



INDUSTRIAL SOLUTION SYSTEMS



INDUSTRIAL SOLUTION SYSTEMS



纳图抖音官方号



纳图视频号



纳图公众号

NRTem-24

环保气体绝缘环网柜

24kV Ring-Main-Unit systems with SF₆ free unit technology



纳图电气集团股份有限公司
NATUS ELECTRIC GROUP CO.,LTD.

地址：中国江苏省常州市天宁区劳动东路369号

Address : No.369 Laodong East Road,Tianning District,Changzhou,Jiangsu Province,China

电话 / Telephone : 400-928-1888

邮箱 / E-mail : sales@natus-cn.com

网址 / Web : www.natus-cn.com
www.natus.de

集团业务 Group Business

集团专注于中低压电力行业的系统集成、EPC工程总包服务及核心产品的研发、生产与销售。在电力设备领域，我们深耕智能电气成套产品、高端电力元器件、先进电能质量治理产品、智能控制仪表与控制系统。基于人工智能与大数据分析的技术积累，我们提供变电站与输电线路的气象灾害预防设备与安全运行综合解决方案。在新技术领域，我们聚焦小区域低空气象高精度预测技术，为低空经济发展提供综合性的产品与服务。



The Group specializes in system integration, EPC turnkey services, and the R&D, production, and sales of core products within the medium and low-voltage power industry. In the field of power equipment, we have deep expertise in intelligent electrical switchgear system, high-end power components, advanced power quality management products, intelligent control instruments, and control systems. Leveraging accumulated expertise in artificial intelligence and big data analytics, we provide comprehensive solutions for meteorological disaster prevention equipment and the safe operation of substations and transmission lines. In the domain of new technologies, we focus on small-area, low-altitude meteorological high-precision prediction technology, offering integrated products and services to support the development of the low-altitude economy.

集团理念 Group Vision

纳图电气集团源自德国，立足中国，服务全球。自1956年成立以来，集团以德国技术为基础，深度融合中国智慧与全球视野，依托强大的中国研发与制造团队，精准响应全球市场需求，为各行业客户提供智慧电力的专业解决方案。集团坚持以客户为中心，致力于创新产品、可靠技术与精益制造，携手全球用户共同构建更智能、高效、可持续的电力能源未来。



Natus Electric Group originates from Germany, is firmly rooted in China, and serves the global market. Since its establishment in 1956, the group has built upon German technology deeply integrating Chinese expertise and a global perspective. Supported by a robust Chinese R&D and manufacturing team, we precisely respond to global market demands, delivering professional intelligent power solutions for clients across various industries. Adhering to a customer-centric approach, the group is committed to innovative products, reliable technology, and lean manufacturing.

Working hand-in-hand with global users to build a smarter, more efficient, and sustainable future for the power and energy sector.



