



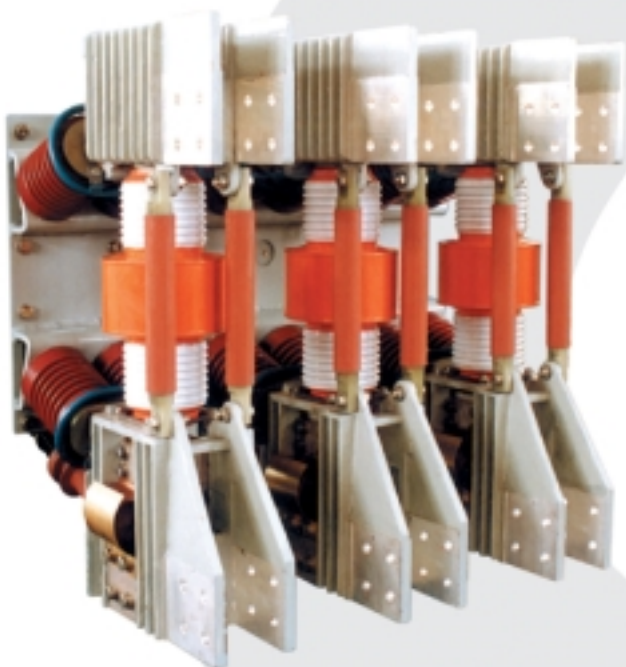
ZN65A-12/

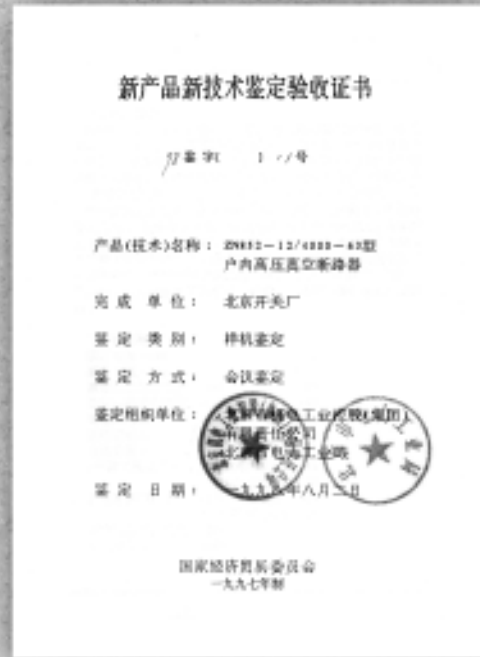
T4000-63

真空断路器

Vacuum Breaker

北开电气荣誉出品





ZN65A-12/T4000-63 型真空断路器

Installation and Use Guides of Type ZN65A-12/T4000-63 Vacuum Breaker

一、概述

ZN65A-12/T4000-63型户内高压真空断路器是北京北开电气股份有限公司针对我国电力行业对大容量负荷用控制、保护断路器尚依赖进口的现状，于一九九八年开发出的新产品，是北京北开电气股份有限公司在消化、吸收自一九八三年引进的德国西门子公司3AF技术(即国产ZN12-12系列真空断路器)基础上，自行设计、研制的集大额定电流(4000A)(借鉴国际上先进的同类产品技术特点)和高开断容量(63kA)于一体的大容量真空断路器。

本断路器为额定电压12kV、三相交流50Hz户内交流高压开关设备，技术性能居国内领先水平，达到了国际先进水平，并填补了国产真空断路器在该参数等级的空白。本断路器于一九九八年八月通过了原国家机械部、电力部两部鉴定。

本断路器可分别配装德国西门子公司灭弧室和国营七七厂灭弧室。

本断路器机构与开关一体式设计，专用的弹簧储能式操动机构可实现交直流及手动操作。

本断路器设计先进、合理、性能可靠，开断能力强，机构寿命长，操作功能齐全，无爆炸危险。适用于发电厂、大型变电所及高负荷用电的工矿企业的控制和保护开关。

本断路器绝缘性能好，全面满足户内II级污秽环境的使用要求。

本断路器符合GB1984《交流高压断路器》标准。

产品使用环境及条件：

海拔高度：低于2000m

环境温度：最高+40℃，最低-15℃(-40℃)*

相对湿度：日平均不大于95%，月平均不大于90%

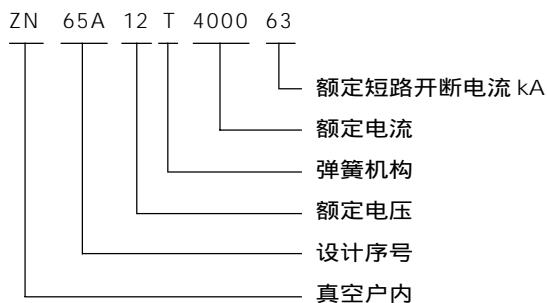
地震烈度：低于8级

无火灾、爆炸、无腐蚀性气体及无剧烈振动的场所。

注：零下40℃用户在订货时提出。

二、技术参数

1. 产品型号 ZN65A-12/T4000-63 的含义：



I. Profile

In 1998, Beijing Beikai Electric Co., Ltd. developed the Type ZN65A-12/T4000-63 indoor high-voltage vacuum breaker as the latest product for the following reason: The Chinese power industry had relied on the imported breakers oriented to the control and protection of high-capacity loads. This large-capacity vacuum breaker is integrated with big rated current (4,000A) (in reference to the international advanced same-product technological features) and high breaking capacity (63kA). It was designed developed on the basis of Germany Siemens 3AF technology (for domestic ZN12-12 series of vacuum breaker) that was imported in 1983.

This breaker is an indoor AC high-voltage switch device of rated voltage 12kV and 3-phase AC 50Hz, whose technological performance tops domestically, hits the internationally advanced level and fills the gaps in the parameter classes of domestic vacuum breakers.

In 1998, this breaker won the certificates of both the former Ministry of Machinery and the Ministry of Power.

This breaker can be equipped with the arc chambers provided from both Siemens and the state-owned No. 777 factory.

The mechanism of breaker is designed with the integration of switches. This special spring energy-storage operating mechanism can achieve the AC, DC and manual manipulations.

The breaker is advanced and reasonable in design, with the characteristics of good performance, strong opening and closing abilities, long mechanical life, complete operation functions and free explosion, so this breaker is applicable to the controlling and protective switches of power plants, big-sized transformer substations and high-load power-consuming industry enterprises.

The breaker features good insulation performance, so it can completely satisfy the use requirements of II-class filthy environment.

The breaker satisfies the standards of GB1984-89《AC high-voltage breaker》.

Environment and Conditions of Use

2. 产品技术参数 (见表 2)

3. 机械特性调整参数 (见表 1)

三、产品结构及工作原理

1、结构设计特点：

- (1) ZN65A-12/T4000-63 型真空断路器在设计上较好地保持了 3AF (即 ZN12-10 系列产品) 设计上的优越性、系列性及零部件通用性。灭弧室采用 CuCr 触头材料、杯状加强的纵磁场结构, 主屏蔽罩为外露式的真空灭弧室, 设计裕量大。操动机构与断路器一体式设计, 仅由两级蜗轮、蜗杆组成的减速箱, 两套四连杆机构(其公共交接点即断路器主轴)及一套变直机构便完成了全部储能、合分闸操作; 整体设计布局合理、结构紧凑, 传动杆系受力均匀, 传动效率高, 机构寿命长; 先进的设计完全吻合纵向磁场灭弧室要求的断路器应具有较高的初分速度的特点, 故开断能力强, 电寿命长。
- (2) 铸紫铜材质的上下出线及其双进(出)线方式, 导电夹下出线双软联接两侧导电结构, 圆满解决了断路器大额定电流 4000A 长期工作时发热问题 - 顺利通过了温升试验。
- (3) 每相上下出线固定方式采用双绝缘子结构, 较好地解决了大容量开断 63kA 时短路电动力对产品强度要求; 而均压环的采用改变了双绝缘子结构电场分布不均的状况。
- (4) 传动环节中的拉杆及支杆均采用引拔棒为基体外护硅橡胶及伞裙, 相间加装 SMC 材质绝缘隔板; 这些措施提高了断路器整体绝缘水平, 增加了绝缘裕度, 使产品绝缘性能高于原 3AF 技术, 并全面满足户内 II 级污秽环境使用要求。

2、整体结构：

断路器主要由真空灭弧室(12)、操动机构及支撑部分组成。在机构箱(11)上固定 12 只绝缘子(1), 三只灭弧室通过上、下出线(2)(3)固定在绝缘子上。下出线端装有两片软联接(4), 其中, 软联接的下端分别固定在下出线的两侧, 软联接的上端与真空灭弧室动导电杆上的导电夹(5)的两侧固定。在动导电杆的底部装有万向杆端轴承(6), 该杆端轴承通过一轴销(7)与下出线端上的杠杆(8)相连, 开关主轴(9)通过三根绝缘拉杆(10)把力传递给动导电杆, 使开关合、分闸(见图 1), 断路器总重量为 308kg。

3、真空灭弧室

断路器的灭弧室由一个金属圆筒屏蔽罩和两只瓷管封在一起作为外壳, 上、下两只瓷管分别封在上、下法兰盘上, 动、静触头分别焊在动、静导电杆上, 静导电杆焊在上法兰盘上, 动导电杆上焊一波纹管, 波纹管的另一端焊

Altitude: Lower than 2,000m

Ambient air temperature: The upper and lower limits are +40°C and -15°C(-40°C)*

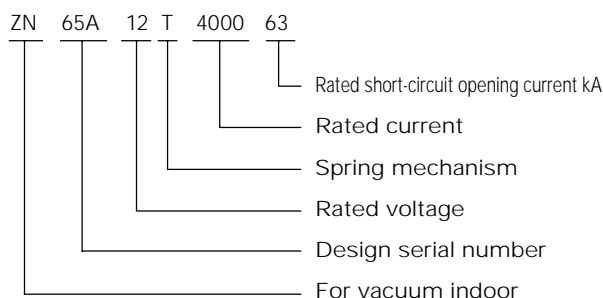
Relative humidity: The daily average is not more than 95% and the monthly is not more than 90%.

