引言 Introduction

产品特点 Characteristics

安全性 Safety

- 各功能隔室完全独立;
- 高压部件完全密封;
- 高压部件不受外界污秽影响;
- 绝缘性能不受现场海拔高度影响;
- 完善的联锁、闭锁及可靠的抗内部燃弧设计, 确保运行人员安全。

- Each functional compartment is completely independent
- High-voltage components are completely sealed
- High-voltage components are not affected by external pollution
- Insulation performance is not affected by site altitude
- Perfect interlock, latch and reliable internal anti-arc design to ensure safety of operators

小型化 Compact

- 设计紧凑, 能更有效的利用空间及节约城市用地;
- 与传统开关柜相比, 节省空间最多达 70%。

- Compact design can use space more effectively and save urban land
- Compared with traditional switchgear, it can save up to 70% of space

经济性 Economical

- 更方便的操作;
- 更长的使用寿命, 并不受环境影响;
- 更少的维护要求, 意味着最大程度地节省了运行费用;
- 使用寿命比其他开关柜更长, 因而节省了新的投资;
- 基建用地及空间的节省使得总投资及运行费用大大降低;
- 环境友好, 使用材料可回收。

- Convenient operation
- Long service life, not affected by ambient environment
- Low maintenance requirements for saving operating costs
- Service life is longer than other switchgears, thus saving new investment
- Saving of infrastructure land and space has greatly reduced total investment and operating costs
- Environmentally friendly. The materials used can be recycled

高效性 High Efficiency

- 模块化设计, 方案灵活;
- 扩展方式灵活, 可向两边任意扩展;
- 插接式设计, 可快速安装, 现场无需气体操作;
- 操作界面友好, 易于现场操作。

- Modular design and flexible scheme
- Clever expansion method. Can be expanded to both sides
- Plug-in design, quick installation, no gas operation on site
- Friendly operation interface, easy on-site operation

典型应用 Typical Application

XGNS2 作为气体绝缘单母线或双母线系统的一次配电设备，主要应用于：

- 变电站和配电站；
- 基础设施，如楼宇；
- 政府机关；
- 钢铁厂；
- 轨道交通；
- 水处理；
- 其他满足电气参数及方案要求的行业。

XGNS2 is used as a primary power distribution equipment of gas insulated single busbar or double busbar system, mainly used in:

- Substation and distribution station
- Infrastructure, such as buildings
- Government agencies
- Steel plant
- Rail traffic
- Water treatment
- Other industries that meet electrical parameters and scheme requirements

质量保证 Quality Assurance

产品质量保证建立在符合质量体系各方面要求的产品的研究、开发、设计和生产过程的不断改进之上，生产工厂取得了 ISO9001 的认证。产品在国家高压试验检测中心进行了规定项目的型式试验验证，产品的基本参数和技术指标均符合以下标准：

IEC62271-200　额定电压 1kV 以上 52kV 及以下交流金属封闭开关设备

GB/T 3906　3.6kV~40.5kV 交流金属封闭开关设备和控制设备

DL/T 404　3.6kV~40.5kV 交流金属封闭开关设备和控制设备

GB/T 1984　高压交流断路器

GB/T 1985　高压交流隔离开关和接地开关

Product quality assurance is based on the continuous improvement of product research, development, design and production processes that meet the requirements of all aspects of quality system. The manufacturer has obtained ISO9001 certification.The product has passed type test in National High Voltage Test and Inspection Center. The basic parameters and technical specifications of the product meet following standards:

IEC62271-200 High-voltage switchgear and controlgear–Part 200:AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

GB/T 3906 Alternating-current metal-enclosed switchgear and controlgear for rated voltages above 3.6 kV and up to and including 40.5 kV

DL/T 404 Alternating-current metal-enclosed switchgear and controlgear for rated voltages above 3.6 kV and up to and including 40.5 kV

GB/T 1984 High-voltage alternating-current circuit-breakers

GB/T 1985 High-voltage alternating-current disconnectors and earthing switches

使用环境条件 Service environment

- 海拔不超过 5000m;
- 周围空气温度: 上限 +40℃, 下限 -40℃;
- 相对湿度: 日平均不大于 95%, 月平均不大于 90%;
- 周围无腐蚀或可燃性气体等明显污染;
- 无经常性的剧烈振动, 地震烈度不超过 8 级。

注: 顾客若偏离正常使用条件可与制造厂家协商

- Altitude: no more than 5000m;
- Ambient air temperature: Max: +40℃ , Min: -40℃ ;
- Relative humidity: the daily average is not more than 95%, and the monthly average is not more than 90%;
- There is no obvious pollution such as corrosive or flammable gas around;
- There is no frequent severe vibration. The earthquake intensity does not exceed degree 8.

Note: If deviation of normal service conditions occurs, the customer should inform the manufacturer before production.

型号及含义 Type and designation

产品型号 Model	额定电压 Rated voltage kV	额定电流 Rated current A	额定短路开断电流 Rated short-circuit breaking current kA
XGNS2	-12	/T1250	—25
	-24	/T2500	—31.5
	-40.5	/T3150	—40

技术数据 Technical Data

名称 Item	单位 Unit	参数 Data		
绝缘水平 Insulation level				
额定电压 Rated voltage	kV	12	24	40.5
额定频率 Rated frequency	Hz	50/60		
1min 工频耐受电压 (有效值) (相间、对地／断口) Rated power frequency withstand voltage 1min (effective value) (Phase to phase, to earth/gaps)	kV	42/48	65/79	95/118
雷电冲击耐受电压 (有效值) (相间、对地／断口) Lightning impulse withstand voltage (effective value) (Phase to phase, to earth/gaps)	kV	75/85	125/145	185/215

名称 Item	单位 Unit	参数 Data
额定电流、短路电流水平 Rated current, short-circuit current level		
额定电流 Rated current	A	630、1250、2000、2500、3150
额定短时耐受电流 / 短路持续时间 Rated short-time withstand current/short-circuit duration	kA/s	25/4、31.5/4、40/4
额定峰值耐受电流 Rated peak withstand current	kA	63、80、100
断路器参数 VCB specifications		
断路器额定短路开断电流 Rated short-circuit breaking current of VCB	kA	25、31.5、40
额定短路关合电流 (峰值) Rated short-circuit making current (peak)	kA	63、80、100
额定单个电容器组 / 背对背电容器组开断电流 Rated single capacitor bank/back-to-back capacitor bank breaking current	A	800/630
额定操作顺序 Rated operating sequence		O-0.3s-CO-180s-CO
断路器等级 VCB rating		M2-E2-C2
防护等级 Protection level		
充气壳体防护等级 Enclosure protection level	IP	67
机构室、低压室、电缆室防护等级 Protection level of mechanism compartment, low-voltage compartment and cable compartment	IP	4X
绝缘气体 Insulating gas		
* SF6 气体额定压力 (20℃时表压) * Rated pressure of SF6 gas (gauge pressure at 20° C)	MPa	0.03
* SF6 气体最低功能压力 (20℃时表压) * Min. functional pressure of SF6 gas (gauge pressure at 20° C)	Mpa	0.01
* SF6 气体年漏气率 * SF6 gas annual leakage rate		≤0.1%
内部电弧等级及外形尺寸 Internal arc level and dimensions		
内部电弧等级 Internal arc level		IAC A (FLR) 31.5kA/0.5s
柜体外形尺寸 (宽 × 深 × 高) Overall dimensions of panel (W×D×H)	mm	500×1410×2330 800×1610×2330 800×1810×2330 / 500×1410×2330 800×1610×2330 800×1810×2330 / 600×1610×2330 800×1610×2330 800×1810×2330 后泄压通道深度为 200, 为可选件 ; 不需要时柜深尺寸减去 200. The depth of rear pressure relief channel is 200mm, which is for optional; When it isn' t needed, the panel depth can be reduced by 200mm.

* 注：对于 12kV 的产品，可用 N2 替代 SF6，使产品成为环保型产品。

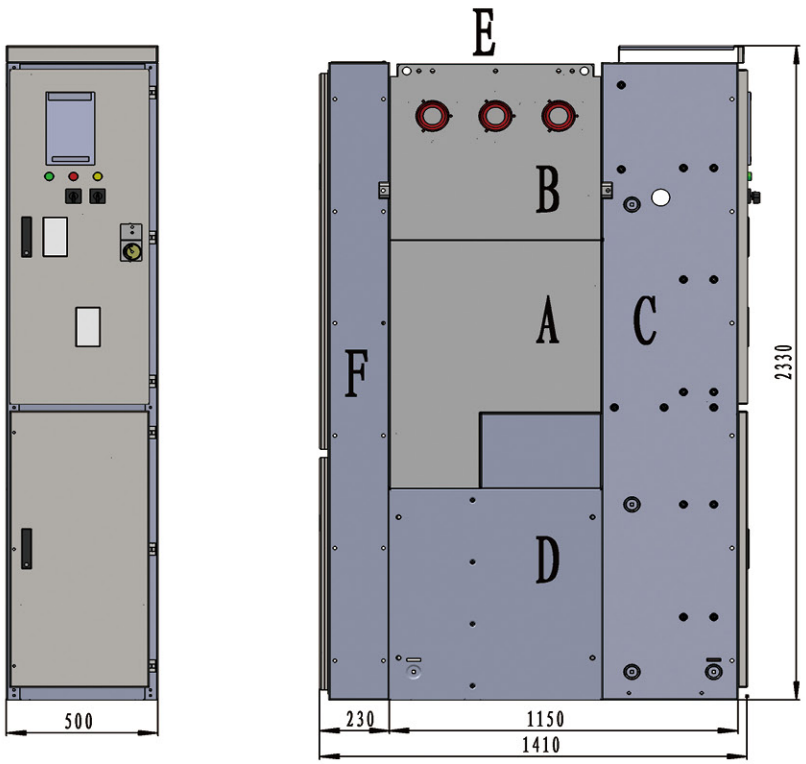
* Note:For 12kV switchgear, N2 can be used instead of SF6 to make the products environmentally friendly.

开关柜重量 Switchgear Weight

- 柜宽 500mm，额定电流 ≤ 1600A，标准柜重量： 大约 1100kg
- 柜宽 600mm，额定电流 ≤ 1600A，标准柜重量： 大约 1200kg
- 柜宽 800mm，额定电流 2000A，标准柜重量： 大约 1400kg
- 柜宽 800mm，额定电流 2500A，标准柜重量： 大约 1600kg
- 柜宽 800mm，额定电流 3150A，标准柜重量： 大约 1800kg

- Width 500mm, rated current ≤ 1600A, standard switchgear weight: about 1100kg
- Width 600mm, rated current ≤ 1600A, standard switchgear weight: about 1200kg
- Width 800mm, rated current 2000A, standard switchgear weight: about 1400kg
- Width 800mm, rated current 2500A, standard switchgear weight: about 1600kg
- Width 800mm, rated current 3150A, standard switchgear weight: about 1800kg

外形尺寸 Overall Dimension

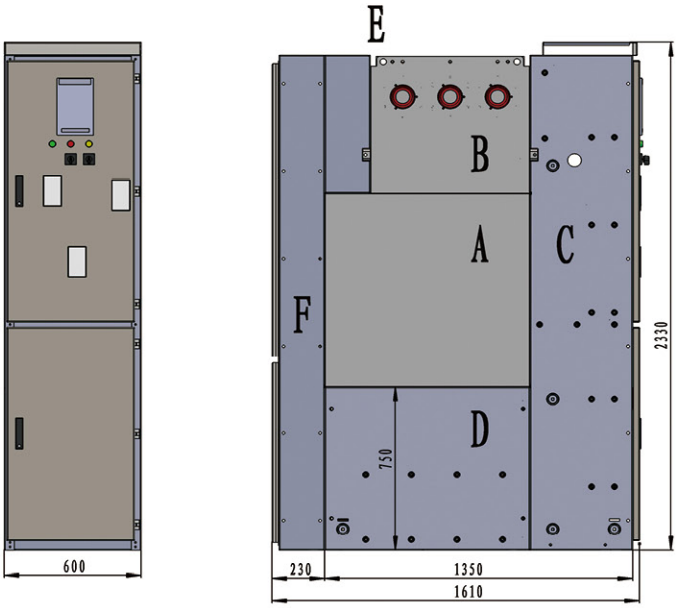


额定电压 12kV、额定电流 ≤1250A（外锥电缆出线）外形尺寸

A 断路器室； B 隔离开关母线室；C 低压室； D 电缆室；E 气压释放通道；F 气压释放通道（可选）

Dimensions for rated voltage 12kV, rated current ≤1250A (Outer cone cable outlet)

A.VCB compartment; B. disconnector busbar compartment; C. low-voltage compartment; D. cable compartment; E. gas pressure release channel; F. gas pressure release channel (for optional)

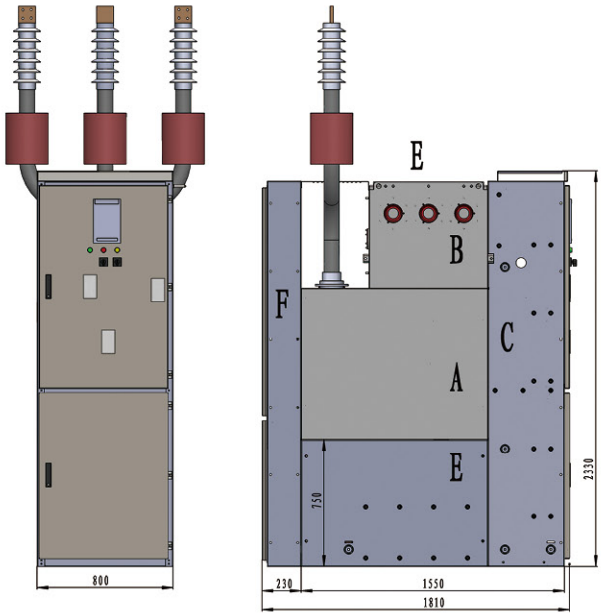


额定电压 40.5kV、额定电流 ≤1600A（内锥电缆出线）外形尺寸

A 断路器室； B 隔离开关母线室；C 低压室； D 电缆室；E 气压释放通道；F 气压释放通道（可选）

Dimensions for rated voltage 40.5kV, rated current ≤1600A (Inner cone cable outlet)

A.VCB compartment; B. disconnector busbar compartment; C. low-voltage compartment; D. cable compartment; E. gas pressure release channel; F. gas pressure release channel (for optional)



