

## LW36A-126 型低温自能式六氟化硫断路器

### LW36A-126 Low Temperature Self-Energy SF<sub>6</sub> Circuit Breaker



#### 一、概述

##### I. Overview

LW36A-126 型低温自能式六氟化硫断路器适用于交流 50Hz、126kV 电力系统中，尤其适用于开断重要负荷的场所，可作为发电、变电所等输配电系统的控制和保护开关，亦可作为电力系统的控制和保护之用的联络断路器。此产品的最大特点就是低表压，可在-40℃的环境下正常运行。

LW36A-126 Low Temperature Self-Energy SF<sub>6</sub> Circuit Breaker is applicable in AC 50Hz, 126kV electric power systems, especially applicable to the sites for breaking important loads, able to serve as the control and protection switch for power generation and power transformation substations and other power transmission and transformation systems, and also able to serve as the tie breaker for the purpose of control and protection for electric power systems. The most significant character of this product is

low gauge pressure, able for normal operation under -40°C environment.

## 二、使用环境条件

### II. Operating Environment Condition

- a. 周围环境温度: -40°C ~ +40°C。 日温差  $\geq 35^\circ\text{C}$
- a. Ambient Temperature: -40°C ~ +40°C Daily Temperature Difference  $\geq 35^\circ\text{C}$
- b. 海拔高度: 不超过 1000m
- b. Altitude: Not Exceeding 1000m
- c. 风速:  $\geq 34\text{m/s}$ (相当于圆柱表面上的 700Pa)
- c. Wind Speed:  $\geq 34\text{m/s}$  (Equivalent to 700Pa on Cylindrical Surface)
- d. 日照强度:  $\geq 1000\text{W}/\text{m}^2$  (晴天的中午时)
- d. Sunlight Intensity:  $\geq 1000\text{W}/\text{m}^2$  (at Noon on Fine Day)
- e. 月平均相对湿度:  $\geq 90\%$
- e. Monthly Average Relative Humidity:  $\geq 90\%$
- f. 地震加速度: 水平  $\geq 0.2\text{g}$ , 竖直  $\geq 0.1\text{g}$
- f. Seismic Acceleration: Horizontal  $\geq 0.2\text{g}$  and Vertical  $\geq 0.1\text{g}$
- g. 覆冰厚度:  $\geq 10\text{mm}$
- g. Icing Thickness:  $\geq 10\text{mm}$
- h. 空气污秽程度: 不超过 GB/T5582 中的IV级
- H. Air Pollution Degree: Not Exceeding IV in GB/T5582
- i. 安装场合: 户内及户外
- i. Installation Site: Indoors and Outdoors

## 三、主要技术参数

### III. Main Technical Parameters

#### 3.1 主要技术参数

#### 3.1 Main Technical Parameters

序号 S/N	项 目 Item	单位 Unit	参 数 Parameter
1	额定电压 Rated Voltage	kV	126
2	额定工频耐受电压 Rated Power Frequency Withstand Voltage (1min)		相间及对地 230 Phase to Phase and Phase to Ground 230

			断口间 230+73* Fracture to Fracture 230+73*
3	额定雷电冲击耐受电压 Rated Lightning Impulse Withstand Voltage		相间及对地 550 Phase to Phase and Phase to Ground 550
			断口间 550+103* Fracture to Fracture 550+103*
4	SF <sub>6</sub> 零表压时的工频耐受电压 SF <sub>6</sub> Power Frequency Withstand Voltage at Zero Gauge Pressure (5min)		相间及对地 95 Phase to Phase and Phase to Ground 95
			断口间 95 Fracture to Fracture 95
5	额定频率 Rated Frequency	Hz	50
6	额定电流 Rated Current	A	3150
7	额定短路开断电流 Rated Short Circuit Breaking Current	kA	40
8	额定峰值耐受电流 Rated Peak Withstand Current		100
9	额定短时耐受电流 Rated Short Time Withstand Current		40
10	额定短路关合电流 Rated Short Circuit Making Current		100
11	首开极系数 First-Pole-to-Clear Factor		1.5
12	额定短路持续时间 Rated Short Circuit Lasting Time	s	4
13	额定失步开断电流(OP2) Rated Out-of-Phase Breaking Current (OP2)	kA	10
14	近区故障开断电流 Short Line Fault Breaking Current	kA	36,30
15	额定线路充电开断电流 Rated Circuit Charging Breaking Current	A	31.5
16	额定操作顺序 Rated Operating Sequence		O- 0.3s- CO- 180s- CO
17	额定六氟化硫气体压力 (20℃表压) Rated SF <sub>6</sub> Gas Pressure (Gauge Pressure at 20℃)	MPa	0.4
18	报警 / 闭锁压力 (20℃表压) Warning/Locking Pressure (Gauge Pressure at 20℃)		0.36/0.32
19	年漏气率 Annual Gas Leakage Rate	%/年 %/Year	≤0.5