Earthquake intensity: lower than the class VIII

The breaker is not used in the places of fire, explosion, corrosive gas and intensive shock

II. Technical Specifications

1. The type of product is ZN65A-12/T4000-63 that means:



2. Technical parameters (See Tab.2)

3. Adjustment parameters in mechanical performance (See Tab.1)

III. Structure and Work Principal of Product

1. Characteristics of structural design:

(1) On design, the Type ZN65A-12/T4000-63 Vacuum Breaker better keeps the advantages of the 3AF (i.e., the ZN12-10 series of products), with the serial feature and the universal components. The arc-quenching chamber applies the CuCr material of contactor as well as the cup-style structure of enforced longitudinal magnetic field. The main shielding cover of chamber exposes with a big designed capacity. The operating mechanism and the breaker are integrated. Only two stages of worm wheels and work pods combine the gearbox. The gearbox, two sets of four-connecting-pod mechanism (whose public connection point is the main axis of breaker) and a set of straightening mechanism make the whole energy-storage, opening and closing operation. The beaker features the reliable whole design layout, compact structure, the even enforcement of transmission-pod system, the high transmission efficiency and the long mechanism life. Its advanced design completely satisfies the following requirements of breaker's longitudinal-magnetic-field arc chamber: a relatively high starting speed, a strong opening

表 1/ Tab.1

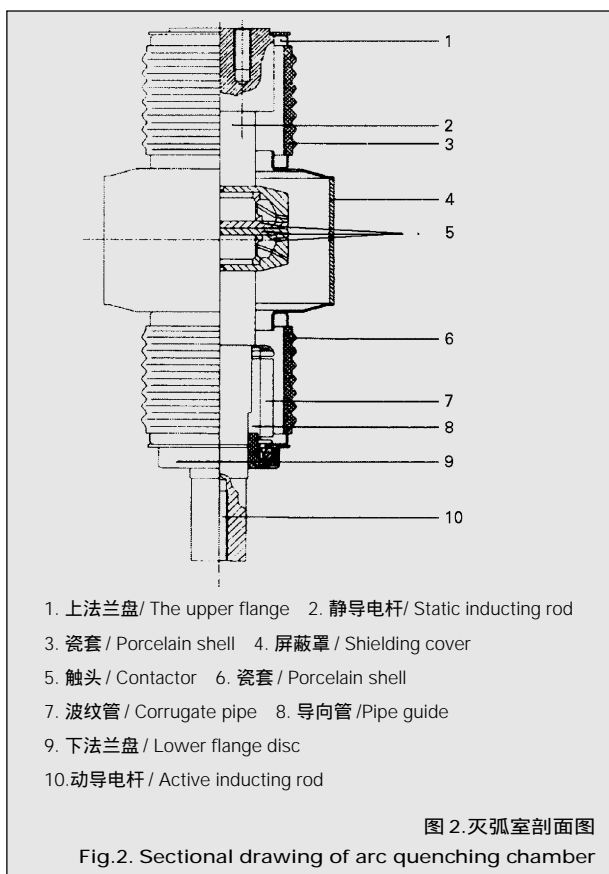
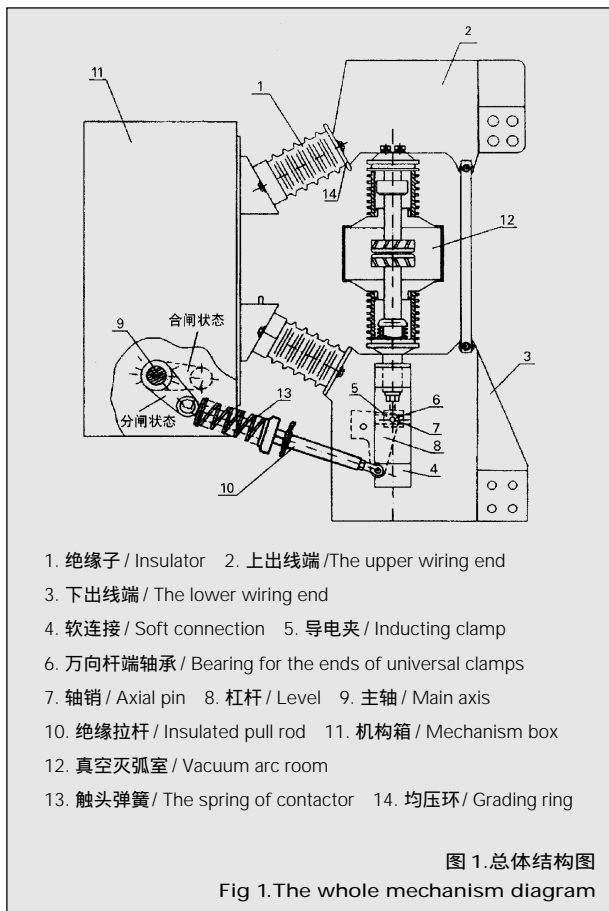
参 数 / Parameter	单 位 / Unit	数 据 / Parameter
触头开距 / The distance of contactor	mm	11 ± 1
触头超行程 / The over travel of contactor	mm	4 ± 1
合闸速度 / The closing speed	m/s	0.8~1.8
分闸速度 / The opening speed	m/s	1.0~1.8
触头全闸弹跳时间 / The time of contactor's full-opening skip	ms	4
相距中心距离 / Distance to center	mm	275 ± 1.5
三触头合分闸同期性 Simultaneity three contactors' opening and closing	ms	2
每相回路电阻 / The resistance of each circuit	μ	25

表 2/ Tab.2

参 数 Parameter	单 位 Unit	数 据 Parameter Common breaker
额定电压 / Rated voltage	kV	12
额定电流 / Rated current	A	4000
额定短路开断电流 / Rated short-circuit opening current	kA	50 63
额定峰值耐受电流 / Rated peak-value endured current	kA	125 160
额定短时耐受电流 / Rated short-time endured current	kA	50 63
额定短路关合电流 (峰值) / Rated short-circuit closing current (peak value)	kA	125 160
额定短路持续时间 / Rated short-circuit duration	S	3
额定短路开断电流开断次数 The rated breaking times of short-circuit breaking current	次 times	8* 20*
额定操作顺序 / Rated operation sequency		分 -180s- 合分 -180s- 合分 o-180s-c o-180s-co
额定频率 / Rated frequency	Hz	50
雷电冲击耐受电压(峰值) The thunder-impacting endured voltage (peak value)	相间对地 / phases to earth	kV 75
	真空断口 / Vacuum break	kV 85
1min 工频耐受电压 The 1min work-frequency endured voltage Intermittent grounding	相间对地 / phases to earth	kV 42
	真空断口 / Vacuum break	kV 48
合闸时间 / The closing time ms	ms	45-75
分闸时间 / The opening time ms	ms	30-60
开断时间 / The breaking time ms	ms	50-80
机械寿命 / Mechanical life times	次 /times	10000
储能电动机额定功率 / The rated power of energy-storage motor	W	275
储能电动机额定电压 / The rated voltage of energy-storage motor	V	~110 220 AC DC
储能时间 / The energy-storage time	S	15
合分闸电磁铁额定电压 / The rated voltage of opening and closing magnet	V	=110 = 220 DC
合分闸电磁铁额定电流 / The rated current of opening and closing magnet	A	1.91 0.89
失压脱扣器额定电压 / The rated voltage of no-voltage releaser	V	~110 220 AC DC
过流脱扣器额定电流 / The rated current of over-current releaser	A	5
辅助开关额定电流 / The rated current of auxiliary switch	A	AC10 DC5

注：* 8 次开断为国营七七总厂提供灭弧室；20 次开断为德国西门子公司提供灭弧室

Note: * If 8 opening times are marked, the state-owned No.777 Factory provides the arc-quenching chamber; and if 5 and 20 opening times are given, Siemens presents the chamber.



ability and a long electrical life.

