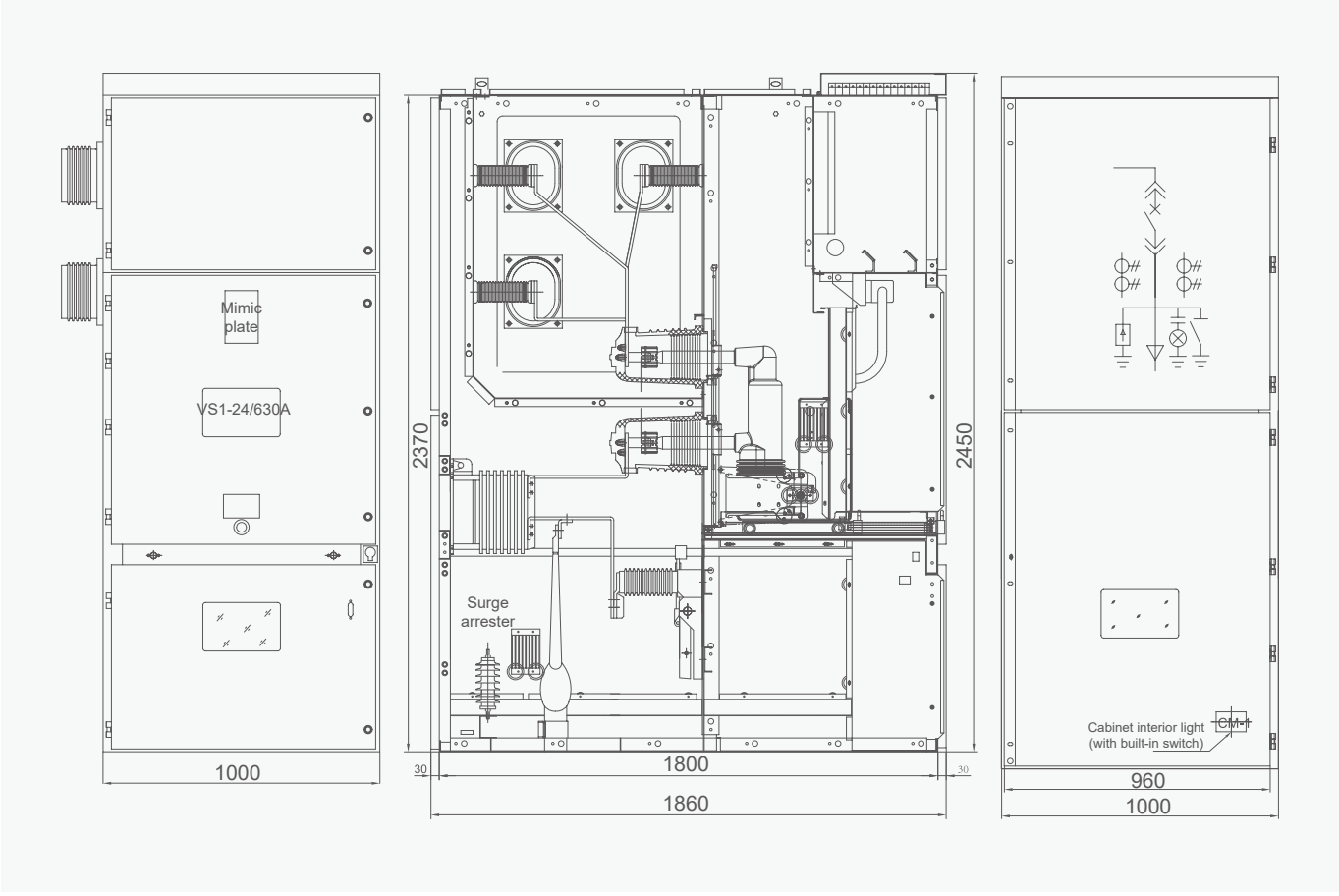
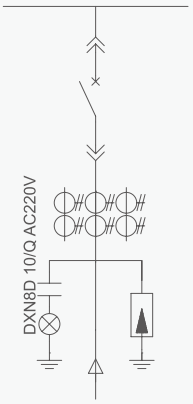


Figure 1 Schematic diagram of KYN28-24 Switchgear

KYN28-24 Metalclad AC Enclosed Switchgear, Withdrawable Type

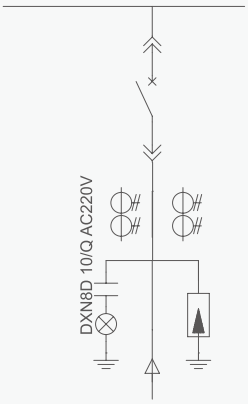
Technical solution book

Incoming Panel 1



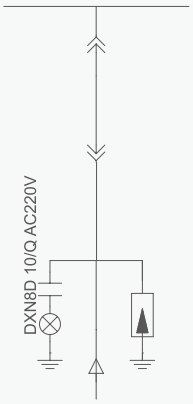
KYN28-24 630~1250A
1000*1800*2300

Incoming Panel 2



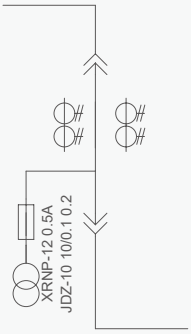
KYN28-24 630~1250A
1000*1800*2300

Incoming Panel 3



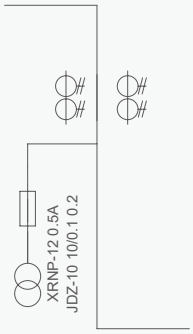
KYN28-24 630~1250A
1000*1800*2300

Metering Panel 1



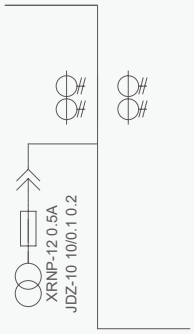
KYN28-24 630~1250A
1000*1800*2300

Metering Panel 2



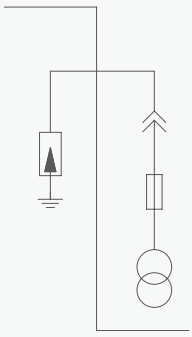
KYN28-24 630~1250A
1000*1800*2300

Metering Panel 3



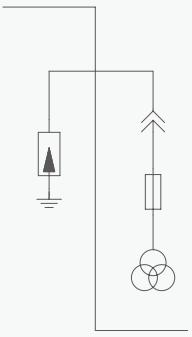
KYN28-24 630~1250A
1000*1800*2300

PT Panel 1



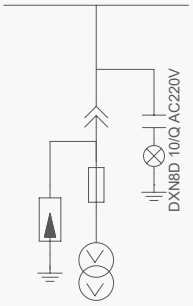
KYN28-24 630~1250A
1000*1800*2300

PT Panel 2



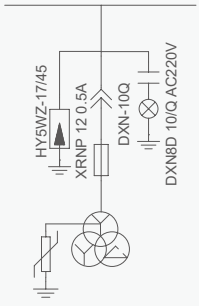
KYN28-24 630~1250A
1000*1800*2300

PT Panel 3



KYN28-24 630~1250A
1000*1800*2300

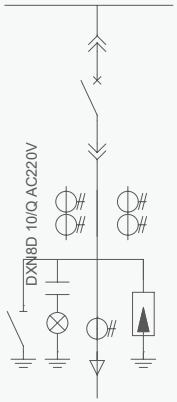
PT Panel 4



KYN28-24 630~1250A
1000*1800*2300

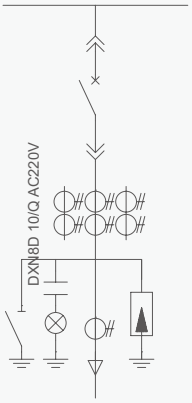
KYN28-24 Metalclad AC Enclosed Switchgear, Withdrawable Type

Outgoing Panel 1



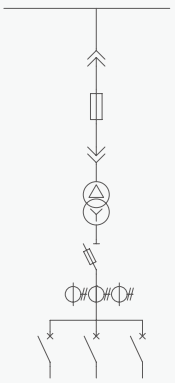
KYN28-24 630~1250A
1000*1800*2300

Outgoing Panel 1



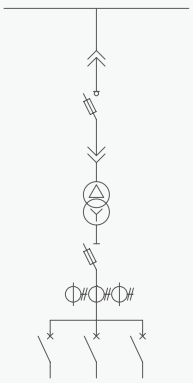
KYN28-24 630~1250A
1000*1800*2300

Auxiliary Transformer Panel 1



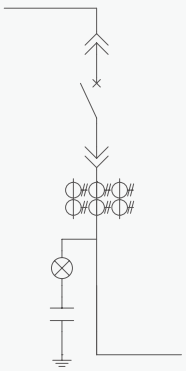
KYN28-24 630~1250A
1000*1800*2300

Auxiliary Transformer Panel 2



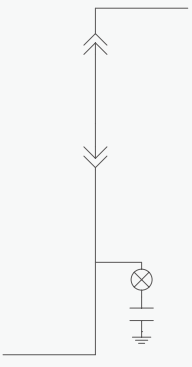
KYN28-24 630~1250A
1000*1800*2300

Bus Coupler Panel 1



KYN28-24 630~1250A
1000*1800*2300

Bus Sectionalizing Panel 1



KYN28-24 630~1250A
1000*1800*2300

Medium Voltage Switchgear

KYN28-12 Metalclad AC Enclosed Switchgear, Withdrawable Type

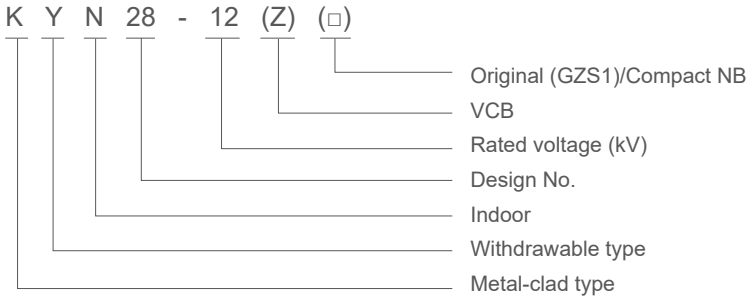
- KYN28A - 12 indoor metal clad movable switchgear is a complete power distribution device for 3.6kV - 12kV, 3 phase AC 50/60Hz, single bus sectionalized system. It is mainly used for power transmission of middle/small generators in power plants, power receiving, transmission for substations in power distribution and power system of factories, mines and enterprises etc. so as to control, protect and monitor the system.
- Standard: IEC62271 - 200

General



KYN28-12 Metalclad AC Enclosed Switchgear, Withdrawable Type

Type designation



Operating conditions

1. Ambient air temperature: -15°C~+40°C.
2. Altitude: ≤1000m.
3. Relative humidity : Daily average≤95%, daily average of vapour pressure≤2.2kpa.
4. Earthquake intensity: ≤magnitude 8.
5. Applicable in the places without corrosive and flammable gas and water vapor.
6. Used in place without frequently intense vibrant.

Note: Customized products are available.

Features

1. The cabinet is made of aluminum-zinc coated sheet processed by CNC equipment, and is assembled by bolts or rivets. The structure is fully assembled.
2. The switchgear has various functions to prevent misoperation, including preventing the load-bearing handcart from moving, preventing the live closing and grounding
3. The switchgear is equipped with high-performance VS1 series medium-voltage AC vacuum circuit breakers and solid-sealed vacuum circuit breakers.
4. The busbar adopts heat-shrinkable insulation materials and optimized electrode shapes, with a compact cabinet structure. This switchgear is technologically advanced, with stable performance, reasonable structure, convenient use, and safe and reliable power distribution equipment

KYN28-12 Metalclad AC Enclosed Switchgear, Withdrawable Type

Technical data

Item			Unit	Data
Rated voltage			kV	3.6, 7.2, 12
Rated frequency of circuit breaker			Hz	50
Rated current of circuit breaker			A	630, 1250, 1600, 2000, 2500, 3150, 4000
Rated current of switchgear			A	630, 1250, 1600, 2000, 2500, 3150, 4000
Rated short-time withstand current			kA	16, 20, 25, 31.5, 40
Rated withstand current (peak)			kA	40, 50, 63, 80, 100
Rated short-circuit breaking current			kA	16, 20, 25, 31.5, 40
Rated short-circuit closing current (peak)			kA	40, 50, 63, 80, 100
Rated insulation level	1 min power frequency withstand voltage	Between poles/pole to earth	kV	24, 32, 42
		Between open contacts	kV	24, 32, 48
	Lightning impulse withstand voltage (peak)	Between poles/pole to earth	kV	40, 60, 75
		Between open contacts	kV	46, 70, 85
Protection level				Shell: IP4X; IP2X when the CPT and CB doors are open

Notes:

1. The short circuit capacity of the current transformer should be separately considered.
2. See technical parameters of ZN63A-12 in related catalogues of our company.

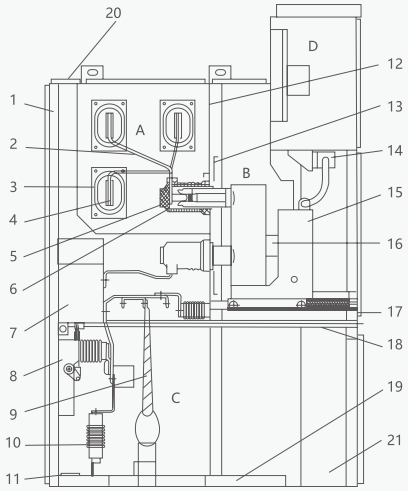
VS1-12 Technical data

Item		Unit	Value		
Rated voltage		kV	12		
Rated insulation level	Rated lightning impulse withstand voltage (peak)		75		
	1min power frequency withstand voltage		42		
Rated current		A	630, 1250	630, 1250, 1600, 2000, 2500, 3150	1250, 1600, 2000, 2500, 3150, 4000
Rated short circuit breaking current (kA)		kA	20/25	31.5	40
Rated thermal stable current (effective value)		kA	20/25	31.5	40
Rated dynamic stable current (peak value)			20/25	80	100
Rated short-circuit making current (peak value)			50/63	80	100
Rated short-circuit breaking current breaking times		Times	30	30	30
Secondary circuit power frequency withstand current		V	2000		
Rated operating sequence		/	Opening -0.3s - closing and opening - 180s - closing and opening -180s - closing and opening -180s - closing and opening (40kA)		
Rated thermal stability time		s	4		
Rated single/back to back capacitor bank breaking current		A	630/400		800/400
Mechanical life		Times	20000		10000

KYN28-12 Metalclad AC Enclosed Switchgear, Withdrawable Type

Structure

A. Busbar compartment
B. Circuit breaker trolley compartment
C. Cable compartment
D. Relay & instrument compartment
1. Shell
2. Small branch bus
3. Bus bushing
4. Main bus
5. Static contact assembly
6. Contact box
7. Current transformer
8. Earthing switch
9. Cable
10. Surge arrester



11. Earthing main busbar
12. Detachable partition
13. Board (Valve)
14. Secondary plug
15. Circuit breaker handcart
16. Heating device
17. Withdrawable level board
18. Earthing switch operation
19. Base board
20. Pressure releasing channel
21. Control mini bus

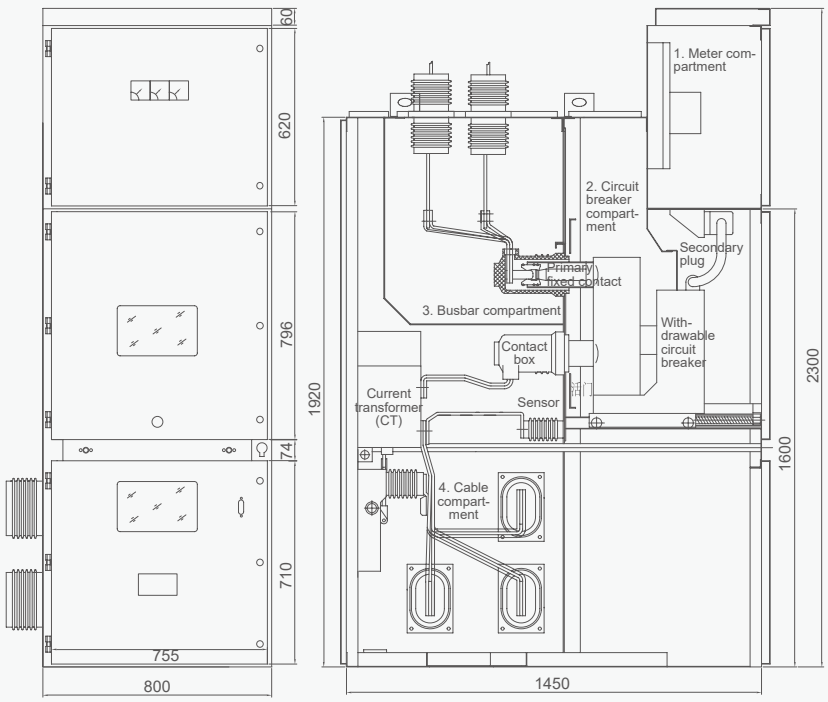
Overall and Mounting Dimensions (Refer to Picture 2, Sheet 2)

(mm)Sheet 2

Shape	Description	Size (mm)
Width (W)	Rated current of branch bus ≤1250A, heat stable current ≤40kA	800 (650)
	Rated current of branch bus ≥1600A	1000
Depth (C)	:Cable incoming and outgoing feeder	1500
	Overhead incoming and outgoing feeder	1660
Height (B)		2300 (2200)

Outline size

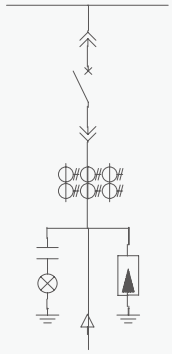
Picture 2



KYN28-12 Metalclad AC Enclosed Switchgear, Withdrawable Type

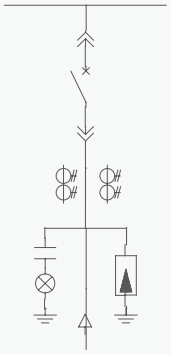
Technical solution book

Incoming Panel 1



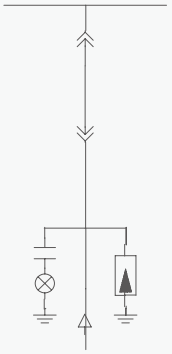
KYN28A-12 630~1250A
800*1500*2300

Incoming Panel 1



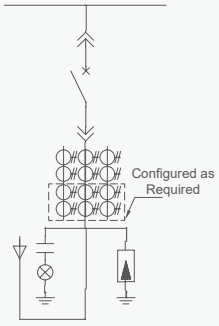
KYN28A-12 630~1250A
800*1500*2300

Incoming Panel 1



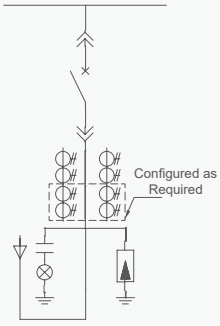
KYN28A-12 630~1250A
800*1500*2300

Incoming Panel 4
(Top Cable Entry)



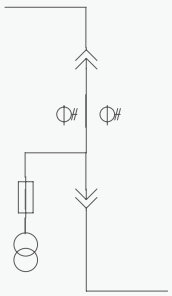
KYN28A-12 1600~4000A
1000*1660/1750*2300

Incoming Panel 5
(Top Cable Entry)



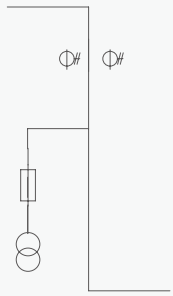
KYN28A-12 1600~4000A
1000*1660/1750*2300

Metering Panel 1



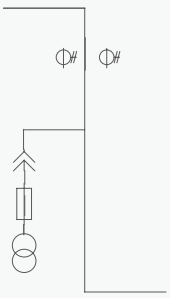
KYN28A-12 630~1250A
800*1500*2300

Metering Panel 1



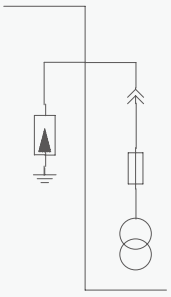
KYN28A-12 630~1250A
800*1500*2300

Metering Panel 1



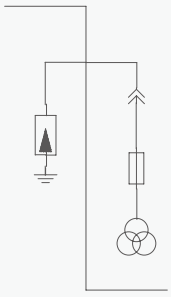
KYN28A-12 630~1250A
800*1500*2300

PT Panel 1



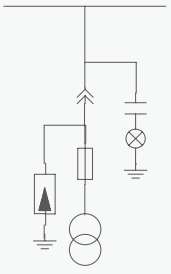
KYN28A-12 630~1250A
800*1500*2300

PT Panel 1



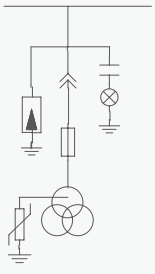
KYN28A-12 630~1250A
800*1500*2300

PT Panel 1



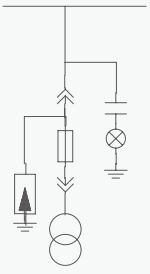
KYN28A-12 630~1250A
800/1000*1500*2300

PT Panel 1



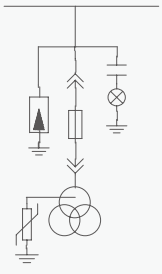
KYN28A-12 630~1250A
800/1000*1500*2300

PT Panel 1



KYN28A-12 630~1250A
800/1000*1500*2300

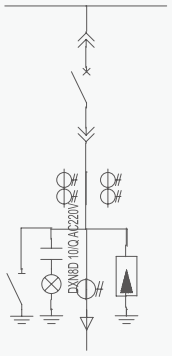
PT Panel 1



KYN28A-12 630~1250A
800/1000*1500*2300

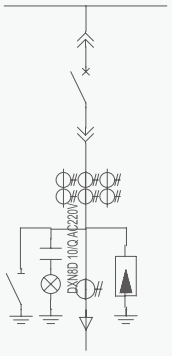
KYN28-12 Metalclad AC Enclosed Switchgear, Withdrawable Type

Outgoing Panel 1



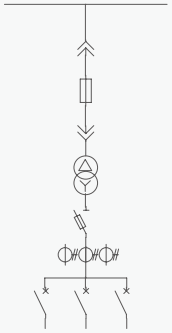
KYN28A-12 630~1250A
800*1500*2300

Outgoing Panel 1



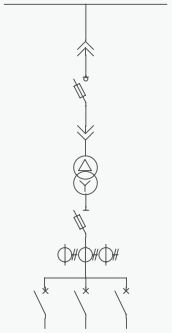
KYN28A-12 630~1250A
800*1500*2300

Auxiliary Transformer Panel 1



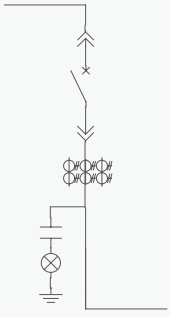
KYN28A-12 630~1250A
800/1000*1500*2300

Auxiliary Transformer Panel 2



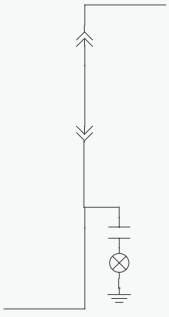
KYN28A-12 630~1250A
800/1000*1500*2300

Bus Sectionalizing & Bus Coupler Panel 1



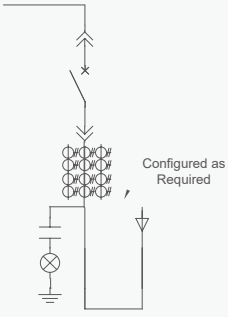
KYN28A-12 630~1250A
800*1500*2300

Bus Sectionalizing & Isolation Panel 1



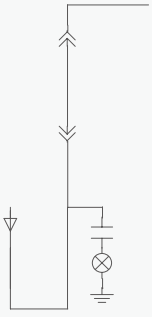
KYN28A-12 630~1250A
800*1500*2300

Bus Sectionalizing & Bus Coupler Panel 2 (Top Cable Entry)



KYN28A-12 1600~4000A
1000*1660/1750*2300

Bus Sectionalizing & Isolation Panel 2 (Top Cable Entry)



KYN28A-12 1600~4000A
1000*1660/1750*2300

Medium Voltage Switchgear

XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

- Rating:
  Rated voltage 12/24kV, rated current reach to 630A.

  Application:
  mainly applicable in urban power grid features and renovation project, industrial and mining enterprises, high-rise buildings and communal facilities. For power distribution, controlling and protection on electric equipment as the loop power supply unit or terminal equipment. It also can be installed in pre-loaded substation
- Feature:
  Use SF6 load switch and load switch-fuse combination as main switch. Equipped with vacuum load switch and spring operating mechanism which can be operated by hand or electric. Grounding switch and insulating switch are equipped with hand operating mechanism, with small volume and high security.
- Standard: IEC60420

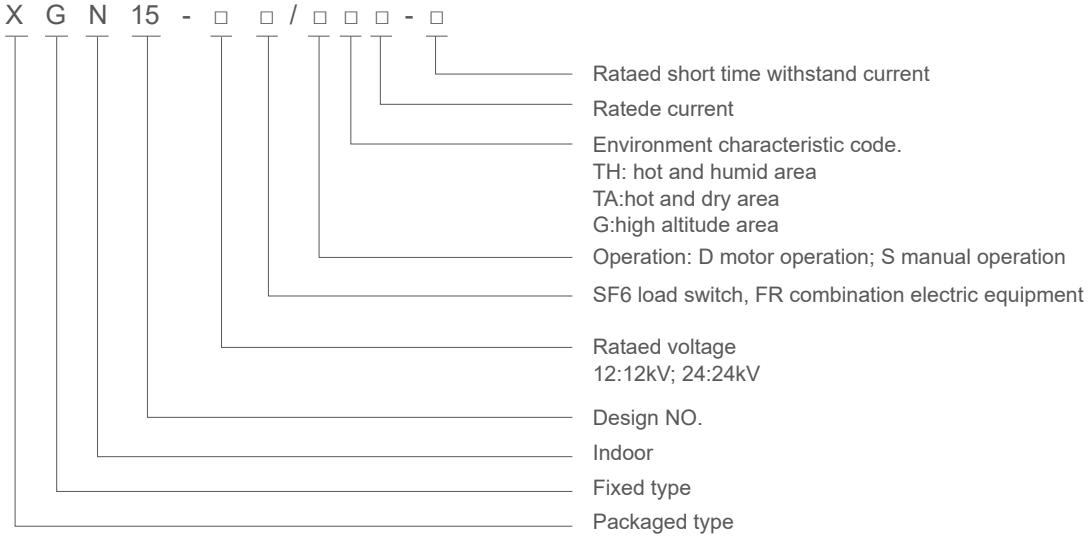
General





XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

Type designation



Operating conditions

1. Ambient air temperature: -15°C~+40°C. Daily average temperature:≤35°C.
2. Altitude: ≤1000m.
3. Relative humidity : Daily average≤95%, daily average of vapour pressure≤2.2kpa Monthly average≤90%, monthly average of vapour pressure≤1.8kpa.
4. Earthquake intensity: ≤magnitude 8.
5. Applicable in the places without corrosive and flammable gas.

Note: Customized products are available.

Features

1. Modular design, where each unit module can be combined and expanded arbitrarily, facilitating flexible system configurations and wide adaptability.
2. The cabinet adopts armored structure with metal partitions between compartments.
3. The operating mechanism adopts corrosion-resistant metals, and the rotating parts are designed with self-lubricating bearings, ensuring unaffected performance in various environments and eliminating the need for regular maintenance.
4. To accommodate power grid automation, and improve distribution reliability, it can be equipped with motorized mechanisms, distribution network control terminal units, and possesses telecontrol functions.
5. The compact design of the cabinet incorporates a three-position rotary load switch, effectively reducing the number of components and enabling mechanical interlocking for five protection measures.
6. The primary circuit simulation single-line diagram and analog display can demonstrate the internal status of the switch, enabling easy, accurate, and safe operation.

XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

Technical data (CNC Type)

Rated voltage		Unit	12kV			24kV
Item		/	Load switch cabinet	Combined electrical cabinet	Circuit breaker cabinet	20kVSF6 Ring switch equipment
Rated frequency		HZ	50/60	50/60	50/60	50/60
Rated current		A	/			
Main busbar		A	630	630	630	630
Branch busbar		A	630	125①	630	630/□100②
Rated insulation level		KV	/			
Power frequency withstand voltage	Phase-to-phase and phase-to-ground	KV	42	42	42	65
	Gap between breaks	KV	48	48	48	/
	Break control and auxiliary circuit	KV	2	2	2	/
Lightning impulse withstand voltage	Phase-to-phase and phase-to-ground	KV	75	75	75	85
	Gap between breaks	KV	85	85	85	/
Rated short-time withstand current		KA	/			
Main circuit		KA	20/3s	-	25/2s	/
Grounding circuit		KA	20/25	-	25/2s	/
Rated peak withstand current		KA	50	-	63	/
Rated short-circuit making current		KA	50	80	63	50
Rated short-circuit breaking current		KA	-	31.5	25	31.5
Rated transfer current		A	-	1750	-	870
Rated active load breaking current		A	630	-	-	630
Rated closed loop breaking current		A	630	-	630	/
Rated cable charging breaking cable		A	10	-	15	25
Protection degree		/	IP3X	IP3X	IP3X	/
Mechanical life	Load switch	times	5000	5000	10000	3000
	Grounding switch	times	2000	2000	2000	2000

Notes:

① up to the fuse rated current

② ≤100 (Load switch - Fuse combination cabinet)

XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

Structure

- Busbar room

1. The busbar room is arranged at the upper part of the cabinet.
   In the busbar room, the main busbar is connected together and runs through
2. The entire row of switchgear

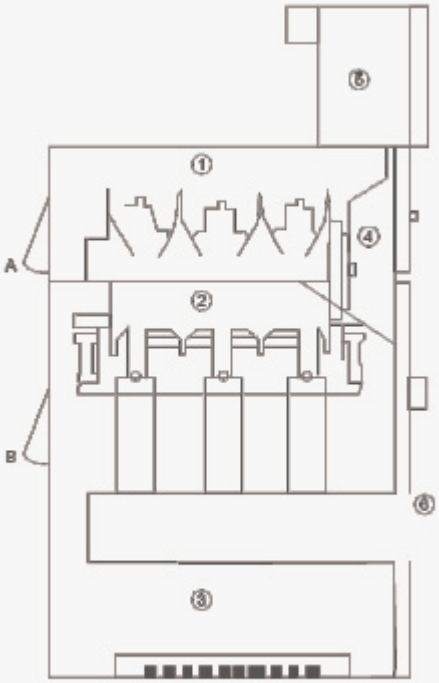
- Load switch

1. There is a three position load switch installed in the switch room. The shell of the load switch is made of epoxy resin cast columns, and filled with sulfur hexafluoride (SF6) gas as the insulation medium. SF6 gas density meters or gas density meters with alarm contacts can be installed in the switch room according to customer requirements

- Cable room

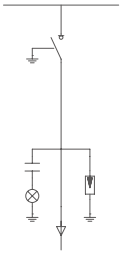
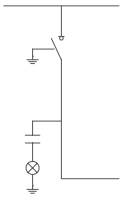
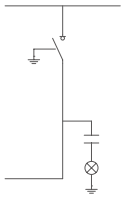
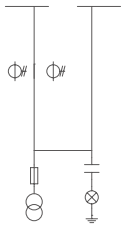
1. The load switch has a spacious cable room, mainly used for cable connections
2. With sufficient space also to install lightning arresters, current transformers, lower grounding switches and other components
3. Operating mechanism, interlock mechanism and low voltage control room
4. Spring operating mechanism and mechanical interlocking device with position indicator installed in low-voltage room
5. The low-voltage room can also be equipped with auxiliary contacts, trip coils,
6. Emergency trip mechanisms, capacitive live displays, keylocks, and electric operating devices
7. The low-voltage room space can also be used to install control circuits, metering instruments and protective relay
8. The 750mm wide cabinet has two identical low-voltage chambers, which can hold more accessories.

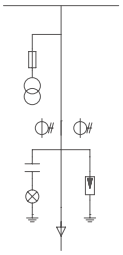
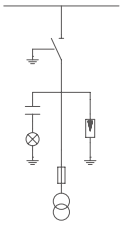
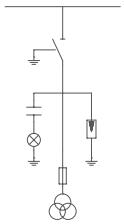
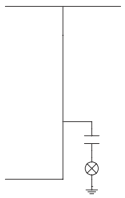
The whole XGN15 switchgear can be divided into upper and lower parts. The upper part of the cabinet includes busbar room, load switch, operating mechanism and low-voltage room, which is separated from the lower part of the cable room. Therefore, it is safer and easier to repair and modify the equipment installed in the upper unit, and to replace the whole upper unit.

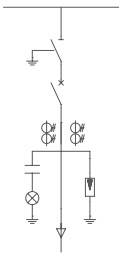
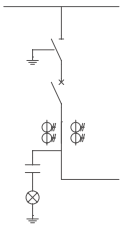
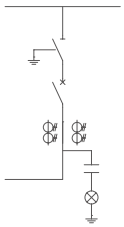
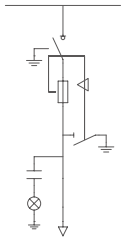


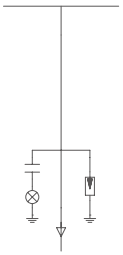
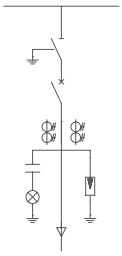
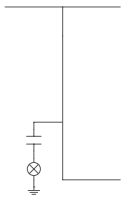
XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

Phase plan

Scheme 1	Scheme 2	Scheme 3	Scheme 4
			
Incoming Line 1	Bus Section Isolator 1	Bus Section Isolator 2	Metering

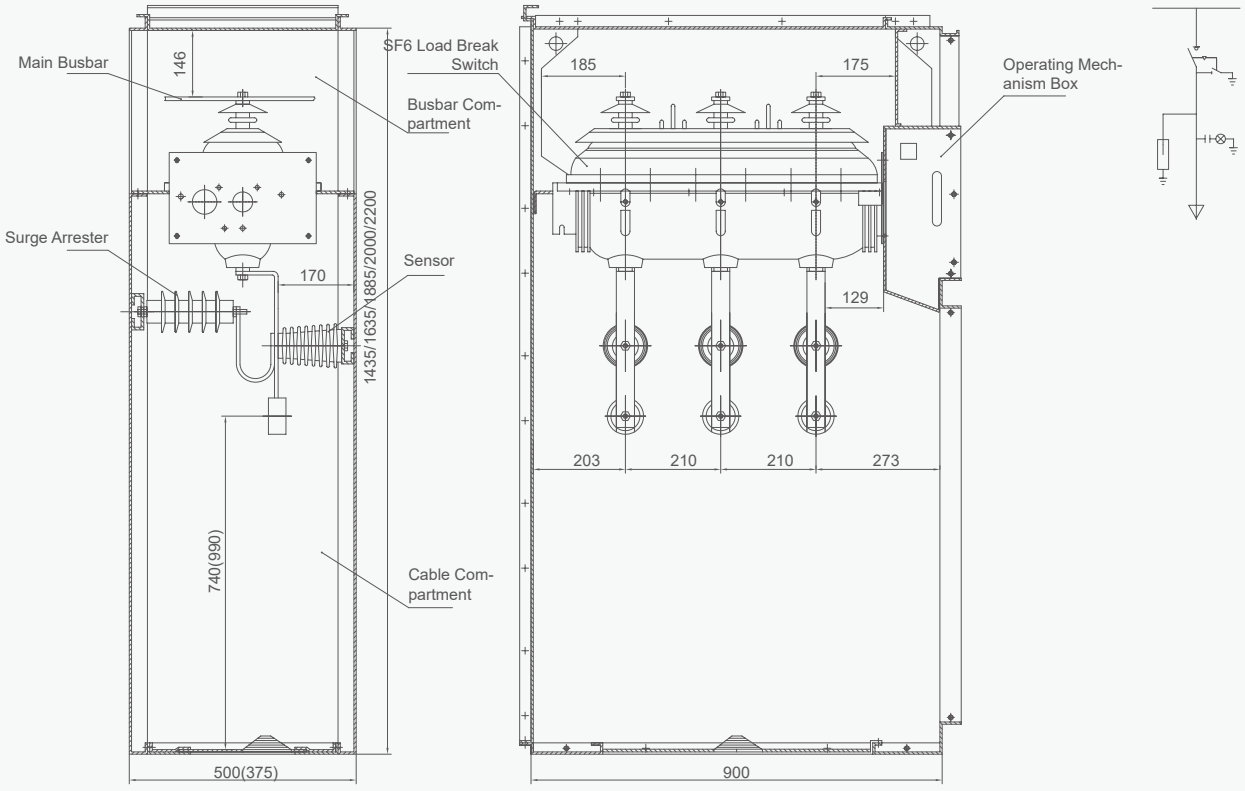
Scheme 5	Scheme 6	Scheme 7	Scheme 8
			
Incoming Metering	PT 1	PT 2	Bus Section Lifting 2

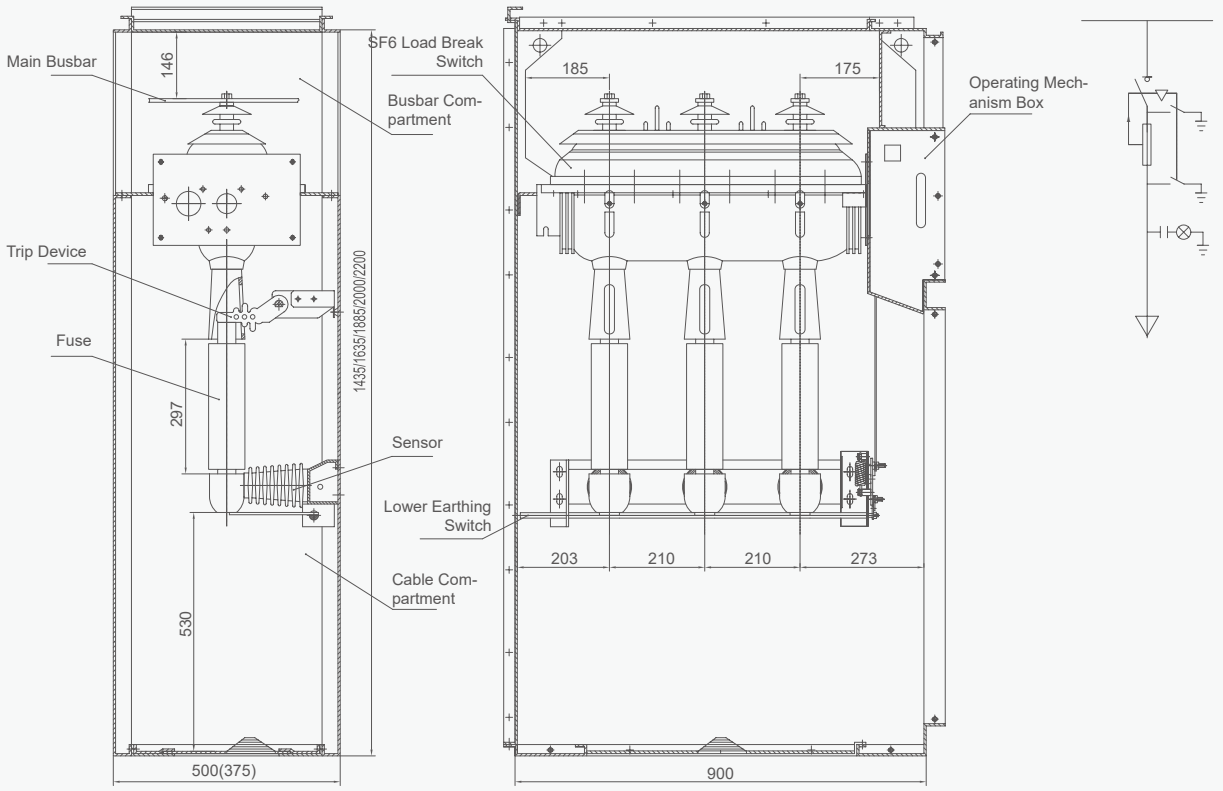
Scheme 9	Scheme 10	Scheme 11	Scheme 12
			
Incoming Circuit Breaker	Bus Section Circuit Breaker 1	Bus Section Circuit Breaker 2	Outgoing Line 1

Scheme 9	Scheme 10	Scheme 12
		
Incoming Lifting	Outgoing Circuit Breaker	Bus Section Lifting 1

XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

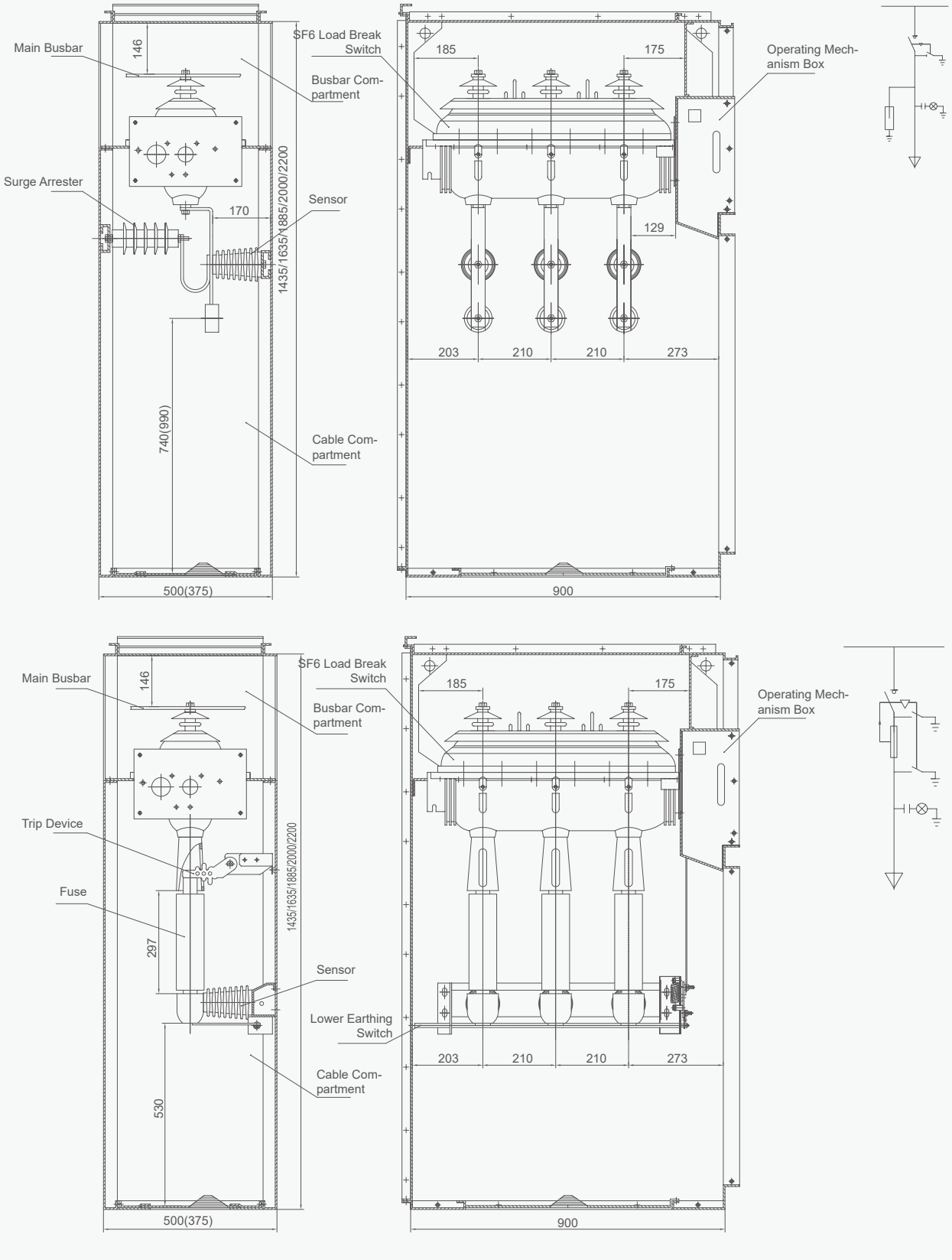
XGN15-12 Overall and mounting dimensions (mm)





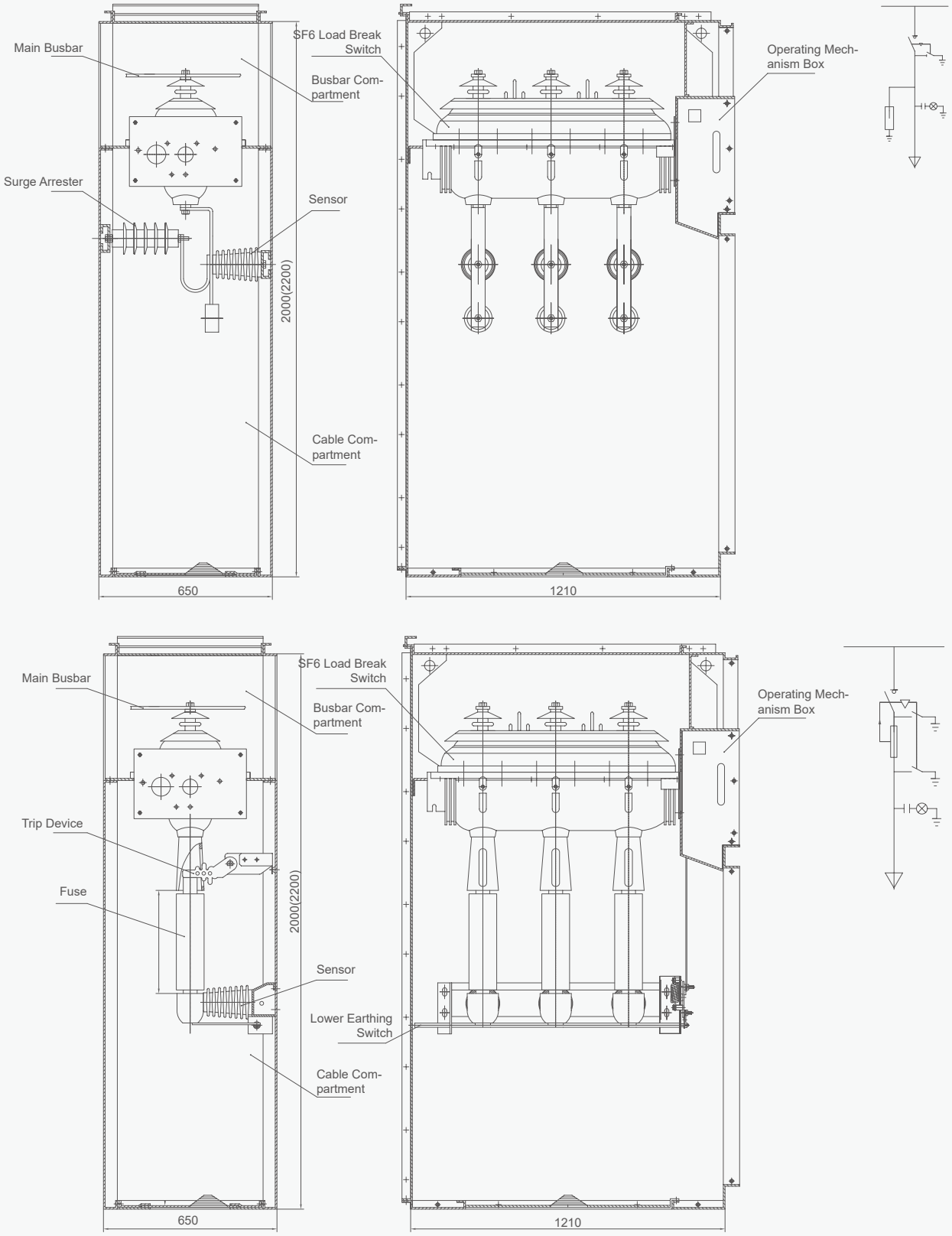
XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

XGN15-12(CNC Type) Overall and mounting dimensions (mm)



XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

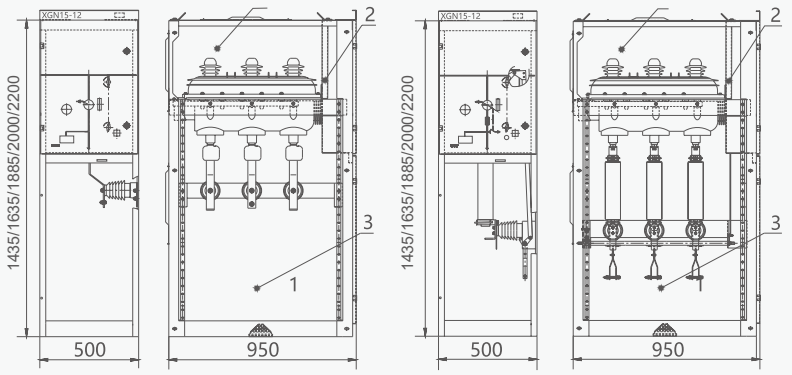
XGN15-24(CNC Type) Overall and mounting dimensions (mm)



XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

XGN15-12 Overall and mounting dimensions (mm)

Picture 1

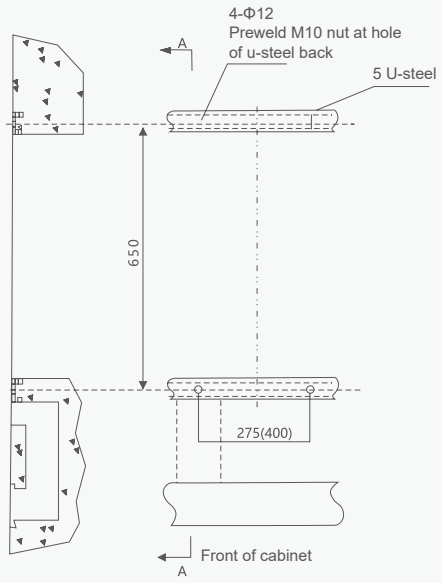


Ring main unit (load switchgear) Ring main unit (combination switchgear)

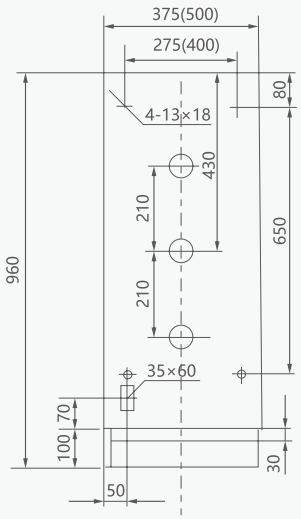
1. Bus compartment
2. Meters compartment
3. Cable compartment

Schematic diagram of foundation

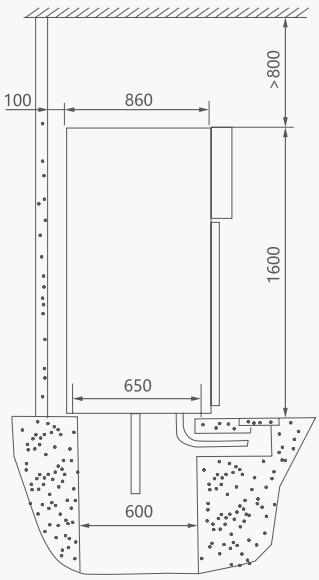
Switchgear diagrammatic sketch Picture 2



Switchgear installation Overall and mounting dimensions (mm)



Cable incoming and outgoing configuration



Ordering information

1. Main circuit diagram, busbar diagram for main circuit, allocation diagram.
2. Switchgear outline size.
3. Spare parts and their quantity.
4. Customized products are available per your requirements.
5. The dimensions shown for the SM6-type ring main unit are the minimum cabinet dimensions. Customers are recommended to select a cabinet size equal to or larger than the dimensions shown.

Medium Voltage Switchgear

YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

- YSM6-12/24 unit type SF6 RMU with SF6 load switch as main switch, for whole cabinet is suitable for electric distribution automation and compact also expandable metal close switchgear. It characters in its simple structure, flexible operation, reliable interlocking and convenient installation etc., which can provide the satisfactory technical projects both for different application occasions and users. With the adoption of sensor technology and the protection relay up to date, plus the advanced technology and flexible assembly project.
- YSM6-12/24 unit type SF6 RMU can completely meet the requirement of continuously variable market. It can take self-produced SF6-12/24 load break switch; Operational methods for the main switch inside ring main unit can be either manual or electric power driven. And it can meet the requirement of “Four Controls” when matched with FTU and RTU.

General



YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

Type designation



Operating conditions

1. Air temperature: Maximum temperature: +40°C; Minimum temperature: 5°C
2. Humidity: Monthly average humidity 95%; Daily average humidity 90%
3. Altitude above sea level: Maximum installation altitude: 2000m
4. Ambient air not apparently polluted by corrosive and flammable gas, vapor etc.
5. No frequent violent shake

Features

1. Incoming unit with switch disconnector (Load break switch) schemas. With other extra components optional. Outgoing unit with
2. Fuse-switch protection schemas
3. With other extra components optional. Incoming/outgoing circuit breaker protection schemas. With other extra components
4. Optional MV metering schemas
5. With other extra components optional. Casings (Bus bar Panel) schemas. With other extra components optional
6. Others

YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

Technical data (SM6 Type)

Rated voltage	Ur kV	kV		7.2	12	17.5	24	36
Insulation level								
Insulation	Ud	50/60 Hz, 1 min (kV rms)		20	28	38	50	70
Isolation	Ud	50/60 Hz, 1 min (kV rms)		23	32	45	60	80
Insulation	Up	1.2/50 µs (kV peak)		60	75	95	125	170
Isolation	Up	1.2/50 µs (kV peak)		70	85	110	145	195
Breaking capacity								
Transformer off load		A		16				
Cables off load		A		31.5				50
Rated current	Ir	A		400 - 630 -1250				630-1250
Short-time withstand current	Ik/tk[1]	kA/1 s	25	630 - 1250				1250
			20[2]	630 - 1250				
			16	630 - 1250				
			12.5	400 - 630 - 1250				630-1250
Making capacity (50 Hz)	Ima	kA	62.5	630		NA		
			50	630				
			40	630				
			31.25	400 - 630				630
Maximum breaking capacity (Isc)								
Units IM, IMC, IMB, IMM		A		630 - 800[3]				630
NSM-cables, NSM-busbars		A		630 - 800[3]				NA
QM, QMC, QMB		kA		25		20		20
PM		kA		25				20
CVM		kA		6.3	NA			
CVM with fuses		kA		25	NA			
SF6 circuit breaker range				7.2	12	17.5	24	36
DM1-A, DM1-D, DM1-W	kA	25		630-1250				1250
		20		630-1250				
DM1-S, DM1-M	kA	25		630				NA
DM1-Z		25		1250				NA
DM2	kA	20		630				
		25		630				1250
Vacuum circuit breaker range				7.2	12	17.5	24	36
DMV-A, DMV-D	kA	25		630-1250			NA	
DMVL-A	kA	20		630				NA
DMVL-D	kA	25		630				NA

NA: Non Available

(1) 3 phases

(2) In 20 kA/3 s for SM6-24 only, consult us

(3) In 800 A, consult us.

YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

Units		Mechanical endurance	Electrical endurance
IM, IMC, IMB, IMM, PM, QM [1], QMC [1], QMB [1], NSM-cables, NSM-busbars		IEC 62271-103 1000 operations class M1	IEC 62271-103 100 breaks at Ir, p.f. = 0.7, class E3
CVM		Disconnector	IEC 62271-102 1000 operations
		Vacuum contactor	IEC 60470 2500000 operations 250000 with mechanical latching
SF6 circuit breaker range			
DM1-A, DM1-D, DM1-M, DM1-W, DM1-Z, DM1-S, DM2	Disconnector	IEC 62271-102 1000 operations	
	SF circuit breaker	IEC 62271-100 10000 operations class M2	IEC 60271-016 30 breaks at 12.5 kA for SM6-24 25 breaks at 25 kA for SM6-24 40 breaks at 16 kA for SM6-36 15 breaks at 25 kA for SM6-36 10000 breaks at Ir, p.f. = 0.7, class E2
		Operating sequence	O - 0.3s - CO - 15s - CO O - 0.3s - CO - 3mn O - 3mn - CO - 3mn - CO
Vacuum circuit breaker range			
DMV-A, DMV-D	Switch	IEC 62271-103 1000 operations class M1	IEC 62271-103 100 breaks at Ir, p.f. = 0.7, class E3
	Evolis circuit breaker	IEC 62271-100 10000 operations class M2	IEC 62271-100 100 breaks at 25kA for SM6-24 10000 breaks at Ir, p.f. = 0.7, class E2
DMVL-A, DMVL-D	Disconnector	IEC 62271-102 1000 operations	
	Evolis circuit breaker	IEC 62271-100 10000 operations class M2	IEC 62271-100 100 breaks at 16kA for SM6-24 100 breaks at Ir, p.f. = 0.7, class E2

(1) As per recommendation IEC 62271-105, three breakings at p.f. = 0.2

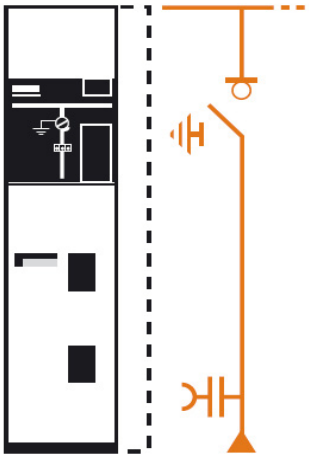
800 A under 36 kV; 1400 A under 24 kV; 1730 A under 12 kV; 2600 A under 5.5 kV.

Internal arc withstand (in accordance with IEC 62271-200)		
SM6-24	Basic	12.5 kA 1 s, IAC: A-FL
	Advance	12.5 kA 1 s, IAC: A-FLR & IAC: A-FL
		16 kA 1 s, IAC: A-FLR & IAC: A-FL
		20 kA 1 s, IAC: A-FLR & IAC: A-FL
SM6-36		16 kA 1 s, IAC: A-FL

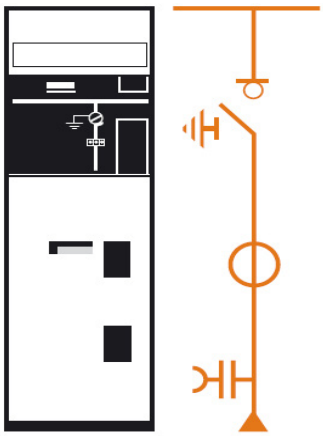
YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

For distribution switchboard schema

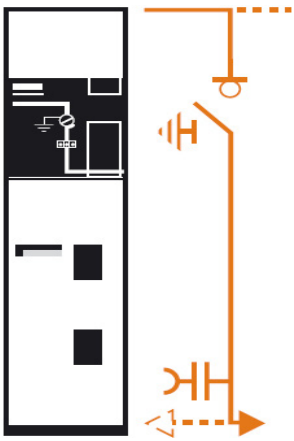
1.:Switch disconnector



Switch unit
(375/500 mm)



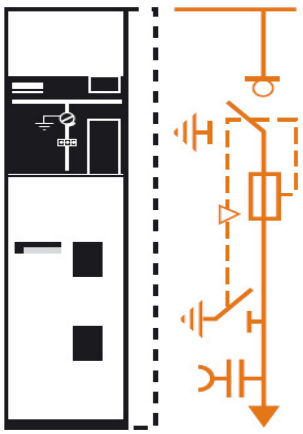
Switch unit
(500 mm)



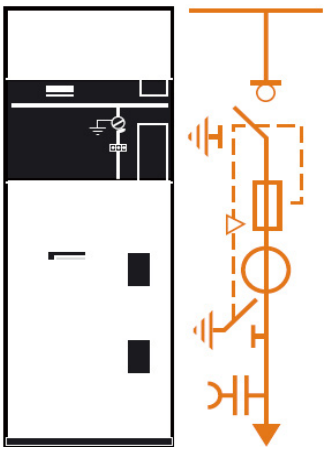
Switch unit-with/ without earthing switch -right or lef toutgoing line
(375 mm)

Note: Extra components for example lightning arresters or lower earthing switch is optional.

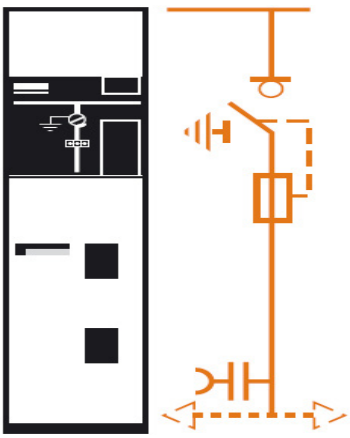
2.:Fuse-switch protection



Fuse-switch-combinati on unit
(375/500 mm)



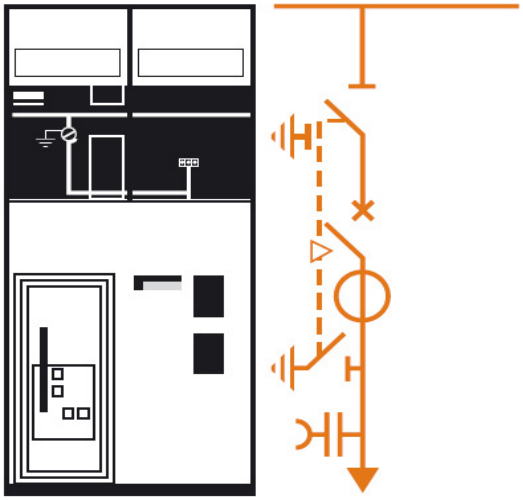
Fuse-switch-combination unit
(625 mm)



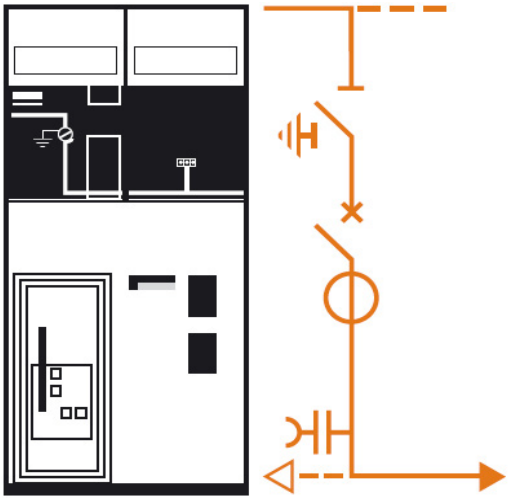
Fuse-switch-combination unit-
right or left outgoing line (375mm)

Note: Extra components for example lightning arresters or zero sequence CT is optional.

3.:Circuit-breaker protection



Single-isolation circuit breaker unit (750 mm)

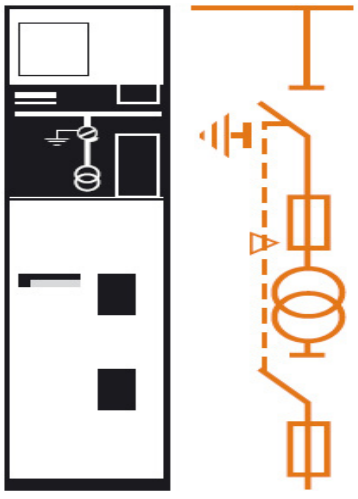


Single-isolation circuit breaker unit right or left outgoing line (750 mm)

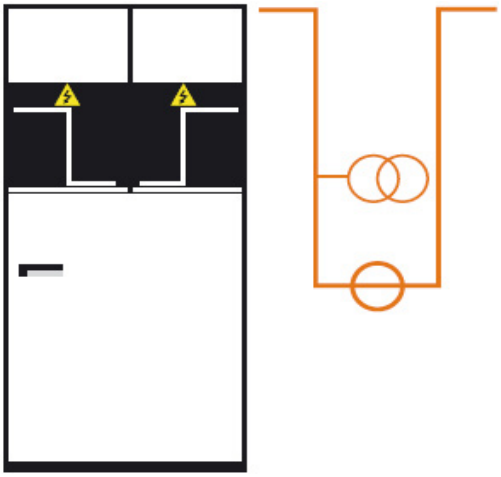
Note:

1. For HV SF6 circuit breaker also with many types can be selected. it ls according to client's requirement . (Sf1/schneider, PF/Areva, etc.) Also Vacuum circuit breaker is also optional.(VD4/S-12/24 or SF6-12/24)
2. Other extra components for example Zero sequence CT is considering after communicated by our company.

4.:MV metering



Voltage transformers for mains with earthed neutral system (375/500 mm)



Current and/or voltage measurement unit (750 mm)

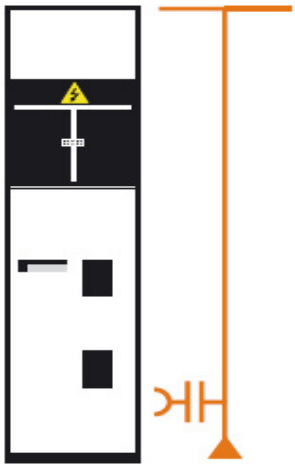
Note: Extra components for example lightning arresters or zero sequence CT is optional.

YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

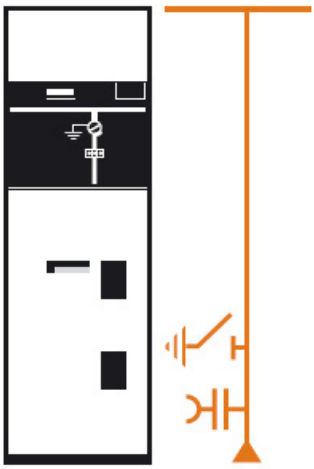
5.:Casings (Bus bar Panel)



Connection unit
Right/left outgoing line (375 mm)



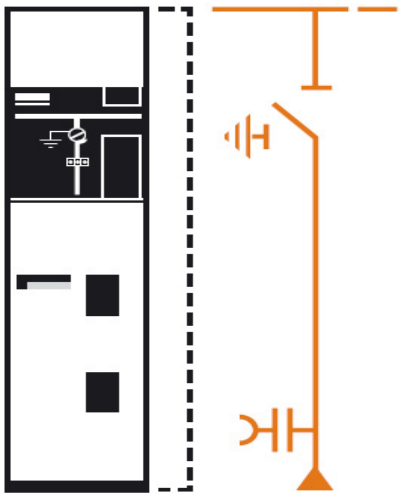
Incoming
cable-connection unit (375 mm)



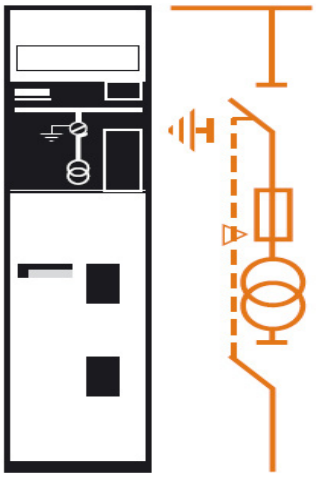
Incoming
cable-connection unit (500 mm)

Note: Other extra components is optional (Disconnecting switch panel, Voltage transformer panel, etc.)

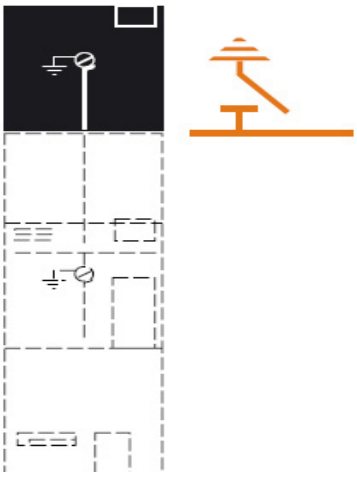
6.:Fuse-switch protection



Disconnector unit
(375/500 mm)

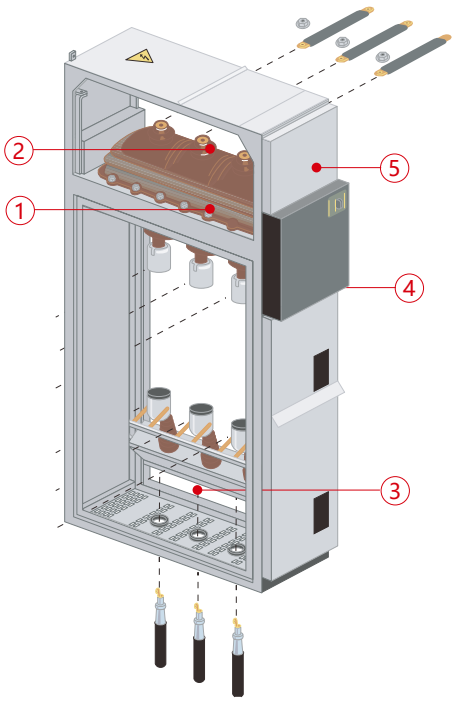


MV/LV transformer unit
for auxiliaries (375 mm)



Busbar earthing
compartment (375 mm)

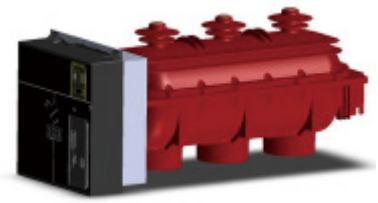
YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)



Parts for the unit type SF6 ring main unit:

1. Switch cubicle switch-disconnector and earthing switch in an enclosure filled with SF6 and satisfying “sealed pressure system” requirements.
2. Bus-bar cubicle all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.
3. connection cubicle accessible through front, connection to the lower switchdisconnector and earthing switch terminals (IM cubicles) or the lower fuseholders (PM and QM cubicles). This compartment is also equipped with an earthing switch downstream from the MV fuses for the protection units.
4. Operation mechanism, interlocking contains the elements used to operate the switch-disconnector and earthing switch and actuate the corresponding indications (positive break).
5. Low voltage cubicle (upper & lower enclosure structure) installation of a terminal block (if motor option installed), LV fuses and compact relay devices. Ifmore space is required, an additional enclosure may be added on top of the cubicle.
6. Optional switch cubicles (IM) can also be fitted with:control motorisation; surge arrestors.

YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)



The three-phase rotary contact is installed in a gas chamber filled with SF6 gas and the relative pressure is 0.4bars. It has excellent operation performance with safety and reliability.

- **Tightness**

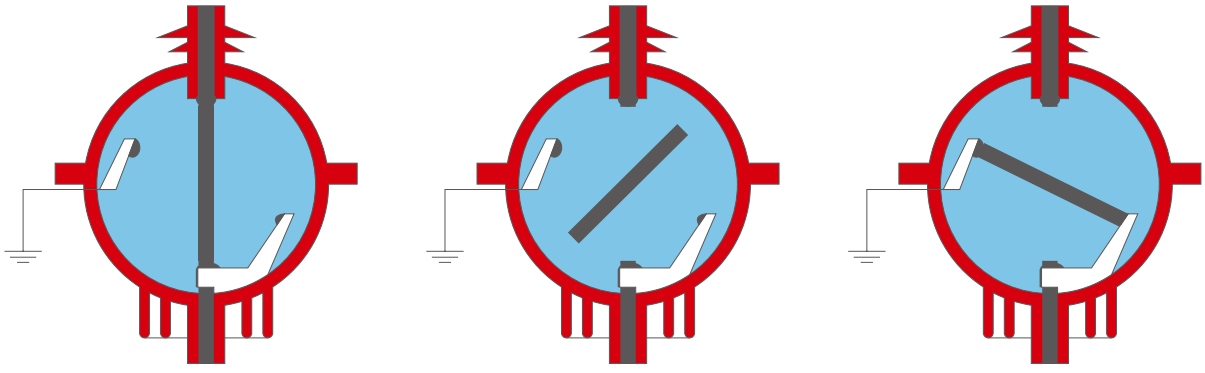
  The air chamber is filled with SF6 gas, which meets the standard requirements of “closed pressure system”, and the sealing performance has been checked and inspected in the factory.

- **Operational Safety**

  1. The switch has three positions of “closed”, “open” and “grounded”, and has a locking function to prevent accidental operation. The contact is driven to rotate by the spring energy storage mechanism, which is not affected by human operation factors.
  2. Has “break” and isolation functions.
  3. The short-circuit making capacity of the SF6 grounding switch meets the standard requirements.
  4. In the event of an accident, the pressure drops after the overpressured SF6 gas breaks through the safety diaphragm, and the gas will directly be sprayed into the back of the cabinet for safety.

- **Operational Safety**

  SF6 gas has excellent arc extinguishing performance. When the switch is opened, the relative movement between the arc and the gas will extinguish the arc. When the moving and static contacts are separated, the arc appears in the electromagnetic field generated by the permanent magnet, and the arc is elongated and extinguished when the current crosses zero by SF6 gas. The distance between the moving and static contacts is sufficient to withstand the recovery overvoltage. The system is simple and reliable, with minimal contact wear and long electrical life.

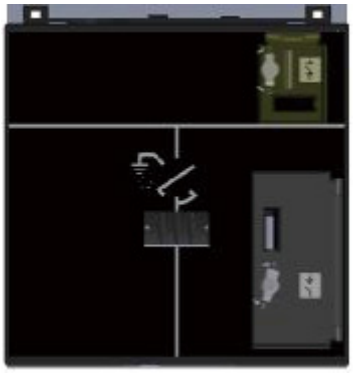


a) Earthing Position

b) Open Position

c) Closed Position

YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)



Cover for LBSkit 24 kV

- **Switchgear status indicator**

  Fitted directly to the drive shaft, these give a definite indication of the contact's position. (appendix A of standard IEC 62271-102).

- **Operating lever**

  This is designed with an anti-reflex device that stops any attempt to reopen the device immediately after closing the switch or the earthing disconnector.

- **Locking device**

  Between one and three padlocks enable the following to be locked:

  • access to the switching shaft of the switch or the circuit breaker

  • access to the switching shaft of the earthing disconnector

  • operating of the opening release push-button.

- **Simple and effortless switching**

  Mechanical and electrical controls are side by side on the front fascia, on a panel including the schematic diagram indicating the device's status (closed, open, earthed):

- **Closed**

  the drive shaft is operated via a quick acting mechanism, independent of the operator. No energy is stored in the switch, apart from when switching operations are taking place.

  For combined switch fuses, the opening mechanism is armed at the same time as the contacts are closed.



Voltage Indicator

- **Opening**

  the switch is opened using the same quick acting mechanism, operated in the opposite direction.

  For a combined switch fuses unit, opening is controlled by:

  • a push-button

  • a fault.

- **Earthing**

  a specific control shaft enables the opening or closing of the earthing contacts.

  Access to this shaft is blocked by a cover that can be slid back if the switch is open but which remains locked in place if it is closed.

- **Voltage presence indicator**

  This device has integrated VPIS (Voltage Presence Indicating System) type lights, in conformity with IEC standard 61958, enabling the presence (or absence) of voltage to be checked on the cables.

- **Insensitivity to the environment**

  • An internal sealed enclosure contains the active parts of the LBSkit (switch, earthing disconnector). It is filled with SF6 in accordance with the definitions in IEC recommendation 62271-200 for "sealed pressure systems".

  Sealing is systematically checked in the factory.

  • Parts are designed in order to obtain optimum electrical field distribution.

YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

Overall and mounting dimensions (mm)

Matching Overall and mounting dimensions (mm) of SF6 load break switch-fuse combination
Fig 1) SF6 load break switch without upper cubicle

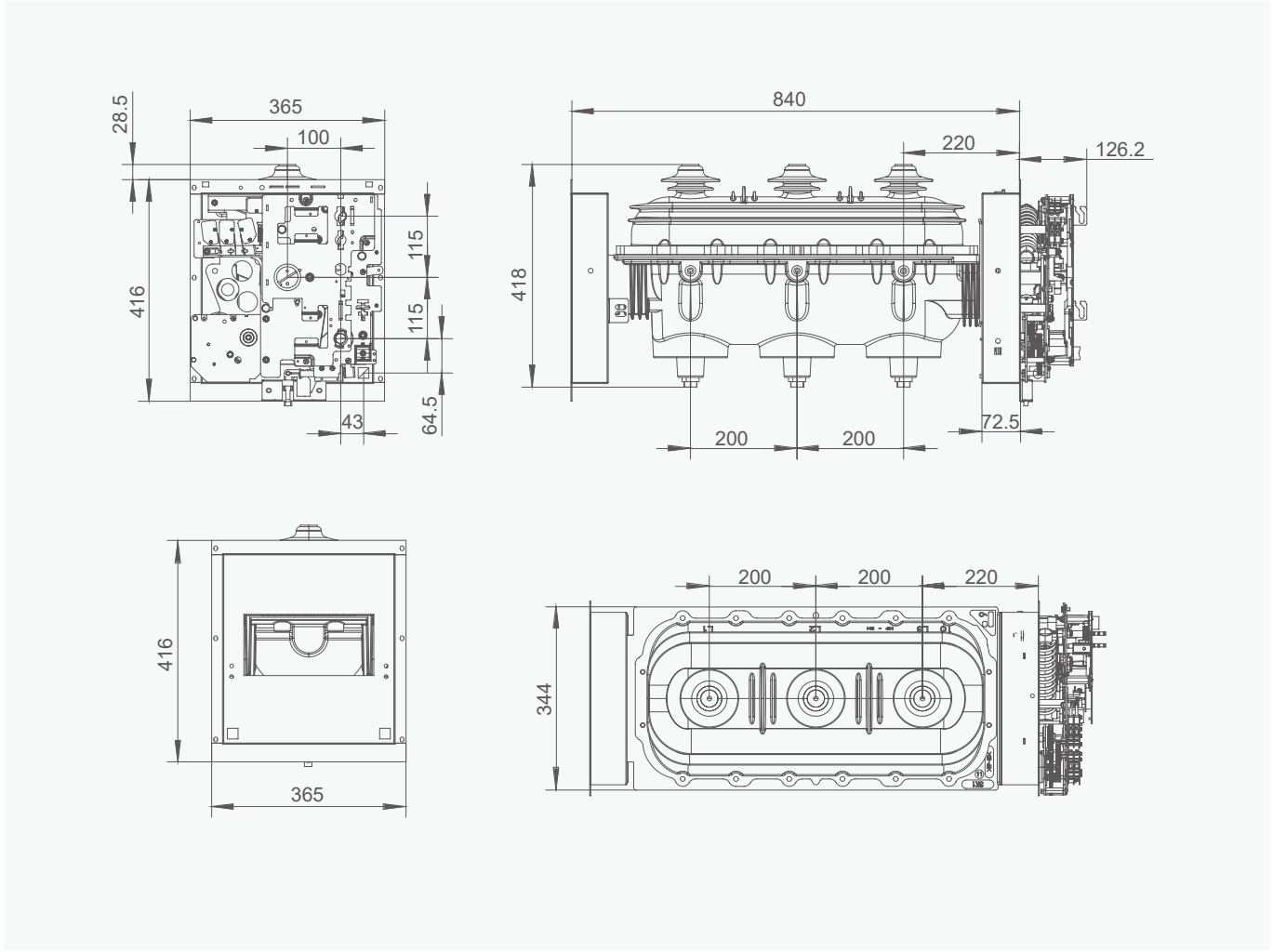
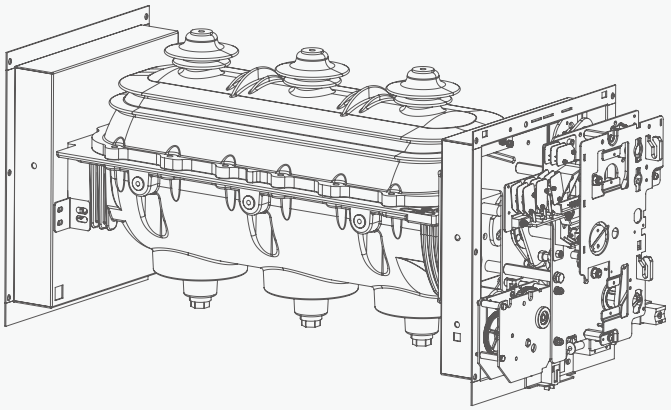


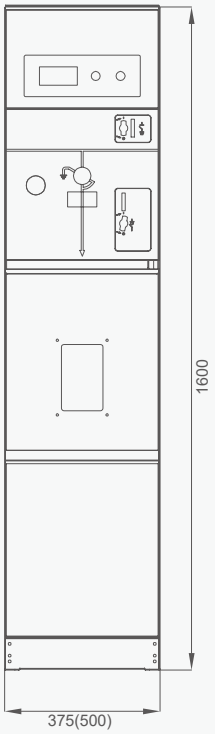
Fig 2) Whole Load break switch outline

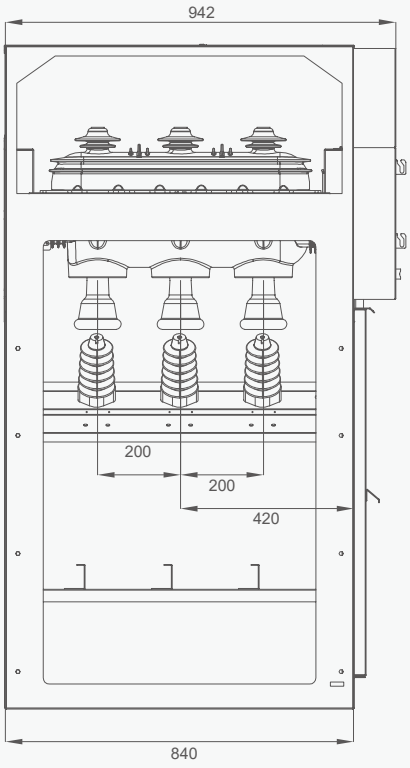


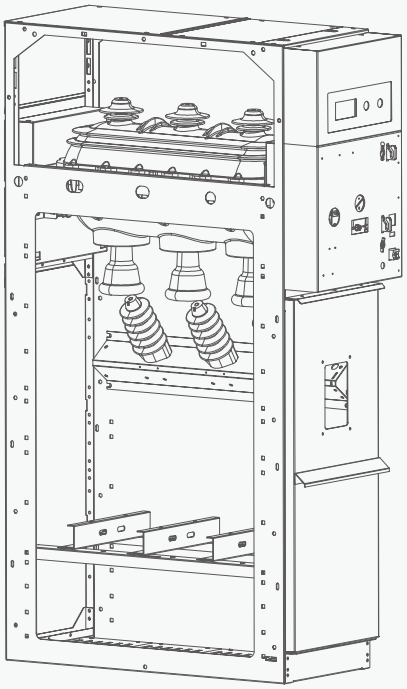
YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

YSM6-12,24,40.5 (SM6 Type) Overall and mounting dimensions (mm)

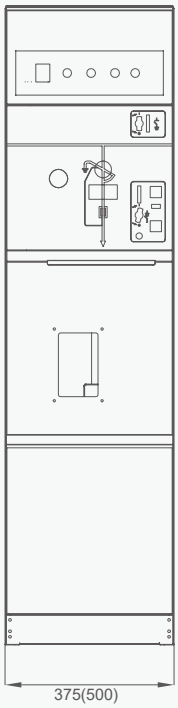
Incoming Cabinet

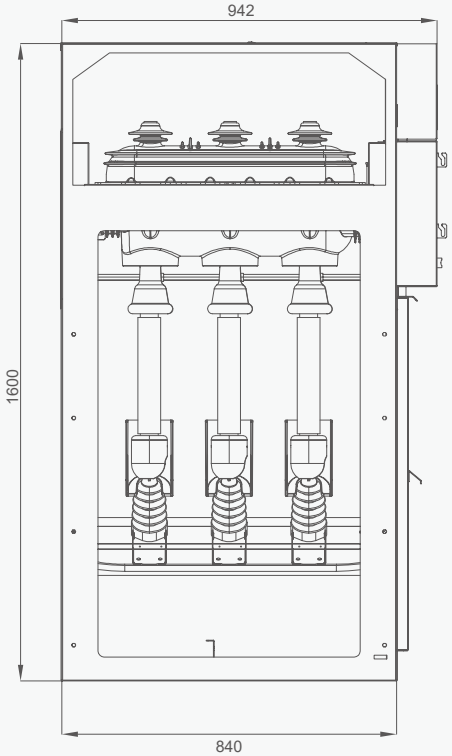


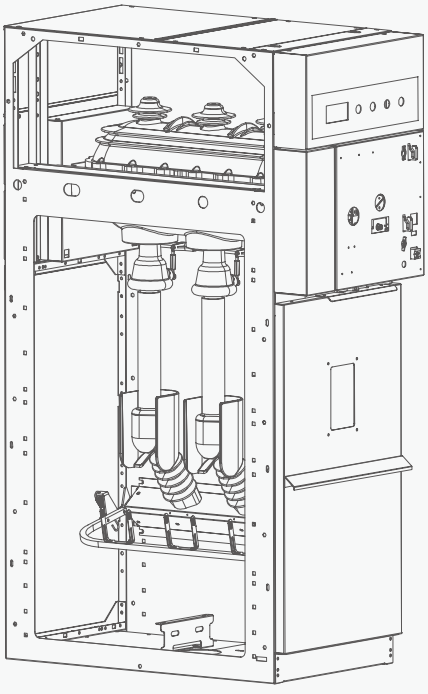




Outgoing Cabinet



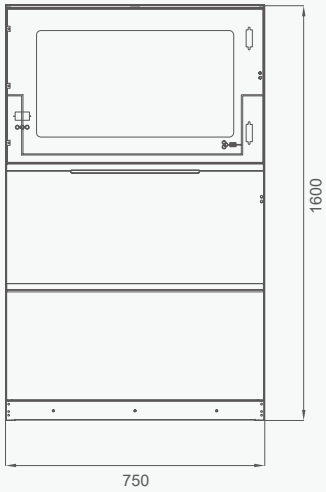


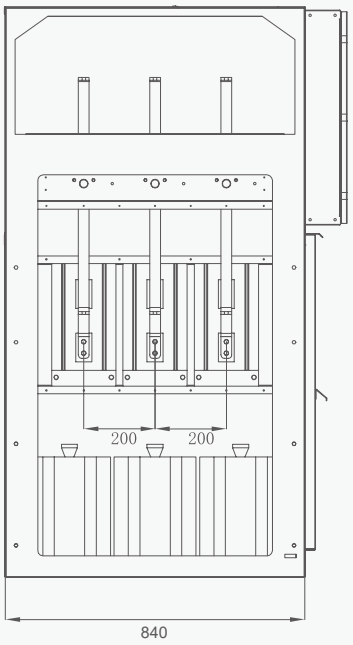


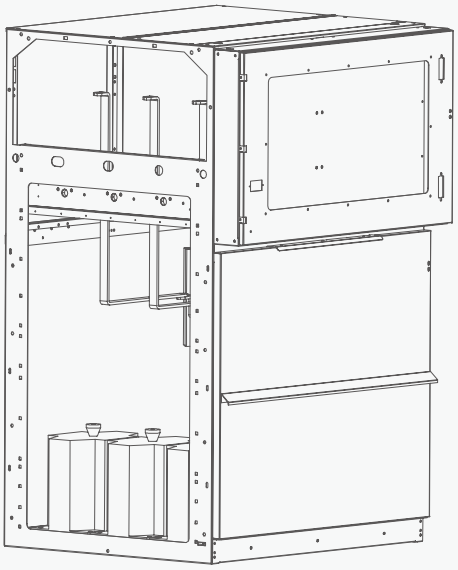
YSM6-12,24,40.5 Air-insulated RMU (Fixed Type)

YSM6-12,24,40.5 (SM6 Type) Overall and mounting dimensions (mm)

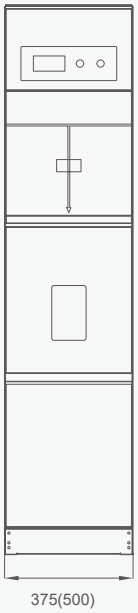
Metering Cabinet

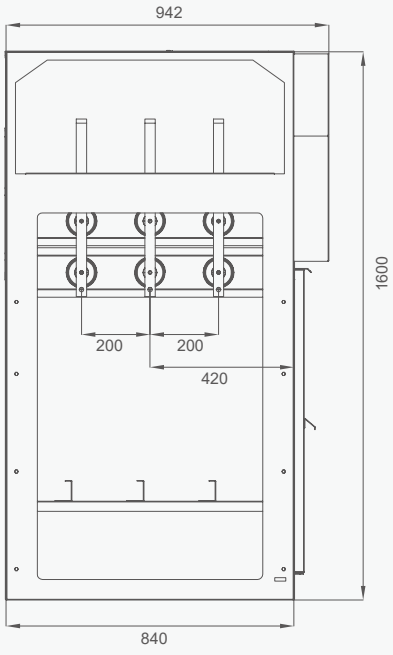


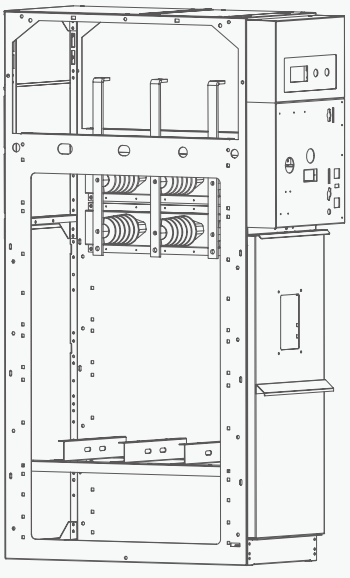




Busbar Riser Cabinet

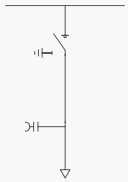


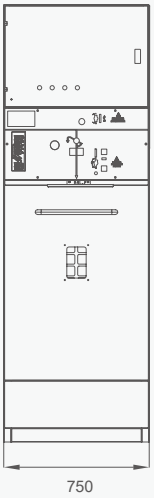


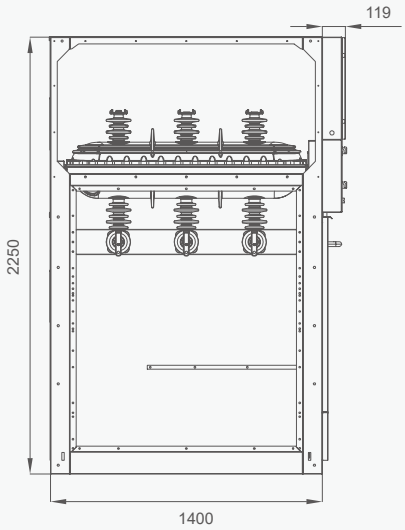


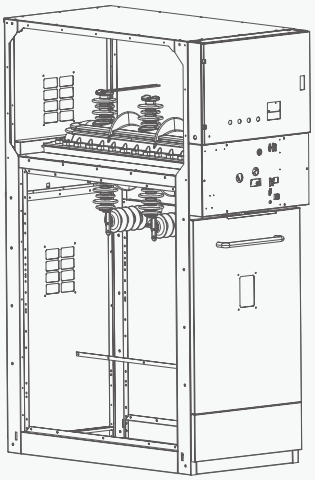
XGN15-12,24,40.5 Air-insulated RMU (Fixed Type)

Incoming Cabinet

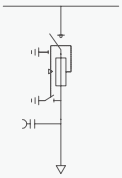


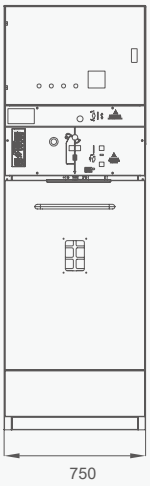


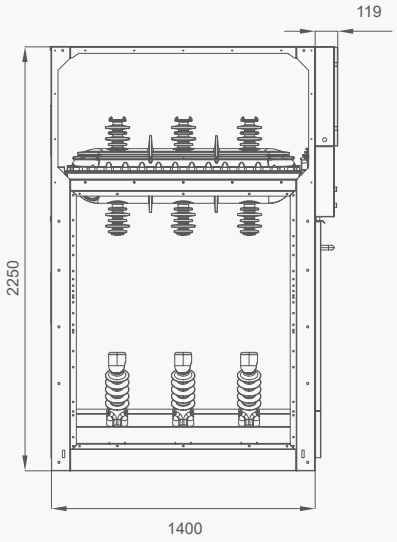


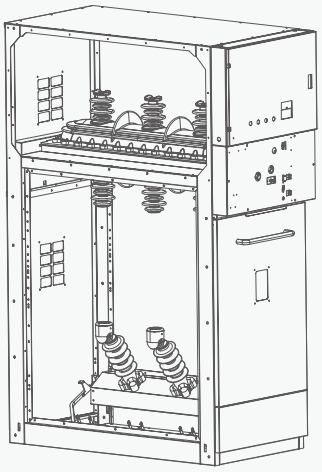


Circuit Breaker Switchgear

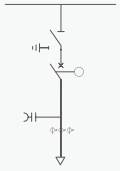


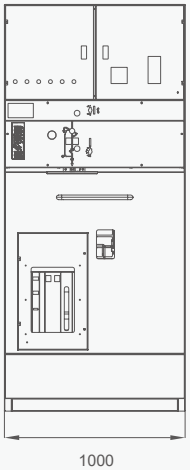


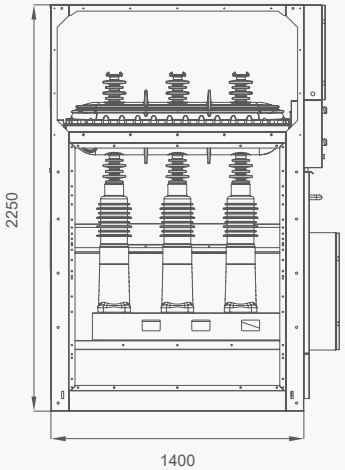


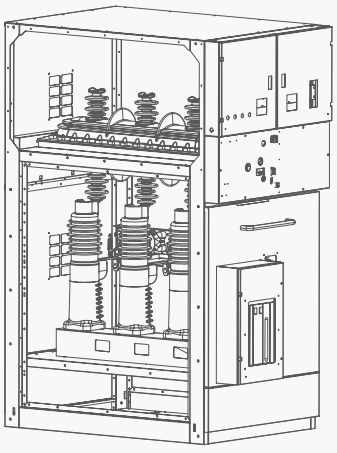


Outgoing Cabinet









Medium Voltage Switchgear

HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

- The HXGN15-12 box-type fixed AC metal-enclosed switchgear (hereinafter referred to as the “ring main unit”) is a medium-voltage switchgear designed to meet the needs of urban power grid construction and upgrading. It is suitable for three-phase AC distribution systems with a rated voltage of 12 kV and rated frequency of 50 Hz. The equipment is widely used in ring-network and terminal power supply of urban grids, switching stations, box-type substations, distribution rooms of industrial and mining enterprises, high-rise buildings, residential communities and public facilities, performing the functions of power distribution, control and protection.

  With a load switch or vacuum circuit breaker as the core element, the ring main unit adopts fixed installation, a box-type structure and metal enclosure. It features strong unit integration, small size, compact layout and convenient installation and maintenance, and is equipped with a complete “five-prevention” interlock function that effectively ensures personal and equipment safety. The core switching unit in the cabinet can be flexibly configured in three typical forms according to usage requirements:
- 1.With FZN25-12 vacuum load switch (including fuse combination unit);
- 2.With FN12-12 puffer load switch (including fuse combination unit);
- 3.With VS1-12 fixed vacuum circuit breaker.

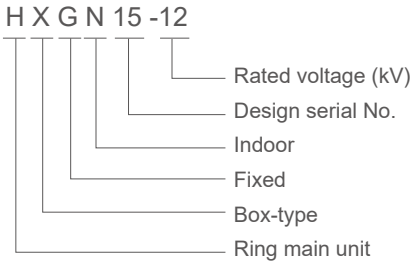
General





HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

Type designation



Applicable standards

1. GB 3906 AC metal-enclosed switchgear and controlgear for rated voltages above 3.6 kV and up to and including 40.5 kV
2. GB 3804 High-voltage AC load switches
3. GB 1984 High-voltage AC circuit breakers
4. GB 1985 High-voltage AC disconnectors and earthing switches
5. GB/T 11022 Common specifications for high-voltage switchgear and controlgear standards
6. GB/T 4208 Degrees of protection provided by enclosures (IP Code)
7. DL/T 404 AC metal-enclosed switchgear and controlgear for rated voltages of 12 kV and above
8. IEC 62271 series, IEC 420 and other relevant international standards

Operating conditions

1. Ambient temperature: Upper limit +40 °C; lower limit −5 °C (down to −25 °C for special requirements)
2. Altitude: Not exceeding 1000 m (some products up to 2000 m)
3. Relative humidity: Daily average not greater than 95%, monthly average not greater than 90%
4. Environmental conditions: Free from corrosive gases, combustible gases and obvious water-vapour pollution, free from frequent severe vibration
5. Seismic intensity: Not exceeding degree 8
6. Installation location: Indoor, free from fire/explosion hazards and heavily polluted locations
7. Pollution degree: Class II

Note: If the service conditions exceed the above provisions, they shall be agreed upon between the user and the manufacturer.

HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

Cabinet Structure Features

The ring main unit adopts a metal-enclosed box-type structure, consisting of the cabinet frame, five independent compartments, a mechanical interlock device and a pressure-relief passage. It features high precision, high strength, corrosion resistance and good versatility, and satisfies the complete "five-prevention" requirements. Its main structural features are described below.

Cabinet Structure

The cabinet frame is made of aluminum-zinc coated sheet (or high-quality cold-rolled steel sheet) with a fully assembled structure, featuring high precision, high strength, corrosion resistance and good versatility. The whole cabinet has a compact profile, with typical overall dimensions of about 800(850) mm (W) × 900 mm (D) × 2000(2200) mm (H).

Compartment Division

The cabinet is divided into five mutually independent compartments, which can effectively prevent a sudden fault from spreading and expanding:

1.Busbar compartment — houses the main busbar;

2.Switch compartment — installs the load switch or vacuum circuit breaker;

3.Operating mechanism compartment — installs the operating mechanism and interlock components;

4.Low-voltage compartment — installs secondary elements, instruments and protection devices;

5.Cable compartment — cable entries/exits and earthing device.

Pressure Relief

Pressure-relief openings are provided in the busbar compartment and cable compartment respectively (pressure-relief passages are provided at the rear and top of the cabinet), so that pressure can be released in a directed manner under extreme conditions such as internal arcing, ensuring personal safety.

Five-Prevention Interlock

The equipment has a reliable “five-prevention” function, and the interlock device is safe and reliable:

1.Prevent mis-opening and mis-closing of the circuit breaker (load switch);

2.Prevent opening and closing of the disconnector under load;

3.Prevent closing the earthing switch (hanging the earthing wire) while energized;

4.Prevent closing the circuit breaker while the earthing switch (earthing wire) is closed;

5.Prevent inadvertent entry into energized compartments.

A three-position (close/open/earth) or two-position interlock is adopted between the load switch and the earthing switch, with natural interlocking of switch positions and interlocking between the operating mechanism and the high-voltage cable compartment door, eliminating human misoperation.

Operation and Display

The panel simulates the primary circuit with clear indication; the live indicator flashes to indicate the energized part; the load switch can be operated manually or electrically, with an operating power supply of AC/DC 110 V or 220 V.

Core configuration options

The core switching unit of the HXGN15-12 ring main unit can be selected in three forms according to usage requirements. The three differ in arc-extinguishing principle, breaking capacity, mechanical life, protection configuration and cost, and are suitable for different power-supply scenarios, as described below.

HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

With FZN25-12 Vacuum Load Switch

Product description

The FZN25-12 series is an indoor high-voltage vacuum load switch and load switch-fuse combination unit, suitable for three-phase AC 50 Hz, 12 kV distribution systems. The product adopts vacuum arc extinguishing, and features no pollution, no fire or explosion hazard, and the ability to operate frequently. It can serve as the main element of ring main units, box-type substations and other types of switchgear, for the control and protection of power equipment such as transformers, cables and overhead lines, and is widely used in distribution systems of factories, residential communities, high-rise buildings, schools and parks.

Technical features

- Vacuum interrupter arc extinguishing with strong breaking capacity and long electrical and mechanical life (mechanical life 5000–10000 operations);
- Capable of breaking load current, closed-loop current, no-load transformer current and cable charging current, and of making short-circuit current;
- With a fuse it forms the FZN25-12R combination unit, in which the load switch breaks the working current and the fuse breaks the short-circuit current; the fuse striker can trip the load switch in linkage, achieving complete protection of the transformer;
- Supports two installation methods — switchgear assembly and wall mounting — and manual or electrical operation.

Main Parameters

Rated voltage 12 kV; load switch rated current 630 A (up to 800 A), combination unit rated current 125 A (up to 200 A); rated short-time withstand current 20 kA/4s, combination unit 31.5 kA; rated peak withstand current and rated short-circuit making current both 50 kA; rated no-load transformer breaking capacity 1250 kVA; rated transfer current 2000 A; fuse rated short-circuit breaking current 31.5 kA; 1-min power-frequency withstand voltage 42 kV to earth and between phases, 48 kV across the isolating distance; lightning impulse withstand voltage 75 kV to earth and between phases, 85 kV across the isolating distance. See Table 2 for detailed parameters.

With FN12-12 Puffer Load Switch

Product description

The FN12-12 series is an indoor high-voltage AC load switch and load switch-fuse combination unit, with a rated voltage of 12 kV and rated frequency of 50 Hz, used for making and breaking load current, closed-loop current, no-load transformer current and cable charging current, and capable of making short-circuit current; a load switch fitted with an earthing switch can withstand short-circuit current. The product is mainly used in urban distribution stations and industrial electrical equipment for three-phase ring-network or terminal power supply, for load control and short-circuit protection.

Technical features

- Adopts the air-puffer (gas-generating) arc-extinguishing principle, with simple structure, few parts, low cost and convenient maintenance;
- With an earthing switch it gains short-circuit current withstand capability and meets the “five-prevention” requirements;
- With a fuse it forms the FN12-12R combination unit, which can reliably break any current up to the short-circuit current: the load switch breaks the working current and the fuse breaks the short-circuit current, and together they break any over-current between the working current and the full short-circuit current; at the same time the fuse trips the load switch via its striker;
- Its arc-extinguishing ability and rated-current breaking times are lower than those of vacuum products, and it is suitable for applications with infrequent operation and mainly load-current breaking.

Main Parameters

Rated voltage 12 kV; load switch rated current 630 A, combination unit rated current 125 A; rated short-time withstand current 20 kA/4s; rated dynamic withstand current and rated making current (peak) both 50 kA; rated short-circuit breaking current with fuse 31.5 kA; rated transfer current 1.5 kA; maximum breaking current (reference value) 1.8 kA; no-load transformer breaking capacity 1250 kVA; rated cable charging breaking current 10 A; rated active load-current breaking times more than 100 operations; fuse-striker tripping time of the load switch less than 0.06 s; earthing switch short-time withstand current 20 kA/2s, dynamic withstand current 50 kA; 1-min power-frequency withstand voltage 42 kV to earth and between phases, 48 kV across the isolating distance; lightning impulse withstand voltage 75 kV to earth and between phases, 85 kV across the isolating distance. See Table 3 for detailed parameters.

HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

With VS1-12 Fixed Vacuum Circuit Breaker

Product description

The VS1-12 (ZN63-12) indoor high-voltage vacuum circuit breaker adopts fixed installation and is mainly used in fixed switchgear. It can be used alone, or in ring-network power supply, box-type substations or various non-standard power-supply systems. The product is suitable for three-phase power systems with a rated voltage of 12 kV and frequency of 50 Hz, used as a protection and control apparatus; owing to the special advantages of the vacuum circuit breaker, it is especially suitable for places requiring frequent operation at rated current or repeated breaking of short-circuit current.

Technical features

- The main insulation adopts solid insulation, with the vacuum interrupter integrally cast in an epoxy-resin insulating cylinder (embedded-pole type), providing high insulation performance and meeting the requirements of humid and high-altitude environmental conditions;
- The interrupter uses vacuum as the arc-extinguishing and insulating medium; an axial magnetic field generated between the contacts keeps the arc in a diffuse form, resulting in low arc voltage, fast arc extinction, and strong and stable breaking capacity;
- It can be equipped with a relay protection device to achieve complete protection functions such as over-current, instantaneous, zero-sequence and reclosing protection, and is suitable as an incoming/outgoing main switch;
- Long mechanical life (10000–20000 operations), rated short-circuit current breaking times of 50, reliable operation and a high degree of maintenance-free performance.

Main Parameters

Rated voltage 12 kV; rated current 630, 1250, 1600, 2000, 2500, 3150 A; rated short-circuit breaking current 20, 25, 31.5, 40 kA; rated short-circuit making current (peak) and rated peak withstand current 50, 63, 80, 100 kA; 4s rated short-time withstand current 20, 25, 31.5, 40 kA; 1-min power-frequency withstand voltage 42 kV to earth and between phases, 48 kV across the contact gap; lightning impulse withstand voltage 75 kV to earth and between phases, 84–85 kV across the contact gap; mechanical life 10000–20000 operations. See Table 4 for detailed parameters.

HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

Technical date

Table 1 HXGN15-12 Ring Main Unit Technical Parameters

Item	Unit	Parameter
Rated voltage	kV	12
Rated frequency	Hz	50
Main busbar rated current	A	630
Branch busbar rated current	A	630
Main circuit rated short-time withstand current	kA/s	20/3 (some products 20/4)
Earthing circuit rated short-time withstand current	kA/s	20/2
Rated peak withstand current	kA	50
Rated short-circuit making current	kA	50
1-min power-frequency withstand voltage (between phases and to earth)	kV	42
1-min power-frequency withstand voltage (across isolating distance)	kV	48
Lightning impulse withstand voltage (between phases and to earth, peak)	kV	75
Lightning impulse withstand voltage (across isolating distance, peak)	kV	85
Secondary circuit 1-min power-frequency withstand voltage	kV	2
Rated transfer current	A	1600~1700
Fuse rated short-circuit breaking current	kA	31.5
Rated closed-loop breaking current	A	630
5% rated load breaking current	A	31.5
No-load transformer breaking current	A	16
No-load cable breaking current	A	25
Load switch mechanical life	operations	2000~10000
Earthing switch mechanical life	operations	2000
Degree of protection	—	IP2X–IP3X (up to IP4X for gas-tank type)
Three-phase center distance	mm	210±2
Overall dimensions (W × D × H)	mm	650~1000×900/1000×2000(2200)

Table 2 FZN25-12 Vacuum Load Switch Technical Parameters

Item	Unit	Load switch	Combination unit
Rated voltage	kV	12	12
Rated frequency	Hz	50	50
Rated current	A	630 (800)	125 (200)
Rated active load breaking current	A	630 (800)	125
Rated closed-loop breaking current	A	630 (800)	125
Rated short-time withstand current (thermal)	kA/s	20/4	31.5
Rated peak withstand current (dynamic)	kA	50	50
Rated short-circuit making current (peak)	kA	50	50
Rated cable charging breaking current	A	25	—
Rated no-load transformer breaking capacity	kVA	1250	1250
Fuse rated short-circuit breaking current	kA	—	31.5
Rated transfer current	A	—	2000
1-min power-frequency withstand voltage (between phases, to earth / across isolating distance)	kV	42/48	42/48
Lightning impulse withstand voltage (between phases, to earth / across isolating distance, peak)	kV	75/85	75/85
Mechanical life	operations	5000~10000	5000~10000
Total breaking time	ms	≤100	≤100
Center distance between phases	mm	210±3	210±3
Contact gap	mm	10±1	10±1
Operating mechanism power-supply voltage	V	AC/DC 110, 220	AC/DC 110, 220
Degree of protection	—	IP2X	IP2X
Earthing switch mechanical life	operations		2000
Degree of protection	—		IP2X–IP3X (up to IP4X for gas-tank type)
Three-phase center distance	mm		210±2
Overall dimensions (W × D × H)	mm		650~1000×900/1000×2000(2200)

Table 3 FN12-12 Puffer Load Switch Technical Parameters

Item	Unit	FN12-12D/630-20	FN12-12R.D/125-31.5
Rated voltage	kV	12	12
Rated frequency	Hz	50	50
Rated current	A	630	125
Lightning impulse withstand voltage (to earth and between phases / across isolating distance)	kV	75/85	75/85
1-min power-frequency withstand voltage (to earth and between phases / across isolating distance)	kV	42/48	42/48
Rated short-time withstand current	kA/s	20/4	20/4
Rated dynamic withstand current (peak)	kA	50	50
Rated making current (peak)	kA	50	50
Rated short-circuit breaking current (prospective, with fuse)	kA	—	31.5
Rated transfer current	kA	—	1.5
Maximum breaking current (reference)	kA	—	1.8
No-load transformer breaking capacity	kVA	1250	1250
Rated cable charging breaking current	A	10	10
Rated active load current breaking times	operations	>100	>100
Striker-triggered tripping time of the load switch	s	—	<0.06
Earthing switch short-time withstand current	kA/s	20/2	20/2
Earthing switch dynamic withstand current (peak)	kA	50	50
Center distance between phases	mm	210±5	210±5
Main circuit resistance	μΩ	≤100	≤100
Mechanical life	operations	2000	2000
Operating voltage	V	AC/DC 220	AC/DC 220

Table 4 VS1-12 Fixed Vacuum Circuit Breaker Technical Parameters

Item	Unit	Parameter
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current	A	630, 1250, 1600, 2000, 2500, 3150
Rated short-circuit breaking current	kA	20, 25, 31.5, 40
Rated short-circuit making current (peak)	kA	50, 63, 80, 100
Rated peak withstand current	kA	50, 63, 80, 100
4s rated short-time withstand current	kA	20, 25, 31.5, 40
1-min power-frequency withstand voltage (to earth / between phases)	kV	42
1-min power-frequency withstand voltage (across contact gap)	kV	48
Lightning impulse withstand voltage (to earth / between phases, peak)	kV	75
Lightning impulse withstand voltage (across contact gap, peak)	kV	84~85
Rated short-circuit current duration	s	4
Rated operating sequence	—	O – 0.3 s – CO – 180 s – CO
Mechanical life	operations	10000~20000
Rated short-circuit breaking current breaking times	operations	50
Closing time	ms	≤100 (some products ≤70)
Opening time	ms	≤50
Contact gap	mm	11±1
Contact travel (contact spring compression length)	mm	3.5±0.5
Three-phase opening/closing non-simultaneity	ms	≤2
Contact closing bounce time	ms	≤2
Average opening speed	m/s	0.9~1.2
Average closing speed	m/s	0.4~0.8
Main circuit resistance per phase	μΩ	≤50
Secondary circuit power-frequency withstand voltage (1-min)	V	2000
Operating mechanism rated opening/closing voltage	V	AC/DC 110, 220
Degree of protection	—	IP4X (IP2X with circuit breaker compartment door open or in compartments)

Note: The parameters in the tables are typical industry values; specific model parameters of different manufacturers may differ. Actual selection shall be based on the manufacturer's official catalogue and type test report.

HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

Option comparison

Comparison item	FZN25-12 vacuum load switch	FN12-12 puffer load switch	VS1-12 fixed vacuum circuit breaker
Arc-extinguishing medium	Vacuum	Air (puffer type)	Vacuum
Main function	Breaking of load current, closed-loop, no-load transformer and cable charging current	Breaking of load current, closed-loop, no-load transformer and cable charging current	Breaking of load current and short-circuit current, complete protection
Short-circuit protection method	With fuse (combination unit)	With fuse (combination unit)	Relay protection device
Rated current	630 A (800 A)	630 A	630–3150 A
Rated short-circuit breaking current	20 kA (31.5 kA for combination unit)	20 kA (31.5 kA for combination unit)	20–40 kA
Mechanical life	5000–10000 operations	2000 operations	10000–20000 operations
Operation frequency	Frequent operation possible	Not suitable for frequent operation	Frequent operation possible
Maintenance workload	Small	Relatively small	Small
Size and cost	Moderate	Simple structure, relatively low cost	Relatively high
Typical application	Main element of ring main unit and box-type substation, transformer protection	Ring-network and terminal distribution, cost-sensitive applications	Incoming/outgoing main switch, applications requiring complete protection

Selection recommendations

1. Frequent operation, many breaking operations required, small maintenance workload — give priority to the FZN25-12 vacuum load switch. Its vacuum arc extinguishing and long mechanical life allow frequent operation, making it the mainstream configuration of current ring main units.
2. Cost-sensitive, infrequent operation, mainly load-current breaking — the FN12-12 puffer load switch can be selected. Its structure is simple and its cost is relatively low, and it can meet general ring-network and terminal distribution needs, but its arc-extinguishing ability and breaking times are relatively limited.
3. Short-circuit protection required, coordination with relay protection, serving as incoming/outgoing main switch — the VS1-12 fixed vacuum circuit breaker should be selected. Its breaking capacity is large and its protection functions are complete, making it suitable for substation incoming/outgoing lines, important load feeders and places requiring over-current, instantaneous and zero-sequence protection.
4. Short-circuit protection required for distribution transformers — the load switch-fuse combination unit (FZN25-12R or FN12-12R) is recommended, in which the load switch handles working-current breaking and the fuse handles short-circuit current breaking, balancing economy and protection function.

Ordering information

Please provide the following information when ordering:

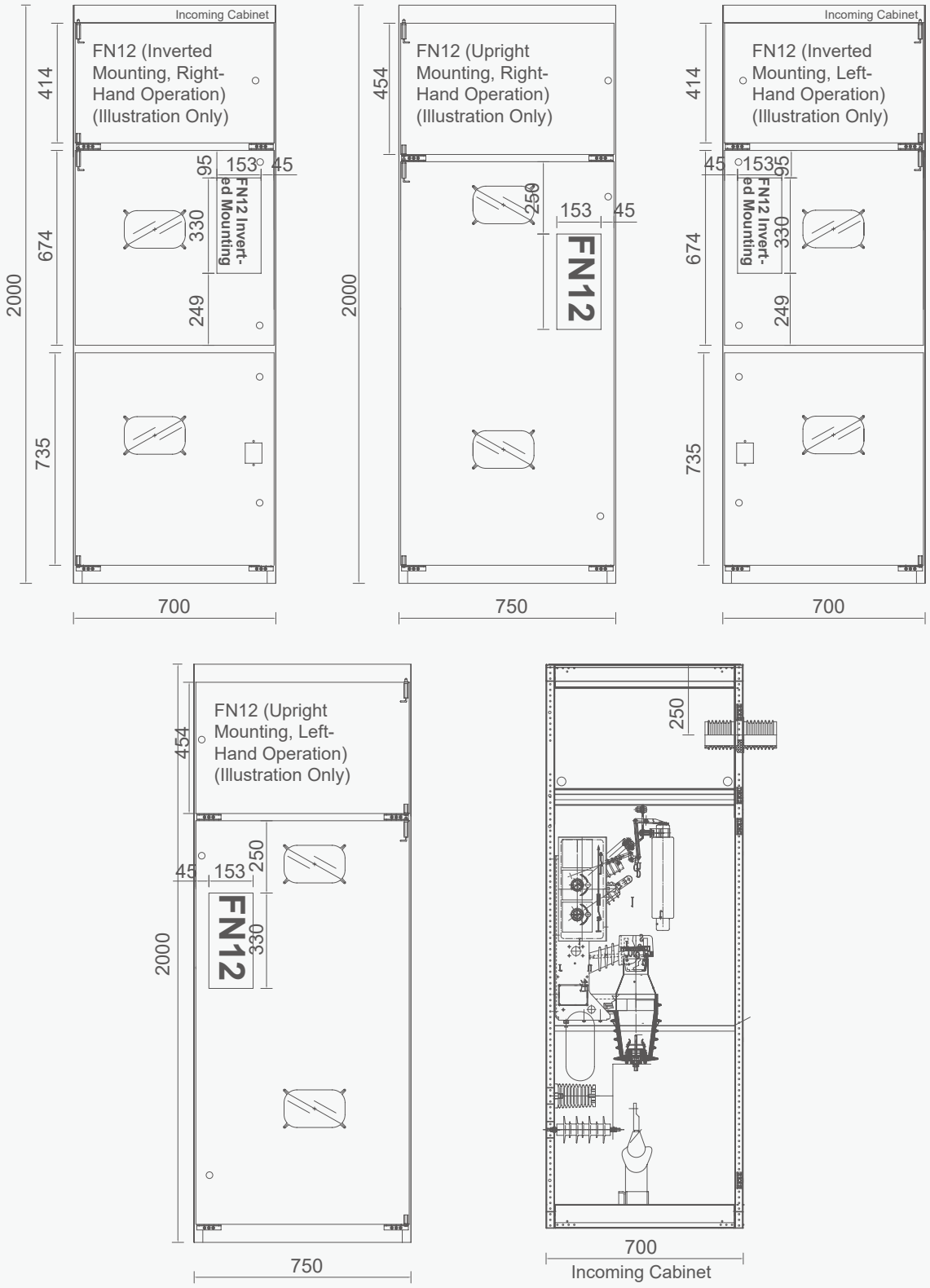
1. Primary system arrangement diagram (single-line diagram);
2. Secondary schematic diagram and terminal block diagram;
3. Ring main unit type, scheme number and quantity;
4. Type, specification and quantity of the main components in the cabinet;
5. Requirements for main technical parameters such as rated current and short-circuit breaking current;
6. Operating mechanism type (manual/electrical) and operating power-supply voltage;
7. Cabinet color, overall dimensions and other special requirements.

The parameters listed in this document are typical industry values for selection reference only. Formal design, quotation and ordering shall be based on the manufacturer’s latest catalogue, type test report and the technical agreement between the two parties.

HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

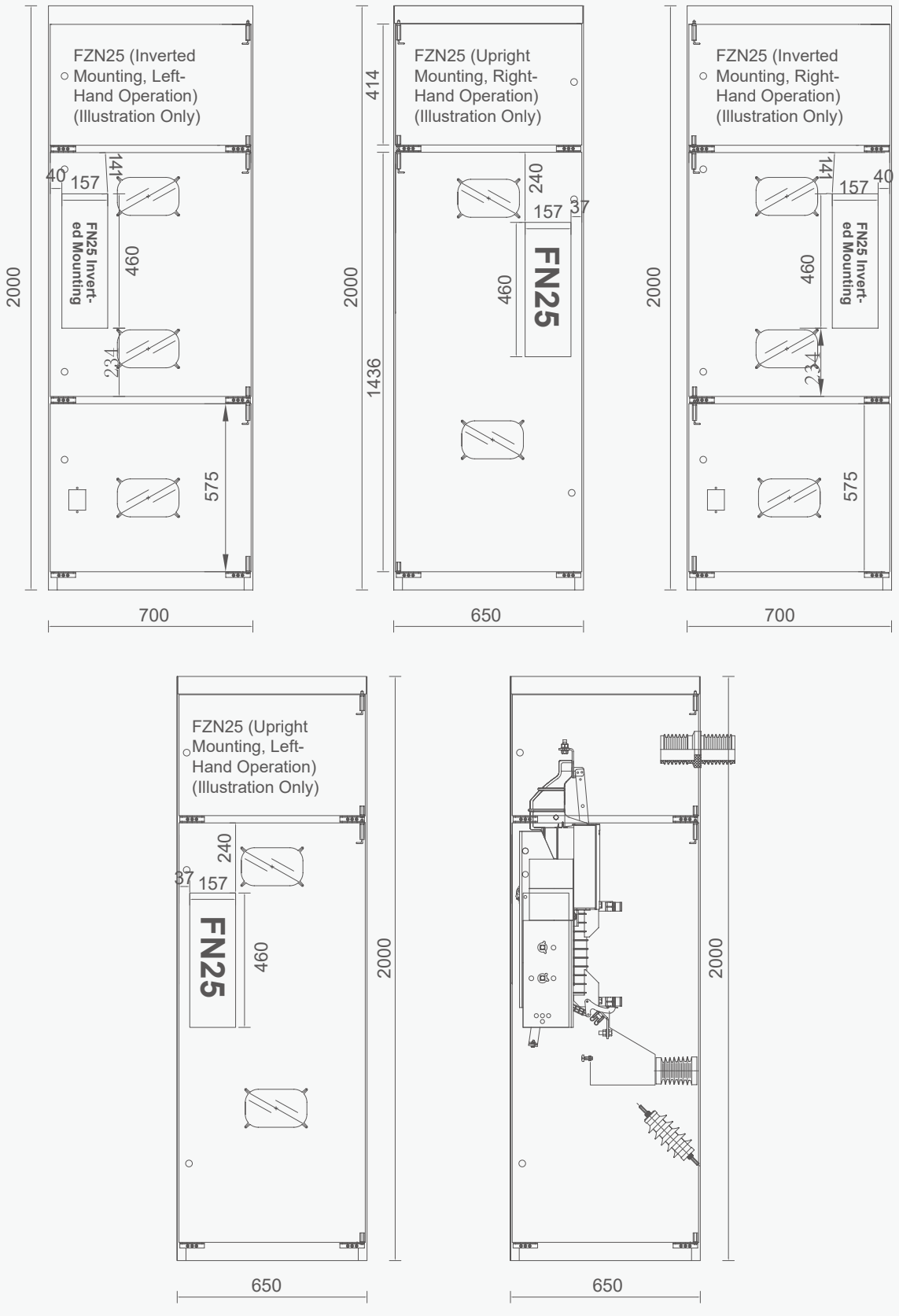
Overall and mounting dimensions (mm)

HXGN15-12 with FN12-12 Air-Blast Load Switch



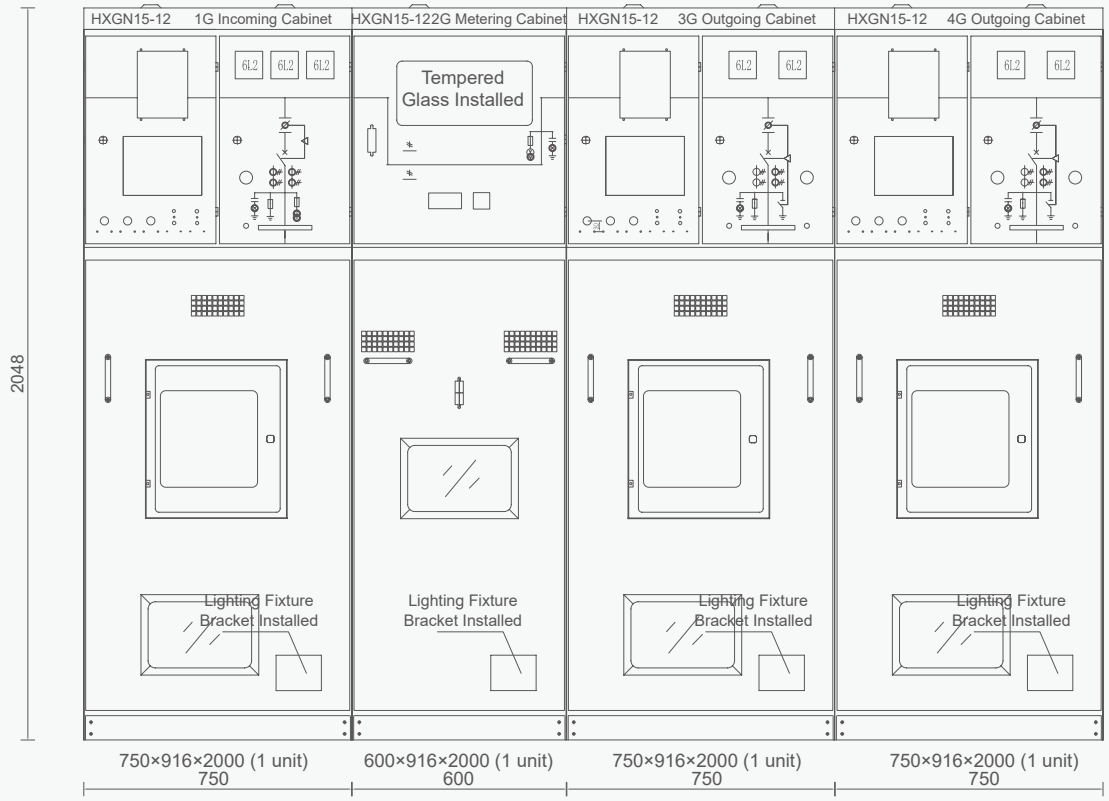
HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

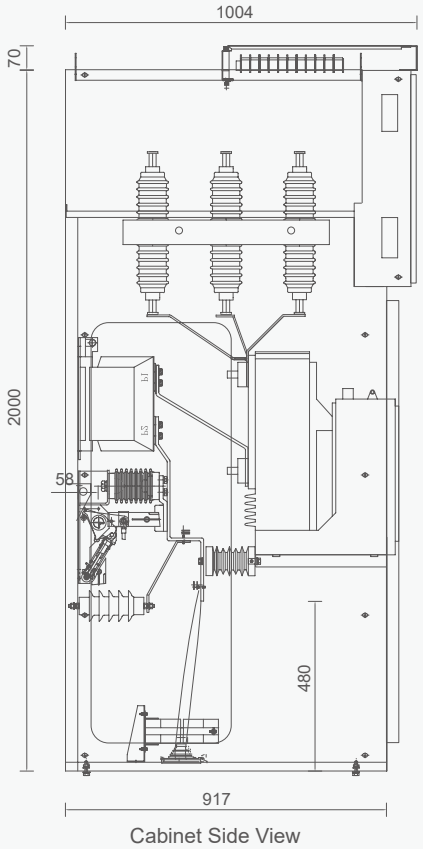
HXGN15-12 with FZN25-12 Vacuum Load Switch



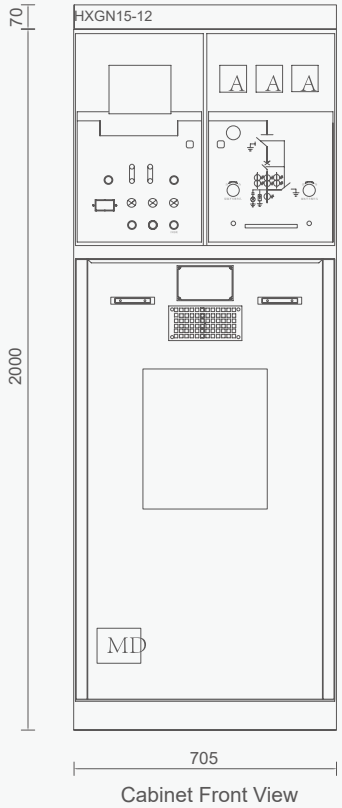
HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

HXGN15-12 with VS1-12 Vacuum Circuit Breaker (750–850 mm Cabinet Width)

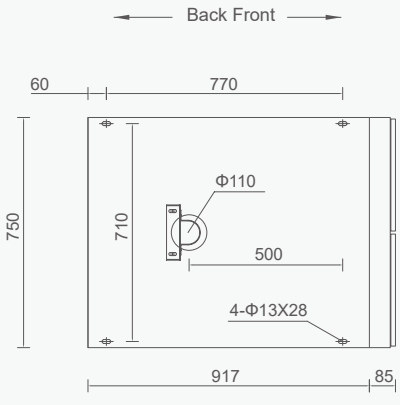




Cabinet Side View



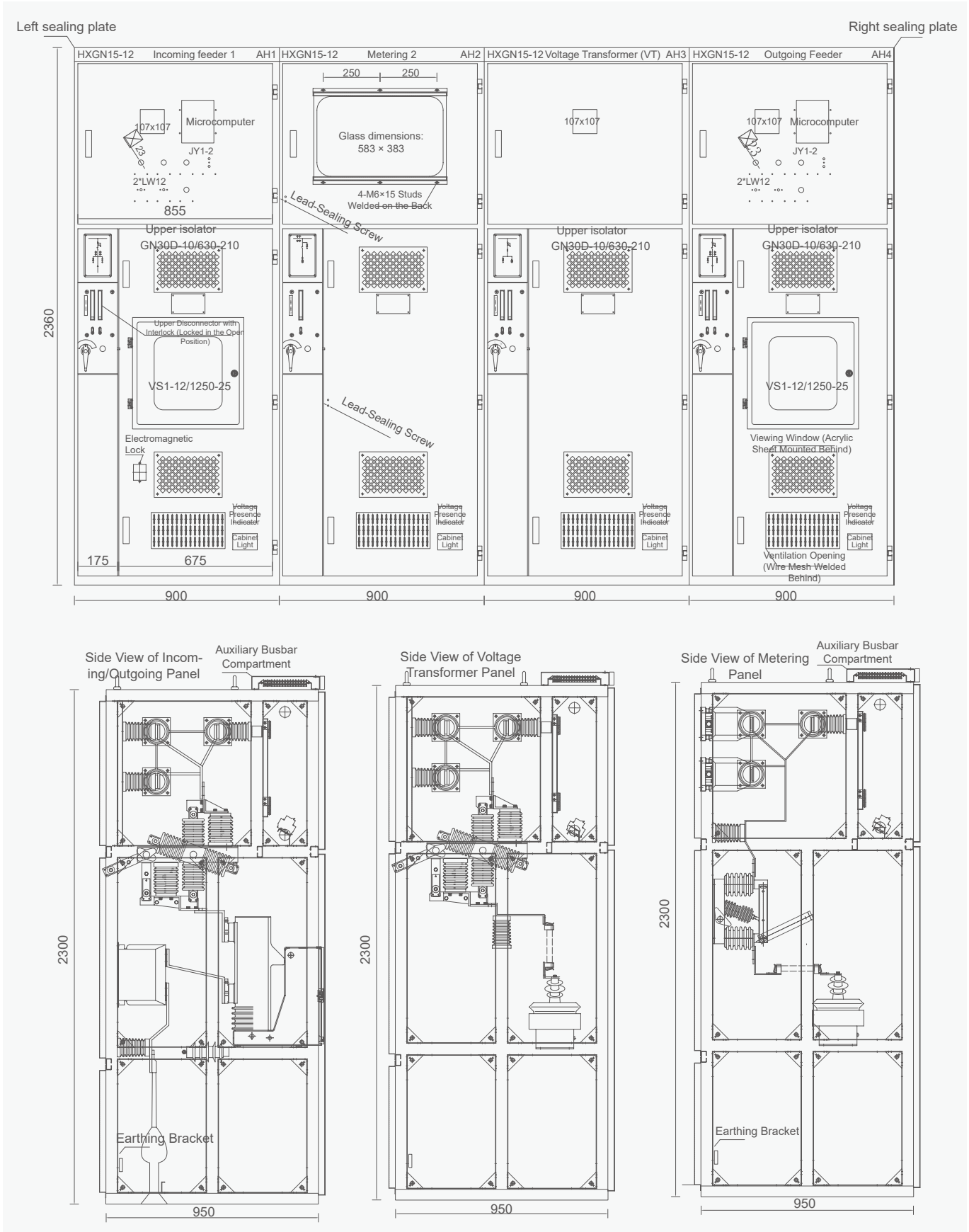
Cabinet Front View



Cabinet Bottom View

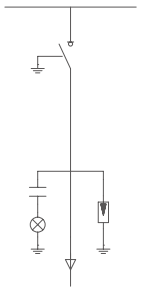
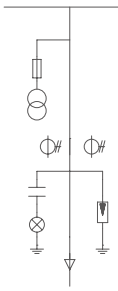
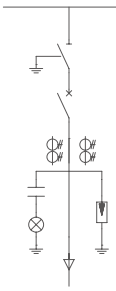
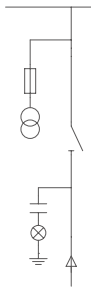
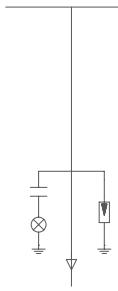
HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

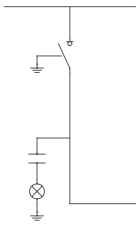
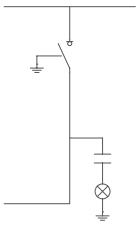
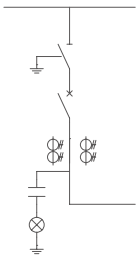
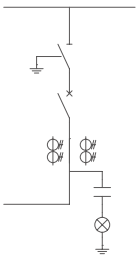
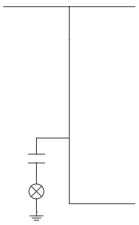
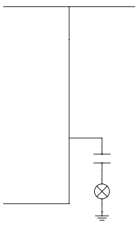
HXGN15-12 with VS1-12 Vacuum Circuit Breaker (900–1000 mm Cabinet Width)

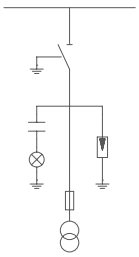
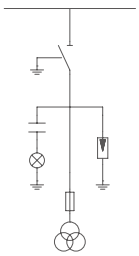
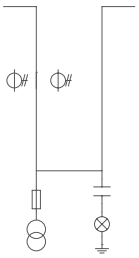


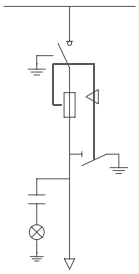
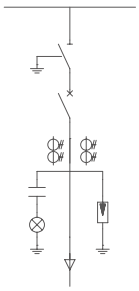
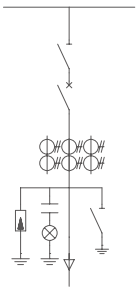
HXGN15-12 Box-type Fixed AC Metal-enclosed Switchgear

Phase plan

Incoming 1	Incoming Metering	Incoming Circuit Breaker	Incoming + PT	Incoming Bus Riser
				

Sectionalizing Disconnector 1	Sectionalizing Disconnector 2	Sectionalizing Circuit Breaker 1	Sectionalizing Circuit Breaker 2	Sectionalizing Bus Riser 1	Sectionalizing Bus Riser 2
					

PT 1	PT 2	Metering
		

Outgoing 1	Outgoing Circuit Breaker 1	Outgoing Circuit Breaker 2
		

Medium Voltage Switchgear

YRM6-12 Gas-insulated Metal-enclosed Switchgear

- YRM6-12 is a medium-voltage ring main unit in the category of gas-insulated metal-enclosed switchgear (GIS), using SF6 gas as the insulating and arc-extinguishing medium, with the primary main circuit fully sealed inside a 3 mm stainless-steel gas tank. Compared with conventional air-insulated ring main units, its core advantages are reflected in four aspects:
  - Fully insulated, fully enclosed: All 12 kV live parts are sealed inside the gas tank with no exposed live parts outside; the primary section has a protection degree of IP67 and is immune to moisture, dust, salt spray and ingress by small animals;
  - Compact size, small footprint: The width of a single functional module is only 325 mm, about one third of an air-insulated switchgear of equivalent capacity, suitable for space-constrained applications such as densely built urban areas, underground substations and box-type substations;
  - Maintenance-free, long service life: The gas tank is welded and sealed, and the mechanism uses self-lubricating bearings, requiring essentially no maintenance over a design life of 20–30 years;
  - Modular expansion: The functional units are combined via plug-in silicone-rubber insulated busbar connectors; expansion requires no gas filling/evacuation, and circuits can be added or removed as needed.

General





YRM6-12 Gas-insulated Metal-enclosed Switchgear

Type designation

YRM 6 - 12 C / V / F / M / D

- Actual ordering is expressed as ‘cabinet type + unit combination’, e.g. YRM6-12 (C+C+F)
- 12 kV
- 6th design (structural finalization number)
- Fully insulated, modular ring main switchgear (enterprise product series code)

Table: Functional Unit Code List

Unit code	Name	With switch?	Main application
C	Load switch unit	Yes (three-position load switch)	Ring-network incoming/outgoing lines, feeders, busbar sectioning
V	Vacuum circuit breaker unit	Yes (vacuum circuit breaker + isolating/ earthing switch)	Incoming/outgoing lines requiring frequent operation or relay protection
F	Load switch-fuse combination unit	Yes (load switch + high-voltage current-limiting fuse)	Transformer protection (distribution and station-service transformers)
M	Metering unit	No	Energy metering (built-in CT, PT)
D	Riser unit (cable connection unit)	No	Cable entry, busbar riser, cubicle-line transition
SL	Bus coupler unit	Yes (load switch)	Busbar sectioning and tie (commonly used expansion unit)
PT	PT unit	With or without switch	Voltage transformer, secondary power supply (commonly used expansion unit)

Scope of application

- 12 kV medium-voltage distribution systems, three-phase AC 50 Hz, with ungrounded neutral or neutral grounded through an arc-suppression coil;
- Incoming/outgoing line control and protection for ring-network supply, dual-source supply and terminal distribution;
- Urban switching stations, box-type substations, underground and semi-underground substations, industrial and mining enterprise distribution rooms, and commercial building distribution rooms;
- Collector lines and step-up transformer protection for wind and photovoltaic power stations;

Places with high requirements for power supply continuity, such as railways, rail transit, airports and ports.

Typical applications: the C unit is used as the ring-network incoming/outgoing line or feeder switch; the F unit is used for transformer circuit protection; the V unit is used for incoming/outgoing lines requiring frequent operation or relay protection; the M metering unit is used for energy metering assessment points; the D riser unit is used for cable entry, busbar riser and cubicle-line transition.

Applicable standards

Standard No.	Standard title
GB/T 3906	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
GB/T 11022	Common technical requirements for high-voltage AC switchgear and controlgear standards
GB/T 7674	Gas-insulated metal-enclosed switchgear for rated voltages of 72.5 kV and below
GB/T 1984	High-voltage AC circuit breakers
GB/T 1985	High-voltage AC disconnectors and earthing switches
GB/T 3804	High-voltage AC load switches for rated voltages from 3.6 kV to 40.5 kV
GB/T 16926	High-voltage AC load switch-fuse combination units
GB 20840.2 / GB 20840.3	Instrument transformers (current transformers / voltage transformers)
DL/T 404	Technical specifications for ordering AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
IEC 62271-200 / -100 / -102 / -105	High-voltage switchgear and controlgear series standards

Table: List of Applicable Standards

Operating conditions

The following are the normal operating environment conditions of the product. When conditions are exceeded (high altitude, low temperature, heavy pollution, strong corrosion), this must be specified at the time of ordering so that the manufacturer can carry out external insulation correction or special design.

Item	Requirement
Ambient temperature	Maximum +40 °C, minimum −40 °C (some manufacturers can reach −50 °C; please specify for low-temperature regions)
Maximum average relative humidity	≤95% (average over 24 h)
Altitude	≤2000 m (above 2000 m, consult the manufacturer and carry out external insulation correction)
Installation location	Indoor (can be fitted with metal/non-metal enclosure for outdoor use); free from severe vibration and shock
Environmental conditions	Free from corrosive, flammable and explosive gases and conductive dust; please specify when the pollution level is high
Seismic intensity	≤8 degrees (special design required when exceeded)
Installation method	Installed level and vertical on foundation; front-to-back or left-right line-up available

Table: Operating Environment Conditions

Cabinet structural features

This chapter describes common structural features such as the gas tank, modular structure, three-position switch, five-prevention interlock, operation display and cable connection, which apply to all five unit types C, V, F, M and D.

Fully Insulated, Fully Enclosed Gas Tank

The primary main circuit (busbar, load switch, vacuum circuit breaker, fuse, instrument transformers) is fully sealed inside a 3 mm thick stainless-steel (201/304/304L) robot-welded gas tank filled with SF6 gas at an absolute pressure of 1.3–1.4 bar at 20 °C. The gas tank has an annual leakage rate ≤0.02%, enabling 30 years of gas-refill-free and maintenance-free operation. Each gas tank is equipped with one SF6 density pressure gauge for real-time gas pressure monitoring; when the pressure falls below the alarm value, the dial shows a prominent indication for easy discovery during inspection.

