

ZF19-252 气体绝缘金属封闭开关设备

ZF19-252 Gas Insulation Metal-Sealed Switching Equipment

一、概述

气体绝缘金属封闭开关设备(简称GIS),由于它将断路器、隔离开关、接地开关、母线、互感器、避雷器等主要元件均装入封闭的金属容器,内充SF₆气体作为绝缘及灭弧介质,故具有体积小、占地面积少、不受外界环境影响、运行安全可靠、维护简单和检修周期长等优点,因此是各类变电站的最佳选择。

北京北开电气股份有限公司(原北京开关厂)自1983年开始生产GIS设备,迄今已经生产了6000余个间隔,装配了约500个变电站,并出口东南亚、非洲等多个国家。多年来北开电气积累了丰富的设计制造经验,为用户提供了安全可靠的产品,受到广大用户的普遍认可。

二、ZF19-252 GIS主要特点

• 安全可靠

ZF19-252 GIS的全部高压带电部件均置于密封金属壳体内。壳体内以SF₆气体作为绝缘介质及断路器的灭弧介质。确保了操作安全,减少了维修要求。

• 高度的绝缘可靠性

GIS中盆式绝缘子、绝缘拉杆、支柱绝缘子等环氧树脂绝缘件,经过严格的电场计算并优化设计,使其绝缘性能可靠,安全系数高。

• 自能灭弧配用轻型弹簧操作机构

自能灭弧技术的应用,大大减小了断路器所需的操作功,配用轻型弹簧机构,杜绝了慢分慢合及漏油漏气现象。提高了机构的可靠性,机械寿命达6000次。

• 优异的壳体结构

壳体的主体材料采用了无缝合金铝管,壳体成型采用了冷翻边工艺,为机械手焊接提供了条件,确保了焊缝质量,同时极大地改善了电场分布,大大地缩小了壳体的外形尺寸。

• 涡流损耗小

ZF19-252 GIS几乎所有与涡流发热有关的壳体元件均采用合金铝材料,抗腐蚀性能强,且大大减少了涡流损耗。

• 环境耐受力强

GIS的所有部件都被金属壳体所包容,故不受自然界风、霜、雨、雪的影响,亦不受外界污秽和高海拔的影响,具有很强的耐环境能力。

• 间隔作业模式,现场工作量小

整机设备在厂内按主接线间隔进行安装调试,每间隔为一个运输单元,便于运输及现场安装,减少了现场装调工作量。

三、ZF19-252 GIS总体构成

1. 产品结构示意图

2. 布置方式

ZF19-252 GIS为主母线三相共用一个壳体,其余为分箱式结构。采用标准元件积木式布置,布置灵活,便于扩展,可满足各种主接线要求。间隔为1.8m,相间距0.58m。产品体积小、紧凑,节省占地面积。

ZF19-252 GIS所有操作机构均布置在便于观察和维护的位置。

3. SF₆气体系统

ZF19-252 GIS SF₆气体系统的设计原则,是按照设备各元件的执行功能并尽可能减少气隔的数量,同时考虑到减小事

故和检修时涉及的范围来设置。

ZF19-252 GIS SF₆ 气体系统采用分散监控方式，取消了大量 SF₆ 气体管路。采用新型的 SF₆ 密度计，大大减少了 GIS 外部的泄露环节，使 GIS 具有更低的 SF₆ 气体漏气率。

4. 电气控制系统

控制系统直接反映元件的工作状态、电力系统运行状态和变电站的运行方式。实现就地及远方操作。与主控屏连接后，可实现自动跳闸和重合闸。

控制部分实现 GIS 元件的闭锁和元件之间的联锁。

5. 标准间隔模块

北开电气已有近 20 年的生产及设计 GIS 的经验，具备了可靠的开发设计能力及制造技术，ZF19-252 GIS 的工程设计生产均结合各工程特点并按标准功能单元及间隔模块进行设计，ZF19-252 GIS 标准间隔可实现模块化生产。

I. General

The gas insulation metal-sealed switchgear(GIS), equipped with circuit breaker, disconnecter, earthing switch, bus, CT or PT and lightning arrester, filled with SF₆ gas insulation as arc-extinguishing, has characteristic of covering small space, free from surrounding influence, safe and reliable operation, simple and long-period maintainable. Therefore, they are very popular with users and have been widely applied in various substations. BBE (the original Beijing Switchgear factory) started to produce GIS since 1983, and up to now it has already produced 6,000 bays, has assembled about 500 substations, and exported to Indonesia and other countries. For many years BBE has accumulated rich experience in design and production, and it has provided safe and reliable products for users, and has thus received universal approval from users.

II. Main characteristics of ZF19-252 GIS

•Safe & reliable

All high-voltage part of ZF19-252 are situated in sealed metal shells. In the shells, SF₆ gas works as the insulation medium and the circuit breaker extinguishing of arc medium. This guarantees the safety of operation, reduces the needs of repair.

•High reliability of insulation

In GIS, the basin type insulator, insulation tension bar, epoxy resin insulation and so on supporting insulator, pass through the strict electric field computation and the optimized design, which makes its insulation ability to be enhanced, the safety coefficient high.

•self-energy arc extinguishing accompanied by light spring operating mechanism

The application of self-energy arc extinguishing technology, greatly reduces the operation merit which the short-circuiting device needed, accompanied by light spring operating mechanism, ceased slow division, slow gather and the oil leak and air leak, enhances the organization reliability, make mechanical life up to 6000 times.

•Outstanding shell structure

The main body material of shells uses the seamless alloy aluminum tube, the shell shape uses the cold flange craft, provides condition for welder to guarantee the welded joint quality, simultaneously and enormously improves the electric field distribution, greatly reduces the shell external dimensions.

• **Small eddy current loss**

Almost all shell parts are of aluminum alloy materials, strong anti-corrosive and significant loss of eddy current.

• **Strong endurance to the environment**

All parts of GIS are contained by the metal shell, therefore they are not influenced by the natural wind, frost, rain and snow, also not influenced by the outside contamination and the high elevation influence, can bear environment strongly.

• **bay work pattern, small scene workload**

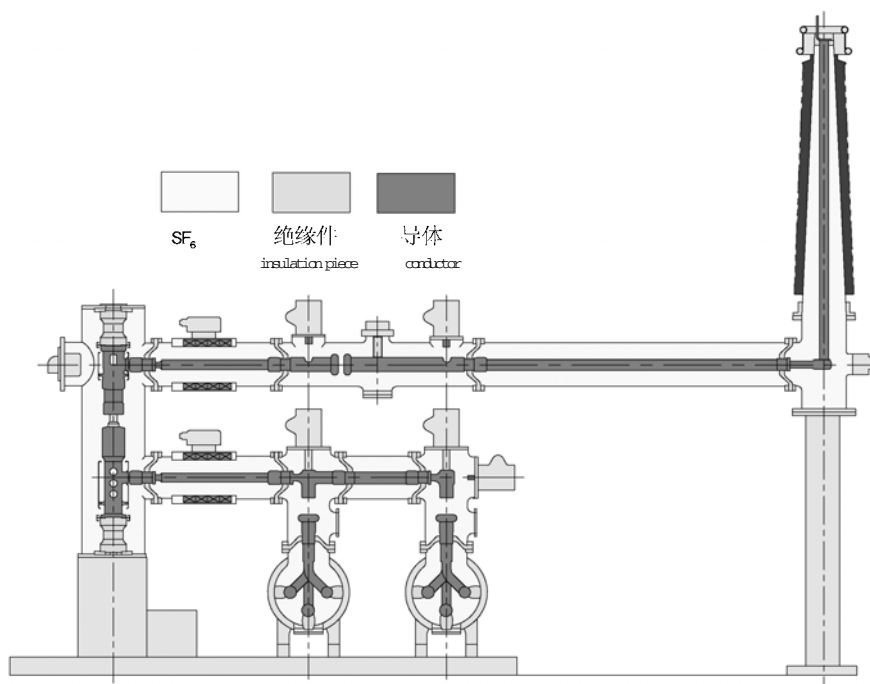
Entire machine equipment carries on installation and commissioning in the factory according to the host-wiring bay. Each bay is a transportation unit, is advantageous for transportation and the installment on site, and reduces the spot work load of installation and commissioning.

III. Overall structure of ZF19-252 GIS

1. Structure Sketch

2. Arrangement way

ZF19-252 GIS is like this; Main three phases use a shell incommon, others are in separate box-typed structure. To use standard part building block system arrangement, this arrangement is nimble and advantageous for the expansion, and can satisfy each kind of main wiring request. The gap is 1.8 meters; distance between phases is 0.58 meters. The product volume is small, compact, and saves area.