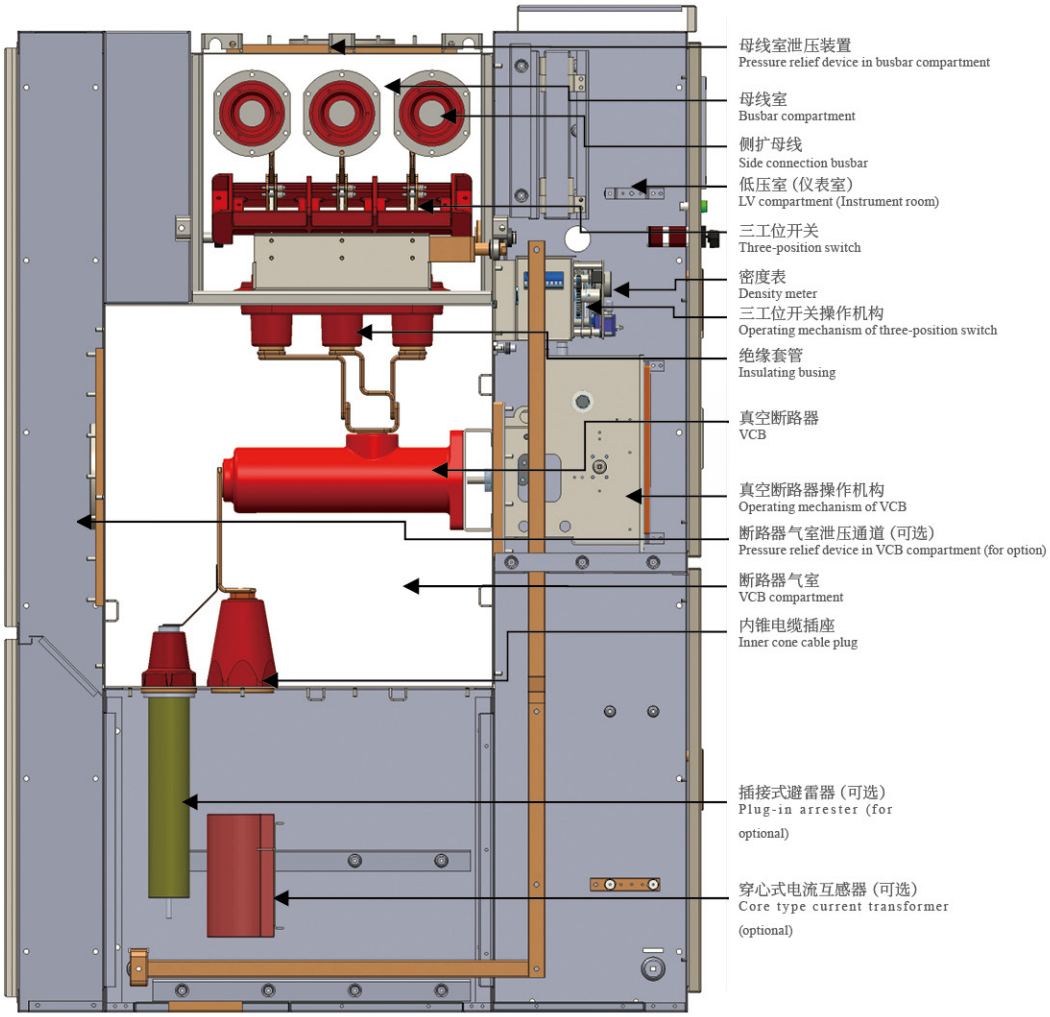
额定电流 2500A、3150A（管型母线或架空进线）外形尺寸

A 断路器室； B 隔离开关母线室；C 低压室； E 气压释放通道；F 气压释放通道（可选）

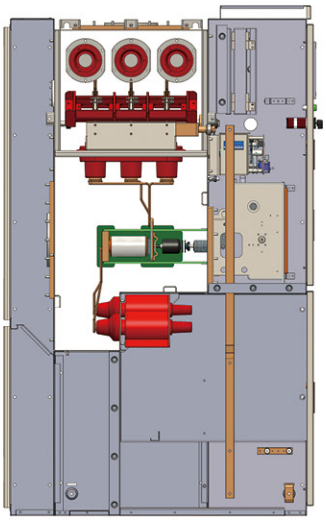
Dimensions for rated current 2500A、3150A (Tubular busbar or overhead incoming line)

A.VCB compartment; B. disconnector busbar compartment; C. low-voltage compartment; D. cable compartment; E. gas pressure release channel; F. gas pressure release channel (for optional)

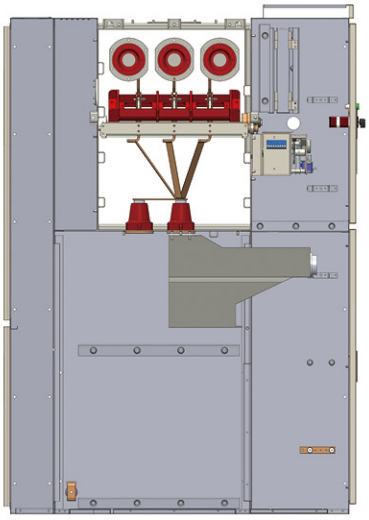
开关柜结构和功能
Switchgear structure and function



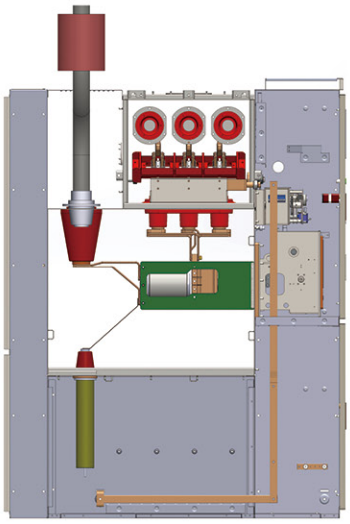
内锥电缆出线、侧扩母线、标准结构图
Standard structure drawing for inner cone cable outlet, side connection bus bar,



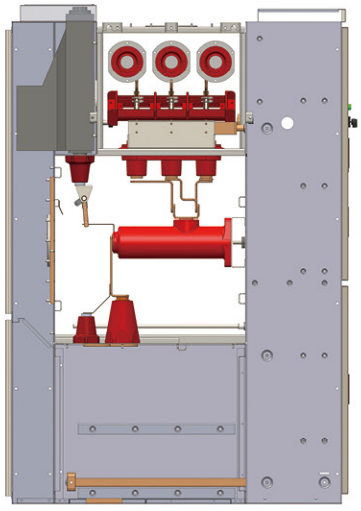
外锥电缆出线、侧扩母线结构图
Structure drawing for outer cone、cable outlet side connection busbar



电缆室 PT；内锥电缆出线、侧扩母线结构图
Structure drawing for cable compartment PT;
Inner cone cable outlet, side connection busbar



管型母线或架空出线、侧扩母线结构图
Structural drawing of tubular bus or overhead outgoing
line and side expansion busbar



进出电缆带 PT；内锥电缆出线、侧扩母线结构图
Structure drawing for inlet and outlet cables with PT;
inner cone cable outlet and side connection busbar.

柜体结构与设备 Switchgear Structure and Equipment

高压电器元件密闭于各自独立的 SF6 气体（12kV 产品可以是 N2 气体）密封气室中，额定充气压力 0.03Mpa，最低运行压力 0.01Mpa。开关柜的气室外壳采用 3mm 不锈钢板焊接成相互独立的密封气室，气箱内面焊有加强筋，保证在高海拔地区气箱的变形在允许范围内。静态密封采用三元乙丙“O”型圈，动态密封采用波纹管和磁流体或“O”型圈，通过以上措施来保证气箱极低的漏气率。气体年泄漏率 <0.1%，全寿命周期为 40 年。产品免维护，但又具备可维护的性能。

断路器气室和母线气室安装压力释放装置，当气室内部很罕见的发生内部电弧故障时，相应的压力释放装置会动作，释放过压，保护人身安全。

高压带电部分由绝缘气体绝缘并封闭在气室中，可以永久有效防止污秽、潮气、异物及其他有害影响。每台开关柜都是一个独立单元，其母线的连接由插接式母线连接装置完成。

The high-voltage electrical components are enclosed in their own independent SF6 gas-sealed compartment, with a rated gas pressure of 0.04Mpa. The lowest operating pressure is 0.02Mpa. The switchgear’ s enclosure is made of 3mm stainless steel plate, which welded into mutually independent sealed gas compartments. The inner surface of the gas tank is welded with reinforcing ribs to ensure that its deformation is within allowable range in high altitude areas. The static seal adopts EPDM "O" ring, and dynamic seal adopts bellows and magnetic fluid or "O" ring. The above measures ensure extremely low gas leakage rate of the gas tanks. The annual gas leakage rate is <0.1%, and the full life cycle is 40 years. The product is maintenance-free, but with maintainable performance.

The VCB compartment and busbar compartment are equipped with pressure release devices. When an internal arc fault rarely occurs in the gas compartment, the corresponding pressure release device will act to release overpressure and protect personal safety.

The high-voltage live part is insulated by insulating gas and enclosed in gas chambers, which can permanently and effectively prevent contamination, moisture, foreign objects and other harmful effects. Each switchgear is an independent unit, and its busbar connection is completed by plug-in busbar connectors.

可提供的柜型（一次方案） Available switchgear type (primary scheme)

可适用于单母线或双母线系统：进线柜、出线柜、馈线柜、母线联络柜、PT 柜、计量柜等，不同的连接方式，如多根电缆并接。典型一次方案见附页。

It can be applied to single busbar or double busbar system: incoming switchgear, outgoing switchgear, feeder switchgear, busbar connection switchgear, PT switchgear, metering switchgear, etc., with different connection methods, such as parallel connection of multiple cables. Please see attached page for typical primary scheme .

开关柜基本配置 Basic configuration of switchgear

配置名称 Basic configuration	说明 Explaination
断路器 VCB	标准配置 Standard configuration
三工位隔离开关 Three-position disconnector	标准配置 Standard configuration
断路器室 VCB compartment	可带电流互感器 Can be equipped with current transformer
母线室 Busbar compartment	可带避雷器 Can be equipped with arrester
	可带电压互感器 Can be equipped with voltage transformer
电缆室 Cable compartment	可带电压互感器 Can be equipped with voltage transformer
	可带电流互感器 Can be equipped with current transformer
	可带避雷器 Can be equipped with arreste
低压室（可选配置）Optional parts in LV compartment	智能控制及保护单元 Intelligent control and protection unit
	保护继电器用机械式辅助开关 Mechanical auxiliary switch for protection relay
电缆及试验插座 Cable and test socket	当绝缘气体充气压力为 0.01MPa(20℃) 时可满足绝缘试验要求 The insulation test requirement can be met when the insulation gas inflation pressure is 0.02MPa (20°C)

开关柜的绝缘气体系统 Insulating gas system of switchgear

高压带电部分安装于充满 SF6 气体为绝缘气体的封闭气室内，保证完全不受外界大气条件影响。

- 每台开关柜的断路器室及母线室均为独立气室，均有独立的气体系统。柜间气室也相互独立。
- 气室内配袋装干燥剂。

运行压力检测：

- 每个独立气室的额定充气压力由独立的密度表监测：断路器室的密度表、母线室的密度表
- 如气室压力降低到报警压力时，智能控制及保护单元将通过密度表的接点检测到此异常，并显示和向后台上传报警信号。
- 作为一个选项，如不带智能控制及保护单元，当气压降到报警压力时，可由特定的信号灯指示报警。

The high-voltage live part is installed in a closed gas chamber filled with SF6 gas as an insulating gas to ensure that it will not be affected by external atmospheric conditions.

- The VCB compartment and busbar compartment of each switchgear are independent gas chambers with independent gas systems. The gas chambers between switchgears are also independent of each other.
- Bag desiccant is placed in gas chamber.

Operating pressure test

- The rated inflation pressure of each independent gas chamber is monitored by an independent density meter: a density meter of VCB compartment, a the density meter of busbar compartment.
- If pressure of a gas chamber drops to alarm pressure, the intelligent control and protection unit will detect the abnormality through contacts of a density meter, and display and upload the alarm signal to background.
- As an option, if there is no intelligent control and protection unit, when gas pressure drops to alarm pressure, a specific signal lamp can indicate the alarm.

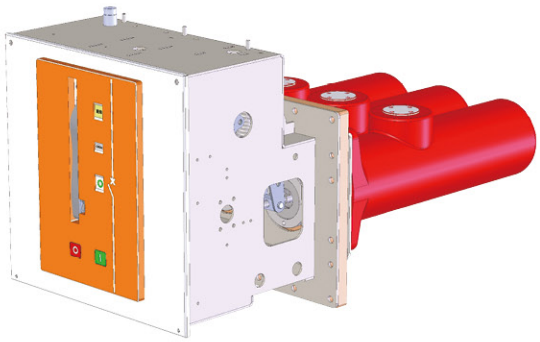
真空断路器 Vacuum Circuit Breaker

真空断路器具有如下功能

- 开、合额定电流；
- 短路开断操作;
- 与三工位开关配合实现接地功能。

三工位开关只有在回路中无电流时，才可操作至接地位置。接地的功能需断路器的配合才能完成。

断路器的三相极柱水平放置于断路器室中。断路器的操动机构置于气室外，便于维修。机构与极柱通过动密封波纹管连接。



40.5kV 真空断路器 VCB

The vacuum circuit breaker has following functions:

- Rated current of opening and closing;
- Short-circuit breaking operation;
- Cooperate with three-position switch to realize grounding function.

The three-position switch can only be operated to grounding position when there is no current in circuit. The grounding function can be realized as cooperating with VCB.

The three poles of VCB are placed horizontally in VCB compartment. The operating mechanism of VCB is placed outside the gas chamber for easy maintenance. The mechanism and poles are connected by a moving sealing bellows.

三工位隔离开关（隔离 | 接地）Three-position disconnector (disconnector | earthing)

开关柜配有特别设计的旋转式电机驱动的三工位隔离开关，实现隔离和接地功能。

三工位隔离开关本体安装于母线室（绝缘气室）中。其操动机构安装于气室外的低压室中。

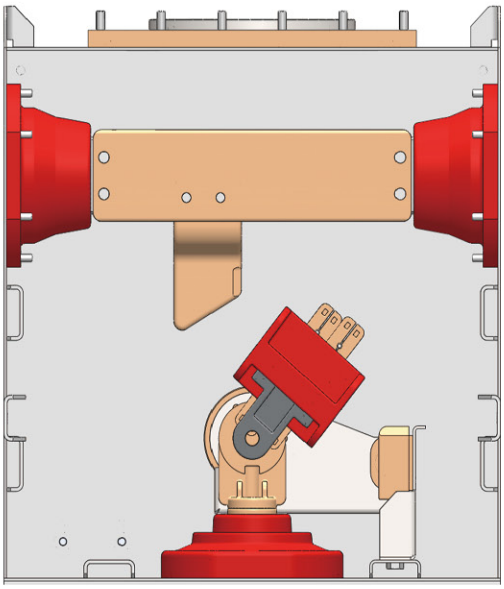
操动机构模块由以下功能单元组成：

- 驱动电机
- 位置微动开关及辅助开关模块；
- 机械位置指示器；
- 手动操动系统及机械联锁；

三工位隔离开关具有如下功能：

- 母线连接；
- 隔离；
- 接地；

三工位隔离开关的三个工作位置在操动机构的面板上都有显示。在中间位置为隔离位。动触头（转动部件）由绝缘转轴驱动，可向两个极限位置转动，分别为隔离开关合与接地开关合位置。每个极限位置各有一个静触头。



三工位隔离开关
Three-position disconnector

The switchgear is equipped with a specially designed three-position disconnector driven by a rotary motor to achieve isolation and earthing functions.