Modular Structure and Expansion

- Standard single module width is 325 mm (12 kV), height about 1336 mm (excluding low-voltage compartment), depth about 751 mm; the metering unit (M) width is 750–800 mm;
- The units are connected to each other via plug-in silicone-rubber insulated busbar connectors, which are fully insulated and fully shielded; expansion requires no gas filling/evacuation and no power interruption;
- The busbar connectors can be combined front-to-back and left-to-right, supporting assembly in any order (e.g. C+C+F, C+C+C+C+C, D+F, etc.);
- A single module can be used as an independent unit only after an expansion connector is fitted.

Three-position Switch and Operating Mechanism

The load switch and isolating/earthing switch adopt a coaxial rotating double-break three-position structure (closed—open—earthed), operated through the same operating hole in coordination with a sliding plate; at any time it can be in only one of the three states, fundamentally preventing misoperation. The operating mechanism is installed at the front outside the gas tank, is anti-corrosion treated, and has self-lubricating rotating bearings; it can be operated manually, or equipped with a motorized operating mechanism for remote control (DC48 V/DC110 V/220 V, AC220 V).

Five-prevention Interlock and Safety Design

1. Prevent misopening and misclosing of the circuit breaker (load switch);
2. Prevent pushing or withdrawing the withdrawable part (truck) under load;
3. Prevent closing the earthing switch when energized;
4. Prevent energizing while the earthing switch is in the closed position;
5. Prevent entering the energized compartment by mistake.

Other safety designs: the gas tank is equipped with a pressure relief device (for internal arc faults, pressure is relieved from the bottom or rear); the cable compartment front cover is interlocked with the earthing switch; the front panel is provided with switch position indication and an observation window for directly observing the contacts and earthing switch position; capacitive live-line indicators are fitted at the bushing positions of incoming/outgoing lines; the earthing busbar is a copper bar with a cross-sectional area ≥120 mm² to ensure earthing continuity.

Operation, Observation and Display

- The mimic diagram on the front panel, combined with mechanical position indication, directly displays the three states of closed, open and earthed;
- Each gas tank is equipped with one SF6 pressure gauge;
- Short-circuit and earth-fault indicators, live-line indicators, ring-type current transformers and ammeters/energy meters can be added to meet condition monitoring and 'three-remote' (telemetry, telesignaling, telecontrol) retrofit requirements;
- Appearance color: front panel RAL7035 (light gray), side panels and cable compartment front cover RAL7035 (light gray), adjustable according to customer requirements.

3.6 Cable Connection and Earthing

- Equipped with silicone-rubber cable plugs (separable connectors) for fully insulated, fully sealed cable termination;
- The cable compartment provides sufficient space for installation and testing of single-core/three-core cable terminations, and supports dual cable termination parallel outgoing lines;
- After the earthing switch is closed, a visible earthing path is formed, meeting the safety requirement for attaching earthing conductors during maintenance.

Functional unit descriptions

This chapter describes the structure, function, features and application of the five functional units C, V, F, M and D one by one, and provides a quick reference of unit combinations for direct use in scheme design.

C Unit — Load Switch Unit

Structure: Three-position load switch (close/open/earth) with single-bushing outgoing line; both the busbar side and the cable side are sealed inside the gas tank.

Function: Used as the incoming/outgoing line switch, feeder switch or busbar section switch of a ring-network line, undertaking opening/closing of normal load current, closed-loop current breaking and cable charging current breaking, and providing cable-side earthing through the earthing position.

Features and applications: Rated current 630 A, rated closed-loop breaking current 630 A, meeting the operating requirements for loop-closing load transfer in a ring network; rated short-time withstand current 20 kA/4 s, rated peak withstand current 50 kA; mechanical endurance 5000 operations; loop resistance ≤300 μΩ; optional motorized operating mechanism, fault indicator and current transformer for 'three-remote' retrofit. Suitable for ring-network incoming/outgoing lines, feeders, switching-station tie circuits and distribution circuits without transformer protection requirements.

V Unit — Vacuum Circuit Breaker Unit

Structure: The vacuum circuit breaker (vacuum interrupter) and the three-position isolating/earthing switch are placed together inside the SF6 gas tank, with the spring operating mechanism located at the front of the gas tank.

Function: Used for incoming/outgoing line circuits requiring frequent operation or relay protection (overcurrent, instantaneous, zero-sequence, auto-reclosing, etc.), capable of breaking load current and short-circuit current.

Features and applications: Rated current 630 A / 1250 A in two levels; rated short-circuit breaking current 20 kA / 25 kA, rated short-circuit making current (peak) 50 kA / 63 kA; rated short-time withstand current 20 kA / 25 kA (4 s); circuit breaker mechanical endurance up to 10000 operations, isolating/earthing switch 5000 operations, loop resistance ≤120 μΩ; equipped with a spring operating mechanism, operable manually or electrically, and fitted with a microprocessor-based integrated protection device with remote-control and remote-signaling interfaces. Suitable for substation incoming/outgoing lines, important load feeders, circuits requiring relay protection, and tie circuits requiring frequent operation.

F Unit — Load Switch-Fuse Combination Unit

Structure: Three-position load switch combined with a three-phase high-voltage current-limiting fuse; the fuse is installed inside the gas tank (or in an insulating tube), with a striker linkage mechanism.

Function: Used for protection of distribution transformers (distribution and station-service transformers). The load switch undertakes opening/

closing of normal load current, while the high-voltage current-limiting fuse undertakes breaking of short-circuit current and overload current; when any phase fuse blows, the striker linkage causes the three-phase load switch to open simultaneously, preventing single-phase (open-phase) operation of the transformer.

Features and applications: The circuit rated current depends on the rated current of the fuse used, maximum 125 A (commonly 40 A, 63 A, 100 A, 125 A); rated transfer current 1750 A, which is the current boundary at which the fuse and load switch cooperate in breaking and is a key parameter of the combination unit; rated short-circuit breaking current 31.5 kA (limited by the high-voltage current-limiting fuse); rated short-circuit making current (peak) 80 kA; loop resistance ≤600 μΩ; mechanical endurance 3000 operations. Fuse replacement must be carried out after the earthing switch is closed and the cable side is reliably earthed. Suitable for protection of 500–1600 kVA distribution transformers and transformer outgoing-line bays in ring main units.

M Unit — Metering Unit (without switch)

Structure: The unit has no switch body, containing only busbar through-passage and metering instrument transformers (CT, PT), a meter position and a sealing structure.

Function: Serves as the energy metering (assessment) point, realizing gateway or assessment metering, usually combined with a C unit or V unit to form an 'incoming switch + metering' combination (e.g. C+M, V+M).

Features and applications: The unit width is 750–800 mm, the widest among the modular products, to allow installation of metering instrument transformers and meters; the current transformer ratio is selected according to the circuit current, accuracy class 0.2S (assessment metering) or 0.5S; voltage transformer ratio (10/0.1) kV, accuracy class 0.2; the instrument transformers comply with GB 20840.2 and GB 20840.3, and the secondary circuit can be provided with dedicated terminals and sealing. As it has no switch itself, its front and rear must be provided with breaking and isolation by adjacent units (C or V); its installation position and adjacent units must be specified at the time of ordering.

D Unit — Riser Unit (Cable Connection Unit)

Structure: A cable connection module without a switch and without an earthing switch, containing only incoming/outgoing bushings, busbar riser conductors and cable fixings.

Function: First, busbar riser, raising the busbar from the lower busbar position to the upper level or another height, facilitating upper busbar expansion, left-right line-up and connection to adjacent equipment; second, cable inlet/outlet, as a cable entry/exit transition unit realizing connection between cables and the main busbar; third, combination transition, as the first or last unit in a standard combination, facilitating incoming/outgoing line layout and subsequent expansion of the entire cubicle line.

Features and applications: Unit width 325 mm, the same as the C/V/F units, reference weight about 130–140 kg; can be fitted with arresters, fault indicators and dual cable terminations; as it has no switch, it has no breaking capability, and maintenance must rely on power-off isolation by adjacent units; the isolation means must be specified in the scheme at the time of ordering. Suitable for cable entry, busbar riser and cubicle-line transition applications.

Unit Combination Quick Reference

Requirement	Recommended combination	Explanation
Single incoming/outgoing line (no protection required)	C+D or D+C	D provides cable entry, C provides breaking and earthing
Ring network, two in and one out (three circuits)	C+C+F or C+C+C	Two ring-network in/out circuits + one transformer/feeder circuit
Ring network, four circuits	C+C+C+C	Dual ring-network in/out + two feeder circuits
Transformer protection outgoing line	C+F or F+D	F unit fitted with high-voltage current-limiting fuse
Incoming/outgoing line requiring relay protection	V+C or V+D	V unit circuit breaker + isolating/earthing
Metering bay	C+M or V+M	M has no switch; front and rear units must provide breaking and isolation
Busbar sectioning	C+C+SL+C+C	SL bus coupler unit realizes sectioning
Voltage transformer and secondary power supply	PT unit	With or without switch

Table: Functional Unit Combination Quick Reference

YRM6-12 Gas-insulated Metal-enclosed Switchgear

Main Technical Parameters

This chapter lists technical parameters in 7 tables for the shared parameters of the complete switchgear and the five units C, V, F, M and D, and provides standard module combination schemes and reference dimensions and weights for item-by-item verification during selection.

Parameter notes: The following parameters are industry-wide typical values for 12 kV YRM6 series products. Different manufacturers differ in rated cable charging breaking current, rated short-time withstand duration (3 s and 4 s), mechanical endurance and overall dimensions and weight; for formal design and ordering, please refer to the manufacturer's latest catalog and type-test report.

Shared Technical Parameters of the Complete Switchgear

Item	Unit	Value
Rated voltage	kV	12
Rated frequency	Hz	50
Main busbar rated current	A	630 / 1250
Rated short-time withstand current	kA/4 s	20
Rated peak withstand current	kA	50
1 min power-frequency withstand voltage (phase-to-phase, to earth)	kV	42
1 min power-frequency withstand voltage (across open contacts)	kV	48
Lightning impulse withstand voltage (phase-to-phase, to earth)	kV	75
Lightning impulse withstand voltage (across open contacts)	kV	85
Auxiliary circuit power-frequency withstand voltage	kV	2
Rated filling pressure (20 °C, absolute pressure)	bar	1.3 ~ 1.4
Annual gas leakage rate	%/yr	≤0.02
Gas tank material and thickness	—	Stainless steel (201/304/304L), 3.0 mm
Primary section protection degree	—	IP67
Cabinet enclosure protection degree	—	IP3X / IP4X
Main busbar inside cabinet	—	≥240 mm² Cu
Earthing busbar	—	≥120 mm² Cu
Front panel color	—	RAL7035
Side panel and cable compartment front cover color	—	RAL7035
Single module overall dimensions (W×D×H, C/V/F/D) excluding low-voltage compartment	mm	325 × 751 × 1336
Metering unit (M) width	mm	750~800
Design service life	yr	20 ~ 30
Installation method	—	Indoor vertical installation; front-to-back / left-right line-up
Busbar connection method	—	Plug-in silicone-rubber insulated busbar connector

Table 1 Shared Technical Parameters of the Complete Switchgear (12 kV)

Technical Parameters of C Unit (Load Switch Unit)

Item	Unit	Value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current	A	630
Number of switch positions	—	Three-position (closed/open/earthed)
Rated closed-loop breaking current	A	630
Rated cable charging breaking current	A	25
Rated short-circuit making current (peak)	kA	50
Rated short-time withstand current	kA/4 s	20
Rated peak withstand current	kA	50
1 min power-frequency withstand voltage (phase-to-phase, to earth / across open contacts)	kV	42 / 48
Lightning impulse withstand voltage (phase-to-phase, to earth / across open contacts)	kV	75 / 85
Main circuit resistance	μΩ	≤300
Load switch mechanical endurance	ops	5000
Isolating/earthing switch mechanical endurance	ops	5000
Operating mechanism	—	Spring-stored-energy, manual operation (motorized mechanism optional)
Motorized operating supply (optional)	V	DC110 / DC220 / AC220
Incoming/outgoing bushing	—	Single bushing (400 series bolted connection)
Live-line indication	—	Capacitive live-line indicator at the bushing
Factory test	—	Per GB/T 3906 and GB/T 11022

Table 2 C Unit Technical Parameters

Technical Parameters of V Unit (Vacuum Circuit Breaker Unit)

Item	Unit	Value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current	A	630 / 1250
Rated short-circuit breaking current	kA	20 / 25
Rated short-circuit making current (peak)	kA	50 / 63
Rated short-time withstand current	kA/4 s	20 / 25
Rated peak withstand current	kA	50 / 63
Rated short-time power-frequency withstand voltage	kV	42
Rated lightning impulse withstand voltage	kV	75
Isolating/earthing switch short-time withstand current	kA/4 s	20
Isolating/earthing switch peak withstand current	kA	50
Main circuit resistance	μΩ	≤120
Vacuum circuit breaker mechanical endurance	ops	10000
Isolating/earthing switch mechanical endurance	ops	5000
Operating mechanism	—	Spring operating mechanism, manual / motorized
Operating supply voltage	V	DC48 /DC110 / DC220 / AC220
Closing/opening operation method	—	Motorized energy storage + motorized closing/opening (manual possible)
Protection configuration	—	Can be fitted with microprocessor-based integrated protection device (overcurrent, instantaneous, zero-sequence, auto-reclosing, etc.)
Auxiliary contacts	—	Circuit breaker position, stored-energy status, abnormal alarm
Factory test	—	Per GB/T 1984, GB/T 3906 and GB/T 11022

Table 3 V Unit Technical Parameters

Technical Parameters of F Unit (Load Switch-Fuse Combination Unit)

Item	Unit	Value
Rated voltage	kV	12
Rated frequency	Hz	50
Circuit rated current	A	Depends on fuse rated current, max. 125
Rated current of fuse used	A	40 / 63 / 100 / 125 (common)
Fuse type	—	High-voltage current-limiting fuse (e.g. SDLAJ, XRNT series)
Rated transfer current	A	1750
Rated short-circuit breaking current	kA	31.5 (limited by high-voltage current-limiting fuse)
Rated short-circuit making current (peak)	kA	80
Rated short-time withstand current	kA/4 s	20
Rated peak withstand current	kA	50
1 min power-frequency withstand voltage (phase-to-phase, to earth / across open contacts)	kV	42 / 48
Lightning impulse withstand voltage (phase-to-phase, to earth / across open contacts)	kV	75 / 85
Main circuit resistance	μΩ	≤600
Load switch mechanical endurance	ops	3000
Fuse striker linkage	—	Any phase fuse blowing trips all three phases
Fuse replacement condition	—	Replace after earthing switch closed and cable side reliably earthed
Operating mechanism	—	Spring-stored-energy, manual (motorized mechanism optional)
Applicable transformer capacity (reference)	kVA	500 ~ 1600
Factory test	—	Per GB/T 16926, GB/T 3804 and GB/T 11022

Table 4 F Unit Technical Parameters

Technical Parameters of M Unit (Metering Unit, without switch)

Item	Unit	Value
Rated voltage	kV	12
Rated frequency	Hz	50
Unit type	—	No switch (without breaking and earthing function)
Unit width	mm	750~800
Current transformer rated ratio	A/A	Selected according to circuit current (e.g. 200/5, 400/5, 600/5)
Current transformer accuracy class	—	0.2S / 0.5S (0.2S for assessment metering)
Voltage transformer rated ratio	kV	(10/0.1)
Voltage transformer accuracy class	—	0.2
Secondary circuit	—	Dedicated metering secondary terminals, sealable
Meter position	—	Can be fitted with multifunction energy meter and meter-reading interface
Applicable standards	—	GB 20840.2 , GB 20840.3
Main circuit insulation level	—	Same as complete switchgear (42/48 kV power-frequency, 75/85 kV impulse)
Protection degree	—	Same as complete switchgear (primary section IP67)
Installation requirement	—	Front and rear must be provided with breaking and isolation by adjacent units (C/V)

Table 5 M Metering Unit Technical Parameters

Technical Parameters of D Unit (Riser Unit, without switch)

Item	Unit	Value
Rated voltage	kV	12
Rated frequency	Hz	50
Unit type	—	Cable connection / busbar riser unit without switch and without earthing switch
Unit width	mm	325
Reference weight	kg	Approx. 130–140
Busbar rated current	A	630 / 1250 (same as complete switchgear)
Rated short-time withstand current	kA/4 s	20
Rated peak withstand current	kA	50
Incoming/outgoing bushing	—	Single or dual bushing, 400 series bolted connection
Cable connection	—	Silicone-rubber separable cable plugs, supporting single/dual cable termination
Optional accessories	—	Arresters, short-circuit and earth-fault indicators, live-line indicators
Main circuit insulation level	—	Same as complete switchgear (42/48 kV power-frequency, 75/85 kV impulse)
Protection degree	—	Same as complete switchgear (primary section IP67)
Usage note	—	No breaking capability itself; maintenance requires power-off isolation by adjacent units

Table 6 D Unit Technical Parameters

Standard Module Combination Schemes and Reference Dimensions and Weight

Unit combination	Circuits / units	Reference weight (kg)	Typical application
D + F	2	260	Cable entry + transformer protection outgoing line
C + F	2	270	Ring-network entry + transformer protection outgoing line
C + C + C	3	300	Ring network, two in and one out (three circuits)
C + C + F	3	320	Ring-network in/out + transformer outgoing line
C + F + C	3	320	Ring-network in/out + transformer outgoing line (F in middle)
F + C + C	3	320	F unit placed on the incoming side
C + C + C + F	4	410	Four circuits (three switches + transformer protection)
C + C + F + F	4	430	Four circuits (dual transformer protection)
C + F + F + C	4	430	Four circuits (F units in middle)
C + C + V + V	4	411	Two ring-network circuits + two circuit breaker outgoing lines
C + C + C + C + C	5	480	Five-circuit ring network (all load switches)
C + C + C + C + F	5	500	Five circuits (four switches + transformer protection)
C+C+F+F (five circuits)	5	520 ~ 540	Five-circuit ring network (dual transformer protection)
Combinations with M metering unit (e.g. C+M, V+M, C+C+M+F)	Per scheme	Accumulate per unit	Metering bay

Table 7 Standard Module Combination Schemes and Reference Dimensions and Weight

Note 1: The weights in the table are reference values for the complete cubicle line (including gas tank, mechanism and busbar); the actual values are subject to the manufacturer's drawings.

Note 2: The M metering unit is 750–800 mm wide and must be accounted for separately when calculating the total cubicle line length.

Note 3: A single module can be used as an independent unit only after an expansion connector is fitted.

Selection Logic

This chapter provides the selection sequence from circuit function to the final cubicle line, typical scenario configuration suggestions, and three key tips for direct reference in quotation and scheme design.

Selection Logic

1. Determine circuit function: ring-network incoming/outgoing line select C; select V when protection or frequent operation is required; transformer circuit select F; metering point select M; select D when only cable entry or busbar riser is needed.
2. Determine rated current: the main busbar and incoming circuit are selected between 630 A and 1250 A — 630 A is suitable for general ring-network feeders and small/medium-capacity outgoing lines; 1250 A is suitable for large-capacity incoming lines, tie circuits or load-concentrated circuits (the V unit supports 1250 A).
3. Determine short-circuit level: calculate according to the system short-circuit capacity. The rated short-time withstand current of 20 kA/4 s of the complete switchgear meets the vast majority of 12 kV distribution networks; the F unit, limited by the fuse, has a rated short-circuit breaking current of 31.5 kA; the V unit can be selected for 20 kA or 25 kA.
4. Determine protection and automation configuration: the V unit is fitted with a microprocessor-based protection device for three-stage overcurrent, zero-sequence and auto-reclosing; the C/F units can be fitted with fault indicators and current transformers for live monitoring and ‘three-remote’ retrofit.
5. Determine combination and cubicle line length: accumulate by the number of units (325 mm/unit, M is 750–800 mm), and check the distribution room length and line-up direction.

Typical Configuration Suggestions

Scenario	Recommended configuration	Explanation
Urban ring-network switching station (three circuits)	C + C + F	Two ring-network in/out circuits and one transformer outgoing line; the most common combination
Ring network, four circuits	C+C+C+F or C+C+C+C+C	Depending on whether a transformer is included
Single-source terminal substation	D + C + F	D for cable entry, C as incoming line, F for distribution transformer protection
Important load distribution room	V + V + C + C	Circuit breaker circuits provide complete relay protection
Bay requiring metering assessment	C+M+C or V+M	M has no switch; switch units required at front and rear
Busbar sectioning or dual-source transfer	C + C + SL + C + C	Bus coupler unit realizes sectioning and tie
New-energy station collector lines	C + C + V + F	Collector lines (V protection) + step-up transformer (F protection)

Table: Recommended Configurations for Typical Scenarios

Three Selection Tips

1. M and D units have no switch themselves: the scheme must specify which adjacent unit provides breaking and earthing, to avoid a scheme defect of ‘no isolation means’.
2. F unit rated current depends on the fuse: the fuse rated current is maximum 125 A; for transformer capacities of 500–1600 kVA, the fuse specification must be selected according to the transformer rated current.
3. Special environments must be noted: for applications at altitudes above 2000 m, ambient temperatures below −40 °C or with high pollution levels, this must be specified at the time of ordering so that the manufacturer can carry out external insulation correction or add a heating device.

Ordering Instructions

Please provide the following information when ordering, so that the manufacturer can confirm the scheme, issue drawings and arrange production.

1. Single-line diagram (or scheme diagram): indicate the unit code combination of each circuit (e.g. C+C+F), circuit purpose and rated current of each unit.
2. Overall switchgear parameters: rated voltage (12 kV), rated frequency, main busbar rated current (630 A / 1250 A), rated short-circuit level (20 kA/4 s or 25 kA).
3. Technical parameters of each unit: whether the C unit is equipped with a motorized mechanism; the rated current and breaking current of the V unit, and the protection device model and function; the fuse rated current and transformer capacity of the F unit; the CT/PT ratio and accuracy class of the M unit; the bushing type (single/dual) and accessory requirements of the D unit.
4. Secondary control requirements: control supply voltage (DC48 V / DC110 V / DC220 V / AC220 V), protection configuration, signal contacts, whether 'three-remote' is required and the communication protocol.
5. Installation and dimensional requirements: cubicle line arrangement (front-to-back line-up / left-right line-up), incoming/outgoing line direction, cable specification and cross-section, and foundation dimensions.
6. Color and marking: cabinet color (default RAL7035/RAL7032), mimic diagram and label requirements (Chinese/English/Russian).
7. Operating environment: altitude, ambient temperature, humidity, pollution level and whether there are special anti-corrosion requirements.
8. Others: spare parts (fuses, operating handles, etc.), test requirements, packaging and transport requirements, delivery date and delivery location.

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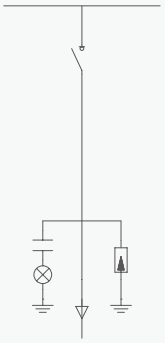
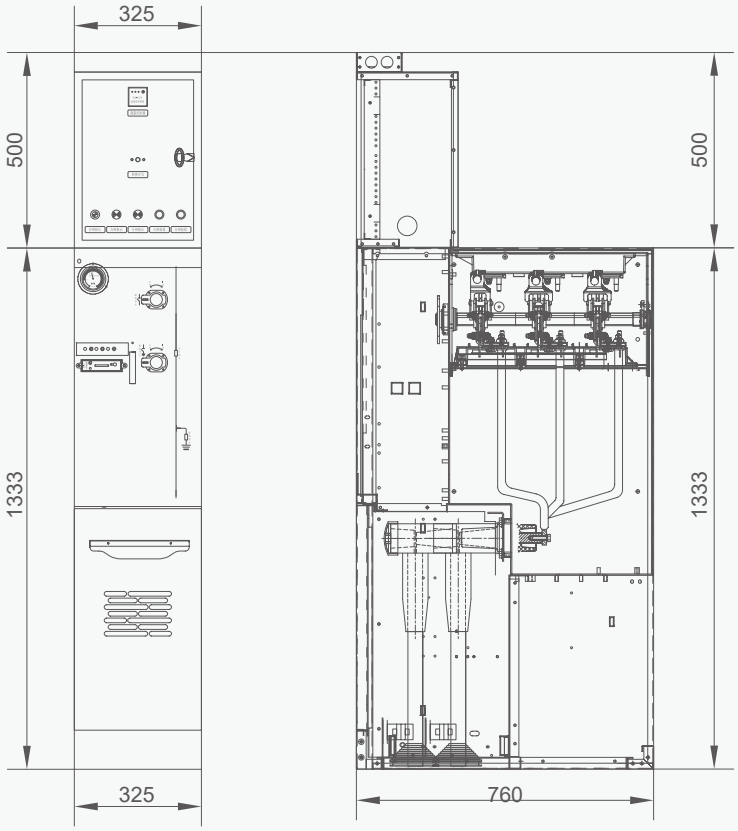
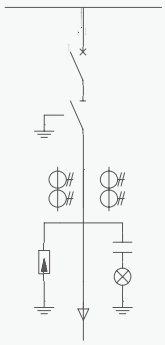
Overall and mounting dimensions (mm)

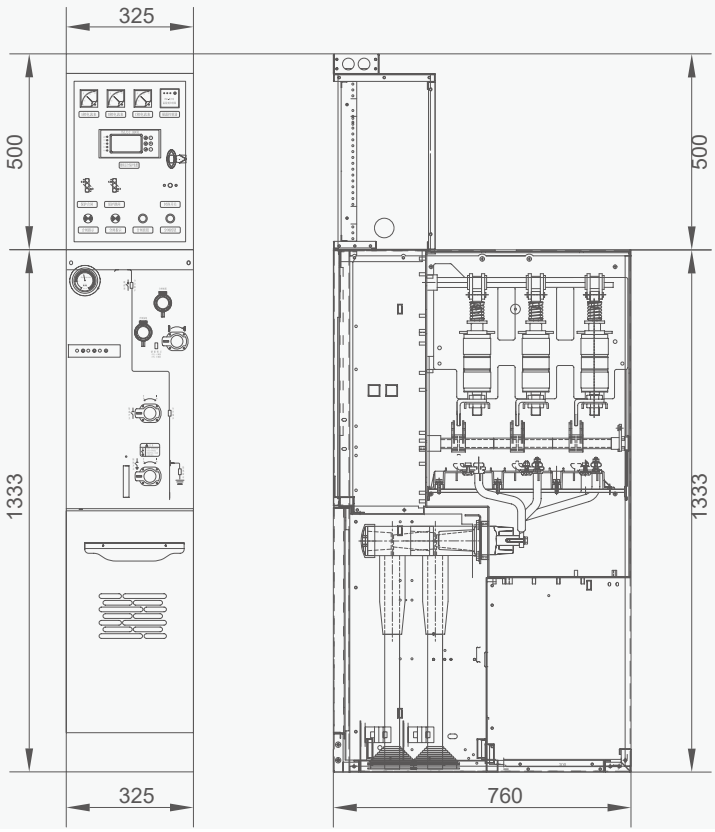


C Load Break Switch Unit

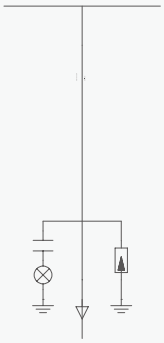




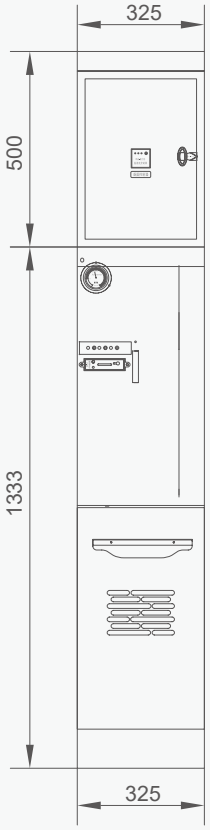
V Circuit Breaker Unit

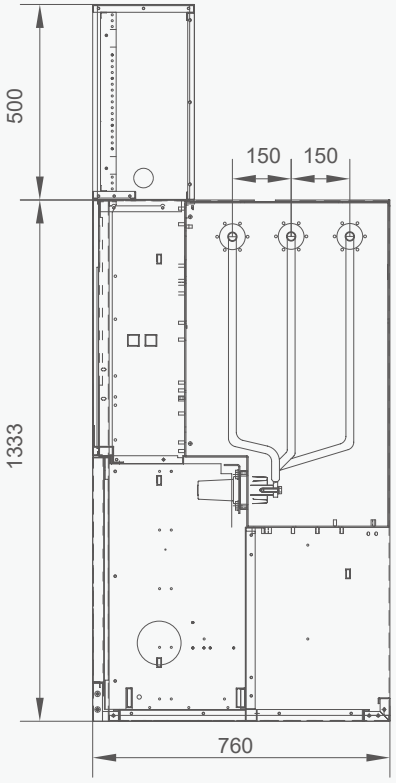


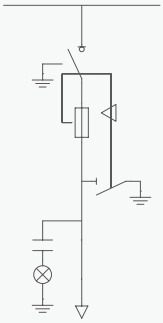
YRM6-12 Gas-insulated Metal-enclosed Switchgear



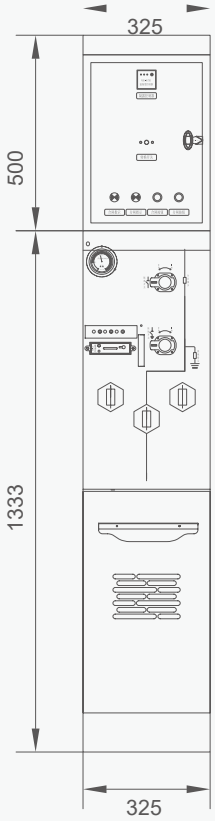
D Metering Unit

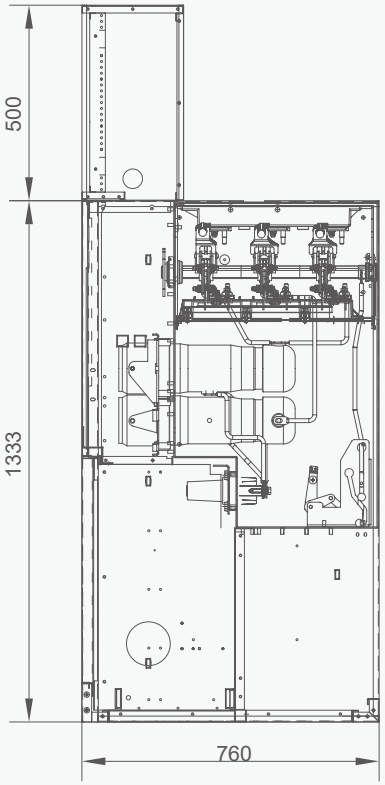




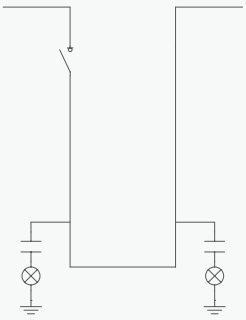


F Switch-Fuse Combination Unit

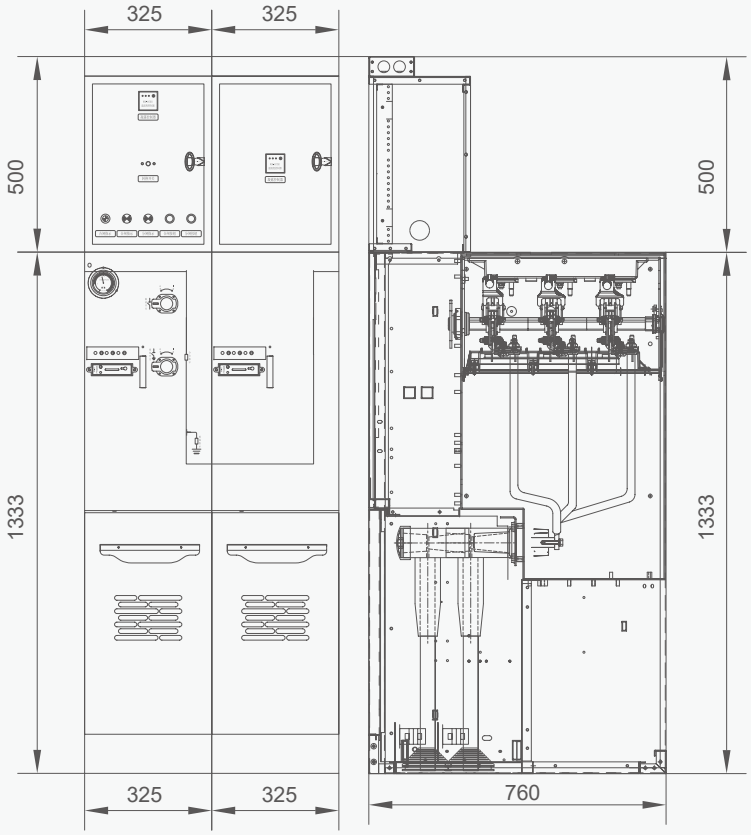


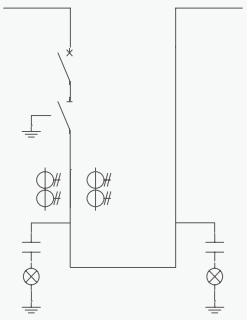


YRM6-12 Gas-insulated Metal-enclosed Switchgear

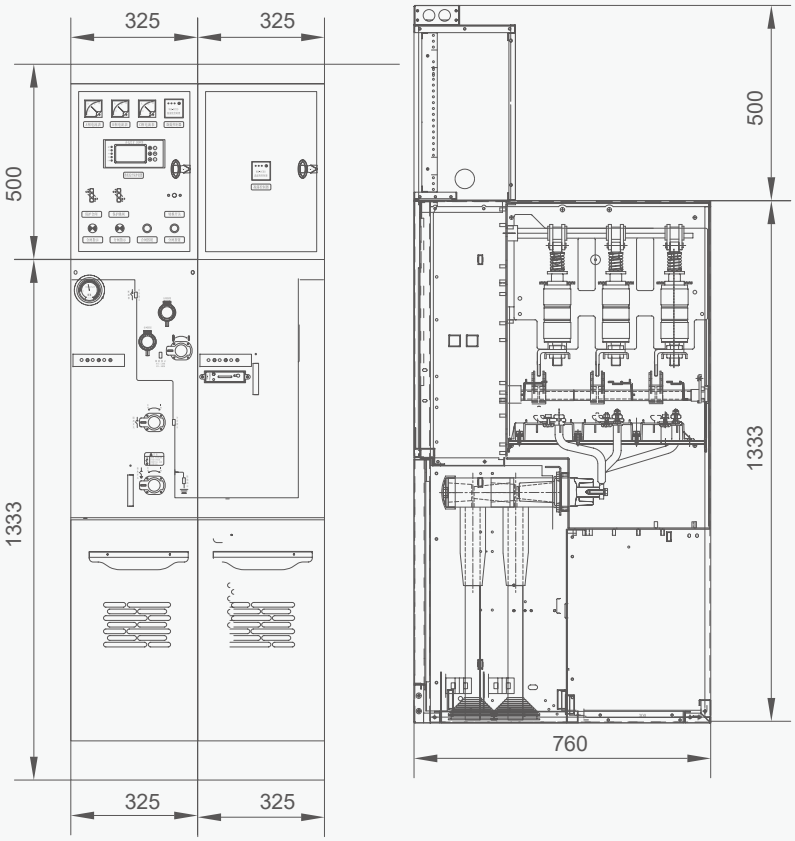


CD Load Break Switch Extension Unit

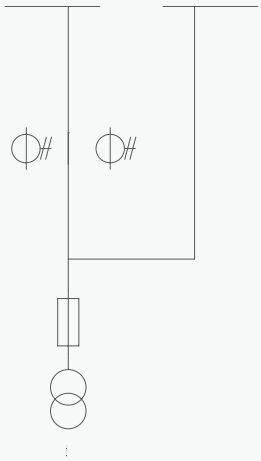




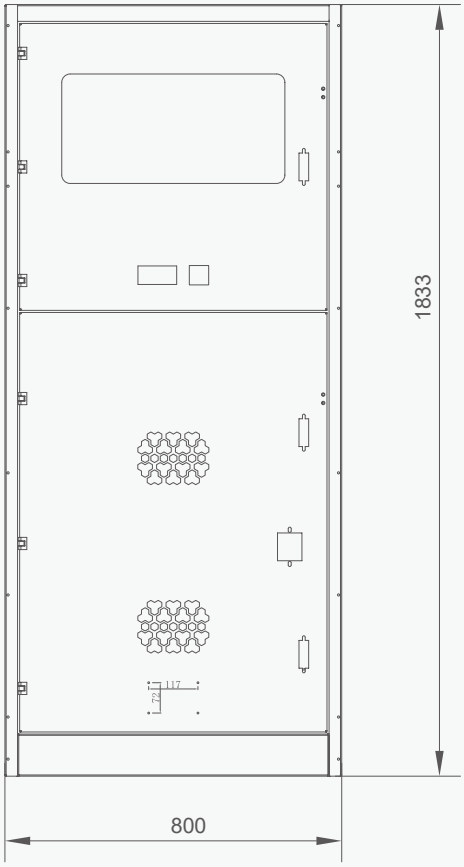
VD Vacuum Circuit Breaker Extension Unitsion Unit



YRM6-12 Gas-insulated Metal-enclosed Switchgear



M Metering Cabinet



Medium Voltage Switchgear

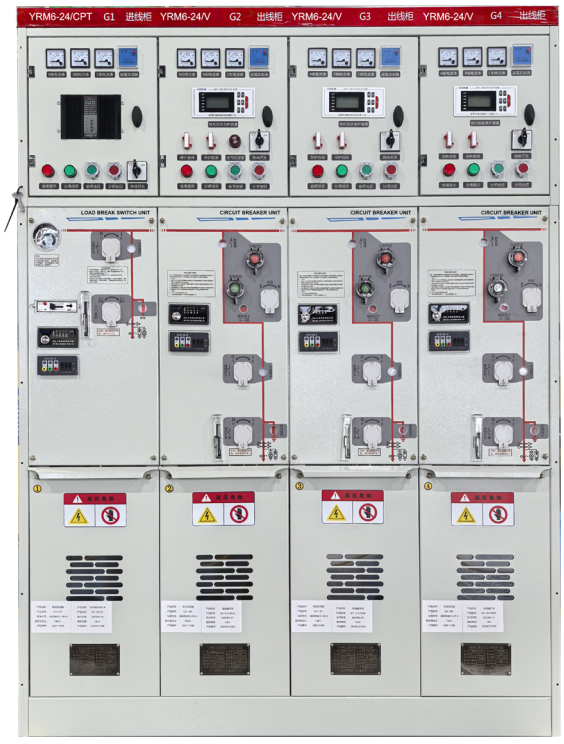
YRM6-24 Gas-insulated Metal-enclosed Switchgear

- YRM6-24 SF6 gas insulated ring main switchgear is a three-phase 50 Hz indoor switchgear assembly with rated voltage 24 kV, adopting a fully insulated, fully enclosed structure: all primary high-voltage live parts and the switch body are sealed in a 3 mm stainless steel laser-welded gas tank, with SF6 gas as the insulating and arc-extinguishing medium, so that the whole unit is unaffected by the external environment and realizes maintenance-free operation. The equipment is divided by function into five unit types: C (load switch), V (vacuum circuit breaker), F (load switch-fuse combination), M (metering) and D (riser), with a rated current of 630 A, supporting up to 3 units in a common tank, and with compact gas tank and unit bay dimensions (unit bay width 400 mm). It is suitable for 20 kV/24 kV urban distribution networks, industrial substations, load-center substations, high-rise buildings, outdoor switching stations and box-type substations.

  The YRM6-24 ring main unit is an SF6 fully insulated fully enclosed metal-enclosed switchgear integrating “full insulation, full sealing, modularity and maintenance-free operation”. The gas tank is made of 3 mm 304 stainless steel plate formed by 3D laser welding, with fully automatic helium leak detection, low leakage rate and a normal service life of more than 30 years; the extension busbar is fully insulated and shielded, with no accessible live part, fundamentally ensuring operational reliability and personal safety. The equipment features simple operation, reliable interlocking and compact size, and is especially suitable for distribution sites with limited space and poor environmental conditions.

General





YRM6-24 Gas-insulated Metal-enclosed Switchgear

Type designation

YRM 6 - 24 C / V / F / M / D

- Actual ordering is expressed as ‘cabinet type + unit combination’, e.g. YRM6-12 (C+C+F)
- Rated voltage 24 kV
- 6th design (structural finalization number)
- Fully insulated, modular ring main switchgear (enterprise product series code)

Type string: YRM6-24□ (□ is the unit type; M/D units are distinguished by wiring scheme No.)

Scope of application

- Ring main supply and terminal supply of urban distribution networks and 20 kV/24 kV switching stations;
- Industrial substations, load-center substations and distribution systems of industrial and mining enterprises;
- High-rise buildings, commercial complexes and distribution rooms of residential areas;
- Outdoor switching stations and box-type substations (with outdoor enclosure);
- Urban network renovation, dual power incoming, busbar sectionalizing interconnection, energy metering and other distribution links.

Applicable standards

Standard No.	Standard name
GB/T 11022	Common specifications for high-voltage switchgear and controlgear
GB 3906	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
GB 1984	High-voltage AC circuit-breaker
GB 1985	High-voltage AC disconnectors and earthing switches
GB 3804	High-voltage AC load switch for 3.6 kV to 40.5 kV
GB 16926	High-voltage AC load switch - fuse combination units
DL/T 403	Ordering specifications for indoor high-voltage vacuum circuit-breakers for 12 kV to 40.5 kV
DL/T 404	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
IEC 62271-1 / 100 / 102 / 105 / 200	Series standards for high-voltage switchgear and controlgear
IEC 60420	High-voltage AC load switch - fuse combination units

Operating environmental conditions

The altitude adaptability of 24 kV products is lower than that of 12 kV products; special attention must be paid to the project altitude during selection. Normal operating conditions are shown in the table below.

Item	Normal operating conditions
Ambient temperature	-40 °C to +55 °C (typical -25 °C to +40 °C for indoor type)
Altitude	≤ 2000 m (up to 4000 m for some products; insulation correction per IEC 62271-1 required above 1000 m)
Relative humidity	Daily average ≤ 95%, monthly average ≤ 90%
Seismic intensity	≤ 8 degrees
Installation environment	Free from fire and explosion hazards, and free from serious pollution, chemical corrosion and severe vibration
Installation method	Fixed indoor installation (or outdoor enclosure / switching station), cables bottom-in bottom-out (changeable as required)
Special conditions	For conditions beyond the above range, products for special operating conditions can be provided through consultation with the manufacturer

YRM6-24 Gas-insulated Metal-enclosed Switchgear

Cubicle structure and technical features

YRM6-24 takes “stainless steel gas tank + SF6 insulation + three-position switch + common-tank modularity” as its core architecture. This chapter explains the gas tank, switch, extension, safety, display and cable connection in five aspects.

SF6 Fully Insulated Fully Enclosed Gas Tank

Stainless steel gas tank: made of 3 mm 304 stainless steel plate, formed by 3D five-axis laser welding and fully automatic helium leak detection to ensure airtightness; the normal service life of the gas tank is more than 30 years;

Rated filling pressure 0.03~0.04 MPa (20 °C gauge), minimum working pressure 0.02 MPa, annual leakage rate ≤0.01%;

The primary high-voltage live parts are completely isolated from the external environment, unaffected by pollution, condensation, salt spray and water immersion; the degree of protection of the gas tank is IP67.

Three-Position Switch and Operating Mechanism

The load switch (or circuit breaker), disconnector and earthing switch are integrated in the gas tank, adopting a three-position (closed—open—earthed) design with obvious mechanical characteristics and clear position indication;

Equipped with a spring operating mechanism featuring manual and motorized operation (typical configuration: control circuit DC110V, auxiliary circuit AC220V);

Circuit breaker opening time ≤45~60 ms and closing time ≤70~75 ms, with fast and reliable operation.

Modularity and Extension

Unit-type structure with free combination and side-by-side assembly; the extension busbar is fully insulated and shielded, connected through insulated busbar connectors, and extension requires no opening of the gas tank;

Supports 1-unit independent gas tank, 2-unit common gas tank and 3-unit common gas tank three forms, with a maximum of 3 units in a common tank, saving floor space and installation cost;

The common-tank scheme is suitable for multiple circuits with adjacent functions in the same wiring scheme, reducing the number of gas tanks and connection links.

Five-Prevention Interlocking and Safety

Complete mechanical interlocking realizes the “five preventions”: preventing mis-closing/mis-opening of the circuit breaker, preventing the disconnector from being opened or closed under load, preventing earthing when live, preventing closing with earthing in place, and preventing entry into live compartments;

The gas tank is provided with a pressure relief device; the internal arc fault class is AFLR 20 kA/0.5 s, with directional pressure relief on fault;

The phase-to-phase and phase-to-earth clearance is ≥180 mm, and the clearance from live parts to the door is ≥210 mm, providing sufficient insulation margin.

Display and Cable Connection

A viewing window is provided on the front of the cubicle to observe the switch open/closed position and earthing status; a live-line indicator is equipped;

The cable compartment has ample space (about 75% of the lower part of the cubicle) and can accommodate cable terminations, fuses, earthing switches, voltage transformers, etc.;

Cables can use fully insulated touchable plug-in terminals with bottom-in bottom-out connection, convenient for installation and maintenance.

YRM6-24 Gas-insulated Metal-enclosed Switchgear

Functional Unit Description

YRM6-24 is divided into three main switch unit types C, V and F by main switch type, plus the switchless M metering unit and D riser unit. All of them can be combined according to the primary system scheme, and an independent gas tank or a common gas tank can be selected within the range of 1~3 units.

C Unit — Load Switch Unit

The C unit uses a three-position SF6 load switch as the main switch, integrating disconnector and earthing switch functions, and is used for making and breaking load current, ring main closed-loop breaking and line isolation and earthing; it is the main unit for ring main incoming and outgoing lines. Rated current 630 A, rated closed-loop breaking current 630 A, mechanical life 5000 times, available with manual or motorized spring mechanism.

V Unit — Vacuum Circuit Breaker Unit

The V unit uses a vacuum circuit breaker as the main switch, equipped with a spring operating mechanism, capable of breaking load current, overload current and short-circuit current (rated short-circuit breaking current 20 kA). Combined with microprocessor-based protection, it realizes instantaneous overcurrent, overcurrent, zero-sequence and automatic standby power supply switching functions, with a mechanical life up to 10000 times. It is suitable for incoming, outgoing and sectionalizing interconnection circuits that require relay protection or frequent operation.

F Unit — Load Switch-Fuse Combination Unit

The F unit is composed of a three-position load switch and a current-limiting fuse. The fuse undertakes short-circuit breaking (breaking capacity 31.5 kA), and the load switch undertakes load current operation and links to open on fuse melting (striker tripping), achieving complete three-phase isolation. The rated transfer current at the 24 kV level is about 1200~1400 A (obviously lower than 1750 A at the 12 kV level). It is suitable for distribution transformer protection circuits; during selection, the transfer current must be calculated according to the transformer capacity.

M Unit — Metering Unit

The M unit is not equipped with any main switch, and is fitted with metering current transformers (class 0.2S/0.5S), voltage transformers (20/0.1 kV) and energy meters, used for trade settlement or assessment metering.

Special note: the M unit itself has no breaking and earthing isolation capability; its supply side must be provided with isolation and protection by a C unit or V unit, and they must be configured in pairs in the scheme when ordering.

D Unit — Riser Unit

The D unit has no main switch and no earthing switch, and is internally fitted with insulated busbars and connection conductors, used for cable entry/exit, busbar riser (transferring from cable level to main busbar height) and busbar transition connection between multiple cubicle sections; it is the transition connecting unit of the whole assembly.

Unit Combination Quick Reference

Unit code	Name	Main switch	Typical application
C	Load switch unit	Three-position SF6 load switch	Ring main incoming, outgoing and busbar sectionalizing
V	Vacuum circuit breaker unit	Vacuum circuit breaker	Incoming, outgoing, sectionalizing interconnection and protection-required circuits
F	Combination unit	Load switch + current-limiting fuse	Distribution transformer circuit protection (fuse ≤125 A)
M	Metering unit	None	High-voltage-supply high-voltage metering (must be combined with C/V)
D	Riser unit	None	Cable entry, busbar riser and interconnection transition

YRM6-24 Gas-insulated Metal-enclosed Switchgear

Main technical data

This chapter gives the detailed technical data of the complete unit and each unit, in 6 tables. The parameters in the tables are typical values commonly used in the industry; for formal ordering, please refer to the manufacturer's catalogue and type test reports.

Table 1 YRM6-24 Complete Unit Main Technical Data

Item	Unit	Value
Rated voltage	kV	24
Rated frequency	Hz	50
Rated current (main busbar)	A	630
Rated short-time withstand current (4 s)	kA	20 (25 optional)
Rated peak withstand current	kA	50 (63 optional)
Rated short-circuit making current (peak)	kA	50 (63 optional)
1 min power-frequency withstand voltage (phase-to-phase, phase-to-earth / across isolating distance)	kV	65 / 79
Lightning impulse withstand voltage (peak, phase-to-phase, phase-to-earth / across isolating distance)	kV	125 / 145
Short-time power-frequency withstand voltage of auxiliary and control circuits	kV	2
Internal arc fault class (AFLR)	kA/s	20 / 0.5
Main circuit resistance	μΩ	≤ 150
Insulating medium	—	SF6 gas, rated pressure 0.03~0.04 MPa (20 °C gauge)
SF6 minimum working pressure (20 °C gauge)	MPa	0.02
Annual leakage rate	%	≤ 0.01
Degree of protection	—	Gas tank IP67, enclosure IP4X
Operating power supply	V	Control circuit DC48/DC110/DC220/AC220, auxiliary circuit AC 220
Mechanical life (load switch / circuit breaker / disconnector-earthing switch)	times	5000 / 10000 / 3000
Service life	years	≥ 30
Gas tank material	—	3 mm 304 stainless steel, laser-welded
Unit bay width	mm	400 (same for C/V/D and F units, different depth)
Max. number of units in a common tank	units	3
Phase-to-phase and phase-to-earth clearance (live parts to door)	mm	≥ 180 (210)
Cable connection	—	Fully insulated touchable plug-in terminals, bottom-in bottom-out
Operating mode	—	Manual / motorized spring operating mechanism

YRM6-24 Gas-insulated Metal-enclosed Switchgear

Table 2 C Unit (Load Switch) Main Technical Data

Item	Unit	Value
Rated voltage	kV	24
Rated frequency	Hz	50
Rated current	A	630
Rated active load breaking current	A	630
Rated closed-loop breaking current	A	630
Rated cable charging breaking current	A	10 ~ 25
Rated short-time withstand current (4 s)	kA	20 (25 optional)
Rated peak withstand current	kA	50 (63 optional)
Rated short-circuit making current (peak)	kA	50
1 min power-frequency withstand voltage (phase-to-phase/phase-to-earth / across open contacts)	kV	65 / 79
Lightning impulse withstand voltage (peak)	kV	125 / 145
Main circuit resistance	μΩ	≤ 150
Mechanical life	times	5000
Disconnector/earthing switch mechanical life	times	3000
Three-position function	—	Closed — Open — Earthed
Arc-extinguishing method	—	SF6 gas arc extinguishing (inside gas tank)
Unit bay dimensions (W × D × H)	mm	400 × 757 × 1450 + LV box height

Table 3 V Unit (Vacuum Circuit Breaker) Main Technical Data

Item	Unit	Value
Rated voltage	kV	24
Rated frequency	Hz	50
Rated current	A	630
Rated short-circuit breaking current	kA	20 (25 optional)
Rated short-circuit making current (peak)	kA	50 (63 optional)
Rated short-time withstand current (4 s)	kA	20 (25 optional)
Rated peak withstand current	kA	50 (63 optional)
Out-of-phase earth-fault breaking current	kA	17.32
Rated operating sequence	—	O-0.3s-CO-180s-CO
Opening time / closing time	ms	≤ 45 ~ 60 / ≤ 70 ~ 75
1 min power-frequency withstand voltage (phase-to-phase/phase-to-earth / across open contacts)	kV	65 / 79
Lightning impulse withstand voltage (peak)	kV	125 / 145
Mechanical life (mechanical endurance)	times	10000 (≥5000)
Operating mechanism	—	Spring mechanism (manual / motorized)
Protection configuration	—	Configurable with microprocessor-based protection (instantaneous, overcurrent, zero-sequence) and DTU
Arc-extinguishing method	—	Vacuum arc extinguishing
Unit bay dimensions (W × D × H)	mm	400 × 757 × 1450 + LV box height

Table 4 F Unit (Load Switch-Fuse Combination) Main Technical Data

Item	Unit	Value
Rated voltage	kV	24
Rated frequency	Hz	50
Rated current of load switch	A	630
Maximum rated current of fuse	A	≤ 125 (selected according to the transformer capacity)
Rated short-circuit breaking current (fuse)	kA	31.5
Rated transfer current	A	1200 ~ 1400
Rated short-circuit making current (peak)	kA	80
Rated cable charging breaking current	A	10
1 min power-frequency withstand voltage (phase-to-phase/phase-to-earth / across open contacts)	kV	65 / 79
Lightning impulse withstand voltage (peak)	kV	125 / 145
Mechanical life	times	5000
Disconnector/earthing switch mechanical life	times	3000
Interlock function	—	Fuse striker linked tripping, complete three-phase isolation
Arc-extinguishing method	—	Load switch SF6 arc extinguishing + current-limiting fuse
Unit bay dimensions (W × D × H)	mm	400 × 830 × 1450 + LV box height

Table 5 M Unit (Metering) Main Technical Data

Item	Unit	Value
Rated voltage	kV	24
Rated frequency	Hz	50
Rated current (busbar)	A	630
Main switch	—	None (without breaking and earthing capability)
Current transformer	—	Measurement class 0.2S / 0.5S, ratio configured per metering requirements
Voltage transformer	—	20/0.1 kV, class 0.2
Metering instrument	—	Configured per power supply department requirements (remote transmission can be reserved)
1 min power-frequency withstand voltage (phase-to-phase/phase-to-earth / across open contacts)	kV	65 / 79
Lightning impulse withstand voltage (peak)	kV	125 / 145
Cubicle dimensions (W × D × H)	mm	≥ 900 × 1100 × 1850
Configuration constraint	—	Must be combined with C/V units, which provide isolation and protection

Table 6 D Unit (Riser) Main Technical Data

Item	Unit	Value
Rated voltage	kV	24
Rated frequency	Hz	50
Rated current (busbar)	A	630
Main switch	—	None
Earthing switch	—	None
Function	—	Cable entry, busbar riser and interconnection transition
1 min power-frequency withstand voltage (phase-to-phase/phase-to-earth / across open contacts)	kV	65 / 79
Lightning impulse withstand voltage (peak)	kV	125 / 145
Unit bay dimensions (W × D × H)	mm	400 × 757 × 1450 + LV box height
Gas tank form	—	Can be 1-unit independent tank or 2~3-unit common tank

Unit bay and gas tank dimensions

YRM6-24 adopts a unified 400 mm unit bay width design, achieving compact combination through shared gas tanks, with a maximum of 3 units in a common tank. This chapter lists the unit bay dimensions, gas tank dimensions and standard combination schemes for arrangement and foundation design.

Table 7 Unit Bay Dimensions (Common-Tank Unit Bay)

Unit type	W × D × H (mm)	Remarks
C / V / D unit	400 × 757 × 1450 + LV box height	Common-tank unit bay dimensions
F unit	400 × 830 × 1450 + LV box height	Common-tank unit bay dimensions, depth 73 mm larger than C/V/D
M metering cubicle	≥ 900 × 1100 × 1850	Overall metering cubicle dimensions, wider than standard unit bay

Table 8 Gas Tank Dimensions (W × D × H, mm)

Number of units	C / V / D gas tank (without F unit)	C / V / D / F gas tank (with F unit)
1 unit (independent tank)	446 × 757 × 1450 + LV box height	446 × 830 × 1450 + LV box height
2 units (common tank)	846 × 757 × 1450 + LV box height	1246 × 830 × 1450 + LV box height
3 units (common tank)	846 × 757 × 1450 + LV box height	1246 × 830 × 1450 + LV box height

Dimension description

The height 1450 mm in the table is the gas tank body height; the complete cubicle height shall be the gas tank height plus the LV box (instrument/mechanism compartment) height; the actual complete cubicle height shall be based on the manufacturer's arrangement drawing;

The 1-unit gas tank is 446 mm wide and the 2-unit gas tank is 846 mm wide; each additional unit bay (400 mm) is the common-tank width increment;

A maximum of 3 units in a common tank is supported; when there are more than 3 units, they must be split into multiple gas tanks assembled side by side;

The 2-unit and 3-unit common gas tank dimensions in this table are listed according to the technical data provided by the purchaser; the actual 3-unit common-tank width shall be finally confirmed by the manufacturer's gas tank arrangement drawing (including LV box stacking height).

Table 9 Standard Combination Schemes (Examples)

Scheme code	Combination	Application	Recommended gas tank form
YRM6-24C	C	Ring main incoming / outgoing	1-unit independent tank
YRM6-24C+C+C	C + C + C	Three-circuit ring main node	3-unit common tank
YRM6-24C+F	C + F	One incoming one transformer	2-unit common tank (special bay, depth 830)
YRM6-24C+F+C	C + F + C	One incoming one outgoing with distribution transformer	3-unit common tank
YRM6-24C+M+C	C + M + C	Incoming - metering - outgoing	M is an independent metering cubicle (≥900×1100×1850)
YRM6-24V	V	Circuit breaker circuit	1-unit independent tank
YRM6-24V+C	V + C	Circuit breaker incoming + load outgoing	2-unit common tank
YRM6-24V+V	V + V	Sectionalizing / interconnection	2-unit common tank
YRM6-24C+D	C + D	Incoming + cable riser	2-unit common tank
YRM6-24C+C+D	C + C + D	Dual circuits + cable transfer	3-unit common tank
YRM6-24V+C+C	V + C + C	One incoming two outgoing	3-unit common tank
As required	Any combination	Customized	When the number of units >3, split into multiple gas tanks assembled side by side

Selection recommendations

YRM6-24 is a 24 kV level product, which differs from 12 kV products in current rating, transfer current and altitude adaptability. This chapter gives a five-step selection logic, typical scenario recommendations and three selection tips.

Selection Logic (Five Steps)

Step 1: Determine the circuit function — select C for ordinary ring main circuits; V for relay protection or frequent operation; F for distribution transformer protection; M for trade metering; D for cable transfer;

Step 2: Check current and short-circuit level — the rated current of this cabinet type is 630 A; select the 20 kA or 25 kA breaking level according to the system short-circuit capacity (corresponding to short-time withstand 20/25 kA·4 s and peak 50/63 kA);

Step 3: Calculate the F unit transfer current — the transfer current at the 24 kV level is about 1200~1400 A, which must be calculated according to the transformer capacity (the transfer current converted from the low-voltage side short circuit must not exceed the limit);

Step 4: Determine the gas tank form — select a 1-unit independent gas tank or a 2~3-unit common gas tank according to the number and arrangement of units, with a maximum of 3 units in a common tank; the M metering unit is an independent metering cubicle without a gas tank unit;

Step 5: Confirm auxiliary requirements — lock the scheme after confirming the operating power supply (DC48V/DC110V/DC220V/AC220V), protection and automation configuration, cable specifications and incoming/outgoing direction.

YRM6-24 Gas-insulated Metal-enclosed Switchgear

Typical scenario recommendations

Scenario	Recommended configuration	Key points
Urban ring main node	C + C + C (3-unit common tank)	Most compact footprint, flexible incoming/outgoing
Residential / industrial distribution transformer circuit	C + F (2-unit common tank)	Calculate transfer current per transformer capacity
Incoming requiring relay protection	V + C + C	V unit with microprocessor-based protection
Busbar sectionalizing / interconnection	V + V	Select per protection and operation frequency
High-voltage supply high-voltage metering	C + M + C	M independent metering cubicle, upstream isolation required
Cable transfer	C + D or C + C + D	D unit completes the busbar transition
Outdoor switching station / box-type substation	Full range + outdoor enclosure	Pay attention to altitude and temperature correction

Selection Tips

The altitude adaptability of the 24 kV level is weaker than that of the 12 kV level: above 1000 m altitude, insulation correction is required per IEC 62271-1; for high-altitude projects, it is recommended to confirm with the manufacturer or select solid-insulated/eco-gas switchgear;

The F unit transfer current (1200~1400 A) is obviously lower than that of the 12 kV level; when the distribution transformer capacity is large, it must be calculated or the V unit with a current-limiting scheme should be used instead;

The M metering cubicle dimensions (≥900×1100×1850) are obviously larger than the standard unit bay; it must be considered separately in arrangement and foundation reservation.

Ordering instructions

When ordering, the purchaser shall provide the manufacturer with the following information:

Primary system wiring diagram (single-line diagram) and the unit configuration requirements of each circuit (C/V/F/M/D arrangement order);

Rated current of each circuit and system short-circuit parameters (short-circuit current / short-circuit capacity);

Gas tank form requirements: 1-unit independent gas tank or 2/3-unit common gas tank, and the combination order of common-tank units;

Transformer capacity and fuse selection requirements for the F unit (specify the brand if designated by the purchaser);

M unit metering requirements: transformer ratio, accuracy class, meter type and the specification requirements of the local power supply department;

Protection and automation requirements: microprocessor protection model, communication protocol, operating power supply (control DC110V, auxiliary AC220V or adjusted as required), and whether a motorized mechanism is equipped;

Cable specifications (cross-section, type), incoming/outgoing mode (bottom-in bottom-out or others) and cable termination requirements;

Cubicle arrangement scheme (including D riser unit position and M metering cubicle position), LV box height requirements, cubicle color and special coating requirements;

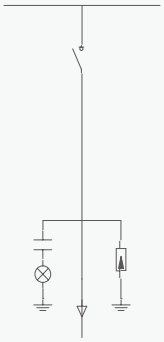
Operating environment: altitude (to be noted if >1000 m), ambient temperature, humidity and whether an outdoor enclosure is required;

Delivery time, transport method and on-site installation conditions (reserved holes, foundation dimensions, transport passage dimensions).

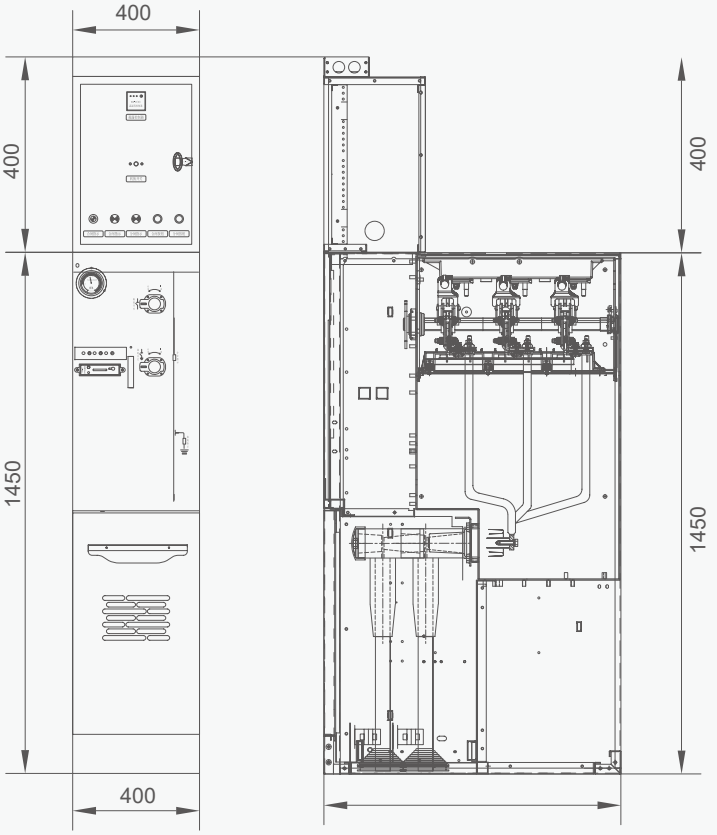
This technical data is for selection reference only; the final interpretation shall be subject to the manufacturer's technical documents.