产品结构示意图
Structure Sketch

3. SF₆ Gas system

The design principle of ZF19–252 GIS SF₆ gas system, refers to the operation function of each part of the equipment part and tries to reduce the quantity of air bound as far as possible, simultaneously considers reducing accidents and the overhaul involved the scope of repair.

ZF19–252 GIS SF₆ gas system adopts disperse monitoring method, cancels massive SF₆ gas pipelines. Use of new SF₆ dens meter, greatly simplifies revelation link of GIS outside, enables GIS to have lower SF₆ gas air leak rate.

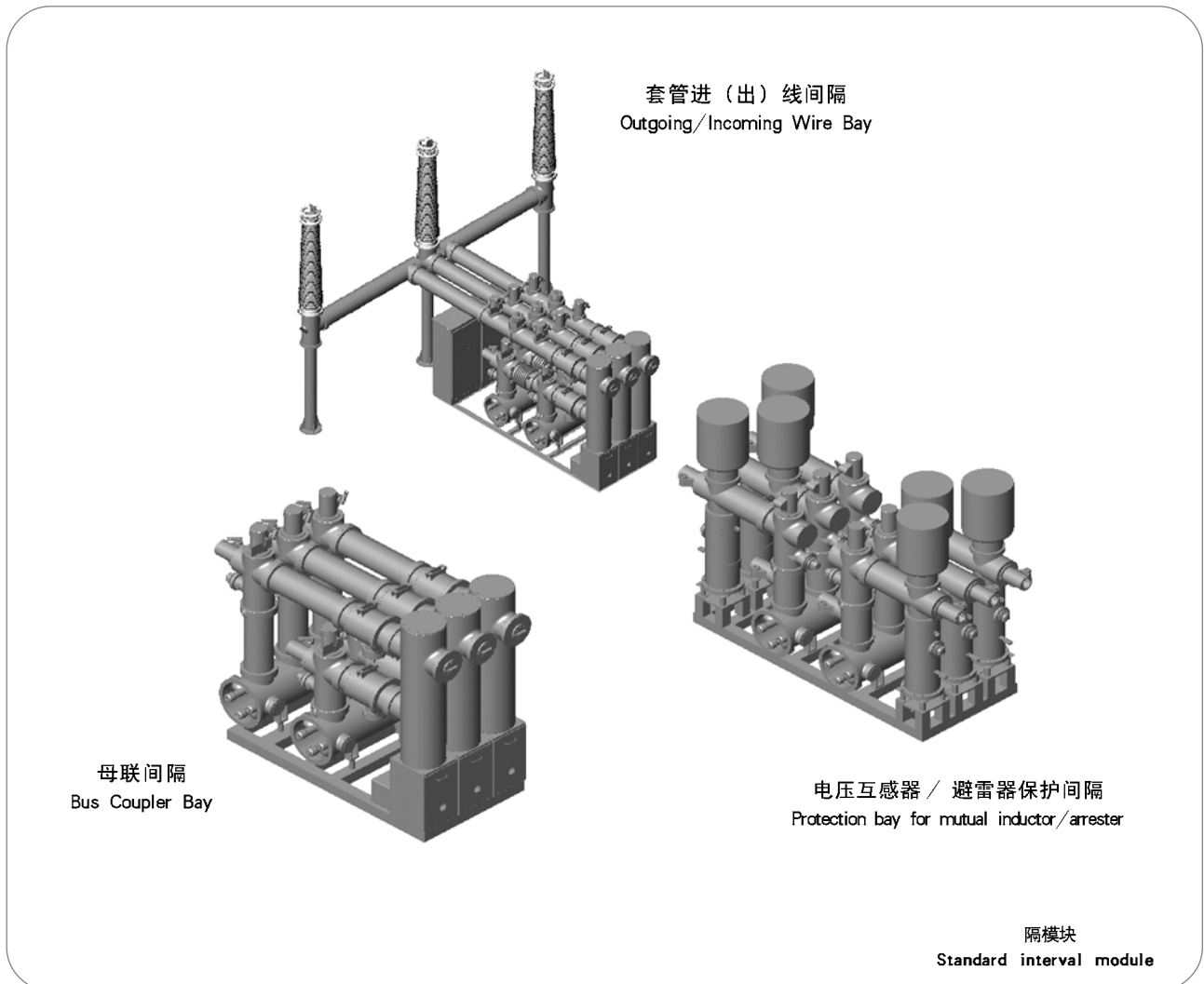
4. Electric control system

Control system directly reflects the active status of parts, the electrical power system running status and the transformer substation running way. They will realize local and long–distant operation. After connecting to the main control screen, they may realize automatic trips realizes and heavy open.

The control section realizes the close of GIS parts and the chain between parts.

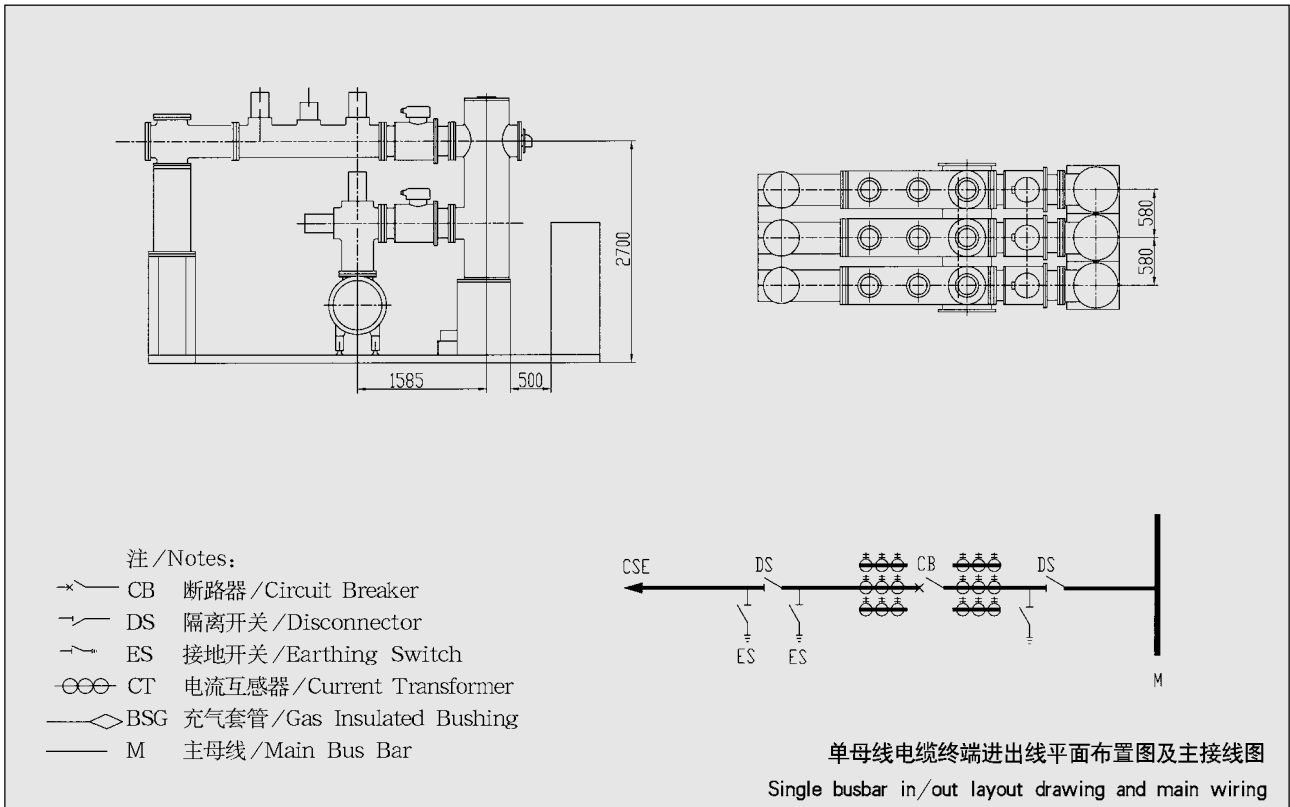
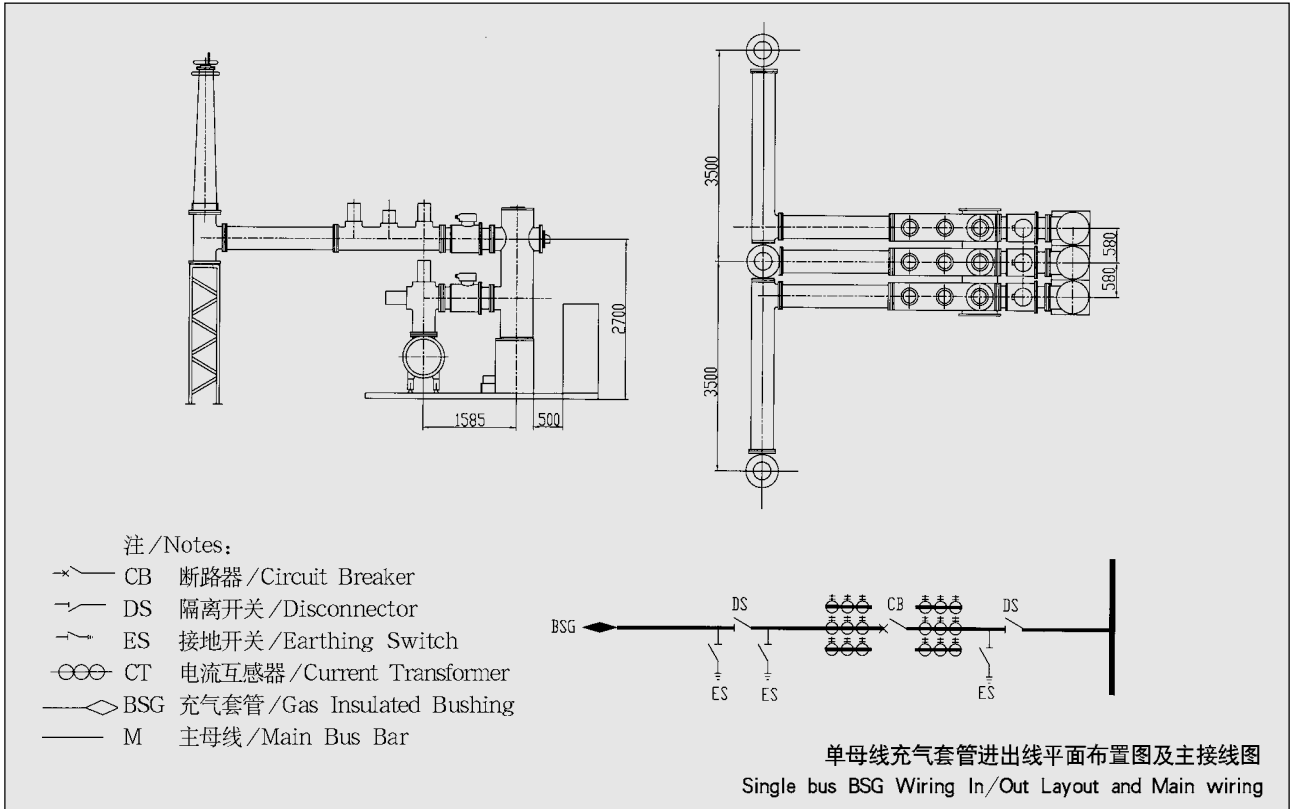
5. Standard interval module