20	气体水分含量 Gas Moisture Content	Ppm (V)	≤150
21	机械寿命 Mechanical Service Life	次 Times	6000
22	无线电干扰水平 Radio Interference Level	μV	≤500
23	关合时间 Making Time	ms	≤70
24	电寿命 Electrical Service Life	次 Times	≥20
25	每台用六氟化硫气体质量 SF <sub>6</sub> Gas Mass Used for Each Set	kg	7
26	每台断路器质量 Circuit Breaker Mass for Each Set		1500
27	爬电距离 Creepage Distance	断口间 Fracture to Fracture	3150
		对地 Fracture to Ground	3150

### 3.2 机构主要技术参数

#### 3.2 Mechanism Main Technical Parameters

序号 S/N	项 目 Item	单位 Unit	参 数 Parameter
1	辅助回路电压 Auxiliary Circuit Voltage	V	DC220 或 AC220 DC220 or AC220
2	分、合闸线圈电压 Opening/Closing Switch Coil Voltage		DC220
3	分闸线圈电流 Opening Switch Coil Current	A	2.0
	合闸线圈电流 Closing Switch Coil Current		2.0
4	储能电动机 Energy Storage Motor	额定电压 Rated Voltage	V AC/DC220
		正常工作电压范围 Normal Operating Voltage Range	V (80%~110%)X220
		功率 Power	W 600
5	电动机储能时间 Motor Energy Storage Time	s	≤15
6	手动储能力矩 Manual Energy Storage Torque	N·m	≤80

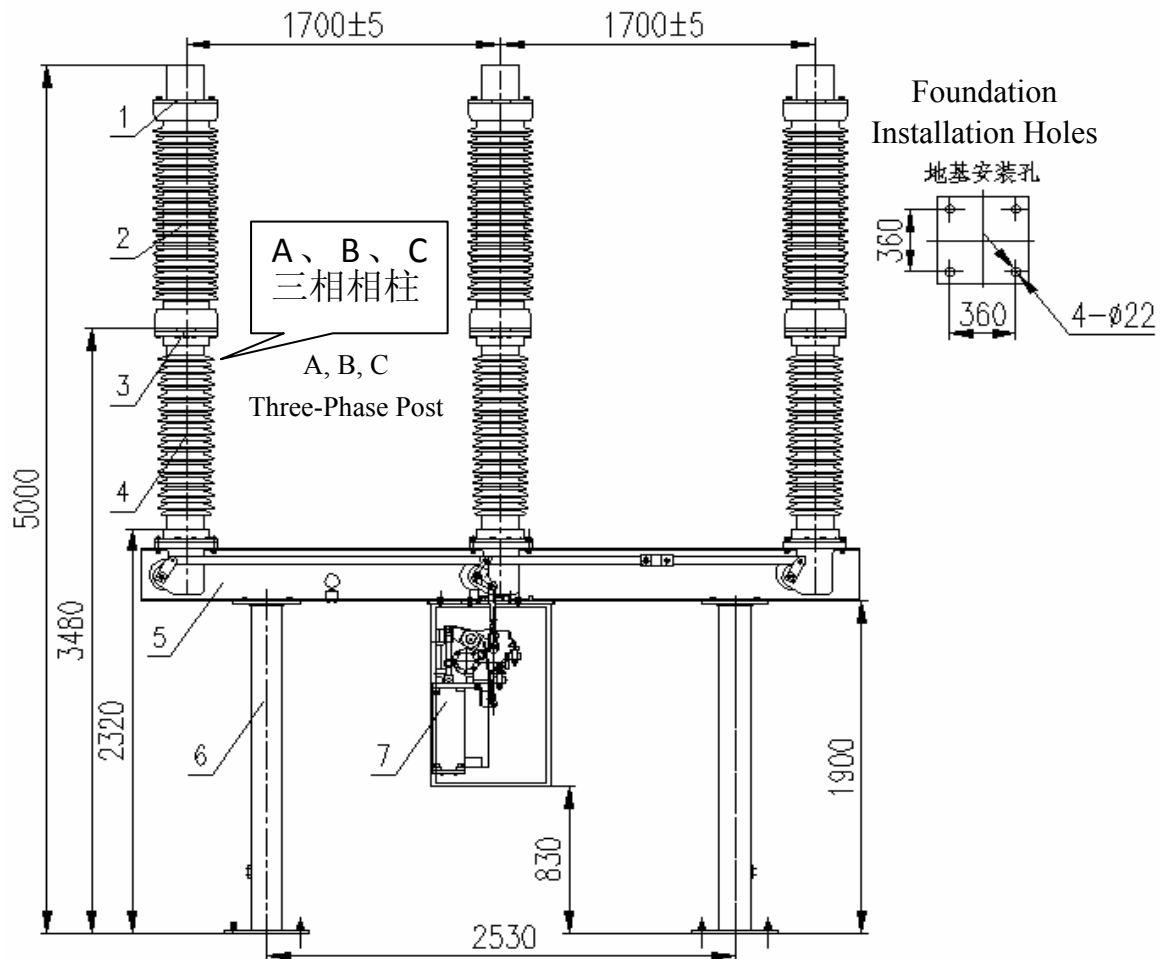
序号 S/N	项 目 Item	单位 Unit	参 数 Parameter
7	加热器及照明回路电压 Heater and Lighting Circuit Voltage	V	AC220
8	辅助开关额定电压 Auxiliary Switch Rated Voltage	V	DC220, AC220
9	辅助开关额定电流 Auxiliary Switch Rated Current	A	10
10	辅助开关接点对数 Auxiliary Switch Joint Pair Number		24

