

## NVU12 型户内高压真空断路器

NVU12 Indoor MV Vacuum Circuit Breaker



镇江大全伊顿电器有限公司

Zhenjiang Daqo Eaton Electrical Systems Co., Ltd

## 技术创造历史

### Technology Makes History



作为世界第一个真空灭弧室的制造者、真空技术的先驱，我们研究、开发和生产真空灭弧室已有 70 多年的历史，积累了极为丰富的经验。Westinghouse 的名字已经成为质量和可靠的同名词。

As the first manufacturer of vacuum arc chute and the pioneer of vacuum technology in the world, we have been embarking on the research, development of production of vacuum arc chutes for more than 70 years, having accumulated rich experience. Westinghouse has become a synonym for quality and reliability.

我们拥有全球最大、一直处于世界领先水平的真空灭弧室工厂，并且是全球唯一一家拥有大容量高压实验室的真空灭弧室工厂。

We have the world's largest vacuum interrupter plant in the world leading level, the globally unique one with the large-capacity high-voltage laboratory.

我们的制造能力和设计研发始终处在领先的位置。

We always rank ahead in the capability of manufacturing, design and development.

## ● 历史

### History

伊顿融合了西屋，卡特拉-汉莫，霍力克上百年的真空技术和研究为客户提供环境友好型的真空泡解决方案。

伊顿真空泡在全球范围的支持

主要特性：

高电流电压等级

快速成型

紧凑的真空泡尺寸

几乎可忽略的消耗和磨损

Eaton has combined more than 100 years of vacuuming technology and design investments by Westinghouse, Cutler-Hammer and Holec, to deliver an environmentally ideal vacuum interrupter solution for your targeted applications. EVIs are available in a wide range of ratings backed by a broad list of capabilities:

- High AC currents and voltages
- Rapid prototyping
- Compact VI volume
- Negligible erosion and wear

## ● 长寿命，低维护和极高的可靠性

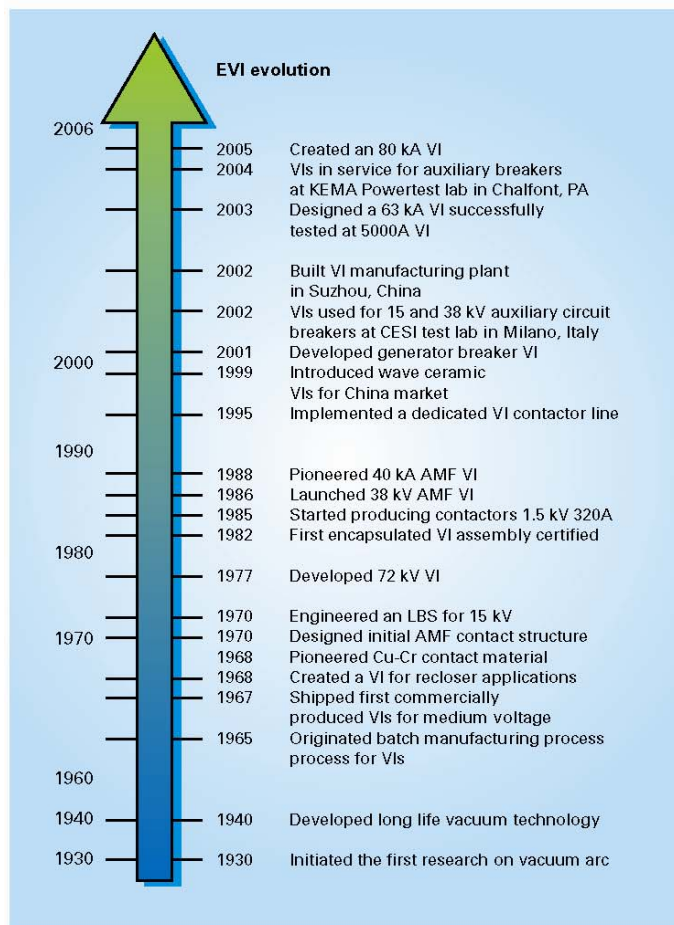
### Longer Life, Lower Maintenance, and Greater Reliability

伊顿真空泡广泛应用在 40.5KV 一下的系统中用于重复开合，电机涌流开断，故障保护以及中压过流及短路保护。超过 400 种标准设计可适用于 40 种电气参数。同时，我们可根据客户要求开发和设计。

Eaton's Cutler-Hammer brand of vacuum interrupters are extensively applied worldwide in AC circuits of 40.5 kV and below for repetitive switching, motor inrush current interruption, and fault protection; and for medium/high voltage overcurrent and short circuit protection. Over 400 standard designs are available in 40 electrical ratings. Additionally, vacuum interrupters can be designed and manufactured to meet specific customer equipment requirements.