产品概述

General Information

01

1

产品特点

Product Characteristics

02~03

2

客户受益

Customer Benefits

04

3

应用领域

Application

05

4

技术参数

Technical Specifications

06~07

5

典型应用方案

Typical Application Solutions

08~09

6

- 针对SF6气体分解带来的温室效应及安全隐患，纳图电气推出24kV环保型气体绝缘环网柜，采用环保气体替代传统SF6，实现全生命周期低碳排放。设备符合IEC 62271-200绿色环保标准，适用于高湿度、盐雾或粉尘污染环境（如箱式变电站、户外开闭所），兼顾环保与可靠性。
- 产品使用纳图自主开发的、行业领先的并联开断式灭弧机构，通过多断口同步分断技术提升电弧能量分散效率，获多项国家专利。其不锈钢气室防护等级达IP67，支持电动/手动双模式操作，并集成四遥功能（遥控、遥调、遥测、遥信），兼容分散式与集中式控制系统，满足复杂工况需求。
- 采用真空箱氦质谱检漏法（灵敏度 $1 \times 10^{-9} \text{Pa} \cdot \text{m}^3/\text{S}$ ）确保气室密封可靠性；配备高频电流互感器与超声波局放检测系统，对整机及绝缘件实施100%出厂试验，局放水平优于行业标准（单个绝缘件 $\leq 3 \text{pC}$ ，整柜 $\leq 10 \text{pC}$ ），有效规避绝缘老化风险。
- Addressing the greenhouse effect and safety hazards caused by SF6 gas decomposition, Natus Electric introduces its 24kV eco-friendly gas-insulated ring main unit. This innovation replaces traditional SF6 with environmentally friendly gases, achieving low-carbon emissions throughout its entire lifecycle. Compliant with IEC 62271-200 green standards, the equipment is suitable for high-humidity, salt-fog, or dust-polluted environments (e.g., box-type substations, outdoor switchyards), balancing environmental protection with operational reliability.
- The product utilizes Natus's proprietary, industry-leading parallel-break arc-extinguishing mechanism, which enhances arc energy dispersion efficiency through multi-break synchronous interruption technology and holds multiple national patents. Its stainless steel air chamber achieves an IP67 protection rating, supports dual electric/manual operation modes, and integrates four remote functions (remote control, remote adjustment, remote measurement, remote signaling). Compatible with both distributed and centralized control systems, it meets the demands of complex operating conditions.
- Vacuum chamber helium mass spectrometer leak detection (sensitivity $1 \times 10^{-9} \text{Pa} \cdot \text{m}^3/\text{s}$) ensures reliable chamber sealing; Equipped with high-frequency current transformers and ultrasonic partial discharge detection systems, the entire unit and insulating components undergo 100% factory testing. Partial discharge levels exceed industry standards ($\leq 3 \text{pC}$ per insulator, $\leq 10 \text{pC}$ per cabinet), effectively mitigating insulation aging risks.

可靠的防护设计确保了运行和使用的安全性：

Reliable protective design ensures operational and usage safety:

- 当断路器处于合闸位置时，禁止电动或手动操作三工位开关。
- 三工位开关采用双孔操作模式，防止操作隔离合闸时，误操作接地开关。
- 当用做双母线分段方案时，可加装三锁两钥匙机械防误操作装置。
- 当接地位置与断路器同时处于闭合状态时，才能打开柜门进行操作和维护。
- 采用关门操作方式，保障人身安全。
- 标配了完整的机械开关防误保护装置，实现了操作安全性。
- 支持远程监测和操控电动开关装置
- 设备操作面板具有明显的状态指示及清晰的操作规范
- Prohibited from operating the three-position switch electrically or manually when the circuit breaker is in the closed position.
- The three-position switch adopts dual-hole operation mode to prevent accidental operation of the grounding switch during isolation closing procedures.
- When used as a double-busbar sectioning scheme, a mechanical anti-misoperation device with three locks and two keys can be installed.
- The cabinet door may only be opened for operation and maintenance when both the grounding position and circuit breaker are in the closed position.
- Adopt a door-closing operation method to ensure personal safety.
- Standard equipment includes a complete mechanical switch anti-misoperation protection device, ensuring operational safety.
- Supports remote monitoring and control of electric switch devices.
- The equipment control panel features clear status indicators and straightforward operating instructions.