#### 四、产品结构及工作原理

### IV. Product Structure and Operating Principle

#### 1、总体结构

##### 1. Overall Structure



- |          |  |
|----------|--|
| 1. 上接线端子 | Upper Wiring Terminal                          |
| 2. 灭弧室瓷套 | Porcelain bushing of arc extinguishing chamber |
| 3. 下接线端子 | Lower Wiring Terminal                          |

4. 支持瓷套	Support Ceramic Bushing
5. 横梁	Cross Beam
6. 支腿	Outrigger
7. 机构	Mechanism

图 1

Fig 1

如图 1 所示，断路器采用单相、单断口，每台断路器的三个相柱安装在同一个共同的机座上，由一弹簧机构带动三相分、合闸。弹簧机构与电气控制部分共用一个箱体，该箱体固定在机座 B 相下部，三个相柱的充气室分别由阀门与管路连通。气室中的 SF<sub>6</sub> 气体压力由带温度的补偿的密度继电器检测并显示。

As indicated in Fig 1, single phase and single fracture are used for the circuit breaker, and three phase posts of each circuit breaker are installed on the same common frame, for one spring mechanism to actuate the three-phase switch opening/closing. The spring mechanism and the electrical control part share the same cabinet, and this cabinet is fixed on the bottom of B phase on the frame, while the inflatable chambers of the three phase posts are respectively connected by valves and pipelines. The SF<sub>6</sub> gas pressure in the gas chamber is detected and displayed by density relay with compensation of temperature.

## 2. 断路器相柱结构特点

### 2. Breaker Phase Post Structural Features

断路器共有 A、B、C 三个相柱。除 B 相柱的外拐臂为双拐臂外，断路器的三个相柱均相同。每个相柱主要包括灭弧室、支持瓷套、绝缘拉杆、拐臂箱等，如图 2 所示。另外拐臂箱内装有吸附剂。灭弧室瓷套均采用优质高强瓷制成，其强度高。气密性好。

The circuit breaker has totally A, B, and C three phase posts. The three phase posts of the circuit breaker are all the same, except for the external rocker arm of the B phase post is a double rocker arm. Each phase post mainly includes arc extinguishing chamber, support ceramic sleeve, insulation pull rod, and curved arm box, etc, as indicated in Fig 2. Additionally, adsorbent is installed inside the curved arm box. The arc extinguishing chamber ceramic bushings are all manufactured using high-quality and high-strength ceramic, typical of high strength and good air tightness.