The body of three-position disconnector is installed in a busbar compartment (insulating gas chamber). The operating mechanism is installed in a LV chamber that outside the gas chamber.

The operating mechanism module is composed of functional units below:

- Drive motor;
- Position micro switch and auxiliary switch module;
- Mechanical position indicator;
- Manual operating system and mechanical interlock;

The three-position disconnector has the following functions:

- Busbar connection;
- Isolation;
- Grounding;

The three working positions of three-position disconnector are all displayed on the panel of operating mechanism. The middle position is a isolation position. The movable contact (rotating part) is driven by an insulated rotating shaft and can rotate to two extreme positions, which are disconnector closed and earthing switch closed positions. Each extreme position has a fixed contact.

高压部件的连接 Connection of high-voltage components

插接式电缆连接系统(可选):

- 内锥式符合EN 50181 / DIN47637标准电缆插座的型号为2号或3号。插入式电缆插座作为一个气密元件安装在断路器气室的下底板上;电缆终端距地高度约 750mm。
- 外锥式: 符合 EN 50181 / DIN47637 标准 (C 型接口) 的套管以连接电缆终端。外锥电缆终端距地高度约 850mm。

固体绝缘母线系统 (可选) :

- 侧扩固体绝缘母线的连接通过特殊插座。
- 顶扩固体绝缘母线的连接通过符合 EN 50181 / DIN47637 标准 (C 型接口 \F 型接口) 的套管。

* 细节请参考订货文件。

Plug-in cable connection system (optional):

- Inner cone type: The cable socket models #2 & #3 are in accordance with EN 50181 / DIN47637. A plug-in cable socket is installed as a gastight element on the lower bottom plate of VCB compartment; the height of a cable terminal to ground is about 750mm.
- Outer cone type: a bushing conforming to standard EN 50181 / DIN47637 (type C interface) to connect with cable terminal. The height of a outer cone cable terminal to ground is about 850mm.

Solid insulated busbar system (optional):

- Side solid-insulated busbar standard is through a special socket.
- Top solid-insulated busbar connection is through a bushing that meets the standard EN 50181 / DIN47637 (C-type interface\F-type interface).

*Please refer to ordering document for details.

各种测量值的监测 Monitoring of measured values

电流数值的监测采用传统的电磁感应式穿心电流互感器, 安装在电缆室内的下部, 其二次线穿过低压室连接到综合保护装置或电 流表上。也可采用内置式电流互感器, 安装在断路器气室内的底板或后板上, 其二次线通过电缆室, 进入低压室。

电压数值的监测采用插接式电压互感器, 安装于检测电压的部位, 其二次线穿入低压室连接到综合保护装置或电压表上。

监测压力的密度控制器安装于断路器和三工位隔离开关操作机构的旁边。

The monitoring of current value adopts traditional electromagnetic induction type through-core current transformer, which is installed in the lower part of a cable compartment, and its secondary wire is connected to comprehensive protection device or ammeter through a LV compartment. A built-in current transformer can also be used, which is installed on the bottom plate or back plate of a VCB compartment, and its secondary wire enters the LV compartment through the cable compartment.

The monitoring of voltage value adopts plug-in voltage transformer, which is installed at the place where voltage is detected, and its secondary wire is inserted into the LV compartment room and connected to comprehensive protection device or voltmeter.

The density controller for monitoring pressure is installed beside VCB and the operating mechanism of three-position disconnector.

智能控制及保护单元 Intelligent control and protection unit

智能控制及保护单元综合了保护、控制、测量、开关位置指示、故障信号及报警、通讯等功能。 测量值: 电流、电压、功率等, 其它信息如报警和故障信号可由 LED 配合文字显示。通过接口或光缆, 智能控制及保护单元可与上级自动监控系统进行通讯。

* 如需得到更详细的智能控制及保护单元的操作及技术细节, 请参阅配套工程的随机《智能控制及保护单元》说明书。

Intelligent control and protection unit integrates protection, control, measurement, switch position indicator, fault signal and alarm, communication and other functions. Measured value: current, voltage, power, etc. Other information such as alarm and fault signals can be displayed by LED with text. Through interface or optical cable, the intelligent control and protection unit can communicate with superior automatic monitoring system.

*For more operating and technical details of the intelligent control and protection unit, please refer to the manual "Intelligent Control and Protection Unit".

防误操作 | 联锁 | 分支母线接地 Misoperation prevention/interlock/branch busbar earthing

联锁概述 General description of interlock

为防止危险情况以及误操作, 采取了一系列的联锁来保护运行人员及设备安全。

智能控制及保护单元可实现防止误操作: 断路器及三工位隔离开关既可直接在柜前控制,也可通过本地／远方切换开关在控制室进行控制。

- 三工位隔离开关与相应断路器间有电气联锁。
- 联锁的其它详情, 如柜间联锁等可参考订货文件。
- 柜间联锁 (仅电气) 可通过柜间小母线实现二次电源故障时的操作: 二次电源故障时, 设备可进行手动操作。

紧急手动操作: 可通过打开低压室门利用操作手柄以及机械按钮实现。

⚠ 注意: 所有开关的操作必须到达极限位置才完成。手动操作前, 一定要断开相应二次空气开关。实际系统的详情请参考订货文件。

In order to prevent dangerous situations and misoperations, a series of interlocks are adopted to protect safety of operators and equipment.The intelligent control and protection unit can prevent misoperation: VCB and three-position disconnector can be controlled directly in front of switchgear, or can be controlled through local/remote switch in a control room.

- There is an electrical interlock between three-position disconnector and the corresponding VCB.
- For other details of interlock, such as inter-switchgear interlock, please refer to ordering documents.
- Inter-switchgear interlock (electrical only) can realize operation through small busbars between switchgears when

Emergency manual operation: It can be realized by using operating handle and mechanical buttons after opening LV compartment door.

⚠ Note: All switch operations must complete after reach the limit positions. Before manual operation, be sure to disconnect the corresponding secondary air switch. Please refer to the ordering document for actual system details.

断路器与三工位隔离开关联锁功能 Interlock function of VCB and three-position disconnetor

电气联锁：电气联锁可通过智能控制及保护单元对三工位隔离开关与断路器位置状态的辅助开关来实现。

⚠注意：只有二次电源正常时才能实现电气联锁。

机械联锁：当断路器处于合闸状态，三工位隔离开关的手动操作盖板是闭锁住的。只有断路器分闸后，相应的手动操作盖板才能打开，才能将操作手柄插入操作孔进行三工位隔离开关的操作。当手动操作盖板打开时，断路器无论电气还是机械都无法进行操作。

三工位开关操作手柄大约需旋转 1/4 圈：

- 从三工位隔离开关合位置到隔离开关分位置；
- 从三工位隔离开关分位置到接地合位置；
- 从三工位隔离开关接地合位置到分位置；
- 从三工位隔离开关分位置到隔离开关合位置。

⚠注意：对三工位隔离开关手动操作时，不得野蛮进行。

操作手柄上的凸块与机构上的缺口相配合可防止未到位就拔出操作手柄。只有手动操作手柄到达极限位置时，才可拔出操作手柄，手动操作的盖板才能合上，之后断路器才可合闸。相反，当断路器分闸时，手动操作盖板才可以被打开，插入操作手柄。

Electrical interlock：Electrical interlock can be realized through contact detection of position state auxiliary switch of three-position disconnector & VCB.

⚠Note：The electrical interlock can only be realized when secondary power supply is normal.

Mechanical interlock：The mechanical interlock can only be realized by manually operating the main shaft of three-position disconnector under certain conditions.When VCB is in closing state, the cover for manual operation of three-position disconnector is latched. Only after VCB is opened, the cover for corresponding manual operation can be opened, and a operation handle can be inserted into the operation hole to operate the three-position disconnector. When the manual operation cover is opened, the VCB cannot be operated either electrically or mechanically.

The operating handle of three-position disconnector needs to be rotated approximately 1/4 turn:

- From the closing position of three-position disconnector to its opening position;
- From the opening position of three-position disconnector to earthing closing position;
- From the earthing closing position of three-position disconnector to its opening position;
- From the opening position of three-position disconnector to its closing position;

⚠Note: When manually operating three-position disconnector, it should not be done brutally.

A protrusion on operating handle cooperates with a notch on mechanism to prevent the operating handle can be pulled out when it is not in place. Only when manual operating handle reaches the limit position, it be pulled out, the cover for manual operation can be closed, and then VCB can be closed. On the contrary, when VCB is opened, the cover for manual operation can be opened and the operation handle can be inserted.

单母线系统的分支母线接地（停电操作）
Grounding of branch busbar of single busbar system (power off operation)

利用智能控制及保护单元进行电动接地（可选），分支母线接地的操作顺序:

①断路器分;②隔离开关分;③测试回路带电情况(利用智能控制及保护单元或电缆端的带电指示和闭锁装置);④ 接地开关合;⑤ 断路器合;⑥分断路器及三工位隔离开关控制回路的空气开关; ⑦ 如有必要锁住低压室门或断路器的分闸按钮; ⑧将此柜标注，指示其已经接地。

解除接地: ①打开低压室门，合上空气开关; ② 解开断路器分闸按钮的闭锁（如有）; ③断路器分; ④接地开关分。

手动接地: 步骤顺序与电动操作相同，但对于断路器需使用机械按钮，而三工位隔离开关需使用操作手柄。

如在断路器与接地开关间有额外的机械联锁，则需进行如下步骤:

①打开低压室门; ②手动分闸断路器; ③打开三工位隔离开关操作机构的手动操作盖板; ④用操作手柄分隔离开关; ⑤测试一次回路掉电情况（电缆端带电指示装置）; ⑥用操作手柄合接地开关; ⑦关闭三工位隔离开关手动操作盖板; ⑧手动合断路器; ⑨分掉断路器及三工位开关控制回路的空气开关; ⑩如有必要锁住低压室门或断路器的分闸按钮; ⑪将此柜标注，指示其已经接地。

⚠注意: 三工位隔离开关的手动操作盖板带有机械闭锁，只可在断路器分闸时打开。不得野蛮操作！

⚠注意: 当手动操作盖板打开时，断路器被闭锁在分闸位置了。

手动解除接地: ①打开低压室门并合上空气开关 ②解除断路器分闸按钮的闭锁（如有）③手动分断路器 ④ 打开三工位隔离开关手动操作盖板⑤ 手动分接地开关 ⑥ 关闭三工位隔离开关手动操作盖板。

Using intelligent control and protection unit for electric grounding (optional), the operation sequence of branch busbar grounding:

① VCB is opened; ② Disconnector is opened; ③ Testing live condition of circuit (using intelligent control and protection unit or live display and latch device at cable end); ④ Earthing switch is closed; ⑤ VCB is closed; ⑥ Open air switch of control circuit of VCB and three-position disconnector; ⑦ If necessary, lock LV compartment door or opening button of VCB; ⑧ Mark the switchgear to indicate that it is grounded.

Grounding released:

① Open LV compartment door and closing air switch; ② Unlatch the opening button of VCB (if any); ③ VCB is opened; ④ Earthing switch is opened;

Manual grounding: The sequence and steps of manual grounding are same as that by electric operation, but through mechanical buttons of circuit breaker, and through operating handle of three-position disconnector.If there is an additional mechanical interlock between VCB and earthing switch, the following steps are required;

① Open LV compartment door; ② VCB is opened by manual; ③ Open the cover for manual operation of operating mechanism of three-position disconnector; ④ Open disconnector by using operating handle; ⑤ Test power failure of primary circuit (Live display device at the cable terminal); ⑥ Close earthing switch with operating handle; ⑦ Close manual operation cover of three-postition disconnector; ⑧ Manually close VCB; ⑨ Open air switch of control circuit of VCB and three-position disconnector; ⑩ If necessary, lock LV compartment door or opening button of VCB; ⑪ Mark the switchgear to indicate that it is grounded.

⚠Note: The cover for manual operation of three-position disconnector has a mechanical lock, which can only be opened when the VCB is opened. No brutal operation!

⚠Note: When manual operation cover is opened, VCB is latched in opening position.

Manually release grounding:

① Open LV compartment door and close air switch; ② Unlatch opening button of VCB (if any); ③ Manually close VCB; ④ Open manual operation cover of three-position disconnector; ⑤ Manually open earthing switch; ⑥ Close manual operation cover of three-position disconnector;

运输及储存 Transport and storage

交付条件 Delivery conditions

工厂内装配完成的开关柜需进行装配正确性及功能检查。

交付条件:

- 根据订单要求检查开关柜。
- 气室充入额定压力的绝缘气体, 并装入袋装干燥剂。
- 依据 GB /T11022、GB/T3906、DL/T404 或 IEC 62271-200 进行出厂试验。
- 安装材料及附件单独包装。
- 母线插座用非绝缘盖板封闭。

⚠ 注意: 个别情况下, 经讨论及同意后方可空运。

The switchgears that assembled in the factory shall be inspected for assembly correctness and their function.

Delivery conditions:

- Check switchgear according to order requirements.
- Gas chamber is filled with insulating gas of rated pressure, and put a bag of desiccant.
- Carry out delivery test according to GB/T11022, GB/T3906, DL/T404 or IEC 62271-200.
- Installation materials and accessories are packaged separately.
- The bus socket is closed with a non-insulating cover.

⚠ Note: In some cases, it can be shipped by air only after discussion and agreement.

包装 Package

开关柜可带标准包装或无包装。

海运或类似条件的包装（包括出口运输）:

- 用聚乙烯塑料膜密封;
- 放入适合的干燥剂;

Switchgear can be supplied with standard package or no package.

Package suitable for sea shipment or similar condition (including export transportation).