可靠性源于卓越品质：

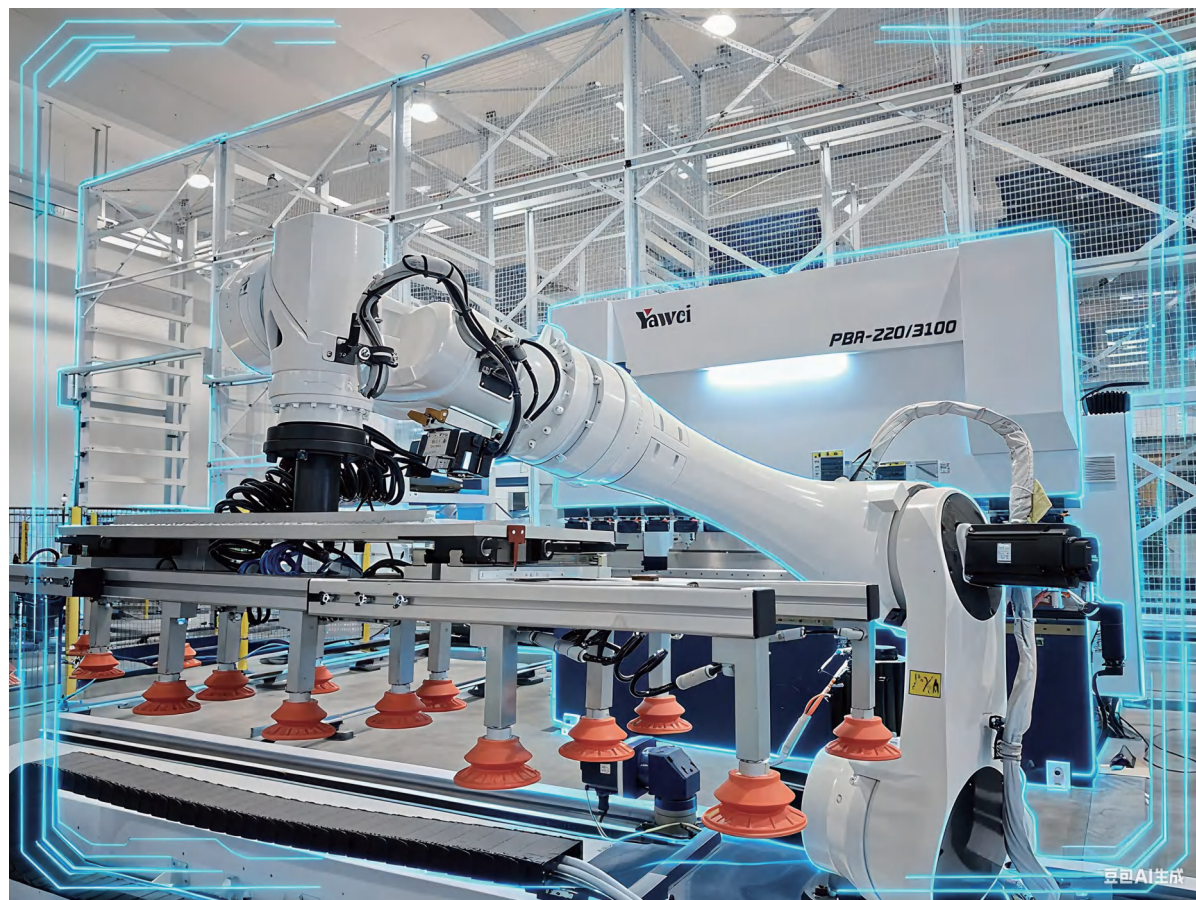
Reliability is the result of excellent quality:

- 凭借先进的高精度冲孔设备与自动化数控折弯中心，加之精良的生产工艺，确保零件的高加工精度。
- 采用优质原材料，如高强度覆铝锌板，该材料具备优异的耐腐蚀性和良好的延展性。
- 具有专门的泄压通道，当燃弧故障时确保人员安全。
- 前门和侧封板采用环氧静电粉末喷涂工艺，不仅美观，且具有良好的耐候性。
- With advanced high-precision punching equipment and automated CNC bending centers, coupled with sophisticated production processes, we ensure high machining accuracy for components.
- Using premium raw materials such as high-strength aluminum-zinc coated steel sheets, this material offers excellent corrosion resistance and good ductility.
- Equipped with dedicated pressure relief channels to ensure personnel safety in the event of an arc fault.
- The front door and side panels feature an epoxy electrostatic powder coating process, which not only enhances aesthetics but also provides excellent weather resistance.