Continued investment in research and development contributes to Eaton's small interruption to envelope ratio.



### Partner with the inventor and innovation leader in VI technology.

While growing as the world leader of vacuum interrupter technology, Eaton has taken the values and technology from acquisitions and combined those with organic development to create one vertically integrated business. Utilizing 3-D solid modeling, finite element analysis and two high-power test labs, Eaton is able to create many of the highest interrupting applications with the smallest envelopes in the industry.

● 工业领导者

**The Industry Leader**

从1929年开始真空技术研究，伊顿一直处于真空开断设计和制造的前沿。产品开始于1960年度中期，迄今已有超过1百万只真空泡可靠应用于全球。伊顿持续的研究已经获得的大量标志性的真空开断技术的革新，提供更高的可靠性，安全性。采用最新工艺和设备的生产技术以及ISO质量管理提供精确的制造工艺已保证质量。

Beginning with early research in 1929, Eaton has been at the forefront of vacuum interrupter design and manufacturing. Production began in the mid-1960s, and since that time over 1 million vacuum interrupters have been in reliable operation worldwide.

Eaton's consistent research and development program has achieved many significant innovations in vacuum interrupter technology that enhance dependability, reliability, and safety. Manufacturing is equally advanced, incorporating state-of-the-art techniques and equipment in an ISO certified quality environment providing precise manufacturing procedures.

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## 1.概述

### Overview

NVU12 系列真空断路器融合了伊顿电气真空技术的卓越性能，集中体现了伊顿数十年配电系统方面丰富的设计和制造经验，具有可靠性高，操作方便，维护简单等特点，为用户提供了高性价比的产品。

NVU12 serial vacuum circuit breaker combines the superior performance of Eaton's electrically vacuum interrupting technology and epitomizes its rich experience of dozens of years in the design and manufacturing of power distribution system, characteristic of high reliability, easy operation and easy maintenance. It is our goal to provide users with cost-effective products.

- 符合 IEC、GB、DL 等标准的规定

Compliant with such standards as IEC, GB, DL and others

GB1984-2003 《高压交流断路器》 ，

GB1984-2003: High-voltage alternating-current circuit-breakers

GB3855-1996 《3.6~40.5kV 户内交流高压真空断路器》 ，

GB3855-1996: Indoor AC High-voltage Vacuum Circuit Breakers for Rated Voltage 3.6 ~ 40.5kV

DL/T403-2000 《12~40.5kV 高压真空断路器订货技术条件》 ，

DL/T403-2000: Order Technical Specifications for HV Vacuum Circuit-Breaker for Rated Voltage 12kv to 40.5kv

IEC62271-100:2001 《高压开关和控制开关》 。

IEC62271-100: 2001: High-voltage Switchgears and Control Switches

- NVU12 系列真空断路器配用伊顿电气新一代的真空灭弧室，更适合电力系统的技术和运行条件，

NVU12 serial vacuum circuit breaker is equipped with Eaton's new-generation vacuum interrupter, which is more suitable for the technology and operating conditions of electric power system.

- 理想的触头材料和形状，保证小的截流值和稳定的接触电阻，

The ideal contact materials and shapes make small chopping current and stable contact resistance guaranteed.

- 零部件少，结构紧凑合理，确保操作更可靠、更安全，

Fewer parts and reasonable structure make its operation more reliable and safer.

- 可理想的切合电阻、感性和容性负荷，

It can switch resistance, inductive and capacitive loads reliably.

## 2.产品使用条件

### Service Conditions

- 周围空气温度不超过 40℃，且在 24h 内测得的平均值不超过 35℃。最低周围空气温度为-15℃。

The ambient air temperature should not exceed 40℃ and its mean measured within 24 hours, 35℃. The lowest one -15℃.

- 阳光辐射的影响可以忽略。

The influence from solar radiation can be neglected.

- 周围空气没有明显的受到尘埃、烟、腐蚀性或可燃性气体、蒸汽或盐雾的污染。

The ambient air is not polluted significantly by dust, smoke, corrosive or flammable gas, steam or salt mist.