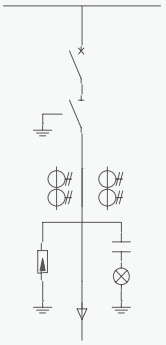
YRM6-24 Gas-insulated Metal-enclosed Switchgear

Overall and mounting dimensions (mm)

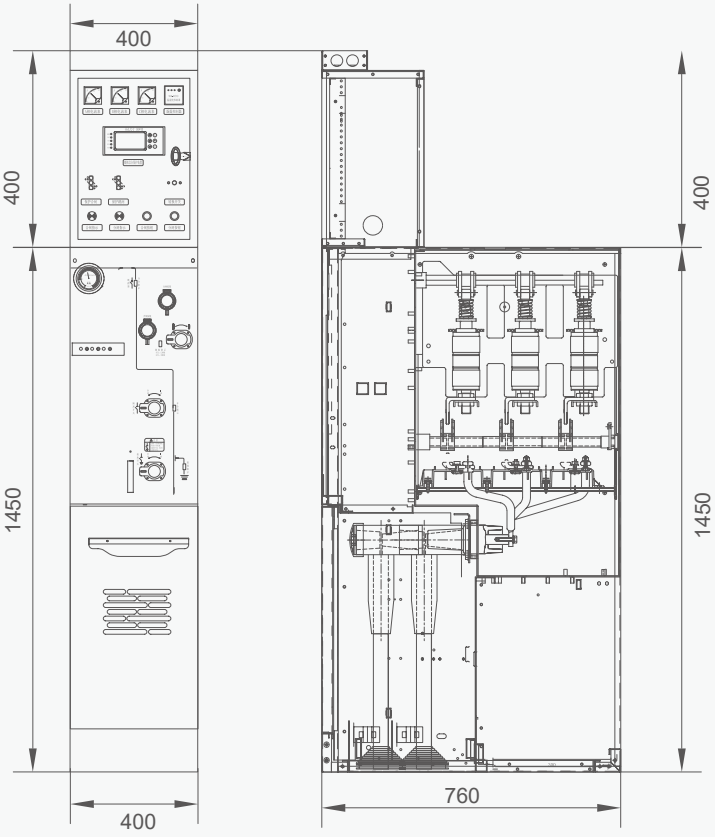


C Load Break Switch Unit

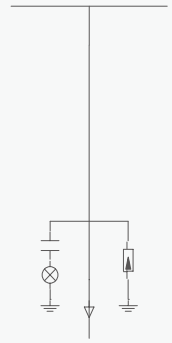




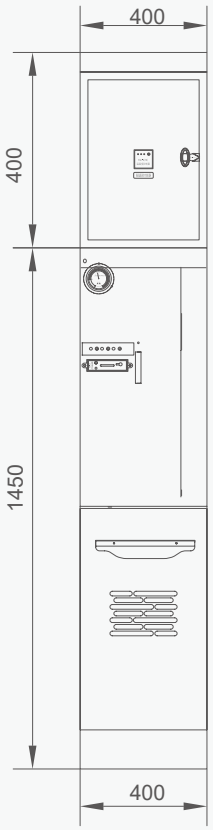
V Circuit Breaker Unit

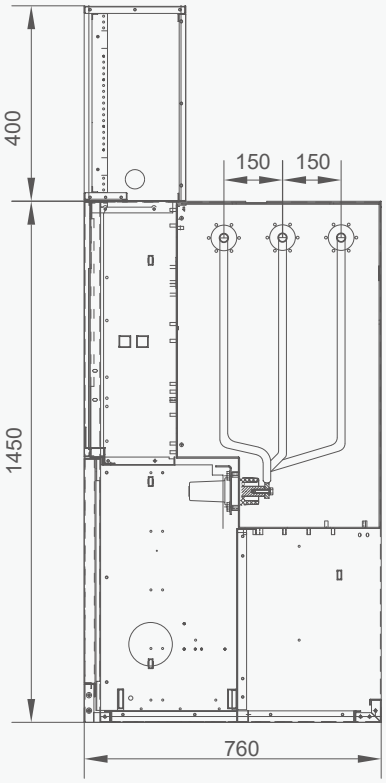


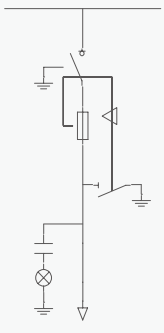
YRM6-24 Gas-insulated Metal-enclosed Switchgear



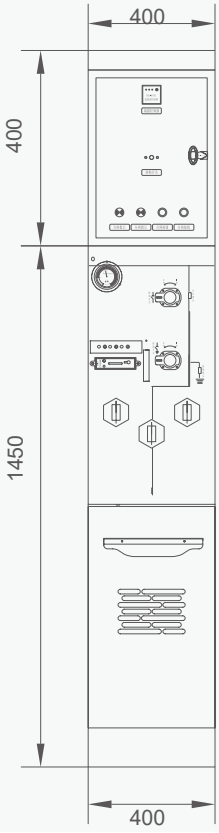
D Metering Unit

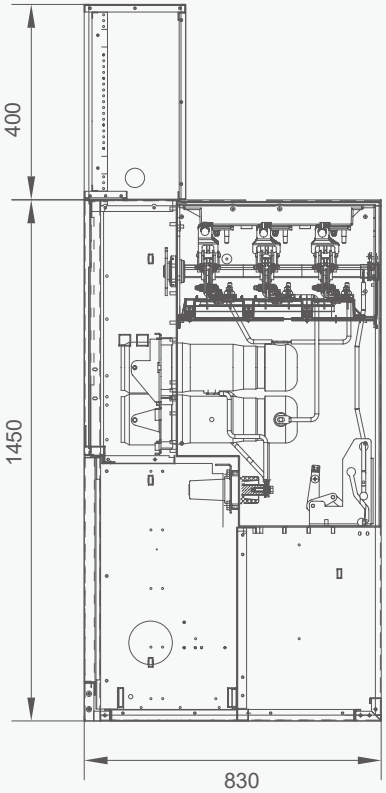




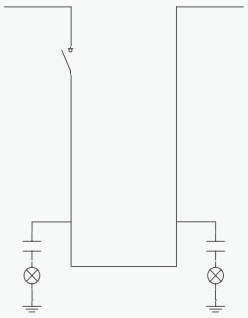


F Switch-Fuse Combination Unit

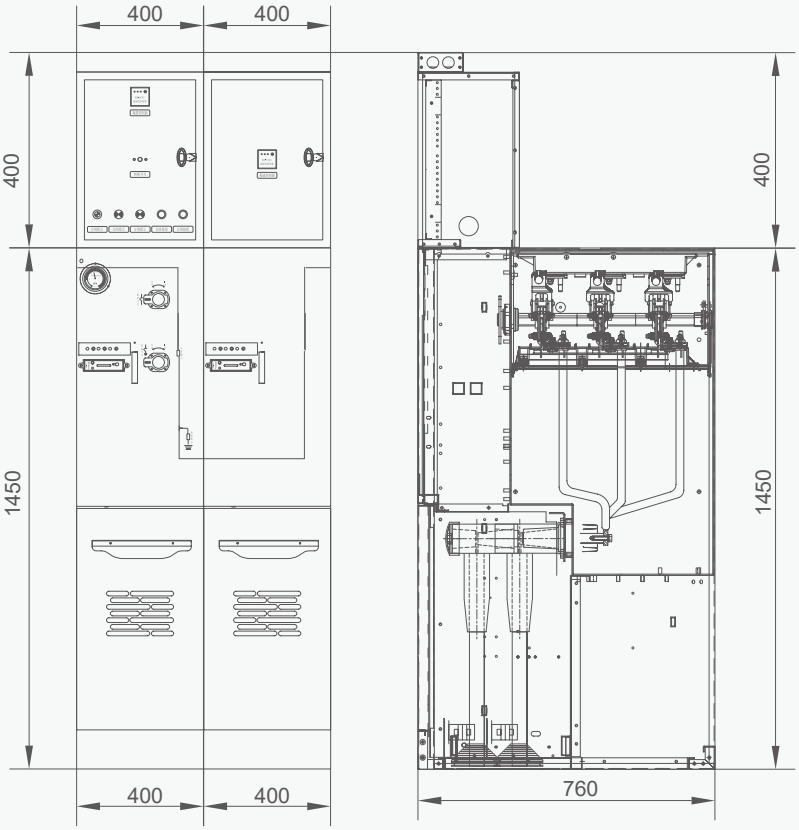


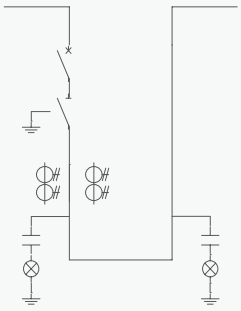


YRM6-24 Gas-insulated Metal-enclosed Switchgear

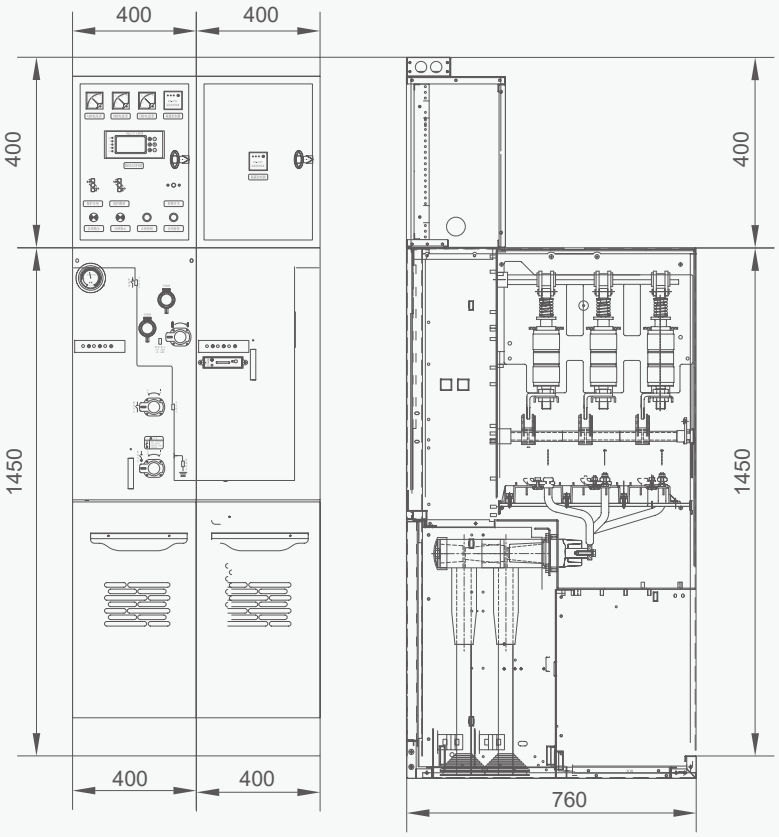


CD Load Break Switch Extension Unit

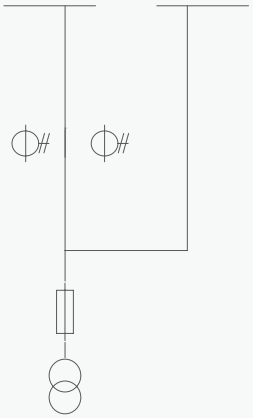




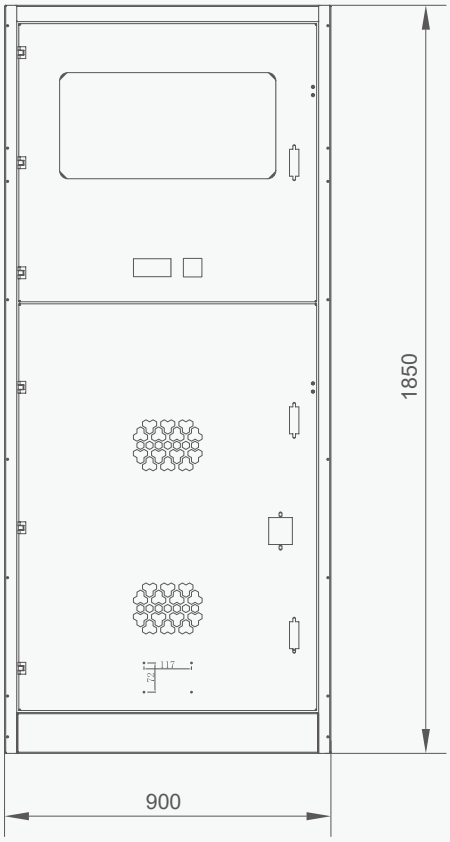
VD Vacuum Circuit Breaker Extension Unitsion Unit



YRM6-24 Gas-insulated Metal-enclosed Switchgear



M Metering Cabinet

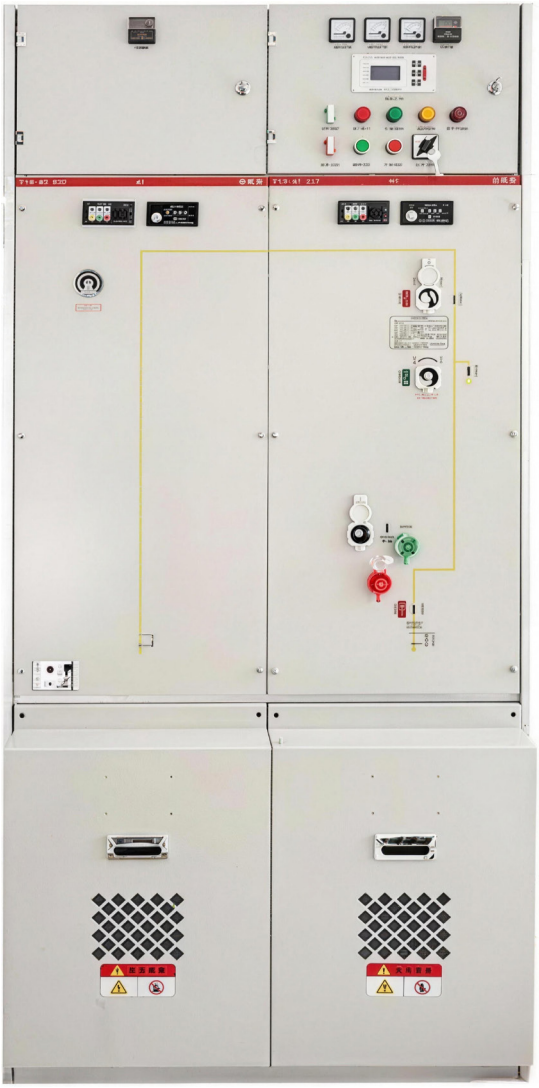


Medium Voltage Switchgear

YRM6-40.5 SF6 Gas Insulated Metal Enclosed Switchgear

This chapter introduces the product positioning, scope of application, type designation rules and applicable standards of the YRM6-40.5 ring main unit (C disconnector scheme), helping readers quickly build an understanding of the overall configuration of gas insulated switchgear at the 35 kV voltage level.

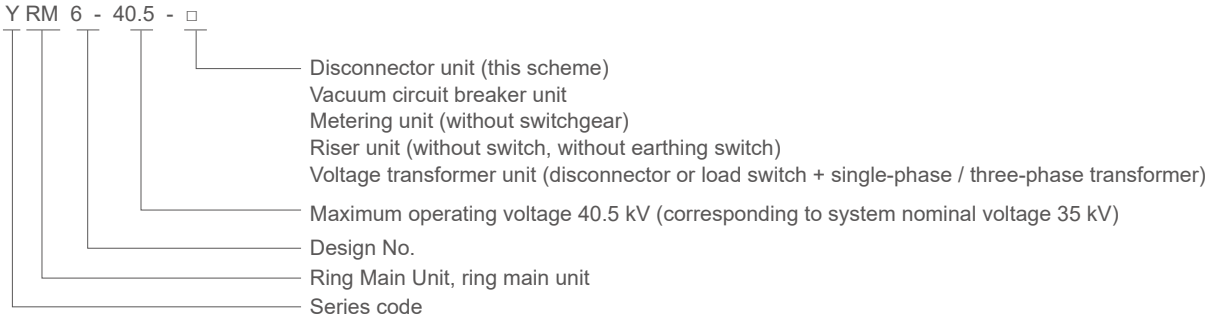
General



YRM6-40.5 SF6 Gas Insulated Metal Enclosed Switchgear

Type designation

Type string: YRM6-40.5□ (□ is the unit type code, distinguished by wiring scheme No.)



Scope of application

1. 35 kV urban distribution network switching stations and switching substations;
2. 35 kV main step-down substations and branch distribution of industrial and mining enterprises;
3. 35 kV collection and transmission of wind power and photovoltaic plant areas;
4. 35 kV traction power supply systems of urban rail transit;
5. Box-type substations, outdoor switching substations and distribution rooms.

Characteristics

The cabinet is not equipped with a load switch-fuse combination unit — the C unit is a disconnector (without load breaking capability), and the V unit is a vacuum circuit breaker (undertaking all load switching and short-circuit breaking). Therefore this scheme is a “disconnector + circuit breaker” configuration. All circuits requiring on-load operation must be equipped with a V unit; the C unit is used only for busbar sectionalizing isolation, incoming isolation, maintenance isolation and earthing. This configuration has a high protection level and a clear operation path, and is suitable for switching stations, switching substations and user main step-down substations where circuit-breaker-based protection predominates.

Item	Value
Rated voltage / maximum operating voltage	35 kV / 40.5 kV
Rated frequency / rated current	50 Hz / 630 A
Rated power-frequency withstand voltage	95 kV (phase-to-phase and to earth) / 118 kV (across isolating distance)
Rated lightning impulse withstand voltage	185 kV (phase-to-phase and to earth) / 215 kV (across isolating distance)
Rated short-time withstand current / peak withstand current	20 kA / 4 s | 50 kA
Unit bay dimensions (C / V / D)	500 × 930 × 1950 + LV box height (mm)
Gas tank degree of protection / SF6 annual leakage rate	IP67 | ≤0.01 %/year

Applicable standards

Standard No.	Standard name
GB/T 3906	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
GB/T 11022	Common specifications for high-voltage switchgear and controlgear
GB/T 1984	High-voltage AC circuit-breaker
GB/T 1985	High-voltage AC disconnectors and earthing switches (applicable to the C unit of this scheme)
GB/T 16927.1	High-voltage test techniques — Part 1: General definitions and test requirements
DL/T 404	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
DL/T 791	Selection guide for indoor AC gas-filled switchgear cubicles
IEC 62271-1	High-voltage switchgear and controlgear — Part 1: Common specifications
IEC 62271-100	High-voltage AC circuit-breaker
IEC 62271-102 / -200	Disconnectors and earthing switches / AC metal-enclosed switchgear and controlgear

YRM6-40.5 SF6 Gas Insulated Metal Enclosed Switchgear

Operating environmental conditions

Item	Technical conditions
Ambient temperature	Maximum +40 °C (24 h average not exceeding +35 °C); minimum -25 °C (low-temperature type -40 °C optional)
Relative humidity	Daily average ≤95%; monthly average ≤90%; daily average water vapor pressure ≤2.2 kPa; monthly average ≤1.8 kPa
Altitude	≤1000 m (standard type); above 1000 m insulation correction per IEC 62271-1 is required, usable up to 4000 m
Seismic capability	Horizontal acceleration ≤0.2 g (seismic intensity 8 degrees); vertical acceleration ≤0.1 g
Pollution class	≤ Class III (for outdoor type, external insulation is recommended to be calculated per Class IV)
Installation site	A site free from severe vibration and shock, fire and explosion hazards, chemical corrosion and serious mold
Installation method	Indoor or outdoor (with outdoor enclosure), foundation levelness deviation ≤2 mm/m
Electromagnetic environment	No electromagnetic interference sources exceeding standard limits at the installation site

Altitude and low-temperature notice: for the 40.5 kV level, every 100 m increase in altitude reduces the external insulation withstand voltage by about 1%; above 1000 m altitude, the insulation level must be raised or the operating voltage reduced according to the correction factor. SF6 gas may liquefy at low temperature; when the ambient temperature is below -25 °C, a gas pressure compensation scheme with a heating device should be selected or the filling pressure level increased. The rated filling pressure of this product is 0.04 MPa (gauge) at 20 °C, with a minimum working pressure of 0.02 MPa (gauge).

Cubicle structure and technical features

The structural design of YRM6-40.5 revolves around “full insulation, full enclosure, modularity and maintenance-free operation”. This chapter explains its technical features in six aspects: gas tank and insulation structure, modular common-tank extension, three-position disconnector and vacuum circuit breaker, five-prevention interlocking, pressure relief and internal arc protection, and display, monitoring and cable connection.

Gas Tank and Insulation Structure

The gas tank is a fully sealed enclosure made of 3 mm thick 304 stainless steel plate by laser cutting and robotic welding, subjected before delivery to synchronized evacuation, gas filling, helium mass-spectrometer leak detection, power-frequency withstand voltage and partial discharge tests. The main busbar, three-position disconnector, vacuum interrupter, earthing switch and connecting conductors are all placed inside the gas tank. The gas tank is filled with SF6 gas at 0.04 MPa (20 °C gauge), with a minimum working pressure of 0.02 MPa; the degree of protection is IP67. The gas tank is equipped with a temperature-compensated gas density meter (outputting low-pressure alarm and interlock contacts) and a bursting-disc pressure relief device that releases pressure in a directed manner through the bottom pressure-relief channel on overpressure.

Modularity and Common-Tank Extension

- Independent gas tank: each functional unit can use an independent gas tank, and can be replaced separately on fault without affecting the operation of other units;
- Common-tank combination: up to 3 functional units share one gas tank, with the internal busbar directly connected through, eliminating exposed busbar connections between units;
- Plug-in connection: fully shielded silicone rubber plug-in connectors (inner-cone/outer-cone type) are used between units and between the gas tank and cables, realizing extension without power interruption and quick replacement;
- Busbar arrangement: the main busbar is arranged horizontally at the rear upper part of the gas tank, and the up-down busbar transition can be realized through the busbar riser unit (RB / D).

Three-Position Disconnector and Vacuum Circuit Breaker

Both the C unit and the V unit are equipped with a three-position disconnector (connected — isolated — earthed), driven by the operating mechanism and ensuring mutual exclusion of the three positions through mechanical interlocking: in the connected position the main circuit is conducting; in the isolated position a standard-compliant isolating distance is formed (power-frequency 118 kV / lightning impulse 215 kV); in the earthed position the main circuit is earthed, for releasing residual charge during maintenance and preventing reverse energization.

The vacuum interrupter of the V unit adopts copper-chromium contacts and a longitudinal magnetic field arc-extinguishing structure, undertaking all load current switching and short-circuit current breaking, equipped with a spring operating mechanism with manual/motorized energy storage, and featuring automatic reclosing and telemetry, telesignalling and telecontrol functions. The C unit is a disconnector and does not have load current breaking capability; a program interlock is provided between it and the V unit circuit breaker to prevent operating the disconnector under load.

Five-Prevention Interlocking

1. Preventing mis-closing/mis-opening of the circuit breaker — the operating mechanism cooperates with key/program locks to prevent mis-operation under load;
2. Preventing opening/closing of the disconnector under load — the disconnector cannot be moved out of the connected position before the circuit breaker is opened;
3. Preventing earthing switch closing when live — the earthing switch cannot be closed when the main circuit is live;
4. Preventing closing and energizing with the earthing switch in place — when the earthing switch is in the closed position, the disconnector cannot be turned to the connected position;
5. Preventing entry into live compartments — the cable compartment door is interlocked with the earthing switch; the door cannot be opened before the earthing switch is closed.
6. The interlocking is realized directly by mechanical structure, independent of electrical circuits, with high reliability.

Pressure Relief and Internal Arc Protection

The product has internal arc fault (IAC) protection capability, type-tested to AFLR class per GB/T 3906 and IEC 62271-200 (accessible from front and side), typically passed under 20~25 kA, 1 s conditions. The protective design includes: directed overpressure relief of the gas tank through the bursting disc; the relief channel arranged at the cabinet bottom, discharging toward the cable trench to avoid facing the operator; independent cable compartment and mechanism compartment with metal earthed partitions limiting arc propagation; and a reinforced door structure to withstand arc impact.

Display, Monitoring and Cable Connection

- Mimic busbar display: a mimic busbar diagram is provided on the front door, intuitively indicating the primary circuit connection and operating status;
- Live-line indicator: a capacitive voltage-divider live-line indicator is fitted, capable of interlocking the disconnector/earthing switch operation;
- Gas density monitoring: the gas tank is fitted with a temperature-compensated gas density meter, outputting low-pressure alarm and interlock contacts;
- Intelligent monitoring (optional): can be configured with temperature, humidity and partial discharge online monitoring, and DTU / FTU distribution automation terminals, realizing telemetry, telesignalling, telecontrol and automatic fault isolation;
- Cable connection: cables and accessories are installed and maintained from the front of the cabinet, at an installation height of 600~700 mm, suitable for single-core or three-core cables; the cable compartment has a degree of protection of IP43 or above, equipped with fully shielded cable terminations and earthing accessories.

Functional unit description

YRM6-40.5 (C disconnector scheme) adopts a modular design of functional units; each unit can be used independently or combined into a common tank according to the wiring scheme. This chapter explains one by one the product positioning, technical characteristics and applicable occasions of the four basic units C, V, M, D and the PT cubicle, and gives a unit combination quick reference table.

C Disconnector Unit

Product description. The C unit is equipped with a three-position disconnector and earthing switch, used for busbar sectionalizing isolation, incoming isolation, maintenance isolation and earthing; it is the isolation safeguarding unit of the busbar system in the cabinet.

Important note: the C unit does not have the capability to break load current and short-circuit current; per IEC 62271-102 it only has the capability to break busbar transfer current (typical rated value 1.6 A, up to the 10 A order for some manufacturers) and the small capacitive current of a no-load busbar. The normal load switching of any circuit must be completed by the V unit; a program interlock is provided between the C unit and the V unit circuit breaker to prevent operating the disconnector under load.

Technical characteristics. Integrated three-position design (connected—isolated—earthed), with mechanical interlocking ensuring the operation sequence; mechanical life 3000~5000 operations; the earthing switch has short-circuit making capability (2~5 times). Main parameters are given in Table 2 of Chapter 5.

V Vacuum Circuit Breaker Unit

Product description. The V unit is equipped with a vacuum interrupter and a three-position disconnector, and is the only unit in this scheme with load current switching and short-circuit current breaking capability. The vacuum interrupter has copper-chromium contacts and longitudinal magnetic field arc extinguishing, with strong breaking capability and long electrical life (class E2); the spring operating mechanism allows manual/motorized energy storage, has automatic reclosing and telemetry, telesignalling and telecontrol interfaces, and can cooperate with microprocessor-based protection and DTU/FTU to realize overcurrent, instantaneous overcurrent, zero-sequence and reclosing protection. It is suitable for

incoming lines, feeders, busbar interconnection and all circuits requiring on-load operation and protection.

Technical characteristics. Vacuum arc extinguishing, short-circuit breaking current 20 kA (25 kA optional), class E2 electrical life; three-position disconnector isolating distance 118 kV / 215 kV; mechanical life 10000 operations (circuit breaker); rated current 630 A (1250 A optional). Main parameters are given in Table 3 of Chapter 5.

M Metering Unit

Product description. The M unit is a dedicated metering unit, with no switchgear inside, only fitted with current transformers, voltage transformers, energy meters and metering secondary accessories, used for gate metering or assessment metering on the 35 kV side; it can be equipped with a three-phase electronic multi-function energy meter, supporting RS-485/infrared communication and remote meter reading.

Important note: the M metering unit itself does not have breaking and earthing capability and cannot independently undertake circuit switching and safe isolation for maintenance. Its upstream and downstream sides must be provided with isolation and protection by V units; before maintaining the equipment inside the M unit, power-off, isolation and earthing must first be completed by adjacent units.

Technical characteristics. The built-in CTs are class 0.2S / 0.5S; the built-in PTs are (35/√3) / (0.1/√3) kV, class 0.2 / 0.5; the cubicle dimensions are larger than those of other units (see Table 7), to meet the insulation and installation distance requirements of 35 kV class transformers. Main parameters are given in Table 4 of Chapter 5.

D Riser Unit

Product description. The D riser unit is a functional transition unit, with no switchgear inside and without an earthing switch. It has three functions: first, as a cable incoming unit, leading external cables into the busbar system inside the gas tank; second, realizing the raising or transition of the busbar in the height direction of the cubicle; third, providing busbar connection transition between two cubicle rows of different wiring forms. Inside the D unit, the busbars are connected by fully shielded silicone rubber plug-in connectors, with conductors fully shielded and no exposed live parts.

Note: the D unit has no earthing switch and no earthing function. Maintenance work involving this unit must be provided with earthing measures by adjacent units.

Main parameters are given in Table 5 of Chapter 5.

PT Voltage Transformer Unit

Product description. The PT cubicle consists of a disconnector or load switch + voltage transformer (three single-phase units or one three-phase unit), providing voltage signals and operating power supply for the secondary system, and serving at the same time as an isolation means for the incoming circuit. The disconnector scheme has a simple structure and low cost, providing only the isolation function, suitable for occasions where circuit breaker protection already exists on the incoming side; the load switch scheme has on-load switching capability, can directly break load current and exciting current, suitable for occasions requiring direct switching of the PT or higher operating flexibility.

Technical characteristics. Voltage transformer ratio (35/√3) / (0.1/√3) kV, accuracy class 0.2 / 0.5; can be equipped with measurement winding + residual voltage winding (open delta); the primary side is provided with a current-limiting fuse or miniature circuit breaker, and the secondary side with an air switch and earthing terminal together with anti-open-circuit measures.

Dimension note: the dimensions of the PT cubicle vary with the model, quantity (single-phase/three-phase) and installation method of the voltage transformer and the specification of the disconnector (or load switch); this document does not give fixed dimensions. Specific dimensions are determined at selection according to the PT parameters, see Section 6.3 for details.

Main parameters are given in Table 6 of Chapter 5.

Common-tank principle: up to 3 functional units share one gas tank; the M metering unit and PT cubicle are usually independent cabinets.

YRM6-40.5 SF6 Gas Insulated Metal Enclosed Switchgear

Technical Data

The technical parameters listed in this chapter are typical values commonly used in the industry for 40.5 kV gas insulated switchgear, for selection reference and technical communication at the scheme stage. Different manufacturers differ in product design, material selection and process level; for formal ordering, please refer to the manufacturer's catalogue and type test reports. See the appendix for common differences.

Table 1 Complete Unit Main Technical Data

Item	Unit	Technical data
Rated voltage	kV	35
Maximum operating voltage	kV	40.5
Rated frequency	Hz	50
Rated current (main busbar)	A	630
Rated short-time withstand current (main circuit, rms)	kA	20 (25 optional)
Rated short-circuit duration	s	4 (3 for some manufacturers)
Rated peak withstand current	kA	50 (63 optional)
Rated short-circuit making current (peak)	kA	50
Rated power-frequency withstand voltage (phase-to-phase and to earth, 1 min)	kV	95
Rated power-frequency withstand voltage (across isolating distance, 1 min)	kV	118
Rated power-frequency withstand voltage (auxiliary and control circuits, 1 min)	kV	2
Rated lightning impulse withstand voltage (phase-to-phase and to earth, peak)	kV	185
Rated lightning impulse withstand voltage (across isolating distance, peak)	kV	215
Internal arc fault withstand class	—	IAC AFLR 20~25 kA / 1 s
Loss of service continuity class	—	LSC 2 (LSC 1 for some configurations)
Main busbar material / cross-section	—	Copper bar, 120 mm² (checked per rated current)
SF6 gas rated filling pressure (20 °C, gauge)	MPa	0.04
SF6 gas minimum working pressure (20 °C, gauge)	MPa	0.02
SF6 gas annual relative leakage rate	%/year	≤0.01
Gas tank degree of protection	—	IP67 (IP68 for some manufacturers)
Enclosure / cable compartment degree of protection	—	IP3X~IP4X / IP43
Degree of protection against mechanical impact	—	IK07~IK08
Expected service life	years	10 (5-year maintenance-free gas tank)
Auxiliary supply voltage (operation / control)	V	DC48/110/220; AC 220 (configured as required)

Table 2 C Disconnector Unit Main Technical Data

Item	Unit	Technical data
Rated voltage	kV	40.5
Rated current	A	630
Rated frequency	Hz	50
Switch type	—	Three-position disconnector (connected / isolated / earthed)
Load current breaking capability	—	None (without the capability to break load current and short-circuit current)
Busbar transfer current breaking capability	A	Per manufacturer's specification (typical 1.6, up to the 10 order for some manufacturers)
Power-frequency withstand voltage across isolating distance	kV	118
Lightning impulse withstand voltage across isolating distance	kV	215
Rated short-time withstand current / duration	kA/s	20 / 4
Rated peak withstand current	kA	50
Mechanical life (disconnector)	times	3000~5000
Mechanical life (earthing switch)	times	2000~3000
Earthing switch rated short-time withstand current / time	kA/s	20 / 4
Earthing switch rated short-circuit making current (peak)	kA	50
Earthing switch short-circuit making operations	times	2~5
Operating mode	—	Manual / motorized (optional)
Interlock with circuit breaker	—	Program interlock, preventing operation of the disconnector under load
Gas tank degree of protection	—	IP67

YRM6-40.5 SF6 Gas Insulated Metal Enclosed Switchgear

Table 3 V Vacuum Circuit Breaker Unit Main Technical Data

Item	Unit	Technical data
Rated voltage	kV	40.5
Rated current	A	630 (1250 optional)
Rated frequency	Hz	50
Arc-extinguishing method	—	Vacuum interrupter (copper-chromium contacts, longitudinal magnetic field)
Rated short-circuit breaking current	kA	20 (25 optional)
Rated short-circuit making current (peak)	kA	50 (63 optional)
Rated short-time withstand current / duration	kA/s	20 / 4 (25 / 2 optional)
Rated peak withstand current	kA	50 (63 optional)
Rated cable charging breaking current	A	50
Rated out-of-phase earth-fault breaking current	kA	Per manufacturer's specification (a special assessment item at the 40.5 kV level)
Breaking operations (electrical life)	class	E2
Mechanical life (vacuum circuit breaker)	times	10000
Mechanical life (three-position switch)	times	3000~5000
Mechanical life (earthing switch)	times	2000~3000
Three-position switch positions	—	Connected / isolated / earthed
Power-frequency withstand voltage across isolating distance	kV	118
Lightning impulse withstand voltage across isolating distance	kV	215
Operating mechanism type	—	Spring stored-energy type, manual / motorized energy storage
Reclosing function	—	Available (adjustable operations)
Telemetry, telesignalling and telecontrol interface	—	Available (telesignalling / telecontrol / telemetry)
Closing time / opening time	ms	≤100 / ≤60 (reference values)
Gas tank degree of protection	—	IP67

Table 4 M Metering Unit Main Technical Data

Item	Unit	Technical data
Rated voltage	kV	40.5
Rated current	A	630
Rated frequency	Hz	50
Switchgear	—	None (without breaking and earthing capability)
Current transformer accuracy class	—	0.2S / 0.5S
Current transformer rated ratio	—	Configured per metering requirements (e.g. 200/5, 400/5, 600/5)
Voltage transformer rated ratio	kV	(35/√3) / (0.1/√3)
Voltage transformer accuracy class	—	0.2 / 0.5
Secondary winding configuration	—	Metering winding + measurement / protection winding (as required)
Energy meter type	—	Three-phase electronic multi-function energy meter (optional)
Communication interface	—	RS-485 / infrared (supporting remote meter reading)
Rated short-time withstand current / duration	kA/s	20 / 4 (busbar and CT primary side)
Cubicle degree of protection	—	IP3X or above (indoor) / per outdoor enclosure configuration
Cubicle dimensions (W × D × H)	mm	≥1400 × 1600 × 2300

Table 5 D Riser Unit Main Technical Data

Item	Unit	Technical data
Rated voltage	kV	40.5
Rated current	A	630
Rated frequency	Hz	50
Switchgear	—	None
Earthing switch	—	None (without earthing switch)
Function	—	Cable entry / busbar riser / cubicle interconnection transition
Busbar connection method	—	Fully shielded silicone rubber plug-in connector
Rated short-time withstand current / duration	kA/s	20 / 4
Rated peak withstand current	kA	50
Cable installation height	mm	600~700
Applicable cable	—	Single-core or three-core XLPE cable (termination selected per cross-section)
Gas tank degree of protection	—	IP67
Unit bay dimensions (W × D × H)	mm	500 × 930 × 1950 + LV box height

Table 6 PT Voltage Transformer Unit Main Technical Data

Item	Unit	Technical data
Rated voltage	kV	40.5
Rated frequency	Hz	50
Unit composition	—	Disconnector or load switch + voltage transformer (three single-phase units / one three-phase unit)
Disconnector (or load switch) rated current	A	630
Disconnector power-frequency withstand voltage (across isolating distance)	kV	118
Disconnector lightning impulse withstand voltage (across isolating distance)	kV	215
Voltage transformer rated primary voltage	kV	35/√3
Voltage transformer rated secondary voltage	kV	0.1/√3
Voltage transformer accuracy class	—	0.2 / 0.5 (measurement), 3P (protection, optional)
Voltage transformer winding configuration	—	Measurement winding + residual voltage winding (open delta, optional)
Primary-side protection	—	Current-limiting fuse or miniature circuit breaker
Secondary-side protection	—	Air switch + earthing terminal, with anti-open-circuit measures
Rated short-time withstand current / duration	kA/s	20 / 4
Rated peak withstand current	kA	50
Cubicle degree of protection	—	IP3X or above (indoor) / per outdoor enclosure configuration
Cubicle dimensions	mm	Determined by the PT model, quantity and disconnector specification; this document does not give fixed dimensions

Unit bay and gas tank dimensions

This chapter lists the bay (cubicle) dimensions and gas tank (common-tank) dimensions of the functional units of YRM6-40.5, and the standard combination schemes. The listed dimensions are product data, in which "+ LV box height" means the dimension is the body height of the gas tank (or cubicle), with the LV box height to be added separately.

Unit Bay Dimensions

The bay (cubicle) dimensions of the functional units are shown in the table below. In the table, "LV box height" refers to the height of the secondary instrument compartment / low-voltage compartment at the top of the cubicle, which varies with the secondary configuration (protection devices, metering instruments, operating power supply, etc.) and is confirmed according to the actual configuration when ordering.

Table 7 Unit Bay Dimensions

Unit code	Unit name	W × D × H (mm)	Remarks
C	Disconnector unit	500 × 930 × 1950 + LV box height	Common-tank unit bay
V	Vacuum circuit breaker unit	500 × 930 × 1950 + LV box height	Common-tank unit bay
D	Riser unit	500 × 930 × 1950 + LV box height	Common-tank unit bay
M	Metering unit	≥1400 × 1600 × 2300	Metering cubicle, dimensions vary with transformer configuration

Gas Tank (Common-Tank) Dimensions

The three unit types C / V / D can be combined into a common tank, supporting up to 3 units in a common tank. The gas tank width increases linearly by the unit bay width, increasing 500 mm for each additional unit.

Table 8 Gas Tank (Common-Tank) Dimensions

Number of common-tank units	Gas tank dimensions (W × D × H, mm)	Note
1 unit	500 × 930 × 1950 + LV box height	Independent gas tank (C / V / D all applicable)
2 units	1000 × 930 × 1950 + LV box height	2-unit common gas tank
3 units	1500 × 930 × 1950 + LV box height	3-unit common gas tank (maximum configuration)

Note 1: "+ LV box height" in the table means the height of the LV box (secondary compartment) above the gas tank is to be added separately; the final overall cubicle height = gas tank height (1950 mm) + LV box height.

Note 2: the gas tank depth of 930 mm and height of 1950 mm are fixed values, not changing with the number of common-tank units (there is no M metering cubicle in the scheme); only the width increases at 500 mm/unit.

Note 3: up to 3 units in a common tank are supported; more than 3 units must be divided into multiple adjacent gas tanks, connected through by plug-in busbar connectors.

PT Cubicle Dimension Note

The PT cubicle consists of a disconnector or load switch + voltage transformer (three single-phase units or one three-phase unit). Its cubicle dimensions are jointly determined by the model, quantity (single-phase/three-phase) and installation method of the voltage transformer and the specification of the disconnector (or load switch); this document does not give fixed dimensions.

To determine the PT cubicle dimensions, the following conditions usually need to be clarified:

1. Voltage transformer type: three single-phase units (V/V or Y/yn connection) or one three-phase unit (five-limb type);
2. Specific model, overall dimensions and weight of the voltage transformer;
3. Primary and secondary connection methods and the required number of secondary windings;
4. Whether a station service transformer, surge arrester or other accessories need to be installed;
5. Installation environment (indoor / outdoor enclosure) and whether side-by-side assembly with adjacent cubicles is required.

Note: this cabinet type can be configured with a PT cubicle, but the dimensions of the PT cubicle do not belong to the standard size series and must be determined separately at selection according to the actual transformer parameters; please confirm with the manufacturer.

6.4 Standard Combination Schemes

Table 9 Standard Combination Schemes

Combination code	Unit composition	Number of common-tank units	Gas tank width (mm)	Typical application
C	1 × disconnector	1	500	Busbar sectionalizing isolation
V	1 × vacuum circuit breaker	1	500	Incoming / feeder protection
D	1 × riser	1	500	Cable entry
CV	Disconnector + circuit breaker	2	1000	Incoming isolation + circuit breaker protection
VV	2 × vacuum circuit breaker	2	1000	Dual-circuit circuit breaker protection
CC	2 × disconnector	2	1000	Busbar sectionalizing isolation
DC	Riser + disconnector	2	1000	Cable incoming + isolation
CCV	2 × disconnector + circuit breaker	3	1500	Isolation + isolation + protection
DCV	Riser + disconnector + circuit breaker	3	1500	Cable incoming + isolation + protection
CVV	Disconnector + 2 × circuit breaker	3	1500	Incoming isolation + dual-circuit protection
CCC	3 × disconnector	3	1500	Busbar sectionalizing (multi-section isolation)
VVV	3 × vacuum circuit breaker	3	1500	Multi-circuit circuit breaker protection
M	Metering unit	Independent cabinet	—	Gate / assessment metering
PT	Disconnector (or load switch) + PT	Independent cabinet	—	Secondary voltage source

Combination principle. The total number of common-tank units does not exceed 3; the M metering unit and PT cubicle are usually independent cabinets, not participating in the common tank; units in the same gas tank should adopt the same rated current and short-time withstand parameters; the metering unit (M) must be arranged adjacent to a V unit to ensure that isolation and protection means are available; the riser unit (D) has no earthing switch, and maintenance must rely on earthing by adjacent units; all circuits requiring on-load switching must be equipped with a V unit.

Ordering instructions

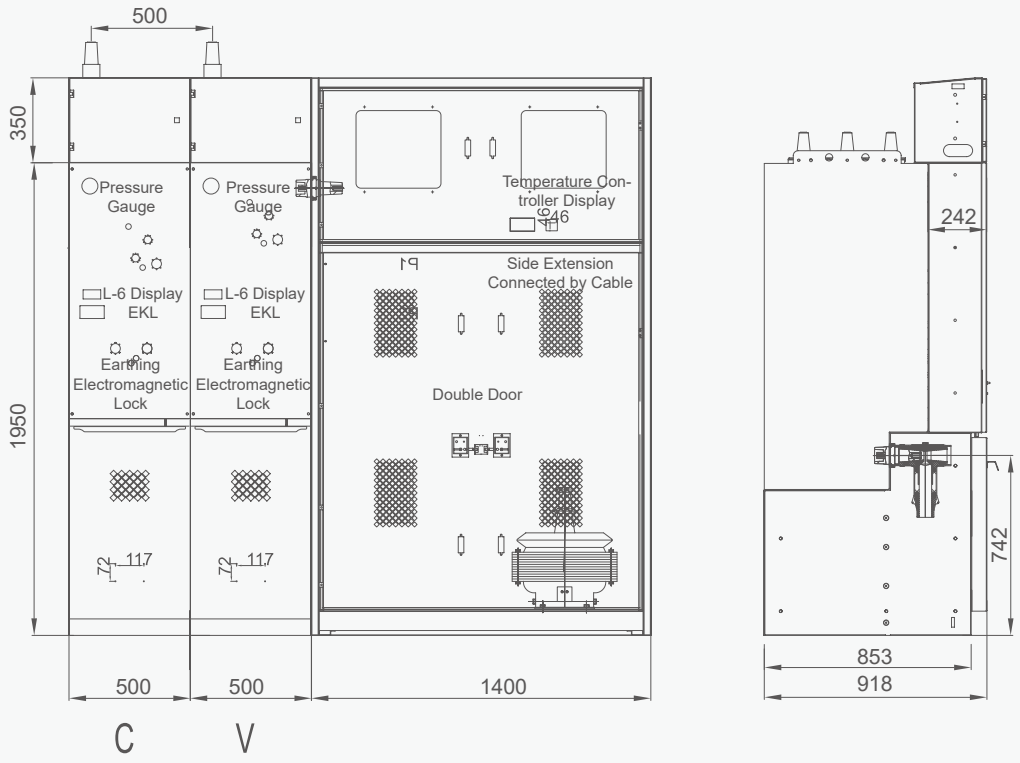
When ordering, the purchaser shall provide the following information. Production can start only after the primary wiring scheme diagram and unit arrangement diagram are confirmed by both parties.

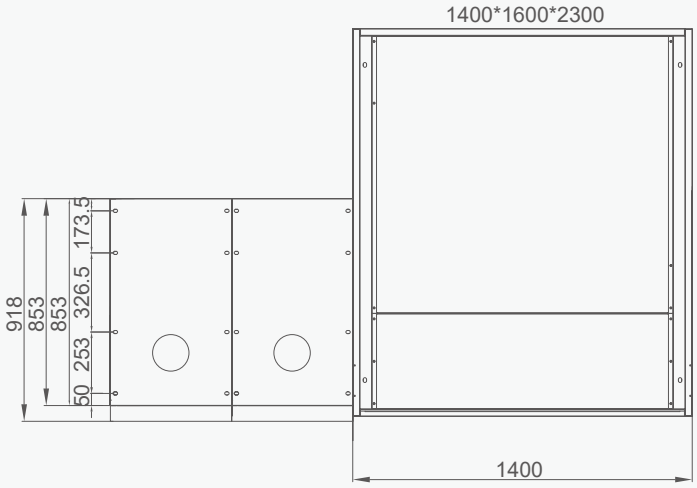
1. Primary wiring scheme diagram (single-line diagram): indicating the unit type (C/V/M/D/PT), quantity and arrangement order of each circuit, and the busbar and branch connection methods;
2. Electrical parameters: system nominal voltage, rated current, short-circuit current level (short-circuit capacity or short-circuit impedance), short-time withstand current and duration requirements;
3. Unit combination and common-tank requirements: number of common-tank units (1~3 units), whether a bus coupler (IL/IR) or busbar riser (RB) unit is required;
4. Metering and voltage transformer requirements: whether a metering unit is required (including CT ratio, accuracy class and meter requirements), whether a PT cubicle is required (single-phase/three-phase, winding configuration), and PT cubicle dimension confirmation conditions;
5. Protection and automation requirements: protection device type and functions (overcurrent, instantaneous overcurrent, zero-sequence, reclosing, etc.), whether DTU/FTU is required, telemetry/telesignalling/telecontrol interface requirements, and communication protocol;
6. Operating power supply: DC 110 V / DC 220 V / AC 220 V, whether an uninterruptible power supply is required;
7. Cable and incoming/outgoing mode: cable specification (cross-section, single-core/three-core), incoming mode (bottom-in bottom-out, side-in side-out), and cable accessory requirements;
8. Operating environmental conditions: indoor/outdoor, ambient temperature range, altitude, pollution class, seismic requirements and humidity conditions;
9. Cubicle appearance and installation requirements: cubicle color (color card No.), overall dimension limits, arrangement method, foundation form, and whether an outdoor enclosure is required;
10. Others: spare parts requirements, packaging and transport requirements, acceptance standards and test item requirements.

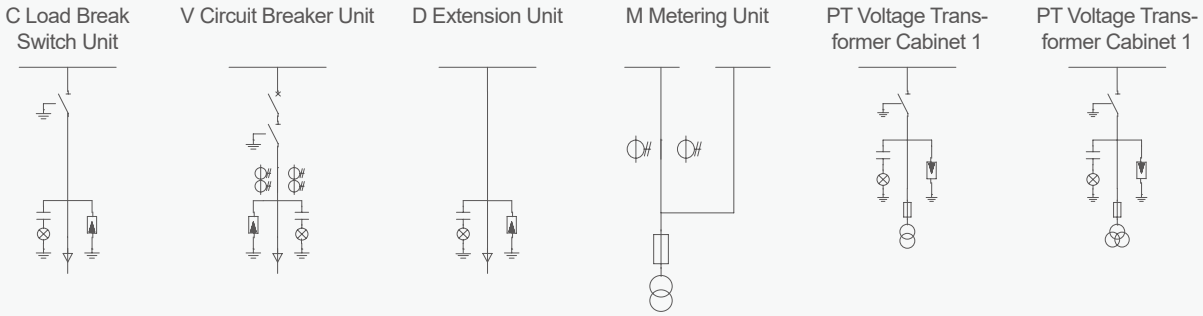
Purchaser confirmation items. Production can start only after the primary wiring scheme diagram and unit arrangement diagram are confirmed by both parties; the wiring relationship in which each on-load operation circuit is correspondingly equipped with a V unit is confirmed; the configuration of units adjacent to the metering unit (M) and riser unit (D) is confirmed; the total number of common-tank units does not exceed 3, and the busbar connection scheme for the excess part is confirmed; the PT cubicle dimensions are confirmed separately according to the transformer parameters; the coordination between short-circuit parameters and upstream protection is calculated and confirmed by the purchaser.

YRM6-40.5 SF6 Gas Insulated Metal Enclosed Switchgear

Overall and mounting dimensions (mm)







Medium Voltage Switchgear

C-GIS-40.5 SF6 Gas Insulated AC Metal-Enclosed Switchgear

C-GIS-40.5 is an indoor metal-enclosed distribution assembly for 40.5 kV three-phase AC 50 Hz single-busbar and single-busbar sectionalized systems, belonging to the metal-enclosed gas insulated switchgear (C-GIS) category. Compared with conventional air insulated switchgear (AIS), all its primary high-voltage components are sealed in a low-pressure SF6 gas tank, the main circuit is fully insulated and maintenance-free, and the footprint is only about 20%~30% of a conventional AIS scheme, especially suitable for distribution scenarios with limited space, harsh environment or high maintenance-free requirements. The busbar rated current is up to 3150 A, with a short-circuit breaking capability of 31.5 kA, making it the compact choice for the main equipment of 35 kV substations and switching stations.

General



C-GIS-40.5 SF6 Gas Insulated AC Metal-Enclosed Switchgear

Type designation

Type string: C-GIS-40.5 (□ is the unit type code, distinguished by wiring scheme No.)

C GIS 40.5 Unit code

- C- disconnector unit; V- vacuum circuit breaker unit; M- metering cubicle; D- riser unit; PT- voltage transformer cubicle (C- disconnector + single-phase / three-phase transformer)
- Rated voltage 40.5 kV (35 kV class)
- Gas Insulated Switchgear, gas insulated metal-enclosed switchgear
- Cubicle (box-type) structure

Scope of application

1. Receiving, feeding and busbar sectionalizing of 35 kV substations in the power system;
2. Feeding and grid-connection circuits of small and medium generators in power plants;
3. Main step-down substations and regional distribution of industrial and mining enterprises and institutions;
4. Places with high requirements on footprint and reliability, such as urban rail transit and data centers;
5. Starting and control circuits of large high-voltage motors;
6. Distribution in step-up substations of new energy power stations such as wind power and photovoltaic.

Characteristics

The C unit of this cabinet type is a disconnector (not a load switch), without load current breaking capability; the cabinet is not equipped with a load switch-fuse combination unit, and the load switching and short-circuit breaking of all functional circuits are undertaken by the V vacuum circuit breaker unit, forming an all-circuit-breaker “disconnector + circuit breaker” configuration scheme. All circuits requiring on-load operation should be equipped with a V unit, and the C disconnector unit only undertakes isolation and earthing functions.

Item	Value
Rated voltage / rated frequency	40.5 kV (35 kV class) / 50 Hz
Rated current	1250 / 2500 / 3150 A
Short-circuit breaking current (corresponding capability of disconnector and circuit breaker)	31.5 kA
Rated short-time withstand current / peak withstand current	31.5 kA / 4 s | 80 kA
Rated power-frequency withstand voltage	95 kV (phase-to-phase and to earth) / 118 kV (across isolating distance)
Rated lightning impulse withstand voltage	185 kV (phase-to-phase and to earth) / 215 kV (across isolating distance)
Unit bay dimensions (C / V / D / PT)	800 × 1600 × 2400 mm
Gas tank degree of protection / internal arc class	IP67 | IAC AFLR 31.5 kA / 1 s

Applicable standards

Standard No.	Standard name
GB/T 3906	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
GB/T 11022	Common specifications for high-voltage switchgear and controlgear
GB/T 1984	High-voltage AC circuit-breaker
GB/T 1985	High-voltage AC disconnectors and earthing switches
GB/T 1207	Inductive voltage transformers
GB/T 1208	Inductive current transformers
DL/T 402	Ordering specifications for high-voltage AC circuit-breakers
DL/T 404	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
DL/T 486	High-voltage AC disconnectors and earthing switches
DL/T 593	Common specifications for high-voltage switchgear and controlgear
GB 50150	Standard for handover test of electric equipment in installation engineering of electrical installations
Q/GDW 13088.16-2018	Procurement standard for high-voltage switchgear cubicles for 12 kV~40.5 kV — Part 16: Special technical specification for 40.5 kV/1250 A~31.5 kA gas-filled high-voltage switchgear cubicles
IEC 62271-200 / -100 / -102	Corresponding international standards (switchgear assembly / circuit breaker / disconnector)

C-GIS-40.5 SF6 Gas Insulated AC Metal-Enclosed Switchgear

Operating environmental conditions

Item	Conditions
Ambient temperature	-25 °C ~ +50 °C (24 h average ≤ +35 °C)
Relative humidity	Daily average ≤95%, monthly average ≤90%
Altitude	≤1000 m no correction required; above 1000 m, external insulation correction per GB/T 11022 (IEC 62271-1) or high-altitude type is adopted
Seismic intensity	≤ 8 degrees (horizontal acceleration 0.25 g)
Installation environment	A site free from fire and explosion hazards, serious pollution, chemical corrosion and severe vibration
Electromagnetic interference to the secondary system	Induced amplitude ≤1.6 kV
Installation vertical inclination	≤5%, cubicle bolted or welded to the foundation channel steel
Electromagnetic environment	No electromagnetic interference sources exceeding standard limits at the installation site

High-altitude notice: above 1000 m altitude, the adoption of high-altitude enhanced insulation design must be confirmed with the manufacturer; some manufacturers' products can meet operating conditions at 3000 m and above, which should be declared at ordering.

Cubicle structure and technical features

This chapter explains the overall structural layout and key design features of C-GIS-40.5, covering gas tank structure, breaking technology, interlocking, internal arc protection and intelligent configuration.

Overall Structure

The cubicle is a metal-enclosed structure, composed of the gas-filled compartment (gas tank), cable compartment, busbar compartment and low-voltage compartment. The primary high-voltage components — three-position disconnector, vacuum circuit breaker, busbar and transformer connection terminals — are enclosed in a gas tank welded from 3 mm thick stainless steel plate, filled with low-pressure SF6 gas as the insulating medium, completely isolated from the external environment and unaffected by condensation, pollution, salt spray, small animals, etc.

Main Technical Features

- SF6 low-pressure gas insulation: rated filling pressure 0.02~0.04 MPa (20 **°C** gauge), annual relative leakage rate ≤0.01%~0.05%, essentially free of gas replenishment over the service life;
- Vacuum breaking technology: the vacuum circuit breaker adopts an embedded-pole, longitudinal magnetic field contact structure, with stable breaking performance, mechanical life 10000~20000 operations, and class E2 electrical life;
- Three-position disconnector: integrated three-position (connected—isolated—earthed) design, with programmatic mechanical/electrical interlocking between it and the circuit breaker, completely preventing pulling/closing the disconnector under load;
- Compact design: unit bay 800 × 1600 × 2400 mm, small footprint, and the single-busbar arrangement can be installed against a wall;
- Five-prevention interlocking: equipped with the functions of preventing mis-opening/mis-closing of the circuit breaker, preventing pushing/pulling isolation under load, preventing hanging earthing wires when live, preventing closing with earthing wires in place, and preventing entry into live compartments;
- Internal arc protection: passed the IAC AFLR class internal arc test (31.5 kA / 1 s), with an independent pressure-relief channel;
- Intelligent monitoring: optional SF6 gas pressure (density) online monitoring, partial discharge monitoring, circuit breaker mechanical characteristic monitoring and intelligent control and protection unit (DTU/integrated protection), supporting one-key sequential control and remote control;
- Fully insulated cable connection: inner-cone cable plug connection; cables, surge arresters and PT can be plug-in connected, and live-line display, voltage verification and cable testing can all be completed from the front.

C-GIS-40.5 SF6 Gas Insulated AC Metal-Enclosed Switchgear

Functional unit description

The matching units of this cabinet type are divided into five categories: C- disconnector unit, V- vacuum circuit breaker unit, M- metering cubicle, D- riser unit and PT cubicle. The functions and capability boundaries of each unit are as follows.

Disconnector Unit

- Three-position disconnector (connected—isolated—earthed), installed in the SF6 gas tank, serving as the incoming/busbar isolation unit;
- Without load current breaking capability, only busbar transfer current (typically ≤1.6 A) and extremely small capacitive current are allowed to be broken;
- Insulation level across the isolating distance: power-frequency 118 kV, lightning impulse 215 kV, meeting the visible isolation requirement;
- A program interlock is provided between it and the V circuit breaker unit: the disconnector may be operated only when the circuit breaker is in the open position, preventing opening/closing of the isolation under load;
- The earthing switch has short-circuit making capability (≥ 2~5 making operations at rated short-circuit current).

V — Vacuum Circuit Breaker Unit

- Embedded-pole vacuum circuit breaker, rated current 1250 / 2500 / 3150 A, rated short-circuit breaking current 31.5 kA;
- Class E2 electrical life, operating sequence O-0.3s-CO-180s-CO, mechanical life 10000~20000 operations;
- Can be configured with a microprocessor-based integrated protection device and a spring (or permanent-magnet) operating mechanism, with AC or DC operating power supply optional;
- It is the core functional unit of this cabinet type undertaking load switching and short-circuit breaking: all on-load operation circuits such as incoming/outgoing lines, bus coupling and sectionalizing should be configured with it.

M — Metering Cubicle

- A unit without switches, internally fitted with current transformers (class 0.2S/0.5S), voltage transformers and metering instruments, used for trade settlement or assessment metering;
- Without breaking capability and without earthing capability, the incoming and outgoing lines must be provided with isolation and protection means by adjacent C or V units;
- The cubicle dimensions are determined by the transformer specification and quantity, see Chapter 6 for details.

D — Riser Unit

- A busbar riser (transition) unit without switch and without earthing switch, used for cable entry, busbar riser, cubicle interconnection transition and sectionalized busbar connection;
- The primary busbar transitions through the SF6 gas tank or fully shielded connectors, with the same unit bay dimensions as the C/V/PT units (800 × 1600 × 2400 mm).

PT Cubicle (C-Disconnector + Transformer)

- Composed of C-disconnector + single-phase/three-phase voltage transformer: the disconnector provides incoming isolation and earthing positions, and the PT provides secondary voltage for measurement, protection and operating power supply;
- Single-phase PTs can be configured as a single-phase group or a three-phase transformer group, specifically determined by the secondary voltage circuit load and connection method;
- The cubicle dimensions are consistent with the C/V/D unit bay (800 × 1600 × 2400 mm);
- A primary fuse can be optionally configured for overcurrent protection of the PT (whether to configure is confirmed per project needs).

C-GIS-40.5 SF6 Gas Insulated AC Metal-Enclosed Switchgear

Unit Combination Quick Reference

Typical circuit	Recommended unit combination
Cable / overhead incoming (with isolation)	C + V or PT cubicle + V
Feeder (cable outgoing)	V (with isolating distance scheme) or C + V
Busbar sectionalizing / bus coupling	V + D or V + V
Metering	M (combined with C/V units)
Voltage transformer circuit	PT cubicle (C disconnector + single-phase / three-phase PT)
Cable entry / busbar transition	D

Main technical data

This chapter lists technical data tables separately for the complete unit and each functional unit; the current is given in three grades of 1250/2500/3150 A, and the breaking capability of both the disconnector and the circuit breaker is 31.5 kA.

Table 1 Complete Unit Main Technical Data

Item	Unit	Parameter
Rated voltage	kV	40.5
Maximum operating voltage	kV	40.5
Rated frequency	Hz	50
Rated current	A	1250 / 2500 / 3150
Main busbar rated current	A	1250 / 2500 / 3150
Rated insulation level (1 min power-frequency withstand, phase-to-phase / to earth)	kV	95
Rated insulation level (1 min power-frequency withstand, across isolating distance)	kV	118
Rated insulation level (lightning impulse, phase-to-phase / to earth)	kV	185
Rated insulation level (lightning impulse, across isolating distance)	kV	215
Auxiliary / control circuit 1 min power-frequency withstand voltage	kV	2
Rated short-time withstand current (4 s)	kA	31.5 (25 optional)
Rated peak withstand current	kA	80
Rated short-circuit breaking current	kA	31.5
Rated short-circuit making current (peak)	kA	80
Rated operating sequence	—	O-0.3s-CO-180s-CO
Insulating gas / rated filling pressure (20 °C gauge)	— / MPa	SF6 / 0.02~0.04
Annual relative leakage rate	%/year	≤ 0.01~0.05
SF6 moisture content (20 °C)	μL/L	≤ 150~300
Internal arc class (IAC)	kA/s	AFLR 31.5 / 1
Degree of protection	—	Gas tank IP67; cubicle IP4X (IP41); between compartments IP2X
Mechanical life (circuit breaker)	times	10000~20000
Mechanical life (three-position disconnector / earthing switch)	times	3000~5000
Secondary circuit rated voltage	V	DC48/110/220 , AC220
Unit bay dimensions (W × D × H)	mm	800 × 1600 × 2400

Table 2 C — Disconnector Unit Main Technical Data

Item	Unit	Parameter
Rated voltage	kV	40.5
Rated current	A	1250 / 2500 / 3150
Type	—	Three-position (connected — isolated — earthed), installed in the SF6 gas tank
1 min power-frequency withstand voltage (phase-to-phase / to earth)	kV	95
1 min power-frequency withstand voltage (across isolating distance)	kV	118
Lightning impulse withstand voltage (phase-to-phase / to earth)	kV	185
Lightning impulse withstand voltage (across isolating distance)	kV	215
Rated short-time withstand current (4 s)	kA	31.5
Rated peak withstand current	kA	80
Busbar transfer current breaking capability	A	≤1.6 (typical value)
Earthing switch short-circuit making capability	times	≥2~5 (making at rated short-circuit current)
Mechanical life	times	3000~5000
Operating mode	—	Manual / motorized (remote controllable)
Interlock with circuit breaker	—	Programmatic mechanical / electrical interlock (operation allowed after circuit breaker opening)
Status indication	—	Position indicator + live-line indicator

Note: the C unit is a disconnector and must not be operated under load; each circuit with on-load switching should be configured with a V circuit breaker unit.

Table 3 V — Vacuum Circuit Breaker Unit Main Technical Data

Item	Unit	Parameter
Rated voltage	kV	40.5
Rated current	A	1250 / 2500 / 3150
Type	—	Vacuum circuit breaker
Rated short-circuit breaking current	kA	31.5
Rated short-circuit making current (peak)	kA	80
Rated short-time withstand current (4 s)	kA	31.5
Rated peak withstand current	kA	80
Rated operating sequence	—	O-0.3s-CO-180s-CO
Electrical life class	—	Class E2
Mechanical life	times	10000~20000
Operating mechanism	—	Spring mechanism (permanent-magnet mechanism optional), manual / motorized energy storage
Rated operating voltage	V	DC48/110/220 , AC220
Reference value of circuit resistance	μΩ	1250 A: ≤120; 2500 A: ≤80~180; 3150 A: per manufacturer's standard
Protection configuration	—	Microprocessor-based integrated protection (instantaneous overcurrent, overcurrent, zero-sequence, reclosing, etc. optional)
Out-of-phase earth-fault breaking current	kA	27.3 (31.5 × 0.87, an assessment item at the 40.5 kV level)
Capacitor bank breaking current (optional)	A	Confirmed per project needs
Unit bay dimensions	mm	800 × 1600 × 2400

Table 4 M — Metering Cubicle Main Technical Data

Item	Unit	Parameter
Type	—	Switchless metering unit
Rated voltage	kV	40.5
Rated current	A	1250 / 2500 / 3150 (following the main circuit)
Current transformer accuracy class	—	Metering 0.2S / 0.5S; measurement 0.5; protection 5P20/10P20
Current transformer ratio	—	Selected per project needs
Voltage transformer ratio	kV	(35/√3) / (0.1/√3) (three-phase); 35 / 0.1 (single-phase)
Voltage transformer accuracy class	—	0.2 / 0.5 / 3P
Metering instrument	—	Active / reactive energy meter (plug-in, multi-function, gate meter optional)
Metering method	—	High-voltage supply high-voltage metering
Breaking capability	—	None (isolation and protection must be provided by adjacent C/V units)
Earthing capability	—	None
Cubicle dimensions	mm	Determined by transformer specification and quantity (see Chapter 6)

Note: the M metering cubicle itself has no breaking and earthing capability; in the primary wiring, its upstream and downstream sides must be provided with isolation and protection means by a C disconnector unit or V circuit breaker unit.

Table 5 D — Riser Unit Main Technical Data

Item	Unit	Parameter
Type	—	Switchless busbar riser (transition) unit
Rated voltage	kV	40.5
Rated current	A	1250 / 2500 / 3150 (following the main busbar)
Rated short-time withstand current (4 s)	kA	31.5
Rated peak withstand current	kA	80
Busbar connection method	—	Busbar inside the SF6 gas tank / fully shielded silicone rubber connector
Switch configuration	—	Without switch, without earthing switch
Application	—	Cable entry, busbar riser, cubicle interconnection transition, sectionalized busbar connection
Unit bay dimensions	mm	800 × 1600 × 2400

Table 6 PT Cubicle Main Technical Data

Item	Unit	Parameter
Unit composition	—	C- disconnector + single-phase / three-phase voltage transformer
Rated voltage	kV	40.5
Disconnector	—	Three-position (connected — isolated — earthed), parameters same as the C unit
Voltage transformer ratio	kV	(35/√3) / (0.1/√3) (three-phase transformer group); 35 / 0.1 (single-phase)
Voltage transformer accuracy class	—	0.2 / 0.5 / 3P
Transformer quantity	—	1~3 single-phase units or a three-phase group, determined by the secondary load
Primary fuse (optional)	—	Selected per PT capacity, configuration confirmed by the project
Secondary output application	—	Measurement, protection, synchronization, operating power supply (with power supply transformer optional)
Cubicle dimensions	mm	900 × 1600 × 2400 (consistent with unit bay)
Surge arrester (optional)	—	Fully insulated plug-in zinc oxide surge arrester

Table 7 Typical Primary Schemes vs Current Grades

Rated current grade	Typical scheme	Disconnector / circuit breaker breaking capability
1250 A	Incoming (PT+V), feeder (V), bus coupling (V+D), metering (M)	31.5 kA
2500 A	Incoming (PT+V), feeder (V), sectionalizing (V+V), metering (M)	31.5 kA
3150 A	Heavy-current incoming (PT+V), feeder (V), bus coupling (V+D)	31.5 kA

Unit bay dimension note

Unit Bay Dimensions

Per the manufacturer's data, the unit bay dimensions of the C / V / D / PT units of this cabinet type are unified as:

Unit	Dimensions (W × D × H, mm)
C disconnector unit	800 × 1600 × 2400
V vacuum circuit breaker unit	800 × 1600 × 2400
D riser unit	800 × 1600 × 2400
PT cubicle	900 × 1600 × 2400

Industry comparison note: among similar 40.5 kV C-GIS products, the actual cubicle width of different current grades has grades of 600/800/900/1000 mm (e.g. 600~800 mm for the 1250 A grade, 800 mm for the 2500 A grade, 900~1000 mm for the 3150 A grade), with the overall height distinguished by raising the LV box. This document lists the value 800 × 1600 × 2400 mm given by the manufacturer; the actual delivered dimensions are subject to the technical agreement and arrangement drawing.

M Metering Cubicle Dimensions

The dimensions of the M metering cubicle are determined by the specification and quantity of the current transformers and voltage transformers; this document does not give fixed dimensions. Please confirm with the manufacturer according to the metering scheme at ordering.

Dimension Confirmation Key Points

1. The actual cubicle width and busbar specification corresponding to each current grade (1250/2500/3150 A);
2. The raised height of the LV box (secondary component compartment), and the matching of the overall height with the substation floor height and busbar bridge elevation;
3. The check of cable compartment depth against cable laying and testing space;
4. The final dimensions of the M metering cubicle and PT cubicle;
5. The overall width, foundation channel steel and anchor hole dimensions under the cubicle assembly scheme;
6. The cabling and maintenance access requirements for wall-mounted (single busbar) or wall-separated installation.

Selection recommendations

This chapter gives a five-step selection logic from system conditions to unit combination, recommended configurations for typical scenarios, and selection notes.

Selection Logic (Five Steps)

1. Determine the system voltage (35 kV / 40.5 kV) and busbar connection method (single busbar / single-busbar sectionalized);
2. Select the current grade (1250/2500/3150 A) according to the circuit load current and system short-circuit level, and check the breaking capability (31.5 kA);
3. Select the unit combination according to circuit function (incoming PT+V, feeder V, bus coupling V+D, metering M, PT cubicle);
4. Confirm the secondary configuration: protection devices, operating power supply, and monitoring and automation (DTU/one-key sequential control) requirements;
5. Check site conditions: altitude, dimension passage, cable direction, wall-mounted/wall-separated installation, and arrange the cubicle assembly scheme.

C-GIS-40.5 SF6 Gas Insulated AC Metal-Enclosed Switchgear

Recommended configurations for scenarios

Application scenario	Recommended configuration
35 kV substation incoming line	PT cubicle (C+PT) + V incoming cubicle
Feeder / outgoing line	V circuit breaker cubicle (can be in series with a C isolation cubicle or use a scheme with isolating distance)
Busbar sectionalizing	V cubicle + D riser unit (or dual-V scheme)
High-voltage supply high-voltage metering	M metering cubicle + isolation by adjacent C/V units
Voltage measurement / operating power supply	PT cubicle (C disconnector + single-phase / three-phase PT)
Cable entry / busbar transition	D riser unit
Large-capacity main transformer incoming (2500/3150 A)	V cubicle + enhanced busbar and heat dissipation check

Selection Tips

1. The C unit cannot be operated under load: this scheme has no load switch and fuse unit, and all circuits with on-load switching must be configured with a V circuit breaker unit; if there are small-capacity circuits that only require load switching without protection requirements, whether to adjust the unit configuration should be confirmed with the design institute;
2. The 3150 A grade has a large operating current, and the busbar temperature rise, cubicle heat dissipation and wall bushing/busbar bridge specification must be checked;
3. Projects at altitude >1000 m must be declared at ordering, with insulation correction or high-altitude design confirmed by the manufacturer.