可持续化发展的低碳环保理念：

Low-carbon environmental protection concept for sustainable development:

- 绝缘部件采用环保型 PC 制成。
 - 传动部件采用电镀环保锌工艺进行表面处理, 无污染。
 - 操作机构寿命长, 免维护。
 - 通过融合技术优势与成本效益, 优化生产工艺与装配流程, 全面提升作业效率。
 - 独立式低压端子箱, 支持预制化接线。
 - 不含 SF6 的气体, 实现可持续发展和面向未来
- The insulating components are made from environmentally friendly polycarbonate.
 - Transmission components undergo surface treatment using an environmentally friendly zinc electroplating process, ensuring zero pollution.
 - Long service life of operating mechanism, maintenance-free.
 - By integrating technological strengths with cost-effectiveness, optimizing production processes and assembly workflows, we comprehensively enhance operational efficiency.
 - Independent low-voltage terminal box, supports prefabricated wiring.
 - SF6-free gases for sustainable and future-oriented solutions.



- 电场优化保障安全
通过ANSYS电场模拟优化主回路设计, 达到均匀电场的效果, 减少局部放电风险, 延长设备绝缘寿命至25年以上。
 - 防护性能突破
上隔离结构加5次接地故障关合能力, 可100%隔离故障线路, 避免馈线单元过载损坏, 保障人员操作安全。
 - 开断技术革新
刀闸辅助开断加旁路灭弧室组合方案, 解决双机构同步失效风险, 单机机构同时控制负荷开关和隔离开关, 降低机构成本的同时, 也优化了操作流程。
 - 气箱密封等级提升
气箱采用304不锈钢激光静态密封焊接工艺, 防护等级IP67, 实现零泄漏率。有效降低运维成本, 保障极端环境 (高盐雾/粉尘) 下稳定运行。
 - 扩展灵活性
支持侧面/顶部两种扩容设计方案, 预制式气箱可使项目改造周期缩短50%, 可满足未来容量升级需求
 - 多重联锁防护
符合GB/T3906及IEC相关标准, 实现机械/电气双重闭锁, 误操作率趋近于零, 确保用户用电零事故
- Electric field optimization ensures safety
Optimize the main circuit design through ANSYS electric field simulation to achieve a uniform electric field, reduce the risk of partial discharge, and extend the equipment insulation lifespan to over 25 years.
 - Breakthrough in Protective Performance
Isolated structure with 5-time ground fault closing capability ensures 100% isolation of faulty circuits, preventing overload damage to feeder units and safeguarding personnel operational safety.
 - Innovations in Switching Technology
The combination solution of knife switch auxiliary breaking with bypass arc-extinguishing chamber eliminates the risk of dual-mechanism synchronous failure. A single mechanism simultaneously controls both the load switch and isolating switch, reducing mechanism costs while optimizing operational procedures.
 - Enhanced the Sealing Performance of Gas Tank
The gas tank adopts 304 stainless steel laser static seal welding technology with an IP67 protection rating, achieving zero leakage. This effectively reduces operational and maintenance costs while ensuring stable operation in extreme environments (high salt fog/dust).
 - Expand Flexibility
Supports both side and top expansion designs. Prefabricated gas tank reduce project retrofit cycles by 50% and accommodate future capacity upgrades.
 - Multiple Interlock Protection
Compliant with GB/T 3906 and relevant IEC standards, achieving dual mechanical/electrical interlocking to reduce misoperation rates to near zero, ensuring zero electrical accidents for users.