- 地震烈度不超过 8 度。

The earthquake intensity does not exceed 8 degrees.

- 在二次系统中感应的电磁干扰的幅值不超过 1.6kV。

The amplitude of electromagnetic interference induced in the secondary system does not exceed 1.6kV.

## 3.技术特点

### Technical Features

- NVU 采用成熟的弹簧操作机构，性能稳定、可靠，寿命长，操作简单，优秀的防腐能力，寿命期内只需极少维护。

NVU is installed with the mature spring operating mechanism, characteristic of stable and reliable performance, long life and easy operation. Its excellent capability of corrosion resistance can minimize maintenance during the lifetime.

- NVU 采用了立式环氧绝缘罩可防御严酷环境的影响，使 NVU 断路器适用于各种场合，独特的触头材料和一次梅花触头应用，使 NVU 断路器适用于中压系统的各种场合。

NVU is equipped with the vertical-type epoxy insulating cover against the impact of harsh environment, which makes NVU breaker applicable to various occasions. The application of unique contact materials and primary tulip contacts makes NVU breaker suitable for the diversified occasions of medium voltage system.

- 按 GB1984-2000/IEC62271-200 中延长的电寿命 E2 级、延长的机械寿命 M2 级及容性电流开合具有非常低的重击穿概率 C2 级完成型式试验。

It has passed the type tests in accordance with the E2-grade extended electrical durability and M2-grade extended mechanical durability in IEC/GB1984-2003, as well as the C2-grade restrike probability for the opening and closing of capacity current.

- 产品装配采用工装保证尺寸的一致性，所有产品在出厂前均进行过标准柜的推柜试验，保证了产品的可互换性和通用性。

For assurance of dimensional consistency, its assembly is done through tooling. All the products have passed the standard bookshelf test, which ensures the interchangeability and versatility of the products.

- 所有产品出厂前经过数百次机械操作磨合试验，确保了产品性能处于最稳定的阶段。

All the products experience hundreds of running-in tests for mechanical operation before leaving the factory, which ensures that the product performance is in the most stable phase.

- 采用先进的进口测试设备，真实记录每一台产品的空载机械特性，并向用户提供这些特性曲线，确保产品质量的可靠性。

The advanced test equipment imported from overseas can truly record the no-load mechanical features of each product and provide users with these characteristic curves to ensure the quality reliability of products.

- 几乎无需相应的维护和保养，伊顿电气真空断路器 NVU 简单的结构设计，进一步减少故障发生率，使日常维护更简单。通过断路器面板上的指示器，无需任何检测仪器，使可方便的判断断路器的工作状况。断路器使用世界一流的伊顿电气真空灭弧室，真空度高达  $10^{-6}\text{Pa}$ ，保用 30 年而无维修。

It hardly needs any relevant care and maintenance. The simple physical design of Eaton NVU electrical vacuum circuit breaker can further reduce the failure rate and simplify routine maintenance. By the indicator on the panel of the breaker it is very easy to judge the working condition of the breaker without any detecting instruments. The vacuum degree of this breaker can reach  $10^{-6}\text{Pa}$  because it is installed with Eaton electric vacuum arc chute. It can be warranted to work for 30 years without maintenance.

- 中压供配电系统中控制与保护的更佳选择，断路器所配操作机构是性能优异的弹簧储能机构，采用模块化设计，使机构主件分布更优化、机构更简单、性能更稳定。整个机构由三个模块组成：储能、合闸、分闸。这三个部分组装维护非常简单，而储能机构由棘轮结构、摆动装置及合闸弹簧组成，机构紧凑、小巧。操作机构通常都配有手动储能装置与电动储能装置，可实现自动重合闸功能。

It is the best choice in control and protection of medium-voltage power supply and distribution system. The operating mechanism attached to the breaker is a kind of spring energy-storage mechanism with outstanding performance. Its modular design optimizes the distribution of its main units, simplifies its structure and stabilizes its performance. This mechanism consists of three modules, namely, energy-storing module, closing module and opening module. These three parts are very simple in assembly and maintenance. The energy-storing mechanism is made up of ratchet mechanism, pendulous device and closing spring, characteristic of compact and small mechanism. The operating mechanism is generally equipped with the manual energy-storing device and electric energy-storing device, enabling automatic reclosing function.