(2) The upper and lower wiring ends of cast red copper, their dual inlet (outlet) wiring methods, the double-side inducting structure of inducting clamp's lower wiring dual soft connection together solve the following problem to pass a temperature-rising test smoothly: The breaker will become hot after working under the big 4,000A rated current for long time.

(3) Each phase of fixed method of lower and upper wiring applies the double-insulator structure, so as to better meet the strength requirement of breaker when the structure sees a full closing capacity of 63kA. In addition, the applied grading ring changes a state that the double-insulator structure sees an uneven distribution of electric field.

(4) Both the pull rod and stand rod of transmission stage use a drawing stick whose shell and cover are made from silicone rubber for protection with the intermittently added SMC insulated plate for separation. This can raise the whole insulation level and extra capacity of breaker. Therefore, its insulating performance is higher than the original 3AF technology, so as to completely meets the requirement of its users on the indoor class-II dirt environment.

2. Whole structure:

The breaker mainly consists of vacuum arc-quenching chambers (12), the operating mechanism and the supporting parts. Twelve insulators (1) are fixed on the mechanism box (11). Three arc-quenching chambers are fixed on the insulators via the lower and upper wires (2) (3). The lower wire is equipped with two pieces of soft connection (4), whose lower ends are fixed on the two sides of lower wire and upper ends are fixed with the two sides of inducting clamp (5) of vacuum arc-quenching chambers' active inducting rods. The bottoms of active inducting rods are equipped with bearing for the ends of universal clamps (6). These ends are connected with the lever (8) of the lower wiring ends via axial pins (7). The main axis of switch (9) transmits the force for the inducting pod via 3 insulated pull rods (10), so as to make the switch make the opening and closing operation (See Fig.1). The breaker totally weighs 308kg.

3. Vacuum arc-quenching chamber

The arc-quenching chamber of breaker consists of a metal cylinder shielding cover and 2 porcelain pipes together

在下法兰盘上，由此而形成一密封的腔体。该腔体经过抽真空，灭弧室气体压力小于了 $1.33 \times 10^{-3} \text{pa}$ 。当合、分闸操作时，动导电杆上、下运动，波纹管被压缩或拉伸，使真空灭弧室内的真空度得到保持。(见图2)

灭弧原理：

在真空中由于气体分子的平均自由行程很大，气体不容易产生游离，真空比大气绝缘强度要高得多。当开关分闸时，触头间产生电弧，触头表面在高温下挥发出金属蒸气，由于触头设计为特殊形状，在短路电流通过时，产生与电弧平行的纵向电磁场，将电弧约束在磁场内，并均匀分布在触头表面，因而电弧电压低，燃弧时间短，触头烧蚀甚微，电弧在电流自然过零时就熄灭了，触头间的介质强度又迅速恢复起来。

本断路器采用的灭弧室开断能力较高，截流水平较低，并且有很长的电寿命。

4、操动机构：

操动机构主要由储能机构、锁定机构、分闸弹簧、开关主轴、缓冲器及控制装置组成。

(1) 储能及锁定机构：

储能机构主体是一个外壳为铸铝的减速箱。减速箱内是两套蜗轮蜗杆，储能轴横穿减速箱中，与蜗轮蜗杆无机械联系，储能轴上套一轴套，此轴套用键联在大蜗轮上，轴套有一轴销，上面装一棘爪；在储能轴的右端装有一凸轮，凸轮上有一缺口，棘爪通过此缺口带动凸轮转动，在储能轴的左端装有一曲柄，合闸弹簧一端挂在此曲柄上。

减速箱的轴销上装有一个三角形的杠杆，杠杆上装一滚针轴承，凸轮将把合闸弹簧的能量传给此轴承，三角形杠杆的另一个孔中用轴销与一连杆连接，该连杆的另一端装在主轴拐臂上，形成一四连杆机构，合闸力通过该机构传递给开关主轴。减速箱的轴销上装有一滚针轴承，作为锁住合闸掣子用。

在开关主轴的拐臂上装有分闸弹簧，主轴上还装有三对拐臂。其中两对分别作用在合闸橡皮缓冲和分闸油缓冲器上，另一对拐臂上装一滚针轴承作为锁住分闸掣子用。该产品的合、分闸掣子完全相同。(如图3所示)

(2) 本断路器可根据用户要求安装不同规格、数量的控制部件。

a. 合、分闸电磁铁：

为尺寸、数据完全相同的螺管式直流电磁铁。

代号	额定电压	额定电流
5JK.647.033	直流 110V	1.91A
5JK.647.034	直流 220V	0.89A

b. 储能式脱扣器：

该脱扣器具有一储能机构，在开关合闸时，脱扣器铸

sealed for its shell. Both the lower and upper porcelain pipes are sealed on the lower and upper flange discs, respectively. Both the static and active contactors are welded on the static and active inducting rods, respectively. The active rod is welded with a corrugate pipe, whose other end is welded on the lower flange disc, so as to make a sealed cavity, whose air can be drawn to make the air pressure of chamber become less than $1.33 \times 10^{-3} \text{pa}$. When the closing and opening operation is made, the active inducting rod will move upward and downward and then the corrugate pipe will be compressed or stretched to keep the vacuum degree of chamber. (See Fig.2)

Arc-quenching principle:

Under the vacuum condition, gas is uneasy to drift away due to the very big average free journey of gas molecule. The strength of vacuum is much higher than that of air insulation. When the switch is opened, the contactor will generate electric arc and the surface of contactor volatilize steel vapor under high temperature. Because of the special design of its shape, the contactor will generate the longitudinal electromagnetic field in parallel to the arc while the short-circuit current passes. This will restrict the arc within the field and make it become averagely distributed on the surface of contactor. As the result, the arc voltage is low and then the arc-combustion time is short. This contactor will fire very little and go out when the current naturally zeros. Therefore, the strength of media between contactors will restore very quickly.

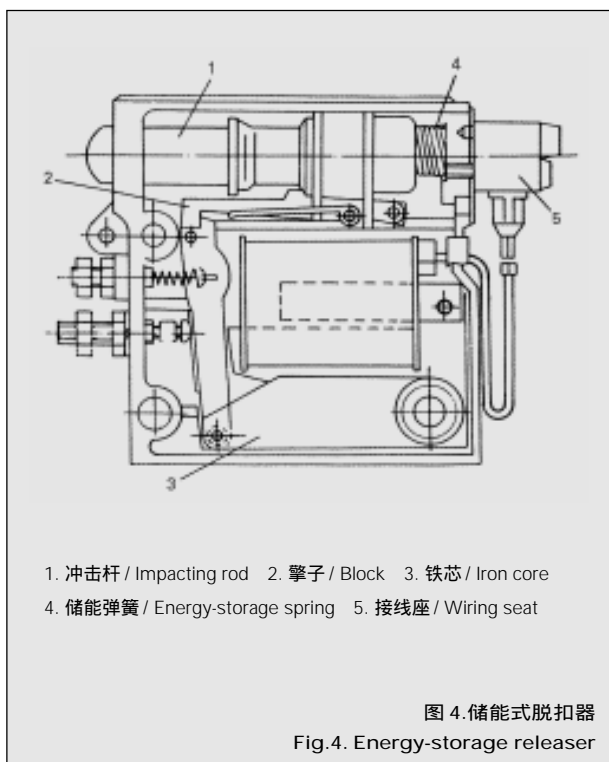
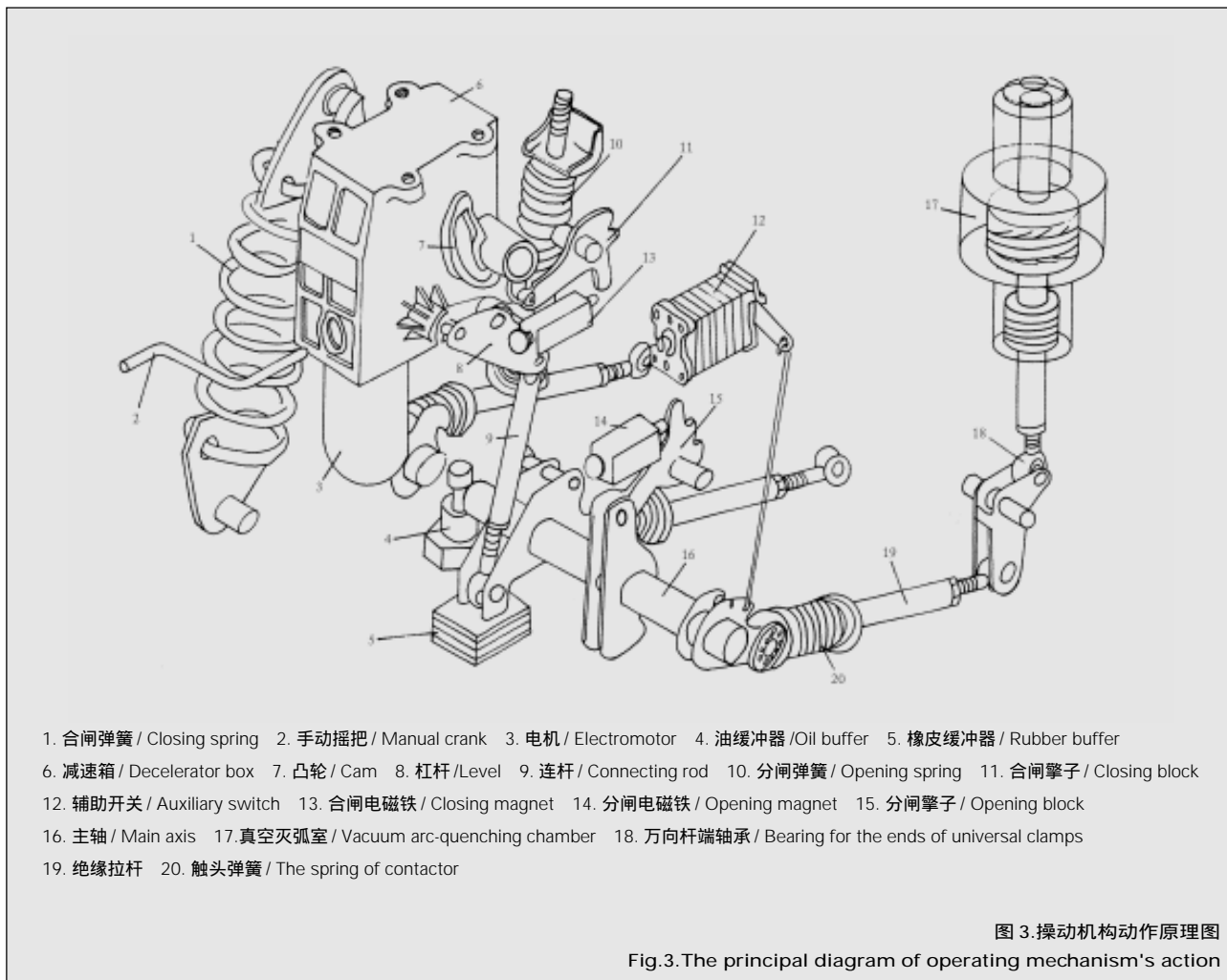
The breaker applies the arc-quenching chamber whose opening ability is very high, current-breaking level is low and power life is quite long.