数据中心
Data Center



变电站
Electrical Substation



储能行业
Energy Storage Industry



风力发电
Wind Power Generation



工厂建设
Industrial Plant Construction



新能源
New Energy



热电行业
Thermal Power Industry

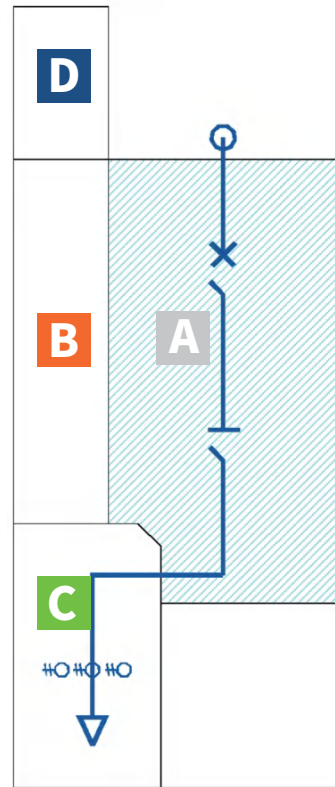
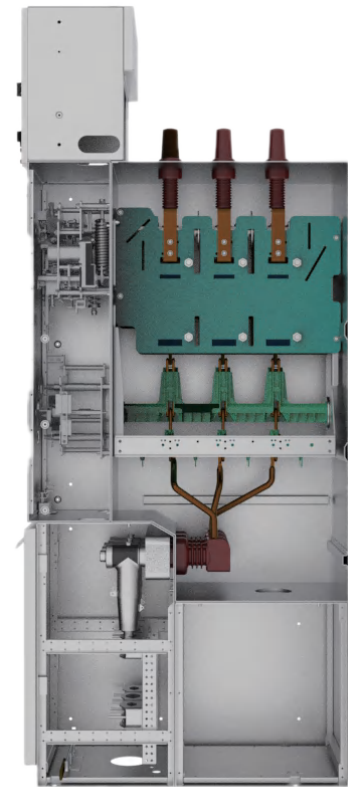


市政公用事业和配电
Municipal Utilities & Power Distribution



食品行业
Food Industry

电气参数 Electrical data		
额定电压 Rated voltage	kV	24
额定工频耐受电压 Rated power frequency withstand voltage	kV	50
额定雷电冲击耐受电压 Rated lightning impulse withstand voltage	kV	125
额定频率 Rated frequency	Hz	50/60
额定正常电流 Rated normal current	A	630
额定短路开断电流 Rated short-circuit breaking current	kA	16/20
额定短路持续时间 Rated duration of short-circuit	s	4
额定短路关合电流 Rated short-circuit making current	kA	41.6/52
额定工频电缆测试电压 Rated power frequency cable test voltage	kV	24
内部电弧等级 Internal arc classification IAC AFL/AFLR	kA	20/1s
气室防护等级 Gas tank Protection class		IP67
额定工作压力 Rated working pressure (20°C) (MPa)	Mpa	0.045 (Rated working pressure)
最小工作压力 Minimum working pressure (20°C) (MPa)	Mpa	0.035 (Rated working pressure)
额定操作顺序 Rated sequence of operations		O-0.3s-CO-3min-CO
电气等级和机械等级（接地开关） Electrical and mechanical classes (earthing switch)		E2, M0
电气等级和机械等级（断路器） Electrical and mechanical classes (circuit-breaker)		E2, M1



功能隔室
Functional compartments

- | | |
|----------|---|
| A | 气箱
Gas tank |
| B | 机构室
Operator compartment |
| C | 电缆室
Cable wiring compartment |
| D | 低压端子室
Low-voltage terminal compartment |

运行环境:

Operating environment:

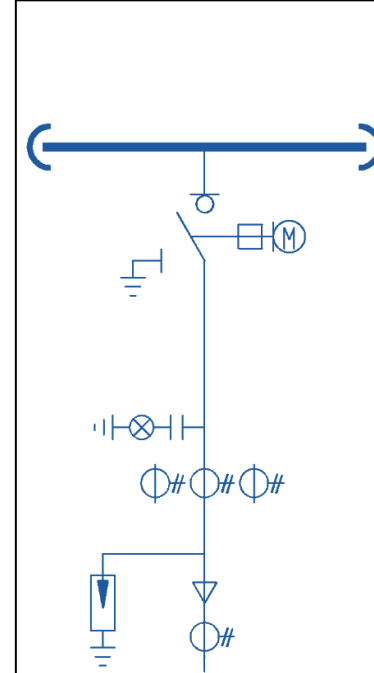
- | | |
|-----------------------|--|
| ■ 环境温度: | ● Ambient temperatures |
| ■ 最高值: +45°C | ● Maximum Temperature: +45°C |
| ■ 最高值 (24小时平均): +35°C | ● Maximum Temperature : (24h average): +35°C |
| ■ 最低值: -15°C | ● minimum ambient temperature: -15°C |
| ■ 安装高度: 最高海拔1000米 | ● Installation altitude: max. 1,000m above sea level |
| ■ 最大湿度 (24小时平均): 95% | ● Max. Humidity (24h average): 95% |

执行标准:

Execution Standard:

- 产品符合GB/T3906-2020、GB/T11022-2020和GB/T1984-2024等国家标准的的要求。气箱标准为“丧失运行连续性类别”LSC1, 可根据客户需要定制LSC2, 满足国家电网标准化要求及“国家电网公司电网十八项重大反事故措施”。
- The product meets the requirements of test items such as GB/T3906-2020, GB/T11022-2020 and GB/T1984-2024. The gas tank defaults to “Loss of Service Category” LSC1, and LSC2 can be customized according to customer needs. It meets the requirements of State Grid standardization and the “Eighteen Major Anti-accident Measures for Power Grids of State Grid Corporation of China”.

C单元 负荷开关方案 (Unit C , Load switch Solution)



功能 (Function)

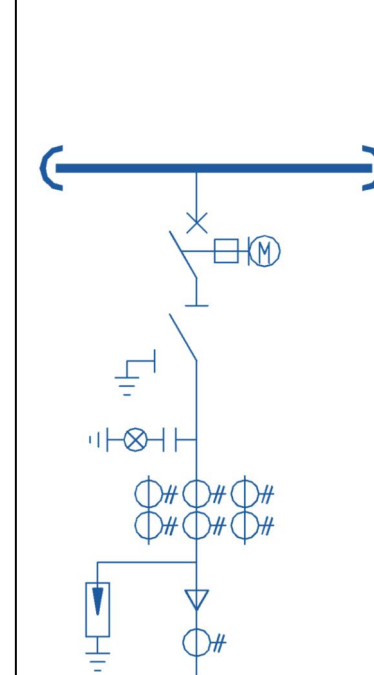
三工位负荷开关用于接通或断开进出线电缆与母线之间的连接, 并能同时将三相进出线电缆接地以便维护。接地回路具备短路关合功能, 常用于进线、出线负荷及线路的控制。

The three-position load switch is used to connect or disconnect the inlet and outlet cables from the busbar, and to ground the inlet and outlet cables in three phases at the same time to facilitate maintenance, and the grounding circuit has a short-circuit shutdown function, which is often used for the control of the inlet and outlet loads and lines.

配置 (Configuration)

- | | |
|---------------|---|
| a 主母线电流: 630A | a Busbar current (A): 630 |
| b 负荷开关 | b Load switch |
| c 气体压力指示表 | c Gas pressure indicator gauge |
| d 弹簧操动机构 | d Spring-operated actuator |
| e 带电显示器 | e Charged display |
| f 机械五防联锁装置 | f Mechanical five-proof interlocking device |
| g 电流互感器 | g Current transformer |
| h 避雷器 | h Lightning arrester |
| i 零序电流互感器 | i Zero sequence current transformers |

V单元 断路器方案 (Unit V , Vacuum Circuit Breaker Solution)



功能 (Function)

三工位隔离开关与真空断路器配合使用。真空断路器用于开断额定电流和故障电流, 而三工位隔离开关则用于将电源侧隔离设备。该组合常用于大容量线路或变压器的控制与保护。

Three-position disconnect switches are used in conjunction with vacuum circuit breakers. Vacuum circuit breakers are adopted to interrupt rated currents and fault currents, while three-position disconnect switches isolate equipment from the power supply side. This combination is commonly used for the control and protection of high-capacity lines or transformers.