- 手动储能操作机构的断路器通常设有手动分合操作按钮，断路器位置指示器及弹簧机构

储能状态指示器，开关操作次数计数器，分励脱扣器辅助开关，位置和故障信号等装置。

The breaker for the manual energy-storing operating mechanism is generally equipped with the manual on/off button, breaker position indicator, energy-storing state indicator for spring mechanism, switch operation counter, shunt-release auxiliary switch, position and error alarm device.

- 电动储能操作机构的断路器：增设有储能电机，分励脱扣器，防跳继电器，储能电机脱扣器的辅助开关。

The breaker for the electrical energy-storing operating mechanism is equipped with the energy-storing motor, shunt release, anti-tripping relay, and auxiliary switch of energy-storing motor release.

还可以根据具体要求提供以下附件：欠压脱扣器、过流继电器等。

The accessories including undervoltage release and overcurrent relay can also provided according to specific requirements.

## 4.湿度条件

### Humidity

- 24h 内测得的相对湿度平均值不超过 95% 。

The average relative humidity measured in 24h does not exceed 95%.

- 24h 内测得的水蒸汽压力平均值不超过 2.2kPa。

The average vapor pressure measured in 24h does not exceed 2.2kPa.

- 月相对湿度平均值不超过 90%。

The monthly average relative humidity does not exceed 90%.

- 月水蒸气压力平均值不超过 1.8kPa。

The monthly average vapor pressure does not exceed 1.8kPa.

## 5.应用领域

### Application Fields



Chemical industry  
Oil industry  
Pipeline industry  
Offshore production  
Shipbuilding industry

Substation and transformer substation  
Cement Industry  
Automobile industry  
Power plant  
Textile and food industries