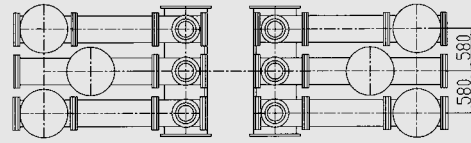
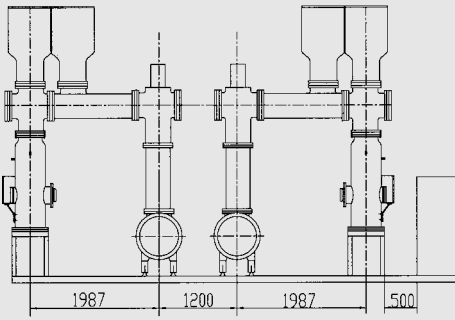
BBE has almost 20 yearsexperience of GIS production and design, it has had thereliable development design and manufacture technology. ZF19–252 GIS engineering design production unifies variousprojects characteristics and may carries on the designaccording to the standard function unit and the gap module, ZF19–252 GIS standard interval may realize themodular production.



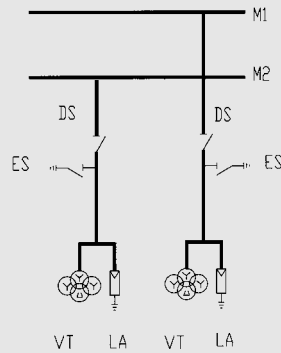
按一次主接线及电气功能的要求，本型GIS 有各种独立的标准间隔。下面是一些标准间隔图例，以供参考。

This type of GIS has each kind of separate standard bay, according to main wiring and the requirements of electric functions. The below are some figures of standard bay for reference.



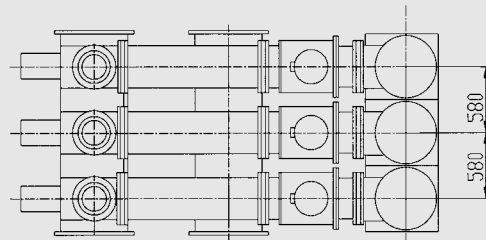
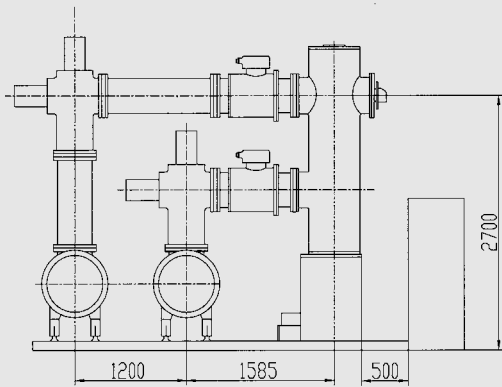


- 注/Notes:
- x— CB 断路器/Circuit Breaker
 - /— DS 隔离开关/Disconnector
 - |— ES 接地开关/Earthing Switch
 - ⊗— VT 电压互感器/Voltage Transformer
 - |— LA 避雷器/Lightning Arrestor
 - M 主母线/Main bus bar