- 1. 上盖            Top Cap
- 2. 灭弧室瓷套   Arc Extinguishing Ceramic Bushing
- 3. 灭弧室        Arc Extinguishing Chamber
- 4. 拐臂箱        Curved Arm Box
- 5. 拐臂           Curved Arm

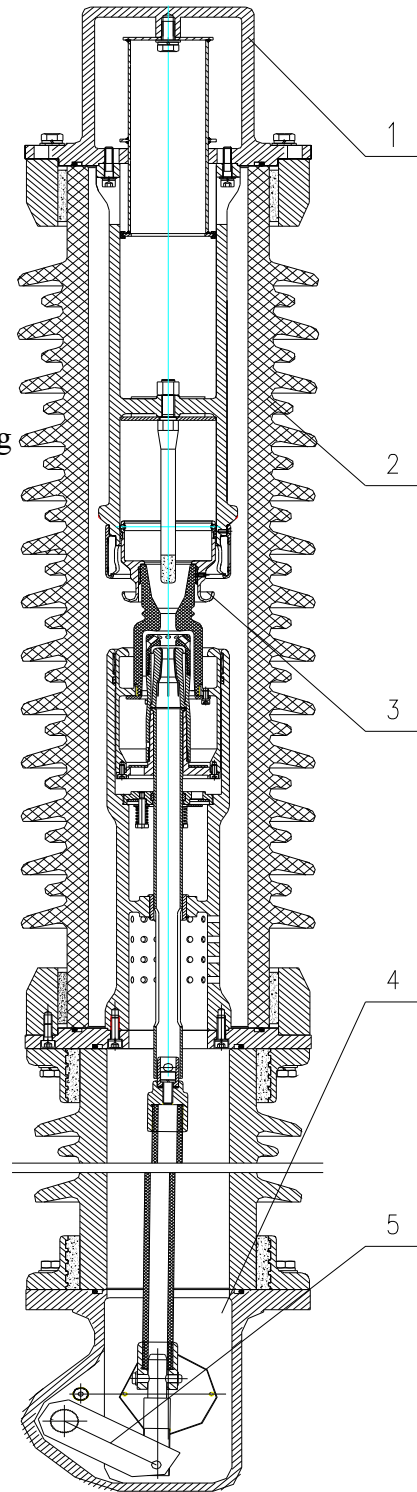


图 2 相柱  
Fig 2 Phase Post

### 3. 断路器的灭弧室结构及灭弧原理

#### 3. Arc Quenching Chamber Structure and Arc Quenching Principle of Circuit Breaker

灭弧室的结构如图 3 所示，主要由导气筒、铸件、触头、喷口、气缸等零部件组成。

The structure of arc extinguishing chamber is indicated as in Fig 3, mainly composed of gas guide sleeve, casting, contact, ejector nozzle, cylinder, and other parts and components.

该灭弧室在开断大的短路电流时采用自能吹弧原理，在开断小电流时所需要的灭弧压力由压缩热膨胀气缸中的 SF<sub>6</sub> 气体产生，在电流过零时，热膨胀气缸中的 SF<sub>6</sub> 气体吹向电弧就可以达到熄弧的目的。

Self-energy blast arc principle is adopted for this arc extinguishing chamber when large short circuit current is to be broken, and the required arc extinguishing pressure is generated by the SF<sub>6</sub> gas in the compression thermal expansion cylinder when small current is to be broken. When current is zero crossing, the SF<sub>6</sub> in the thermal expansion cylinder blows the electric arc to achieve the purpose for extinguishing the arc.



- |         |                          |
|---------|--------------------------|
| 1.导气筒   | Gas Guide Sleeve         |
| 2.上铸件   | Top Casting              |
| 3.静弧触头  | Static Arc Contact       |
| 4.屏蔽罩   | Shielded Enclosure       |
| 5.大喷口   | Large Ejector Nozzle     |
| 6.小喷口   | Small Ejector Nozzle     |
| 7.动弧触头  | Moving Arc Contact       |
| 8.不锈钢拉杆 | Stainless Steel Pull Rod |
| 9.泄压阀   | Relief Valve             |
| 10.下铸件  | Bottom Casting           |