- Sealing with polyethylene plastic film;
- Put suitable desiccant;

运输 Transportation

- 通常单柜进行包装并发运。特殊柜型在厂内组装好，经过一体包装后发运。
- 保持柜体垂直向上放置。
- 应考虑包装后的重量。
- 应考虑包装后的重心、高度。

⚠警告：倾斜危险！

- 禁止在柜顶（压力释放通道）行走。
- 在装卸操作时须考虑到对人身物资的安全防护措施。
- 为保护人员和物资的安全，应使用下列工具才能进行装载工作：叉车；可升小车；起重机；带滑轮的小车；
- 用叉车或可提升小车作业：柜体必须放在栈板上；栈板必须完全由叉车或升高小车的叉子支撑，否则将有很大的重心倾倒的危险；
  不得用猛力或暴力；
- 用起重机作业： 吊索应有足够的承载能力；
  吊索通过吊钩与四个吊耳连接，吊索角度不大于 60°。

⚠注意：在开关室内搬运开关柜可利用带滑轮的小车，要注意开关柜重心，小心倾覆。

- Usually a single switchgear is packaged and shipped.
- Special switchgear type is assembled in factory and shipped after beingpackaged in one piece.
- Keep switchgear upright.
- he weight after packaging should be considered.
- The center of gravity and height after packaging should be considered.

⚠Warning: Danger of tilting!

- It is forbidden to walk on the top of switchgear (pressure release channel).
- Protection measures for personnel and materials should be considered during loading and unloading.
- In order to protect safety of personnel and materials, the following tools should be used for loading work:Forklift;Lift car;Crane;Trolley with pulley;
- Use a forklift or a liftable trolley to work:
  The switchgear must be placed on a pallet;
  The pallet must be completely supported by fork of forklift or liftable trolley, otherwise there will be a great risk of center of gravity falling;
  Do not use force or violence;
- Working with crane:
  The sling should have sufficient carrying capacity;
  The sling is connected to four lifting lugs by hooks, and angle of sling is not more than 60°.

⚠Note: A trolley with pulleys can be used to move switchgear in switch room. Pay attention to the center of gravity of switchgear and be careful to avoid overturn.

交货 Delivery

收货人有责任（但不限于）进行以下工作:
检查到货完整性和损坏性与否（如潮湿及其损害）;
任何短缺与运输损坏必须: 在运货单上记录并证明，及时通知拖运人，运输公司及保险公司。
⚠注意： 如有重大损失应附照片加以证明。

The consignee is responsible for (but not limited to) the following tasks:
When acceptance, please check completeness or damage if any (such as humidity and damage);
Any shortage or transportation damage must: record and prove it on waybill, and notify forwarder, transportation company and insurance company in time.
⚠Note: If there is a big loss, a photo should be attached to prove it.

中间储存 Storage

适宜的中间储存条件: 带标准包装或无包装的开关柜。

- 储存室内应干燥、通风良好。气候条件应遵循 GB 11022 或 IEC 60694。
- 室温不得低于 -15 度;
- 无其他有害的气候影响;
- 开关柜应直立存放;
- 开关柜不得叠放;
- 标准包装的开关柜: 尽可能少地拆开包装。
- 无包装的开关柜: 用保护膜松散的覆盖在开关柜，保持空气流通;
- 定期做凝露检查;

Suitable storage conditions: switchgears with standard packages or without packages.

- The storage room should be dry and well ventilated. The climatic conditions should follow GB 11022 or IEC 60694.
- The room temperature shall not be lower than -15℃ ;
- No other harmful climate impact;
- Switchgear should be stored upright;
- Switchgear can’ t be stacked;
- Switchgear with standard package: Unpack as little as possible.
- Switchgear without package: Cover switchgear loosely with a protective film and keep ventilation.
- Condensation check regularly;

适合海运或类似情况带内部保护膜包装的开关柜
Switchgear with internal protective film packaging that suitable for sea shipment or similar shipment:

- 运输单元应存放干燥处，谨防损坏;
- 检查包装有无破损;
- 到货后检查干燥剂，以后要做定期检查;
- 从包装之日起，超过保管期限时，包装的保护功能可能无法保证，如需继续存放，需采取适当措施。

- The unit for transportation should be stored in a dry place, beware of damage;
- Check whether the package is damaged or not;
- Check the desiccant after arrival, and do regular inspections in the future;
- From date of packaging, when storage period expires, protective function of packages may not be guaranteed. If you need to continue to store it,
- appropriate measures must be taken.

开关柜的现场安装 On-site installation of switchgear

为了保证最佳安装顺序及安装质量，开关柜的安装应在专业技术人员的监督下进行。

In order to ensure good installation sequence and installation quality, installation of switchgear should be carried out under supervision of professional technician.

安装现场的一般要求 General requirements to installation site

开关柜的现场安装应在配电室的土建工程彻底完工，且具备照明及现场安装用电源之后进行，配电室应保持干燥，配备通风装置，可上锁。必须预先设置电力和控制电缆沟槽。必须满足相关标准所规定的户内开关柜工作条件，包括户内温度条件。

The on-site installation of switchgear should be carried out after civil engineering of power distribution room is completed, and power supply for lighting and on-site installation is available. The power distribution room should be kept dry, equipped with ventilation devices, and lockable. The power and control cable grooves must be set up in advance. Must meet working conditions of indoor switchgear working that in relevant standards, including indoor temperature conditions.

配电室安装结构尺寸 Installation structure size of power distribution room

柜宽 Switchgear width	500mm	600mm	800mm	800mm
额定电流 Rated current	≤1600A	≤1600A	≤2000A	≥2500A
配电间天花板高度 Ceiling height of power distribution room	2800mm	2800mm	2900mm	3000mm
检查通道宽度 Check channel width	700mm	700mm	700mm	700mm
操作通道宽度 Operating channel width	1000mm	1000mm	1000mm	1000mm
开关柜重量（标准柜） Switchgear weight (standard switchgear)	1100kg	1200kg	1400kg	1600kg
楼面承重 Floor load-bearing	1200kg/m2	1300kg/m2	1400kg/m2	1500kg/m2

- 开关柜应安装在配电室的基础框架上。电力电缆沟应开得尽量大，主要取决于高压电缆根数。
- 电力电缆沟应能防止涡流。
- 当发生极为罕见的内部燃弧故障时，开关柜内压力将会升高。必须进行计划及计算，避免产生危险的后果。

- Switchgear should be installed on basic frame of power distribution room. Power cable trench should be opened as large as possible, mainly depending on the number of high-voltage cables.
- The power cable trench should be able to prevent eddy currents.
- When an extremely rare internal arcing fault occurs, pressure in switchgear will increase. It is necessary to plan and calculate to avoid dangerous consequences.

现场安装的基本注意事项
Basic precautions for on-site installation

带硅橡胶绝缘件的插接连接件的处理
Treatment of plug connectors with silicone rubber insulators

- 检查硅橡胶件是否有损伤。如有任何损伤则只有制造商确认后才可使用。
- 硅橡胶绝缘表面必须没有： 气泡、划痕、损伤、异物、磨损;
- 清洁硅橡胶绝缘件上的脏污，用柔软干净的无毛纸去除多余或脏的油脂。
- 用干的无毛纸与电缆清洁剂清洁硅橡胶绝缘件。将于无毛纸用电缆清洁剂稍弄湿。只可用中等力度清洁母线连接用硅橡胶绝缘件的黑色区域。不得从黑色区域向红色绝缘表面擦抹。
- 清洁后用干的无毛纸擦掉多余的清洁剂。因清洁剂会使橡胶有些膨胀，故应在空气中放置约 15min 使其干燥。
- 在绝缘件上涂抹硅脂，均匀地在硅橡胶件上涂抹硅脂。
- 使用量如下表:
- 清洁插座与硅橡胶件接触的表面（电缆插座、母线插座也需清洁）。均需使用清洁剂，并晾干。再涂抹一薄层干净的硅脂。
- 马上装配。

- Check if there is any damage on silicone rubber parts. If yes, it can only be used after confirmation by manufacturer.
- Silicone rubber insulation surface must be free of: bubbles, scratches, damage, foreign matter, abrasion;
- Clean silicone rubber insulation parts with soft, clean, lint-free paper, to remove dirty grease.
- Clean silicone rubber insulation parts with dry lint-free paper and cable cleaner. Slightly moisten the dry lint-free paper with cable cleaner. Only can use moderate force to clean black areas of silicone rubber insulators that used for busbar connection, but can’ t wipe from the black area to red insulating surface.
- Wipe off excess cleaner with dry lint-free paper after cleaning, sine the cleaner will swell silicone rubber a little. The silicone rubber should be placed in the air for about 15 minutes to dry it.
- Apply silicone grease on insulating parts, and evenly apply silicone grease on silicone rubber parts.
- The usage amount is as follows:
- Clean contact surface of socket and silicone rubber part (cable socket and busbar socket also need to be cleaned). All cleaning need to use detergent and dry. Then apply a thin layer of clean silicone grease.
- Assemble immediately.

部件 Name	硅脂用量 Usage amount of silicone grease
母线连接绝缘件 Busbar connection insulator	约 Around 20g
母线堵头 Busbar plug	约 Around 20g
电压互感器，电压传感器，避雷器，试验套管与电缆堵头 Voltage transformer, voltage sensor, arrester, test bushing and cable plug	约 Around 10g

基础框架 Foundation frame

基础框架的施工应符合 DL/T5190 “电力建设施工及验收技术规范” 中相关条款的规定。

基础框架由用户负责埋设,且应在专职技术人员的管理下进行调整和检查。为了开关柜能顺利安装,埋设基础框架时应遵照 GB 50171 标准,尤其应遵守平面度与垂直度的形位公差要求:

- 平面度允许公差: ±1mm/m ;
- 直线度允许公差最大: 2mm/m。

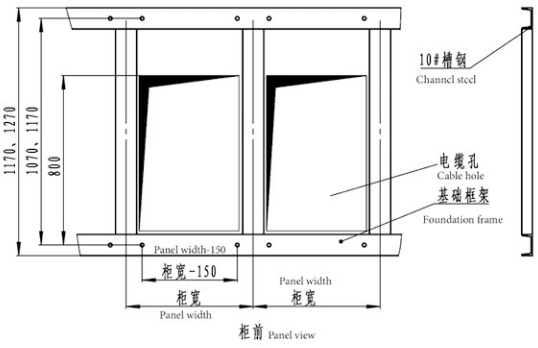
通常在配电室内安装开关设备, 是采用点焊或螺栓栓接的方式, 将开关设备紧固在预置于配电室混凝土地面上的由槽钢预制的基础框架之上。基础框架主要采用 10# 槽钢, 其对应的地基开孔请见示意图。基础框架的槽钢外延距离应与开关柜本体框架的尺寸一致, 根据开关柜的平面布置情况及每排开关设备的总台数决定框架的总长度。

Construction of foundation frame shall comply with the relevant provisions of DL/T5190 "Technical Specifications for Construction and Acceptance of Electric Power Construction".

Foundation frame is buried and set by users and should be adjusted and inspected under management of full-time technical personnel. For smooth installation of switchgears, the GB 50171 standard should be followed when setting foundation frame, especially the form and position tolerance requirements of flatness and perpendicularity:

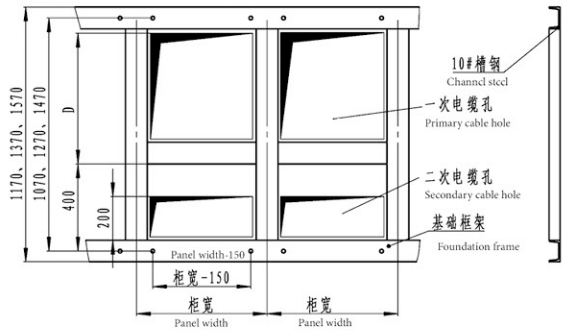
- Allowable tolerance of flatness: ±1mm/m;
- Maximum allowable tolerance of straightness: 2mm/m.

Usually switchgears are installed in power distribution room by spot welding or bolting. Switchgears are fastened on foundation frame that prefabricated by channel steel and pre-placed on concrete floor of power distribution room. Foundation frame mainly uses channel steel 10#. Corresponding foundation openings are shown in below schematic drawing. The extension distance of channel steel of foundation frame should be consistent with size of switchgear body frame. The total length of foundation frame is determined according to switchgear layout and total number of switchgear in each row.



内锥电 11 缆出线、侧扩母线、标准结构图 .
Standard structure drawing for inner cone cable outlet,side connection bus bar.

外锥电缆插座 ≤1250A 开关柜的基础框架



D 可视电缆根数而定: 2*3 根电缆时, D 为 600; 3*3 根电缆时, D 为 800; 4*3 根电缆时, D 为 1000. 内锥电缆插座开关柜的基础框架 .
D depends on cable' s quantity: for cables 2*3, D is 600;for cables 3*3, D is 800; for cables 4*3, D is 1000.Foundation frame of inner cone cable socket switchgear.

内锥电缆插座开关柜的基础框架

开关柜的安装与拼接 Installation and connection of switchgear

现场处理 On-site pre-treatment

- 清理现场障碍物，以便顺利将开关柜就位，防止发生搬运事故；
- 同时对吊车进行安全检查；
- 对照装箱单，开箱检查开关柜及柜内安装的零部件是否完好无损；
- 在基础框架的上面涂润滑油脂（有利于开关柜的安装与对齐）。

- Clean up obstacles on site, so as to smoothly place switchgear in position and prevent handling accidents;
- Carry out safety inspection to crane;
- Unpack and check switchgear and its components inside by comparing with the packing list, to make sure all products are intact;
- Apply lubricating grease on the top of foundation frame (it is beneficial to installation and alignment of switchgears).

安装人员及现场要求 Installation personnel and on-site requirements

- 开关柜安装人员应经过制造厂商的培训，熟悉所有安装程序。否则必须在制造商技术专家的指导下才可进行安装。
- 现场安装人员至少在 3 人左右。
- 现场电源应具备如下条件： AC 380V /10A，AC220V /15A。

- The installer of switchgear should be trained by the manufacturer and be familiar with all installation procedures. Otherwise, the installation can
- only be carried out under guidance of the manufacturer's technical experts. .
  At least 3 installers on site.
- The on-site power supply should meet the following conditions: AC 380V /10A, AC220V /15A.

现场安装所需设备及工具 Equipment and tools required for on-site installation

- 设备运载车（1 台）
- 安装专用工具车（1 套）
- 专用吸尘器（1 台）

- Equipment carrier (1 set)
- Special tool cart for installation (1 set)
- Special vacuum cleaner (1 set)

⚠ 注意： 严禁在柜顶行走（会破坏压力释放系统）。

⚠ Note: it is strictly forbidden to walk on the top of the cabinet
(it will damage the pressure relief system).