4. Operating mechanism

The operating mechanism mainly consists of the energy-storage unit, locking unit, opening spring, main switch axial, buffer and control unit.

(1) Energy-storage and locking units

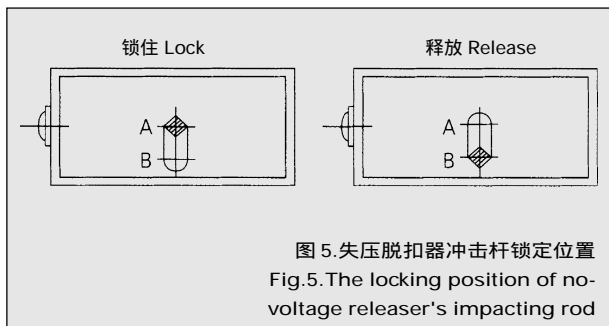
The energy-storage unit mainly comprises a decelerator box whose shell is cast aluminum. In this box, there are two sets of worm wheels and worm rods. The energy-storage axial is cross the decelerating box without mechanical connection with the wheels and rods. The energy-storage axial is covered with a sleeve, which is connected with a big worm wheel via keys. On this sleeve,



an axial pin is equipped with a pawl. The right end of the axial is mounted with a cam on which there is a gap. The claw rotates the cam just with this gap. The left end of axial is equipped with a crank, on which an end of closing spring is hanged.

The axial pin of decelerator box is equipped with a triangle lever, on which a needle bearing is mounted. The cam transmits the energy of closing spring for the bearing. The rest hole of triangle lever is connected with an end of the connection rod via axial pins. The other end of the rod is installed on the arm of main axis to form a four-connecting-pod mechanism. With this mechanism, the closing force is transmitted for the main axis of switch. The axial pin of decelerator box is equipped with a needle bearing, which is used to lock the closing block.

The arm of switch's main axis is equipped with the opening spring, and this axis is mounted with 3 pairs of arms. Two of these pairs play roles on the opening rubber buffer and the closing oil buffer; and the rest pair is



铝壳内的弹簧被储上能，掣子被锁住，开关需要分闸时，线圈带电，电磁铁动作，掣子解脱，脱扣器冲击杆在弹簧力作用下弹出，使开关分闸。（见图 4）

储能式脱扣器有过流和失压二种，过流脱扣器结构与失压脱扣器的结构略有不同。

代号及名称	额定电压	额定电流	额定消耗功率
过流脱扣器		5A	20VA
失压脱扣器	交流 110V/220V		27VA
	直流 110V/220V		18W

脱扣器	工作范围
过流脱扣器	90~110%I _H
失压脱扣器	可靠释放 35%U _H 可靠吸合 85%U _H

在调试过程中，需将失压脱扣器的冲击杆锁住，方能进行手动分、合闸操作（见图 5）

断路器可最多安装二个脱扣器，其组合方案见下表：

基本件	附加件	
分闸电磁铁	过流脱扣器	失压脱扣器
1		
1	2	
1	1	
1		1
1	1	1

二次回路电器元件及参数(见图 6、图 8)

符号	名称	型号规格	数量
YA2	分闸电磁铁	5JK647.033-034	1
YA1	合闸电磁铁	5JK647.033-034	1
S1-7	微动开关	LXW20-11	7
S	辅助开关	F10-22II/W2	1
M	储能电机	12880B:22880B	1
XT	接线端子	JH24	1
K	中间继电器	JZD1-22/OB	1

辅助开关有五对常开、常闭接和十一对常开、常闭接点两种。其中最大通过电流为 AC10A，DC5A。

本断路器可带有一微型整流器，供无直流电源的用户使用，由用户订货提出。标准断路器接线方案见图 6、图 7。

equipped with a needle bearing for locking the opening block. The breaker's closing and opening blocks are same. (See Fig.3.)

(2) The breaker can be assembled with the control components of different specification and quantity up to the requirement of users.

a. The closing and opening magnets: They are of the screw-pipe style with same sizes and data.

Code	Rated voltage	Rated current
5JK.647.033	DC110V	1.91A
5JK.647.034	DC220V	0.89A

b. The energy-storage releaser:

This releaser features an energy-storage mechanism. When the switch is closed, the spring in the cast-aluminum shell of releaser will store the energy with the locked block. When the switch needs opening, the wiring will be powered for the magnet taking actions and the block will become unlocked. Under the role of spring force, the impacting rod of releaser will prop out to make the switch become opened. (See Fig.4.)

The energy-storage releaser sees two varieties, the over-current and the no-voltage. The structure of over-current releaser is a little different from that of no-voltage releaser.