## 6.主要技术参数

### Main Technical Parameters

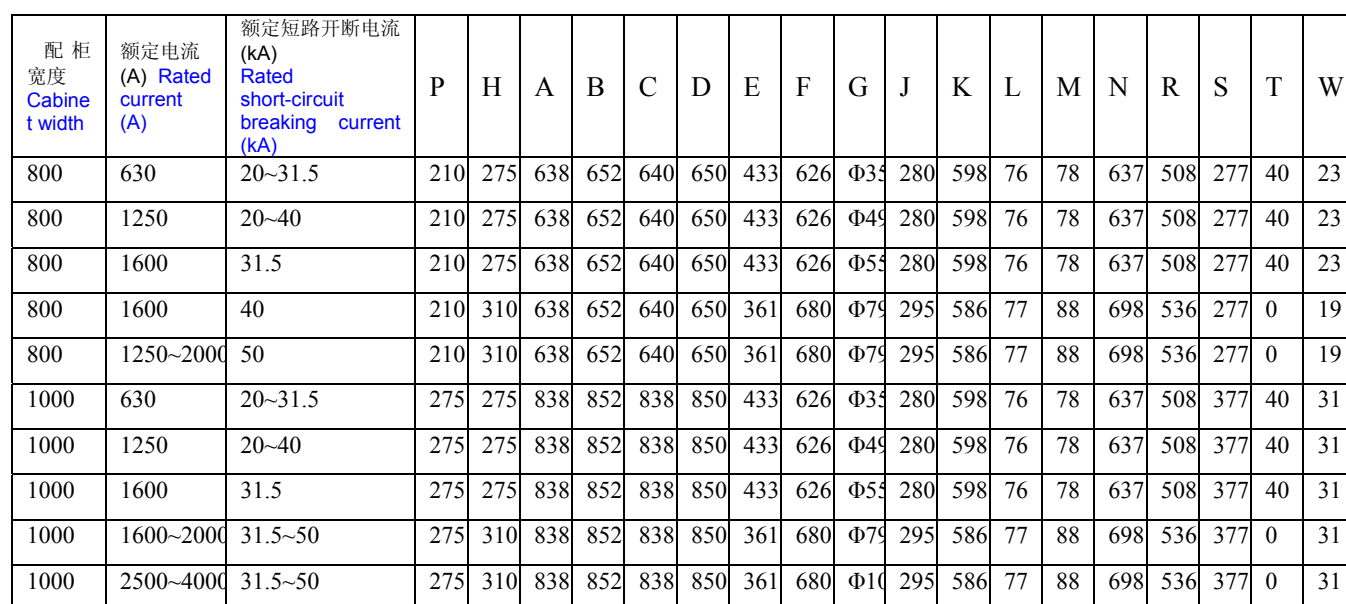
	项目 Items	单位 Units	数值 Values
1	额定电压 Rated voltage	kV	12
2	工频耐压 1min (有效值) Power frequency withstand voltage 1min (rms)		42
3	额定雷电冲击耐受电压 (峰值) Rated lightning impulse withstand voltage (peak)		75
4	额定频率 Rated frequency	Hz	50/60
5	额定电流 Rated current	A	1250 1600 2000 2500 3150 4000 <sup>(1)</sup>
6	额定短路开断电流 Rated short-circuit breaking current	kA	25 31.5 40 50
7	额定短时耐受电流 Rated short-time withstand current		25 31.5 40 50
8	额定短路持续时间 Rated short-circuit duration	s	4
9	额定峰值耐受电流 Rated peak withstand current	kA	63 80 100 125
10	额定短路关合电流 Rated short-circuit making current		63 80 100 125
11	二次回路工频耐受电压 (1min) Power frequency withstand voltage for secondary circuit (1 min)	V	2000
12	额定单个/背对背电容器组开断电流 <sup>(2)</sup> Rated single/back-to-back capacitor bank breaking current	A	630/400 (800/400 for 40 kA)
13	额定电容器组关合涌流 Rated capacitor bank making current	kA	12.5 (frequency no more than 1000Hz)
14	分闸时间 Opening time	ms	20~50
15	合闸时间 Closing time		35~70
16	机械寿命 Mechanical life	Times	M2 30000(<=31.5KA, 1600A) 20000(40KA)/10000(50KA)
17	额定电流开断次数 Rated current breaking frequency	Times	M2 30000(<=31.5KA, 1600A) 20000(40KA)/10000(50KA)
18	额定短路电流开断次数 Rated short-circuit current breaking frequency		E2
19	动、静触头允许磨损累计厚度 Allowable wear cumulative thickness for moving and stationary contacts	mm	3
20	额定合闸操作电压及范围 Rated close operating voltage and range	V	AC 110/220 DC 110/220 (80%~110%)
21	额定分闸操作电压及范围 Rated open operating voltage and range		AC 110/220 DC 110/220 (65%~120%)
22	储能电机额定电压及范围 Rated voltage for spring-charging motor and range		AC 110/220 DC 110/220 (80%~110%)
23	储能电机额定功率 Rated power for spring-charging motor	W	65 (80 for 50 kA)
24	储能时间 spring-charging time	s	≤15
25	触头开距 Contact stroke	m	9±1
26	超行程 Over travel		3.5±1
27	触头合闸弹跳时间 Contact Bounce Duration, Max	ms	≤2
28	三相分、合闸不同期性 Non-synchronism of triphase contactor when opening or closing		≤2
29	分闸速度 0~75%额定开距平均值 Opening Speed, Average to 75% of Rated Stroke	m/s	1.0~1.4

30	合闸速度最后 33%额定开距的平均值 Closing Speed, Average of Last 33% of Rated Stroke		0.7~1.0
31	触头分闸反弹幅值 Rebound amplitude When Contact opening	mm	≤3
33	触头合闸接触压力 contact pressure of VI	N	2400±200(20kA、25kA) 3100±200(31.5kA) 4250±250(40kA) 7000±250(50kA)
34	额定操作顺序 Rated operating sequence		Open-0.3S- CO -180S-CO