配置 (Configuration)

- | | |
|---------------|---|
| a 主母线电流: 630A | a Busbar current (A): 630 |
| b 三工位隔离开关 | b Three-position disconnect switch |
| c 断路器 | c Vacuum breaker |
| d 气体压力指示表 | d Gas pressure indicator gauge |
| e 电流互感器 | e Current transformer |
| f 带电显示器 | f Charged display |
| g 机械五防联锁装置 | g Mechanical five-proof interlocking device |
| h 避雷器 | h Lightning arrester |
| i 零序电流互感器 | i Zero sequence current transformers |
| j 弹簧操动机构 | j Spring-operated actuator |

PT单元 母线电压测量方案(UnitPT , Busbar Voltage Measurement Solution)																
	功能 (Function) 母线电压测量单元用于对主母线系统的电压测量和保护, 同时也可从电压互感器(PT)获取操作电源, 作为开关设备的操作电源。 The busbar voltage measurement unit is used for voltage measurement and protection of the main busbar system. It can also obtain operating power from the voltage transformer (PT) to serve as the operating power source for switchgear.															
	配置(Configuration) <table><tr><td>a 主母线电流:630A</td><td>a Busbar current(A):630</td></tr><tr><td>b 三工位复合开关</td><td>b Three-position disconnect switch</td></tr><tr><td>c 气体压力指示表</td><td>c Gas pressure indicator gauge</td></tr><tr><td>d 电压互感器</td><td>d Voltage Transformer</td></tr><tr><td>e 高压熔断器</td><td>e High Voltage Fuses</td></tr><tr><td>f 带电显示器</td><td>f Charged display</td></tr><tr><td>g 机械五防联锁装置</td><td>g Mechanical five-proof interlocking device</td></tr><tr><td>h 避雷器</td><td>h Lightning arrester</td></tr></table>	a 主母线电流:630A	a Busbar current(A):630	b 三工位复合开关	b Three-position disconnect switch	c 气体压力指示表	c Gas pressure indicator gauge	d 电压互感器	d Voltage Transformer	e 高压熔断器	e High Voltage Fuses	f 带电显示器	f Charged display	g 机械五防联锁装置	g Mechanical five-proof interlocking device	h 避雷器
a 主母线电流:630A	a Busbar current(A):630															
b 三工位复合开关	b Three-position disconnect switch															
c 气体压力指示表	c Gas pressure indicator gauge															
d 电压互感器	d Voltage Transformer															
e 高压熔断器	e High Voltage Fuses															
f 带电显示器	f Charged display															
g 机械五防联锁装置	g Mechanical five-proof interlocking device															
h 避雷器	h Lightning arrester															
M单元 计量方案(Unit M , Measurement Solution)																
	功能 (Function) 用于电力设备电量的计量 For measuring electrical energy in power equipment.															
	配置(Configuration) <table><tr><td>a 主母线电流:630A</td><td>a Busbar current(A):630</td></tr><tr><td>b 电流互感器</td><td>b Current transformer</td></tr><tr><td>c 高压熔断器</td><td>c High Voltage Fuses</td></tr><tr><td>d 电压互感器</td><td>d Voltage Transformer</td></tr><tr><td>e 带电显示器</td><td>e Charged display</td></tr></table>	a 主母线电流:630A	a Busbar current(A):630	b 电流互感器	b Current transformer	c 高压熔断器	c High Voltage Fuses	d 电压互感器	d Voltage Transformer	e 带电显示器	e Charged display					
a 主母线电流:630A	a Busbar current(A):630															
b 电流互感器	b Current transformer															
c 高压熔断器	c High Voltage Fuses															
d 电压互感器	d Voltage Transformer															
e 带电显示器	e Charged display															



PRECISION IN DETAIL