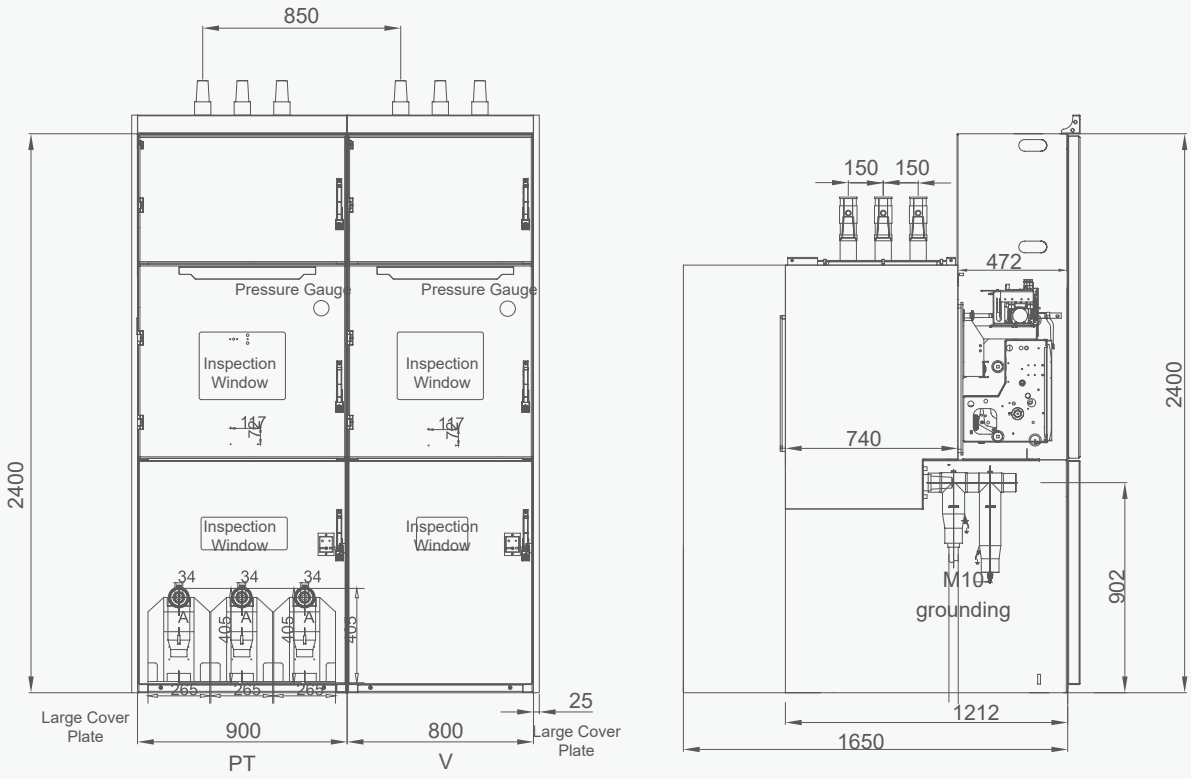
Ordering instructions

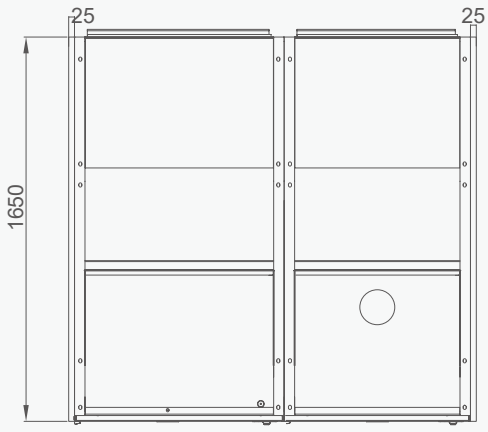
When ordering, the purchaser shall provide the manufacturer with the following information:

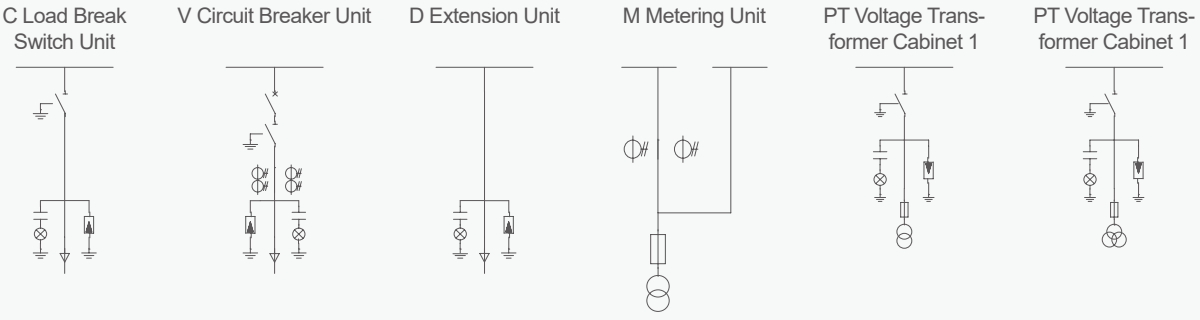
1. Primary system wiring diagram and the unit combination scheme of each circuit (C/V/M/D/PT);
2. Rated current of each circuit and the corresponding current grade (1250/2500/3150 A);
3. System short-circuit level and the check requirements for breaking capability (31.5 kA);
4. Busbar sectionalizing/bus coupling scheme and cubicle assembly arrangement diagram (including overall width and bay order);
5. Operating environmental conditions (temperature, altitude, pollution class, seismic intensity);
6. Secondary parameters: operating power supply (DC/AC and voltage level), protection device model and functions, metering method and transformer ratio/accuracy class;
7. PT cubicle configuration: single-phase/three-phase transformer, ratio, accuracy class, and whether a primary fuse and power supply transformer are equipped;
8. Cable specification (cross-section, quantity, single-core/three-core) and incoming/outgoing direction (top-in/bottom-in);
9. Confirmation of the transformer specification, quantity and cubicle dimensions of the M metering cubicle;
10. Cubicle color, coating requirements and special protection (anti-corrosion, anti-condensation) requirements;
11. Monitoring and automation configuration: gas pressure online monitoring, partial discharge monitoring, DTU/integrated protection, one-key sequential control, etc.;
12. Spare parts list and acceptance and test requirements (factory test and handover test per GB 50150).

C-GIS-40.5 SF6 Gas Insulated AC Metal-Enclosed Switchgear

Overall and mounting dimensions (mm)







Medium Voltage Switchgear

YHB-12 Eco-Gas Insulated Ring Main Switchgear

YHB-12 eco-gas insulated ring main switchgear is a new-generation green and environment-friendly metal-enclosed switchgear for distribution networks: all high-voltage live parts are sealed in a dry-air gas tank, the vacuum interrupter undertakes current breaking, and the three-position disconnector realizes the three-state changeover of connected, isolated and earthed. The equipment has a large insulation margin — it can operate normally even when the gas tank is at zero gauge pressure, fundamentally eliminating the greenhouse effect and leakage risk of SF6 gas while retaining the advantages of a compact gas-insulated structure, uniform electric field and high reliability.

General



YHB-12 Eco-Gas Insulated Ring Main Switchgear

Type designation

Type string: YHB-12□ (□ is the unit type; M / D units are distinguished by wiring scheme No.)

Y HB 12 □ (PT) □ (V) □ (M / D)

- Metering unit / riser unit (without main switch, distinguished by wiring scheme No.)
- Vacuum circuit breaker unit
- Three-position disconnector + voltage transformer unit
- Rated voltage 12 kV
- Eco-gas insulation (H— environmental protection, B— dry-air insulation)
- Enterprise code

Scope of application

1. Ring-main power supply, terminal power supply, switching stations and switching posts in urban distribution networks;
2. Distribution automation renovation projects (can be configured with DTU/FTU and microprocessor protection, meeting the State Grid standardized design scheme);
3. Power distribution for residential communities, commercial complexes, industrial parks, and industrial and mining enterprises;
4. Special environments such as high altitude (≤3000 m, some manufacturers verified up to 5000 m) and extreme cold (-40 °C);
5. Distribution links such as dual-source incoming lines, busbar sectionalizing/bus coupling and energy metering.

Applicable standards

Standard No.	Standard name
GB/T 11022	Common specifications for high-voltage switchgear and controlgear
GB 3906	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
GB 1984	High-voltage AC circuit-breaker
GB 1985	High-voltage AC disconnectors and earthing switches
DL/T 403	Ordering specifications for indoor high-voltage vacuum circuit breakers for 12 kV~40.5 kV
DL/T 404	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
Q/GDW 730 (reference)	Technical specification for 12 kV solid-insulated ring main units
State Grid standardized design customization scheme	Standardized Design Customization Scheme for 12 kV Ring Main Units (Cabinet) (2019 Edition)
IEC 62271-1 / 62271-200	Series standards for high-voltage AC switchgear and controlgear
IEC 466	AC insulated-enclosure switchgear and controlgear for rated voltages above 1 kV and below 38 kV

Operating environmental conditions

YHB-12 has strong adaptability to the environment, with obvious advantages especially in extreme-cold and high-altitude environments. The normal operating conditions are shown in the following table; when beyond the range, customization can be negotiated with the manufacturer.

Item	Normal operating conditions
Ambient temperature	Indoor: -25 °C ~ +45 °C; outdoor enclosure: -40 °C ~ +55 °C
Altitude	≤3000 m (some manufacturers verified up to 5000 m, negotiable customization when exceeding the limit)
Relative humidity	Daily average ≤95%, monthly average ≤90%
Seismic level	AG3 (seismic intensity ≤ 8 degrees)
Pollution class	Class □
Installation environment	Free from fire and explosion hazards, serious chemical corrosion and severe vibration
Installation mode	Indoor (or outdoor enclosure) fixed installation, cable bottom-in bottom-out (changeable per needs)

YHB-12 Eco-Gas Insulated Ring Main Switchgear

Cubicle structure and technical features

YHB-12 takes “dry-air insulation + vacuum breaking + modular gas tank” as its core architecture, balancing environmental friendliness, reliability and ease of operation and maintenance. This chapter explains five aspects: insulation, breaking, structure, intelligence and safety.

Eco-Gas Insulation Technology

Dry-air/pure-nitrogen insulation: adopts high-purity synthetic dry air (moisture content ≤15 ppm, ≤150 ppm inside the gas tank) or pure nitrogen, with no greenhouse effect and no toxic arc decomposition products, requiring no recovery treatment after leakage;

Slight positive-pressure sealing: rated filling pressure 0.02~0.03 MPa (20 °C gauge), the rated insulation level is still met and normal operation is possible at zero gauge pressure, high reliability;

Annual leakage rate ≤0.01%~0.05%: the gas tank is laser-welded and integrally sealed, with a degree of protection of IP67, realizing no gas replenishment and no maintenance;

Fully shielded uniform electric field design: live parts are fully enclosed, the electric field is optimized by 3D simulation, and the partial discharge of the complete unit is ≤10 pC.

Vacuum Breaking and Three-Position Switch

- The vacuum interrupter is fixed-mounted, equipped with a spring operating mechanism, with high electrical life and long maintenance-free intervals;
- Three-position disconnector (connected—isolated—earthed) adopts a linear-motion structure, with visible breaks and clear mechanical characteristics; reliable electrical and mechanical interlocks are provided between it and the circuit breaker mechanism;
- The earthing switch has short-circuit making capability (2~5 operations), meeting the earthing safety requirements for maintenance.
-

Modularization and Interlocking

- Each unit has an independent gas tank and modular assembly, and the busbars are plug-connected with fully shielded silicone rubber connectors, allowing fast and reliable extension and cubicle assembly;
- Complete mechanical interlocks realize “five-prevention”: preventing mis-opening/mis-closing of the circuit breaker, preventing opening/closing of the disconnector under load, preventing hanging earthing wires when live, preventing closing with earthing wires in place, and preventing entry into live compartments.

Intelligent Configuration

- Both the circuit breaker and the three-position switch support manual/motorized operation, meeting intelligent and remote operation requirements;
- Can be configured with a microprocessor protection device, DTU/FTU distribution automation terminal, live-line indicator and instruments, meeting the State Grid standardized design customization scheme;
- Electromagnetic interference immunity of the secondary system: induced interference amplitude ≤1.6 kV.

Safety and Environmental Protection

- Internal arc fault class IAC AFLR: 20 kA / 0.5~1 s, with a pressure-relief channel for safe pressure release;
- No SF6 emission, in line with the “carbon peaking and carbon neutrality” goal and the green procurement requirements of the grid;
- Gas tank IP67 and enclosure IP4X, adapting to condensation, pollution and high-humidity environments.

YHB-12 Eco-Gas Insulated Ring Main Switchgear

Functional Unit Description

YHB-12 is functionally divided into two switch units, PT and V, and two switchless units, M and D, which can be arranged in any combination according to the primary system scheme.

PT Unit — Three-Position Disconnector + Voltage Transformer Unit

The PT unit consists of a three-position disconnector (connected—isolated—earthed) and a fully insulated cast-resin voltage transformer, providing the dual functions of incoming isolation/earthing and voltage transformation: the three-position switch provides visible isolation and reliable earthing on the line side; the voltage transformer ((10/√3)/(0.1/√3) kV, class 0.2/0.5) provides secondary voltage for metering, protection and operating power supply. The PT unit is the isolation-guarantee unit of the incoming circuit of this cabinet type, with a cabinet width of about 600 mm, 1.2~1.4 times that of a standard V cubicle.

V Unit — Vacuum Circuit Breaker Unit

The V unit uses the vacuum circuit breaker as the main switch (with integrated three-position disconnector), with rated current 630 A~1250 A and rated short-circuit breaking current 20/25 kA, able to break load current, overload current and short-circuit current, and realizing instantaneous overcurrent, overcurrent, zero-sequence and automatic transfer functions together with microprocessor protection. Vacuum arc extinction and spring operation, mechanical life 10000 operations, breaking times meeting class E2 (30 operations), applicable to all circuits requiring control and protection such as incoming, outgoing and sectionalizing/bus-coupling — all functional circuits of this cabinet type are undertaken by the V unit.

M Unit — Metering Unit

No main switch is installed inside the M unit; only metering current transformers (class 0.2S/0.5S), a voltage transformer and energy meters are installed, for billing settlement or assessment metering.

Special note: the M unit itself has no breaking and earthing/isolation capability; its supply side must be provided with isolation and protection means by a PT unit or V unit, and they must be configured in pairs in the scheme at ordering.

D Unit — Riser Unit

The D unit has no main switch and no earthing switch; fully shielded insulated busbars and connecting conductors are installed inside, used for cable entry/outgoing, busbar riser (transferring from the cable level to the main busbar height) and busbar transition connection between multiple cubicle sections. It is the transition/link unit of the complete cubicle assembly.

Unit Combination Quick Reference

Unit code	Name	Main switch	Typical application
PT	Three-position disconnector + voltage transformer unit	Three-position disconnector	Incoming isolation / earthing + metering, protection and operating power supply
V	Vacuum circuit breaker unit	Vacuum circuit breaker (integrated three-position)	Incoming, outgoing, sectionalizing/bus coupling and all controlled circuits
M	Metering unit	None	High-voltage supply high-voltage metering (must be combined with PT/V)
D	Riser unit	None	Cable entry, busbar riser and cubicle interconnection transition

YHB-12 Eco-Gas Insulated Ring Main Switchgear

Main Technical Data

This chapter gives the detailed technical data of the complete unit and each unit, in 6 tables in total. The parameters in the tables are typical values commonly used in the industry; for formal ordering please refer to the manufacturer's catalogue and type-test reports.

Table 1 YHB-12 Complete Unit Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current (main busbar)	A	630 / 1250
Rated short-time withstand current (main circuit, 4 s)	kA	20 (25 optional)
Rated peak withstand current (main circuit)	kA	50 (63 for the 25 kA grade)
Rated short-circuit making current (peak)	kA	50 (63 for the 25 kA grade)
Earthing circuit short-time withstand current / peak withstand current	kA	17.4 / 2 s; 43.5
1 min power-frequency withstand voltage (to earth, phase-to-phase / across break)	kV	42 / 48
Lightning impulse withstand voltage (peak, to earth, phase-to-phase / across break)	kV	75 / 85
Partial discharge (at 1.1 times rated voltage)	pC	≤ 10
Main circuit resistance	μΩ	≤ 140 ~ 150
Insulating medium	—	Dry air / pure nitrogen (high-purity synthetic, moisture ≤150 ppm)
Rated filling pressure (20 °C gauge)	MPa	0.02 ~ 0.03
Minimum operating pressure (20 °C gauge)	MPa	0 (normal operation at zero gauge pressure)
Annual leakage rate	%	≤ 0.01 ~ 0.05
Internal arc fault class (IAC AFLR)	kA/s	20 / 0.5 ~ 1
Degree of protection	—	Gas tank IP67, cubicle IP4X
Rated operating voltage	V	AC 220 / DC 220 (selectable per needs)
Mechanical life (circuit breaker / three-position switch / earthing switch)	times	10000 / 3000 ~ 5000 / 3000
Cubicle structure	—	Unit-type gas tank, modular assembly
Typical cabinet width (V cubicle / PT cubicle)	mm	420~600 / about 600
Cubicle overall dimensions (W × D × H)	mm	Determined by the combination scheme, typically 420×850×1950
Busbar connection	—	Fully shielded silicone rubber connector, plug-in type
Environmental characteristics	—	No SF6, no gas maintenance

Table 2 PT Unit (Three-Position Disconnector + Voltage Transformer) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current	A	630
Three-position switch positions	—	Connected — isolated — earthed
Three-position switch mechanical life	times	3000 ~ 5000
Earthing switch short-circuit making capability	times	2 ~ 5
Voltage transformer ratio	kV	(10/√3) / (0.1/√3) /(0.1/3)
Voltage transformer accuracy class	—	0.2 / 0.5 (metering / protection)
Voltage transformer type	—	Fully insulated epoxy resin cast
1 min power-frequency withstand voltage (to earth phase-to-phase / across break)	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Operating mode	—	Manual / motorized spring mechanism
Interlock relation	—	Electrical + mechanical interlock with the V unit circuit breaker
Typical cabinet width	mm	about 600
Application note	—	Incoming isolation and earthing, also as secondary voltage source

Table 3 V Unit (Vacuum Circuit Breaker) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current	A	630 / 1250
Rated short-circuit breaking current	kA	20 / 25
Rated short-circuit breaking times (class E2)	times	30
Rated short-circuit making current (peak)	kA	50 / 63
Rated short-time withstand current (4 s)	kA	20 / 25
Rated peak withstand current	kA	50 / 63
Out-of-phase earth-fault breaking current	kA	17.4
Rated cable charging breaking current (class C2)	A	10
Rated operating sequence	—	O-0.3s-CO-180s-CO
Opening/closing time	ms	Opening ≤60 / closing ≤75 (typical)
1 min power-frequency withstand voltage (to earth phase-to-phase / across break)	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Mechanical life	times	10000
Operating mechanism	—	Spring mechanism (manual / motorized)
Protection configuration	—	Can be configured with microprocessor protection (instantaneous overcurrent, overcurrent, zero-sequence) and DTU
Arc extinction mode	—	Vacuum arc extinction
Typical cabinet width	mm	420 ~ 600

YHB-12 Eco-Gas Insulated Ring Main Switchgear

Table 4 M Unit (Metering) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current (busbar)	A	630 / 1250
Main switch	—	None (without breaking and earthing capability)
Current transformer	—	Class 0.2S / 0.5S, ratio configured per metering requirements
Voltage transformer	—	(10/0.1) kV, class 0.2
Metering instrument	—	Configured per power supply department requirements (remote transmission can be reserved)
1 min power-frequency withstand voltage	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Primary insulation	—	Fully insulated cast transformers, shielded busbar
Degree of protection	—	No gas tank, IP4X
Typical cabinet width	mm	800~850

Table 5 D Unit (Riser) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current (busbar)	A	630 / 1250
Main switch	—	None
Earthing switch	—	None
Function	—	Cable entry, busbar riser, cubicle interconnection transition
1 min power-frequency withstand voltage	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Busbar connection	—	Fully shielded silicone rubber connector plug-in
Degree of protection	—	Gas tank / enclosed part IP67
Typical cabinet width	mm	420 ~ 600
Typical cabinet weight	kg	about 140~180

Table 6 Standard Combination Schemes (Examples)

Scheme code	Combination	Application	Note
YHB-12PT	PT	Incoming isolation + PT power source	Single-circuit isolation / earthing, also as voltage source
YHB-12V	V	Circuit breaker circuit	Single-circuit circuit breaker cubicle
YHB-12PT+V	PT + V	Incoming (isolation + PT) + circuit breaker outgoing	Typical "one-in one-out" basic combination
YHB-12PT+V+V	PT + V + V	One-in two-out	Dual outgoing with protection
YHB-12V+V	V + V	Sectionalizing / bus coupling	Busbar sectionalizing or dual-source bus coupling
YHB-12PT+V+M	PT + V + M	Incoming - outgoing - metering	High-voltage supply high-voltage metering scheme
YHB-12PT+M+V	PT + M + V	Incoming - metering - outgoing	Metering placed on the load side
YHB-12V+PT+V	V + PT + V	Bus coupling - PT - bus coupling	Busbar equipment section centrally arranged
YHB-12PT+D	PT + D	Incoming + cable riser	Cable transfer scheme
YHB-12PT+V+V+V	PT + 3V	Switching station	One-in three-out with protection
YHB-12PT+M+V+V	PT + M + 2V	Metering + dual outgoing	Customized per metering point position
YHB-12PT+V+D	PT + V + D	Incoming - outgoing - transfer	Including cable riser transition
As needed	Any combination	Customized	Configured per the single-line diagram, protection requirements and cable routing

Selection recommendations

All functional circuits of this cabinet type are undertaken by the vacuum circuit breaker unit, belonging to the "all-circuit-breaker" configuration, suitable for distribution sites with high protection and automation requirements. This chapter gives a four-step selection logic, recommended typical scenarios and three tips.

Selection Logic (Four Steps)

Step 1: determine the circuit function based on the primary system diagram — this cabinet type has no load-switch unit, and all circuits requiring switching operations are realized by the V circuit breaker unit, while isolation and earthing are completed by the PT unit or the built-in three-position switch of the V unit;

Step 2: select the current and breaking grade — select 630 A or 1250 A according to the load current, and select the 20 kA or 25 kA grade according to the system short-circuit capacity (corresponding short-time withstand 20/25 kA·4 s);

Step 3: configure metering and voltage source — select the M unit for trade/assessment metering (which must have an upstream PT or V for isolation); the protection and operating power supply are provided by the voltage transformer of the PT unit;

Step 4: confirm automation and operating mode — select DTU/FTU, microprocessor protection, motorized operation and communication protocol according to the distribution automation requirements, then lock in the scheme.

Recommended Typical Scenarios

Scenario	Recommended configuration	Key point
Urban switching station / switching post	PT + V + V + V	All-circuit-breaker configuration, complete protection
Distribution automation renovation	PT + V(+V) + DTU	Meets the State Grid standardized design scheme
Busbar sectionalizing / bus coupling	V + V (or PT+V)	Selected per protection and operation frequency
High-voltage supply high-voltage metering	PT + M + V	The M unit must have upstream isolation protection
Dual-source incoming	PT + V + PT + V	Both incoming lines with isolation and voltage source
Cable transfer	PT + D or V + D	The D unit completes the busbar transition
High-altitude, extreme-cold environment	Full-series eco-gas cubicle	Operable at zero gauge pressure, verified up to 5000 m

Selection Tips

This cabinet type is not equipped with C/F load-switch units, and all circuits are configured as circuit breaker cubicles, suitable for sites with high protection and automation requirements; if only simple load switching is required, please consider the manufacturer's load-switch cubicle of the same series;

The breaking current of the V unit and the short-time withstand current of the complete unit have 20/25 kA grades, which must be checked against the system short-circuit parameters before ordering;

The metering scheme must be confirmed in advance with the local power supply department regarding transformer ratio, accuracy class and meter communication protocol; the PT unit capacity must be checked for the simultaneous power supply demand of the protection device and motorized mechanism.

Ordering instructions

When ordering, the purchaser shall provide the manufacturer with the following information:

- Primary system wiring diagram (single-line diagram) and the unit configuration requirements of each circuit (PT/V/M/D arrangement order);
- Rated current of each circuit and system short-circuit parameters (short-circuit current/short-circuit capacity);
- Main busbar rated current (630 A or 1250 A) and busbar sectionalizing/bus-coupling requirements;
- Insulating gas requirements: dry air or pure nitrogen (dry air by default), filling pressure and pressure monitoring requirements;
- M unit metering requirements: transformer ratio, accuracy class, meter type and local power supply department specifications;
- PT unit requirements: voltage transformer ratio, accuracy class, capacity and secondary load list;
- Protection and automation requirements: microprocessor protection/DTU model, communication protocol, operating power supply (AC/DC, voltage level), and whether a motorized mechanism is equipped;
- Cable specification (cross-section, type), incoming/outgoing mode (bottom-in bottom-out or others) and cable termination requirements;
- Cubicle arrangement scheme (including the D riser unit position), cubicle color and special coating requirements;
- Delivery time, transport mode and site installation conditions (reserved holes, foundation dimensions).

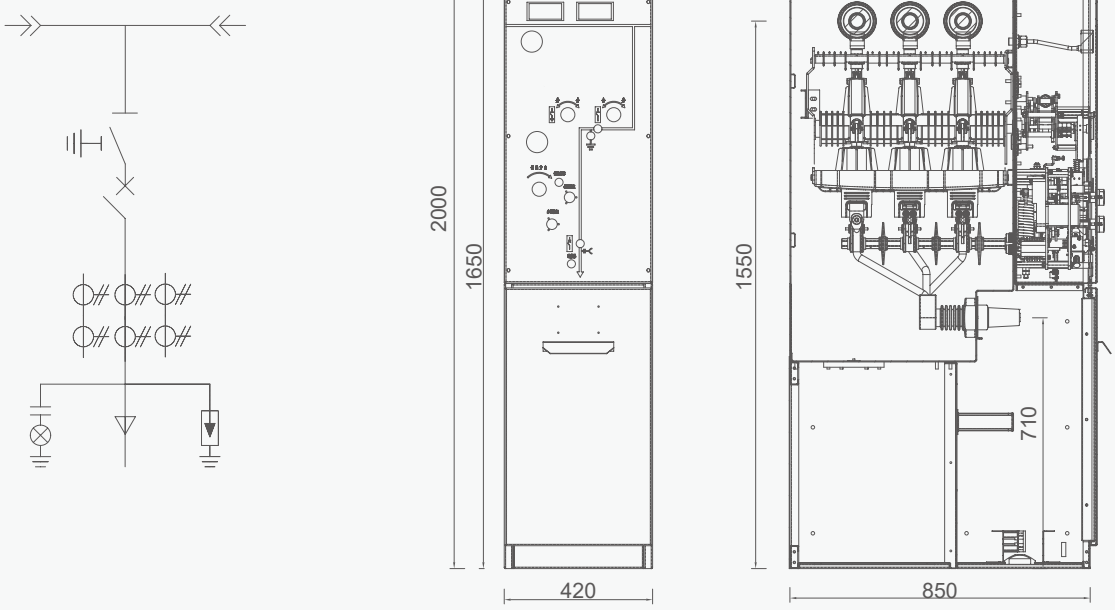
Appendix: Parameter Notes

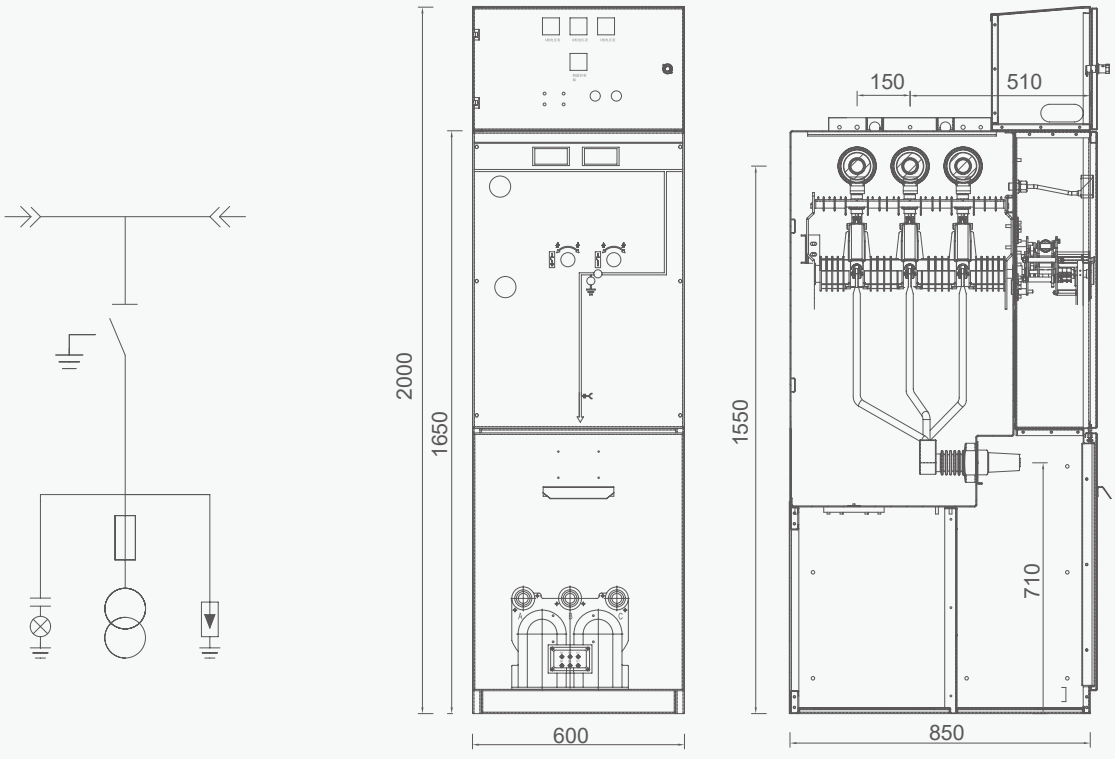
The parameters listed in this document are typical values commonly used in the industry for the YHB-12 eco-gas insulated ring main switchgear, compiled from public catalogues, the State Grid “Standardized Design Customization Scheme for 12 kV Ring Main Units (Cabinet) (2019 Edition)” and related standards. Different manufacturers differ in the following items: rated short-time withstand current grade (20/25 kA), annual leakage rate (0.01%~0.05%), mechanical life of the three-position switch (3000~5000 operations), altitude verification height (3000~5000 m), unit overall dimensions and gas tank pressure monitoring mode. For formal quotation and ordering, please refer to the manufacturer’s latest catalogue, technical agreement and type-test report.

YHB-12 Eco-Gas Insulated Ring Main Switchgear

Overall and mounting dimensions (mm)

Circuit Breaker Unit / V (Three-Position Switch on Busbar Side)





Medium Voltage Switchgear

DFW-12/24/35 European-Type Cable Branch Box (Switchless)

- This chapter introduces the product positioning, scope of application, type designation rules and applicable standards of the DFW series European-type cable branch box, and clarifies the boundary constraints that the "switchless" premise places on node functions. The DFW-12/24/35 European-type cable branch box (commonly known as the European-type cable connection box) is a pure connection device in the cable-based distribution network. It combines one or more medium-voltage cables into a fully insulated, fully sealed and fully shielded touchable connection body through European plug-in connectors, coupling sleeves and rear-connected surge arresters, housed inside an outdoor enclosure, to realize branching, interconnection and bridging of cable lines, while undertaking no breaking, isolation or earthing function. This is the most essential difference between it and ring main units and switchgear, and it is the premise of this entire document.
- The equipment covers three voltage levels of 12 kV / 24 kV / 35 kV, with the main circuit rated current mainly in 400 A / 630 A; a 1250 A large-capacity type is available for 12 kV and 24 kV. All core live components comply with the DIN 47636 / EN 50181 European mating standards, with socket interface protection up to IP67 and a touchable surface; the enclosure offers three materials: cold-rolled steel plate, 201 stainless steel plate and 304 stainless steel plate, selected according to the environmental corrosion class and whole life-cycle cost, with an enclosure degree of protection of IP33 ~ IP54.

General



DFW-12/24/35 European-Type Cable Branch Box (Switchless)

Key Indicators at a Glance

Item	Value
Voltage level	10 kV | 20 kV | 35 kV (corresponding rated voltage 12 / 24 / 40.5 kV)
Main circuit rated current	400 A | 630 A (1250 A available for 12 / 24 kV)
Short-time withstand current	20 kA / 3 s, peak 50 kA (25 kA / 63 kA optional for 35 kV)
Insulation level (power-frequency / impulse)	42 / 75 kV , 65 / 125 kV , 95 / 185 kV
Core components	European plug-in connector | European coupling sleeve | European rear-connected surge arrester
Enclosure material	Cold-rolled steel plate | 201 stainless steel plate | 304 stainless steel plate
Degree of protection	Enclosure IP33 ~ IP54; plug-in interface IP67
Breaking capability	None (switchless, without breaking, isolation and earthing functions)

Product Positioning

The DFW series European-type cable branch box is a branching and interconnection device for cable lines, not a switching device. Its design logic is: in urban distribution networks with a high degree of cabling, many nodes only need to split one cable into two or combine two cables into one, without needing load breaking, fault isolation or maintenance earthing at the node.

If ring main units are uniformly used in the above scenarios, it brings the over-configuration problem of "using switchgear for pure connection", which is not only costly and space-consuming but also increases the maintenance workload of primary equipment. The branch box is a dedicated device designed precisely for such "connect-only, no-breaking" scenarios. The roles the product plays in the distribution network include three categories: line branching, line interconnection and node transition:

Line branching — distributing the capacity of one trunk cable to several branch cables;

Line interconnection — combining several branch cables into one trunk cable, or serving as the bridging point of two cable lines;

Node transition — providing a standardized, detachable cable connection interface at locations such as cable trenches, work pits and the incoming/outgoing lines of box-type substations.

Since it has no switch, this device does not have the following capabilities, which must be confirmed one by one during selection:

It cannot break load current and cannot clear short-circuit current;

It cannot isolate the downstream line to form a visible break (cannot serve as a safety isolation point for maintenance);

It cannot realize automatic isolation of the faulty section and ring-network transfer (cannot serve as an independent node of distribution automation).

Selection tip: if a node needs breaking, isolation or ring-network transfer functions, a ring main unit should be selected (such as HXGN15-12, XGN15-12, YRM6 series gas-insulated cubicles, KYN28-12, etc.), rather than this product.

Scope of Application

This product is suitable for the following scenarios:

- Three-way and four-way connection nodes on cable-based renovation lines of urban distribution networks;
- Cable incoming connection points of residential communities, commercial complexes and office buildings;
- Branch distribution of internal cable lines of industrial parks and industrial and mining enterprises;
- Incoming/outgoing cable connection and reserved interfaces of box-type substations and ring main units;
- Connection of power supply cables for urban road lighting, landscape lighting and traffic facilities;
- Cable line nodes at airports, docks, subways, tunnels and other sites;
- Branching and collection of collector lines at new energy (photovoltaic, wind power, energy storage) stations;
- Cable trench and cable well locations where long-term expansion interfaces need to be reserved but switching devices should not be installed.

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Type Designation

DFW is the general code for cable branch boxes: D means cable (connection) equipment, F means branch / tap-off, and W means outdoor type. The complete type format is DFW-voltage level-circuit number[suffix].

1.3 Type Designation (Continued)

Table 1-1 Meaning of Each Position in the Type

Position	Meaning	Example value
DFW	Cable branch box (D cable / F branch / W outdoor)	Fixed code
First segment	Voltage level (kV)	12 , 24 , 35
Second segment	Number of circuits, i.e. total incoming/outgoing lines in one phase	2 , 3 , 4 , 6 , 8
Suffix	Whether a (rear-connected) surge arrester is equipped	A = equipped; no suffix = not equipped

Type Examples

Model	Description
DFW-12-4	12 kV European-type cable branch box, 4 circuits per phase (one-in three-out or two-in two-out), without surge arrester
DFW-12-6A	12 kV European-type cable branch box, 6 circuits per phase, with rear-connected surge arrester
DFW-35-3A	35 kV European-type cable branch box, 3 circuits per phase (one-in two-out), with rear-connected surge arrester

Type convention note: the DFW type meaning is a general engineering convention in the industry, and the numbering rules of different manufacturers may differ (e.g. 2# / 3# / 4# denoting the number of tap-off circuits, or a separate enterprise code). If inconsistent with the manufacturer's catalogue, the manufacturer's catalogue and the ordering technical agreement prevail.

Applicable Standards

This product is designed, manufactured and tested in accordance with the following national standards, industry standards and international standards.

Standard No.	Standard name
GB/T 3906	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
GB/T 11022	Common specifications for high-voltage switchgear and controlgear
GB/T 4208	Degrees of protection provided by enclosures (IP code)
GB/T 12706.4	Extruded insulation power cables and their accessories for rated voltages from 1 kV to 35 kV — Part 4: Cable accessories
GB/T 22381	Test requirements for cable accessories for rated voltages from 6 kV to 35 kV
GB/T 7354	High-voltage test techniques — Partial discharge measurements
DL/T 404	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
DL/T 5221	Technical regulations for the design of urban power cable lines
DL/T 620	Overvoltage protection and insulation coordination for AC electrical installations
IEC 60502-4	Extruded insulation power cables and their accessories for rated voltages from 1 kV to 30 kV — Part 4: Cable accessories
IEC 62271-200	AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
EN 50180 / EN 50181	Bushings and plug-in bushings (inner cone / outer cone) for equipment with rated voltage above 1 kV and up to 52 kV
DIN 47636	Mating and dimension requirements for European separable connectors (T-type connector, elbow connector, coupling sleeve)

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Operating Environmental Conditions

Table 2-1 Operating Environmental Conditions

Environmental parameter	Technical requirement
Ambient temperature	-30 °C ~ +40 °C (standard configuration); stainless steel enclosure and low-temperature-resistant plug-in connectors can be extended to -40 °C ~ +55 °C
Relative humidity	Daily average ≤95%, monthly average ≤90% (no condensation at 25 °C)
Altitude	≤1000 m; above 1000 m, external insulation correction per GB/T 11022 or a derated specification should be selected
Wind resistance	Equivalent wind speed 34 m/s (wind pressure no more than 700 Pa)
Seismic capability	Horizontal acceleration ≤0.4 m/s², vertical acceleration ≤0.15 m/s²
Installation inclination	Installation site inclination no more than 3° (foundation should be leveled)
Pollution class	Class Ⅲ; class IV optional for heavily polluted areas (correspondingly increase creepage distance or select a fully insulated plug-in structure)
Degree of protection	Enclosure IP33 ~ IP54 (IP65 optional for coastal and low-lying easily flooded sites); plug-in connection interface IP67
Salt spray condition	≥500 h for general areas; ≥1000 h recommended for coastal and chemical industrial areas (corresponding to 304 stainless steel enclosure)
Installation site	The surrounding air is not obviously polluted by corrosive or flammable gases and water vapor; no severe vibration; no explosion hazard

Special notes on environmental conditions:

High altitude — when the altitude exceeds 1000 m, the air insulation strength decreases and the heat dissipation capability weakens; external insulation correction must be carried out per the standard, or the insulation level increased, the air clearances of the enclosure enlarged, and the continuous operating current of the main circuit appropriately reduced.

Heavy pollution and hot-humid — in pollution class IV or perennially high-humidity regions, it is preferable to select a 304 stainless steel enclosure and increase the creepage distance of live parts to earth; a temperature/humidity controller and heating/dehumidification device should be configured inside the enclosure to avoid surface flashover caused by condensation.

Coastal salt spray and acid rain — 201 stainless steel is prone to pitting in chloride ion environments and is not recommended for seaside, salt fields and chemical industrial areas; in the above environments, 304 stainless steel should be selected or a higher-grade anti-corrosion treatment applied to the surface.

Possibly water-immersed sites — for underground garages, low-lying areas and easily flooded cable wells, IP65 or immersion-type requirements should be raised, and the cable entry/exit holes sealed with sealants, with a moisture-proof interlayer added at the enclosure bottom.

Icing and snow-covered regions — the snow and ice load on the enclosure top should be considered, the rigidity of the roof and door frame reinforced, and rain eaves added if necessary.

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Structural Composition and Technical Features

Overall Structure

The DFW European-type cable branch box consists of three parts: outdoor enclosure, live connection part and auxiliary accessories.

Table 3-1 Overall Structural Composition of the Branch Box

Component part	Main components	Function
Outdoor enclosure	Enclosure frame, door panels (double-side opening), roof, bottom plate, foundation frame, cable entry/exit holes	Load-bearing, protection, rain/dust/small-animal proofing, anti-theft
Live connection part	European plug-in connectors (front connector, rear connector), coupling sleeve, inner-cone insulating bushing, wall bushing, insulating cap / semiconductive end cap, rear-connected surge arrester	Cable branching and interconnection, interface insulation, overvoltage protection
Auxiliary accessories	Live-line indicator, short-circuit fault indicator, temperature/humidity controller and heater, cable fixing bracket, earthing copper bar, door lock and hinges, nameplate	Status monitoring, anti-condensation, mechanical support, earthing and safety

Three typical structural features:

Double-side opening doors — the front and rear sides can both be opened, allowing cable laying and plug-in connector installation from both directions, facilitating the respective nearby entry of cables on both sides of adjacent cable trenches;

Wall bushings as connection busbars — inside the enclosure, wall-mounted (inner-cone) insulating bushings replace metal busbars; each circuit is directly connected to both ends of the bushing through plug-in connectors, eliminating exposed busbars and bolted lap joints, and significantly shortening the structure length;

Three-core cables require no large-span crossing — since the connection interface is a longitudinally arranged bushing-type structure, the phases of a three-core cable are naturally aligned, with no need for cross-over between phases, making the cable arrangement clear and construction convenient.

European Plug-in Connectors (Separable Connectors)

The European plug-in connector is the core live component of this product, whose mating dimensions and test requirements comply with the DIN 47636 and EN 50181 (inner-cone / outer-cone bushing) standards, and is divided into two categories: front connector and rear connector.

Table 3-2 Types and Applications of European Plug-in Connectors

Category	Structure	Application	Touchable or not
European T-type front connector	T-shape, inner-cone plug-in type, 630 A bolted	Main connection between cable and equipment bushing (wall bushing / inner-cone bushing)	Touchable (fully shielded type)
European T-type rear connector	Mates with the tail end of the T-type front connector	Extends the tap-off point downward in series to realize multi-circuit tap-off	Touchable (fully shielded type)
European elbow (bent) connector	Elbow shape, 400 A/630 A	Small-cross-section cable tap-off, space-restricted locations	Touchable / non-touchable
European coupling sleeve	Double-ended inner cone, shielded in the middle	Intermediate coupling between two rear connectors	Touchable
European inner-cone insulating bushing	Inner-cone structure, 630 A / 1250 A	Serves as the connection busbar of the branch box (wall-mounted)	Closed interface after installation
Insulating cap / semiconductive end cap	Insulating plug	Plug the reserved spare interface, dust-proof and moisture-proof, maintaining insulation	Touchable

Table 3-3 Comparison of Touchable and Non-Touchable Plug-in Connectors

Comparison item	Touchable type (Touchable)	Non-touchable type (Dead-break)
Outer surface potential	Fully shielded, metal outer shield layer earthed, surface near zero potential	No continuous outer shield, floating potential on the surface
Touch during operation	Allowed (site safety regulations still apply)	Strictly prohibited
Live plug-in/pull-out	Can be plugged/unplugged under no-load conditions per prescribed procedures (no arc-extinguishing capability, plugging under load strictly prohibited)	Plugging/unplugging only after de-energization
Cost	Higher	Lower
Application	Nodes requiring live maintenance, temporary transfer, or high safety	Conventional nodes, switched by upstream switch with de-energization

Installation key points (construction quality directly determines the interface insulation level):

Strip the cable strictly per the connector instruction manual; stripping of the semiconductive layer must not damage the insulation layer;

Clean the insulation surface with a dedicated cleaning agent and lint-free paper; cotton yarn is prohibited;

Apply silicone grease evenly without entrained air bubbles; the axial position error of the stress cone (stress tube) should be controlled within ±2 mm;

The crimping terminal specification should match the cable core; after crimping, remove burrs, smooth the surface and clean it;

Tighten with a torque wrench to the torque value in the instruction manual, avoiding interface deformation caused by insufficient or excessive torque;

The shield earthing lead-out must be reliable, and the independent earthing wire connected firmly to the earthing copper bar;

Reserved spare interfaces must be reliably plugged with insulating caps or semiconductive end caps; open-port operation is strictly prohibited.

Coupling Sleeve

The coupling sleeve (Butt sleeve) is a touchable shielded component with a double-ended inner-cone interface, used for the intermediate coupling between two European rear connectors; it is the key link forming the "multi-circuit tap-off chain".

Structure — both ends are inner-cone interfaces complying with EN 50181, with an epoxy resin or silicone rubber insulating body in the middle, an external metal shield layer and an earthing lead-out, and a touchable surface;

Function — connect several groups of "front connector + rear connector" in series into a tap-off chain, realizing multi-circuit tap-off of 4, 6 or 8 circuits per phase without metal busbars;

End treatment — the end of the tap-off chain must be plugged with an insulating cap or semiconductive end cap; if it is a long-term reserved interface, it must also be plugged and given dust-proof and moisture-proof protection;

Earthing — the outer shield layer must be reliably earthed to keep the touchable surface at zero potential.

Enclosure-less coupling type: when the site is too restricted to place an enclosure, the "front connector + coupling sleeve + rear connector" assembly can be placed directly in the cable trench (or cable work pit), eliminating the enclosure and retaining only the fixing bracket and earthing. This saves space and investment, but requires good waterproofing and ventilation of the cable trench, and proper overall earthing and marking.

Rear-Connected Surge Arrester

The rear-connected surge arrester is an overvoltage protection element installed at the tail of a European T-type connector (or rear connector), used to limit lightning overvoltage and switching overvoltage on the cable line and protect the cable body, connector interface and downstream equipment. Its structural features are as follows:

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Fully insulated and fully sealed structure; the composite outer sheath is injection-molded in one piece from high-quality silicone rubber or EPDM, with good sealing and weather resistance, waterproof and moisture-proof;

Built-in gapless zinc oxide (ZnO) surge arrester valve blocks with excellent volt-ampere characteristics and large current-carrying capacity;

Adopts a unique stress cone structure to effectively relieve the electric field stress and solve the electric field concentration problem at the cable shield cut-off;

With a uniform outer shield layer, the earthing resistance is less than 5000 Ω, keeping the outer surface of the surge arrester at zero potential and ensuring personal safety during maintenance;

Connected to the main connector through a dedicated T-type connector (such as a TTL-type connector), with the same installation method as the plug-in connector, and can be removed and replaced together with the connector.

Selection key points:

The continuous operating voltage Uc must be greater than or equal to the system maximum operating voltage Um — this is a hard constraint for surge arrester selection in unearthed systems. During a single-phase earth fault, the healthy phase voltage rises to the line voltage, and the surge arrester must be able to withstand this voltage throughout the entire earth-fault duration;

Select the rated voltage and residual voltage by voltage level: for 12 kV systems 17/50 and 17/45 are commonly used; for 24 kV systems 34/85 should be selected (Uc 27.2 kV ≥ 24 kV), which can be relaxed to 24/66 if the system is earthed through a small resistance; for 35 kV systems 51/134 is selected;

The nominal discharge current is generally 5 kA, and 10 kA can be selected for important lines or high lightning-frequency areas;

Earthing must be reliably made together with the cable metal shield and the enclosure earthing copper bar, and the earthing resistance should meet the engineering requirements.

Fully Insulated, Fully Sealed, Fully Shielded Technical Features

Table 3-4 Fully Insulated/Fully Sealed Technical Features and Engineering Value

Technical feature	Realization method	Engineering value brought
Fully insulated	The connector body is injection-molded integrally from EPDM / silicone rubber, with inner-cone / outer-cone rubber interference fit at the interface	Eliminates air gaps, stable interface withstand voltage, unaffected by pollution and humidity
Fully sealed	Cone interference + sealing ring + insulating cap, interface assembled at factory	Waterproof, moisture-proof and dust-proof, interface up to IP67, operable under long-term immersion
Fully shielded	The connector is wrapped with a continuous metal outer shield layer and reliably earthed	Surface near zero potential, touchable, significantly improved personal safety
Grading structure	Built-in stress cone (stress tube) relieves the electric field	Low partial discharge (≤10 pC order), extends insulation life
Maintenance-free	No exposed conductor, no mechanical operating parts, no gas pressure	No periodic inspection, no gas replenishment, no lubrication

Life note: this product contains no operating mechanism or arc-extinguishing parts, so there are no parameters such as mechanical life or breaking times; its "life" depends on the aging of rubber parts and the interface condition, and the design life under normal environments can reach over 20 years.

Optional Auxiliary Accessories

Table 3-5 List of Optional Auxiliary Accessories

Accessory	Function	Remark
Live-line indicator	Indicates the live state of the cable line	Can be configured with per-phase or combined indication
Short-circuit fault indicator	Indicates the passage of short-circuit fault current	Supports local flag/flash and remote upload
Cable fixing bracket and clamps	Fix cables, bear gravity and short-circuit electrodynamic force	Configured per cable specification and number of circuits
Fire-stop material	Plug cable entry/exit holes	Prevent fire spread and small-animal entry
Earthing copper bar and earthing terminal	Collect the metal shield earthing and surge arrester earthing of each circuit	Cross-section checked against short-circuit current
Door lock, hinges and limiters	Opening/closing and fixing of the enclosure door	Can be configured with padlock holes and door switch alarm
Nameplate and warning signs	Model, parameters, warnings and circuit number	Includes "no plugging under load" warning

Outdoor Enclosure and Material Selection

The outdoor enclosure provides protection, load-bearing and anti-theft functions, and its material directly determines the service life and whole life-cycle cost of the equipment. This chapter explains the enclosure structure forms, the quantitative comparison of three materials, surface treatment and anti-corrosion, protection and anti-condensation, and earthing requirements.

Structure Forms

Enclosure shape — rectangular floor-standing type, with front/rear double-side opening doors (some specifications single-side opening); rain eaves and water-stop edges are provided between the door and the enclosure, with the outer edge higher than the inner edge so that rainwater cannot enter the enclosure;

Roof — integrally flanged or integrally welded, with a slight slope (no less than 3%) on the top surface for drainage, and no top direct ventilation opening;

Bottom plate — with cable entry/exit openings (matching the number of circuits and cable outer diameter), detachable sealing plates and fire-stop blocks; a moisture-proof interlayer can be added at the bottom if needed;

Ventilation — a bottom-in bottom-out ventilation structure with rain covers, with stainless steel dust screens installed at the ventilation openings, providing both dust-proofing and small-animal-proofing;

Foundation — the enclosure is installed on a precast concrete foundation or channel steel foundation frame, with the foundation rising no less than 200 mm above the ground and a drainage slope arranged around it;

Interior — cable fixing brackets, an earthing copper bar and mounting beams are arranged, with each circuit marked by phase sequence and circuit number to facilitate construction and later operation and maintenance.

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Comparison of Three Enclosure Materials

This product offers three enclosure materials: cold-rolled steel plate, 201 stainless steel plate and 304 stainless steel plate. The three differ significantly in corrosion resistance, service life and investment cost, and should be selected comprehensively according to the corrosion class of the installation environment and the whole life-cycle cost of the project.

Table 4-1 Enclosure Material and Selection Comparison Table

Comparison item	Cold-rolled steel plate (powder coated)	201 stainless steel plate	304 stainless steel plate
Common plate thickness	1.5 ~ 2.0 mm	1.5 ~ 2.0 mm	1.5 ~ 2.0 mm
Surface treatment	Electrostatic powder coating after pickling and phosphating	Brushed / polished / sandblasted, can be re-coated	Brushed / polished / sandblasted, can be re-coated
Expected service life	10 ~ 15 years	15 ~ 20 years	25 ~ 30 years
Neutral salt spray test	≥500 h	≥500 h	≥1000 h
Chloride ion corrosion resistance	General, prone to rust after coating damage	Poor, prone to pitting in chloride environments	Excellent
Impact resistance and structural rigidity	Good	Good	Good
Appearance and shape flexibility	Good, color customizable per color chart	General, mainly metallic natural color	General, mainly metallic natural color
Self-weight (same specification)	Lighter	Medium	Medium-heavy
Cost ratio (relative to cold-rolled steel plate)	1.0 (reference)	about 1.6 ~ 2.0 times	about 2.5 ~ 3.2 times
Maintenance requirement	Periodic coating inspection and touch-up of damaged areas required	Generally no coating maintenance, periodic cleaning required	Essentially maintenance-free, easy to clean surface
Applicable environment	Inland general industrial and civil environments	General humid, mildly corrosive environments; not recommended for seaside	Coastal, salt spray, chemical, high-humidity high-salt environments
Economic evaluation	Lowest cost, high cost-performance	Moderate cost, better anti-corrosion than cold-rolled steel plate	Highest cost, but often the lowest whole life-cycle cost

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Material selection recommendations:

Inland general environment (low average annual humidity, no salt spray, no chemical pollution) — select a cold-rolled steel plate enclosure with electrostatic powder coating for best economy, but ensure the pretreatment quality before coating (acid pickling and phosphating) and require a coating thickness ≥60 μm;

Humid, rainy and mildly corrosive environments (such as southern cities and general industrial areas) — select a 201 stainless steel enclosure, which can significantly delay the onset of rust;

Coastal, salt spray, chemical and heavily polluted environments — a 304 stainless steel enclosure must be selected, with weld passivation treatment and stainless steel fasteners to avoid galvanic corrosion;

Sites with high landscape requirements — the stainless steel enclosure can be spray-coated (adhesion pretreatment required first) to harmonize the enclosure color with the surrounding environment;

Cost comparison principle — comparison should be based on whole life-cycle cost rather than initial purchase price. The initial cost of a 304 stainless steel enclosure is about 2.5~3.2 times that of a cold-rolled steel plate, but its life can reach more than 2 times and it is essentially maintenance-free, often more economical in long-cycle applications.

Surface Treatment and Anti-Corrosion

Cold-rolled steel plate — degreasing → pickling → phosphating → cleaning → electrostatic powder coating (outdoor polyester powder) → high-temperature curing, with coating thickness ≥60 μm; the adhesion and impact resistance meet outdoor use requirements;

Stainless steel plate — after welding, the weld must be acid-pickled and passivated to remove oxide scale and free iron ions and restore the passive film;

Fasteners — fasteners on the exterior of the enclosure use stainless steel to avoid galvanic corrosion with the enclosure;

Seals — the door frame sealing strip uses EPDM or silicone rubber, aging-resistant and weather-resistant;

Marking and coating — the model, circuit number and warning signs are screen-printed or film-applied on the enclosure door, using weather-resistant ink or reflective material for outdoor use.

Protection and Anti-Condensation

Degree of protection — enclosure normally IP33 ~ IP54, plug-in connection interface IP67;

Small-animal proofing — stainless steel dust screens installed at all cable openings and ventilation openings, and holes sealed with fire-stop material;

Rain proofing — the outer door edge is higher than the inner edge and rain eaves are installed; exposed rain-proof locks are used.

Earthing

An earthing copper bar is arranged inside the enclosure (cross-section checked against short-circuit current thermal stability, generally no less than 30×4 mm); the cable metal shield, the plug-in connector metal outer shield, the rear-connected surge arrester earthing terminal and the enclosure body of each circuit are all connected to this copper bar;

No fewer than 2 earthing terminals (arranged diagonally), with M12 stainless steel bolts and lock washers;

The enclosure earthing is reliably connected to the line earthing grid, and the earthing resistance is per the engineering design requirements (generally no more than 4 Ω);

The earthing marking is clear, and the earthing link plate should have anti-loosening and anti-corrosion measures.

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Main Technical Data

This chapter summarizes the technical data of the complete unit, plug-in connectors, coupling sleeves and insulating accessories, rear-connected surge arresters, enclosure, and cable adaptation range, for selection and ordering. The parameter values are compiled based on national standard values and the general ranges of multiple manufacturers' catalogues.

Table 5-1 Complete Unit Main Technical Data

Item	Unit	DFW-12	DFW-24	DFW-35
System nominal voltage	kV	10	20	35
Rated voltage (Um)	kV	12	24	40.5
Rated frequency	Hz	50	50	50
Main circuit rated current	A	400 / 630 (1250 available)	400 / 630 (1250 available)	400 / 630
Branch circuit rated current	A	400 / 630	400 / 630	400 / 630
Rated short-time withstand current	kA	20 (3 s)	20 (3 s)	20 (3 s), 25 optional
Rated peak withstand current	kA	50	50	50, 63 optional
Rated short-time withstand duration	s	3 (2 / 4 for some manufacturers)	3	3
1 min power-frequency withstand voltage (phase-to-phase, to earth)	kV	42	65	95
Lightning impulse withstand voltage (peak)	kV	75	125	185
15 min DC withstand voltage (reference)	kV	52	80	118
Partial discharge (at 1.73 U_0)	pC	≤10	≤10	≤10
Creepage distance	mm/kV	≥25 (pollution class Ⅲ)	≥25	≥25
Maximum permissible temperature of main circuit conductor	°C	90 (ambient 40 °C, temperature rise ≤50 K)	90	90
Maximum permissible temperature of plug-in interface	°C	105	105	105
Contact resistance of plug-in interface	μΩ	≤25 (630 A type)	≤25	≤25
Enclosure degree of protection	—	IP33 ~ IP54 (IP65 optional)	IP33 ~ IP54	IP33 ~ IP54
Plug-in connection interface degree of protection	—	IP67	IP67	IP67
Separable connector standard	—	DIN 47636 / EN 50181	Same as left	Same as left
Installation mode	—	Outdoor floor-standing (or enclosure-less type in cable trench)	Same as left	Same as left

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Test note: the 15 min DC withstand voltage is a reference value, mainly used for handover tests and insulation condition assessment; the on-site handover test of cable lines should be applied in stages by DC withstand voltage or AC withstand voltage of 4U□ per DL/T 5221, subject to the test scheme.

Table 5-2 European Plug-in Connector Technical Data

Item	630 A T-type (mainstream)	1250 A large-capacity type
Rated voltage	12 / 24 / 35 kV	12 / 24 kV
Rated current	630 A	1250 A
1 min power-frequency withstand voltage	42 / 65 / 95 kV	42 / 65 kV
Lightning impulse withstand voltage	75 / 125 / 185 kV	75 / 125 kV
Interface form	Inner cone (EN 50181 type)	Inner cone (heavy-current type)
Connection method	Bolted connection type	Bolted connection type
Connection specification	Same as left	Same as left
Body material	Same as left	Same as left
Outer shield and earthing	Same as left	Same as left
Applicable cable cross-section (12 kV)	50 ~ 400 mm²	240 ~ 630 mm²
Applicable cable cross-section (24 / 35 kV)	50 ~ 400 mm²	—
Partial discharge	≤10 pC	≤10 pC
Test basis	Same as left	Same as left

Table 5-3 Coupling Sleeve and Insulating Accessory Parameters

Item	Parameter	Remark
Coupling sleeve rated current	630 A (1250 A optional)	Matching the current rating of the plug-in connector
Applicable voltage level	12 / 24 / 35 kV	Selected by voltage level
Interface form of both ends	Inner cone (EN 50181), double-ended coupling	Mates with the rear connector
1 min power-frequency withstand voltage	42 / 65 / 95 kV	Corresponding to 12 / 24 / 35 kV
Lightning impulse withstand voltage	75 / 125 / 185 kV	Peak
Partial discharge	≤10 pC	at 1.73 U_0
Outer shield and earthing	Metal outer shield layer, with earthing lead-out, touchable surface	Surface near zero potential
Inner-cone insulating bushing	630 A, wall-mounted, serving as connection busbar	Complies with EN 50181
Insulating cap / semiconductive end cap	For plugging spare interfaces	Reserved interfaces must be plugged
Silicone grease	Applied at the interface, brand and model per connector instruction manual	Products containing impurities are prohibited

Table 5-4 Rear-Connected Surge Arrester Technical Data

Item	Unit	12 kV system	24 kV system	35 kV system
Recommended model example	—	BLQ-17/50 、 YH5WS-17/50	BLQ-34/85 (Uc 27.2 kV)	BLQ-51/134 、 YH5WS-51/134
Surge arrester rated voltage	kV	17	34	51
Continuous operating voltage Uc	kV	13.6	27.2	40.8
DC 1 mA reference voltage U_{1mA}	kV	≥24	≥48	≥73
Nominal discharge current In	kA	5 (10 optional)	5	5 (10 optional)
Lightning impulse residual voltage (5 kA)	kV	≤50	≤85	≤134
Switching impulse residual voltage	kV	≤42.5	≤72	≤114
Steep-front impulse residual voltage	kV	≤57	≤97	≤154
Leakage current at $0.75U_{1mA}$	μA	≤50	≤50	≤10
2 ms rectangular wave impulse current withstand	A	150	150	400 (600 / 800 available)
High-current impulse withstand	kA	65 ~ 100	65 ~ 100	100
Partial discharge	pC	≤10	≤10	≤10 (at 45 kV)
Outer sheath material	—	Silicone rubber / EPDM	Same as left	Same as left
Outer shield earthing resistance	Ω	<5000	<5000	<5000
Installation mode	—	Installed at the tail of the main connector via a T-type connector	Same as left	Same as left

Surge arrester selection warning: the surge arrester selection for 24 kV systems is the most error-prone. When Um = 24 kV and the system neutral is unearthed, the healthy phase voltage can reach 24 kV during a single-phase earth fault, so Uc must be ≥24 kV, and 34/85 (Uc 27.2 kV) should be selected; if 24/66 (Uc 20.8 kV) is mistakenly selected, the surge arrester will be continuously overloaded during the single-phase earth fault, with a risk of thermal runaway. For systems well earthed through a small resistance or well compensated through an arc suppression coil, it can be relaxed as appropriate after calculation, but with justification.

Table 5-5 Enclosure Technical Data and Material Quantitative Comparison

Item	Cold-rolled steel plate	201 stainless steel plate	304 stainless steel plate
Common plate thickness	1.5 ~ 2.0 mm	1.5 ~ 2.0 mm	1.5 ~ 2.0 mm
Surface treatment	Phosphating + electrostatic powder coating ≥60 μm	Brushed / polished, can be coated	Brushed / polished, can be coated
Expected life	10 ~ 15 years	15 ~ 20 years	25 ~ 30 years
Neutral salt spray test	≥500 h	≥500 h	≥1000 h
Degree of protection	IP33 ~ IP54 (IP65 available)	Same as left	Same as left
Door opening mode	Front/rear double-side opening (or single-side opening)	Same as left	Same as left
Foundation height	≥200 mm above the ground	Same as left	Same as left
Installation inclination	≤3°	Same as left	Same as left
Ventilation structure	Rain-cover bottom-in bottom-out + stainless steel dust screen	Same as left	Same as left
Earthing copper bar	≥30×4 mm, earthing terminals ≥2 (M12)	Same as left	Same as left
Earthing resistance	Per engineering requirements (generally ≤4 Ω)	Same as left	Same as left

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Table 5-6 Cable Adaptation Range

Item	DFW-12	DFW-24	DFW-35
Cable rated voltage U_0/U	6/10, 8.7/10, 8.7/15 kV	12/20, 12.7/22 kV	21/35, 26/35 kV
Common cable cross-section	70 ~ 300 mm²	70 ~ 300 mm²	95 ~ 300 mm²
Adaptable cross-section range	25 ~ 400 mm²	35 ~ 400 mm²	50 ~ 400 mm²
Number of cable cores	Mainly three-core, single-core adaptable	Same as left	Same as left
Conductor material	Copper core / aluminum core (matched per connector terminal)	Same as left	Same as left
Cable insulation form	Cross-linked polyethylene (XLPE) extruded insulation	Same as left	Same as left
Cable outer diameter adaptation	Ø30 ~ Ø110 mm	Ø40 ~ Ø120 mm	Ø50 ~ Ø130 mm
Whether armor is required	Armored cable should be used for outdoor direct burial or locations prone to mechanical damage	Same as left	Same as left

Overall Dimensions and Installation Layout

Overall Dimensions

Table 6-1 DFW-12 Series Overall Dimensions

Specification	Number of circuits (per phase)	Overall dimensions W×D×H (mm)
DFW-12-2	2 (one-in one-out)	640×600×1000
DFW-12-3	3 (one-in two-out)	740×600×1000
DFW-12-4	4 (one-in three-out / two-in two-out)	840×600×1000
DFW-12-5	5	940×600×1000
DFW-12-6	6 (two-in four-out)	1040×600×1000
DFW-12-7	7	1140×600×1000
DFW-12-8	8 (double-row arrangement)	1240×600×1000

Because the insulation distance increases, the enclosure dimensions of the 24 kV and 35 kV series are correspondingly enlarged; the reference dimensions are as follows.

Table 6-2 DFW-24 / DFW-35 Series Reference Dimensions

Number of circuits	DFW-24 reference dimensions (mm)	DFW-35 reference dimensions (mm)
2	640×600×1000	800×900×1200
3	740×600×1000	800×1100×1200
4	840×600×1000	800×1300×1200
5	940×600×1000	800×1500×1200
6	1040×600×1000	800×1700×1200
7	1140×600×1000	/
8	1240×600×1000	/

Dimension note: Table 6-2 lists reference dimensions calculated per insulation distance and circuit arrangement, used for scheme comparison and site reservation. The actual overall dimensions vary with the manufacturer's structural design (plate thickness, frame form, wall bushing spacing, whether a surge arrester compartment is included), and the design liaison stage must be based on the manufacturer's formal outline drawing and foundation drawing.

6.2 Foundation and Installation Requirements

The foundation is made of concrete or section steel, with the top surface rising no less than 200 mm above the ground and the foundation levelness deviation no more than 3°;

Cable entry/exit holes and cable trench (or conduit) interfaces are reserved in the foundation, with opening dimensions determined by the cable outer diameter and bending radius;

A drainage slope (no less than 2%) is arranged around the foundation to avoid water accumulation soaking the enclosure bottom or seeping into the cable trench;

After the enclosure is positioned, level it and tighten the anchor bolts, with a moisture-proof cushion layer between the enclosure and the foundation;

When laying cables, the bending radius is no less than 15 times the cable outer diameter (no less than 12 times for three-core armored cables), avoiding an excessively small bending radius inside the enclosure;

After entering the enclosure, the cable is first fixed and then stripped, to avoid tension on the cable after stripping;

Before energizing after construction, insulation resistance measurement, earthing continuity check, plug-in interface appearance check, reserved interface plugging confirmation, and plugging and marking check must be completed.

Ordering Instructions

Information to Be Provided at Ordering

Table 7-1 Ordering Information List

No.	Item	Description
1	Model and specification	e.g. DFW-12-4A, indicating the voltage level and circuit number suffix
2	Quantity	Number of units, and indicate whether spare interfaces are needed
3	System conditions	System nominal voltage, maximum operating voltage, neutral earthing mode
4	Main circuit and branch rated current	400 / 630 / 1250 A; distribution of each branch
5	Short-time withstand current and time	e.g. 20 kA/3 s, peak 50 kA
6	Incoming/outgoing combination and circuit distribution	One-in how-many-out, two-in how-many-out, with a primary wiring schematic
7	Plug-in connector specification	Current rating, type (T-type / elbow type), touchable or non-touchable, brand requirements
8	Cable data	Cable model (e.g. YJV22-8.7/15 3×240), cross-section, copper/aluminum, three-core or single-core, cable outer diameter
9	Surge arrester requirements	Whether configured, model (e.g. 17/50, 51/134), nominal discharge current, whether touchable is required
10	Enclosure requirements	Material (cold-rolled steel plate / 201 / 304), plate thickness, color (color chart No.), degree of protection, number of doors and opening direction
11	Accessory requirements	Live-line indicator, fault indicator, door switch alarm
12	Installation requirements	Installation mode (floor-standing / in cable trench), incoming/outgoing direction, foundation form, earthing resistance requirements
13	Marking and nameplate	Circuit numbering rules, warning signs, nameplate content and language requirements
14	Tests and documents	Whether a third-party type-test report is needed, routine test item requirements, as-built document list

Type Writing Examples

DFW-12-3A / 630 A touchable T-type plug-in connector / 304 stainless steel enclosure / YJV22-8.7/15 3×240 / one-in two-out / bottom-in bottom-out / IP54 / with 17/50 rear-connected surge arrester and live-line indicator;

DFW-24-4 / 630 A touchable T-type plug-in connector / 201 stainless steel enclosure / YJV22-12/20 3×185 / two-in two-out / IP54;

DFW-35-3A / 630 A plug-in connector / 304 stainless steel enclosure / YJV22-26/35 3×185 / one-in two-out / with 51/134 rear-connected surge arrester.

Factory Tests and Delivery Documents

Table 7-2 Routine (Factory) Test Items

No.	Test item	Basis	Description
1	Main circuit resistance measurement	GB/T 11022	Including plug-in interface, compared with type-test value
2	1 min power-frequency withstand voltage test	GB/T 11022 / GB/T 3906	Apply 42 / 65 / 95 kV per voltage level
3	Partial discharge measurement	GB/T 7354	≤10 pC at 1.73 U_0
4	Auxiliary circuit and wiring check	Manufacturer's standard	Function check of live-line indicator, temperature controller and heater
5	Earthing continuity check	Manufacturer's standard	Continuity of each metal outer shield layer with the earthing copper bar
6	Appearance and plugging check	Manufacturer's standard	Coating, marking, reserved interface plugging, plug integrity
7	Mechanical dimension and interchangeability check	Manufacturer's standard	Interface mating dimensions comply with DIN 47636 / EN 50181

Documents delivered with the goods:

Product certificate of conformity and factory test report;

Product instruction manual (including plug-in connector installation manual and stripping dimension drawing);

Primary wiring diagram, overall dimension drawing and foundation drawing;

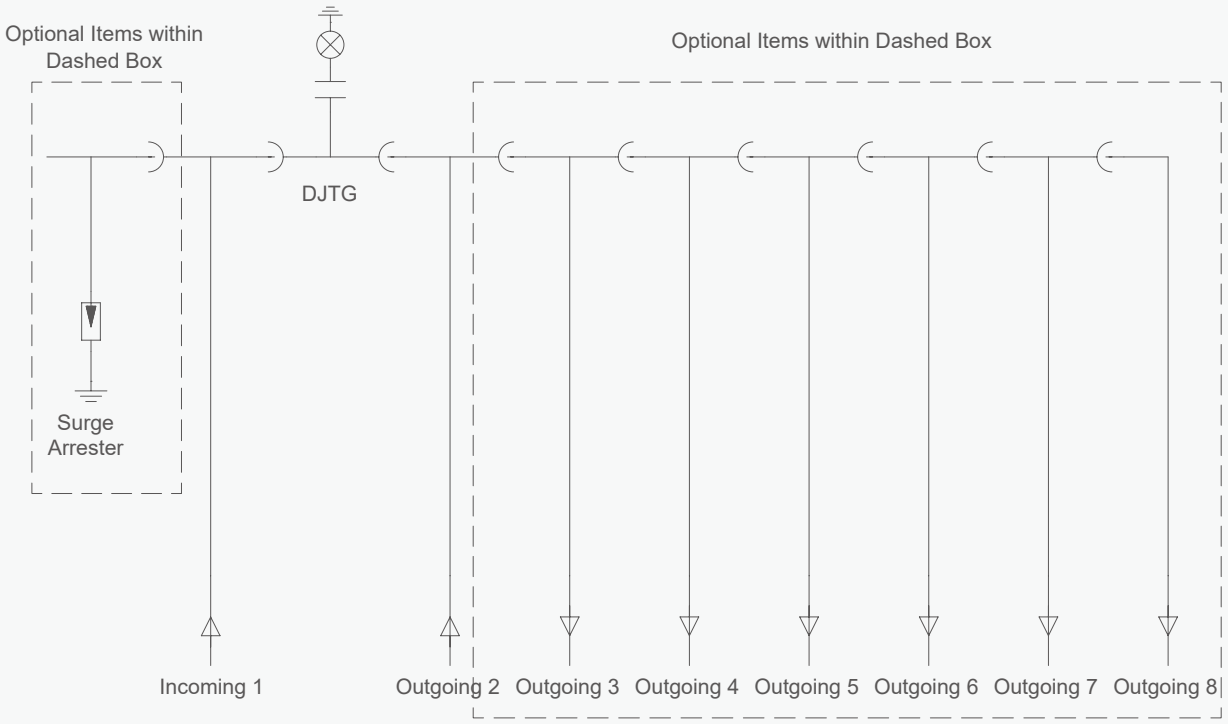
Main component list and conformity certificates (plug-in connectors, surge arresters, live-line indicators, etc.);

Packing list and accompanying accessory list (including insulating caps, silicone grease, cleaning paper, fasteners, etc.);

Suggested list of on-site installation and handover test items.