现场安装所需设备及工具
Equipment and tools required for on-site installation

侧面母线扩展：

- 将 2 个定位销从柜侧插入相应孔中（见图）。
- 将端柜安装在基础框架上预设的位置。
- 将开关柜的固定螺栓插入基础框架上相应的螺栓孔中。
- 开关柜排好。
- 检查开关柜的水平度并对齐后，锁紧固定螺栓使其固定在基础框架上。
- 取下母线插座的防护盖板。
- 仔细检查绝缘套管及母线连接件有否脏污，如必要需清除。

⚠ 注意：现场安装需用到时，才能取出绝缘套管及母线连接件。以防止任何脏污！

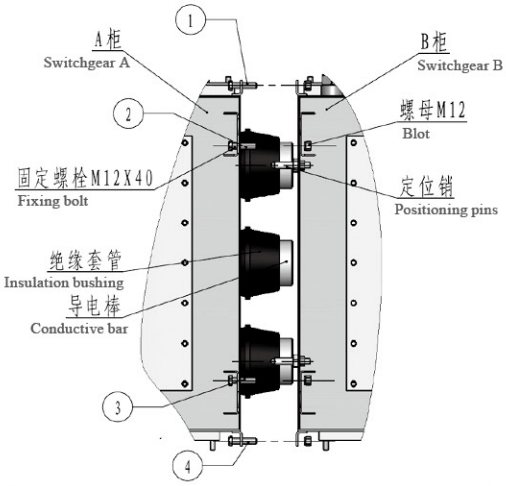
- 在绝缘套管的锥形表面 均匀地涂抹一薄层硅脂 AP。

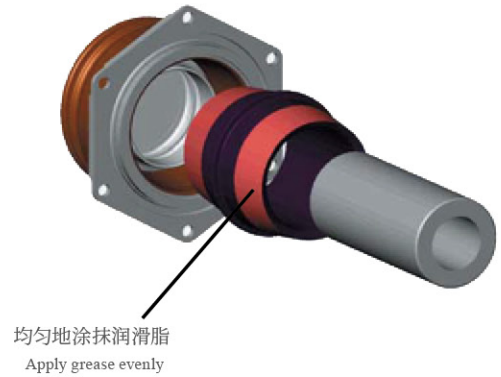
⚠ 注意：锥形表面 必须均匀涂抹，不得有遗漏。

- 小心地先将母线连接件插入母线插座，然后插入绝缘套管。
- 将邻柜缓慢地滑动至已安装好的柜体旁（不要倾斜），以使连接件、绝缘套管和定位销可以准确地插入对应孔中。

⚠ 注意：不得野蛮操作。如需要将柜体对齐。

- 一旦两柜间距离小到螺栓可以插入邻柜对应孔中，用螺母及垫片将其带上。
- 接着逐步锁紧其他拼柜螺栓，将两柜拼接在一起。
- 拼接完成后，再仔细检查第二台开关柜的水平度。然后用螺栓将开关柜固定在基础框架上。
- 柜间接地排连接：相邻 2 柜主接地母排通过接地连接片用螺栓配合垫片及螺母锁紧。
- 用同样的程序安装和拼接其它开关柜。





根据接地设计，将柜内主接地排与主站接地连接。建议尽可能多地将开关柜系统的主接地排与主站接地连接（在安装时的第一面及最后一面柜，以及每两面或三面柜）。对于额定短路电流＞ 31.5kA 时，在第一与最后一面柜间至少需要两个接地连接。

顶部母线扩展：

- 按一次方案排列顺序依次把开关柜固定在基础框架上完成拼柜。
- 分别测量相邻 2 台开关柜上的三相母线插座之间的中心距离 L，该尺寸应该满足母线长度规格的要求。
- 母线连接有 2 种主要类型：三通式母线连接器应用于端柜及母联分段柜，四通式母线连接器应用于位于中间的开关柜。
- 取下母线插座的防护盖板。
- 仔细检查绝缘套管及母线连接件有否脏污，如必要需清除。

⚠ 注意：现场安装需用到时，才能取出绝缘套管及母线连接件。以防止任何脏污！

- 安装连接母线的详细情况请参考母线连接器生产厂家的说明书。
- 母线安装完毕后，按照随开关柜一并提供的安装图纸的说明，将母线盖板和端板全部装上。

Side busbar connection:

- Insert 2 positioning pins into the corresponding holes from swichgear side (see drawing).
- Install end switchgear at preset position on foundation frame.
- Insert fixing bolts of switchgear into the corresponding bolt holes on foundation frame.
- Place switchgears in position.
- After checking levelness of switchgears and aligning them, tighten fixing bolts to fix switchgears on foundation frame.
- Remove protective cover of busbar socket.
- Check carefully if insulation bushing and busbar connectors are dirty, and clean it.

⚠ Note: The insulation bushing and busbar connectors can only be taken out when needed for on-site installation. To prevent any dirt!

- Apply a thin layer of silicone grease AP evenly on tapered surface of insulation bushing.

⚠ Note: The tapered surface must be applied evenly without any omissions.

- Carefully insert busbar connector into busbar socket firstly, and then insert into insulating bushing.
- Slowly slide adjacent switchgear to the side of installed switchgear (do not tilt), so that the connectors, insulating bushings and positioning pins can be accurately inserted into the corresponding holes. No brutal operation. If necessary, align the switchgears.

⚠ Note: Once distance between two switchgears is small enough that bolts can be inserted into the corresponding holes of adjacent switchgear, use nuts and washers to connect them together.

- Then gradually tighten other connected bolts to join two switchgears together.
- After connection is completed, carefully check levelness of the second switchgear. Then fix the switchgear on foundation frame with bolts.
- Earthing busbar connection between switchgears: main earthing busbars of adjacent two switchgears are locked through earthing connecting piece and fixed by bolts with gaskets and nuts.
- Use same procedures to install and connect other switchgears.

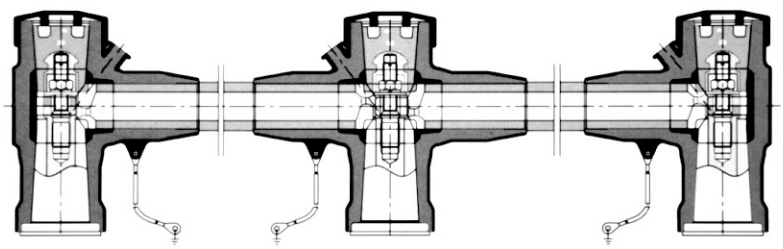
According to earthing design, connect main earthing busbar that inside switchgear to main station earthing. It is recommended to connect main earthing bar of switchgear system with main station grounding as much as possible (on the first and last switchgear during installation, and every two or three switchgears). For rated short-circuit current> 31.5kA, at least two earthing connections are required between the first and last switchgears.

Top busbar connection:

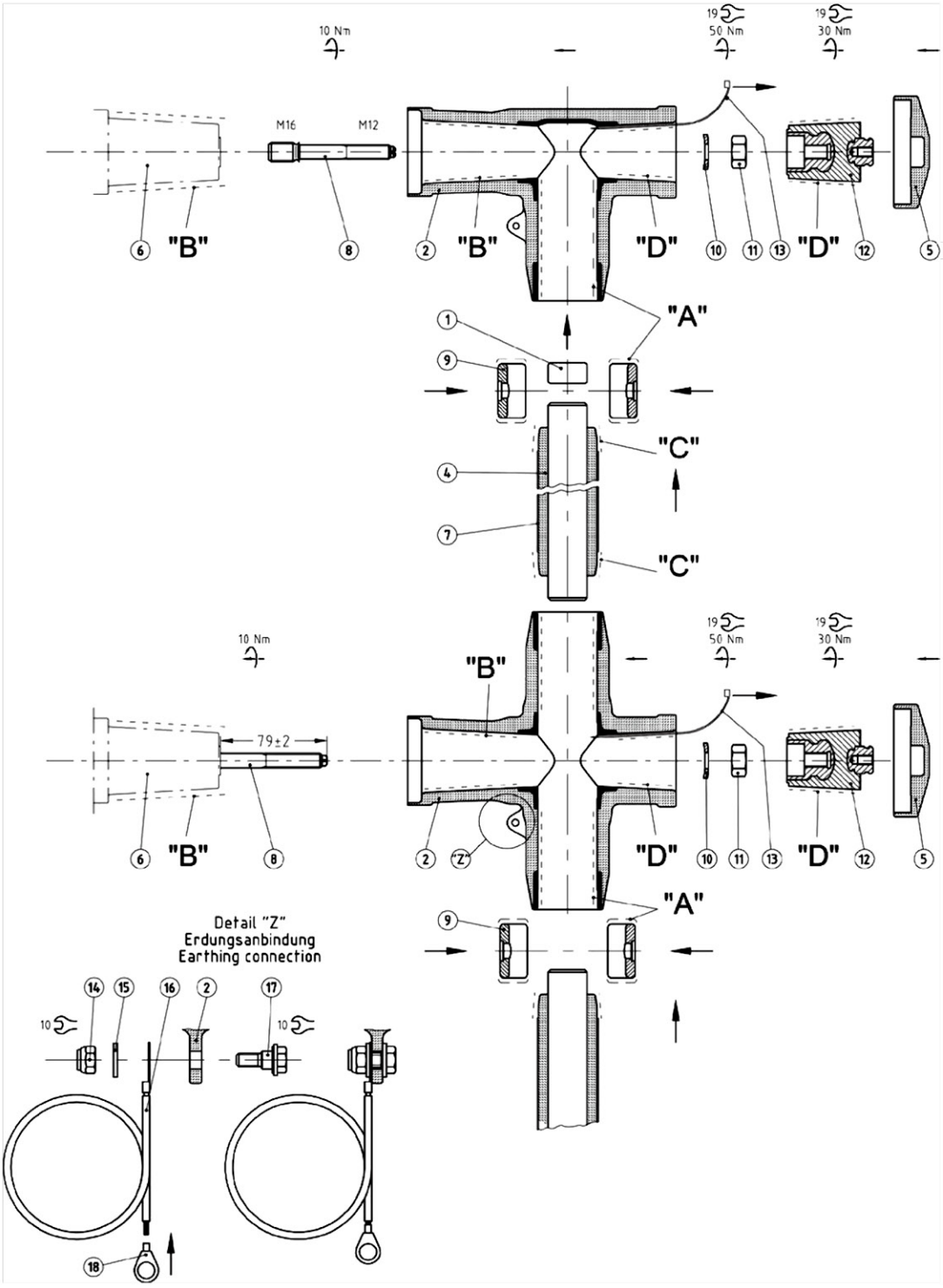
- Fix switchgears on foundation frame to complete connection according to arrangement sequence of the primary scheme.
- Respectively measure center distance L between the three-phase busbar sockets on two adjacent switchgears. This size should meet the requirements of busbar length specification.
- There are two main types of busbar connections: three-way busbar connectors are used in switchgears at two ends and busbar section switchgears; four-way busbar connectors are used in switchgears in the middle.
- Remove protective cover of busbar socket.
- Check carefully if insulation bushing and busbar connectors are dirty, and clean it.

⚠ Note: The insulation bushing and busbar connectors can only be taken out when needed for on-site installation. To prevent any dirt!

- For details of installation and connection of busbar, please refer to the instructions from manufacturer.
- After busbar is installed, install busbar cover and end plates according to the instructions of installation drawing that provided with the switchgear.



顶部扩展母线
Top busbar connection


10 Nm
19
50 Nm
19
30 Nm
M16
M12
"B"
"D"
"A"
"C"
79±2
Detail "Z"
Erdungsanbindung
Earthing connection

电压互感器的安装 Installation of voltage transformer

以下操作必须有受过专业培训人员进行,在任何时候都要确认操作是否正确:

- 将相关的母线接地;
- 取下硅橡胶防护帽并备好稍后使用;
- 检查电压互感器上的硅橡胶是否磨损, 参考“带硅橡胶绝缘件的插接连接件的处理”;
- 将硅橡胶清洁并涂脂, 参考“带硅橡胶绝缘件的插接连接件的处理”;
- 清洁插座区, 取下塑料盖好并移开区内的二次配线;
- 清洁插座内与硅橡胶件接触的部分, 参考“带硅橡胶绝缘件的插接连接件的处理”;
- 将互感器轻缓地插入插座。确保互感器垂直(不得倾斜或翻倒)。插入的连接件必须可以轻松滑动到相应的插座内,如需要查硅橡胶件与相应的插座是否连接正确。到达约 20mm 的位置时就能明显感觉到反作用力;
- 用螺栓将法兰锁紧在机械固定位置上。均匀地按对角锁紧(至多施加 15Nm 扭距);
- 将盖板固定在电压互感器上。
- 根据电路图将二次配线与接地导线接到二次接线端子。检查所有的接线是否锁紧;

The following operations must be carried out by professionally trained personnel, and must confirm whether the operation is correct at all times.

- Related busbar grounding;
- Remove the silicone rubber protective cover and prepare it for later use;
- Check whether silicone rubber on voltage transformer is worn or not. Refer to “Treatment of plug connectors with silicone rubber insulators”;
- Clean and grease silicone rubber. Refer to “Treatment of plug connectors with silicone rubber insulators”;
- Clean socket area. Remove plastic cover and remove secondary wiring in the area;
- Clean the parts in socket that are in contact with silicone rubber parts. Refer to “Treatment of plug connectors with silicone rubber insulators”;
- Insert voltage transformer into socket gently. Ensure that transformer is vertical (do not tilt or tip over). The inserted connector must be easily slid into the corresponding socket. If necessary, check whether silicone rubber parts are properly connected to the corresponding sockets. When reaching a position of about 20mm, reaction force can be clearly felt;
- Use bolts to lock flange to a mechanically fixed position. Lock evenly diagonally (max 15Nm torque applied).
- Fixed a cover on voltage transformer;
- Connect secondary wires and grounding wires to the secondary wiring terminal according to circuit diagram. Check whether all wiring is fixed.

避雷器的安装 Installation of arrester

参照电压互感器的安装方法,并检查避雷器接地位置与开关柜接地系统是否连接,检查所有的接线是否锁紧。

Refer to installation method of voltage transformer. Check whether grounding position of arrester is connected to grounding system of switchgear, and check whether all wiring is fixed.