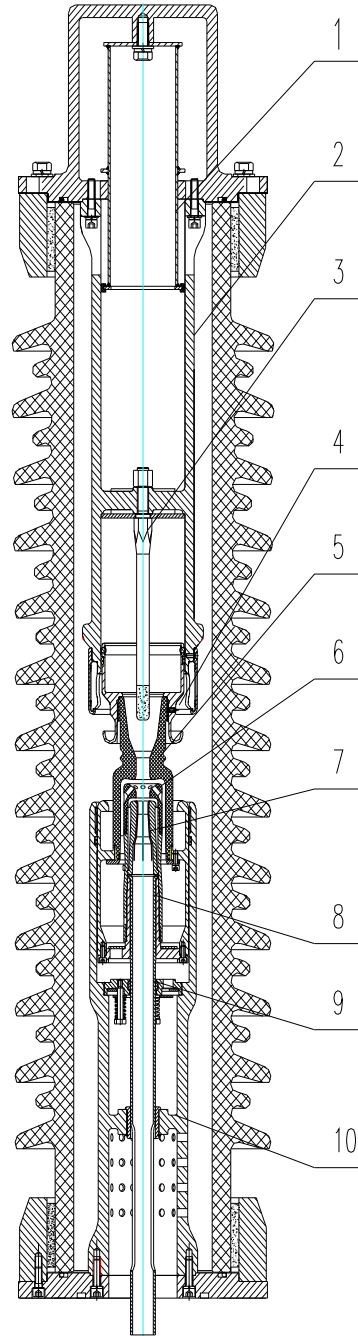


图 3  
Fig 3

## 五、产品的主要特点

### V. Product Main Features

- **灭弧室:** 采用自能、双缸室灭弧室。无论是原理还是结构方面, 在国内及国际的同行业中都是处于领先水平的。
- **Arc Extinguishing Chamber:** Self-energy and double-cylinder arc extinguishing chamber is used. No matter it is in the aspects of principle or structure, it takes the leading position in both domestic and international same industries.
- **表压:** 额定表压只有 0.4MPa,可在-40℃的环境下正常运行。
- **Gauge Pressure:** The rated gauge pressure is only 0.4MPa, able for normal operation under -40℃ environment.
- **机构特点:** 机构采用三菱公司的核心技术, 分合闸弹簧采用压缩弹簧, 并采用优质的 60si2crvA 弹簧材料, 加工精度和弹簧的力特性有很好的保证。各转动部位所用轴承均采用进口产品。机构的分闸速度可达到  $5.8 \pm 0.5\text{m/s}$  ( $5.3 \sim 6.3$ ) m/s, 是开断低表压必不可少的条件之一。在同类产品中处于领先水平。
- **Mechanism Characteristics:** Core technology of Mitsubishi Corporation is applied to the mechanism, compression spring is used for switch opening/closing spring, and quality 60si2crvA spring material is employed, provided with very satisfactory assurance for both processing precision and force characteristic of the spring. Product of German INA Corporation is used for all the bearings for respective turning parts. The switch opening speed for the mechanism is able to reach  $5.8 \pm 0.5\text{m/s}$  ( $5.3 \sim 6.3$ ) m/s which is one of the absolutely necessary conditions for breaking low gauge pressure, and takes the leading position among the similar products.
- **中间触头:** 中间触头为瑞士 MC 公司生产的表带触指, 此触指通过多点接触技术, 实现极低的接触电阻, 接触电阻稳定, 载流能力强, 而且安装方便。
- **Intermediate Contact:** The intermediate contact is the watchband contact finger produced by Swiss MC Corporation, and this contact finger achieves extremely low contact resistance through multi-point contact technology, typical

of stable contact resistance and strong current carrying capacity, as well as easy installation.

- **喷口电场：**大喷口处增加屏蔽罩，使静弧触头电场分布均匀，大大提高了开断性能，是低表压灭弧不可缺少的部分。
- **Ejector Nozzle Electric Field:** Shielded enclosure is added in the place of large ejector nozzle, for static arc contact electric field to be uniformly distributed, which has considerably improved the breaking performance, as one of the indispensable part for low gauge pressure arc extinction.

## 六、包装与运输

### VI. Package and Transport

断路器三个相柱在一个包装箱内，基座和机构在另一个包装箱内。

The three phase posts of the circuit breaker are inside the one packing box, while the base frame and the mechanism are inside the other packing box.

运输和储存期间，断路器内充入 0.02~0.03MPa 的 SF<sub>6</sub> 气体，以防潮和防止灰尘进入断路器。

During transportation and storage, 0.02~0.03MPa SF<sub>6</sub> gas is inflated into the circuit breaker, to prevent damp and entry of dust into the breaker.

## 七、开箱

### VII. Unpacking

1. 开箱后应按安装清单清点部件；随机技术文件及数量。

1. It is required to check the parts, as well as the attached technical documents and quantities according to the packing list after unpacking.