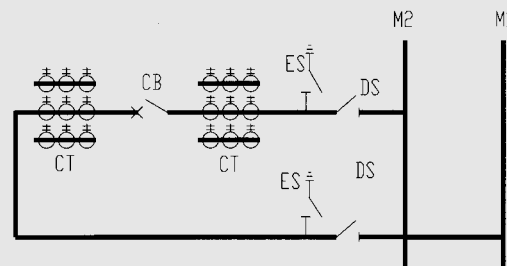


测量保护间隔平面图及主接线图

Map for measuring protection bay and Main wiring

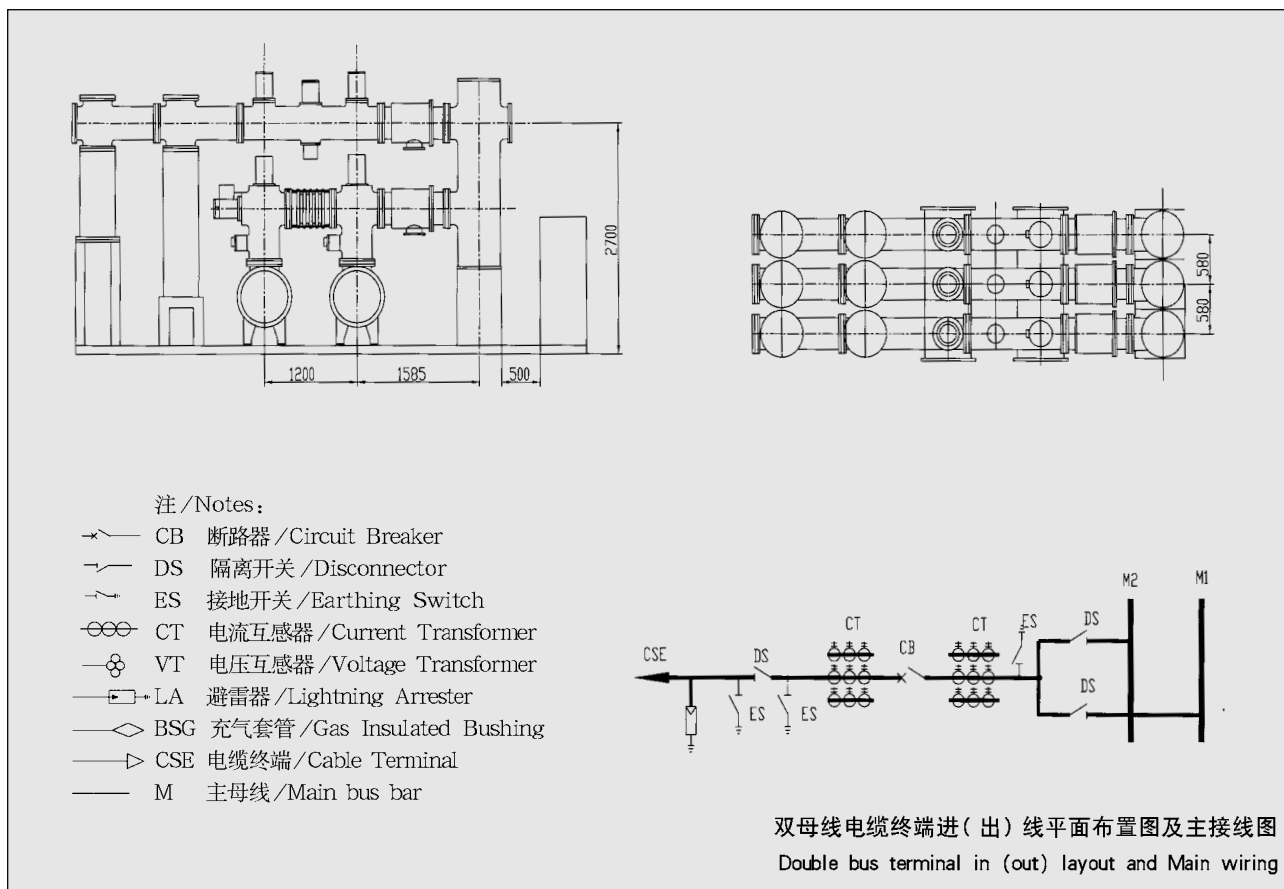


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- x— CB 断路器/Circuit Breaker
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 - ⊗— CT 电流互感器/Current Transformer
 - M 主母线/Main bus bar



母联间隔平面布置图及主接线图

Layout for bus connection interval and Main wiring



四、 主要技术参数

● 252kV SF6 气体绝缘金属封闭开关设备通用技术条件

General Technical Conditions of 252kV SF6 Gas Insulation Metal-Sealed Switching Equipment

1、使用环境条件/The Environmental Conditions

项目 Item	单位 Unit	技术参数 Technical Datas	备注 Remarks
安装/Installation		户外、户内/ Indoor and Outdoor	
环境温度/Environmental Temperature	℃	-30 ~ +40	
太阳辐射/Sun Radiation	W/cm ²	0.1	风速在0.5m/s wind speed
湿度(月平均)/Humidity (monthly average)	%	≤ 9	温度在25℃/Temperat are 25℃
海拔/Altitude	m	≤ 1000	
风速/Wind speed	m/s	≤ 35	
地震烈度/Earthquake Scales	度/Degree	9	
爬电比距/Creepage ratio			按额定电压计算 Calculated in accordance with the rated voltage
一般污秽 I 级/Ordinary Filthiness I	mm/kV	17	
轻污秽 II 级/Mild Filthiness II	mm/kV	21	
重污秽 III 级/Filthiness III	mm/kV	25	
重污秽 IV 级/Filthiness IV	mm/kV	31.5	

2、技术参数/Technical data

项目 Item	单位 Unit	技术参数 Technical Datas	备注 Remarks	
额定电压/Rated Voltage	kV	252		
额定电流/Rated Current	A	3150		
4s 额定短时耐受电流 4s/rated short-time withstand current	kA	50		
额定峰值耐受电流/rated peak withstand current	kA	125		
额定雷电冲击耐受电压(峰值) rated light impulse withstand voltage(peak)	kV	1050		
额定工频耐受电压(有效值) rated power-frequency withstand voltage(valid)	kV	460	1min	
零表压工频耐受电压(有效值) zero pressure power-frequency withstand voltage (valid)	kV	1.1~1.3 倍额定工作相电压 1.1~1.3 Rated phase voltage	5min	
可见电晕/Visual Corona		1.1 倍额定相电压时无可见电晕 Unvisual corona at 1.1 rated phase voltage		
无线电干扰/Radio Interference		1.1 倍额定相电压时小于 500 μ V Less than 500 at 1.1 rated phase voltage		
SF ₆ 气压(除断路器) SF ₆ Gas Pressure	额定压力/Rated Pressure	Mpa	0.6	20℃
	报警压力/Alarming Pressure	Mpa	0.55	20℃
SF ₆ 年漏气率/SF ₆ Annual Gas Leakage Ratio	%/年 %/Year		≤ 0.5	
气隔内水份含量/Humidity Ratio	断路器/Circuit Breaker	PPM(体积比)	< 150	交接/turn over rate
	其他元件/Other Components	PPM(体积比)	< 250	交接/turn over rate
外壳型式(除母线)/Shell Type			单相/Single Phase Current	
材料/Materials	外壳/Shell		铝/aluminum	
	导体/Conductor		铜/铝 Copper/aluminum	
	触头/Contactor		铜镀银/Copper plated with silver	
标准/Standard	IEC 517 《额定电压 72.5kV 及以上气体绝缘金属封闭开关设备》 IEC517 《GAS-INSALATED METAL-ENCLOSED》 Switchgear for rated voltages of 72.5kV and above			
	GB7674 -1997 《气体绝缘金属封闭开关设备》/《GAS-INSALATED METAL-ENCLOSED switchgear》			

3、断路器/Circuit Breaker

额定电压(kV)/Rated Voltage (kV)	252
额定频率(Hz)/Rated Frequency (Hz)	50
额定电流(A)/Rated Current (A)	3150
额定开断电流(kA)/Rated break Current (kA)	50
关合电流(kA 峰值)/Switch make Current (kA peak)	125
4 秒短时耐受电流(kA)/Four seconds rated short-time withstand current	50
峰值耐受电流(kA 峰值)/rated peak withstand current	125
全开断时间(ms)/Time for Switch break	50
合闸时间(ms)/Closing Time	70 ± 10
分闸时间(ms)/Opening Time	30 ¹³ / ₂
额定操作循环/Rated Operating cycle	O-0.3s-CO-180s-CO
金属短接时间(ms)/dead Time	≤ 60
操作不同期时间(ms)/Time for Operation	合闸 ≤ 5, 分闸 ≤ 3
SF ₆ 气体额定压力(Mpa)/SF ₆ Rated Pressure Mpa	≤ 0.5
SF ₆ 气体泄露率(%年)/Annual SF ₆ Gas Leakage Ratio	< 1
每相断口数/Broken numbers per phase current	1
产品外型尺寸(长×宽×高)(mm)/Products Size (Length Width Height)	1750 × 700 × 3200

产品总重量(包括SF ₆)(kg)/Gross Weight of Products	3000	
机械操作稳定性(次)/Stability for Mechanical Operating(times)	6000	
产品在正常工作条件下能承受下表所列试验电压 Experimental Voltages (listed as follows) could be borne under the right circumstances		
试验项目 /Experiment Project	加压部位条件 /Pressured Parts	
基本冲击水平(kV 峰值)/basic impulse level (kV peak)	断口间 /Inter-ports	950 + 206
	对地 /Over the ground	1050
工频(kV)1min/Power Frequency (kV) 1min	断口间 /Inter-ports	395 + 145
	对地 /Over the ground	460
SF ₆ 气体压力为零表压时, 5 分钟工频耐压(kV) 5 minutes rated power-frequency withstand voltage (kV), when SF ₆ Gas Pressure is zero		
断口间 /Inter-ports	1.1~1.3 × 额定相电压 /1.1~1.3 Rated phase current voltage	
相对地 /Over the ground	1.1~1.3 × 额定相电压 /1.1~1.3 Rated phase current voltage	
操动机构配置 Operating Mechanism type	弹簧操动机构 / 液压弹簧操动机构 Spring operating mechanism/hydraulic spring mechanism	

4. 隔离开关 GR/GL 型 /Switch-disconnector (Type GR/GL)

项目 Item	单位 Unit	技术参数 Technical Datas	备注 Remarks
额定电压 /Rated Voltage	kV	252	
额定雷电冲击耐受电压 (峰值) /Rated peak withstand current	kV	1050	
额定工频耐受电压 (对地有效值) Rated industrial frequency withstand voltage (effective value to earth)	kV	460	1min
每相断口数 /Broken numbers per phase current		1	
额定电流 /rated current	A	3150	
额定短时耐受电流 /rated short-time withstand current	kA	50	
额定峰值耐受电流 /rated peak withstand current	kA	125	
操作机构型式 /Operating Structure Mechanism		弹簧 / 电动 /Spring and Motorised	
切充电电流能力 /Cutting charging Currents capacity	A	2	
切激磁电流能力 /Currents capacities of magnetic	A	0.5	
操作时间 /Operating Time	分闸 /Switch open	s	< 6 (含弹簧储能时间) < 6 (including spring capacity-storing time)
	合闸 /Switch close	s	< 6 (含弹簧储能时间) < 6 (including spring capacity-storing time)
控制电压 /Voltage Control	V	DC 220/110	