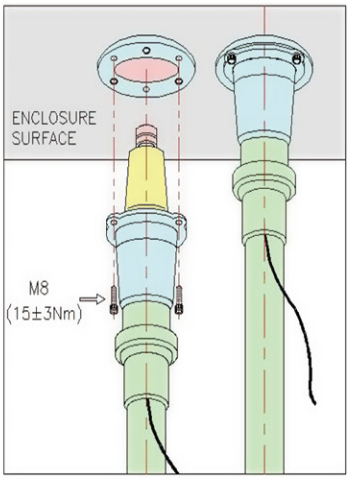
高压电缆及二次线的连接
Connection of high-voltage cables and secondary cables

根据工程的具体要求，电缆室内安装有适用于特定电缆形式和尺寸的电缆插座。安装电缆插头的详细情况请参考插头生产厂家的说明书。在母线已通过高压试验测试和开关柜回路电阻测量后才能安装高压电缆。

According to specific requirements of a project, cable sockets that suitable for specific cable types and sizes are installed in a cable room. For details of installation of cable plug, please refer to the manual from plug manufacturer. High-voltage cables can be installed only after busbars have passed high-voltage test and switchgear’ s circuit resistance measurement.

高压插接式电缆连接 High voltage plug-in cable connection

内锥式插接电缆的连接：



- 将符合工程需求的单芯塑料绝缘电缆放入各个开关柜。
- 取下插座上的运输防护盖，拆下电缆室底板。
- 剥开电缆套，露出电缆芯，确认电缆与插座的对应相序并标示。
- 按制造商指导书安装电缆头，最好在柜下进行。
- 如有需要，安装穿芯式电流互感器。
- 根据制造商的指导书清洁电缆插头的相应部分并涂硅脂。
- 以下步骤需两人完成：
  第一人在柜下，向柜内送电缆。第二个人则躺在电缆室中将电缆导入相应的插座内。
- 按照制造商的说明书进行下一步安装。
- 对齐电缆，然后固定在电缆夹上。
- 将电缆的屏蔽线连接到开关柜的接地排上。
- 将所有空置的电缆插座，如备用柜，用电缆堵头封闭。
- 将电缆室底板装上。

⚠ 注意：不能有悬臂力和扭力作用于电缆插座与电缆头上，以免影响电缆与电缆头的使用寿命。

外锥式插接电缆的连接

- 先要拆下电缆室的底板。
- 依照项目计划将电缆放置在相应开关柜的旁边。

⚠ 注意：要确保电缆安装的相序位置的正确性。

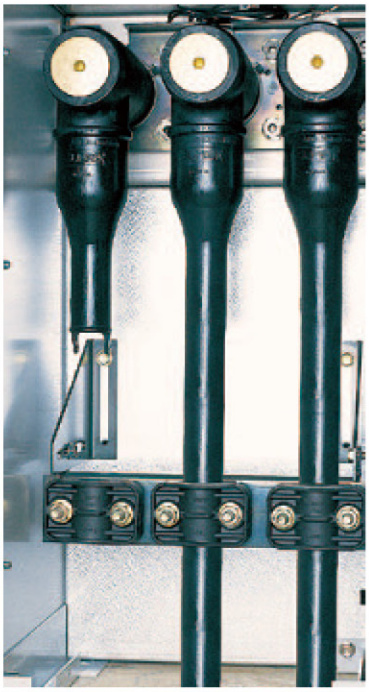
- 依次将电缆套管套入电缆上。
- 按照制造商的指导说明文件安装电缆头。
- 按照制造商的指导说明文件将电缆头与相应外锥电缆插座连结。
- 将电缆屏蔽层的接地导线联接至柜体接地铜排上。
  * 如果柜体中采用了环形电流互感器，电缆屏蔽层的接地导线在联接至柜体接地铜排之前要先穿过环形电流互感器。

⚠ 注意：电缆屏蔽层的接地线要尽量取最短的距离联接至柜体接地铜排上。螺栓的锁紧力矩要满足生产商所提供的指导说明文件中的要求。

- 外锥式插接方式的电缆可以选单芯电缆。由于三芯电缆是从三指套开始进行分叉，所以从三指套到电缆插头根部要有足够的
- 长度，要保持合理的电缆弯曲半径。从三指套出头的三根电缆长度应不一致，A、C 两边相一样长，B 相（中间位置）相应短一些，
- 这样才能保证三相电缆水平一致。
- 对齐电缆，然后固定在电缆夹上。
- 重新装上电缆室底板及柜体上的盖板。

⚠ 注意：如果单芯电缆在柜内分叉，电缆插座的高度必须在 800mm 以上，订货时应注明单芯电缆是否在柜内分叉。

Inner cone type plug-in cable connection



- Put single-core plastic insulated cables that meet project requirements into each switchgear.
- Remove protective cover on socket, and remove bottom plate of cable compartment;
- Strip cable sheath to expose cable core. Confirm corresponding phase sequence of cables and sockets and mark them;
- Install cable plug according to the manufacturer's instructions, preferably under switchgear on-site;
- If necessary, install a through-core current transformer;
- Clean the corresponding part of cable plugs and apply silicone grease according to the manufacturer's instructions;
- The following steps need to be completed by two people: the first person is under switchgear and sends the cable into the switchgear. The second person lies in cable compartment and guides cable into the corresponding socket;
- Follow the manufacturer's instructions for next installation.
- Align cables and fix them on cable clamps.
- Connect shielded cable to grounding busbar of switchgear.
- Seal all vacant cable sockets, such as spare switchgears, with cable end cap.
- Install bottom plate of cable compartment.

⚠ Note: Cantilever force and torsion are not allowed to apply on cable socket and cable head, so as not to affect their service life.

Cone plug-in cable connection

- Firstly, remove the bottom plate of cable compartment.
- Place cables beside the corresponding switchgears according to the project scheme.

⚠ Note:Ensure that phase sequence position of cable installation is correct.

Put cable bushing on cables.

- Install cable plug according to the manufacturer's instructions
- Connect cable plug to the corresponding outer cone cable socket according to the manufacturer’ s instructions
- Connect grounding wire of cable shielding layer to grounding copper busbar of switchgear.

*If a toroidal current transformer is used in switchgear, the grounding wire of cable shielding layer should pass through the toroidal current transformer before being connected to switchgear’ s grounding copper busbar.

⚠ Note:The grounding wire of cable shielding layer shall be connected to switchgear’ s grounding copper busbar of with the shortest distance possible. The locking torque of bolts should meet requirements of the manufacturer’ s instruction.

- Single-core cable can be selected for outer cone plug-in cable. Since three-core cable is bifurcated from three-finger busing, there should be
- enough length from three-finger bushing to the root of cable plug, and a reasonable cable bending radius should be maintained. The lengths of three cables that coming out of three-finger bushing should be inconsistent. The phases A and C are the same length, and phase B (the middle position) is correspondingly shorter, so as to ensure the same level of three-phase cables.
- Align cables and fix them on cable clamps.
- Reinstall the bottom plate of cable compartment and cover on switchgear.

⚠ Note:If single-core cable is branched in switchgear, the height of cable socket must be above 800mm. When ordering, it should be noted whether single-core cable is branched in the cabinet.

控制电缆及其接线Control cable and its wiring

- 按照图纸的详细要求，采用连接和跨接方式将进线和馈出柜的配线连接起来；
- 控制电缆及配线都从底部引向低压室、并在端子排上进行连接；
- In accordance with the detailed requirements of drawings, use connection and jumper methods to connect wiring of incoming and outgoing switchgears;
- Control cables and wiring are led from the bottom to low-voltage compartment and connected on terminal block;

最后检查 Final check

- 清理柜体表面以及控制室内，检查表面漆层是否有损伤，如有，用合适的油漆补漆。
- 重新装好安装过程中拆除的部件，如操动机构、电缆通道等的盖板，在一次电缆、二次电缆通过柜体处封好防火泥
- 从开关柜中取走所有的工具以及其它非开关柜的器件。
- 确认开关柜处于正常状态。
- 确认开关柜周围环境处于正常状态。

- Clean switchgear surface and control room. Check whether surface paint is damaged, if so, use suitable paint to repair the surface.
- Reinstall the parts that removed during installation process, such as operating mechanism, cover of cable channel, etc. Seal fireproof mud at the place where primary and secondary cables pass through switchgear.
- Remove all tools and other components (not belong to switchgear) from the switchgear
- Confirm that switchgear is in a normal state
- Confirm that the surrounding environment of switchgear is in a normal state

调试 / 运行 Commissioning/Operation

⚠ * 安装操作注意事项：只能由经过专业培训的人员来进行相关的工作和操作程序。

⚠ *Warning for installation and operation: Only professionally trained personnel can carry out related work and operating procedures.

调试 Commissioning

准备工作Preparation

调试准备阶段，在准备接通高压电源之前，应完成以下工作:

- 接好辅助和控制电源并检查极性正确性;
- 检查机械及电气联锁在特定条件下的有效性;
- 按相关标准进行保护装置功能测试;
- 检查系统的整体状态;
- 在配电室内明显位置放置说明书;
- 向现场操作员详细介绍开关柜的常规操作;
- 检查运行准备情况及上、下级电气设备的运行及操作情况的完好性。

如必要，以下开关柜邻近的设备也需检查：

- 电力电缆;
- 控制电缆;
- 辅助电源及其极性;
- 远方控制系统;
- 接到主接地排的外部接地;
- 开关室设备;
- 开关室环境。

In the preparation stage for commissioning, the following works should be completed before connection of high-voltage power:

- Connect auxiliary and control power supply and check correctness of polarity;
- Check effectiveness of mechanical and electrical interlocks under specific conditions;
- Perform function test for protection device according to relevant standards;
- Check general status of system;
- Place a instruction manual in an obvious place in power distribution room;I
- ntroduce regular operation of switchgears in detail to on-site operators;
- Check operational readiness and integrity of operation of electrical equipment in upper and lower level .

If necessary, the equipment adjacent to the following switchgears shall also be inspected:

- Power cables;
- Control cable;
- Auxiliary power supply and its polarity;
- Remote control system;
- External grounding system that connecting to main grounding busbar;
- Switchgear room’ s equipment;
- Switchgear room’ s environment.

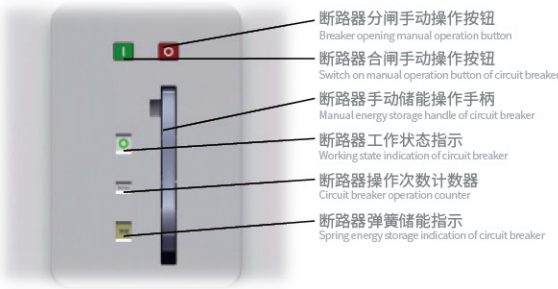
启动 Start up

- 遵守所有相关的安全规则;
- 确认柜内断路器处于分闸位置;
- 相关母线系统的隔离开关合闸;
- 取掉危险工作区域的短路接线及接地线;
- 在同一段母线有数条进线和几个母线段时应检查相序;
- 按正常程序启动开关柜，观察智能控制及保护单元的信号显示;
- 用所接的高压电源，检查测量及其它功能;
- 注意任何异常情况。

- Comply with all relevant safety rules;
- Confirm that circuit breaker in switchgear is in opening position;
- Disconnector in related busbar system is closed;
- Remove short-circuit wiring and grounding wires in hazardous work areas;
- The phase sequence should be checked when there are several incoming lines in the same busbar section and several busbar sections;
- Start switchgear according to normal procedure and observe signal display of intelligent control and protection unit;
- Use the connected high-voltage power supply to check measurement and other functions;
- Pay attention to any abnormal conditions.

开关柜的操作 Switchgear operation

断路器 Vacuum Circuit Breaker



断路器配有储能机构，可电动完成储能。断路器的合闸与分闸：

- 合闸和分闸由所配的控制设备或者开关柜面板上的操作按钮和转换开关来操作；
- 合、分操作通常按照设计要求的不同，分为就地和远方进行，在操作前，请注意远方 / 就地转换开关的所在位置；
- 就地操作可以通过手动或电动来实现；
- 在操作过程中注意位置指示。

紧急手动操作：若储能电机故障。则应手动储能： 打开低压室门；将储能手柄上下拉压 20 次左右，直至储能状态指示器显示储能完成。储能完成后，储能机构自动脱开，继续操作储能手柄已无效。

断路器合闸状态下，若失去控制电源可使用机械分闸按钮分闸。

⚠ 注意： 若失去控制电源，可按下断路器的手动分闸按钮，进行分闸操作。

（注：机构也可以选用旋转式储能手柄）

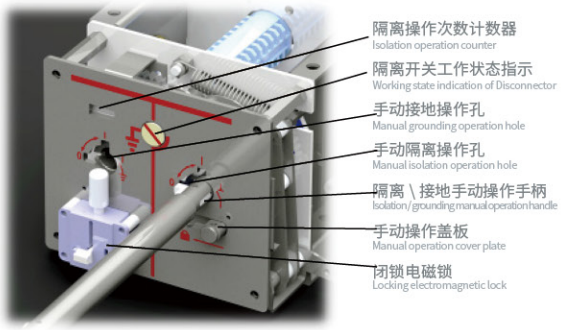
VCB is equipped with an energy storage mechanism, which can complete energy storage electrically. VCB's closing and opening:

- Closing and opening are operated by the control equipment or the operation button and transfer switch on the panel of switchgear;
- Closing and opening operations are usually divided into local and remote operations according to differentdesign requirements. Before operation, please pay attention to the location of remote / local transfer switch.
- Local operation can be realized by manual or electric.
- Pay attention to position indication during operation.

Emergency manual operation：If energy storage motor fails, it needs to charge energy by manual.Open low-voltage compartment’s door.Push energy storage handle up and down for 20 times around, until energy storage status indicator shows that energy storage is completed. After energy storage is completed, energy storage mechanism is automatically tripped, and it is no longer valid to continue to operate the energy storage handle.In VCB closed state, if control power supply isn’t available, mechanical opening button can be used to open the VCB.

⚠ Note: If control power isn’t available, press VCB’s manual opening button to open it.

三工位隔离开关 Three-position disconnector



三工位隔离开关配有操作电机。合、分闸操作即可通过在智能控制及保护单元上的按钮,也可通过开关柜盘面上的转换开关(可选)来实现。

⚠ 注意:合分闸操作通常根据设计要求分为远方和就地操作,在操作前,请注意远方 / 就地转换开关的位置。

观察操作机构面板上或控制单元上的开关位置指示器。

手动操作指南:

开关操作过程可用手动操作替代电动。

⚠ 警告！三工位隔离开关手动操作盖板打开后，电动控制回路电源将自动关闭。

按以下操作进行三工位隔离开关的手动合、分:

- 打开低压室门;
- 断路器分闸;
- 打开三工位隔离开关机构上的手动操作盖板。

⚠ 注意: 三工位隔离开关机构上的手动操作盖板仅能在断路器分闸状态时打开。

将操作手柄插入操作孔;

三工位隔离开关: 假如三工位隔离开关在分开位置 (即隔离开关分、接地开关分), 若手柄插入隔离开关操作孔, 顺时针转动约 1/4 圈, 则三工位隔离开关合闸 (母线接通); 若手柄插入接地开关操作孔, 顺时针转动约 1/4 圈, 则接地开关合。

⚠ 注意: 每次操作必须到达极限位置停止后, 才算完成。

⚠ 注意: 当线路侧带电时, 接地操作孔被闭锁电磁锁闭锁, 防止带电合接地开关。

注意观察机械位置指示器; 拔出手动操作手柄, 应及时关闭三工位隔离开关手动盖板; 关上低压室门。

Three-position disconnector is equipped with an operating motor. Closing and opening operations can be achieved either through the buttons on intelligent control and protection unit, or through the switch (optional) on switchgear' s panel.