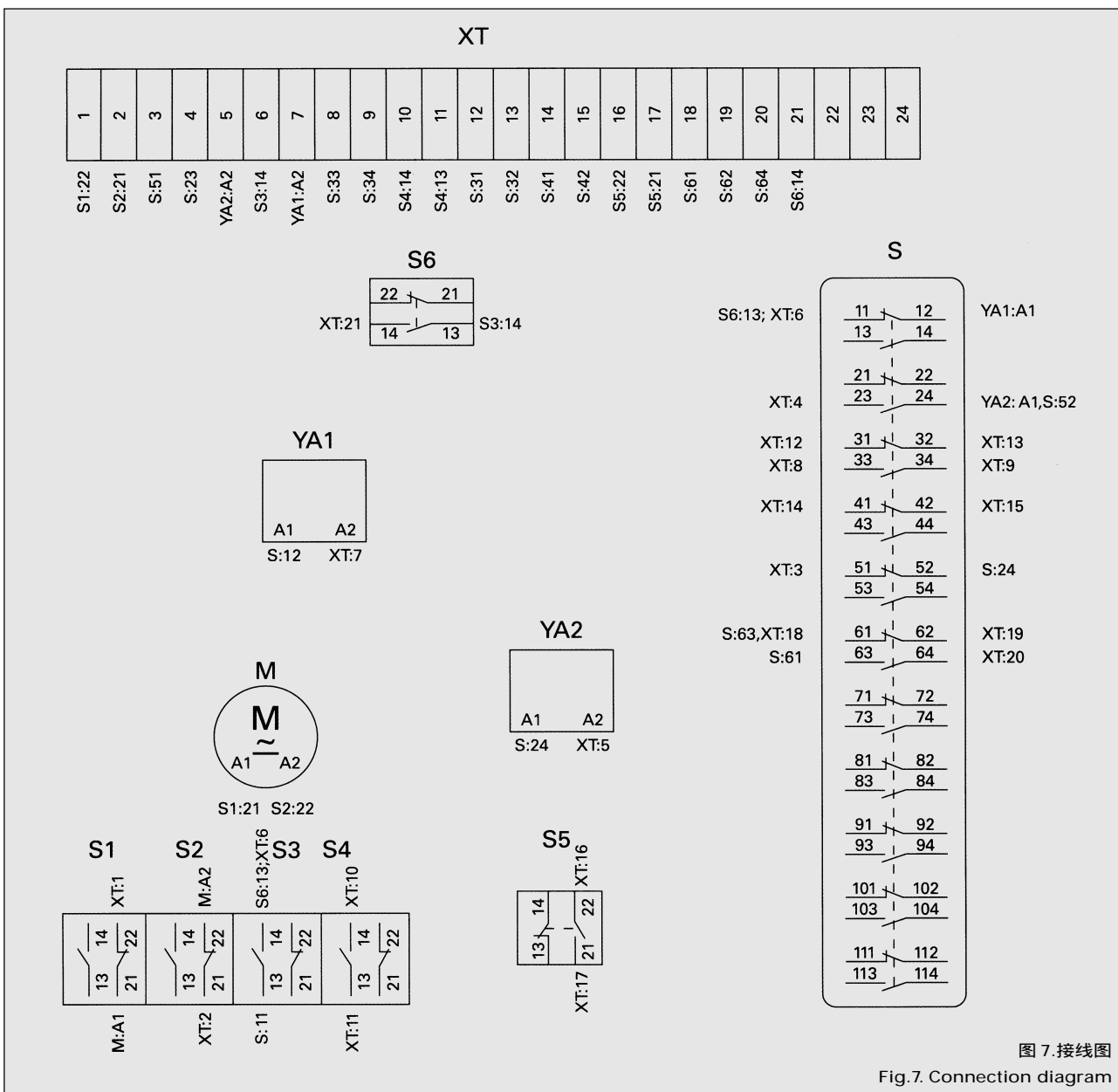
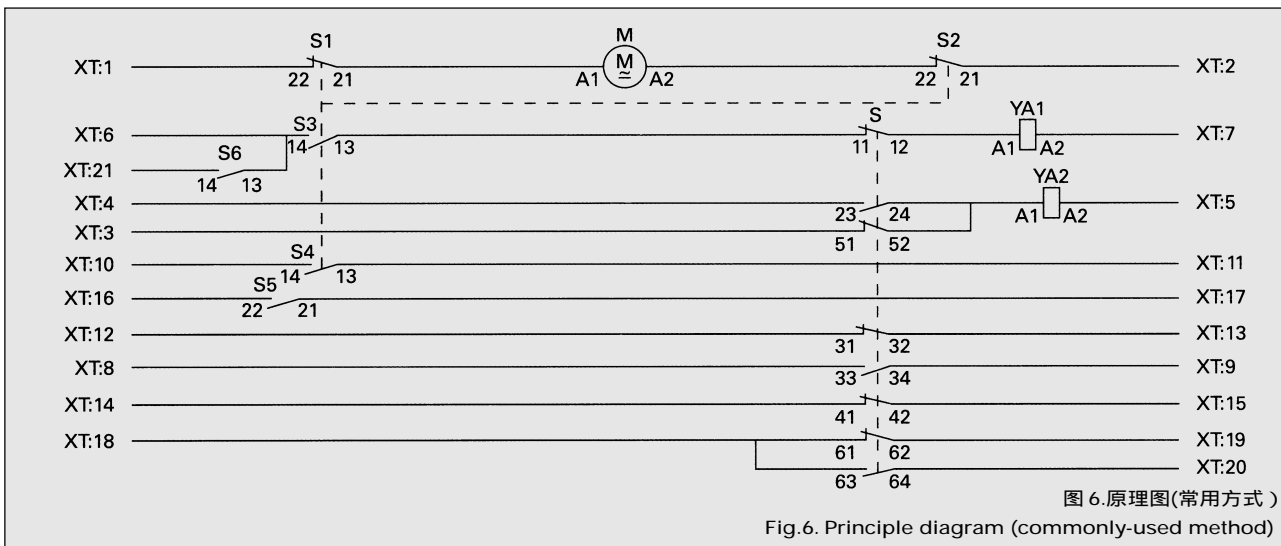
Code and name	Rated voltage	Rated current	The rated consumed power
Over-current releaser		5A	20VA
No-voltage releaser	AC110V/220V		27VA
	DC110V/220V		18W

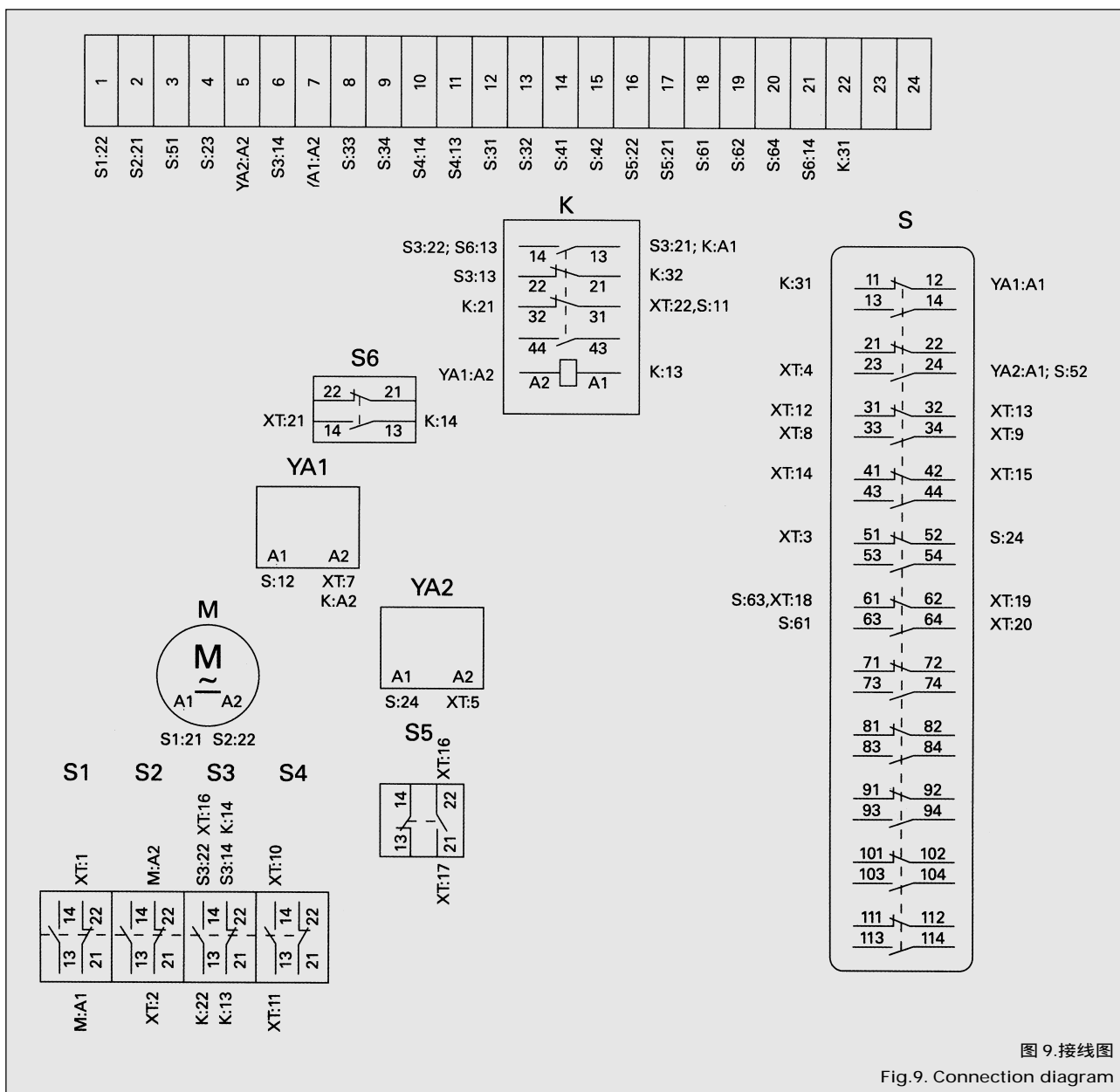
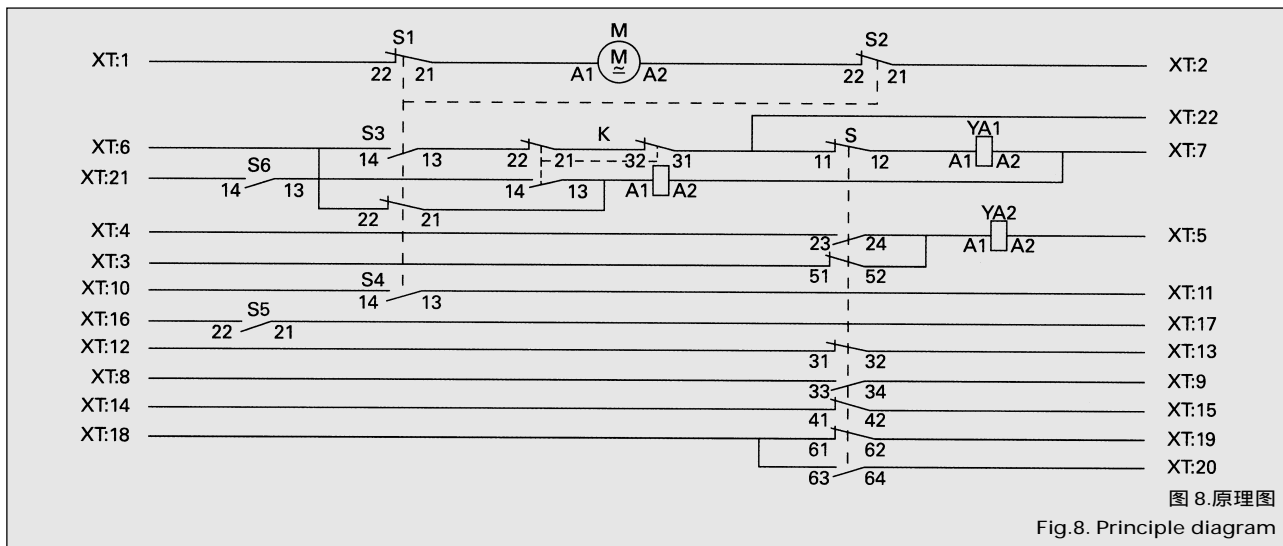
Releaser	Work scope
Over-current releaser	90~110%I _H
No-voltage releaser	Reliable release 35%U _H
	Reliable closing 85%U _H