DFW-12/24/35 European-Type Cable Branch Box (Switchless)

Electrical single-line diagram



Medium Voltage Switchgear

YVG-12 Solid-Insulated Ring Main Switchgear

The YVG-12 solid-insulated ring main switchgear is a three-phase AC 50 Hz indoor switchgear assembly with a rated voltage of 12 kV. It adopts the epoxy resin APG (automatic pressure gelation) process to integrally encapsulate the vacuum interrupter, disconnector, earthing switch and main current-carrying circuit, fully replacing SF6 gas with a solid insulating medium, featuring full insulation, full sealing, maintenance-free operation, environmental friendliness and strong weather resistance and other outstanding features, and is an SF6 ring main unit replacement product promoted by State Grid. By function the equipment is divided into five units: C (load break switch), V (vacuum circuit breaker), F (load break switch-fuse combination), M (metering) and D (riser); the main busbar rated current covers 630 A to 1250 A, and it is widely used in ring-network power supply and terminal distribution in urban distribution networks, residential communities, industrial parks, rail transit and commercial complexes.

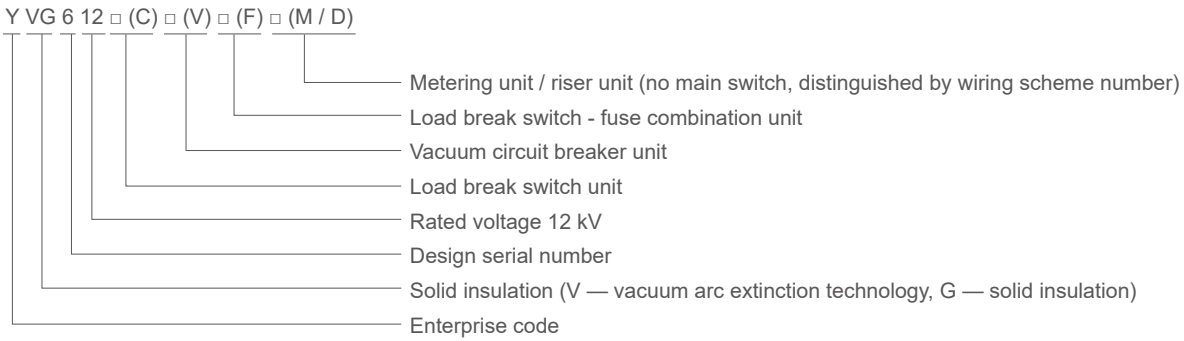
General



YVG-12 Solid-Insulated Ring Main Switchgear

Type designation

Type string: YVG-12□ (□ is the main switch type; M / D units are distinguished by the wiring scheme number)



Scope of application

1. Ring-network power supply, terminal power supply and switching stations in urban distribution networks;
2. Power distribution for residential communities, commercial complexes and high-rise buildings;
3. Power supply and distribution systems of industrial parks and industrial and mining enterprises;
4. Transport infrastructure such as subways, tunnels, airports and railways;
5. Special environments such as plateaus, humid, severe-cold and dusty areas that are unfriendly to SF6 equipment;
6. Distribution links such as cable branching, dual-supply transfer, line sectioning and interconnection.

Applicable standards

Standard No.	Standard name
GB/T 11022	Common specifications for high-voltage switchgear and controlgear
GB 3906	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
GB 1984	High-voltage AC circuit breakers
GB 1985	High-voltage AC disconnectors and earthing switches
GB 3804	High-voltage AC load break switches for rated voltages from 3.6 kV to 40.5 kV
GB 16926	High-voltage AC load break switch - fuse combination units
DL/T 403	Technical requirements for ordering indoor high-voltage vacuum circuit breakers from 12 kV to 40.5 kV
DL/T 404	AC metal-enclosed switchgear and controlgear for rated voltages from 3.6 kV to 40.5 kV
Q/GDW 730	Technical requirements for 12 kV solid-insulated ring main units
IEC 62271-1 / 62271-200 / 62271-202	Series of standards for high-voltage AC switchgear and controlgear

Operating environmental conditions

The normal service conditions are shown in the table below; when the actual service conditions exceed the above range, products for special service conditions can be provided by negotiation with the manufacturer.

Item	Normal service conditions
Ambient temperature	-45 °C ~ +45 °C (24 h average not exceeding +35 °C)
Altitude	≤ 3000 m (solid insulation requires no high-altitude correction; exceeding the limit is negotiable)
Relative humidity	Daily average ≤ 95%, monthly average ≤ 90% (water vapor pressure: daily average ≤ 2.2 kPa, monthly average ≤ 1.8 kPa)
Seismic intensity	≤ 8 degrees
Installation environment	No fire or explosion hazard, no severe pollution, chemical corrosion or severe vibration
Installation mode	Indoor fixed installation, bottom-in bottom-out cables (changeable as needed)
Special conditions	When beyond the above range, products for special service conditions can be provided by negotiation with the manufacturer

YVG-12 Solid-Insulated Ring Main Switchgear

Enclosure Structure and Technical Features

The core competitiveness of the YVG-12 lies in its structural design of "solid insulation + modularization + intelligence". This chapter explains its technical features from five aspects: insulation technology, modular structure, operating interlock, intelligent monitoring, and environmental protection and safety.

Solid Insulation Technology

- APG automatic pressure gelation process: the vacuum interrupter, disconnector, earthing switch and main current-carrying circuit are integrally encapsulated in the epoxy resin pole, with a three-phase split design and an earthed shielding layer on the outer surface, realizing a fully insulated, fully sealed, touchable structure;
- High-quality epoxy resin: dielectric strength 30–40 kV/mm, high heat resistance class (heat deflection temperature >110 °C), high mechanical strength, small curing shrinkage (1%–2%), no cracking and no aging embrittlement;
- Low partial discharge: partial discharge ≤ 10 pC at 1.1 times the rated phase voltage;
- Gas maintenance-free: no SF6 filling, monitoring, refilling or recovery links; routine maintenance only requires cleaning the enclosure, checking interlocks and tightening terminals.

Modular Structure

- Each functional unit consists of three parts: instrument compartment, operating mechanism and primary circuit, and can be used alone or expanded and combined with adjacent cubicles to either side;
- Compact unit width (typically 420–500 mm), overall enclosure height about 1700–2000 mm, small footprint;
- The main busbar adopts encapsulated insulated busbars connected through dedicated plug-in connectors, with no gas release or hot work required for expansion.

Operation and Interlock

- A dedicated spring operating mechanism integrated with the switch is adopted, with few transmission links and high reliability; it can be operated manually or fitted with an electric operating mechanism (AC 220 V / DC 220 V / DC 110 V / DC 48 V);
- The three-position switch (closed–open–earthed) adopts an over-center spring design, with distinct mechanical characteristics and clear indication;
- Complete mechanical interlocking realizes "five-prevention": preventing mis-opening and mis-closing of the circuit breaker, preventing pulling/inserting or opening/closing the disconnector under load, preventing earthing while energized, preventing closing while earthed, and preventing entry into energized compartments.

Intelligence and Monitoring

- The instrument compartment can be configured with a microcomputer protection device (intelligent controller), live-line indicator, current/voltage meters and sensors, with reserved distribution automation interfaces for remote metering, remote signaling, remote control and line-loss measurement;
- Passive/active protection (overcurrent, zero-sequence), fuse protection, section switch controller (watchdog) and automatic bus transfer functions can be configured.

Environmental Protection and Safety

- No SF6 emission throughout the entire life cycle, complying with national greenhouse gas emission reduction policies and the environmental procurement requirements of power grids;
- Fire-proof and explosion-proof design, with no risk of gas leakage explosion or internal arc escalation;
- The primary encapsulated part has a degree of protection up to IP67 and the enclosure IP4X, adaptable to condensation, polluted and high-humidity environments.

YVG-12 Solid-Insulated Ring Main Switchgear

Functional Unit Description

The YVG-12 is divided by main switch type into three main switch units — C, V and F — plus the switchless M metering unit and D riser unit, all of which can be freely combined and expanded to the left or right per the scheme.

4.1 C Unit — Load Break Switch Unit

The C unit uses a vacuum load break switch (three-position) as the main switch, integrating disconnector and earthing switch functions, and is used for making/breaking load current, ring-network closed-loop breaking and line isolation/earthing; it is the main unit for ring-network incoming/outgoing lines. Vacuum arc extinction and encapsulated poles allow frequent operation, with a manual or electric spring mechanism.

4.2 V Unit — Vacuum Circuit Breaker Unit

The V unit uses a vacuum circuit breaker as the main switch with a spring operating mechanism, and can break load current, overload current and short-circuit current; with microcomputer protection it realizes instantaneous overcurrent, overcurrent and zero-sequence protection functions. Its rated current covers 630 A to 1250 A, suitable for important circuits requiring relay protection, automatic switching or frequent operation (incoming lines, sectionalizing interconnection, large-capacity outgoing lines, etc.).

4.3 F Unit — Load Break Switch-Fuse Combination Unit

The F unit is a combination of a vacuum load break switch and current-limiting fuses (maximum fuse rated current 125 A). The fuse handles short-circuit breaking (breaking capacity 31.5 kA), while the load break switch handles load current operations and trips in coordination when a fuse blows (striker tripping), realizing complete three-phase isolation. It is suitable for protection circuits of 500–1600 kVA distribution transformers and is the classic configuration for transformer circuits in ring main units.

4.4 M Unit — Metering Unit

The M unit contains no main switch, only metering current transformers (class 0.2S), voltage transformers (10/0.1 kV) and meters, for electricity settlement or assessment metering.

Special note: the M unit itself has no breaking or earthing/isolation capability; its supply side must be provided with isolation and protection by a C unit or V unit, and must be configured in pairs in the scheme at ordering.

4.5 D Unit — Riser Unit

The D unit also has no main switch and no earthing switch; it contains encapsulated insulated busbars and connecting conductors, and is used for cable entry/exit, busbar rising (transferring from the cable level to the main busbar height) and busbar transition connection between multiple cubicle sections. Its width is the same as the standard module, making it the transition unit in cubicle assemblies.

4.6 Quick Reference for Unit Combination

Unit code	Name	Main switch	Typical application
C	Load break switch unit	Vacuum load break switch (three-position)	Ring-network incoming, outgoing, bus coupler sectionalizing
V	Vacuum circuit breaker unit	Vacuum circuit breaker	Incoming, large-capacity outgoing, sectionalizing interconnection, circuits requiring relay protection
F	Combination unit	Load break switch + current-limiting fuse	Distribution transformer circuit protection (≤125 A)
M	Metering unit	None	High-voltage supply high-voltage metering (must be used with C/V)
D	Riser unit	None	Cable entry, busbar riser and cubicle interconnection transition

YVG-12 Solid-Insulated Ring Main Switchgear

Main Technical Data

This chapter gives the detailed technical data of the complete unit and each unit, in 7 tables in total. The parameters in the tables are typical values commonly used in the industry; for formal ordering please refer to the manufacturer's catalogue and type-test report.

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current (main busbar)	A	630 / 1250
Rated short-time withstand current (4 s)	kA	20
Rated peak withstand current	kA	50
Rated short-circuit making current (peak)	kA	50
Rated insulation level: 1 min power-frequency withstand voltage (phase-to-phase, phase-to-earth / across isolating distance)	kV	42 / 48
Rated insulation level: lightning impulse withstand voltage (peak, phase-to-phase, phase-to-earth / across isolating distance)	kV	75 / 85
Partial discharge (1.1 times rated phase voltage)	pC	≤ 10
Main circuit resistance	μΩ	≤ 200
Degree of protection	—	Enclosure IP4X, primary encapsulated part IP67
Rated operating voltage	V	AC 220 / DC 220 (optional as needed)
Mechanical life	times	5000 ~ 10000 (per unit)
Enclosure structure	—	Unit assembly type, fully insulated and fully enclosed
Typical unit width	mm	400 ~ 500 (M metering unit appropriately widened)
Enclosure overall dimensions (W × D × H)	mm	Determined by combination scheme, typically 420×850×1700
Busbar material	—	T2 copper, encapsulated insulation coating
Cable connection	—	Touchable front-plug cable termination, bottom-in bottom-out
Operating mode	—	Manual / electric spring operating mechanism
Five-prevention interlock	—	Fully mechanical forced interlock
Insulating medium	—	Epoxy resin solid insulation (SF6-free)
Temperature rise limits	K	Per national standard (silver-plated busbar contact surfaces ≤ 65 K, etc.)
Installation altitude	m	≤ 3000 (no correction required)
Environmental characteristics	—	No SF6 greenhouse gas, gas maintenance-free

Table 2 C Unit (Load Break Switch) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current	A	630
Rated closed-loop breaking current	A	630
Rated cable charging breaking current	A	10 (up to 25 for some manufacturers)
Rated active load breaking current	A	630
Rated short-time withstand current (3 ~ 4 s)	kA	20
Rated peak withstand current	kA	50
Rated short-circuit making current (peak)	kA	50
1 min power-frequency withstand voltage (phase-to-phase, phase-to-earth / across isolating distance)	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Main circuit resistance	μΩ	≤ 200
Mechanical life	times	5000
Operating mechanism	—	Integrated spring mechanism (manual / electric)
Three-position function	—	Closed — open — earthed
Arc extinction method	—	Vacuum arc extinction, APG encapsulated pole
Typical unit width	mm	400 ~ 500

Table 3 V Unit (Vacuum Circuit Breaker) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current	A	630 / 1250
Rated short-circuit breaking current	kA	20 (25 / 31.5 optional)
Rated short-circuit making current (peak)	kA	50 (80 for the 31.5 kA rating)
Rated short-time withstand current (3 ~ 4 s)	kA	20 (25 / 31.5 optional)
Rated peak withstand current	kA	50 (80 for the 31.5 kA rating)
Rated operating sequence	—	O-0.3s-CO-3min-CO
Opening/closing time	ms	Opening ≤ 60 / closing ≤ 75 (typical)
1 min power-frequency withstand voltage (phase-to-phase, phase-to-earth / across isolating distance)	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Mechanical life	times	10000 (5000 ~ 20000 for some manufacturers)
Operating mechanism	—	Integrated spring mechanism (manual / electric)
Protection configuration	—	Microcomputer protection configurable (instantaneous overcurrent, overcurrent, zero-sequence)
Arc extinction method	—	Vacuum arc extinction, APG encapsulated pole
Contact material	—	Copper-chromium alloy, axial magnetic field contacts
Typical unit width	mm	400 ~ 500

Table 4 F Unit (Load Break Switch-Fuse Combination) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Load break switch rated current	A	630
Maximum fuse rated current	A	125 (selected per the connected transformer capacity)
Rated short-circuit breaking current (fuse)	kA	31.5
Rated transfer current	A	1700 ~ 1750 (typically 1750)
Rated short-circuit making current (peak)	kA	80
Rated cable charging breaking current	A	10
1 min power-frequency withstand voltage (phase-to-phase, phase-to-earth / across isolating distance)	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Main circuit resistance	μΩ	≤ 500
Mechanical life	times	3000 (load break switch)
Interlock function	—	Fuse striker tripping in coordination, complete three-phase isolation
Arc extinction method	—	Vacuum arc extinction, APG encapsulated pole
Applicable transformer capacity	kVA	500 ~ 1600 (selected per fuse)
Typical unit width	mm	400 ~ 500

Table 5 M Unit (Metering) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current (busbar)	A	630 / 1250
Main switch	—	None (no breaking or earthing capability)
Current transformer	—	Class 0.2S, ratio configured per metering requirements
Voltage transformer	—	(10/0.1) kV, class 0.2
Metering meter	—	Configured per power supply department requirements (remote transmission can be reserved)
1 min power-frequency withstand voltage	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Primary encapsulation	—	Busbar and transformer connection section epoxy resin encapsulated
Degree of protection	—	Primary encapsulated part IP67
Typical unit width	mm	750 ~800 (wider than standard module)
Configuration constraint	—	Must be used with a C/V unit, which provides isolation and protection

Table 6 D Unit (Riser) Main Technical Data

Item	Unit	Parameter value
Rated voltage	kV	12
Rated frequency	Hz	50
Rated current (busbar)	A	630 / 1250
Main switch	—	None
Earthing switch	—	None
Function	—	Cable entry, busbar riser, cubicle interconnection transition
1 min power-frequency withstand voltage	kV	42 / 48
Lightning impulse withstand voltage (peak)	kV	75 / 85
Primary encapsulation	—	Busbar epoxy resin encapsulation, dedicated plug-in connector
Degree of protection	—	Primary encapsulated part IP67
Typical unit width	mm	400 ~ 500
Typical unit weight	kg	about 130 ~ 160

Table 7 Standard Combination Schemes (Examples)

Scheme code	Combination	Application	Description
YVG-12C	C	Ring-network incoming / outgoing	Single-circuit load break switch cubicle
YVG-12C+C	C + C	One-in one-out	Double-circuit load break switch cubicle
YVG-12C+F	C + F	One-in one-transformer	Incoming + distribution transformer protection
YVG-12C+F+C	C + F + C	One-in one-out with distribution transformer	Common "two-in one-out + transformer" basic combination
YVG-12V	V	Circuit breaker incoming	Incoming circuit requiring relay protection
YVG-12V+C	V + C	Circuit breaker incoming + load outgoing	Protected mixed circuit
YVG-12V+V	V + V	Sectionalizing / interconnection	Busbar sectionalizing or dual-supply interconnection
YVG-12C+M+C	C + M + C	Incoming - metering - outgoing	High-voltage supply high-voltage metering scheme
YVG-12C+F+M	C + F + M	Incoming - distribution transformer - metering	Metering + transformer protection combination
YVG-12C+D	C + D	Incoming + cable riser	Cable transition scheme
YVG-12V+M+V	V + M + V	Interconnection - metering - interconnection	Metering sectionalizing scheme
YVG-12C+C+C+C	2C + 2F or 4C	Multi-circuit expansion	Left/right expansion to multiple circuits (400 ~ 500 mm per circuit)
YVG-12V+C+M+F	Mixed	Typical switching station	Customized per primary system diagram
As needed	Arbitrary combination	Customized	Configured per single-line diagram, protection requirements and cable routing

Selection Recommendations

Selection Logic (Five Steps)

Step 1: determine the number and function of circuits based on the primary system diagram (incoming/outgoing/distribution transformer/metering/interconnection);

Step 2: select the unit by circuit purpose — C for ordinary ring-network circuits; V where relay protection, automatic switching or high current (up to 1250 A) is needed; F for distribution transformer protection; M for trade metering; D for cable transition;

Step 3: check the short-circuit level — the system short-circuit capacity corresponds to the V unit breaking current rating (20/25/31.5 kA) and the 20 kA/4 s short-time withstand of the complete unit;

Step 4: select the F unit fuse rating (≤125 A) according to transformer capacity, and determine the M unit transformer ratio and accuracy class according to metering requirements;

Step 5: confirm the operating supply (manual/electric, AC/DC), protection configuration, cable specification and incoming/outgoing direction, then lock in the scheme.

Recommended Configurations for Typical Scenarios

Scenario	Recommended configuration	Key points
Urban ring-network ordinary switching station	C + C + C + C	Load break switch incoming/outgoing, manual or electric
Residential community distribution transformer circuit	C + F + C (M can be added)	F unit selects fuse per distribution transformer capacity
Incoming line requiring relay protection	V + C + …	V unit with microcomputer protection, current selected at 630/1250 A
Busbar sectionalizing / interconnection	V + V or C + C	Selected per protection and operation frequency
High-voltage supply high-voltage metering	C + M + C or V + M + V	M unit must have upstream isolation and protection
Dual-supply automatic transfer	V + V + automatic bus transfer	Equipped with automatic transfer and telecontrol interfaces
Plateau, humid, severe-cold environments	Whole series prefers solid insulation	No high-altitude correction required, IP67 primary part

Selection Tips

When used in situations involving frequent switching of unloaded long cables, please confirm with the manufacturer whether the C unit cable charging breaking current (10–25 A) meets the requirement;

The V unit breaking current and F unit transfer current are graded differently by different manufacturers; verify them against the system parameters before ordering;

The metering scheme must be confirmed in advance with the local power supply department for the transformer ratio, accuracy class and meter communication protocol.

Ordering Instructions

When ordering, the purchaser shall provide the manufacturer with the following information:

- Primary system wiring diagram (single-line diagram) and the unit configuration requirements of each circuit;
- Rated current of each circuit and system short-circuit parameters (short-circuit current/short-circuit capacity);
- Main busbar rated current (630 A or 1250 A) and busbar sectionalizing/interconnection requirements;
- Transformer capacity and fuse selection requirements for the F unit (indicate if the purchaser specifies a brand);
- Metering requirements for the M unit: transformer ratio, accuracy class, meter type and local power supply department specification requirements;
- Protection and automation requirements: microcomputer protection model, communication protocol, operating supply (AC/DC, voltage level), and whether an electric mechanism is equipped;
- Cable specification (cross-section, type), incoming/outgoing mode (bottom-in bottom-out or other) and cable termination requirements;
- Cubicle arrangement scheme (including the position of the D riser unit), enclosure color and special coating requirements;
- Delivery schedule, transport mode and on-site installation conditions (reserved openings, foundation dimensions).

Appendix: Parameter Notes

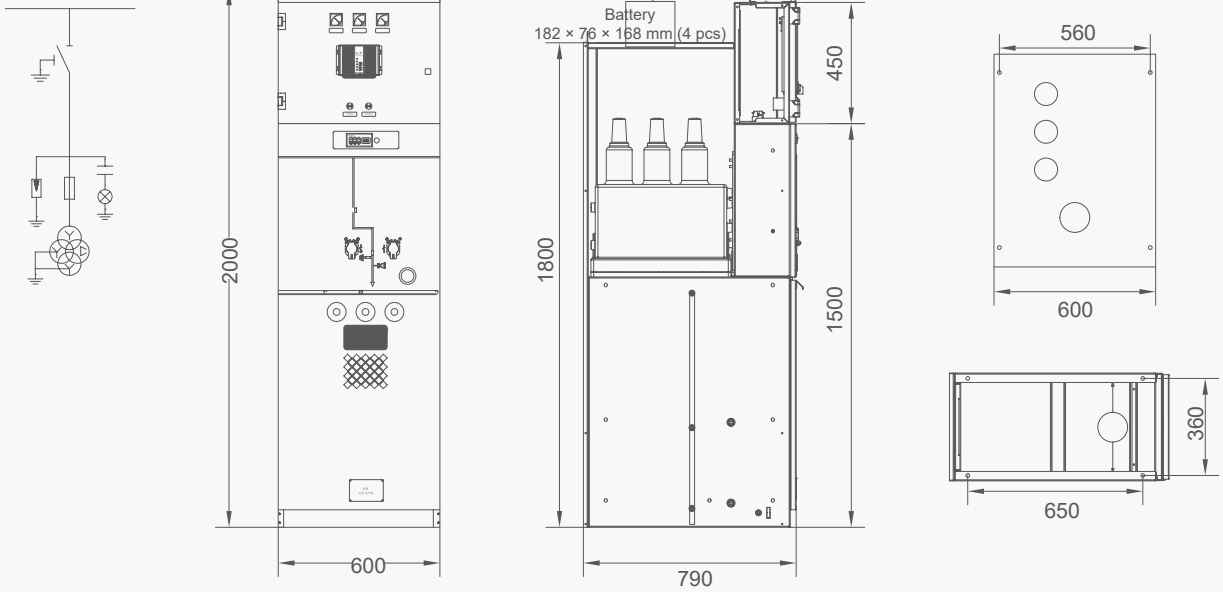
The parameters listed in this document are typical industry values for the YVG-12 solid-insulated ring main switchgear, compiled from public catalogues and standards such as Q/GDW 730. Different manufacturers differ in the following items: V unit rated short-circuit breaking current grading (20/25/31.5 kA), short-time withstand duration (3 s / 4 s), F unit rated transfer current (1700/1750/3150 A), cable charging breaking current (10/25 A), mechanical life and unit overall dimensions. For formal quotation and ordering, the manufacturer's latest catalogue, technical agreement and type-test report shall prevail.

This technical data is for selection reference only; the final interpretation is subject to the manufacturer's technical documents.

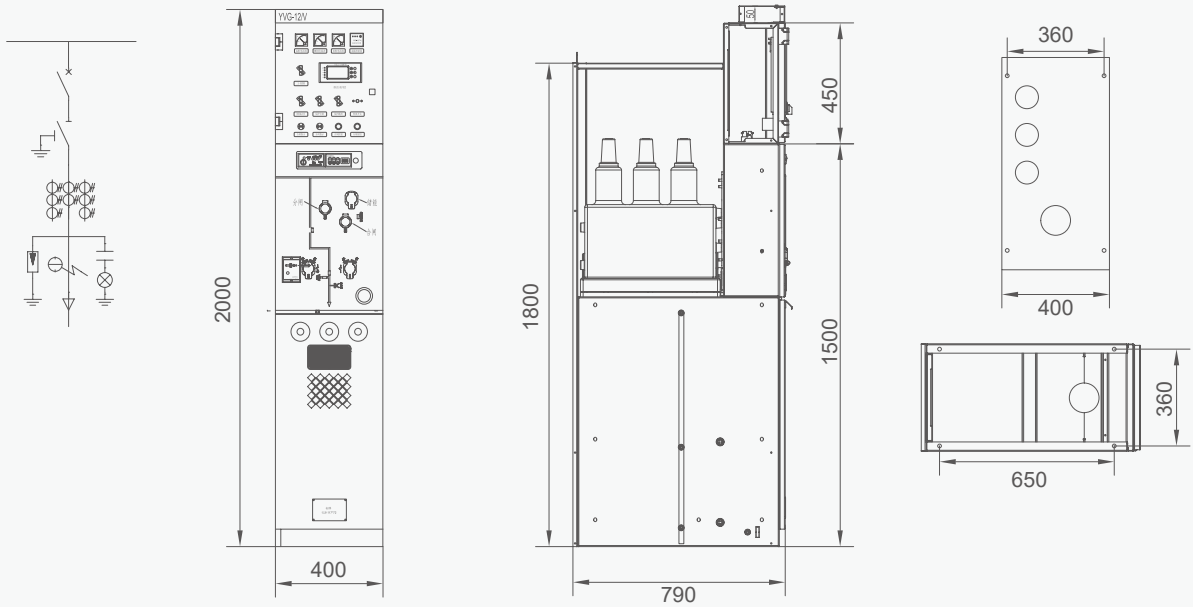
YVG-12 Solid-Insulated Ring Main Switchgear

Overall and mounting dimensions (mm)

Voltage Transformer (VT/PT) Unit

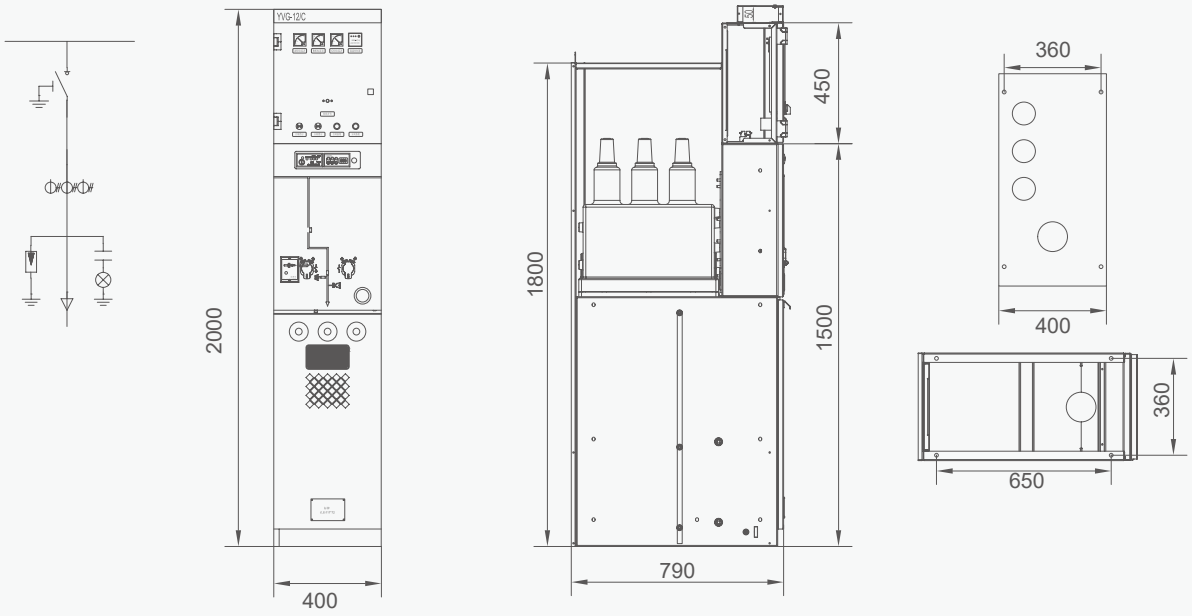


Circuit Breaker Unit (V Unit)



YVG-12 Solid-Insulated Ring Main Switchgear

Load Break Switch Unit (C Unit)



Medium Voltage Switchgear

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

- The KBS-12/24/40.5 outdoor switching station is a primary-secondary integrated, outdoor prefabricated complete switching device. Its design concept is to integrate the medium-voltage switchgear, secondary equipment and operating power supply, which would otherwise require a separate civil-work distribution room, into one high-protection outdoor enclosure through modular, compact design, achieving a prefabricated construction mode of “factory prefabrication, complete-unit transportation and on-site assembly”. The KBS-12/24/40.5 outdoor switching station (outdoor box-type switchgear) is oriented to urban distribution networks, industrial parks, residential districts, highway and railway lines and renewable-energy stations. It integrates medium-voltage switchgear, protection, measurement and control devices, metering devices, distribution automation terminals and DC operating power supply into an outdoor enclosure with rain-proof, dust-proof, anti-condensation and anti-corrosion capability. Assembly and commissioning are completed in the factory and the complete unit is transported to the site, where only foundation works and cable connection are needed before commissioning; compared with a traditional civil-work distribution room, the construction period is significantly shortened and the on-site work load reduced. The product covers three voltage classes of 12 kV / 24 kV / 40.5 kV, main busbar rated current from 630 A (up to 3150 A), and optional short-circuit breaking capacities of 20 / 25 / 31.5 kA.
- Five enclosure material options are available: cold-rolled steel sheet, aluzinc (aluminium-zinc coated) steel sheet, GRC (glass-fibre reinforced concrete), 201 stainless steel sheet and 304 stainless steel sheet, selected according to the environmental corrosion class and the whole-life-cycle cost; the enclosure protection degree is IP33D ~ IP54. The enclosure can accommodate seven types of high-voltage switchgear, including HXGN15-12, XGN15-12, YRM6 gas-insulated (C-GIS) cabinets, C-GIS-40.5 gas-insulated cabinets, YVG6 solid-insulated cabinets, YHB eco-gas-insulated cabinets and KYN28-12, and can be equipped with secondary equipment such as DTU distribution automation terminals, FTUs, communication terminals, GZDW microcomputer-controlled DC power supply panels, UPS, dehumidifying heaters and temperature control devices, meeting the “four-remote” (telemetry, telesignal, telecontrol, teleadjust) and remote O&M requirements of distribution network automation.

General





KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Core Indicators at a Glance

Item	Value
Voltage class	12 kV / 24 kV / 40.5 kV
Main busbar rated current	630 A (12/24 kV) / 630 ~ 3150 A (40.5 kV)
Rated short-circuit breaking current	20 kA / 25 kA / 31.5 kA
Enclosure protection degree	IP33D ~ IP54
Enclosure material	Cold-rolled steel / aluzinc sheet / GRC / 201 stainless steel / 304 stainless steel
Built-in HV cabinet types	HXGN15-12 / XGN15-12 / YRM6 / C-GIS-40.5 / YVG6 / YHB / KYN28-12
Equipped secondary equipment	DTU / FTU / GZDW DC panel / UPS / communication terminal

In the distribution network the product performs the following roles: receiving and distributing electric energy; controlling, protecting and monitoring the supply lines; realizing ring-main supply and fault isolation; and serving as a field execution terminal and data acquisition node of the distribution automation system. The three basic features of the product are as follows:

Outdoor type - the enclosure is rain-proof, dust-proof, anti-condensation, anti-corrosion and prevents small animal intrusion, and can operate outdoors in the open for a long time;

Integration - primary HV switchgear, secondary protection/measurement & control, metering, communication and DC power supply are arranged integrally inside the enclosure; wiring and joint commissioning are completed in the factory, reducing on-site work and wiring errors;

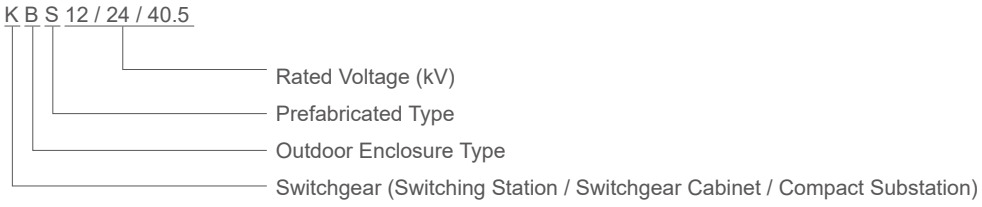
Modularization - incoming/outgoing units, bus-tie unit, metering unit and PT unit can be combined freely, supporting later expansion, reducing initial investment and outage time.

Scope of Application

This product is suitable for the following applications:

- Ring-main supply nodes, switching stations and distribution stations of urban distribution networks;
- Power supply access points for residential districts, commercial complexes and office buildings;
- Power distribution and control centers of industrial parks, factories and mines, and oilfields;
- Auxiliary power supply for airports, schools, hospitals, metro lines and municipal works;
- Distribution points along highways and railways and in remote areas;
- Collection and export nodes of renewable-energy stations (PV and wind power);
- Distribution facilities in coastal, high-altitude, humid, dusty and salt-fog environments.

Type Designation



KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Applicable Standards

This product is designed, manufactured and tested in accordance with the following national standards, industry standards and international standards.

Standard No.	Standard title
GB 17467	High-voltage/low-voltage prefabricated substation
GB/T 3906	3.6 kV ~ 40.5 kV AC metal-enclosed switchgear and controlgear
GB/T 11022	Common specifications for high-voltage switchgear and controlgear standards
GB/T 4208	Degrees of protection provided by enclosure (IP Code)
GB/T 1985	High-voltage AC disconnectors and earthing switches
GB/T 1984	High-voltage AC circuit breakers
DL/T 537	Selection guide for HV/LV prefabricated substations
DL/T 404	3.6 kV ~ 40.5 kV AC metal-enclosed switchgear and controlgear
IEC 62271-200	AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV up to 52 kV
IEC 62271-202	High-voltage/low-voltage prefabricated substation
Q/GDW 730	Technical requirements for 12 kV ring main units
Q/GDW 13088.16	Technical specification for distribution automation terminals

Special notes on environmental conditions:

High altitude - when the altitude exceeds 1000 m the air insulation strength decreases; insulation correction shall be made according to the standards, or cabinet types using solid insulation or gas insulation (YVG6 / YRM6 / YHB / C-GIS) shall be selected to reduce the altitude effect.

Low temperature - when the ambient temperature is below -25 °C, heating and temperature control devices shall be provided inside the enclosure, and the minimum operating temperature of the circuit breaker operating mechanism and secondary components shall be verified.

Coastal salt fog - 304 stainless steel or GRC enclosures are recommended; fasteners, hinges and locks shall also be of stainless steel; cable entry/exit holes shall be sealed, and the enclosure coating shall withstand salt fog for ≥1000 h.

Low-lying waterlogged areas - raise the enclosure foundation by ≥200 mm (300 mm recommended); select an IP65 reinforced enclosure if necessary and provide bottom drainage.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Outdoor Enclosure Structure and Technical Features

The enclosure is the core component that distinguishes the outdoor switching station from indoor switchgear; its structural strength, sealing performance, anti-corrosion capability and thermal performance jointly determine the service life and operational reliability of the complete unit. This chapter describes the overall enclosure structure, comparison and selection of the five materials, sealing and protection design, ventilation, heat dissipation and temperature control schemes, and safety and user-friendly design.

Overall Structure

The enclosure consists of a base, frame, door panels, wall panels and roof. The base, frame, doors, walls and roof are connected with a labyrinth-panel structure forming a tortuous sealing channel, achieving water-proofing, dust-proofing and prevention of small animal intrusion and ensuring reliable operation of the internal electrical equipment.

The enclosure interior is divided into the following zones:

- HV switchgear room - accommodates the high-voltage switchgear installed in the enclosure (RMU, gas-insulated cabinet, solid-insulated cabinet or withdrawable cabinet);
- Operating corridor - the operating and maintenance aisle in front of the cabinets; its width shall meet the safety clearance and O&M requirements;
- Secondary equipment room (secondary panel positions) - accommodates the DTU, protection, measurement and control devices, communication equipment, metering instruments, etc.;
- DC power supply room (panel position) - accommodates the GZDW DC power supply panel, battery bank or wall-mounted power supply;
- Cable room (cable trench / cable interlayer) - cable entry, fixing, sealing and earthing copper bar installation.

The enclosure generally has front and rear double doors with an opening angle ≥90° (≥120° for some products) and positioning devices; doors are fitted with handles and concealed locks, and are rain-proof, rust-proof and jam-proof. All doors inside the enclosure are provided with lighting that switches on/off automatically with the door. The enclosure is provided with lifting points, reinforced hinges and anti-theft door locks for easy hoisting, installation and routine maintenance.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Enclosure Materials and Selection Comparison

Five enclosure material options are available. The materials differ significantly in corrosion resistance, fire performance, thermal insulation and anti-condensation capability, service life and investment cost; selection shall be based on the corrosion class of the installation environment and the whole-life-cycle cost of the project.

Table 3-1 Enclosure material and selection comparison

Item	Cold-rolled steel sheet (powder coated)	Aluzinc sheet	GRC (glass-fibre reinforced concrete)	201 stainless steel sheet	304 stainless steel sheet
Common sheet thickness	2.0 ~ 3.0 mm	1.5 ~ 2.5 mm	Monolithic casting, wall thickness 10 ~ 25 mm	2.0 ~ 2.5 mm	2.0 ~ 2.5 mm
Surface treatment	Rust removal + powder coating / hot-dip galvanizing	Aluzinc coating self-anti-corrosive, self-healing cut edges	Inorganic body anti-corrosion, paintable surface	Brushed / powder coated	Brushed / powder coated / passivated
Corrosion resistance	Fair	Good	Good	Good	Excellent
Mechanical strength	Good	Good	High (impact- and bending-resistant)	Good	Good
Fire resistance	Non-combustible	Non-combustible	Class A non-combustible, non-flame-spreading, non-toxic fumes	Non-combustible	Non-combustible
Thermal insulation & anti-condensation	Poor	Poor	Excellent (light- and heat-blocking; no condensation under sudden temperature changes)	Poor	Poor
Salt-fog resistance	≤500 h	≥500 h	Excellent (acid/alkali and salt resistant)	Fair; not recommended for seaside	≥1000 h
Estimated service life	10 ~ 15 years	20 ~ 25 years	40 ~ 50 years	15 ~ 20 years	25 ~ 30 years
Appearance	Fair	Fair	Excellent (rich variety of shapes and patterns)	Good	Good
Anti-sticker surface	Poor	Poor	Excellent (special surface design)	Good	Good
Weight	Relatively heavy	Relatively light	Relatively heavy (about 1/5 of concrete of the same thickness)	Relatively heavy	Relatively heavy
Relative cost	Low	Medium	Medium-high	Medium	High
Recommended applications	Inland conventional environments, budget-sensitive projects	Inland humid areas, general industrial zones	Urban landscape areas, coastal areas, occasions requiring long maintenance-free life	Inland humid environments	Coastal, chemical, high-humidity and strongly corrosive environments

Material selection recommendations:

1. Inland conventional environment, budget priority - cold-rolled steel sheet with powder coating, sheet thickness ≥2.0 mm, with primer + topcoat double anti-corrosion treatment;
2. Inland humid areas, general industrial zones - aluzinc sheet: good workability, corrosion resistance superior to ordinary galvanized sheet, high cost-effectiveness;
3. Urban roads, landscape areas, renovation of old residential districts - GRC enclosure: appearance harmonized with the surroundings, Class A non-combustible, thermal insulation and anti-condensation, especially suitable for applications with requirements on cityscape and fire protection;
4. Coastal areas, islands, chemical zones - 304 stainless steel sheet, salt-fog test ≥1000 h, with stainless steel fasteners and exposed hardware;
5. 201 stainless steel is suitable for inland humid environments with relatively high cost-effectiveness, but is not recommended for coastal environments with severe salt fog.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Sealing and Protection Design

- Rain eaves and sloped-roof drainage - the roof is of double-layer structure with rain eaves and a sloped drainage gradient to avoid water accumulation and leakage; the double-layer roof also reduces the temperature rise inside the enclosure caused by solar radiation;
- Double-door structure - the outer door is rain-proof and the inner door carries the components; the water-proofing is better than that of a single door; the door frame is fitted with a full-length waterproof sealing strip;
- Cable entry/exit sealing - dedicated bottom entry holes are provided with waterproof glands or sealing rings; cable terminations use the bushing type (with T-type / elbow-type plug-in cable connectors) or the bushing-base type (crimp type), with emphasis on the reliability of the electric field distribution and the silicone rubber sealing ring;
- Breathing and dehumidification - the enclosure is equipped with a dehumidifying heater and thermostat to prevent condensation-induced flashover of insulating parts; a ventilation fan can be added to form a "bottom-in, top-out" natural convection heat dissipation channel;
- Earthing and electric-shock protection - the enclosure is provided with reliable earthing terminals with earthing resistance less than 4 Ω; live parts are fully isolated from the metal enclosure, and the cable room is provided with an earthing copper bar; electrical interlocking between the enclosure doors and the internal main switch prevents maloperation when the door is open.

Ventilation, Heat Dissipation and Temperature Control

The enclosure temperature rises markedly under direct summer sunlight; this product adopts the following measures to control the temperature inside the enclosure:

1. Double-layer roof structure + thermal insulation layer to block solar radiant heat conduction;
2. Natural convection channel with air intake at the bottom and outlet at the top ("bottom-in, top-out");
3. Thermostat + axial fan (optional) inside the enclosure; forced ventilation starts automatically when the temperature exceeds the set value;
4. Dehumidifying heater inside the enclosure, put into operation automatically when the humidity exceeds the set value to prevent condensation.

Safety and User-Friendly Design

- Lighting inside the enclosure (switching automatically with the doors), emergency lighting and maintenance sockets;
- Live-line indicator, earthing switch and anti-maloperation interlock to ensure maintenance safety;
- Temperature and humidity controller, smoke / water-flooding alarm (optional), connected to the DTU and uploaded to the master station;
- Door locks are rain-proof, rust-proof and jam-proof; dedicated metering locks and access control (optional) can be added to important cabinet doors.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

High-Voltage Switchgear Configuration inside the Enclosure

The HV switchgear inside the enclosure is the core primary unit of the outdoor switching station. According to the distribution scheme, protection requirements, environmental conditions and investment budget, the following seven types of high-voltage switchgear can be installed. This chapter describes the technical features, insulation mode and typical applications of each cabinet type, and provides an adaptation comparison table at the end.

Table 4-1 HV switchgear that can be installed in the enclosure

Cabinet type	Insulation mode	Main switch	Applicable voltage	Typical application
HXGN15-12	Air insulation + SF6 load break switch	SF6 LBS / LBS-fuse combination	12 kV	Ring-main incoming/outgoing, distribution transformer protection
XGN15-12	Air insulation + SF6 load break switch	SF6 LBS / vacuum circuit breaker	12 / 24 kV	Ring-main incoming/outgoing, small switching stations
YRM6 series	SF6 gas insulation (gas-filled cabinet)	LBS / vacuum circuit breaker / combination	12 / 24 / 40.5 kV	Fully insulated & enclosed; ring mains and switching stations
C-GIS-40.5	SF6 gas insulation (C-GIS)	Three-position disconnector + vacuum circuit breaker	40.5 kV	Large-current (1250/2500/3150 A) switching stations
YVG6	Solid insulation (APG epoxy-embedded)	LBS / vacuum circuit breaker	12 kV	High altitude, humid, severe cold, strict environmental requirements
YHB	Eco-gas insulation (dry air / pure nitrogen)	Three-position disconnector + vacuum circuit breaker	12 kV	SF6-free requirement, distribution automation retrofit
KYN28-12	Air insulation (armoured withdrawable)	Vacuum circuit breaker (withdrawable)	12 kV	Main switch for station incoming/outgoing, with relay protection

HXGN15-12 Box-Type Fixed Ring Main Unit

Air-insulated metal-enclosed box-type structure with an SF6 load-break switch or a switch-fuse combination as the main switch, which is fixedly installed in the cabinet. The cabinet is generally divided into an upper and a lower part: the upper part contains the busbar room, switch room and LV room, and the lower part is the cable room (outgoing cabinets contain fuses); the separation avoids mutual influence.

The cabinet is assembled from multi-bend aluzinc sheets with bolts, providing high mechanical strength; cabinet doors are powder-coated, impact-resistant and corrosion-resistant. Enclosure protection degree IP4X, compartments IP2X. Simple and effective "five-prevention" interlocking is provided. A switch-fuse combination can be used for distribution transformer protection; simple in structure and economical, it is one of the most commonly used built-in cabinet types in outdoor switch boxes.

XGN15-12 Box-Type Fixed Ring Main Unit

Similar in structure to the HXGN15-12, this is a new-generation air-insulated metal-enclosed switchgear with an SF6 load-break switch or vacuum circuit breaker. The body is divided into busbar room, switch room, cable room and LV room (relay room); heaters and lighting can be added in each room on request to prevent condensation and corrosion.

The cabinet can be equipped with a load-break switch for ring-main supply or a vacuum circuit breaker (e.g. VS1) for circuits requiring protection coordination. Highly versatile, it covers both 12 kV and 24 kV and is one of the most flexible built-in cabinet types for outdoor switching stations.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

YRM6 Series SF6 Gas-Insulated Switchgear (C-GIS)

Fully insulated and fully sealed SF6 gas-insulated switchgear; all live parts are completely sealed in a 3 mm stainless steel gas tank, and multiple feeder switches can be installed in the same tank, making the switchgear immune to environmental influence and truly maintenance-free and reliable.

Functional units are identified by letters: C (load-break switch), V (vacuum circuit breaker), F (switch-fuse combination), M (metering unit), D (riser unit), PT (three-position disconnector + voltage transformer); up to 3 units share one tank. Widely used in mines, coastal areas, high mountains and plateaus, airports, hotels, schools, metro and municipal applications. The single-module width is about 325 mm at 12 kV, about 400 mm at 24 kV, and the 40.5 kV unit is about 500 mm wide; it is the mainstream built-in cabinet type for outdoor switching stations and ring-main boxes.

C-GIS-40.5 Gas-Insulated Metal-Enclosed Switchgear

A cabinet-type gas-insulated switchgear for the 40.5 kV voltage class, adopting a three-position disconnector + vacuum circuit breaker "disconnection + breaking" configuration, rated current covering 1250 A / 2500 A / 3150 A and short-circuit breaking capacity 31.5 kA. A 3 mm stainless steel gas tank with double gas chambers is used, with complete five-prevention interlocking and internal arc protection (IAC). Suitable for large-capacity switching stations, substation incoming/outgoing bays and general power distribution of industrial and mining enterprises where high-current breaking capability is required.

YVG6 Solid-Insulated Ring Main Unit

The APG (automatic pressure gelation) epoxy process encapsulates the conductive circuit in epoxy resin; the main insulation is solid dielectric containing no SF6 gas - no leakage, no gas refilling, no recovery and no greenhouse gas emission. The three-position switch integrates closing, disconnection and earthing; the primary part reaches IP67. Especially suitable for plateau, humid, severe-cold and dusty environments, and no insulation correction is needed at altitudes up to 3000 m.

YHB Eco-Gas-Insulated Ring Main Unit

Dry air or pure nitrogen is used instead of SF6 as the insulating medium, with a filling pressure of only 0.02 ~ 0.03 MPa (slight overpressure); the switchgear still meets the insulation level and operates normally even at zero gauge pressure, with a low annual leakage rate and absolutely no SF6, meeting green low-carbon and distribution network standardization requirements. Configured with V vacuum circuit breaker units, PT units (three-position disconnector + voltage transformer), M metering units and D riser units, it is suitable for switching stations with explicit environmental protection requirements or a high level of distribution automation.

KYN28-12 Armoured Withdrawable Metal-Enclosed Switchgear

Air-insulated, armoured, withdrawable (truck-type) switchgear with a vacuum circuit breaker truck and microprocessor-based comprehensive protection, providing complete protection functions (e.g. 50/51/50N/51N two-stage four-element overcurrent protection, auto-reclosing, under-frequency load shedding, etc.); cabinet protection degree IP4X. Suitable for incoming/outgoing circuits in switching stations that require protection coordination, higher rated current (630 ~ 3150 A) or frequent operation.

Dimension note: the KYN28-12 cabinet is relatively large (typically of the 800 × 1500 × 2300 mm class) and imposes high requirements on enclosure height and operating corridor width; when selecting, verify the enclosure clear space and transport dimensions.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Secondary and Auxiliary Equipment

As an important node of distribution automation, the outdoor switching station can accommodate the following equipment at the secondary panel positions and DC power supply panel positions inside the enclosure, realizing data acquisition, remote control, DC operating power supply and environmental assurance. This chapter describes the configuration essentials of the DTU distribution automation terminal and the GZDW micro-computer-controlled DC power supply panel, and summarizes other frequently equipped auxiliary equipment.

DTU Distribution Automation Terminal

The DTU (Distribution Terminal Unit) realizes data acquisition, fault detection and location, and remote control of the primary equipment inside the enclosure, and interconnects with the distribution network master station (SCADA / DMS) through communication channels; it is the field execution unit of the "four-remote" functions. Main functions include:

- Data acquisition - voltage, current, power, switch status, ambient temperature and humidity;
- Fault detection and location - rapid identification and display of fault sections, coordinating isolation and power restoration;
- Remote control - supports remote opening/closing;
- Protection - phase-to-phase short-circuit and single-phase-to-earth fault monitoring; three-stage three-phase overcurrent + two-stage zero-sequence overcurrent + auto-reclosing + post-acceleration;
- Fault recording - 6.4 kHz sampling, 1128 points/cycle, Comtrade 1999 standard format;
- Information security - dedicated security chip hardware encryption, X.509 standard SM2 digital certificates;
- Multiple communication modes - RS485, Ethernet, optical fibre, 4G/5G, compatible with SCADA / DMS systems.

For technical parameters see Section 6.5, Table 6-5.

GZDW Microcomputer-Controlled DC Power Supply Panel

It provides a reliable and uninterrupted DC operating power supply for circuit breaker operating mechanisms, protection, measurement and control devices, and communication equipment inside the enclosure. A high-frequency switching charging module + maintenance-free lead-acid battery (or wall-mounted power supply) scheme is adopted; the monitoring unit realizes automatic conversion between equalizing charge and float charge and charges the battery according to the charging curve, avoiding overcharge and undercharge and extending battery life.

The system accepts single-phase 220 V or three-phase four-wire 380 V AC input and outputs DC 110 V or DC 220 V; for small-capacity systems (≤40 Ah) an integrated charger/distribution cabinet can be used to save space inside the enclosure; for larger systems, a split arrangement of charging cabinet + distribution cabinet + battery cabinet is used. For technical parameters see Section 6.6, Table 6-6.

Other Auxiliary Equipment

Table 5-1 Other auxiliary equipment configuration

Equipment	Function	Configuration notes
FTU feeder terminal unit	Feeder data acquisition and control	For pole-mounted switches or feeder section points, coordinated with the DTU
Communication terminal / industrial switch	Field data aggregation and uploading	Ethernet, optical fiber and 4G/5G wireless communication
UPS (uninterruptible power supply)	Short-term backup supply for secondary equipment	Can be combined with the GZDW DC system
Dehumidifying heater + thermostat	Anti-condensation, anti-freezing	Power selected by enclosure volume and region
Axial fan + thermostat	Forced ventilation and cooling	Recommended for high-temperature regions
Temperature & humidity monitoring	Environmental monitoring inside the enclosure	Data can be fed to the DTU and uploaded to the master station
Smoke / water-intrusion alarm	Safety early warning	Recommended for unattended stations
Intelligent access control / access lock	Unauthorized-entry prevention, operation logging	Door-opening events uploaded when linked to the master station
Metering instruments	Electric energy metering	Per the metering scheme; independent metering cabinet possible
Lighting and maintenance sockets	For O&M work	On/off automatically with the doors; with emergency lighting

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Main Technical Data

This chapter summarizes all main technical parameters of the KBS series outdoor switching station, including three-voltage-class comparison parameters of the complete unit, enclosure technical parameters, quantified enclosure material indicators, built-in cabinet adaptation parameters, and technical parameters of the DTU and GZDW DC panel. All parameters are typical industry values; for formal ordering, the manufacturer's samples and type test reports shall prevail.

Table 6-1 Complete-unit main technical data (three voltage classes)

Item	Unit	KBS-12	KBS-24	KBS-40.5
Rated voltage	kV	12	24	40.5
Maximum working voltage	kV	12	24	40.5
Rated frequency	Hz	50	50	50
Main busbar rated current	A	630 (1250 optional)	630 (1250 optional)	630 ~ 3150
Rated short-circuit breaking current	kA	20 / 25	20 / 25	20 / 25 / 31.5
Rated short-time withstand current (main circuit)	kA	20	20	20 ~ 31.5
Rated short-time withstand current (earthing circuit)	kA	20	20	20 ~ 31.5
Rated duration of short-time withstand	s	4	4	4
Rated peak withstand current	kA	50	50	50 ~ 80
Rated short-circuit making current	kA	50	50	50 ~ 80
Rated power-frequency withstand voltage (phase-to-phase / to earth)	kV	42	65	95
Rated power-frequency withstand voltage (across open contacts)	kV	48	79	118
Rated lightning impulse withstand voltage (phase-to-phase / to earth)	kV	75	125	185
Rated lightning impulse withstand voltage (across open contacts)	kV	85	145	215
Partial discharge level	pC	≤20	≤20	≤20
Internal arc (IAC)	—	20 kA / 0.5 s	20 kA / 0.5 s	20 ~ 31.5 kA / 1 s
Protection degree (enclosure)	—	IP33D ~ IP54	IP33D ~ IP54	IP33D ~ IP54
HV cabinet protection degree	—	IP4X (compartments IP2X)	IP4X (compartments IP2X)	IP4X / gas tank IP67
Earthing resistance	Ω	<4	<4	<4
Auxiliary power supply	V	AC/DC 220 or 110	AC/DC 220 or 110	AC/DC 220 or 110
Secondary circuit power-frequency withstand voltage	kV	2	2	2
Design service life	years	≥20	≥20	≥20

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Table 6-2 Enclosure technical parameters

Item	Technical requirement
Enclosure structure	Base + frame + wall panels + roof; labyrinth-plate lap sealing
Frame material	Welded channel/angle steel or profiles, or bolted assembly (mechanical strength meeting hoisting and transport requirements)
Roof	Double-layer structure with rain eave and sloped drainage; heat-radiation resistant
Door structure	Front/rear double doors, opening angle ≥90° (≥120° optional), with position limiters and sealing strips
Protection degree	IP33D / IP43 / IP54 (IP65 optional)
Ventilation mode	Natural convection (bottom-in, top-out); forced ventilation optional (axial fan + thermostat)
Anti-condensation measures	Dehumidifying heater + temperature & humidity controller
Lighting	On/off automatically with the doors; emergency lighting and maintenance sockets optional
Earthing	Enclosure earthing terminal + earthing copper bar in cable room; earthing resistance <4 Ω
Cable entry/exit mode	Mainly bottom entry/exit (bottom-in, bottom-out), side entry optional; waterproof cable glands or sealing rings
Surface treatment	Metal enclosure: rust removal + primer + topcoat (or hot-dip galvanizing + powder coating); GRC: surface coating
Hardware	Hinges, locks and fasteners in stainless steel or hot-dip galvanized
Anti-corrosion requirement	Salt fog ≥500 h in general areas; ≥1000 h in coastal / chemical zones
Hoisting and transport	Lifting points provided; complete-unit transport with transport fixing devices

Table 6-3 Key technical indicators of enclosure materials

Material	Sheet/wall thickness	Corrosion resistance	Fire rating	Salt-fog resistance	Estimated life	Relative cost
Cold-rolled steel sheet (powder coated)	2.0 ~ 3.0 mm	Fair	Non-combustible	≤500 h	10 ~ 15 years	Low
Aluzinc sheet	1.5 ~ 2.5 mm	Good	Non-combustible	≥500 h	20 ~ 25 years	Medium
GRC	10 ~ 25 mm	Good	Class A non-combustible	Excellent	40 ~ 50 years	Medium-high
201 stainless steel sheet	2.0 ~ 2.5 mm	Good	Non-combustible	Fair	15 ~ 20 years	Medium
304 stainless steel sheet	2.0 ~ 2.5 mm	Excellent	Non-combustible	≥1000 h	25 ~ 30 years	High

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Table 6-4 Adaptation table of built-in cabinet types

Cabinet type	Insulation mode	Applicable voltage	Typical cabinet reference dimensions (W × D × H, mm)	Remarks
HXGN15-12	Air + SF6 load break switch	12 kV	375 / 500 × 960 × 1885	Compact, economical
XGN15-12	Air + SF6 LBS / circuit breaker	12 / 24 kV	500 ~ 800 × 960 ~ 1200 × 1885 ~ 2000	Fairly versatile
YRM6 series	SF6, fully insulated and fully enclosed	12 / 24 / 40.5 kV	12 kV: 325 mm/module; 24 kV: 400 mm/module; 40.5 kV: 500 mm/module	Up to 3 units sharing one tank
C-GIS-40.5	SF6 gas insulation	40.5 kV	800 × 1600 × 2400 (unit bay)	Large current 1250 ~ 3150 A
YVG6	Solid insulation (APG-embedded)	12 kV	400 ~ 500 × 900 ~ 1000 × 1600 ~ 1800	High altitude, eco-friendly
YHB	Eco-gas (dry air / nitrogen)	12 kV	420 ~ 600 × 900 ~ 1000 × 1600 ~ 1800	SF6-free
KYN28-12	Air-insulated armoured withdrawable	12 kV	800 × 1500 × 2300	Withdrawable; wider aisle required

Table 6-5 DTU distribution automation terminal technical data

Item	Technical parameters
Working power supply	AC/DC 220 V or AC/DC 110 V + backup power supply
Digital input channels	Up to 105
AC analog input channels	Up to 56
DC analog input channels	2
Digital output channels	Up to 34
Number of lines / switches monitored	16
Communication interface(s)	2 Ethernet + 4 RS232/RS485
Communication protocols	DL/T 634.5101 , DL/T 634.5104 , Modbus , DNP3.0
Relay protection functions	Phase-to-phase short-circuit and single-phase earthing fault monitoring; three-stage three-phase overcurrent + two-stage residual overcurrent, auto-reclosing, post-acceleration
Fault recording	Sampling frequency 6.4 kHz, 1128 points/cycle, configurable number of cycles, Comtrade 1999 standard format
Historical data storage	Event sequence records, telecontrol operation records, load curves, fixed-time and extreme-value records, fault records
Information security	Dedicated security chip hardware encryption; X.509 standard SM2 digital certificate
Analog measurement accuracy	Voltage & current 0.5%, others 1%
Telesignal resolution	2 ms
Communication modes	Ethernet, optical fiber, RS485, 4G/5G wireless
Mounting	Panel-mounted at the secondary panel position or wall-mounted in the enclosure

Table 6-6 GZDW microcomputer-controlled DC power supply panel technical data

Item	GZDW1 (small capacity)	GZDW2 (small-medium capacity)
System configuration	Single-phase	Three-phase four-wire
AC input voltage	220 VAC ±15%	380 VAC ±15%
AC input frequency	45 ~ 55 Hz	45 ~ 55 Hz
Battery rated capacity	17 ~ 40 Ah	40 ~ 100 Ah
DC rated voltage	110 VDC / 220 VDC	110 VDC / 220 VDC
DC rated current	5 A	10 ~ 20 A
Float charge voltage	99 ~ 130 VDC / 198 ~ 260 VDC	99 ~ 130 VDC / 198 ~ 260 VDC
Equalized charge voltage	110 ~ 143 VDC / 220 ~ 286 VDC	110 ~ 143 VDC / 220 ~ 286 VDC
Ripple factor	≤±0.5%	≤±0.5%
Voltage stabilization accuracy	≤±0.5%	≤±0.5%
Current stabilization accuracy	≤±0.5%	≤±0.5%
Current sharing imbalance	≤±5%	≤±5%
System efficiency	≥90%	≥90%
Power factor	≥0.92	≥0.92
Communication interface(s)	RS485	RS485
Protection degree	Not lower than IP30	Not lower than IP30
Structure	Integrated charging/feeding cabinet possible for capacity ≤40 Ah	Split: charging cabinet + feeding cabinet + battery cabinet
Panel reference dimensions (H × W × D)	2260 × 800 × 600 mm	2360 × 800 × 550 mm

Note: DC panel dimensions are given for standard panels; when installed in an outdoor enclosure, customized low-profile panels or wall-mounted power supplies can be used, subject to the clear space of the panel positions inside the enclosure.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Overall Dimensions and Internal Layout

The enclosure dimensions of the outdoor switching station are not fixed values but are jointly determined by the matched HV cabinet type, the number of units, the operating corridor width and the secondary panel positions. This chapter provides reference dimensions for common combinations, internal layout principles, and foundation and installation requirements.

Enclosure Overall Dimensions

Key points for dimension determination (to be confirmed before ordering): ① model, number of units and unit width of the built-in HV cabinets; ② operating corridor width (shall meet safety clearance and door opening angle requirements); ③ number and dimensions of secondary panel positions (DTU, communication, metering) and DC power supply panel positions; ④ cable entry/exit mode (bottom-in bottom-out / side entry) and the number and cross-section of cables; ⑤ transport gauge (road height and width limits) and hoisting conditions; ⑥ foundation type and enclosure height above ground (foundation ≥200 mm above ground recommended).

Internal Layout Principles

- Separation of power and control circuits - the HV switchgear room, secondary equipment room and DC power supply room are arranged in separate zones to reduce electromagnetic interference;
- Operating corridor in the centre - the front operating faces of cabinets face the operating corridor, and sufficient space is reserved behind the cabinets for maintenance;
- DC power supply in close proximity - the GZDW DC panel and batteries are located close to the secondary equipment room to shorten DC feeder lengths;
- Layered cable routing - power and secondary cables are routed in separate layers; the cable room is provided with fixing supports and an earthing copper bar;
- Unobstructed ventilation path - air inlets and outlets are not blocked by cabinets, ensuring "bottom-in, top-out" natural convection;
- Space reserved for expansion - configured for the near-term scale with cabinet positions and busbar extension space reserved for future capacity increase.

Foundation and Installation Requirements

1. The foundation is made of precast or cast-in-place reinforced concrete, with the top surface ≥200 mm above ground (≥300 mm recommended in low-lying areas);
2. The foundation shall provide cable entry/exit holes and a drainage gradient, with waterproof sealing around the holes;
3. After hoisting and positioning, the enclosure shall be levelled, with vertical inclination not exceeding 5‰;
4. The enclosure earthing terminal shall be reliably connected to the earth grid, with earthing resistance <4 Ω;
5. Outdoor installation shall avoid locations with strong direct sunlight and water accumulation; sunshade and rain covers shall be added if necessary;
6. Power may be switched on only after cable connection, secondary circuit wiring and interlocking tests are completed on site.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Selection Recommendations

Selection of an outdoor switching station involves six dimensions: voltage class, enclosure material, built-in cabinet type, unit combination, secondary configuration and dimension verification; any improperly selected dimension may become the weak point of the complete set. This chapter provides a six-step selection logic, scenario-based recommended configurations and five selection tips.

Selection Logic (Six Steps)

1. Determine the voltage class - select KBS-12 / KBS-24 / KBS-40.5 according to the rated voltage of the system to be connected;
2. Determine the enclosure material - select according to the environmental corrosion class (inland / humid / coastal / chemical) and life requirements with reference to Table 3-1;
3. Determine the built-in cabinet type - select according to protection requirements, whether frequent operation is required, whether SF6 must be avoided, altitude and space conditions;
4. Determine the unit combination - determine the number of units and busbar scheme according to the number of incoming/outgoing circuits and the supply scheme (single ring / double ring / radial);
5. Determine secondary equipment and power supply - configure DTU/FTU according to distribution automation requirements, and determine the DC power supply capacity according to the operating mechanism and secondary load;
6. Verify dimensions and transport - check whether the enclosure dimensions, operating corridor, foundation and transport gauge are satisfied.

Recommended Configurations by Scenario

Table 8-1 Recommended configurations by scenario

Scenario	Recommended voltage	Recommended enclosure material	Recommended built-in cabinet type	Remarks
Residential districts	12 kV	Cold-rolled steel / aluzinc sheet	XGN15-12 / HXGN15-12	Economy first
Commercial complexes	12 kV	Aluzinc sheet / 304 stainless steel	YRM6-12 / YVG6	Maintenance-free, aesthetic
Industrial parks	12 / 24 kV	Aluzinc sheet	YRM6 / XGN15	Selected by load capacity
Urban road & landscape areas	12 kV	GRC	YHB / YVG6	Appearance harmonized with surroundings
Coastal / islands	12 / 24 kV	304 stainless steel / GRC	YRM6 / C-GIS	Salt fog ≥1000 h
High-altitude areas	12 kV	Aluzinc sheet / 304 stainless steel	YVG6 / YHB	Solid / eco-gas insulation; no insulation correction required
Severe cold regions	12 kV	304 stainless steel	YVG6 / YRM6	With heating and temperature control
Large-capacity switching stations	40.5 kV	Aluzinc sheet / 304 stainless steel	C-GIS-40.5	1250 ~ 3150 A , 31.5 kA
Relay protection coordination required	12 kV	Aluzinc sheet / 304 stainless steel	KYN28-12	Withdrawable; wider aisle required
Distribution automation retrofit	12 kV	Aluzinc sheet / GRC	YHB / YRM6	With DTU and communication terminals

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Selection Tips

Selection essentials:

① The enclosure material and built-in cabinet type must match the environment - if an ordinary cold-rolled steel enclosure is used in a severely corrosive environment, it will become the weak point of the complete set; the material class should be determined according to the most severe environmental conditions.

② Although the GRC enclosure requires a slightly higher initial investment, its service life reaches 40 ~ 50 years and is maintenance-free; the whole-life-cycle cost is often more favourable.

③ With 40.5 kV and KYN28 built-in cabinets the enclosure dimensions increase significantly; transport gauge and site hoisting conditions must be calculated in advance.

④ The DC power supply capacity should have a margin - calculated according to the inrush current of the operating mechanism and the long-term secondary load, also considering auxiliary loads such as communication and dehumidifying heating.

⑤ The distribution automation interface should be clarified in advance - the DTU communication protocol, point table and the connection mode with the master station should be determined before ordering to avoid rework on site.

Ordering Instructions

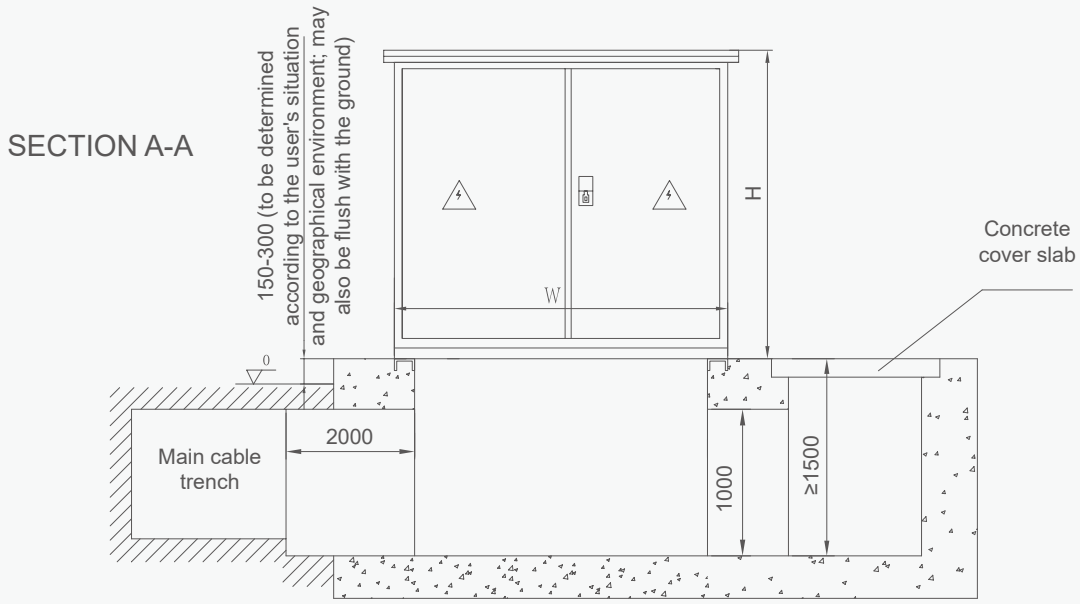
When ordering, the purchaser shall provide the following information so that the supplier can complete the scheme design, enclosure dimension calculation and production scheduling.