⚠ Note: Closing/opening operation has remote and local operation according to design requirements. Before operation, please pay attention to position of remote/local switch.

Observe switch position indicator on panel of operating mechanism or on control unit.

Manual operation guide:Disconnector can be manually operated instead of by electric.

⚠ Warning! After the manual operation cover of three-position disconnector is opened, power supply of electric control circuit will be automatically turned of.

Perform manual closing and opening of three-position disconnector according to the following operations:

- Open low-voltage compartment door;
- VCB is opened;
- Open the manual operation cover on three-position disconnector mechanism.

⚠ Note: The manual operation cover on three-position disconnector mechanism can only be opened when VCB is opened.

Insert a operating handle into operating hole;Three-position disconnector: If three-position disconnector is in opening position (i.e. disconnector is opened and earthing switch is opened), if a handle is inserted into the operating hole of disconnector and turning clockwise about 1/4 turn, the three-position disconnector is closed (busbar is connected); if a handle is inserted into the operation hole of earthing switch, turn clockwise about 1/4 turn, the earthing switch is closed.

⚠ Note: Each operation is completed after reaching limit position and stopping.

⚠ Note: When circuit side is lived, grounding operation hole is latched by latch electromagnet to prevent lived earthing switch closed.

Observe mechanical position indicator;Pull out manual operation handle, and close the manual cover of three-position disconnector in time;Close low-pressure chamber door.

欠压脱扣Undervoltage tripper

欠压脱扣是可选项。为防止因电源失电由欠压脱扣器引起的断路器跳闸,必须加装联锁杆和相应的连线。

Undervoltage tripper is optional. In order to prevent VCB from tripping caused by undervoltage tripper due to power loss, an interlock lever and corresponding wiring must be installed.

状态显示与监视 Status display and monitoring

绝缘气体监视 Insulating gas monitoring

在运行中的开关柜的所有气室必须充足够的绝缘气体，最低运行压力 0.01Mpa。

气体压力由密度表监测，如气体压力降到最低运行压力以下时，密度控制器会发出报警信号。

⚠ 注意：如开关柜处于长期（几个星期）备用状态，气体压力的监测也应该进行。

All gas chambers of switchgear must be filled with sufficient insulating gas during operation. The minimum operating pressure is 0.01Mpa.Gas pressure is monitored by a density meter. If gas pressure drops below the minimum operating pressure, a density controller will send out an alarm signal.

⚠ Note: If switchgear is in standby state for a long-term (several weeks), gas pressure monitoring should also be carried out.

开关柜运行状态的显示及监视 Display and monitoring of operating status of switchgear

开关柜运行时，应注意观察所有的运行数据和状态指示，警惕任何异常情况，包括开关柜运行的外部环境条件。

When switchgear is running, should pay attention to observe all operating data and status indications, and be alert to any abnormal conditions, including external environmental conditions of switchgear operation

测试程序 Test program

主回路断电状态测试 Main circuit power-off state test

开关柜配有低阻抗容式带电显示装置来检测回路断电情况。

⚠ 注意：仅与本带电指示系统匹配，并符合相关国家标准或国际标准的带电显示器验电装置才能使用。除了在开关柜的高电压试验（如工频耐压或雷电冲击耐压）期间，测试插孔不得短路。

显示器的使用：

- 在例行试验的前后应立即进行功能检测，显示必须清晰可见。
- 亮灯信号显示运行电压的存在。
- 请参阅相应开关柜的显示器各自的使用说明书。

接口检测：

- 用专用的验电装置在所有元器件上进行功能试验完成接口检测。
- 根据 EC61243 Part5 或 DL/538 进行测试。

The switchgear is equipped with a low-impedance capacitive live display device to detect power failure of circuit.

⚠ Note: Only a live display (electrical test device) that matches the live indication system and complies with relevant national or international standards can be used. Except during high voltage test of the switchgear (such as power frequency withstand voltage or lightning impulse withstand voltage), the test socket can not be short-circuited.

Use of display:

- Function test should be carried out immediately before and after routine test. Display must be clearly visible.
- Light signal indicates existence of operating voltage.
- Please refer to respective operating instructions of corresponding switchgear's display.

Interface detection:

- Perform functional tests on all components with a specialized electrical testing device to complete interface testing.Test according to IEC61243
- Part5 or DL/538.

主回路相序测试 Phase sequence test of main circuit

当有两路及以上进线时，可使用核相器极性测试。核相器可插入电容式带电显示装置的测试插孔中进行测试。

测试步骤:

- 只能使用满足 IEC 或国家标准并与开关柜的指示系统技术设计向匹配的核相器;
- 测试前应对核相器进行功能测试;
- 测量距离不得超过引线的最大长度;
- 将核相器准确插入各相对应的插孔;
- 必须遵循核相器的使用说明书;

When there are two or more incoming lines, can do polarity test by using phasing tester. Phasing tester can be inserted into the test socket of capacitive live display for testing.Test steps:

- Only phasing testers that meet IEC or national standards and match technical design of switchgear’ s indicator system can be used;
- Before test, should do functional test for phasing tester;
- The measurement distance shall not exceed the maximum length of lead wire;
- Insert phasing testers into each corresponding socket accurately;
- The operating instructions of phasing tester should be followed.

高压试验 High voltage test

高压试验用试验电缆。电压试验程序:

- 根据 IEC62271-200 和 DL/T791 安全规范，设置隔离区域，并保证安全;
- 用手持式显示器插入电容式带电显示装置的插孔检测主回路断电情况;
- 拆下避雷器和电压互感器;
- 将所有空出的电缆插座用电缆堵头封堵;
- 检查试验电缆表面是否清洁、干燥，如有必要，需进行清洁;
- 在试验电缆用来封堵的表面均匀地涂一层薄硅脂;
- 将试验电缆的接地线接地;
- 将试验电缆插入准备好的电缆插座并锁紧。

⚠注意： 只有在电压试验期间才可安装电压试验电缆。

- 在工频耐压值试验期间. 需将带电显示装置的测试插孔短接。
- 电缆试验时，开关柜处于分支母线接地的状态，可用断路器分闸断开电缆的接地。

Test cable should be used for high voltage test. Voltage test procedure:

- According to IEC62271-200 and DL/T791 safety regulations, set up isolation areas and ensure safety,
- Use a handheld display to insert into the socket of capacitive live display device to detect power failure of main circuit;
- Remove arrester and voltage transformer;
- Block all vacant cable sockets with cable plugs;
- Check whether the surface of test cable is clean and dry, if necessary, clean it;
- Spread a thin layer of silicone grease evenly on the surface of test cable used for plugging;
- Ground the grounding wire of test cable;
- Insert test cable into prepared cable socket and lock it tightly.

⚠Note: Voltage test cable can only be installed during voltage test.

- During power frequency withstand voltage test, test socket of live display needs to be short-circuited.
- During cable test, switchgear is in a state of grounding branch busbar, and VCB’ s opening can be used to disconnect grounding of cable.

回路电阻测量 Circuit resistance measurement

测量主回路电阻采用电压 - 电流法，测试电流 100A，测量时需相邻的两台一起测，即电流夹子夹在相邻开关柜的电缆套管导体处。
Voltage-current method is used to measure resistance of main circuit.Test current is 100A. When measuring, two adjacent switchgears need to be measured together, that is, a current clamp is clamped at cable bushing’ s conductor of the adjacent switchgears.

类型 Type	额定电流规格 Rated current	回路电阻 Circuit resistance (μΩ)
单个开关柜 Single switchgear	630A	≤120
	1250A	≤70
	2500A	≤40
柜 + 柜 (通过母线连接) Switchgear+ switchgear (Connection by busbar)	630A+630A	≤255
	630A+1250A	≤205
	1250A+1250A	≤155
	1250A+2500A	≤120
	2500A+2500A	≤90

注入一次电流时的保护测试 Protection test when injecting primary current

当进行注入一次电流的保护功能测试时，一次电流注入开关柜必须通过试验插座，根据以下描述将电流试验插头插入并锁紧到电缆插头中：

- 电流试验插头应参照制造商的说明；
- 根据 IEC60694 或 DL/T791 等相关国家标准，设置隔离区域，并保证安全；
- 拆下电压互感器，避雷器或电缆堵头；
- 检查试验插头表面是否清洁、干燥，如有必要，需进行清洁；
- 将试验插头插入已备好的插座. 并锁紧；
- 根据设备生产商的说明，装配测试元器件，并进行测试；
- 完成试验后，立即取下电流试验插头并换上相应的设备或元器件（电压互感器，避雷器或电缆堵头）。

⚠ 注意：在断路器的分闸脱扣器线圈上加电压只能持续 1000ms，如超过将会烧毁。因此，保护测试系统必须在分闸命令时断开或将分闸脱扣器隔离。

⚠ 警告！如试验必须通过断路器，则必须考虑到如断路器分闸将导致通过断路器的接地被取消！为避免这种情况，分闸线圈在试验中应隔离。

When testing protection function of injecting primary current, primary current injected into switchgear must through a test socket. Insert and lock a current test plug into a cable plug according to the following description:

- Current test plug should refer to the manufacturer's instructions;
- According to relevant national standards such as IEC60694 or DL/T791, set up isolation areas and ensure safety;
- Remove voltage transformer, arrester or cable plug;
- Check whether the surface of test plug is clean and dry, if necessary, clean it;Insert a test plug into prepared socket and lock it tightly;
- Assemble and test components according to the equipment manufacturer’ s instructions;
- After completing the test, immediately remove current test .
- plug and replace it with the corresponding equipment or components (voltage transformer, arrester or cable plug)

⚠ Note: The voltage applied to opening tripping coil of VCB can only last for 1000ms, if exceeding it, it will be burnt. Therefore, protection test system must disconnect or isolate the opening tripping coil during opening command.

⚠ Warning! If test must through VCB, it must be considered that if VCB is opened, grounding through the VCB will be cancelled! To avoid this situation, opening coil should be isolated during the test.

维护接地 Maintenance grounding

实现维护接地的方式有两种:

- 母线接地可通过母联／提升柜实现;
- 通过短路接地装置进行接地;

前面所述电流试验插头配合相应的短路与接地电缆装置, 可用作维护接地。

⚠警告: 在使用接地与短路装置时, 应注意联锁。

- 根据 IEC60694 或 DL/T791, 设置隔离区域, 并保证安全;
- 用手持式显示器插入电容式带电显示系统的插孔检测主回路断电情况;
- 检查试验插头表面是否清洁、干燥, 如有必要, 需进行清洁;
- 小心地将短路接地电缆装置锁入试验插头;
- 将电缆的公共接地端, 接到开关柜接地端;
- 拆除相应电缆插座内的堵头;
- 将试验插头插入插座并锁紧;

There are two ways to achieve maintenance grounding:

- The busbar grounding can be realized through the busbar coupler/lifting switchgear;
- Grounding through a short-circuit grounding device;

The aforementioned current test plug can be used for maintenance grounding with the corresponding short-circuit and grounding cable device.

⚠Warning: When using grounding and short-circuit devices, pay attention to interlock.

- According to IEC60694 or DL/T791, set up isolation area and ensure safety;
- Use a handheld display to insert into the socket of capacitive live display system to detect power failure of main circuit;
- Check whether the surface of test plug is clean and dry, if necessary, clean it;
- Carefully lock short-circuit grounding cable device into test plug;
- Connect common ground terminal of cable to ground terminal of switchgear;
- Remove plug in the corresponding cable socket;
- Insert test plug into socket and lock it;

电压互感器运行时的安全注意事项
Safety precautions during operation of voltage transformer

- 二次接线盒中, 相关接线由带标记的螺栓进行接地;
- 二次接线以及接线的接地应根据线路图连接;

⚠警告: 在互感器运行中解开“N”端的接地螺栓会有潜在的高压危险！ 仅允许在互感器与主回路脱离的情况下(试验目的, 才可以解开 “N” 端的接地螺拴！ 只能使用原配的接地螺栓！ 设备安装调试完成后, 应遵循以下程序:

- 确认所有设备安装、调试是否正确, 记录是否完整;
- 确认制造商是否提供完整的技术资料和图纸 (包括设计图、配线图等) ;
- 确认操作人员是否已经过培训, 获取上岗证。

- In the secondary wiring box, related wiring is grounded by marked bolts;
- The secondary wiring and grounding of wiring should be connected according to wiring diagram;

⚠ Warning: There is a potential high voltage hazard when grounding bolt on the "N" terminal is loosened during the operation of voltage transformer! Only when the transformer is disconnected from main circuit (for test purposes), can grounding bolt on the "N" end be released! Can only use original grounding bolts!*Note: After installation and commissioning of equipment, the following procedures should be followed:

- Confirm whether all equipment is installed and debugged correctly and whether records are complete;
- Confirm whether the manufacturer provides complete technical data and drawings (including design drawings, wiring diagrams, etc.);
- Confirm whether the operator has been trained and obtain job certificates.

维护 Maintenance

维护可保持开关柜无故障运行，并达到尽可能长的使用寿命。

按照 IEC 60694 和 DL/T791 等标准规定，包括下列紧密相关的工作:

- 检查: 对实际运行状况的确认;
- 保养: 保持规定运行状况的措施;
- 检修: 恢复规定运行状况的措施;

Maintenance can maintain trouble-free operation of switchgear and achieve the longest possible service life. According to standards such as IEC 60694 and DL/T791, it includes the following closely related work:

- Inspection: Confirmation of actual operating conditions;
- Maintenance: Measures to maintain specified operating conditions;
- Recondition: measures to restore specified operating conditions;

概述 Overview

在整个维护工作期间，必须遵守下述规定:

- 相关标准和规范的规定;
- 在工作时的安全须知见本说明书“开关柜的安装”; (建议: 最好让我公司售后服务专职人员来进行维修工作)
- 将本手册和说明书保存在配电室内显眼并易于取得的位置。
- 开关设备的检查和维护周期取决于操作频繁程度和短路故障开断次数。
- 控制室及其内设备的维护周期受运行环境 (包括污染及腐蚀性空气) 的影响。
- 除本安装使用手册外，还必须遵守开关柜所配智能控制 / 保护单元相应的说明手册。

During entire maintenance work, the following regulations must be observed:

- Relevant standards and regulations;
- For safety instructions at work, see "Installation of Switchgear" in this manual;
- Suggestion: It is best to let our company's professional after-sales personnel to carry out maintenance work.(Keep this manual and instructions in a conspicuous and easily accessible place in power distribution room)
- The inspection and maintenance cycle of switchgear depends on frequency of operation and number of short-circuit fault interruptions.The
- maintenance cycle of control room and its equipment is affected by operating environment (including polluted and corrosive air).
- In addition to this installation manual, the corresponding instruction manual of intelligent control/protection unit of the switchgear must also be followed.