In the debugging program, the impacting rod of no-voltage releaser needs to be locked for the manually closing and opening operation (See Fig.5).

The breaker can be equipped with 2 releasers at most, with the solution in the following table:

Essential parts	Added parts	
Opening magnet	Over-current releaser	No-voltage releaser
1		
1	2	
1	1	
1		1
1	1	1





断路器可具有防跳跃功能,该功能由一防跳继电器完成。由用户订货时提出。接线方案见图 8、图 9。

(3) 操作

a. 储能：

电动储能：接通电动机电源，轴套由减速箱中的大蜗轮带动使其转动，轴套上安装着棘爪迅速进入凸轮上的缺口，这时，带动储能轴转动，合闸弹簧被拉起而储能。当合闸弹簧被拉到最高点后被合闸掣子锁住，曲柄上的小连杆带动弯板压下微动开关，电机电源被切断。“储能指示”显示在面板孔中，整个储能时间小于 15s。

手动储能：将手摇把插入减速箱前方孔中，顺时针摇转 25 圈，这时，棘爪进入了凸轮缺口带动储能轴转动。再继续用力摇转手把 25 圈，合闸储能完毕，卸下手把。

b. 合闸：

接通合闸电磁铁电源或用手按压合闸按钮(黑色)。合闸掣子被解脱，储能轴在合闸弹簧力的作用下逆时针转动，这时，凸轮压在三角杆上的滚针轴承上，杠杆上的连杆将力传给开关主轴，导电杆向上运动，主轴转角约 60 度时被分闸掣子锁住，开关合闸。在合闸的同时，分闸弹簧被储能，绝缘拉杆上安装的触头弹簧被压缩。给触头施加了一个压力。“合闸指示”显示在面板孔中。

c. 分闸：

接通分闸电磁铁电源或用手按压分闸按钮(红色)。分闸掣子解脱，主轴在分闸弹簧和触头弹簧力的作用下逆时针旋转，断路器处于分闸状态，“分闸指示”显示在面板孔中。

d. 断路器在合闸以后，电动机立即给合闸弹簧储能，也可用手动再储能。

四、运输、验收及储运：

断路器在出厂时为合闸状态，合闸弹簧不得储能。

断路器安装在手车上时与开关柜一起包装，如果单独供货则按包装规范包装。

断路器在运输时处于合闸状态，不得倾斜及受强烈振动或雨淋。

用户收到断路器时应及时进行以下工作：

- 1、检查包装是否损坏和受潮。
- 2、开箱取出装箱单，并对其检查装箱文件是否齐全。
- 3、检查断路器铭牌上的技术参数是否符合订货要求。
- 4、检查附件及设备是否齐全。
- 5、检查断路器是否受潮，如果已受潮则需将绝缘支杆与绝缘拉杆拆下放入 70~80℃ 的烘箱中烘烤 48h。
- 6、断路器长期不使用时，需在导电面上涂以工业凡士林油，并用清洁油纸包上绝缘件。
- 7、断路器应放在通风干燥的室内储存，垂直放置，不得叠放。

The auxiliary switches are oppositely opened and closed with 5 or 11 pairs for usual state, where the maximum passing current is AC10A and DC5A, respectively.

See the electric components and parameters of second loops (Fig.6 and Fig.8).

Symbol	Name	Type and specification	Quantity
YA2	Opening magnet	5JK647.033-034	1
YA1	Closing magnet	5JK647.033-034	1
S1-7	MS switch	LXW20-11	7
S	Auxiliary switch	F10-22II/W2	1
M	Energy-storage motor	12880B;22880B	1
XT	Terminal block	JH24	1
K	Middle Relay	JZD1-22/OB	1

The breaker can be equipped with a mini-sized rectifier, which is used for the users of DC power supplies and will be ordered by the users. For the wiring solution of standard breaker, see Fig.6 and Fig.7.

The breaker features a skip-resistant function, which is finished with a skip-resistant relay and will be ordered by the users. For the wiring solution, see Fig.8 and Fig.9.

(3) Operation

a. Energy storage

Electric energy storage: After the motor is powered, the axial sleeve will be driven rotating by the big worm wheel in the decelerating box. The claw equipped on this sleeve will quickly enter the gap of cam. For this time, the claw drives the energy-storage axis rotating and the closing spring is pulled up storing the energy. When this switch is pulled up by the highest point and then locked by the closing block, the small connection rod on crank will drive the curve plate pressing down the MS switch, so as to turn off the power of motor. The "energy-storage indication" is shown on the panel hole. The whole energy-storage time is less than 15s.

Manual storage: Insert the handle into the front square hole of decelerating box. Rotate this handle for 25 circles in clockwise. At this time, the claw enters the gap of cam to drive the energystorage axis rotating. Then, energetically rotate the handle for 8 circles. After the program of closing for energy storage is over, dismantle the handle.

b. Closing

After the closing magnet is turned on or the closing button

8、在机构箱的两侧带有吊装孔，作为起吊时挂钩用，不得勾住绝缘子或断路器的其它部位吊起。

五、安装:

导电部分用钢刷刷出金属光泽后用干布擦净，涂上工业凡士林油。

带失压脱扣器的断路器需放松脱扣器的自锁螺母(见图5)。

将机构箱侧面的接地孔锉出金属光泽并以工业凡士林油涂于接地线。

用手动使开关分、合闸。检查“储能”、“合闸”、“分闸”指示是否正确。

用开关底板上的安装孔安装。外形图见图14。

六. 运行前的准备：

运行前用户无需对断路器进行任何调整。仅需检查各部位螺钉有无松动现象，若有则紧固。

断路器各转动部分涂以润滑油。

绝缘件表面擦拭干净。

断路器通电进行试操作，无异常现象时，即可投入运行。

七. 使用、维护与检修:

当断路器安装在海拔1000m以上，但不超过4000m时，其试验电压应按本标准规定的额定耐受电压乘以系数ka。

$$k_a = \frac{1}{1.1 \cdot H \times 10^4}$$

式中：H-安装地点的海拔高度m。

断路器的额定电流和短路开断电流不同时，其电寿命不同。

断路器应根据现场运行情况进行清洁、润滑保养，并检测断路器各项技术参数。

真空灭弧室在使用或达到技术参数中规定的短路电流开断次数后，即需更换灭弧室。

更换灭弧室时：首先将开关分闸，然后按以下顺序进行。

- 1、先拆下绝缘支杆，然后拧下上出线端与灭弧室联接的四条螺栓，同时拧下绝缘子压板与上出线联接的螺母。然后，卸下上出线(见图10)
- 2、拆下绝缘拉杆与拐臂联接的轴销，拧下软联接与下出线端、导电夹连接的螺栓。再将固定板拆下。然后，将灭弧室下的万向杆端轴承与拐臂连接的带槽销卸下。将定位板的四条螺栓松开，最后，双握住灭弧室往上提即可卸下(见图11)
- 3、将新灭弧室导电杆用钢刷刷出金属光泽后涂上工业凡士林油。
- 4、双手握紧新灭弧室装入固定板及导电夹的孔中。
- 5、装上上出线端，注意三相垂直及水平位置不超过1mm。

(black) is manually pressed, the closing block will be unlocked and then the energy-storage axis will rotate in counter-clockwise under the role of closing spring. For this time, the cam is depressed on the needle bearing of triangle rod, the connection rod of lever transmits force for the main axis of switch, the inducting rod moves upward, and the main axis turns about 60 degrees to be locked by the closing block. At the closing time, energy is stored on the opening spring and the contactor spring installed on the insulated pulling rod is depressed, in order to give the contactor a press. The "closing indication" is shown on the penal hole.

c. Opening

After the opening magnet is turned on or the opening button is manually pressed, the opening block will be unlocked and then the main axis will rotate in counter-clockwise under the roles of opening spring and contactor spring. The breaker stays at the opening state. The "opening indication" is shown on the penal hole.

d. After the breaker is closed, the motor will immediately store energy for the opening spring or the operator will be able to manually store the energy.