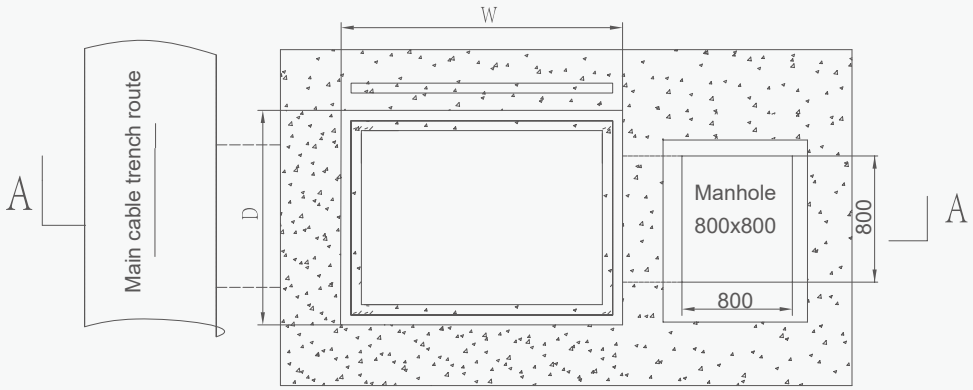
Information to Be Provided by the Purchaser

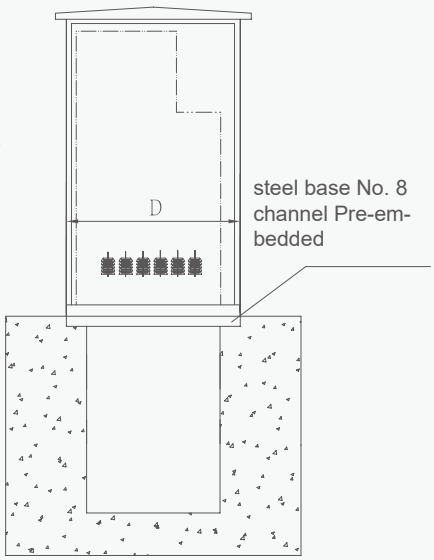
1. Basic parameters - model (KBS-12 / KBS-24 / KBS-40.5), rated voltage, rated current, short-circuit breaking capacity;
2. Enclosure requirements - enclosure material, sheet thickness, surface colour and coating requirements, overall dimensions (or recommended by the supplier according to the scheme), protection degree, cable entry/exit mode (bottom-in bottom-out / side entry), foundation type;
3. Primary system scheme - primary connection diagram (single-line diagram), number of incoming/outgoing circuits, unit combination scheme and busbar scheme (single busbar / single busbar with section / double busbar);
4. Built-in equipment - model and quantity of built-in HV cabinets, main switch type (load-break switch / vacuum circuit breaker / combination), instrument transformer ratios and accuracy classes, arrester specifications, earthing switch configuration;
5. Protection and automation - protection device model and functional requirements (e.g. 50/51/50N/51N etc.), protection setting principles, whether DTU/FTU is configured, communication protocol and interface requirements, whether connection to the distribution network master station is required;
6. DC power supply - GZDW DC panel system voltage (110 V / 220 V), battery capacity, integrated or split cabinet, backup time requirements;
7. Metering requirements - metering mode, accuracy class and installation position of metering instruments, whether a separate metering cabinet is required;
8. Environmental conditions - maximum/minimum temperature at the installation site, altitude, relative humidity, pollution class, salt-fog conditions, seismic intensity, presence of special corrosive gases;
9. Auxiliary requirements - optional items such as dehumidifying heating, ventilation fans, lighting, temperature and humidity monitoring, smoke / water-flooding alarm, intelligent access control;
10. Others - enclosure surface marking and painting/graphic requirements (e.g. landscape patterns harmonized with the surroundings), spare parts requirements, delivery place and transport mode, site foundation and installation conditions.

KBS-12/24/40.5 Outdoor Switching Station (Box-Type Switchgear)

Overall and mounting dimensions (mm)







Note:

1. Outdoor switching station, 1 unit in total.
2. The model of the outdoor switching station is KBS-12 (outdoor type); overall dimensions W*D*H (width*depth*height).
3. Cable entry/exit of the incoming/outgoing cabinets: bottom cable entry, bottom cable exit.
4. The enclosure is made of 201 stainless steel, painted State Grid green, no nameplate holes.

Notes:

1. Brick wall laid with M5 cement mortar; the inner face and the outer edge above ground shall be finished with 1:2.5 cement mortar.
2. When the bottom slab is below the groundwater level, apply waterproofing; otherwise apply seepage treatment.
3. The lintel is made of 6 mm diameter reinforcement and C20 concrete.
4. The base is made of No. 10 channel steel and shall be given anti-corrosion treatment after fabrication (the anti-corrosion method to be confirmed by the user).
5. The channel-steel base is placed in the foundation notch and fixed with tie bars and concrete.
   Earth electrodes shall be embedded in the foundation; the
6. earthing resistance shall meet the requirements of the power supply authority;
7. An access opening shall be provided beside the cable manhole so that personnel can enter it for cable installation.

This drawing is for reference only.

Low Voltage Switchgear



CNC ELECTRIC

Low Voltage Switchgear

GGD Low Voltage Power Distribution Cabinet

- Rating: Rated voltage: 380V.
- 50 - 60Hz
- Application:

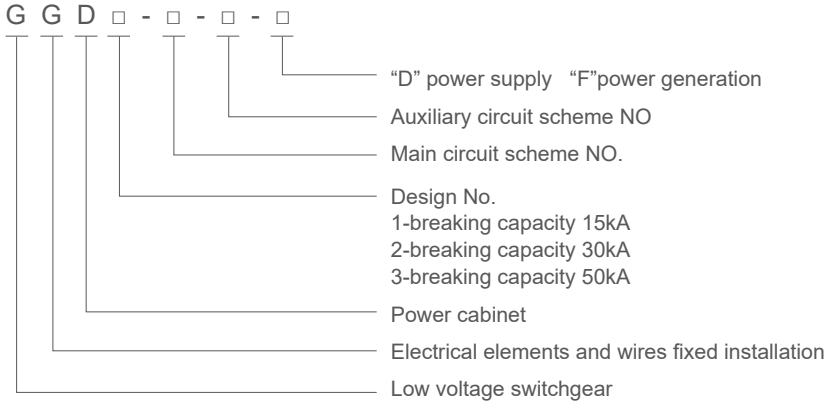
  mainly applicable in power station, power substation industrial and mining enterprises as energy converter, distributor and controller of power, light and distribution device.
- Standard: IEC60439 - 1

General



GGD Low Voltage Power Distribution Cabinet

Type designation



Operating conditions

1. Ambient air temperature: -15°C~+40°C
   Daily average temperature: ≤35°C
   When the actual temperature exceed the range, it should be used by reducing the capacity accordingly.
2. Transport and store temperature: -25°C~+55°C. do not exceed +70°C in short time.
3. Altitude: ≤2000m
4. Relative humidity: ≤50%, when temperature is +40°C
   When temperature is low, larger relative humidity is allowed. when it is +20°C, relative humidity can be 90%. Since the temperature change will make out condensation.
5. Installation inclination: ≤5%
6. Applicable in the places without corrosive and flammable gas.

Note: Customized products are available.

GGD Low Voltage Power Distribution Cabinet

Technical data

1. Main technical data

Sheet 1

Type	Rated voltage (V)	Rated current (A)	Rated short-circuit breaking current (kA)	Rated short-circuit withstand current (1s)(kA)	Rated peak withstand voltage (kA)
GGD1	380	A 1000	15	15	30
	380	B 600 (630)	15	15	30
	380	C 400	15	15	30
GGD2	380	A 1500 (1600)	30	30	63
	380	B 1000	30	30	63
	380	C 600	30	30	63
GGD3	380	A 3150	50	50	105
	380	B 2500	50	50	105
	380	C 2000	50	50	105

2. Main bus

a. Single copper busbar adopted when the rated current<=1500A

b. Double copper busbar adopted when the rated current>1600A

c. Brushing &anodizing process adopted which is better than traditional zinc-coatedprocess.

3. Selection of horizontal bus

Sheet 2

Rated current (A)	Copper busbar specification (mm)
400	40×4
630	50×5
1250	60×10
1600	80×10
2000	2×(60×10)
2500	2×(80×10)
3150	2×(100×10)

4. Selection of neutral earthgin bus

Sheet 3

Cross section of phase conductor (mm²)	Cross section of PE (N) conductor (mm²)
500~720	40×5
1200	60×6
>1200	60×10

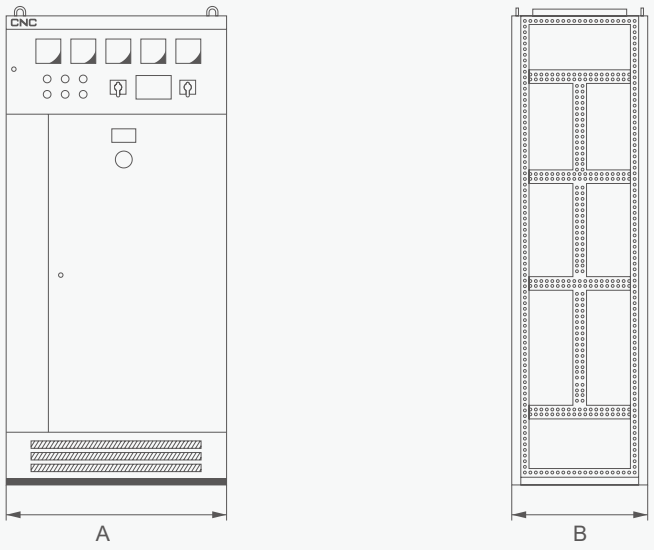
GGD Low Voltage Power Distribution Cabinet

Features

1. The accuracy and quality of the switchgear could be ensured as the framework parts and special parts supplied by CNC. Modular design of the Overall and mounting dimensions (mm) s concerning (E=20mm), which has cut production time and enhanced efficiency.
2. The heat dispensation channel at the top and bottom of the switchgear formulate a ventilation loop to dispens the beat.
3. Easy for installation and dismantling.
4. The switchgear with perfect earthing protection system.
5. The cover of the switchgear could be removed for installation and adjustment of the main bus bar. there are also rings for lifting and delivery of switchgear.
6. The protection degree is IP30, As per you requirements, switchgears with protection degree of IP20~IP40 are available.
7. Flexible circuit plans are available.

Overall and mounting dimensions (mm)

Picture 1



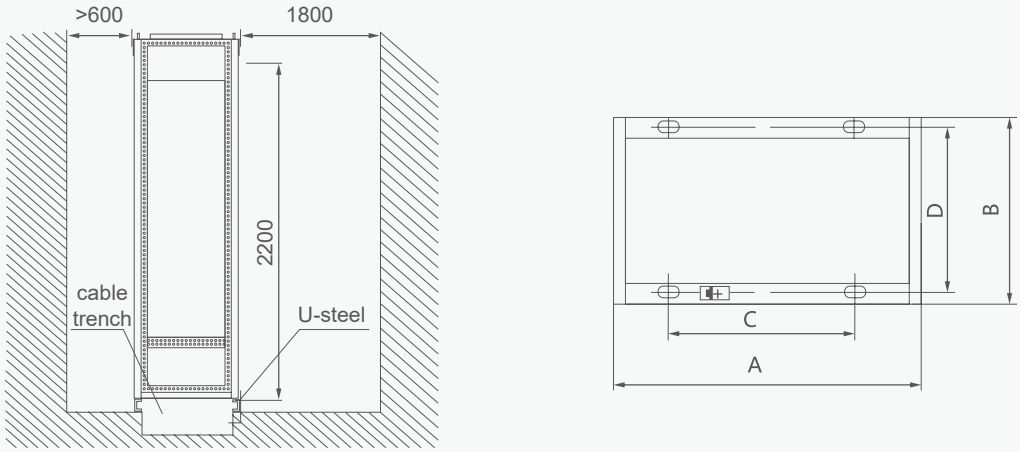
mm

Product code	A	B
GGD 06	600	600
GGD 06A	600	800
GGD 08	800	600
GGD 08A	800	800
GGD 10	1000	600
GGD 10A	1000	800
GGD 12	1200	800

GGD Low Voltage Power Distribution Cabinet

Overall and mounting dimensions (mm)

Picture 2



mm

Product code	A	B	C	D
GGD 06	600	600	450	556
GGD 06A	600	800	450	756
GGD 08	800	600	650	556
GGD 08A	800	800	650	756
GGD 10	1000	600	850	556
GGD 10A	1000	800	850	756
GGD 12	1200	800	1050	756

Ordering information

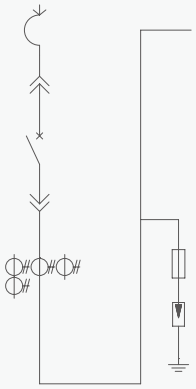
Please specify the following information when ordering:

1. The full model, including main circuit plan and auxiliary circuit plan.
2. The diagram of main circuit system allocation.
3. Inner allocation diagram of the switchgear.
4. Electric diagram of auxiliary contact.
5. Name, Model, Specification and list of adopted components.
6. Customized products are available.

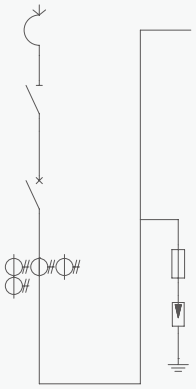
GGD Low Voltage Power Distribution Cabinet

Configuration Collection

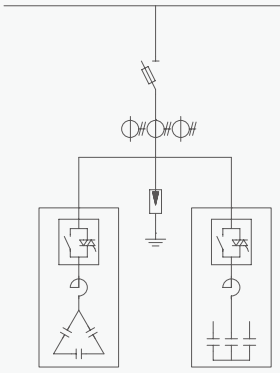
Incoming Panel 1



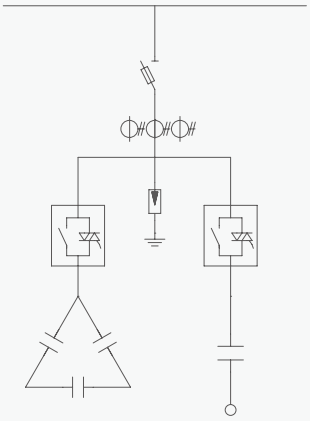
Incoming Panel 2



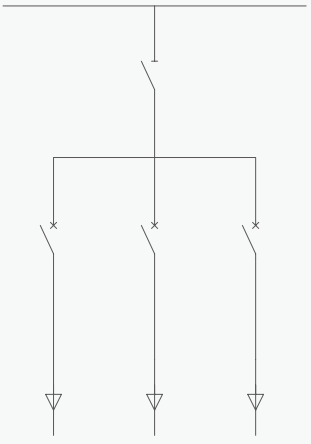
Capacitor Compensation Panel 1



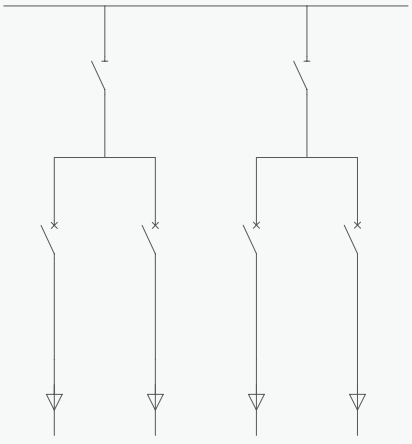
Capacitor Compensation Panel 2



Outgoing Panel 1



Outgoing Panel 2



Low Voltage Switchgear

GCS Low-voltage Switchgear Panel, Withdrawable Type

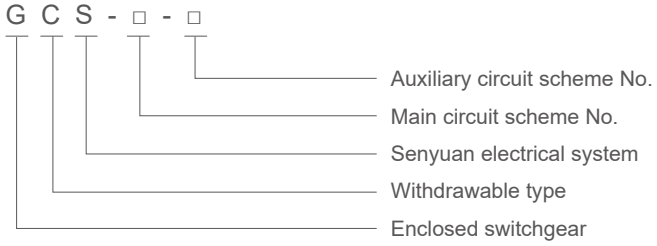
- Rating: Rated voltage 400V, 690V, rated current reach to 4000A.
- Application:
  mainly applicable in place with high automation and need to communicate with computer, like large power station and petrochemistry system, as the low voltage distribution device of the distribution and motor controlling, and reactive power compensation in power system.
- Protection degree: IP30, IP40
- Standard: IEC60439-1

General



GCS Low-voltage Switchgear Panel, Withdrawable Type

Type designation



Operating conditions

1. Ambient air temperature: -15°C~+40°C
   Daily average temperature: ≤35°C
   When the actual temperature exceed the range, it should be used by reducing the capacity accordingly.
2. Altitude: ≤2000m
3. Relative humidity: ≤50%, when temperature is +40°C
   When temperature is low, larger relative humidity is allowed. when it is +20°C, relative humidity can be 90%. Since the temperature change will make out condensation.
4. Installation inclination: ≤5%
5. Applicable in the places without corrosive and flammable gas.

Note: Customized products are available.

GCS Low-voltage Switchgear Panel, Withdrawable Type

Technical data

Sheet 1

Item		Data
The main circuit of rated voltage (V)		AC400, 690
The auxiliary circuit of rated voltage (V)		AC220, 400; DC110, 220
Rated frequency (Hz)		50 (60)
Rated insulation voltage (V)		660 (1000)
Rated current (A)	Horizontal busbar	≤4000
	Vertical bus (MCC)	1000
Busbar rated short time withstand current (KA/1S)		50, 80
Busbar rated peak withstand current (KA/0.1s)		105, 176
Power frequency test voltage (V/1Min)	Main circuit	2500
	Auxiliary circuit	2000
Main Busbar	3 Phase 4 Wires	A, B, C, N
	3 Phase 5 Wires	A, B, C, PE, N

Features

1. C type material adopted for the main frame, frame use the form of Assembling structure. Main frame have the installation modular hole E=20mm
2. The Compartment is divided into functional unit rooms, bus room, cable rooms, Each unit is relatively independent. ”
3. Take the drawer as main body, meanwhile have the draw out type and fixed type, can mixed combination, Arbitrary selection.
4. Cabinet size (refer to sheet 2)

Sheet 2

Height	2200			
Width	400	600	800	1000
Depth	600	800	1000	

5. Functional unit
   a. The higher modulus of drawer is 160mm, divide to1/2 unit, 1 unit, 1.5unit, 2 unit,3 unit 5 different size series. Unit loop rated voltage below 400A.
   b. The same functional unit of the drawer has good interchangeability. Each MCC cabinet can install max 11 set drawer with 1 unit, or
   c. 22 sets drawer with 1/2 unit. Drawer with more than 1 unit adopt multi-functional plate.
   d. Drawer incoming and outgoing line adopt the same standardized plug of slice structure with different quantity according to current
   e. The transfer between ½ unit drawer and cable cabinet use ZJ-2 adapter.
   f. The transfer between drawer which is above 1 unit and cable cabinet use standardized bar type or tube type ZJ-1 adapter according to different current rated.
   g. Drawer panel have the open, close, test, draw out position indicator.
   h. Drawer unit have Mechanical linkage.
   i. Feeder cabinet and motor control cabinet have special cable insulation cabinet. The connection between functional unit and cable cabinet adopts adapter. Not only improves the reliability of the cable, and greatly facilitates the user safety and repair of cable.

GCS Low-voltage Switchgear Panel, Withdrawable Type

6. Busbar

In order to improve the bus dynamic thermal stability and improved contact surface temperature rise, device use TMY-T2 series of hard copper, Copper plate surface will be treated with new advanced oxidation process. The performance index is superior to the traditional tin plating process.

a. Horizontal busbar

Horizontal busbar is arranged in Busbar compartment at the back of cabinet, double busbar for above 2500 A, single layer busbar for current below 2500A. Each phase is composed of 4 or 2 pcs busbar, improve the Short circuit strength of bus.

b. Vertical bus

"L" shape hard copper tin bus is used for vertical busbar of drawer. L type bus specification (mm):

(Height×thickness)+(button×Thickness)(50×5)+(30×5)Rated current 1000A

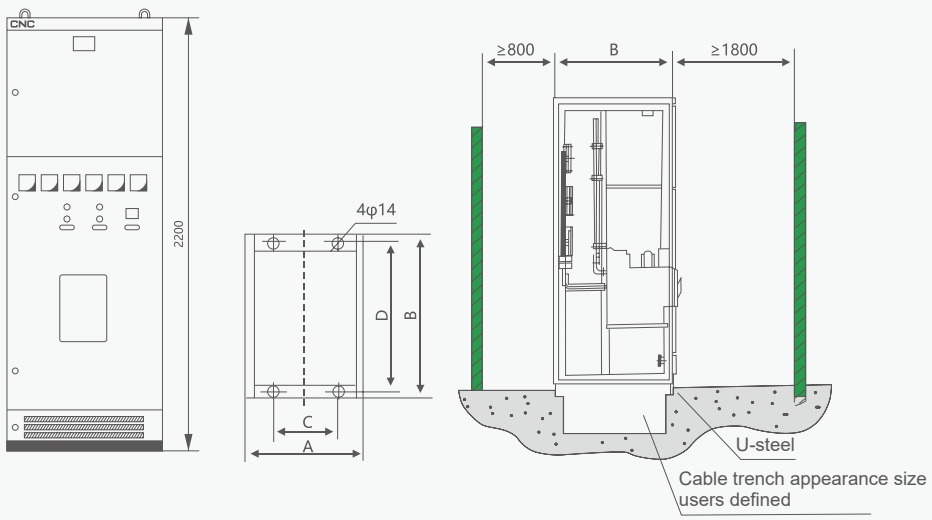
Neutral grounding busbar

c. Adopt hard copper. Through the level of neutral grounding wire (PEN) or ground +neutral line (PE+N).

Overall and mounting dimensions (mm)

Electric power, communication cabinet installation diagram

Picture 1



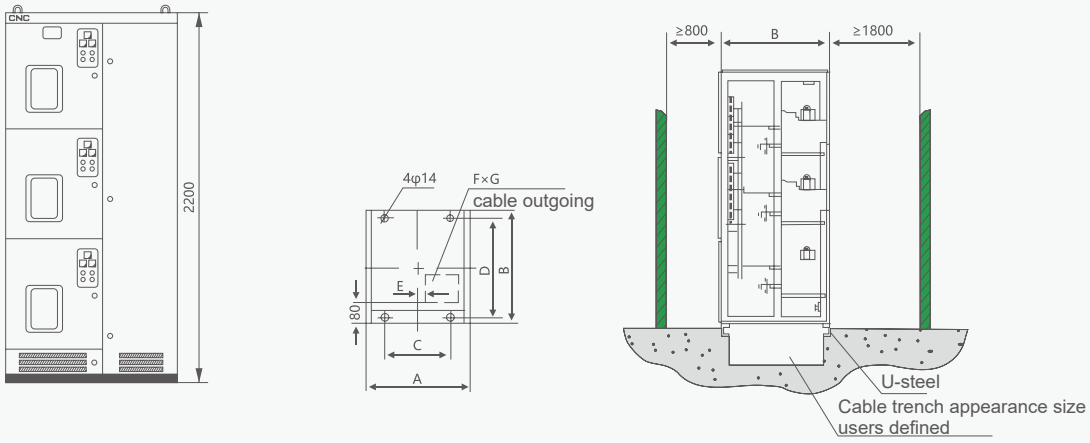
(mm) Sheet 3

Cabinet code	A	B	C	D	Remark
GCS-TG1010-4	1000	1000	900	900	Communication cabinet
GCS-TG0810-4	800	1000	700	900	Electric power cabinet
GCS-TG0808-4	800	800	700	700	Electric power cabinet
GCS-TG0608-4	600	800	500	700	Electric power cabinet

GCS Low-voltage Switchgear Panel, Withdrawable Type

PC cabinet installation diagram

Picture 2

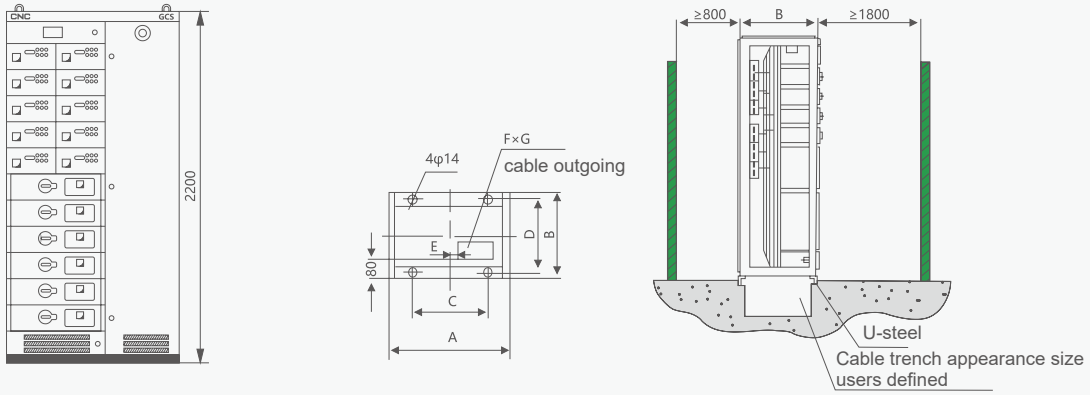


(mm) Sheet 4

Cabinet code	A	B	C	D	E	F×G
GCS-TG1010-2	1000	1000	900	900	60	400×400
GCS-TG0810-2	800	1000	700	900	160	200×400
GCS-TG1008-2	1000	800	900	700	60	400×400
GCS-TG0808-2	800	800	700	700	160	200×400

MCC cabinet installation diagram

Picture 3



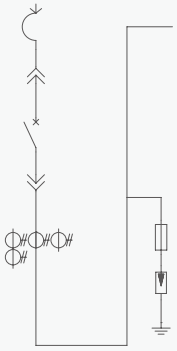
(mm) Sheet 5

Cabinet code	A	B	C	D	E	F×G
GCS-TG1008-1	1000	800	900	700	60	400×350
GCS-TG1006-1	1000	600	900	500	60	400×350
GCS-TG0806-1	800	800	700	500	160	200×350

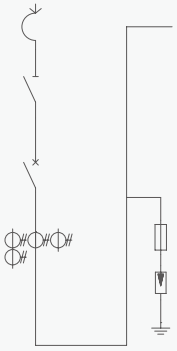
GCS Low-voltage Switchgear Panel, Withdrawable Type

Configuration Collection

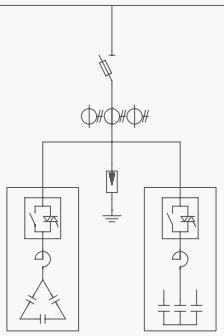
Incoming Panel 1



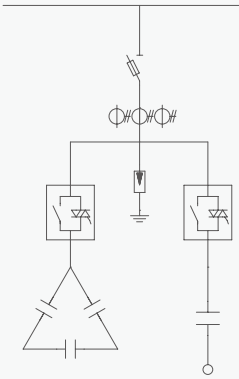
Incoming Panel 2



Capacitor Compensation Panel 1



Capacitor Compensation Panel 2



Outgoing Panel 1

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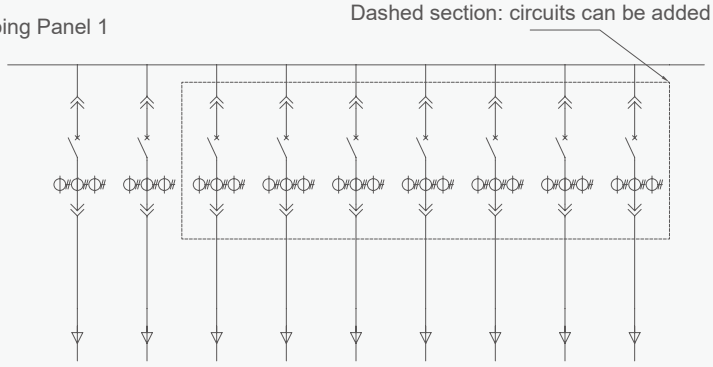

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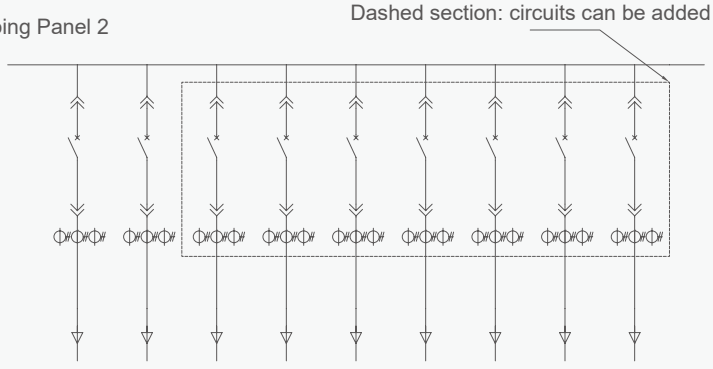
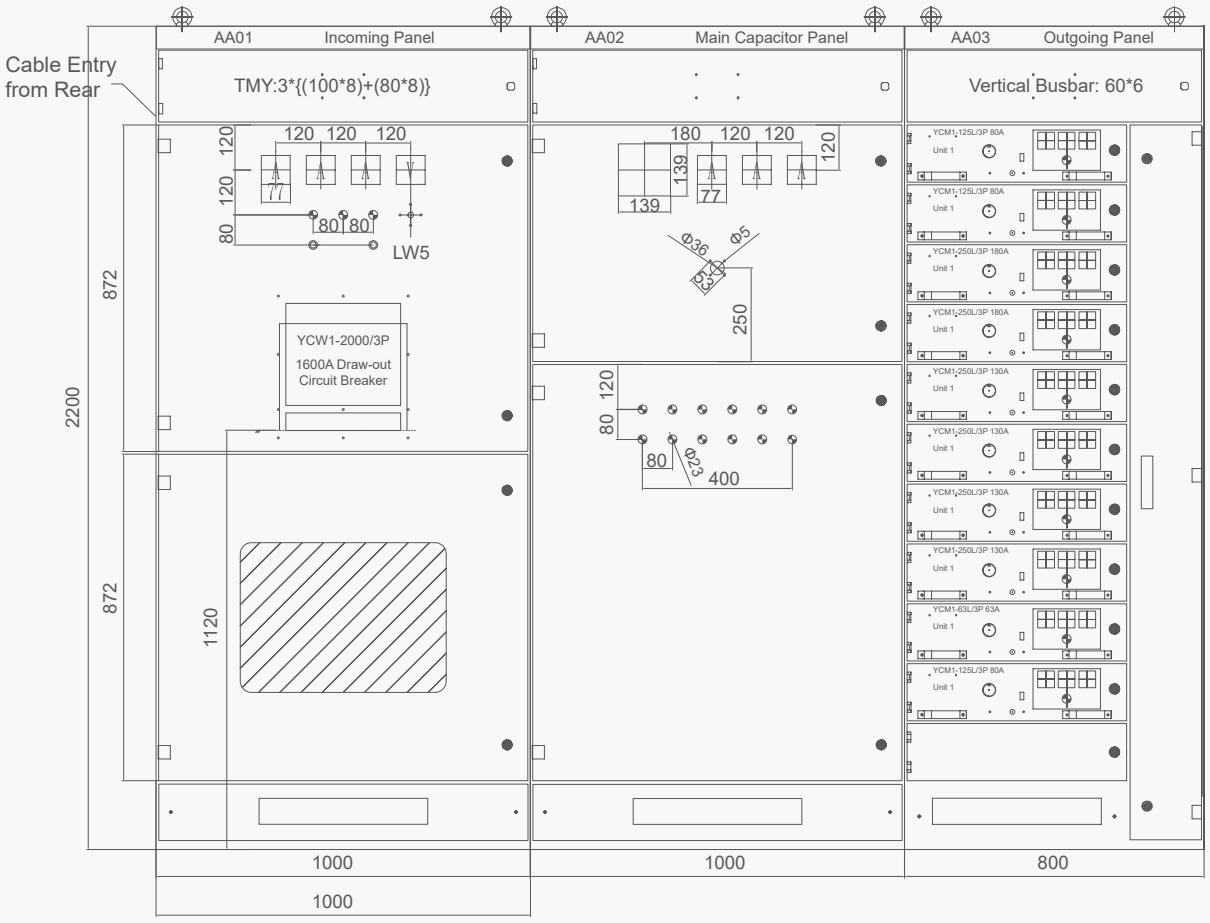


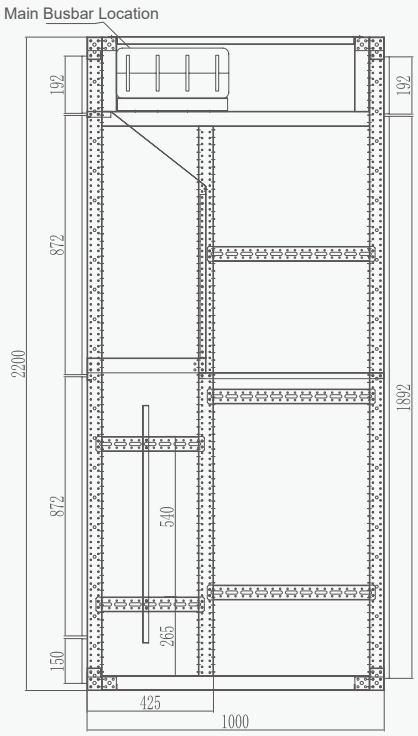
GCS Low-voltage Switchgear Panel, Withdrawable Type

Overall and mounting dimensions (mm)

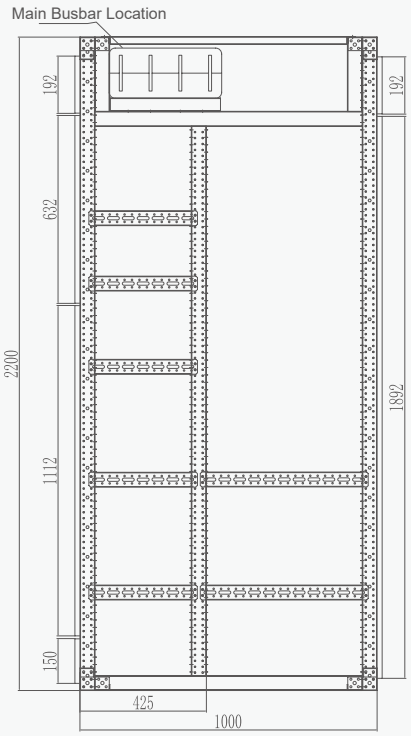


GCS Low-voltage Switchgear Panel, Withdrawable Type

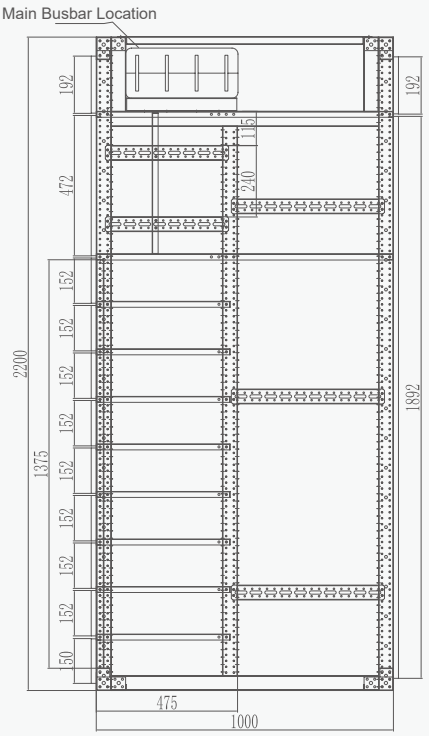
Side View of Incoming Panel



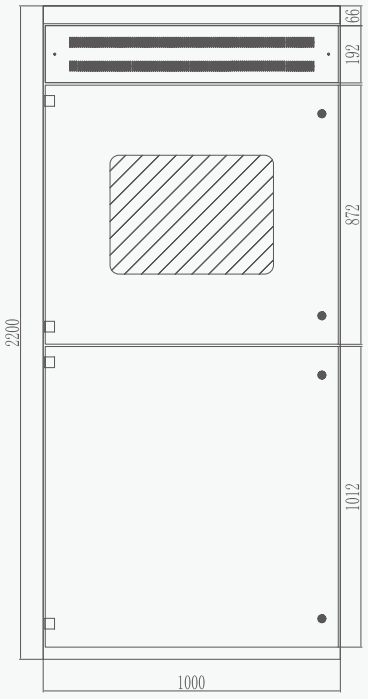
Side View of Capacitor Panel



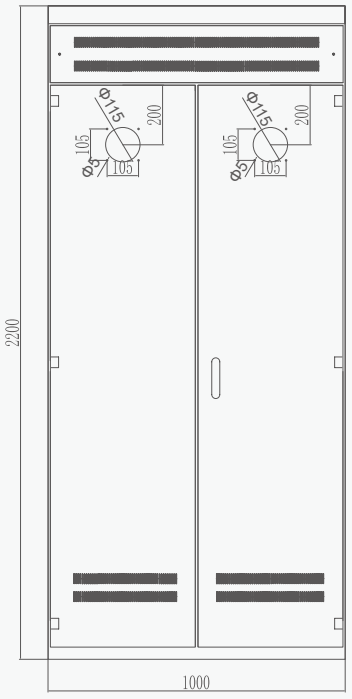
Side View of Drawer Panel



Rear View of Incoming Panel



Rear View of Capacitor Panel



Low Voltage Switchgear

GCK Low-voltage Switchgear Panel, Withdrawable type

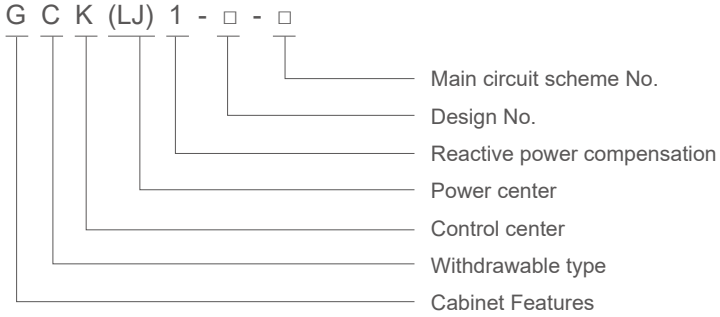
- Application: mainly applicable in places with high automation and need to communicate with computer, like large power station and petro-chemistry system, as the low voltage distribution device of the distribution and motor controling, and reactive power compensation in power system.
- Protection degree: IP30, IP40. Bus type: three phase four wires, three phase five wires. Operation type: in-place, long-distance and automatic.
- Standard: IEC60439-1

General



GCK Low-voltage Switchgear Panel, Withdrawable type

Type designation



Operating conditions

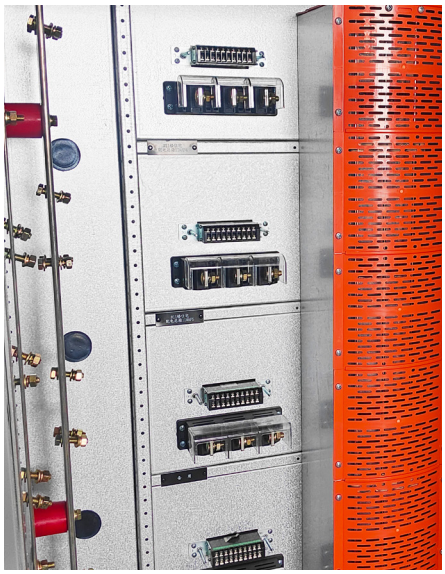
1. Ambient air temperature: -5°C~+40°C.
   Daily average temperature: ≤35°C.
   When the actual temperature exceed the range, it should be used by reducing the capacity accordingly.
2. Transport and store temperature: -25°C~+55°C. do not exceed +70°C in short time.
3. Altitude: ≤2000m.
4. Relative humidity : ≤50%, when temperature is +40°C.
   When temperature is low, larger relative humidity is allowed. when it is +20°C, relative humidity can be 90%. Since the temperature change will make out condensation.
5. Installation inclination: ≤5%
6. Applicable in the places without corrosive and flammable gas.

Note: Customized products are available.

Technical datas

1. Electric datas
   a. Rated insulation voltage: 690V/1000V
   b. Rated operational voltage: 400V/690V
   c. Rated frequency: 50/60Hz
   d. Rated impulse withstands voltage: 8kV
   e. Rated voltage of auxiliary circuit: AC380/220V, DC110/220V
   f. Over-voltage grade: III
   g. Rated current: ≤5000A
   h. Rated current of horizontal bus bar: ≤5000A
   i. Rated current of vertical bus bar: 1000A
2. Mechanical items
   a. Incoming and outgoing mode
   b. Cable incoming and outgoing
   c. Connection mode
   d. The functional units completely separated or partially separate

GCK Low-voltage Switchgear Panel, Withdrawable type





Feature

GCK panel is combination structure with bolt. The complete panel is composed of door, terminal board, baffle plate, supporting frame and drawer, busbar, etc.

Basic frame adopts FA28 type or KB type (C type) to combine with together. Total structural components of frame are connected by self-tapping screw.

It should add to door, face place, baffle plate, supporting frame and drawer to finish completed panel by requirements.

The installation hole of body and components modules E=25mm change, flexible and convenient to install.

Drawer unit height divide into ½ unit, 200mm, 300mm, 400mm, 500mm, and 600mm series. The loop current decide the drawer height, virtual installation height is 1800mm.

GCK panel withdrawable function unit adopts special push (pull) mechanism, light structure, perfect interchange. It indicate of working position, test position and isolating position mechanical locking condition. Install additional pad lock for operating handle.

The frame and inner metal components are galvanized to assure reliable earthing.

GCK basic frame is combination assembly type structure, adopt standardized module design. for combination assembly type structure, the standard module design.

Compact structure, flexible assembly, can be assembled into a protection, measurement and control, indicating etc. standard unit, Can choose assembly according to requirement, To form different frame Features and drawer unit.

1. The cabinet frame

C type material adopted for the main frame, Frame parts and Special parts will be provided by our company to make sure the accuracy and quality.

- Parts forming size, hole size, Equipment interval adopt modularization. (E=25mm)
- The internal structure should be galvanized.
- The top cover is detachable, horizontal bus can be installed easily after removing the top cover, Hand ring
- External phosphating treatment; Then use electrostatic epoxy powder coating.
- Cabinet frame is divided into the busbar compartment, functional compartment, the cable compartment three separate interval, Can prevent accidents diffusion and convenient charged repair.

2. Functional unit (Withdrawable part)

- Functional unit: Feeder unit, Motor unit, utility power unit.
- The high modulus of drawer unit is 200mm, include 1/2unit,1unit,2 unit,3 unit four size series.
- Unit loop rated current below 630A.
- Each MCC Cabinet can install 9 set drawer with 1 unit, or 18 set drawer with ½ unit.

GCK Low-voltage Switchgear Panel, Withdrawable type

- The compartment door plate is interlocked between operating mechanism and drawer, the door can be open until the main switch is on the close position
- The main switch operating mechanism can be locked in close or open position by a padlock, the equipment can be maintained safely.
- There are main circuit outlet plug, auxiliary circuit secondary plug and earthing plug at the back of function unit.
- The earthing tests plug make sure the protection circuit continuity when drawer on Separation unit connection position.
- Functional tests compartment by metal partition board.
- Compartment valve, can be open and close automatically, with drawers pushed and pulled so that in the compartment without touching the vertical busbar.

3. Busbar system

- Vertical bus uses polycarbonate engineering plastic shell sealed
- GCK, GCL busbar system use 3P4W, 3P5W, Horizontal busbar will be installed at the top of cabinet, N phase, PE phase. Can be installed on the top of the cabinet, and can also be arranged in the cabinet bottom.

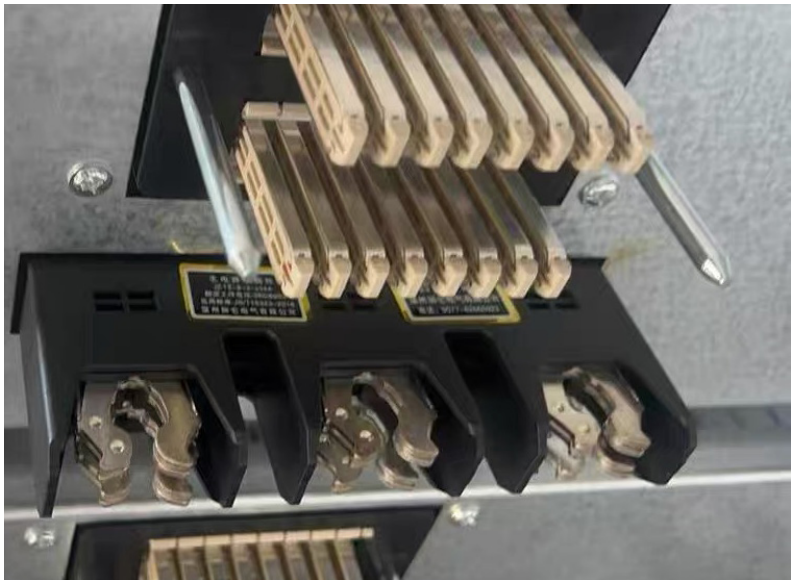
Overall and mounting dimensions (mm)

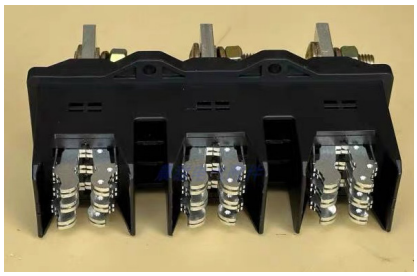
The effective height of installation

1. Electric cabinet and buscouble cabinet
   Cabinet width can be 600, 800, 1000, 1200, (800-400) mm according to rated current and method of incoming and outgoing.
   Depth of cabinet is 800, 1000 (Advise to use 1000mm, The top incoming and top outgoing must be 1000mm)
2. Feeder cabinet
   Cabinet Width: 600, 800mm
   Cabinet depth: 600, 1000 (advise to use 1000mm top outgoing cabinet must be 1000mm)
3. Motor control cabinet
   Width: 600, 600+200mm
   Depth of cabinet: 800, 1000mm (advise to use 1000mm top outgoing cabinet must be 1000mm)
   Power compensation cabinet
   Width: 600 (4, 6 loop), 800 (8), 1000 (10 loop) mm
   cabinet depth: 800, 1000mm

GCK Low-voltage Switchgear Panel, Withdrawable type







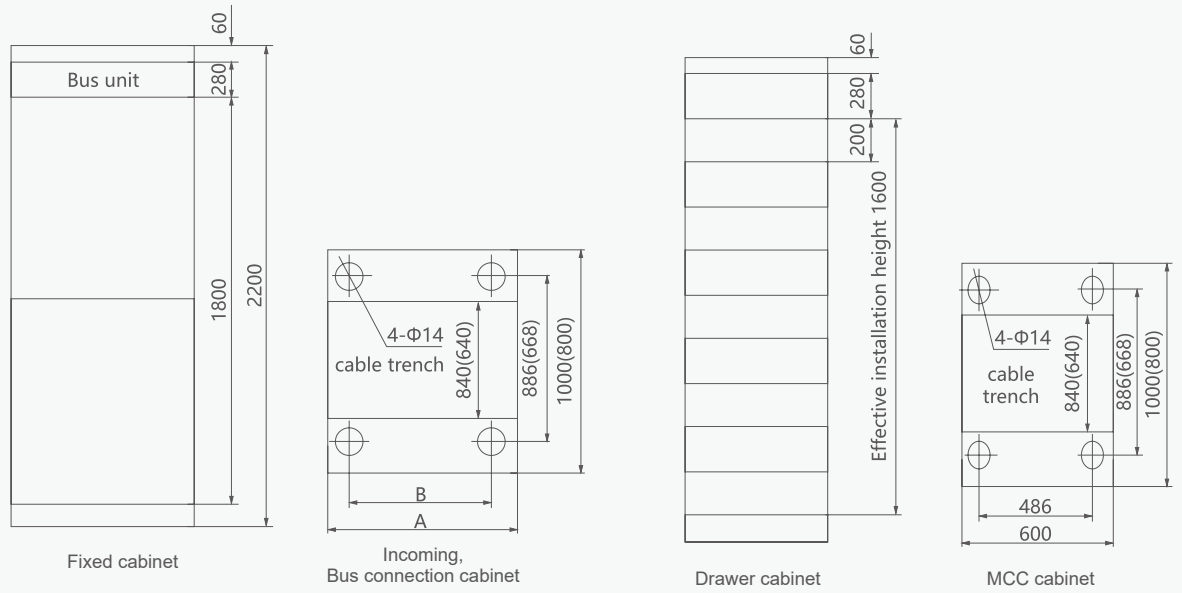
(mm)

Rated current (A)	Copper bus model (mm)
630	50×5
1250	60×10
1600	80×10
2000	100×10
2500	2 (80×10)
3150	2 (100×10)





GCK Low-voltage Switchgear Panel, Withdrawable type

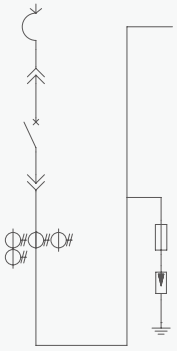


Cabinet code / Size	A	B
Electric power or Electric feeder	600	486
Electric power or Bus connection	800	686
Electric power or Bus connection	1000	886

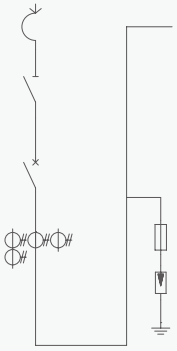
GCK Low-voltage Switchgear Panel, Withdrawable type

Configuration Collection

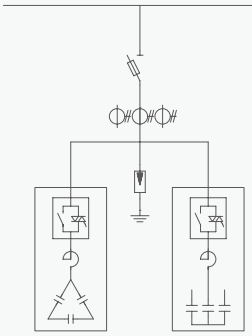
Incoming Panel 1



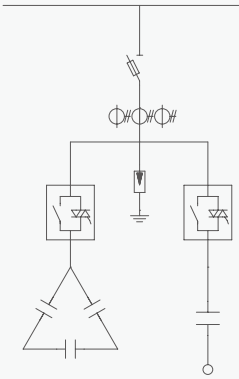
Incoming Panel 2



Capacitor Compensation Panel 1

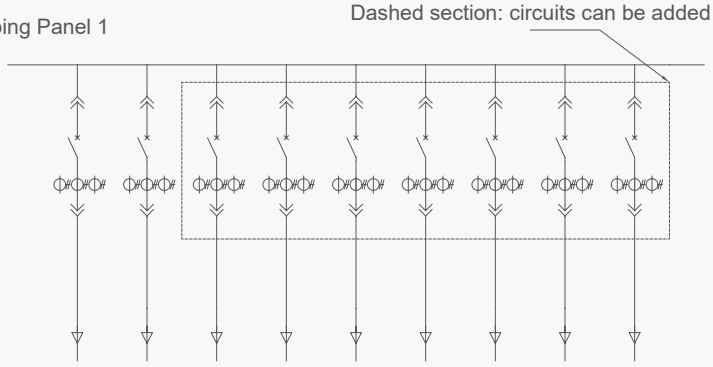


Capacitor Compensation Panel 2



Outgoing Panel 1

Dashed section: circuits can be added or removed as required.



Outgoing Panel 2

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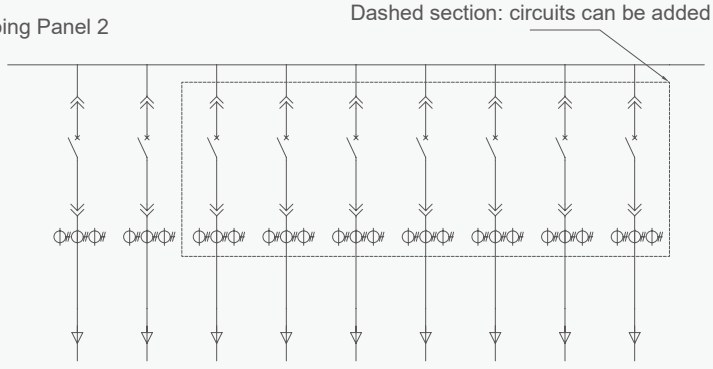
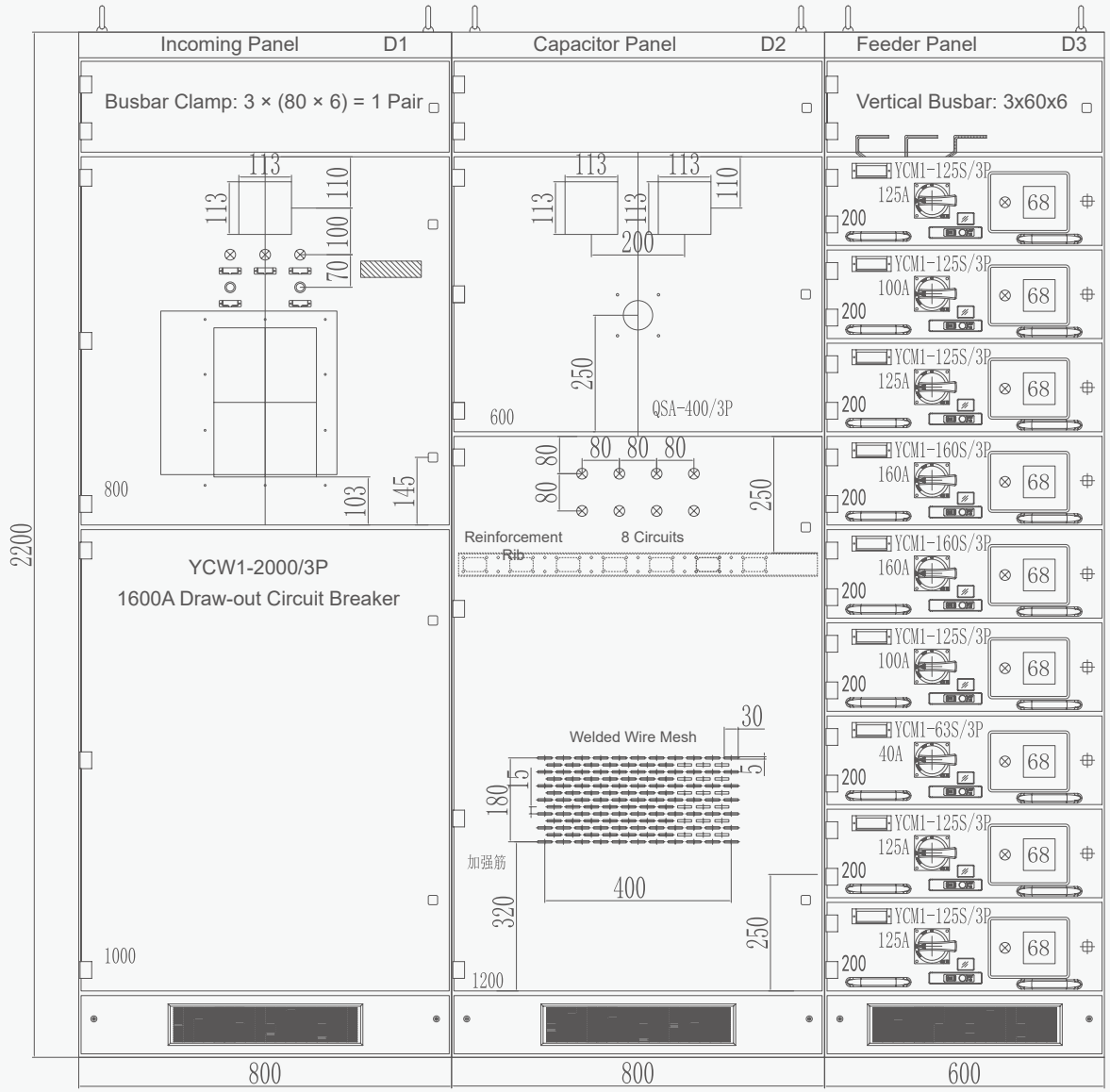


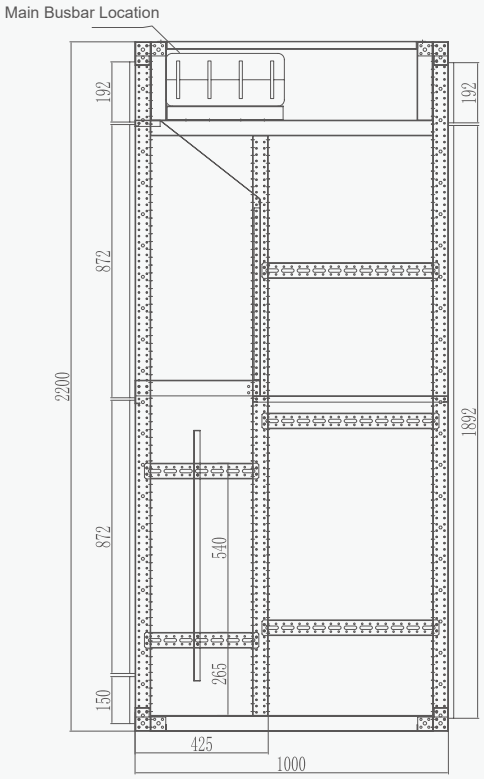
GCK Low-voltage Switchgear Panel, Withdrawable type

Overall and mounting dimensions (mm)

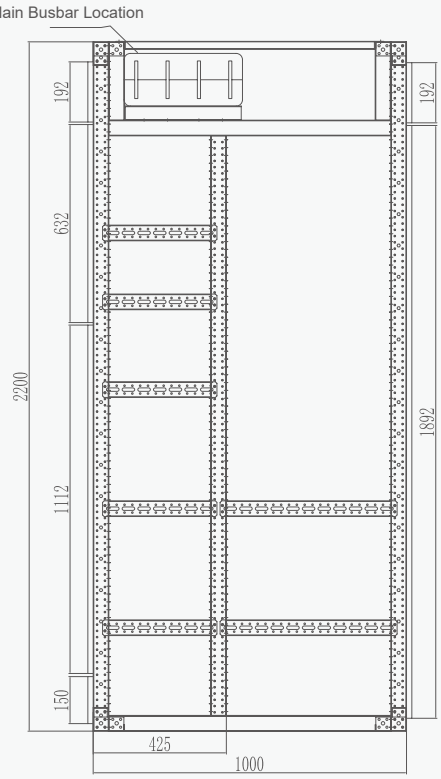


GCK Low-voltage Switchgear Panel, Withdrawable type

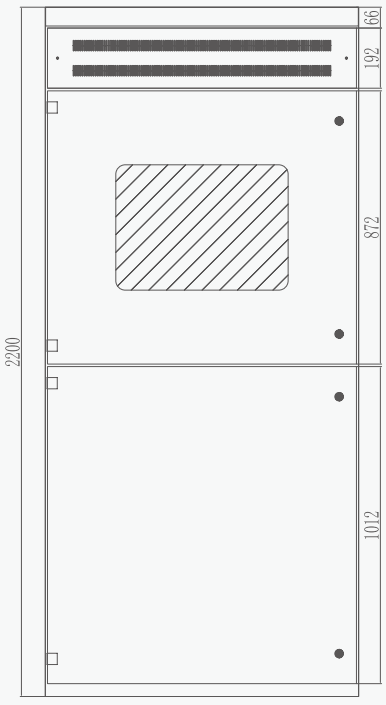
Side View of Incoming Panel



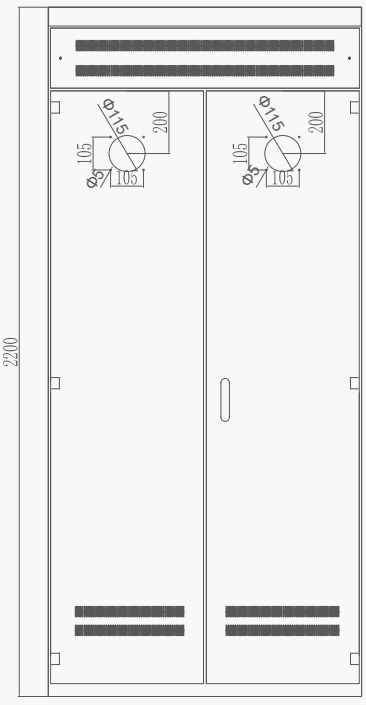
Side View of Capacitor Panel



Rear View of Incoming Panel



Rear View of Capacitor Panel



Low Voltage Switchgear

MNS Low-voltage Switchgear Panel, Withdrawable Type

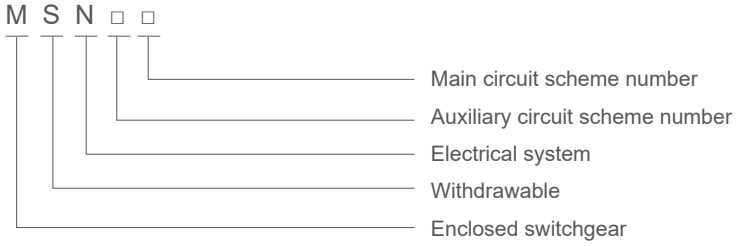
- MNS low-voltage withdrawable switchgear is suitable for power systems with an AC 50Hz and a rated working voltage of 400V. It is mainly used for energy conversion, distribution, and control of distribution equipment.
- Mainly suitable for airports, power stations, transportation and energy, industrial and mining enterprises, residential communities, and other places.
- Standard: IEC439

General



MNS Low-voltage Switchgear Panel, Withdrawable Type

Type designation



Operating conditions

1. Installation Site: Indoor;
2. Altitude: No more than 2000m.
3. Earthquake Intensity: No more than 8 degrees.
4. Ambient Temperature: No more than +40°C and no less than -15°C. Average temperature is no more than +35°C within 24 hours.
5. Relative Humidity: the average daily value is no more than 95%, the average monthly value is no more than 90%.6. Installation locations: without fire, explosion danger, serious pollution, chemical corrosion and violent vibration.

Features

1. The operation and control handle of the drawer are combined into one, simplifyingthe operation while retaining the mechanical interlocking function. This overcomes the drawbacks of complex operation and susceptibility to damage in traditional MNS cabinets due to possible miso-peration.
2. The MCC units are available in various combinations, compact in structure, and the cabinet can share back-to-back arrangement of busbars. Each cabinet can accommodate up to 36 circuits.
3. The cabinet can be arranged back-to-back or against the wall, saving installation space.
4. Standard components are used throughout, making it convenient for engineering designers.
5. The entire series is standardized, with strong structural versatility and flexible assembly.
6. A single cabinet can accommodate more units and can be freely combined into different types, such as fixed partition type and drawer type. Drawer units of the same specifications can be easily interchanged.
7. Stable combination performance and good grounding continuity.
8. High continuity and reliability of equipment operation.
9. The product has passed earthquake resistance, salt spray, and EMC electromagnetic compatibility tests, ensuring safe and reliable opera-tion.

MNS Low-voltage Switchgear Panel, Withdrawable Type

Technical data

Content		Unit	Value
Rated Operating Voltage		V	400
Rated Insulation voltage		V	690
Rated Frequency		Hz	50/60
Main Bus-Bar	Rated Current	A	≤6300
	Rated Short-time Withstand Current	kA	≤100
	Rated Peak Withstand Current	kA	≤220
Distribution Bus	Rated Current	A	≤1300
	Rated Short-time Withstand Current	kA	≤50
	Rated Peak Withstand Current	kA	≤105
Frequency Withstand Vcltage in 1min of Aux Control Loop		kV	1.89
Rated Impulse Withstand voltage		kV	8
Protection Degree		IP	IP40
Electrical Clearance		mm	≥10
Creepage Distance		mm	≥12.5
Overvoltage Level		-	III/IV
Pollution Degree		-	3

Switchgear type

Power Center Cabinet

It adopts fixed installation withdrawable switches with various high-breaking capacity ranging from 630A to 630A, featuring advanced and intelligent circuit breakers.

Drawer type

Assembled with drawers of different sizes, each circuit's main switch adopts high-breaking capacity plastic case circuit breakers or load switches with rotary-type fuse.

Fixed type:

MCC cabinet (Motor Control Center cabinet) functional units are assembled using plug-in plastic case circuit breakers, offering distinct breaking points and advantages such as enhanced safety and reliability.

Drawer/Fixed type:

There are five standard sizes, all based on a height of 8E (200mm).

8E/4: Assemble 4 drawer units in an 8E height space.

8E/2: Assemble 2 drawer units in an 8E height space.

8E: Assemble 1 drawer unit in an 8E height space.

16E: Assemble 1 drawer unit in a 16E (400mm) height space.

24E: Assemble 1 drawer unit in a 24E (600mm) height space.

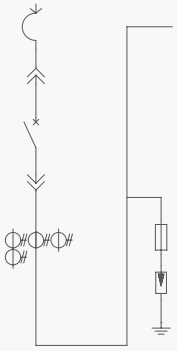
Five types of drawer units can be assembled in a single cabinet or as a mixed assembly. The maximum number of fixed units for a single assembly in a cabinet is shown in Table 1

	8E/4	8E/2	8E	16E	24E
Maximum number of units	26	18	9	4	3

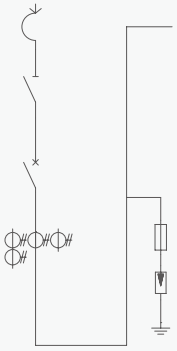
MNS Low-voltage Switchgear Panel, Withdrawable Type

Configuration Collection

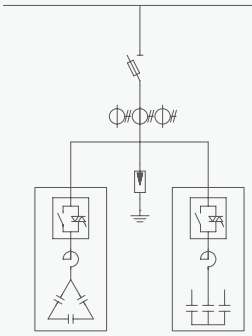
Incoming Panel 1



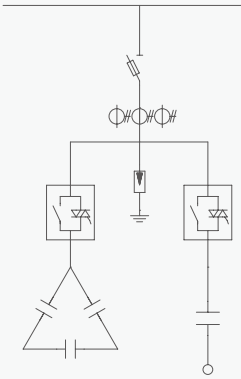
Incoming Panel 2



Capacitor Compensation Panel 1

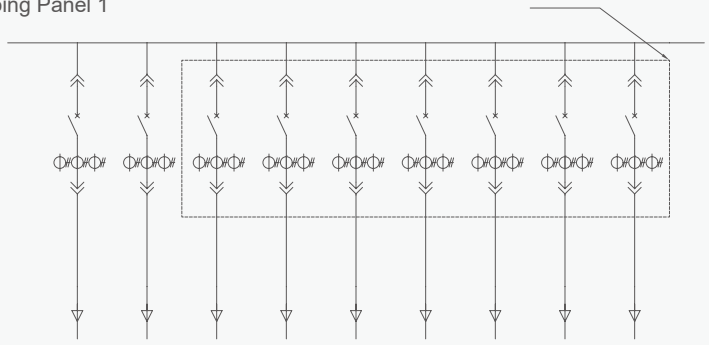


Capacitor Compensation Panel 2



Outgoing Panel 1

Dashed section: circuits can be added or removed as required.