5. 故障关合接地开关 /Earth Switches for shut in error

项目 Item	单位 Unit	技术参数 Technical Datas	备注 Remarks
额定电压 /Rated Voltage	kV	252	
额定雷电冲击耐受电压 (对地峰值) rated light impulse withstand voltage (peak)	kV	1050	
额定工频耐受电压 (对地有效值) rated power-frequency withstand voltage (valid)	kV	460	1min
额定关合电流 (峰值) /Rated make Current (peak)	kA	125	
额定短时耐受电流 (有效值) 4s /rated short-time withstand current	kA	50	
额定峰值耐受电流 /rated peak withstand current	kA	125	

操作机构型式 / Operating Mechanism			电动弹簧 Motorise spring	
操作时间 / Operating Time	分 / Open	s	≤ 6	(含弹簧储能时间) (including spring capacity-storing time)
	合 / Close	s	≤ 6	(含弹簧储能时间) (including spring capacity-storing time)
控制电压 / Voltage Control		V	DC 220/110	

6、检修用接地开关 / Earth Switches for checking use

项目 Item	单位 Unit	技术参数 Technical Datas	备注 Remarks
额定电压 / Rated Voltage	kV	252	
额定雷电冲击耐受电压 (对地峰值) rated light impulse withstand voltage (peak)	kV	1050	
额定工频耐受电压 (对地有效值) rated power-frequency withstand voltage (valid)	kV	460	1min
额定短时耐受电流 (有效值) 4s rated short-time withstand current 4s	kA	50	
额定峰值耐受电流 / rated peak withstand current	kA	125	
操作机构型式 / Operating Mechanism		电动 / Motorised	

7、母线 / Bus Bar

项目 Item	单位 Unit	技术参数 Technical Datas	备注 Remarks
额定电压 / Rate Voltage	kV	252	
额定电流 / Rated Current	A	3150	
额定短时耐受电流 (有效值) 4s rated short-time withstand current (valid)	kA	50	
外壳型式 / Shell type		三相共箱 / Three phases in a case	
外壳材料 / Materials for shell		钢或铝合金 / Steel or aluminum alloys	
导体材料 / Materials for conductor		铜 / 铝 / Copper / aluminum	

8、电流互感器 / Current Transformers

电流互感器的主要技术参数 / Major Technical Specifications for Current Transformers

额定电流比 / Rate Current Ratio	300-400-600-800-1250-2000 2500/5
容量 (VA) / Capacity (VA)	15, 20, 25, 30, 40, 50
精度 Accuracy	测量级 0.5, 0.2 级; 保护 10P20, 5P20 0.5, 0.2 for measuring degrees, 10P20, 5P20 for protection
注: Remarks:	可提供额定二次电流为 1 A 的二次绕组, 高于本表的精度要求可另议 Second current 1A of the second windings for measuring use can be provided

9、电压互感器 / Voltage Transformers

电压互感器的主要技术参数 / Major Technical Specifications for Voltage Transformers

(1) 电压互感器的额定值 / Rated Figures for Voltage Transformers

系统额定电压 / System Rated Voltage	kV	252
额定一次电压 / Primary Rated Voltage	kV	$220/\sqrt{3}$
额定二次电压 / Secondary Rated Voltage	V	$100/\sqrt{3}$
剩余绕组电压 / Remaining Windings Voltage	V	100

额定频率/Rate Frequency	Hz	50
20℃时SF ₆ 额定气压 Mpa/SF ₆ Rated Pressure (20℃)	Mpa	0.5

(2) 准确级及额定负荷/Rated Loads and Accuracy

二次绕组 Second Windings				剩余电压绕组 Winding for remaining voltages	
绕组一 Windings 1		绕组二 Windings 2		准确级 Accuracy Degree	额定负荷 Rated Loads
准确级数 Accuracy Degree	额定负荷 Rated Loads	准确级数 Accuracy Degree	额定负荷 Rated Loads	准确级数 Accuracy Degree	额定负荷 Rated Loads
0.2	75	0.5	120	3P	200
0.2	75	3P	120	3P	200
0.2	75	0.5	120
0.2	75	3P	120

10、避雷器/Lightning arrester

避雷器主要技术参数/Major Technical Specifications for Lightning arrester

项目 Project	单位 Units	技术参数 Technical Specification
额定电压/Rated Voltage	kV	252
避雷器额定电压/Rated Voltage for Lighting arrester	kV	200
标称放电电流/Electricity-releasing current nominal	kA	5-10
额定雷电冲击耐受电压(峰值) rated lightning impulse withstand voltage (peak)	kV	1050
中心接地方式/Grounding Measures		有效接地/Effective grounding
直流1mA 参考电压/DC 1mA reference voltage	kV	≥ 290
雷电冲击电流下残压(峰值) Voltage after lightning impulse (peak)	kV	≥ 520
标准/Standards		IEC-60099-1 《氧化锌避雷器》 IEC-60099-1 Zinc Oxide Lightning Pod

11、辅助回路/auxiliary circuit

合闸回路数/Closing Circuit Times	1
分闸回路数/Openorg Circuit Times	2
常开接点数(对)/NO	6-10
常闭接点数(对)NC	6-10

12、控制回路电源/Circuit Control Power Supply

操作控制回路电源电压(V) Voltages for Circuit Control Power Supply (V)	DC220/110
分闸线圈电流(A) Trip Coil Current (A)	2.5
合闸线圈电流(A) Closing Coil Current (A)	2.3

四、订货须知

1. 客户应提供准确的主接线图、注明各元件的必要技术参数、进出线方式和相序、进出线间距及各元件的电气连锁表。若有特殊要求，如外壳颜色、操作电源、辅助触点数量等应一并提出。
2. 双方进行技术协商，以便就结构、布置等技术问题加以讨论和确认。此后，即可签定合同。
3. 签定合同的同时，应一并确定客户所需的辅助设备的品种和数量、设备运输方式及是否需要我公司提供安装技术服务等事项。
4. 签合同后，我公司进行方案设计，并向客户提供必须的土建设计资料和二次设计资料，双方确认上述资料后，分别进行施工设计，并及时交换必要的图纸和磋商。双方紧密配合，保证工程的顺利进行。

IV. Notice for Goods Ordering

1. The customer shall provide accurate main wiring chart, detailed technical specifications for each components, in and out of wiring, current phase type, and diagram for each components. If alternative requirements are needed like color of outer coat, operating power supply, auxiliary points, shall be notified upon.
2. Technical negotiations shall be conducted, so as to achieve discussions or confirmations concerning structure, layout etc. Then, the contract could be signed.
3. Issues like types or qualities of required auxiliary goods, transportation methods, or installation services required by the customers shall be discussed and confirmed, when the contract being signed.
4. After the signing of contract, our Party shall conduct scheme design, and provide the customers with relevant documents concerning constructing designing. After the confirmation, construction and design shall be conducted correspondingly, and relevant graphs and negations shall be exchanged. Both Parties shall cooperate closely so as to ensure the smooth process of the project.

提示:

Notice:

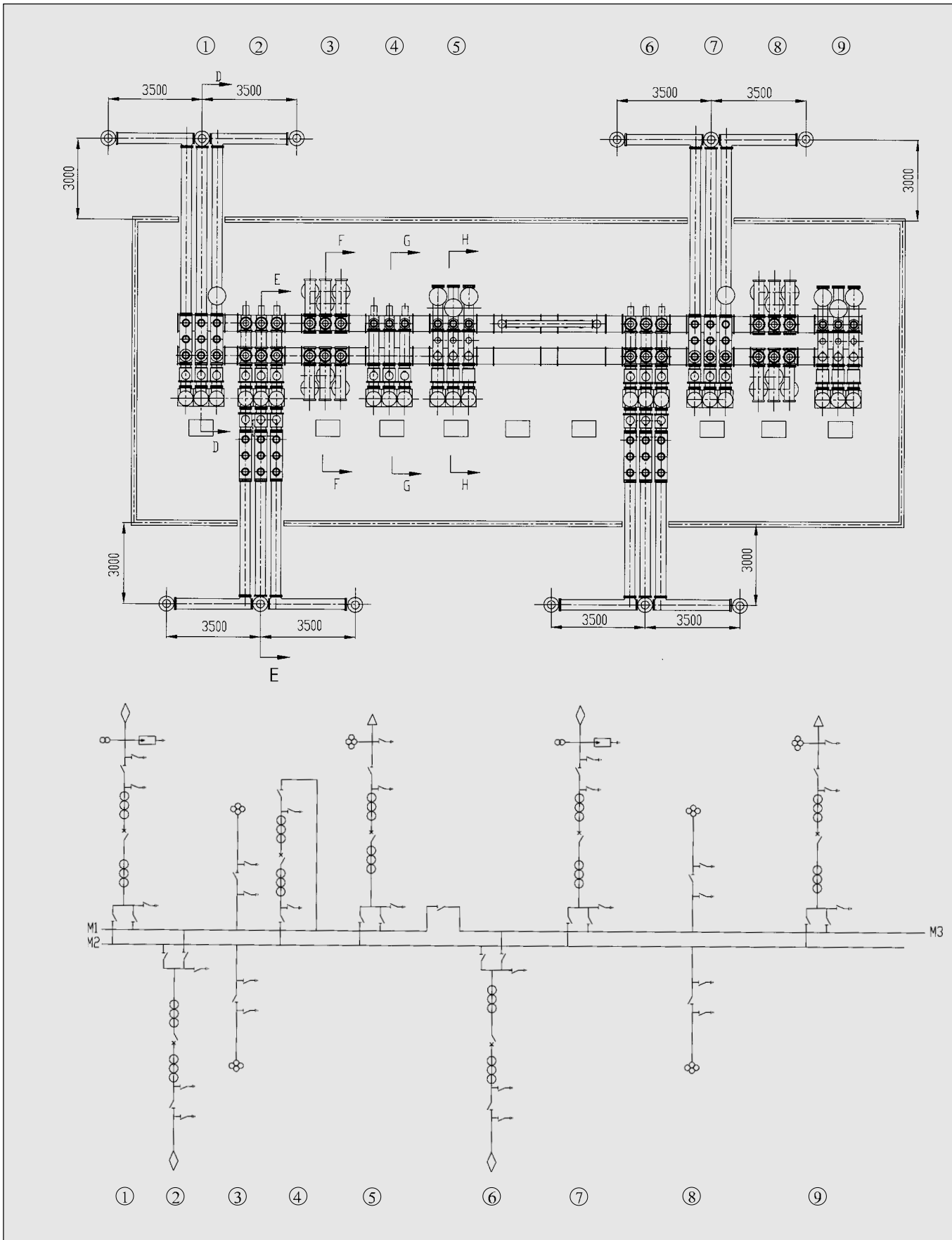
本说明书所涉及的内容，包括文字、图形、参数等，如做任何修改，恕不另行通知！

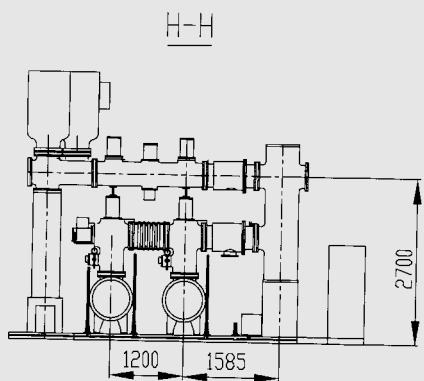
We will not inform you seperately if there is any changes in specifications and datas.

注意人身健康与安全，加强环境保护，做好包装物及废弃物的处理！

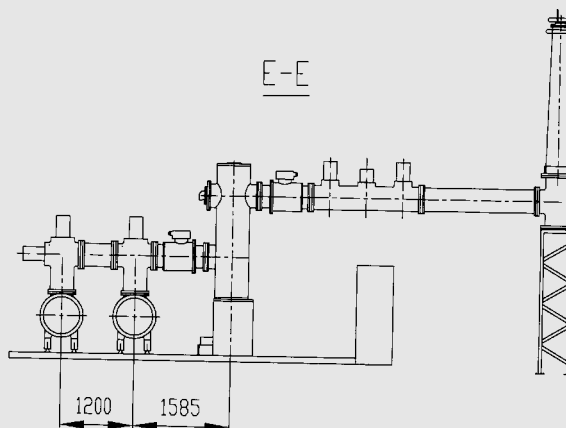
Please dispose the package and castoff in right place to keep the environment clean and safe for everyone

五、接线图 / V. Wiring Drawings

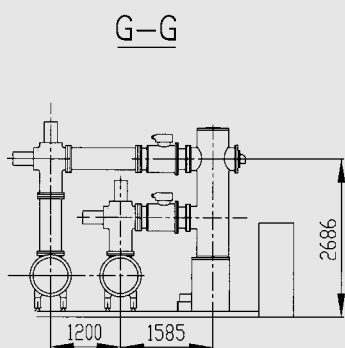




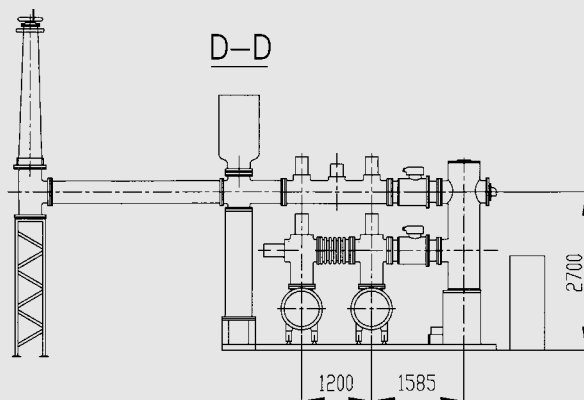
5、9 间隔



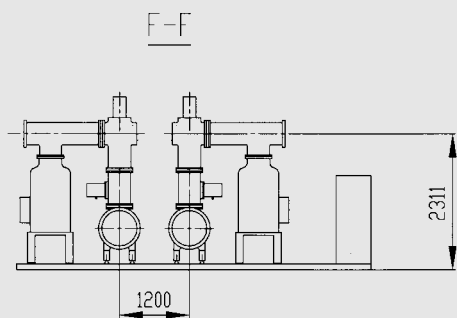
2、6 间隔



4 间隔



1、7 间隔



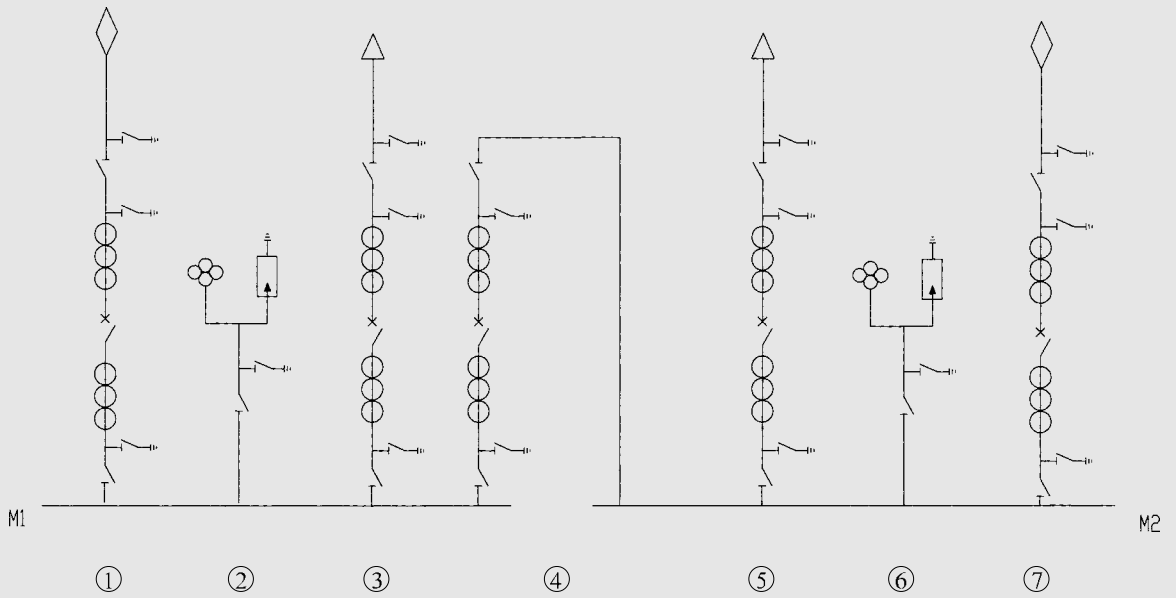
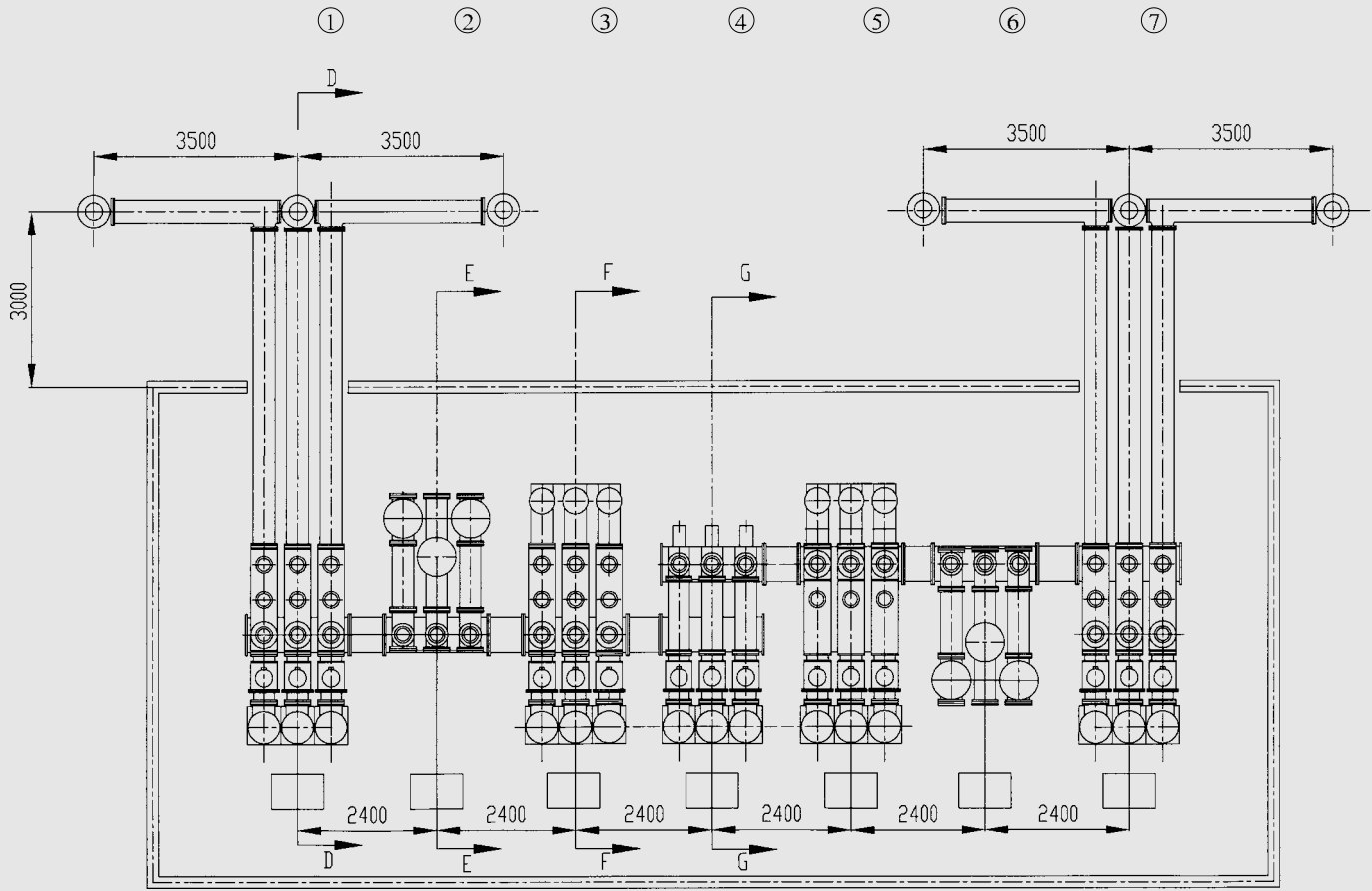
3、8 间隔