2. 拆箱时请小心以免损坏瓷瓶。

2. Please take care during unpacking to avoid damage of ceramic bottles.

3. 在为正式安装充气前，断路器的所有阀门都应保持关闭状态。不要拆除管路端头的保护帽，以防止灰尘和潮气进入内部。

3. Before formal installation and inflation, all the valves of the circuit breaker shall be maintained under the closed state. Don't remove the protection cap on the end of pipeline, to prevent entry of dust and damp.

## 八、安装与调试

### VIII. Installation and Adjustment

安装前请先安装箱单验收各组件及附件，若有疑问请立即同生产厂家联系。若包装组件吊装不当或安装过程中使用不合适的螺栓和紧固方式，会造成产品倾倒，引起设备损坏和人身伤害事故，安装紧固件需采用制造厂提供的附件箱中的备件，并用力矩扳手装配。螺栓采用8.8级或更高级的，紧固力矩如下：

Please firstly check and accept respective components and accessories according to packing list, and contact the manufacturer immediately if any query arises. Improper hoist and installation of packaging components or use of improper bolts and fastening methods during installation may cause product to be tilted, giving rise to equipment damage and personal injury accident. Spare parts in the box of accessories provided by the manufacturer shall be used for installing fasteners, and torque wrench shall be used for assembly. When grade 8.8 or higher grade bolts are used, the tightening torques are given as follows:

M6	8±1Nm	M12	70±7Nm
M8	22±2Nm	M16	200±20Nm
M10	45±5Nm	M20	400±40Nm

固定式断路器操作室的冲击力为：

The impact forces for the fixed circuit breaker operating room are:

分闸(向下): 25000N                      合闸(向上): 15000N

Switch Opening (Downwards): 25000N    Switch Closing (Upwards): 15000N

断路器安装前，应将瓷瓶擦拭干净。不许使用任何工具或起重设备碰击瓷瓶。严禁将扶梯靠在竖起的瓷瓶上。整个安装过程中需要有成熟安装经验的专业人员现场指导。注：所有地脚螺栓用户自备。

Before the circuit breaker is installed, the ceramic bottle shall be wiped up. It is not allowed to use any tool or hoisting device to hit the ceramic bottle. It is strictly forbidden for ladder to lean against on the erected ceramic bottle. Professionals with rich installation experience shall be available for site instruction in the entire installation process. Note: All the foundation bolts shall be self prepared by users themselves.

## 8.1 地基的安装

### 8.1 Foundation Installation

固定式断路器地基安装如图4所示，断路器安装前，必须检查地脚螺栓是否符合标准，露出基础高度是否满足要求，混凝土基础应用水平仪检查水平度，两个基面的高度相差不超过2mm，每个基面的水平度不超过2mm。

Installation of the foundation for fixed circuit breaker is indicated as in Fig 4, and before installation of the breaker, the foundation bolts must be examined as to whether or not they are compliant with the standard, and whether or not the exposed foundation height is compliant with the requirement. The levelness of the concrete foundation shall be examined using level meter, and the difference in the heights of the two base levels shall not exceed 2mm, while the levelness of each base level shall not exceed 2mm