注：（1）4000A 需强制风冷；（2）为需要时才提供的额定参数。

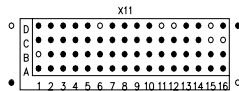
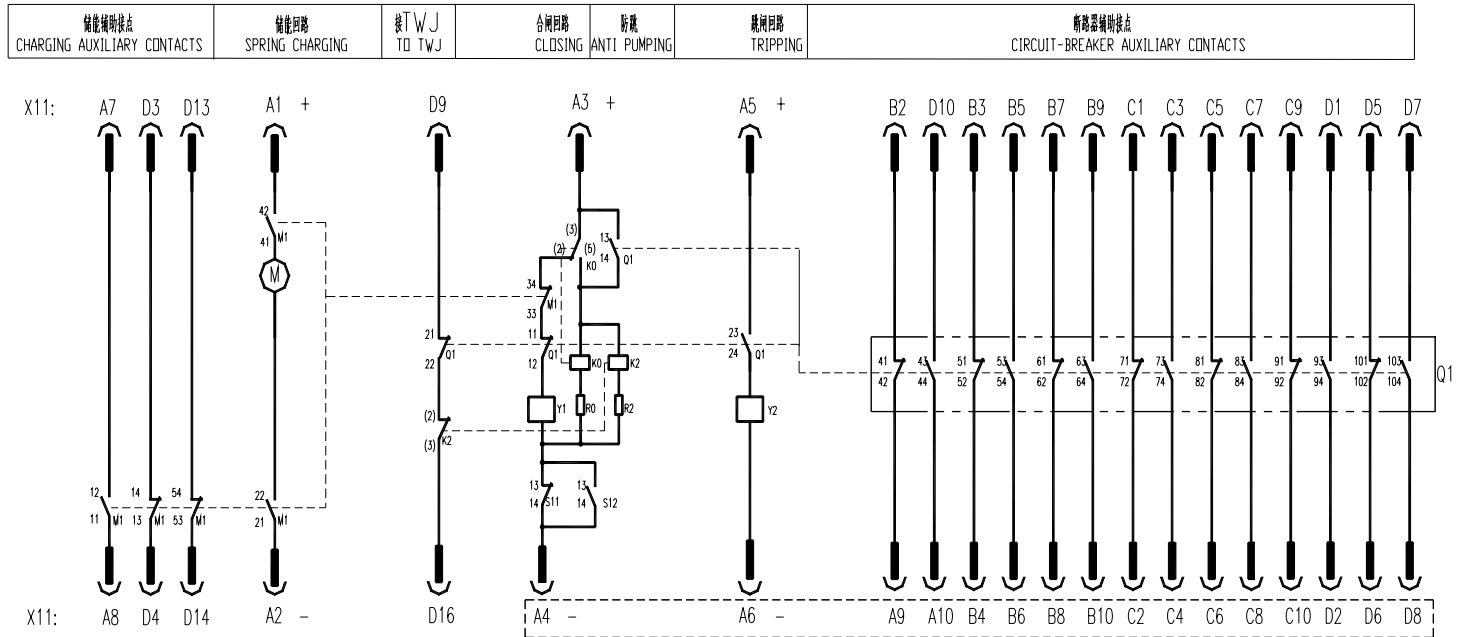
Note: (1) 4000A requires forced air cooling; (2) Ratings provided when required.

## Overall Dimensions



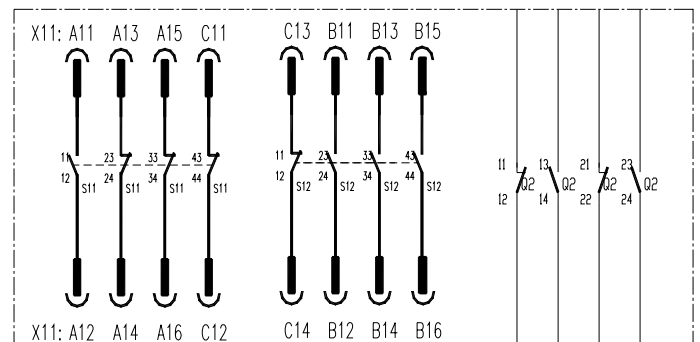
## 8.电气原理图

### Electrical Schematics



Y1 合闸脱扣器 110VDC 2.0A CLOSING COIL	
Y2 分闸脱扣器 110VDC 1.8A SHUNT TRIP COIL	S11 限位开关 (工作位置) SERVICE AUXILIARY CONTACTS
M 弹簧机构储能电机 110VDC SPRING CHARGING MOTOR	S12 限位开关 (试验位置) TEST AUXILIARY CONTACTS
K0 防跳继电器 ANTI-PUMPING RELAY	Q1 断路器主触头辅助开关(10N□,10NC) VCB AUXILIARY CONTACTS
K2 防跳继电器 ANTI-PUMPING RELAY	M1 储能开关辅助开关 CHARGING AUXILIARY CONTACTS
Q2 接地开关辅助开关 E.S. AUXILIARY CONTACTS	X11 插头 PLUG
说明: 1、断路器处于分闸状态、机构未储能、手车处于工作位置: VCB OPENED,SPRING DISCHARGED,IN SERVICE POSITION.	

手车工作位置辅助触点 SERVICE AUXILIARY CONTACTS	手车试验位置辅助触点 TEST AUXILIARY CONTACTS	接地刀闸辅助触点 E.S. AUXILIARY CONTACTS
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