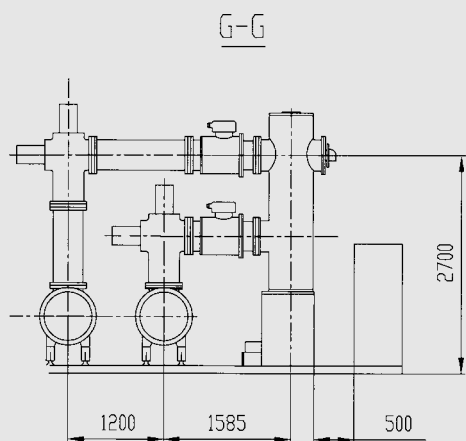
注/Notes:

- CB 断路器/Circuit Breaker
- DS 隔离开关/Disconnecter
- ES 接地开关/Earthing Switch
- CT 电流互感器/Current Transformer
- VT 电压互感器/Voltage Transformer
- LA 避雷器/Lighting Arrester
- BSG 充气套管/Gas Insulated Bushing
- CSE 电缆终端/Cable Terminal
- M 主母线/Main Bus Bar

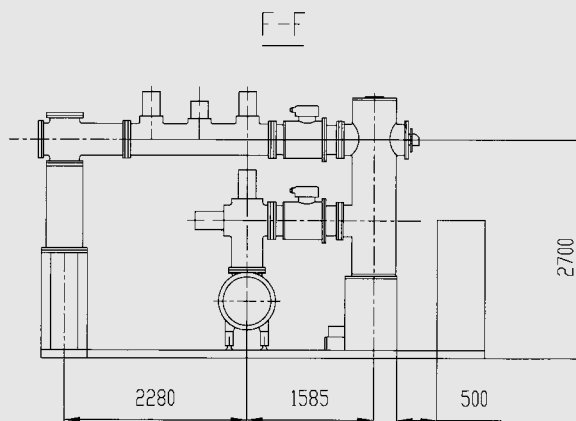
双母线分段接线

Wiring Chart (Double Bus Bar Current Subsection Wiring)