检查及保养 Inspection and maintenance

- 在正常运行条件下，机构可在运行十年后，或在断路器操作 10000 次循环后，三工位开关操作 2000 次循环后，由经过专门培训的专职人员来检查。
- 在异常运行条件下（包括不利的天气状态）或在特别不利的环境中（包括污染、腐蚀环境），检查周期应该相应缩短。
- 检查首先是外观检查，包括污染、腐蚀和湿度的检查。
- 检查也应包括下面装置的机械和电气功能的检查： 开关设备、智能控制及保护单元、传统控制单元。
- 如发现异常情况，应立即进行相应的维修工作。

外表面清洁:

- 用干的软布轻轻擦去表面沉积的灰尘;
- 用弱碱性家用清洁剂及湿布去除附着污染物，液体不得渗入低压室及操作机构设备的前表面。

- Under normal operating conditions, mechanism can be inspected after ten years of operation, or after 10,000 cycles of VCB operations, and 2,000 cycles of three-position disconnector operations by specially trained full-time personnel.
- Under abnormal operating conditions (including unfavorable weather conditions) or in particularly unfavorable environments (including pollution and corrosive environment), inspection period should be shortened accordingly.
- The inspection is visual firstly, including pollution, corrosion and humidity inspection.
- The inspection should also include mechanical and electrical functions' check of the following devices: switchgear, intelligent control and protection units, and traditional control units.
- If abnormal conditions are found, corresponding maintenance work should be carried out immediately.

Surface cleaning:

- Use a dry soft cloth to gently wipe away dust deposited on the surface;Use a weak alkaline household cleaner and a damp cloth to remove attached
- contaminants. The liquid must not penetrate into a low-pressure chamber and the front surface of operating mechanism.

真空断路器 Vacuum circuit breaker

真空断路器有很长的运行寿命，操作机构仅需要极少的维护，断路器极柱免维护。
The vacuum circuit breaker has a long operating life. Its operating mechanism only requires minimal maintenance, and its pole is maintenance-free.

三工位隔离开关 Three-position disconnector

- 三工位隔离开关在 2000 次操作循环内免维护。
- 三工位隔离开关在 2000 次操作循环后的维护应由我公司专业工程师负责。
- Three-position disconnector is maintenance-free within 2000 operations.
- Maintenance of the three-position disconnector after 2000 operation cycles should be undertaken by our company's professional engineers.

绝缘气体及其维护Insulating gas and maintenance

- 警惕在气室中作业时，过高密度的绝缘气体会导致窒息;
- 密封压力系统遵循 IEC 60694 和 DL/T791 气室内的 SF6 不得放入大气，应予回收。
- Be wary of suffocation caused by high-density insulating gas when working in a gas chamber;
- The sealed pressure system complies with IEC 60694 and DL/T791. The SF6 in the gas chamber must not be put into the atmosphere and should be recycled.

维修 Repair

断路器部件及附件的更换 Replacement of VCB parts and accessories

仅允许在断路器分闸，开关柜周围区域已隔离并确保不会与带电母线重接，断路器储能弹簧能量已释放的情况下才能进行断路器部件及附件的拆除及重新装配。在拆除及重新装配期间，所有辅助电源必须切断，并保证不会重新接通。

It is only allowed to dismantle and reassemble VCB components and accessories when the VCB is opened, the area around the switchgear has been isolated to ensure that it will not be reconnected with live busbar, and energy storage spring’s energy of VCB has been released. During dismantling and reassembly, all auxiliary power must be cut off, and it is guaranteed that it will not be reconnected.

检查装置的尺寸精度 Check dimensional accuracy of device

在对断路器或三工位隔离开关必须的维修工作结束后，如机械联锁已装好，必须进行各联锁控制杆与凸轴间隙、半轴锁扣间隙的检查，确保灵活、可靠。

After necessary maintenance work for VCB or three-station disconnector, if mechanical interlock has been installed, clearance between each interlocking lever and cam shaft, and clearance of half shaft lock must be checked to ensure flexibility and reliability.

表面修复 Surface repair

油漆的钢板部件：

- 清除锈迹，例如使用钢刷；
- 去掉漆层和油脂；
- 刷上防锈底漆；
- 待底漆干透后，刷上表面漆层，请使用 RAL7035 标准色，或相关的特殊颜色 .

覆铝锌板和有表面防锈功能的钢板部件：

- 使用钢刷或清洁布，清除锈迹；
- 用干布擦干净；
- 用锌喷雾料或锌粉遮盖。

功能部件，磷酸盐化的：

- 使用钢刷或清洁布，清除白色锈迹；
- 用干布擦干净；
- 涂上润滑脂。

Painted steel plate parts:

- Remove rust, such as using a steel brush;
- Remove paint and grease ;
- Apply anti-rust primer;
- After primer is dry, apply surface paint layer, please use RAL7035 standard color, or related special color .

Aluminum-zinc-clad plate and steel plate parts with surface anti-rust function:

- Use steel brush or cleaning cloth to remove rust;
- Wipe clean with a dry cloth;
- Cover with zinc spray or zinc powder.

Functional parts, phosphate:

- Use steel brush or cleaning cloth to remove white rust;
- Wipe clean with a dry cloth;
- Apply grease.

备用和辅助材料 Spare and auxiliary materials

备用材料 Spare materials

- 绝缘气体系统：六氟化硫（SF6）。发运形式：在钢瓶中以压缩气体发运，请遵守相关的标准要求。
  * 注意： 如果储存气体处极限温度 ≥60℃，并无法排除阳光直射到的地方，为安全起见，订购时要减少 0.75kg ／ L 钢瓶容量的充气系数。
- 干燥剂：袋装干燥剂符合相关标准，每袋 210g。

- Insulating gas system: sulfur hexafluoride (SF6).Shipment method: Shipped with compressed gas in steel cylinders, please comply with relevant standard requirements.
  *Note: If limit temperature for gas storage is ≥60 ℃ , and the place exposed to direct sunlight cannot be excluded, for safety reasons, inflation coefficient of a cylinder capacity of 0.75kg/L should be reduced when ordering.
- Desiccant: The bagged desiccant meets relevant standards, 210g per bag.

辅助材料 Auxiliary materials

- 润滑剂；
- 硅脂：用于绝缘部件或环氧浇注插接连接件；
- 导体部分，部分绝缘材料及所有的重污秽部件的清洁剂：
- 母线绝缘部件，母线插座及电缆插座：电缆清洁剂 MAB；
- 涂料：标准颜色 RAL 7035。

- Lubricant;
- Silicone grease: used for insulating parts or epoxy casting plug connectors;
- Cleaner for conductor part, part of insulation material and all heavily polluted parts:
- Busbar insulation parts, busbar sockets and cable sockets: cable cleaner MAB;
- Paint: standard color RAL 7035.

随机文件
Random document

- 产品合格证;
- 产品说明书;
- 二次施工接线图;
- 技术协议中规定的其他文件;
- 装箱单。

- Product qualification certificate;
- Product manual;
- Secondary wiring diagram for construction;
- Other documents specified in technical agreement;
- Packing list.

订货须知
Ordering instructions

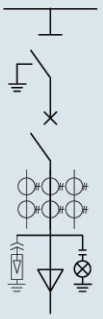
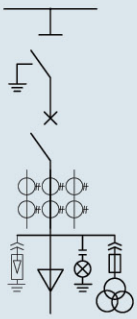
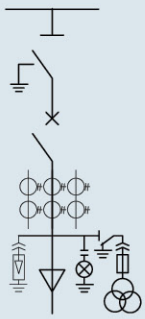
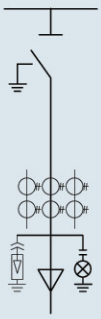
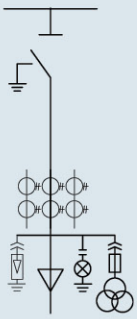
- 主接线方案编号及单线系统图, 平面布置图;
- 二次回路原理图, 端子排列图, 如端子无排列图时按制造厂规定;
- 电缆及电缆终端应在订货时确定其规格、型号;
- 开关柜使用在特殊环境条件, 应在订货时提出并与制造厂协商;
- 需要备件、附件时, 应提出其名称和数量。

⚠ 注: 产品如有更新, 恕不另行通知。

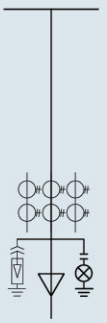
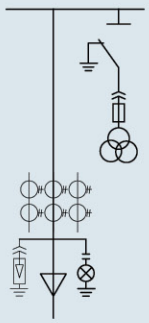
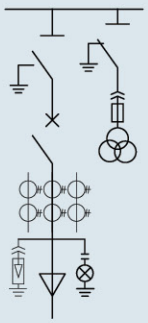
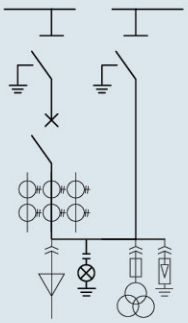
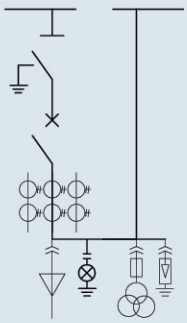
- Main wiring scheme number, single-line system diagram, and floor plan;
- Secondary schematic diagram, terminal arrangement diagram, if there is no arrangement diagram for terminals, follow the manufacturer's regulations;
- The specifications and models of cables and cable terminals should be determined when ordering;
- Switchgear is used in special environmental conditions, which should be advised when ordering and negotiated with the manufacturer;
- When spare parts and accessories are needed, their name and quantity should be mentioned.

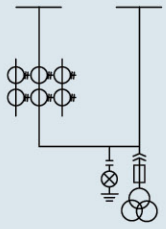
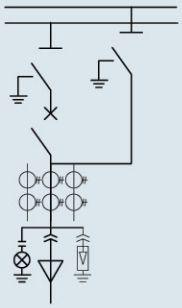
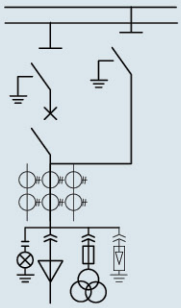
⚠ Note: The product is subject to update without prior notice.

附：典型一次方案图
Attachment: typical primary scheme diagram

方案编号 Scheme number			01	02	03	04	05
主接线方案 Main wiring scheme							
用途 Application			断路器柜 VCB switchgear	断路器柜 VCB switchgear	断路器柜 VCB switchgear	隔离柜 Isolation switchgear	PT 柜 PT switchgear
额定电流 Rated current (A)			630 ～ 3150	630 ～ 2500	630 ～ 2500	630 ～ 3150	630 ～ 2500
主要元件 Main component	真空断路器 VCB Vacuum circuit breaker VCB		1	1	1		
	三位开关 DS Three position switch DS		1	1	1	1	1
	电流互感器 CT (可选) CT (optional)		2-3	2-3	2-3	2-3	2-3
	电流互感器 PT Current transformer PT			3	3		3
	避雷器 (可选) Arrester (optional)		3	3	3	3	3
	带电显示器 Live display		1	1	1	1	1
柜体尺寸 switchgear size	12-24Kv	1250-1600A	600*1410*2330	800*1610*2330	800*1610*2330	500*1410*2330	800*1410*2330
	40.5Kv	1250-1600A	600*1410*2330	800*1610*2330	800*1610*2330	600*1410*2330	800*1610*2330
	12-40.5Kv	2000-2500A	800*1610*2330	800*1610*2330	800*1610*2330	800*1610*2330	800*1610*2330
	12-40.5Kv	3150A	800*1810*2330			800*1810*2330	

附：典型一次方案图
Attachment: typical primary scheme diagram

方案编号 Scheme number			06	07	08	09	10
主接线方案 Main wiring scheme							
用途 Application			提升柜 Lifting switchgear	提升柜 (母线带 PT) Lifting switchgear (busbar with PT)	断路器柜 (母线带 PT) VCB switchgear (busbar with PT)	联络柜 Coupling switchgear	联络柜 Coupling switchgear
额定电流 (Rated currentA)			630 ～ 3150	630 ～ 3150	630 ～ 2500	630 ～ 2500	630 ～ 2500
主要元件 Main component	真空断路器 VCB Vacuum circuit breaker VCB				1	1	1
	三位开关 DS Three position switch DS				1	2	1
	电流互感器 CT（可选） CT (optional)		2-3	2-3	2-3	2-3	2-3
	电流互感器 PT Current transformer PT			3	3		3
	避雷器（可选） Arrester (optional)		3	3	3	3	3
	带电显示器 Live display		1	1	1	1	1
柜体尺寸 switchgear size	12-24Kv	1250-1600A	500*1410*2330	800*1610*2330	800*1610*2330	800*1410*2330	800*1410*2330
	40.5Kv	1250-1600A	600*1410*2330	800*1610*2330	800*1610*2330	1000*1610*2330	800*1610*2330
	12-40.5Kv	2000-2500A	800*1610*2330	800*1610*2330	800*1810*2330	1000*1610*2330	1000*1610*2330
	12-40.5Kv	3150A	800*1810*2330	800*1810*2330		1400*1810*2330	1000*1810*2330

方案编号 Scheme number			11	12	13
主接线方案 Main wiring scheme					
用途 Application			计量柜 Measurement switchgear	双母线断路器柜 VCB switchgear with double busbar	双母线断路器柜 VCB switchgear with double busbar
额定电流 Rated current (A)			630 ～ 2500	630 ～ 2500	630 ～ 2500
主要元件 Main component	真空断路器 VCB Vacuum circuit breaker VCB		-	1	1
	三位开关 DS Three position switch DS		-	2	2
	电流互感器 CT (可选) CT (optional)		2~3	2~3	2~3
	电流互感器 PT Current transformer PT		3		3
	避雷器 (可选) Arrester (optional)		3	3	3
	带电显示器 Live display		1	1	1
柜体尺寸 switchgear size	12-24Kv	1250-1600A	800*1610*2330	500*2010*2330	800*2010*2300
	40.5Kv	1250-1600A	800*1610*2330	600*2010*2330	800*2010*2300
	12-40.5Kv	2000-2500A	800*1610*2330	800*2010*2330	800*2010*2300