Outgoing Panel 2

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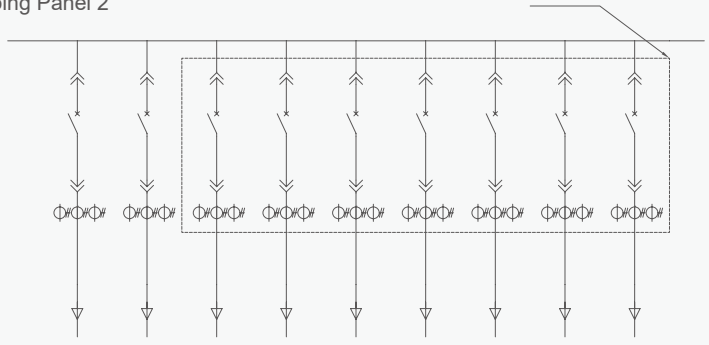
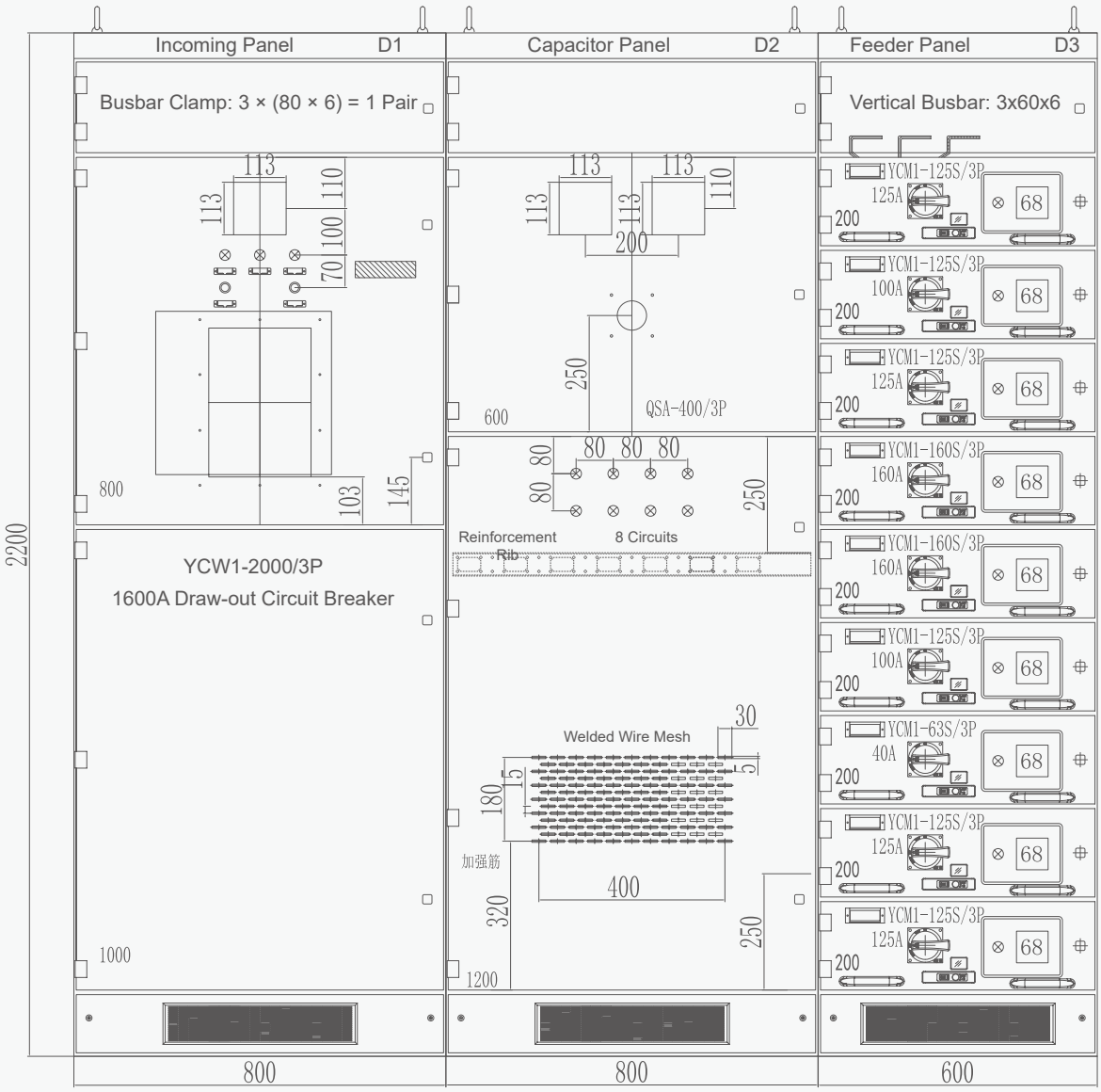


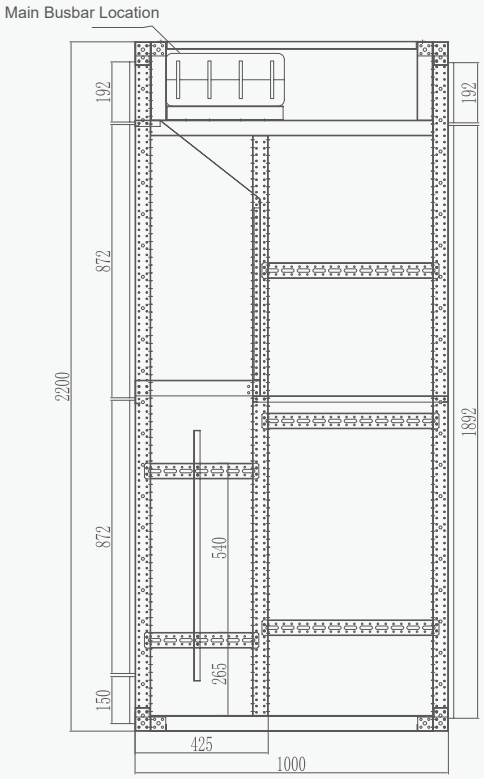
MNS Low-voltage Switchgear Panel, Withdrawable Type

Overall and mounting dimensions (mm)

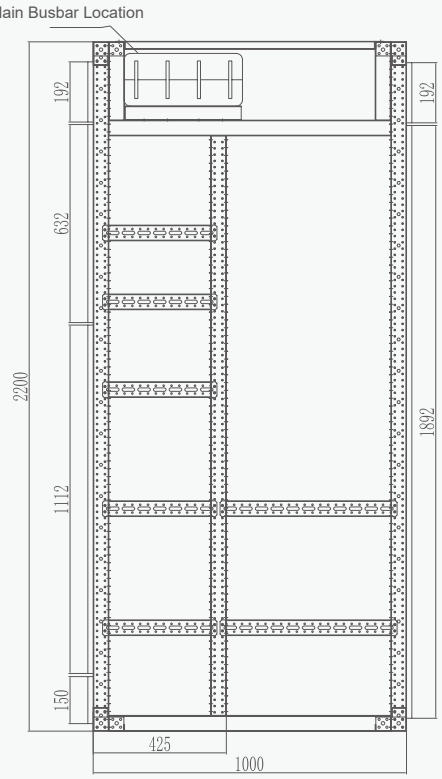


MNS Low-voltage Switchgear Panel, Withdrawable Type

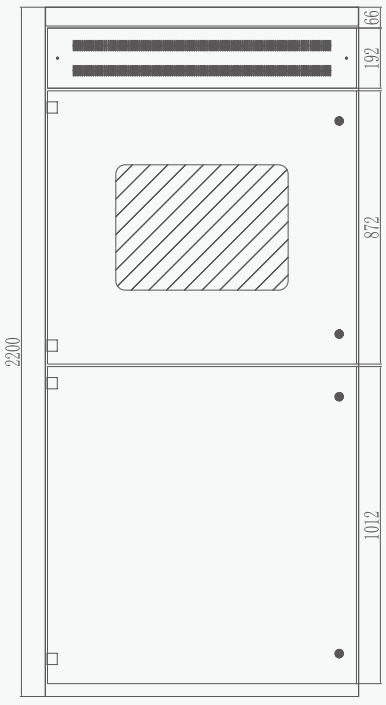
Side View of Incoming Panel



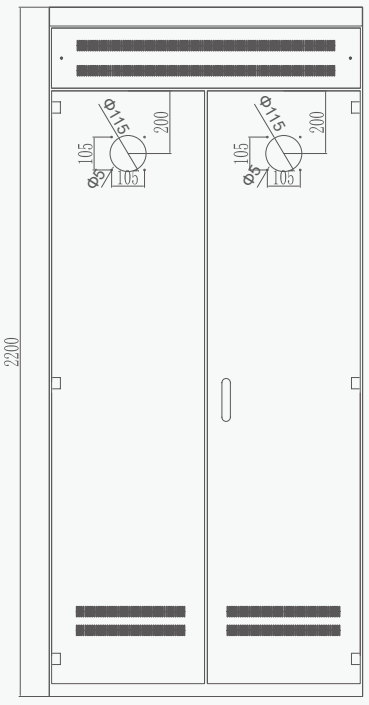
Side View of Capacitor Panel



Rear View of Incoming Panel



Rear View of Capacitor Panel



Low Voltage Switchgear

XL Low Voltage Power Distribution Cabinet

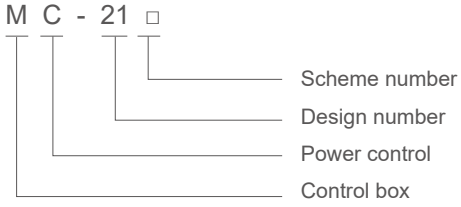
- The XL-21 low voltage power distribution cabinet is suitable for three-phase four-wire systems with AC voltages up to 500V. It is primarily used for power distribution purposes in power plants, industrial and mining enterprises, high-rise buildings, and other occasions.
- The XL-21 low-voltage power distribution cabinet is securely wall-mounted and allows for front-panel maintenance and inspection.

General



XL Low Voltage Power Distribution Cabinet

Type designation



Operating conditions

1. Environmental Conditions 1. Installation Site: Indoor;
2. Altitude: No more than 2000m.
3. Earthquake Intensity: No more than 8 degrees.
4. Ambient Temperature: No more than +40°C and no less than -15°C. Average temperature is no more than +35°C within 24 hours.
5. Relative Humidity: the average daily value is no more than 95%, the averagemonthly value is no more than 90%.
6. Installation locations: without fire, explosion danger, serious pollution, chemical corrosion and violent vibration.

Features

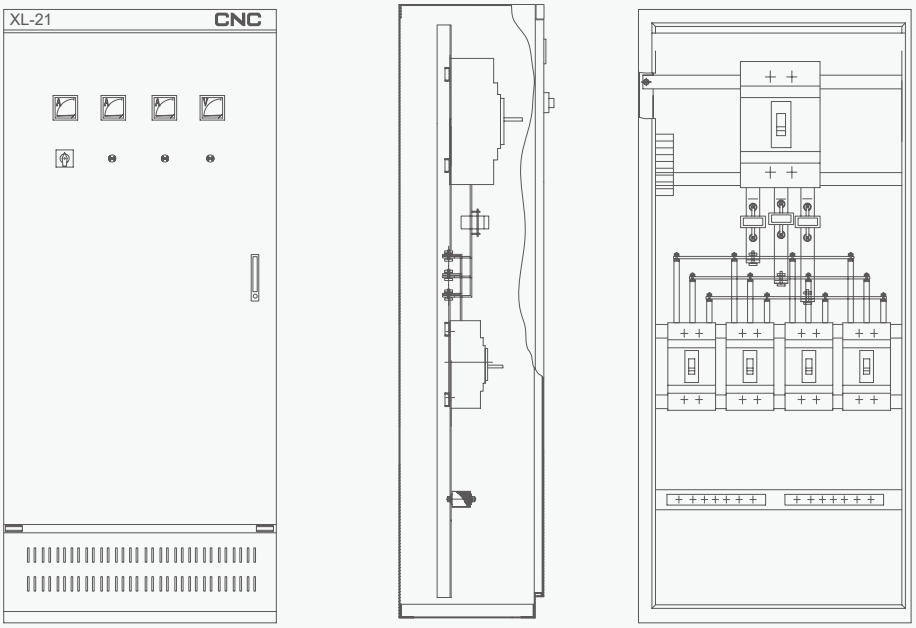
1. Harmonious and beautiful color matching.
2. Standardized design, compact structure, strong versatility
3. The size of the box can be changed according to the demand.
4. The unique characteristic for the logo desilign.
5. Doors can be 18o opened.
6. The electric mounting plate can be dismantle separately.

Technical data

Content	Unit	Value
Rated Operating Voltage	V	400
Rated Insulation Voltage	V	690
Rated Frequency	Hz	50/60
Rated Current1min	A	≤630
Frequency withstand Voltage in 1min cl Aux Control Loop	kV	1.89
Rated Impulse 'Withstand voltage	kV	8
Protection Degree	IP	Ip30
Electrical Clearance	mm	10
Creepage Distance	mm	≥12.5

XL Low Voltage Power Distribution Cabinet

Schematic diagram of structure



*:Sizes are customized as needed

Low Voltage Switchgear

JP Low-Voltage Integrated Distribution Cabinet (JP Cabinet)

The JP series low-voltage integrated distribution cabinet (hereinafter referred to as the JP cabinet) is an outdoor integrated power distribution device installed on the low-voltage side of the distribution transformer. It integrates incoming-line metering, main switch control, outgoing-circuit distribution and reactive power compensation in one unit, and is suitable for Low Voltage Switchgear networks of AC 50 Hz and rated voltage 380 V/220 V, used in the transformer supply area of 10 ~ 500 kVA distribution transformers.

The JP cabinet is divided by function into four independent compartments: an incoming-line metering compartment, a main switch compartment, an outgoing switch compartment and a capacitor compensation compartment, each with a clear layout and easy maintenance. The metering unit and the compensation unit are housed in separate compartments, making it convenient for the power supply authority to manage and seal them in a unified way. The front of the cabinet is provided with an instrument observation window and an operation panel, while the rear is a double-door maintenance structure .

General





JP Low-Voltage Integrated Distribution Cabinet (JP Cabinet)

Type Designation

JP 0.4 □□ ~ □□ KVA / □

- Structural scheme code
- Applicable distribution transformer capacity range (kVA)
- Rated voltage 0.4 kV
- Low-voltage integrated distribution cabinet

Note: /1 and /2 are structural scheme codes for different combinations of outgoing circuits and reactive power compensation; the specific configuration is subject to the technical agreement of the project.

Operating Conditions

1. Installation site: outdoors, free from violent vibration and shock, fire and explosion hazards and severely corrosive gases;
2. Ambient temperature: -25 °C ~ +40 °C (orders for special conditions beyond this range can be negotiated);
3. Altitude: not exceeding 1000 m (customized design for higher altitude can be negotiated);
4. Installation: outdoor floor-mounted or pole-mounted, to be determined by the project.

Technical Data

Item	Parameter
Product name	JP cabinet / low-voltage integrated distribution cabinet
Rated voltage	AC 380V / 220V (0.4kV)
Rated frequency	50Hz
Applicable transformer capacity range	10 ~ 500 kVA (5 specifications in total)
Functional compartments	Incoming-line metering, main switch, outgoing switch and capacitor compensation compartments
Metering unit	Class 0.2S metering current transformer + energy meter (incoming-line metering compartment)
Sampling / protective transformer	Class 0.5 current transformer (sampling)
Reactive power compensation	BZMJ0.45 series self-healing low-voltage shunt capacitors, automatically switched
Main busbar	TMY copper busbar
Enclosure dimensions (reference)	See Section 5, specification list

Note: the table above is the conventional configuration; the degree of protection, the enclosure material (steel sheet / stainless steel / composite material) and the brands of components can be determined according to user requirements, subject to the technical agreement of the order.

JP Low-Voltage Integrated Distribution Cabinet (JP Cabinet)

Specification List

Type	Applicable transformer capacity (kVA)	Enclosure dimensions W×D×H (mm, reference)
JP-0.4-10~80KVA/1	10 ~ 80	1000 × 600 × 1000
JP-0.4-100~160KVA/1	100 ~ 160	1200 × 600 × 1000
JP-0.4-200~315KVA/1	200 ~ 315	1200 × 600 × 1000
JP-0.4-315KVA/2	315	1300 × 600 × 1000
JP-0.4-400~500KVA/2	400 ~ 500	1300 × 600 × 1300

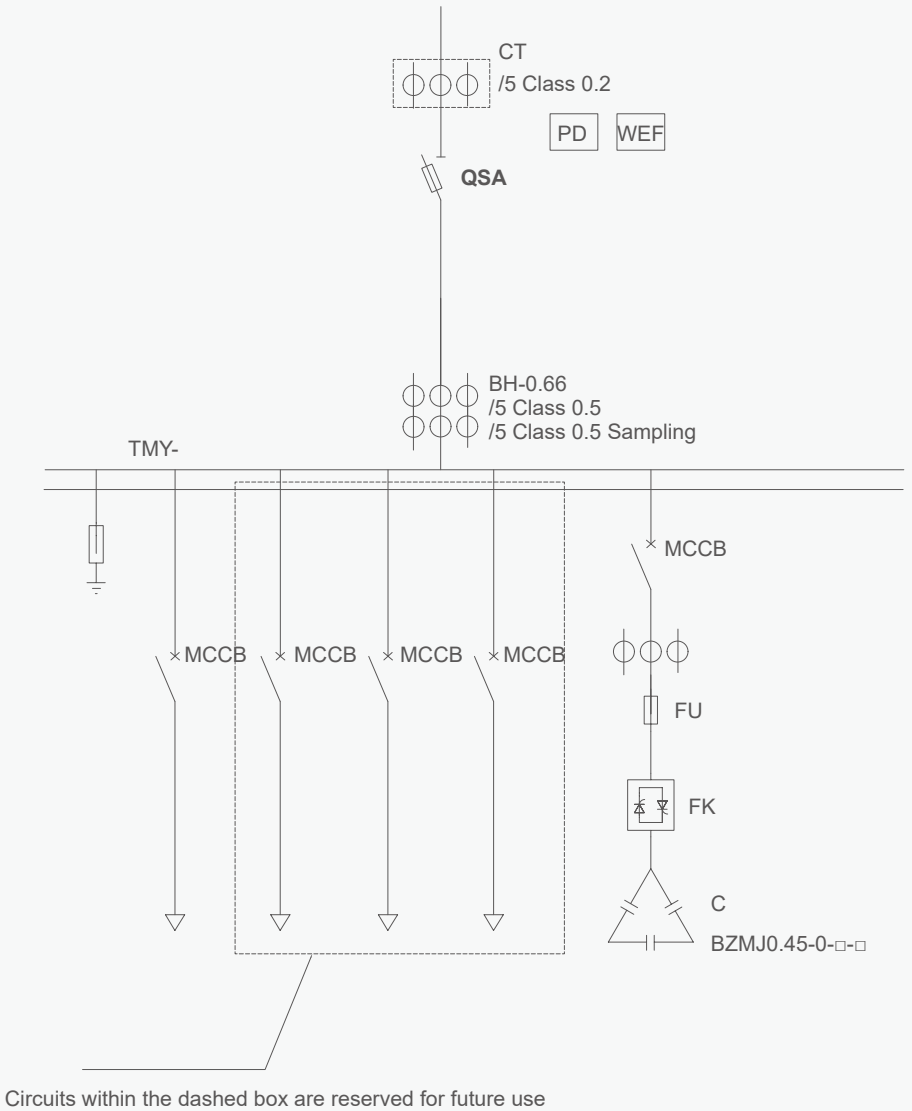
Main Component Configuration (Based on the Primary Scheme Diagram)

Code	Component	Function
QSA	Isolating switch (disconnector)	Incoming-line isolation with a visible break point
MCCB	Moulded-case circuit breaker	Protection of the main switch and each outgoing circuit
CT	Current transformer	Metering (class 0.2S) and sampling (class 0.5)
BH-0.66	Low-voltage current transformer	LV-side measurement and sampling
FU	Fuse	Short-circuit protection of capacitor circuits
FK	Capacitor switching device	Automatic switching of capacitor banks
C	AC contactor	Switching execution of capacitor banks
BZMJ0.45-□-□	Self-healing low-voltage shunt capacitor	Reactive power compensation (0.45 kV)
TMY	Copper busbar	Main-circuit busbar

Note: the circuits in the dashed frames are standby reserved circuits (see the primary scheme diagram); the number and capacity of outgoing circuits are configured according to project requirements.

JP Low-Voltage Integrated Distribution Cabinet (JP Cabinet)

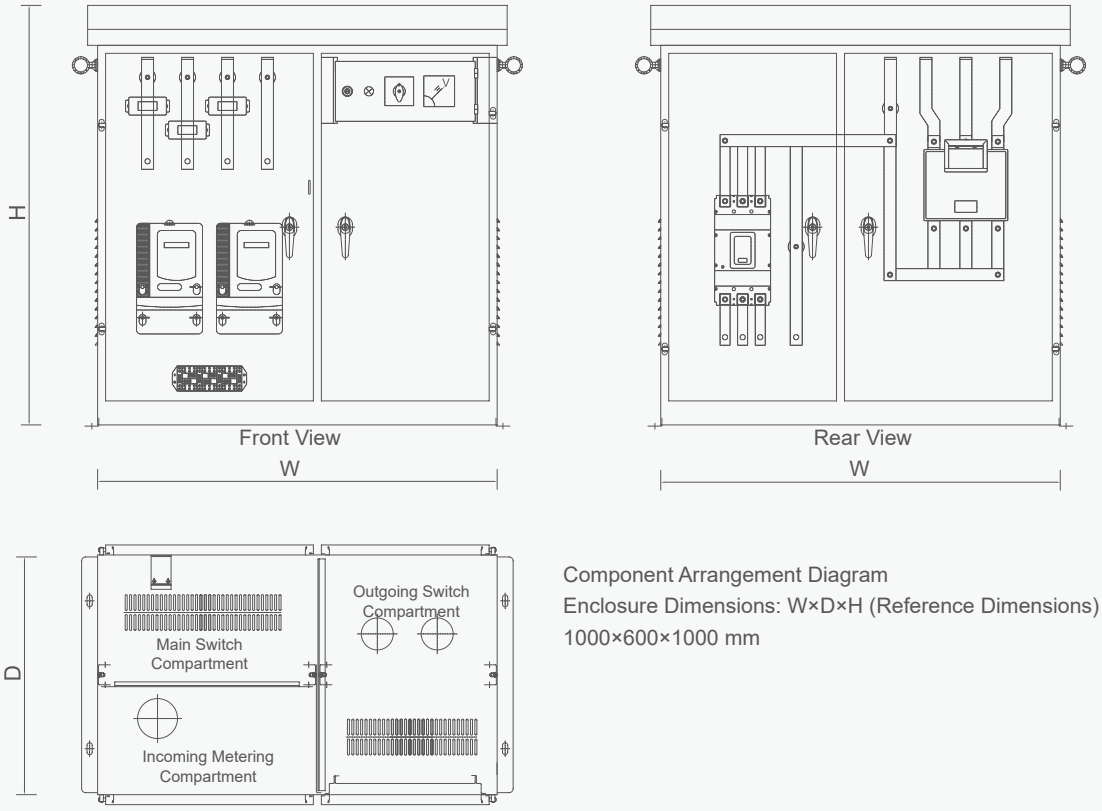
Primary Scheme Diagram



Primary scheme diagram of the JP cabinet (dashed frames = standby reserved circuits)

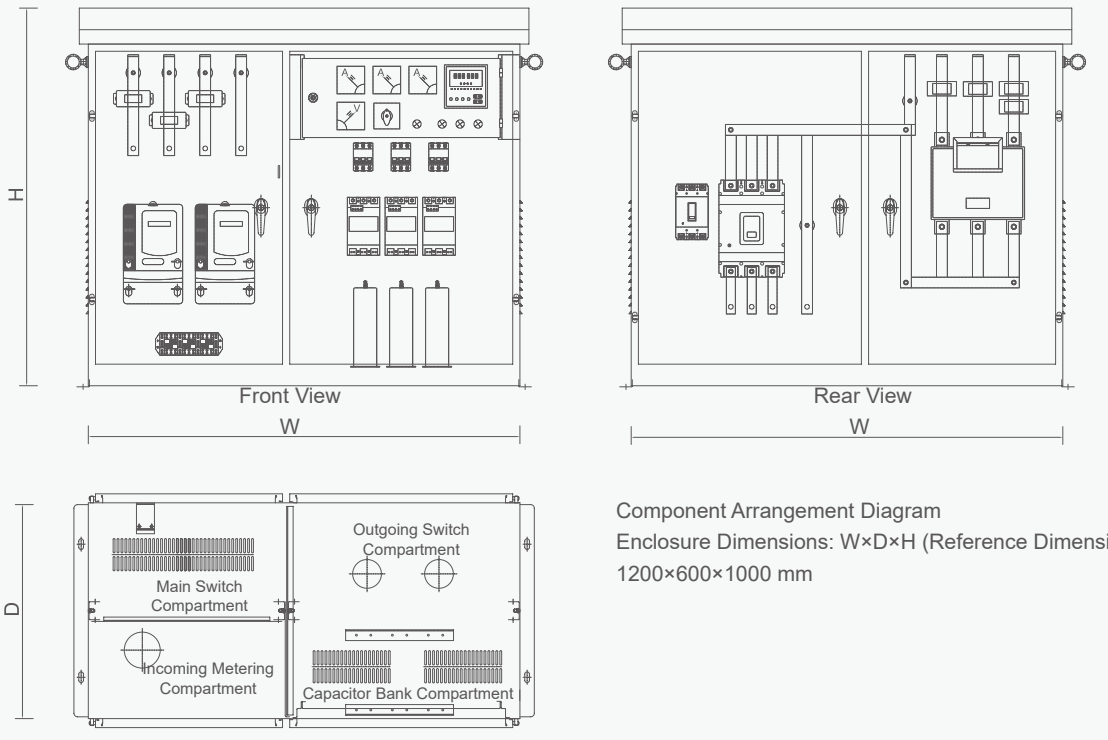
JP Low-Voltage Integrated Distribution Cabinet (JP Cabinet)

Overall and mounting dimensions (mm)



Component Arrangement Diagram
Enclosure Dimensions: W×D×H (Reference Dimensions)
1000×600×1000 mm

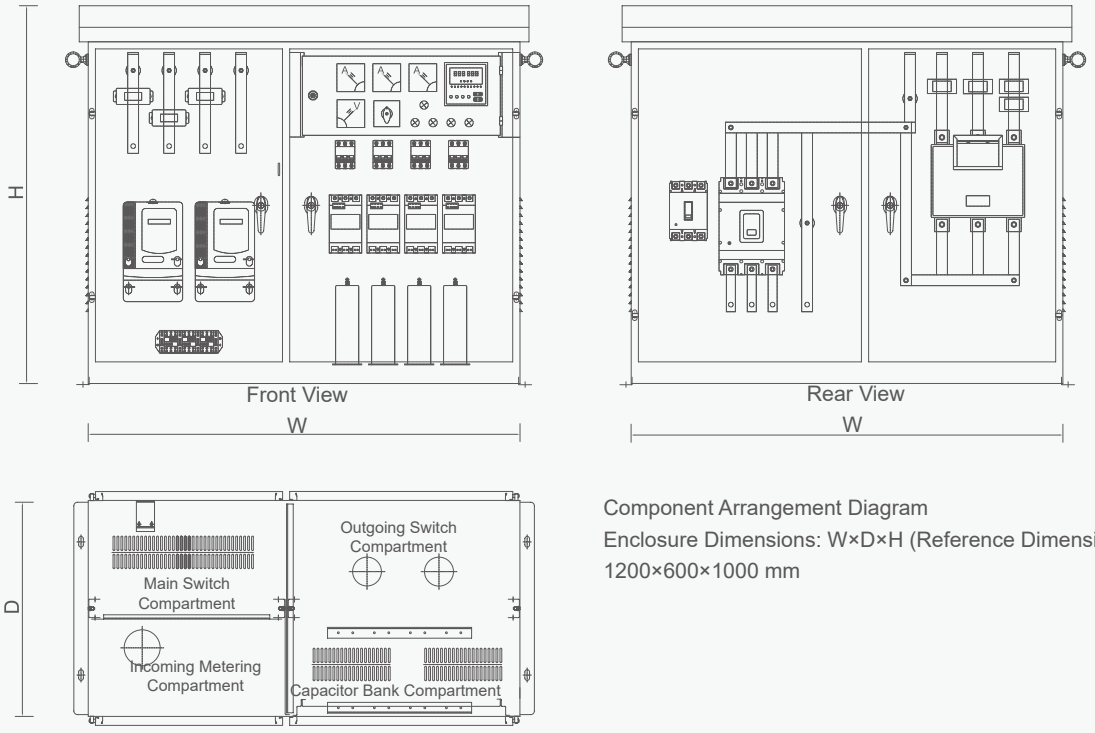
Specification 1: JP-0.4-10~80KVA/1, enclosure 1000 × 600 × 1000 (front view / rear view / compartment layout)



Component Arrangement Diagram
Enclosure Dimensions: W×D×H (Reference Dimensions)
1200×600×1000 mm

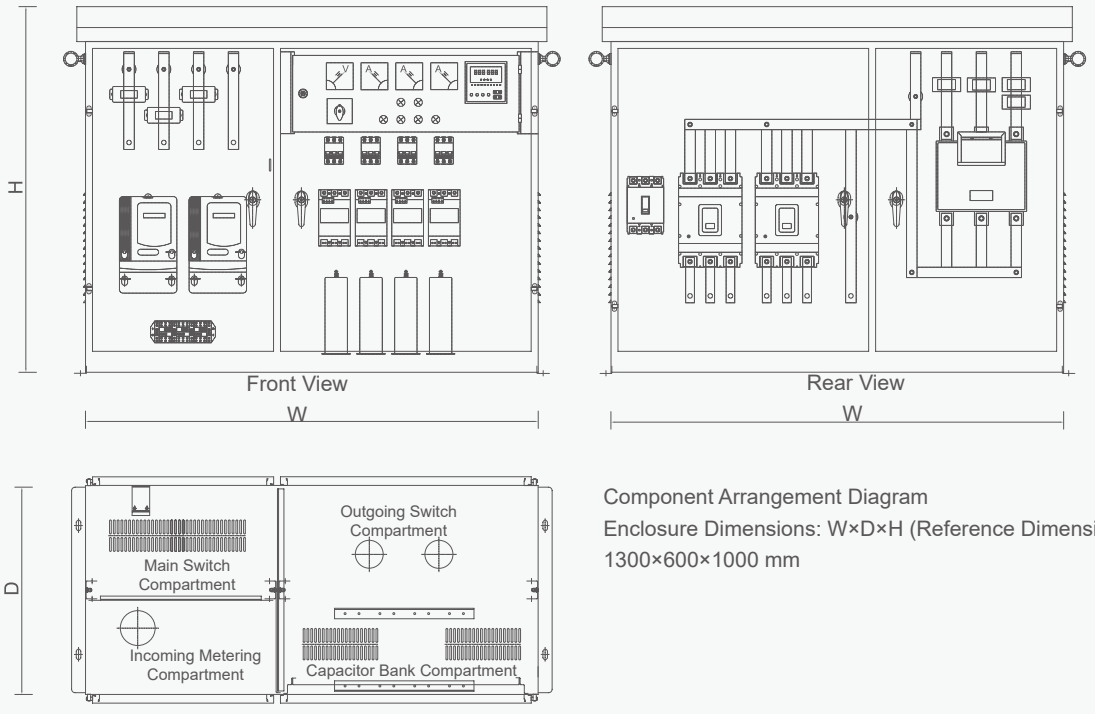
Specification 2: JP-0.4-100~160KVA/1, enclosure 1200 × 600 × 1000 (front view / rear view / compartment layout)

JP Low-Voltage Integrated Distribution Cabinet (JP Cabinet)



Component Arrangement Diagram
Enclosure Dimensions: W×D×H (Reference Dimensions)
1200×600×1000 mm

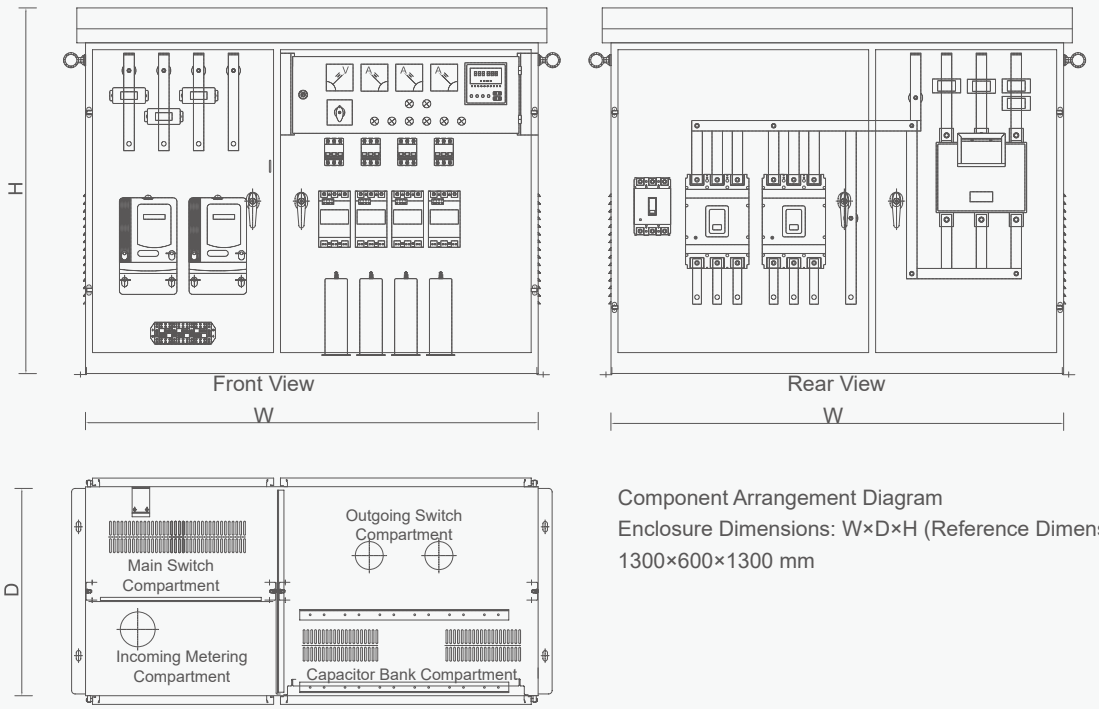
Specification 3: JP-0.4-200~315KVA/1, enclosure 1200 × 600 × 1000 (front view / rear view / compartment layout)



Component Arrangement Diagram
Enclosure Dimensions: W×D×H (Reference Dimensions)
1300×600×1000 mm

Specification 4: JP-0.4-315KVA/2, enclosure 1300 × 600 × 1000 (front view / rear view / compartment layout)

JP Low-Voltage Integrated Distribution Cabinet (JP Cabinet)



Component Arrangement Diagram
Enclosure Dimensions: W×D×H (Reference Dimensions)
1300×600×1300 mm

Specification 5: JP-0.4-400~500KVA/2, enclosure 1300 × 600 × 1300 (front view / rear view / compartment layout)

Low Voltage Switchgear

DFW-0.4 Low-Voltage Cable Branch Box Series

The DFW-0.4 low-voltage cable branch box is a standardized complete-set device for cable-based distribution in 0.4 kV public power networks. It splits one incoming cable into several outgoing cables, or combines several cables into one. As a product that replaces overhead branch lines in the construction and upgrading of urban distribution networks, it is widely used in substations and switching stations, industrial and mining enterprises, along streets, in residential districts, high-rise buildings, airports and other key construction and renovation projects.

According to the function of the node, the series is offered in two configurations:

- With switch - the enclosure is fitted with an incoming HGL load-break switch or an MCCB molded-case circuit breaker and outgoing MCCB molded-case circuit breakers, so that the node provides tapping as well as breaking, protection and isolation functions;
- Without switch - no switch, fuse or protective device is installed in the enclosure. The node consists only of the main busbar copper bars, the branch connections and the cable terminals, forming a fully insulated, sealed and maintenance-free electrical connection point.

General



DFW-0.4 Low-Voltage Cable Branch Box Series

Type Designation

DFW is the general designation of cable branch boxes: D stands for cable (tap) complete-set equipment, F for branch / tap and W for box type (outdoor construction). Both configurations use the same coding format: DFW-0.4 - main busbar current / number of circuits - installation environment - enclosure material - mounting method. The switchless version carries no switch code and is identified as “without switch” on the order.

Position	Meaning	Example
DFW	Fixed code for low-voltage cable branch box	Fixed code
0.4	Voltage class (kV)	0.4
Main busbar current / number of circuits	Main busbar rated current (A) / number of circuits	630/6
Installation environment	Indoor / outdoor	N indoor | W outdoor
Enclosure material	Four materials	L cold-rolled steel sheet | 201 | 304 | S SMC
Mounting method	Wall-mounted / floor-standing	G wall-mounted | D floor-standing

Applicable Standards

Both configurations comply with the standards listed below. The switchgear standards (GB/T 14048.2 / GB/T 14048.3 and IEC 60947-2 / IEC 60947-3) apply to the with-switch configuration only.

Standard No.	Standard title
GB/T 7251.1	Low-voltage switchgear and controlgear assemblies - Part 1: General rules
GB/T 7251.5	Low-voltage switchgear and controlgear assemblies - Part 5: Assemblies for power distribution in public networks
GB/T 14048.1	Low-voltage switchgear and controlgear - Part 1: General rules
GB/T 14048.2	Low-voltage switchgear and controlgear - Part 2: Circuit-breakers (with-switch version)
GB/T 14048.3	Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units (with-switch version)
GB/T 20641	Low-voltage switchgear and controlgear assemblies - General requirements for empty enclosures
GB/T 4208	Degrees of protection provided by enclosures (IP code)
GB 50054	Code for design of low-voltage power distribution
DL/T 5221	Technical code for design of city electric power cable lines
IEC 61439-1 / -5	Low-voltage switchgear and controlgear assemblies - Part 1 General rules / Part 5 Assemblies for power distribution in public networks

Comparison of the Two Configurations

Item	With switch	Without switch
Rated operating voltage	AC 380 / 220 V (0.4 kV)	AC 380 / 220 V (0.4 kV)
Main busbar rated current	125 | 250 | 400 | 630 A	125 | 250 | 400 | 630 A
Number of circuits	2 - 8	2 - 8
Switchgear inside the enclosure	Incoming HGL / MCCB, outgoing MCCB	None
Breaking and protection	Provided (branch level Icu 15 - 65 kA)	Not provided (relies on upstream)
Isolating gap	Yes	No
Main busbar short-time / peak withstand	15 kA / 1 s | 30 kA	15 kA / 1 s | 30 kA
Enclosure material	Cold-rolled steel sheet | 201 | 304 | SMC	Cold-rolled steel sheet | 201 | 304 | SMC
Enclosure sheet thickness	1.5 - 2.0 mm (SMC 4 mm)	1.5 - 2.0 mm (SMC 4 mm)
Installation environment / method	Indoor | outdoor; wall-mounted | floor-standing	Indoor | outdoor; wall-mounted | floor-standing
Degree of protection	Indoor IP34D - IP44; outdoor IP44 - IP54	Indoor IP34D - IP44; outdoor IP44 - IP54

DFW-0.4 Low-Voltage Cable Branch Box Series

Normal Service Conditions

Environmental parameter	Technical requirement
Ambient temperature	-25 °C to +40 °C (standard); SMC enclosures and wide-temperature components extend this to -40 °C to +60 °C
Relative humidity at maximum temperature	≤50 % at +40 °C; a higher relative humidity is permitted at lower temperatures (up to 90 % at +20 °C)
Altitude	≤2000 m; above this, the insulation level and temperature rise shall be corrected in accordance with GB/T 7251.1
Pollution degree	Degree 3; a higher degree may be selected for heavily polluted areas with a correspondingly increased creepage distance
Seismic capability	Seismic intensity not exceeding 8
Installation inclination	Site inclination not greater than 3° (the foundation shall be levelled)
Degree of protection	Indoor IP34D - IP44; outdoor IP44 - IP65 (optional)
Installation site	Free from fire and explosion hazard, severe pollution, chemical corrosion and heavy vibration
Installation environment	Indoor (no direct sun or rain) or outdoor (continuous open-air operation)
Mounting method	Wall-mounted or floor-standing, selected according to enclosure size and load-bearing conditions

Special Environmental Conditions and Countermeasures

Special environment	Main risk	Countermeasure
Coastal salt-fog areas	Corrosion of metal parts, increased contact resistance	Prefer a 304 stainless steel or SMC enclosure; thicker plating on hardware; salt-fog test ≥1000 h
Chemical corrosion areas	Acid and alkali mist attacking the enclosure and insulation	Prefer an SMC enclosure; corrosion-resistant sealing materials; reinforced sealing of cable entry / exit holes
High-humidity, rainy areas	Condensation inside the enclosure, reduced insulation	Use an SMC enclosure (condensation-resistant); fit a dehumidifying heater or a breathing-type anti-condensation structure
Low-lying, waterlogged areas	Immersion of the enclosure, damp cable terminations at the bottom	Raise the degree of protection to IP65; raise a floor-standing foundation ≥200 mm; seal cable entries
High-altitude areas	Reduced external insulation margin and heat dissipation	Increase clearances and creepage distances; correct the rated current using the derating curve
Areas of strong sunlight and high temperature	Additional temperature rise inside the enclosure, derating of components and busbars	Light-coloured enclosure surface; add a convection cooling hood; correct the current-carrying capacity by temperature coefficient
Heavily polluted outdoor areas	Surface flashover, pollution flashover	Increase the creepage distance to ≥14 mm; fully insulated sealed construction; periodic cleaning
Coastal typhoon areas	Structural deformation of the enclosure, door opening	Reinforced ribs in the enclosure; strengthened door locks and hinges; wind-load verification of the foundation and anchor bolts
Areas requiring no scrap value	Theft of copper bars and enclosure	Prefer an SMC composite enclosure (no scrap value)
Vibrating and seismic areas	Loosening of bolted joints, rising contact resistance	Use lock nuts or disc spring washers; periodic retightening to the specified torque; increase bracket stiffness

DFW-0.4 Low-Voltage Cable Branch Box Series

General Structure and Differences between the Two Versions

Structural part	With switch	Without switch
Main busbar	Provided (size selected according to current)	Provided (size selected according to current)
Incoming unit	HGL load-break switch or MCCB molded-case circuit breaker	None; the incoming cable is crimped directly onto the busbar via terminals
Outgoing unit	MCCB molded-case circuit breaker for each circuit	None; outgoing cables are crimped directly onto the busbar via terminals
Operating mechanism	Provided (switch handle / operating hole)	None
Branch connection	Busbar lapped onto the switch incoming terminal	Lapped branch bar / T-type cable clamp / one-piece branch bar
Protective device	Provided (MCCB trip unit)	None
Number of live parts in the enclosure	Relatively many (including switch contacts and terminals)	Minimal (busbar and terminals only)
Prerequisite for maintenance work	Work after local isolation (operate to the regulations)	The upstream supply must be switched off, voltage verified and earthing leads applied

Installation Environment: Indoor and Outdoor

Item	Indoor installation	Outdoor installation
Direct sun and rain	None	Yes; temperature-rise build-up and sealing must be considered
Ambient temperature	-5 °C to +40 °C (typical for a distribution room)	-25 °C to +40 °C, extendable to -40 °C to +60 °C
Humidity and condensation	Relatively dry, low condensation risk	High humidity and large temperature difference, high condensation risk
Pollution and corrosion	Slight	Varies widely by region (salt fog, chemicals, dust)
Required degree of protection	IP34D - IP44	IP44 - IP54
Ingress protection	Protection against solid foreign objects and splashing water is sufficient	Protection against rain, dust and small animals, and against theft, is required
Recommended enclosure material	Cold-rolled steel sheet (economical)	201 / 304 stainless steel, or SMC
Anti-condensation measures	Generally not required	A dehumidifier is recommended, or choose an SMC enclosure
Installation foundation	Indoor floor or wall is sufficient	Concrete foundation, ≥200 mm above ground
Maintenance convenience	Good (maintenance from inside the distribution room)	Fair (on-site opening of the enclosure)
Cost	Low	High (upgraded material and degree of protection)

DFW-0.4 Low-Voltage Cable Branch Box Series

9 Complete-Unit Main Technical Data (Comparison of the Two Versions)

Item	Unit	With switch	Without switch
Rated operating voltage	V	AC 380 / 220	AC 380 / 220
Rated insulation voltage	V	AC 660 (800 optional)	AC 660 (800 optional)
Rated frequency	Hz	50 (60 optional)	50 (60 optional)
Main busbar rated current	A	125 | 250 | 400 | 630	125 | 250 | 400 | 630
Main busbar short-time withstand current	kA / s	15 / 1	15 / 1
Main busbar peak withstand current	kA	30	30
Number of circuits	circuits	2 - 8	2 - 8
Short-circuit breaking capacity (Icu)	kA	25 | 35 | 50 | 65	None (cleared upstream)
Switchgear configuration	-	Incoming HGL / MCCB + outgoing MCCB	None
1 min power-frequency withstand voltage	V	2500 - 3000	2500 - 3000
Electrical clearance	mm	≥10	≥10
Creepage distance	mm	≥12.5 (≥14 in heavily polluted areas)	≥12.5 (≥14 in heavily polluted areas)
Class of protection against electric shock	-	Class I	Class I
Enclosure degree of protection	-	Indoor IP34D - IP44; outdoor IP44 - IP65	Indoor IP34D - IP44; outdoor IP44 - IP65
Earthing bolt size	-	M10	M10
Ambient temperature	°C	-25 to +40 (extendable to -40 to +60)	-25 to +40 (extendable to -40 to +60)
Altitude	m	≤2000	≤2000

Switchgear Data

HGL Load-Break Switch (Incoming) Data

Item	Unit	Size A	Size B	Size C	Size D	Size E
Conventional free-air thermal current Ith	A	63	100	160	250	630
Covered rated current In	A	40 / 63	80 / 100	125 / 160	200 / 250	315 - 630
Rated insulation voltage Ui	V	690	690	690	690	1000
Rated impulse withstand voltage Uimp	kV	8	8	8	6	6
Rated operational current Ie (380 V, AC-23B)	A	40	80	125	200	315 - 630
Rated short-time withstand current Icw (1 s)	kA	2	2	6	9	12.6
Rated short-circuit making capacity Icm	kA peak	2.84	2.84	9.2	15.3	25.2
Motor power P (380 V)	kW	18.5	40	80	132	160 - 315
Mechanical life	operations	1700	1700	1400	1400	800
Electrical life	operations	300	300	200	200	200

With-Switch Version: MCCB Molded-Case Circuit Breaker Data

Item	Unit	Incoming switch	Outgoing switch (branch)
Frame size	A	125 | 160 | 250 | 400 | 630	125 | 160 | 250 | 400
Rated current In	A	125 - 630	63 - 400
Rated ultimate short-circuit breaking capacity Icu	kA	25 | 35 | 50 | 65	15 | 25 | 35 | 50
Trip unit type	-	Thermal-magnetic / electronic (L / S / I three-stage optional)	Thermal-magnetic (residual current protection optional)
Utilization category	-	Category A (Category B with Icw optional)	Category A
Mechanical life	operations	4000 - 7000	4000 - 7000
Electrical life	operations	1000 - 2000	1000 - 2000

DFW-0.4 Low-Voltage Cable Branch Box Series

Without-Switch Version: Busbar and Cable Terminal Data

Main busbar current	Incoming / outgoing cable cross-section (copper)	Busbar size	Terminal type	Fastening bolt / torque (typical)
125 A	16 - 50 mm²	30×3	DT copper terminal	M8 / 20 N·m
250 A	35 - 120 mm²	40×4	DT copper terminal	M10 / 40 N·m
400 A	95 - 185 mm²	40×4	DT / DTG copper terminal	M10 - M12 / 40 - 60 N·m
630 A	150 - 240 mm²	50×5	DT / DTG copper terminal	M12 / 60 N·m
Aluminium cable connection	Selected for equal current-carrying capacity	As above	DTL copper-aluminium transition terminal	As above

Enclosure Material Data

Item	Cold-rolled steel sheet	201 stainless steel sheet	304 stainless steel sheet	SMC composite
Sheet thickness	1.5 - 2.0 mm	1.5 - 2.0 mm	1.5 - 2.0 mm	4 mm (one-piece moulded)
Forming process	Bending + electrostatic powder coating	Bending + brushing	Bending + brushing / passivation	High-temperature moulding
Surface colour	Customizable (army green / camel grey / grey)	Natural metal / coated	Natural metal / coated	Standard grey (customizable)
Salt-fog test	≤500 h	500 - 1000 h	≥1000 h	≥1000 h
Outdoor life (reference)	10 - 15 years	15 - 20 years	25 - 30 years	20 - 30 years
Relative cost	1.0	1.6 - 2.0	2.5 - 3.2	1.8 - 2.6

Degree of Protection and Tests

Item	Data
Indoor degree of protection	IP34D - IP44
Outdoor degree of protection	IP44 (standard) - IP54 (optional)
1 min power-frequency withstand voltage	2500 - 3000 V
Insulation resistance	≥2×10⁴ MΩ (500 V DC)
Main circuit resistance	In accordance with the design value and the manufacturer's specification
Mechanical load (door surface / hinge)	>980 N / >200 N
Earthing resistance	≤4 Ω (design requirement)

Dimension Range

Housing dimensions of the SMC enclosure (W × D × H).

Housing designation	W × D × H (mm)	Mounting method
Wall-mounted branch box housing	600 × 350 × 1000	Wall-mounted
Wall-mounted branch box housing	800 × 350 × 1000	Wall-mounted
Wall-mounted branch box housing	1000 × 350 × 1000	Wall-mounted
Wall-mounted branch box housing	1200 × 350 × 1000	Wall-mounted
Wall-mounted branch box housing	1400 × 350 × 1000	Wall-mounted
Wall-mounted branch box housing	1600 × 350 × 1000	Wall-mounted
Floor-standing branch box housing	600 × 350 × 1200	Floor-standing
Floor-standing branch box housing	800 × 350 × 1200	Floor-standing
Floor-standing branch box housing	1000 × 350 × 1200	Floor-standing
Floor-standing branch box housing	1200 × 350 × 1200	Floor-standing
Floor-standing branch box housing	1400 × 350 × 1250	Floor-standing
Floor-standing branch box housing	1600 × 350 × 1250	Floor-standing

DFW-0.4 Low-Voltage Cable Branch Box Series

Foundation and Installation Layout Requirements

- **Floor-standing foundation:** the top of the concrete foundation shall be ≥200 mm above ground; cable holes and ducts shall be reserved at the cable entry and exit positions; the foundation shall be levelled, with an inclination of ≤3°;
- **Wall-mounted installation:** the wall must be load-bearing; on masonry walls use embedded steel plates or through-wall bolts; the bottom of the enclosure shall be 1.2 - 1.5 m above the floor;
- **Access clearance:** leave an operating and maintenance passage in front of the enclosure of not less than the door width + 0.6 m; enclosures with front and rear doors require maintenance space on both sides;
- **Group arrangement:** when several enclosures are arranged as a group, use a common foundation level and connect the enclosures with busbars at the enclosure top;
- **Earthing arrangement:** the main earthing point of the enclosure (M10 bolt) shall be connected to the earthing grid nearby, with an earthing resistance of ≤4 Ω;
- **Environmental isolation:** outdoor floor-standing enclosures should be surrounded by a fence or warning signs; drainage shall be provided in low-lying locations;
- **Warning signs:** the door of the without-switch version shall be marked “no switch, circuits live, live working strictly prohibited” together with the circuit numbers.

Ordering Information

Information Required for Ordering

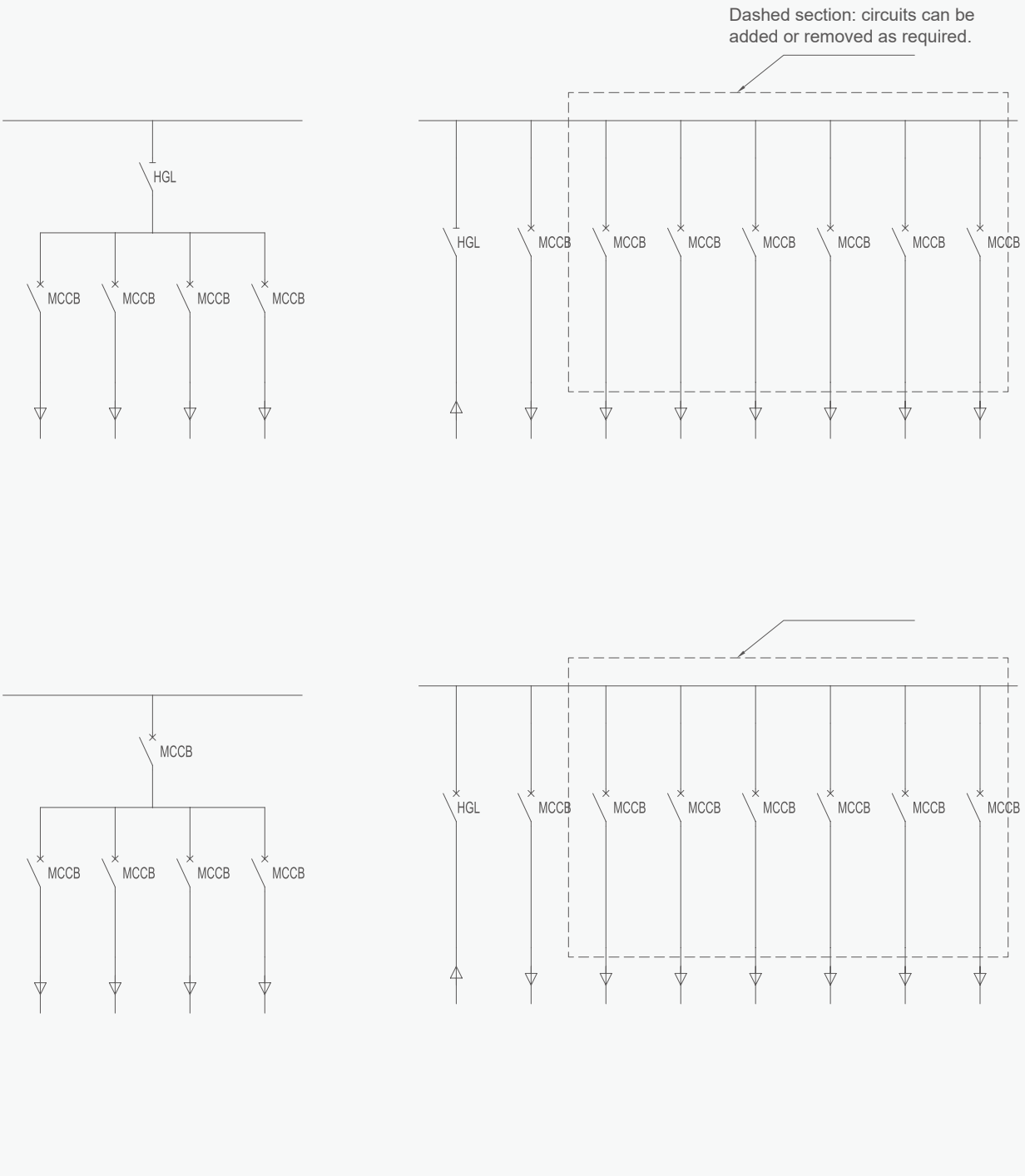
Information	Remarks
Product type and version	DFW-0.4 - main busbar current / number of circuits - installation environment - enclosure material - mounting method; state “with switch / without switch”
Rated voltage / frequency	0.4 kV, 50 Hz (or 60 Hz)
Main busbar rated current	125 / 250 / 400 / 630 A
Number of circuits and incoming / outgoing allocation	E.g. one incoming and three outgoing, two incoming and four outgoing; state the circuit numbers
Incoming switch type and size (with-switch version)	HGL load-break switch or MCCB molded-case circuit breaker, with frame size and Icu
Outgoing switch size (with-switch version)	Rated current and Icu for each circuit
Cable terminal type (without-switch version)	DT / DTG copper terminal or DTL copper-aluminium transition terminal (mandatory for aluminium cable connections)
Number of spare circuits	1 - 2 circuits recommended
Cable type, number of cores and nominal cross-section	Including the cable outer diameter (to determine the cable entry / exit hole size)
System short-circuit current level	To verify the breaking capacity (with-switch version) and the busbar short-time withstand (without-switch version)
Upstream protection configuration	Upstream switch type, rated current and settings (for discrimination verification)
System earthing system	TN-S / TN-C-S / TT (affects the number of poles and the PE busbar configuration)
Enclosure material and colour	Cold-rolled steel sheet / 201 / 304 / SMC; colour selected from the colour chart
Installation environment and mounting method	Indoor / outdoor; wall-mounted / floor-standing
Degree of protection required	Indoor IP34D - IP44; outdoor IP44 - IP65
Metering, monitoring and anti-condensation requirements	Whether ammeters, live-line indicators, fault indicators, heating and dehumidifying devices are required
Foundation, transport and marking requirements	A foundation drawing is required for floor-standing units; including circuit numbering, warning signs and delivery location

Type Designation Examples

Designation example	Meaning
DFW-0.4-250/4-N-L-G (with switch)	0.4 kV, 250 A, 4 circuits, indoor, cold-rolled steel sheet, wall-mounted, HGL incoming + MCCB outgoing
DFW-0.4-250/4-N-L-G (without switch)	Same rating and enclosure; busbars and cable terminals only inside the enclosure
DFW-0.4-400/5-W-201-D (with switch)	0.4 kV, 400 A, 5 circuits, outdoor, 201 stainless steel, floor-standing, MCCB incoming
DFW-0.4-400/5-W-S-D (without switch)	0.4 kV, 400 A, 5 circuits, outdoor, SMC, floor-standing, no switch
DFW-0.4-630/8-W-304-D (with switch)	0.4 kV, 630 A, 8 circuits, outdoor, 304 stainless steel, floor-standing, dual-supply incoming

DFW-0.4 Low-Voltage Cable Branch Box Series

Configuration Collection

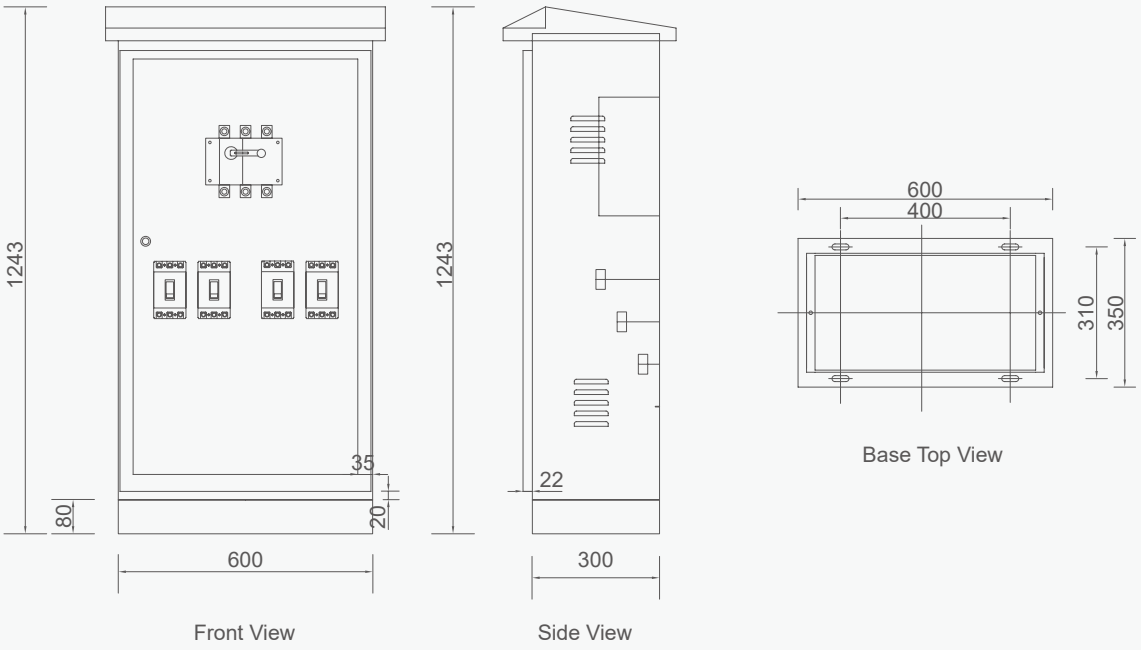


DFW-0.4 Low-Voltage Cable Branch Box Series

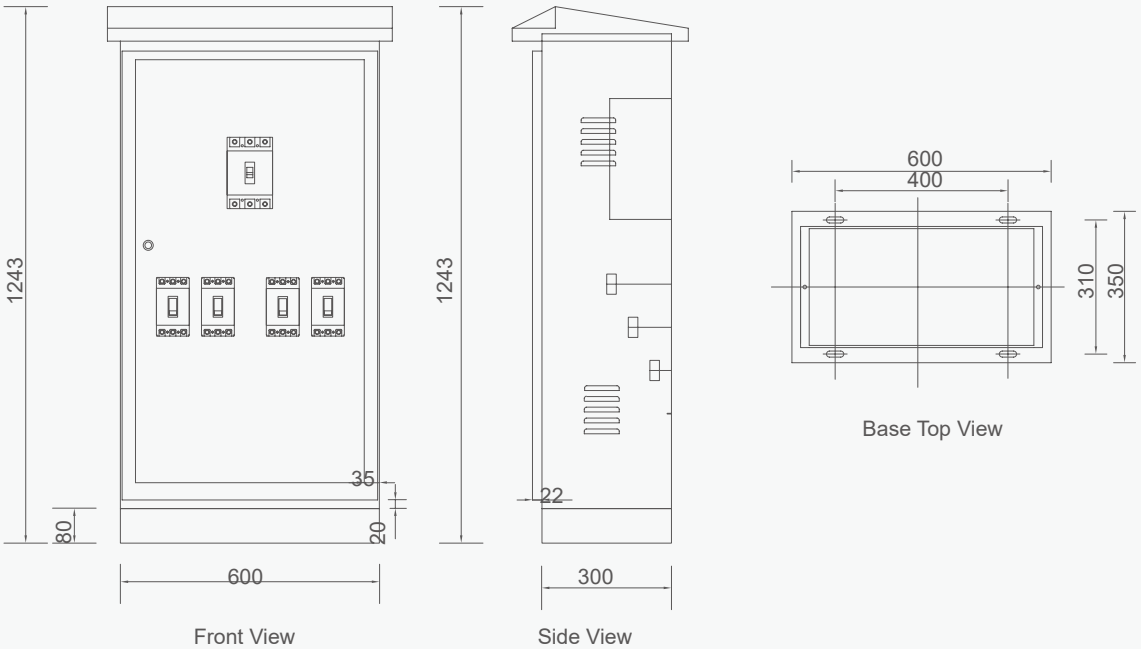
Overall and mounting dimensions (mm)

DFW-0.4 Metal Enclosure

Option 1: Incoming Isolator + Outgoing MCCB

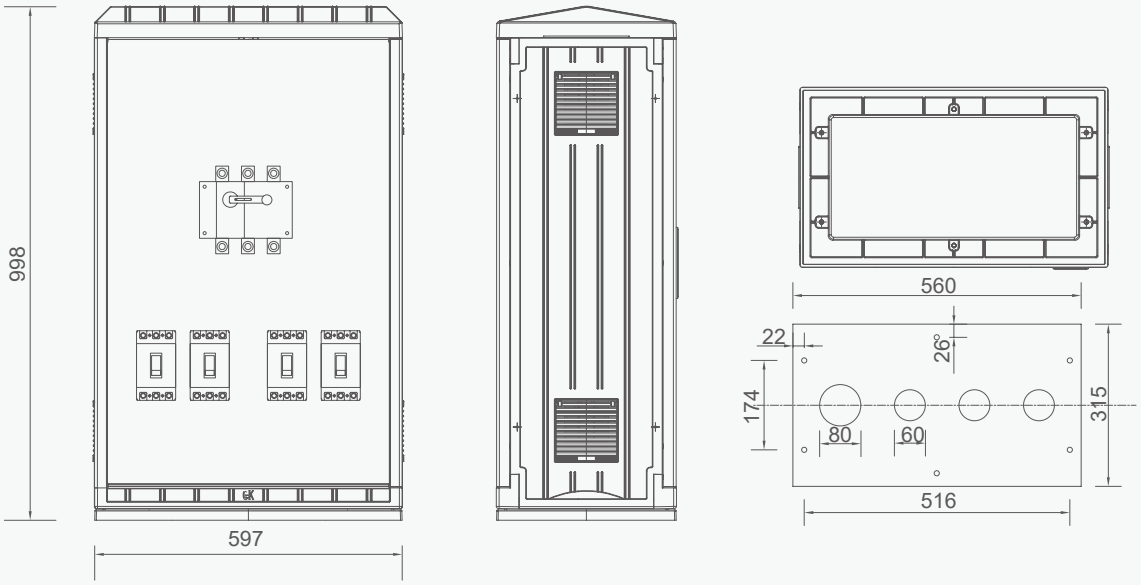


Option 2: Incoming MCCB + Outgoing MCCB



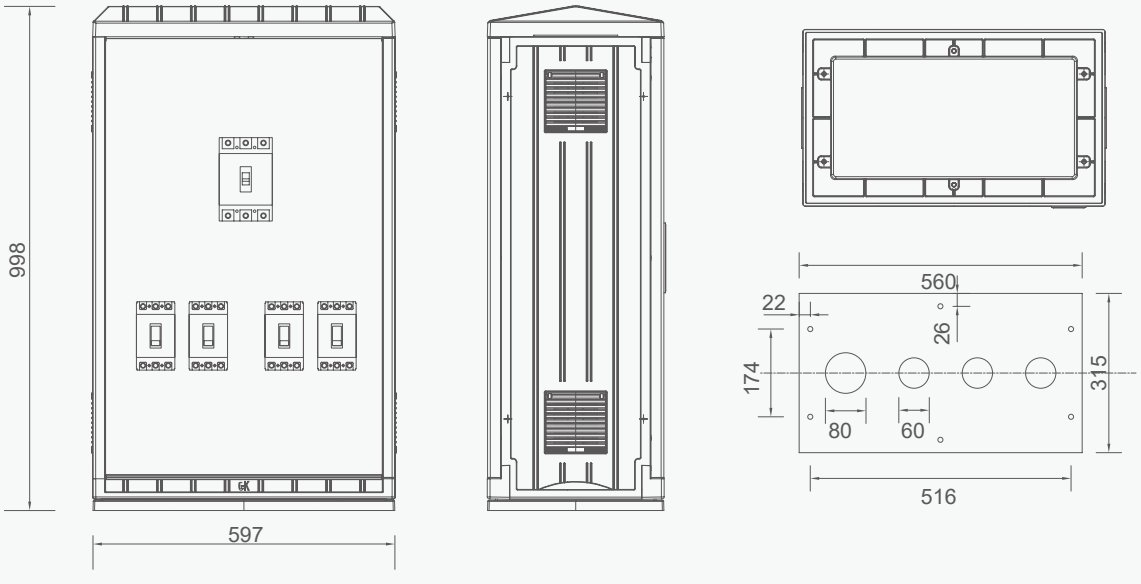
DFW-0.4 Low-Voltage Cable Branch Box Series

Option 1: Incoming Isolator + Outgoing MCCB



Front View　　Side View　　Base Top View

Option 2: Incoming MCCB + Outgoing MCCB



Front View　　Side View　　Base Top View

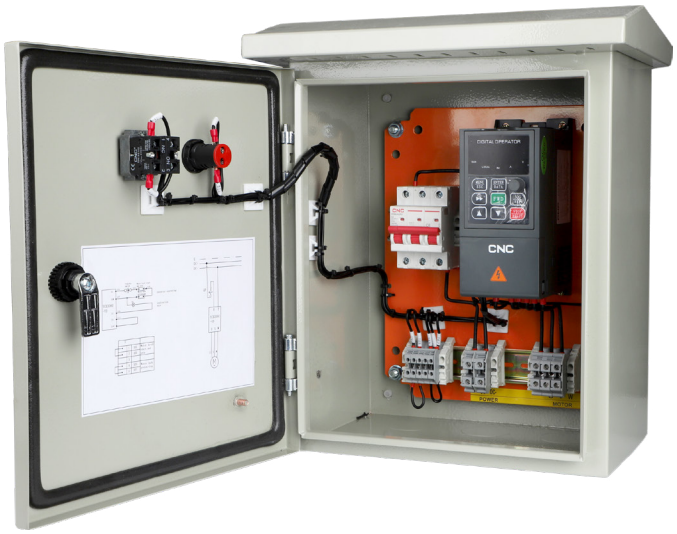
Low Voltage Switchgear

JXF Low-voltage Integrated Distribution Box

- Application: mainly applicable in places with high automation and need to communicate with computer, like large power station and petro-chemistry system, as the low voltage distribution device of the distribution and motor controlling, and reactive power compensation in power system.
- Protection degree IP30, IP40. Bus type: three phase four wires, three phase five wires. Operation type: in-place, long-distance and automatic.
- Standard: IEC60439-1

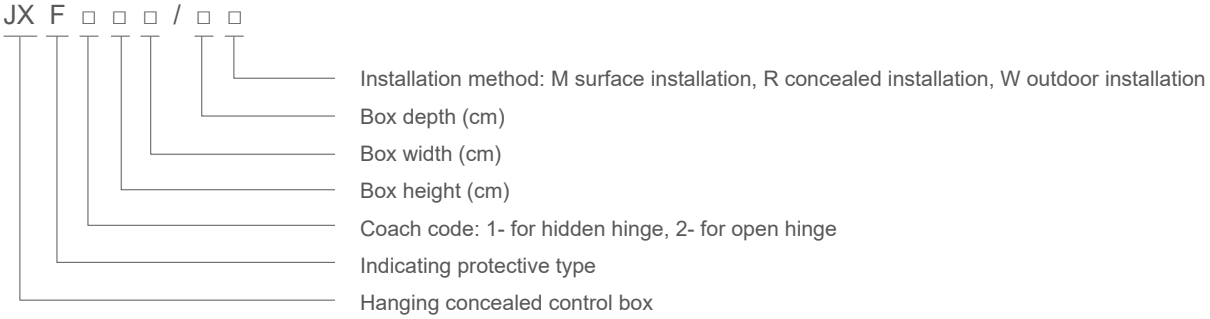
General





JXF Low-voltage Integrated Distribution Box

Type designation



Operating conditions

1. Installation Site: Indoor or outdoor;
2. Attitude: No more than 2000m.
3. Earthquake Intensity: No more than 8 degrees.
4. Ambient Temperature: No more than +40°C and no less than -25°C. Average temperature is no more than +35°C within 24 hours.
5. Relative Humidity: the average daily value is no more than 95%, the averagemonthly value is no more than 90%.
6. Installation locations: without fire, explosion danger, serious pollution, chemical corrosion and violent vibration.

Features

1. Harmonious and beautiful color matching.
2. Standardized design, compact structure, strong versatility
3. The size of the box can be changed according to the demand.
4. The electric mounting plate can be detachable separately.
5. It has dozens of single line scheme numbers or derivative scheme numbersfor choice and wide range of application.

Technical data

Content	Unit	Value
Rated Operating Voltage	V	380
Rated Insulation Voltage	V	500
Rated Frequency	Hz	50/60
Rated Current1min	A	≤250
Frequency withstand Voltage in 1min cl Aux Control Loop	kV	1.89
Rated Impulse 'Withstand voltage	kV	2.5
Protection Degree	IP	IP30
Electrical Clearance	mm	≥3
Creepage Distance	mm	≥10

*:Sizes are customized as needed

DELIVER POWER FOR BETTER LIFE!

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