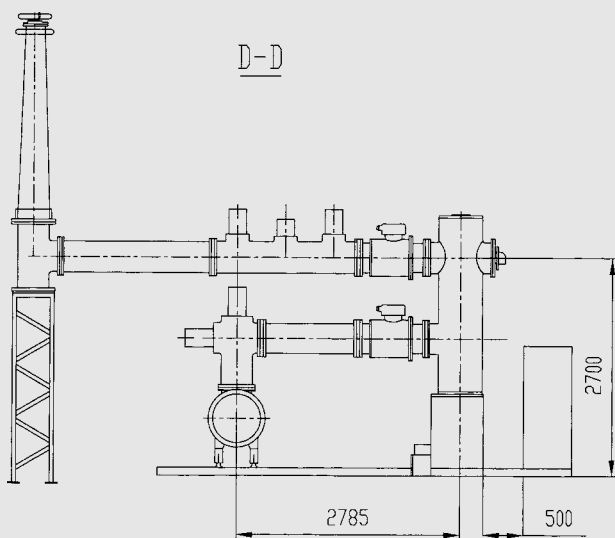




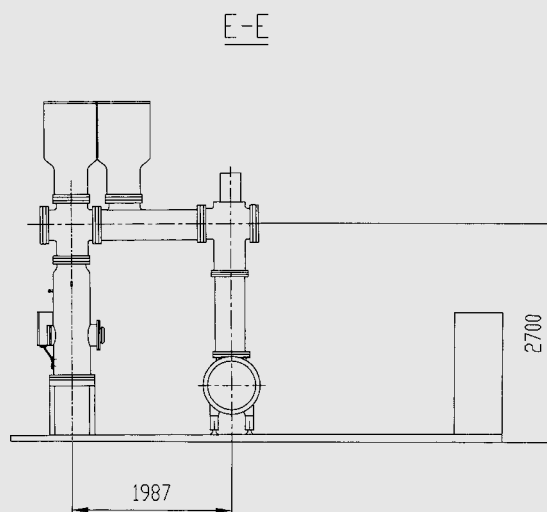
4 间隔



3(5)间隔



(1)7 间隔



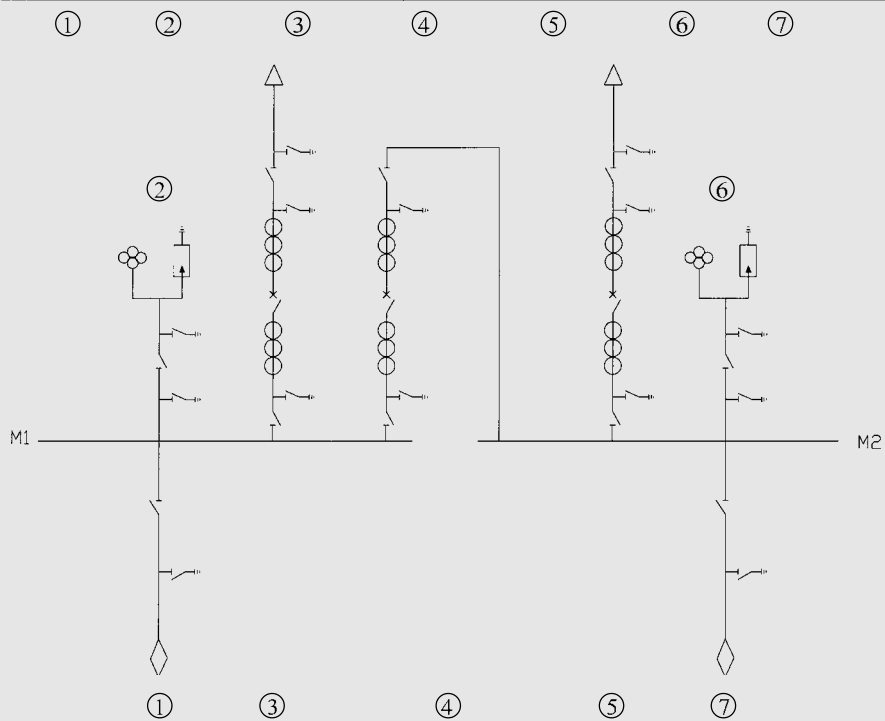
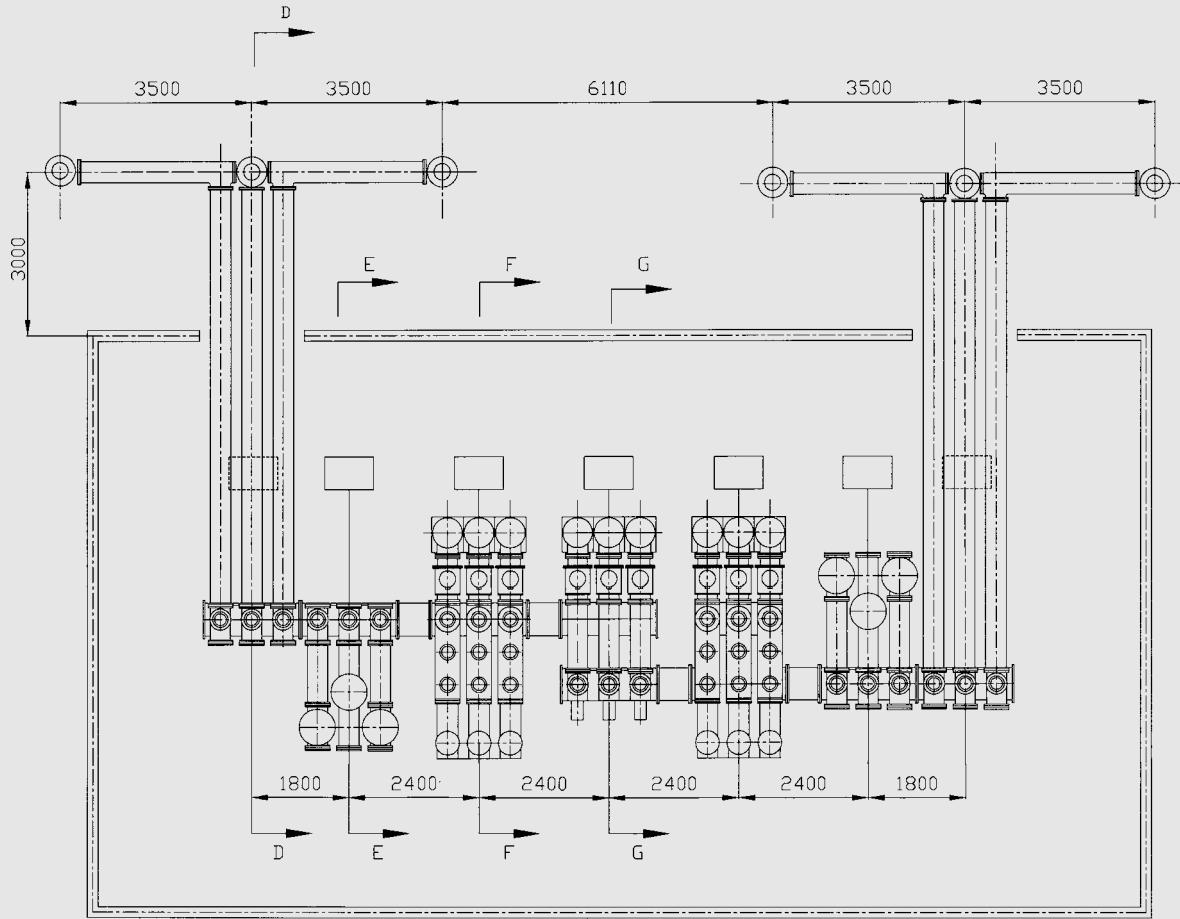
2(6)间隔

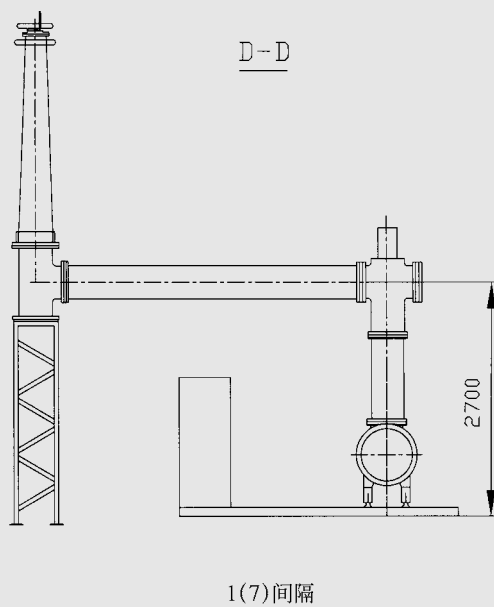
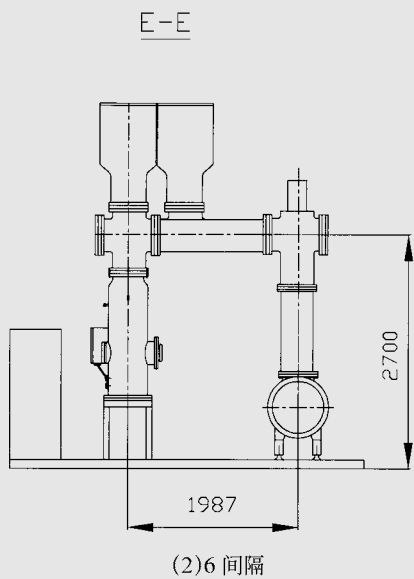
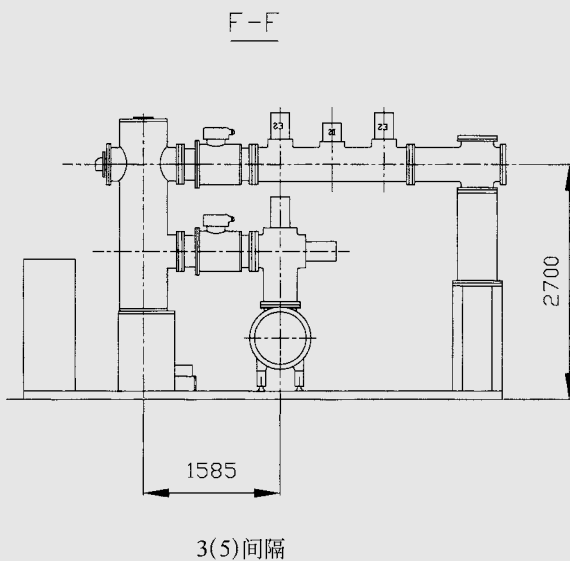
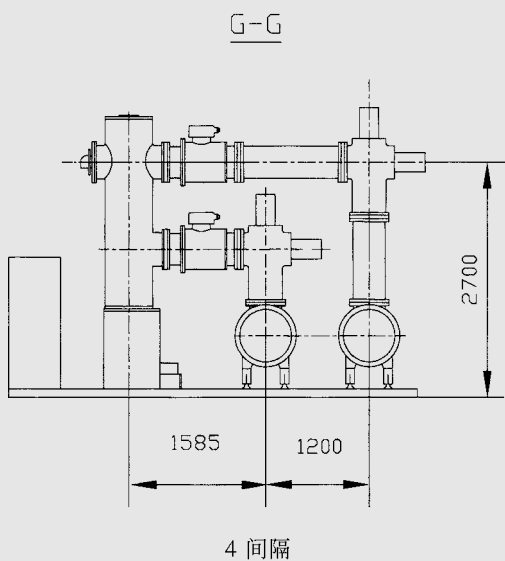
注/Notes:

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- ES 接地开关/Earthing Switch
- CT 电流互感器/Current Transformers
- VT 电压互感器/Voltage Transformers
- LA 避雷器/Lighting Arrestor
- BSG 充气套管/Gas Insulated Bushing
- CSE 电缆终端/Cable Terminal
- M 主母线/Main Bus Bar

单母线分段接线

Wiring Chart (Single Bus Bar Current Subsection Wiring)





注/Notes:

- CB 断路器/Circuit Breaker
- DS 隔离开关/Disconnecter
- ES 接地开关/Earthing Switch
- CT 电流互感器/Current Transformers
- VT 电压互感器/Voltage Transformers
- LA 避雷器/Lighting Arrester
- BSG 充气套管/Gas Insulated Bushing
- CSE 电缆终端/Cable Terminal
- M 主母线/Main Bus Bar

桥形接线

Wiring Chart (Bridge-typed Wiring)