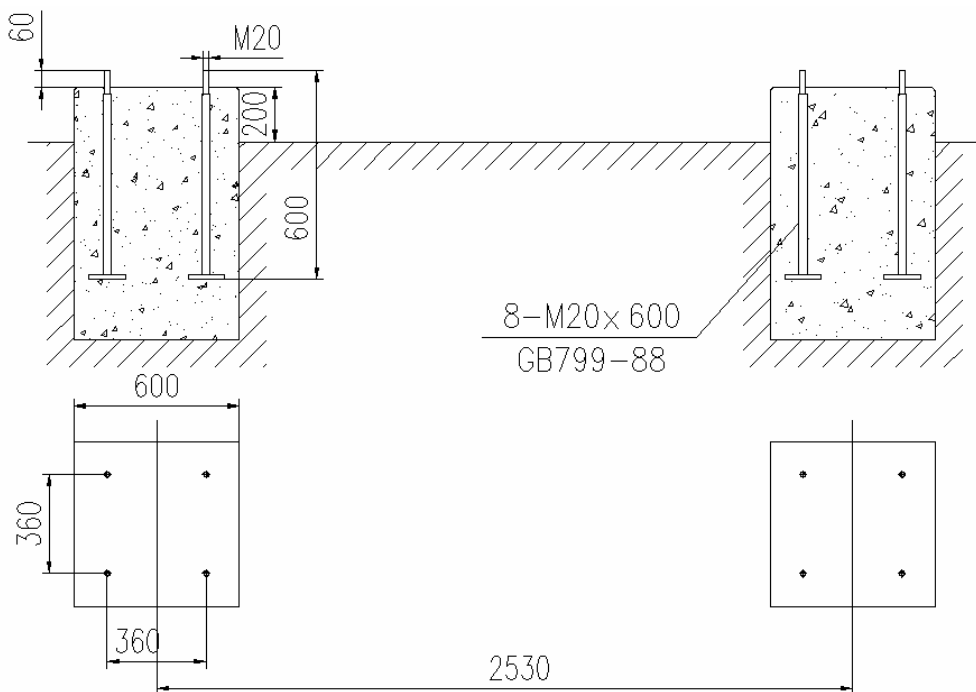


图4 地基安装

Fig 4 Foundation Installation

## 8.2 基座的安装

### 8.2 Base Installation

固定式断路器的基座与操作机构是在一起包装出厂的，在打好如图4的基础后，用起重设备将基座组件调运至基础处，用8个M20的螺母将其固定在地基上。基座安装紧固后，用水平仪矫正基座平面，水平面应不大于2mm。如图5

The base frame and the operating mechanism of the circuit breaker are packed and delivered together when they are to be fixed, and after the foundation has been properly laid as indicated in Fig 4, use hoisting device to transfer the base frame component to

the place of the foundation, and fix it on the foundation using 8 M20 bolts. After the base frame is installed and fastened, correct the base level using level meter, and the level surface shall not be larger than 2mm, as indicated in Fig 5.

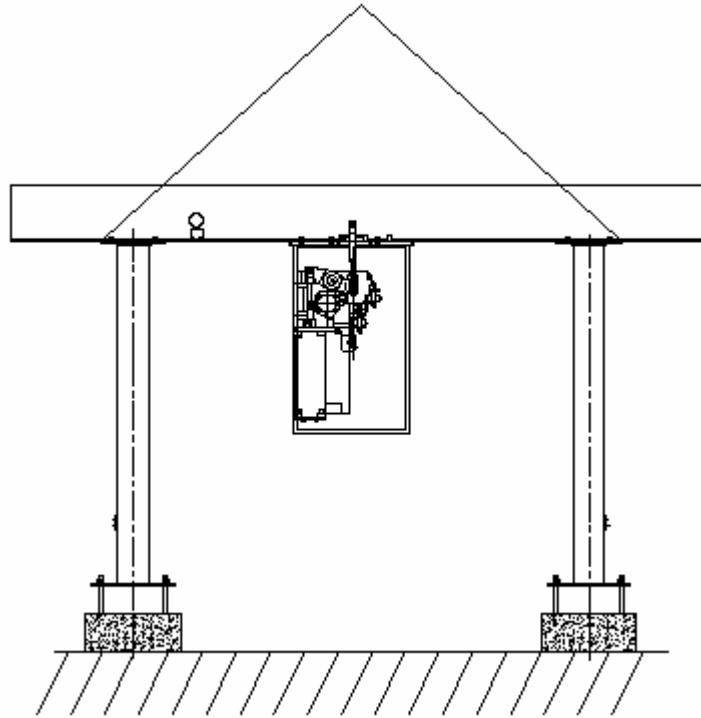


图 5  
Fig 5

## 九. 使用和维护

### IX. Operation and Maintenance

#### 9.1 试操作

##### 9.1 Trial Operation

安装工作完成后，断路器处于分闸位置，合闸弹簧未储能。试操作前应对开关做以下几项检查：

After installation work has been completed, the circuit breaker is on the switch opening position, and energy has not yet been stored for switch closing spring. The switch shall be examined for the following items before trial operation:

1. 确保开关内无安装时留下的零部件或工具，并检查断路器在运动方向上是否有阻挡物未拆除，尤其检查拐臂上的固定螺栓与水平操作连杆的垂直距离大于 20mm。

1. Ensure that no parts and components or tools are left behind inside the switch during installation, and examine whether or not any obstacle is not yet removed on the

movement direction of the circuit breaker, and especially examine that the vertical distance between the retaining bolt on the rocker arm and the horizontal operating linkage is larger than 20mm.

2. 一次端不能与高压系统相连。

2. The primary end shall not be connected with high service system.

3. 检查SF<sub>6</sub>气体压力不得低于0.32Mpa，否则会引起断路器的机械损伤。

3. Examine that the SF<sub>6</sub> gas pressure shall not be lower than 0.32MPa, and otherwise it may cause mechanical injury to the circuit breaker.