IV. Transportation, Acceptance and Storage

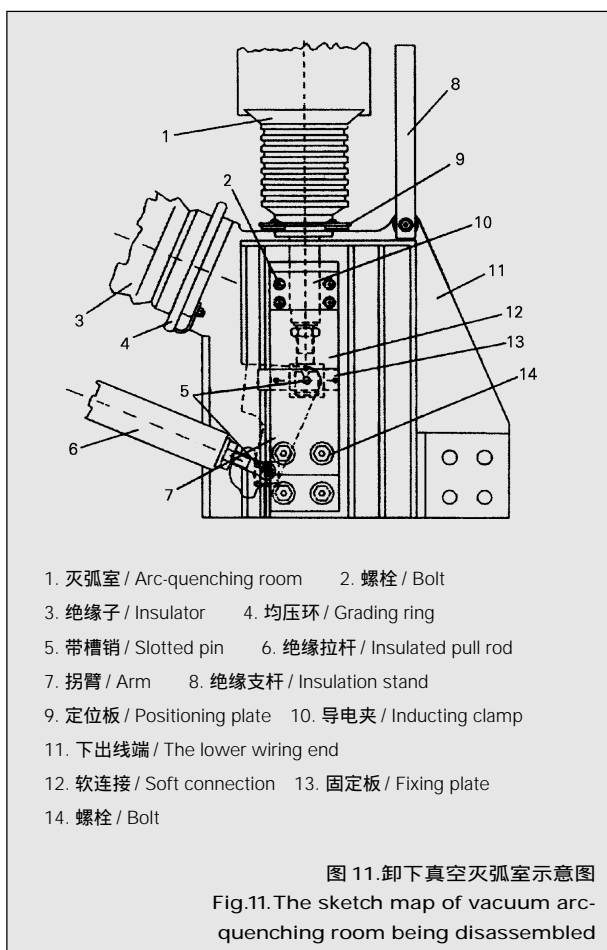
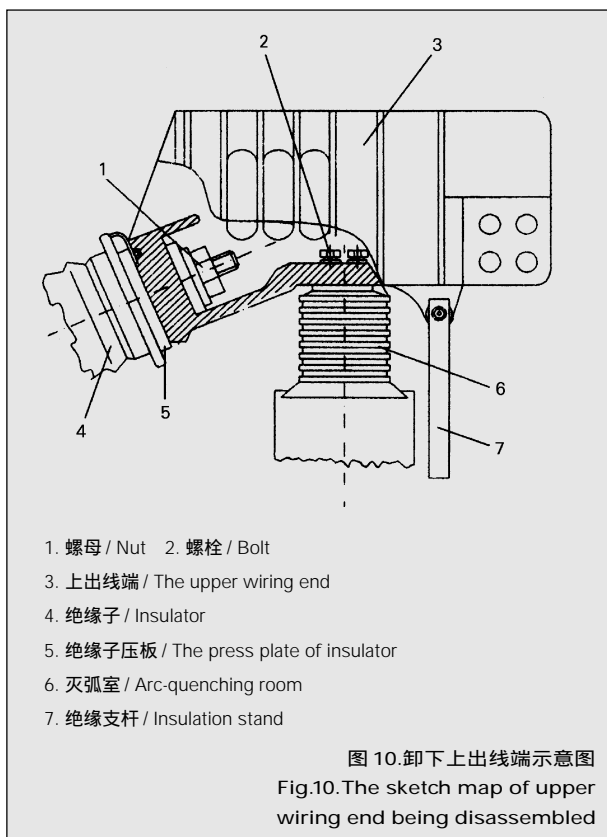
While being delivered from the factory, the breakers stay at the closing state where no energy is stored on the closing spring.

While being mounted on the manual car, the breakers cannot be packed with the switch cabinet. If needing to be singly provided, the breakers ought to be packed in conformity with the packing standard.

While being delivered, the breakers stay at the closing state where no inclination, intensive shocking or dripping is allowed.

The users ought to do the following work at once after receiving the breakers:

1. Check whether the package is damaged or rained.
2. Take out the packing list from the case and see whether the attached document is complete in comparison to the list.
3. Check whether the technical specifications on the nameplates of breakers can satisfy the ordering requirements or not.
4. Check whether the attachment and the equipment both



are complete.

5. Check whether the breakers are humidified. If these breakers are rained, both the insulated props and the insulated pulling rods ought to be dismantled and placed in the ovens of 70~80°C for the 48h drying.

6. If the breakers have not been used for long time, their inducting surface ought to be coated with industrial petroleum jelly and the insulated parts should be wrapped with clean oily paper.

7. The breakers ought to be stored in dry fanned rooms where they the breakers are vertically placed without overlay.

8. On the two sides of mechanism box, there are lewis holes being used for lifting hooks. While the breakers are lifted, neither their insulated trunks nor the other parts can be hooked.

V. Installation

The users ought to polish the electrically inducting parts for metal luster with steel brushes and then wipe these parts for cleaning and coat them the industrial petroleum jelly.

On the breakers of no-voltage releasers, the self-locking nuts (see Fig.5) ought to be unbolted.

On the sides of mechanism boxes, the grounding holes ought to be rasped for metal luster and coated with the industrial petroleum jelly.

The users ought to make the switches closed and opened manually, in order to see whether the indications of energy storage, closing and opening are normal or not.

The users ought to mount the breakers with the installation holes on the switch bottom. For the appearance drawing, see Fig.14.

VI. Preparation for Operation

Before the operation, the users do not need to have any adjustment on the breakers, but ought to tighten loose screws on any of the parts.

The users ought to coat lubricant oil on all of the rotating parts.

The users ought to wipe the insulated surface for cleaning.

The breakers should be tested with power supply. Only if they have no abnormal phenomenon, can the breakers be put into operation.

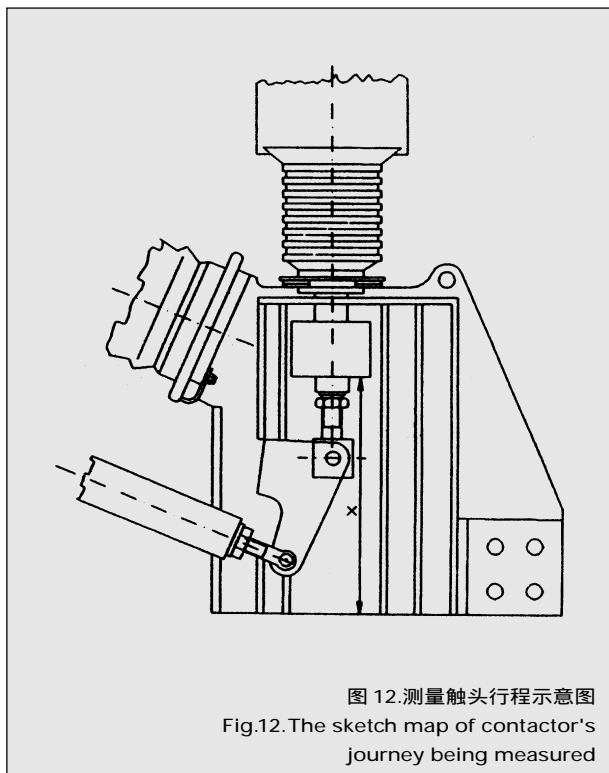


图 12.测量触头行程示意图
Fig.12. The sketch map of contactor's journey being measured

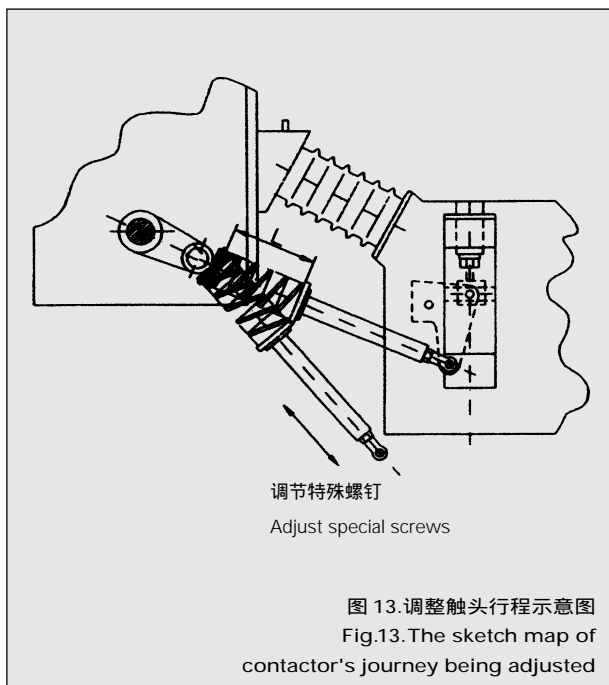


图 13.调整触头行程示意图
Fig.13. The sketch map of contactor's journey being adjusted

拧紧螺钉及螺母。

- 6、装上轴销。
- 7、拧紧固定板及导电夹螺钉。
- 8、装上两侧软联接。

灭弧室更换后应测量触头行程和超行程：

量出分、合闸位置时的X，X合 - X分 = X触头行程，X应为 11 ± 1mm 量出分、合闸位置时的L，L分 - L分

VII. Use, maintenance and overhaul

The breaker ought to be installed in a place of altitude more than 1,000m and less than 4,000m, the testing voltage is as follows: According to the standard of this user guide, the rated enduring voltage times the coefficient ka.

$$ka = \frac{1}{1.1 \cdot H \times 10^4}$$

Where, H-the altitude (m) of the installation place

The power life of the breaker is varied if its rated current is different from the short-circuit-closing current.