4. 检查所有销连接是否被紧固。

4. Examine whether or not all the pin connections are fastened.

5. 试操作最好采用电动远方控制，操作前所有操作人员应站在15m外或有屏蔽的地方。

5. It is advisable to use electric remote control for trial operation, and all the operators shall stand beyond 15m or in the shielded place before operation.

6. 在任何情况下，严禁断路器单相或两相操作。

6. In any case, single-phase or double-phase operation of the circuit breaker is strictly forbidden.

在确认开关可以操作后，完成断路器的五次合闸、五次分闸操作、三次标准循环操作，记录和闸与分闸时间，并将结果填写在投运报告中。

After it has been confirmed that the switch is operable, operations of switch closing for five times and switch opening for five times as well as standard cycle operation for three times to the circuit breaker shall be completed, note down the switch closing and opening times, and fill the results into the operation report.

## 十、断路器的大修

### X. Circuit Breaker General Maintenance

断路器的大修主要指对灭弧室的检修，需生产厂家派专业人员处理。严禁用户自行对断路器解体大修。断路器在下列情况下需大修：

General maintenance of the circuit breaker mainly indicates the examination and maintenance of the arc extinguishing chamber, and it is required for the manufacturer to send professionals for the treatment. It is strictly forbidden for users to disassemble the

circuit breaker on themselves for general maintenance. General maintenance of the circuit breaker is required in the following cases:

- a) 连续运行20年
- a) Continuous operation for 20 years
- b) 机械操作次数达6000次
- b) Mechanical operation reaching 6000 times
- c) 断路器达到其累计开断电流总值后
- c) After the circuit breaker having reached its cumulative breaking current total

value

## 十一、故障排除

### **XI. Failure Removal**

#### 1、开关拒合或拒分

##### 1. Refusal of switch to be closed or opened

- a) 分、合闸回路开路或错线，检查二次线路
- a) Switch opening/closing circuit in open circuit or in wrong circuit - Secondary circuit to be examined
- b) 辅助开关接触不良，调整辅助开关位置
- b) Bad contact of auxiliary switch - Auxiliary switch position to be adjusted
- c) 分、合闸线圈断线，更换线圈
- c) Switch opening/closing coil broken – Coil to be replaced
- d) SF<sub>6</sub> 气体闭锁，检查密度表及管路是否有漏点并补气
- d) SF<sub>6</sub> gas locked – Densimeter and pipeline to be examined as to whether or not leakage point exists and gas to be filled

#### 2、电机不储能

##### 2. Motor failed for energy storage

- a) 限位开关移动或损坏，调整限位开关或更换
- a) Limit switch moved or damaged – Limit switch to be adjusted or replaced
- b) 时间继电器延时动作，检查时间整定值
- b) Time relay delayed action – Time setting value to be examined

#### 3、SF<sub>6</sub> 压力降低

##### 3. SF<sub>6</sub> pressure dropped



查找泄漏点，如阀门、管路接头、密度继电器及密封面。

Leakage point to be found out, such as valve, pipeline joint, density relay and sealing surface

## 十二、随机文件

### **XII. Documents Attached**

- |                 |  |
|-----------------|--|
| a) 产品合格证明书一份    | One Certificate for Product Compliance                   |
| b) 安装使用说明书一份    | One Installation and Operation Manual                    |
| c) 断路器电气控制原理图一份 | One Circuit Breaker Electrical Control Schematic Diagram |
| d) 装箱单一份        | One Packing List   |

## 十三、订货须知

### **XIII. Notices for Order Placement**

订货时用户应提供下述资料：

User shall provide under mentioned data when order is placed:

- |                           |  |
|---------------------------|--|
| a) 断路器的型号和机构型号            | a) Model of Circuit Breaker and Model of Mechanism   |
| b) 额定电气参数（电压、电流）          | b) Rated Electrical Parameters (Voltage and Current)   |
| c) 操作电源类型                 | c) Type of Operating Power Supply  |
| d) 一次端子的接线方向              | d) Wiring Direction of Primary Terminal  |
| e) 使用环境条件                 | e) Operating Environment Condition   |
| f) 注明备件、配件、专用工具、专用设备名称和数量 | f) Name and Quantity of Spare Parts, Accessories, Special Tools, and Special Equipment Specified |

提示：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！

**Reminder: The contents involved in this manual including text, graphics, and parameters, etc are subject to modifications, without prior notice!**

**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！**

**Pay attention to personal health and safety, strengthen environmental protection, and treat packages and wastes properly!**