Depending on its operation on site, the breaker ought to be cleaned, maintained with lubricant oil and tested on a variety of its technical specifications.

Vacuum arc-quenching room ought to be replaced immediately if it has used or seen the short-circuit current up to the technical specification and then it has been opened for several times.

When the arc-quenching chamber is changed: First of all the switch is opened and then the following procedures are made:

1. Disassemble the insulated prop, then twist off the four bolts which connect the upper and lower wiring ends with the arc chamber. Meanwhile, unscrew the nuts which connect the lower insulator-press plate with the upper wiring end. Next, disassemble the upper outer wiring (See Fig.10).
2. Disassemble the axial pin which connects the insulated pulling rod with the arm. Twist off the bolts which connect the soft connection with the lower wiring end and inducting clamp. Then, take down the fixing plate and unbolt the slotted pin that connects the bearing for the ends of universal clamp with the arm below the arc chamber. Next, unscrew the four bolts of positioning plate. At last, hold the chamber with two hands to raise it. (See Fig.11)
3. Polish the electrically inducting parts of arc chamber for metal luster with steel brushes and then wipe these parts for cleaning and coat them the industrial petroleum jelly.
4. Firmly hold the chamber with two hands to place it in the bundle of fixing plate and inducting clamp.
5. Assemble the upper wiring end. Pay attention to the three-phase vertical and horizontal position is no more

= X 触头超行程, L 应为 $4 \pm 1\text{mm}$ 。X 测量部位见图 12 ;
L 测量部位 (见图 13)。

触头行程不符合要求时可卸下绝缘拉杆处轴销, 调整绝缘拉杆的长度, 行程偏小时, 将特殊螺钉往里拧入, 使拉杆变短, 行程偏大时则将特殊螺钉往外拧出, 使拉杆变长 (见图 13)

灭弧室在卸下绝缘拉杆后动导电杆要用很大力才能拉出, 即证明真空度良好。

八、随机文件:

- 1、产品合格证明书;
- 2、安装使用说明书;
- 3、装箱单。

九、备品及附件

名称	手摇把	护套	压接簧片
数量(个)	1	24	24

十、订货须知:

订货时应注明断路器型号、名称、主要技术参数及订货数量; 电动机电压种类及参数、脱扣器种类及参数、数量、辅助开关接点对数; 合、分闸电磁铁电压, 用户如果需要备品须在订货时提出。

提示: 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!

than 1mm. Then, screw down the bolts and nuts.

6. Assemble the axial pin.
7. Screw down the bolts of fixing plate and inducting clamp.
8. Assemble the soft connection of two sides.

After the arc-quenching chamber is changed, the journey and super journey of contact are both measured. For the opening and closing positions, $X_c - X_o = X_j$ (the journey of contactor). X should be $11 \pm 1\text{mm}$. For the positions $L_c - L_o = L_j$ (the super journey of contactor). L should be $4 \pm 1\text{mm}$. For the measured parts of X, see Fig.12; and for those of L, see Fig.13.

If the journeys of contactor do not meet the requirements, the axial pin of insulated pulling rod can be disassembled. Then, the operator ought to adjust the length of rod. If the journey is on the small side, the operator can screw down the special bolts to make the rod become shorter; and if the journey is bigger, the operator can twist off the bolts to lengthen the rod. (see Fig.12)

The vacuum degree proves good if the operator spends much energy pulling the inducting rod after the insulated pulling rod of arc chamber is disassembled.

VIII. Attached Document

1. The certificate of product's quality
2. The user guide on installation
3. The packing list

IX. Accessories and Spare Parts

Name	Manual crank	Protective sleeve	Pressing and connection spring
Number	1	24	24

X. Ordering Notice

While ordering the breakers, the users ought to remark the types, names, main technical parameters and ordered quantity of breakers, as well as the types and parameters of motors' voltage, the types, parameters and number of releasers, the number of pairs of auxiliary-switch connection points and the voltage of closing and opening magnet. If needed, the accessories and spare parts ought to be mentioned in the ordering.

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

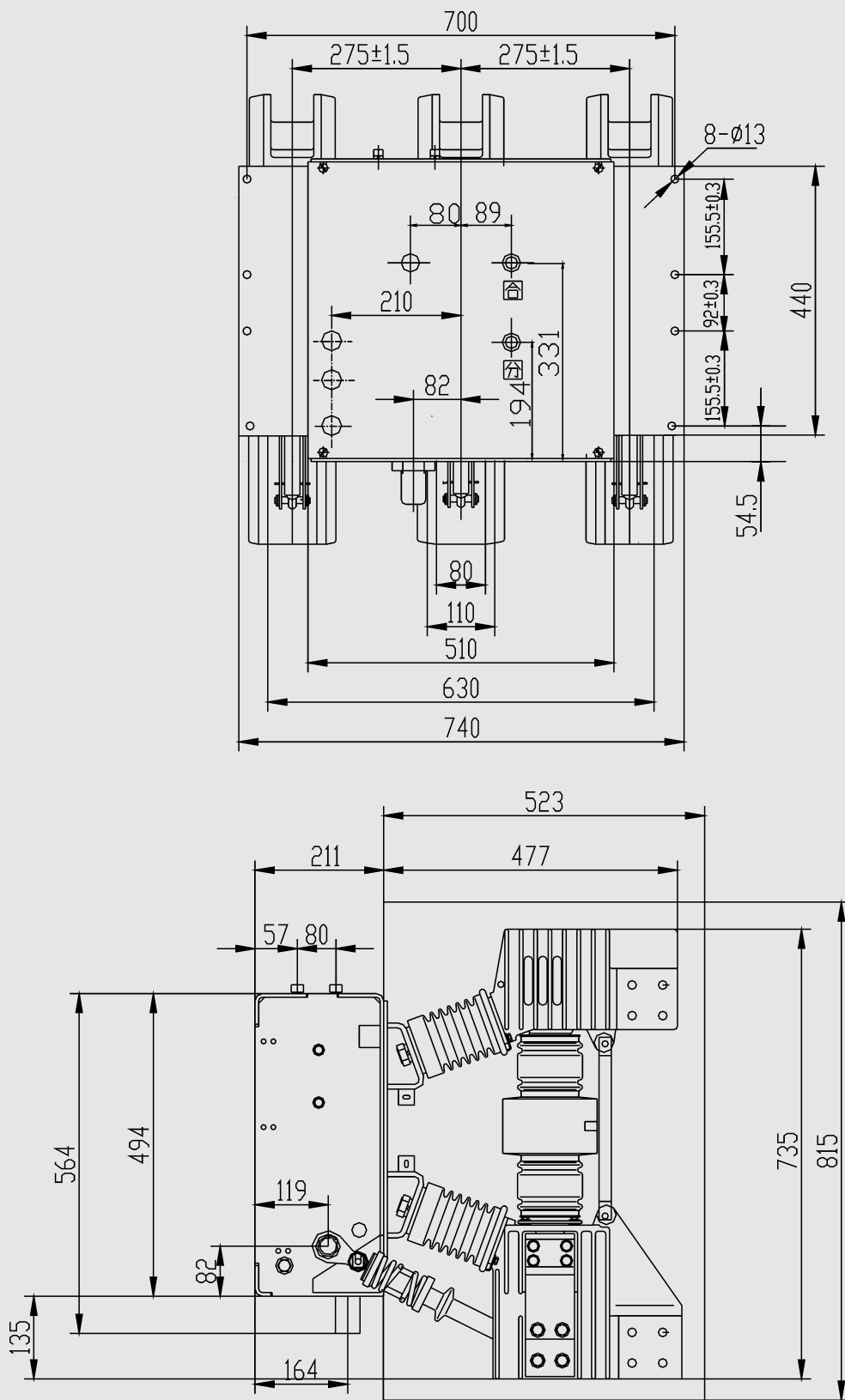


图 14.外形图

Fig.14.The appearance figure



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