证 书

授予 北京北开电气股份有限公司

北开牌高压真空开关设备 产品为

2000年北京名牌产品

北京市质量技术监督局 北京市经济委员会

二〇〇〇年七月

有效期：2000年7月至2002年7月

Certificate
Confer

the honorary title of "2000 Beijing Brand Product" to Beikai High-Voltage Vacuum Switch Equipment of Beijing Beikai Electric Co., Ltd

Beijing Bureau of Quality and Technical Supervision (Seal)
Beijing Economic Committee (Seal)
July, 2000

Validity Period: From July, 2000 to July, 2002

- 专为30万千瓦以上火电机组引进项目。
  The project specially imported for the thermal generator unit of over 300,000 kilowatts
- 获国务院嘉奖。
  The winner of State's Council's Award
- 可适用于3000米的高海拔地区。
  Suitable to the high-altitude areas above 3,000m
- 可在低温环境下（零下40摄氏度）运行。
  Operation available under low-temperature environment (-40ºC)
- 可提供各种不同相间距组合。
  Different phase-distance units able to be provided
- 切合电容器组性能可靠。
  Reliable performance of switching capacitor unit
- 机械寿命可达20000次。
  Mechanical life up to 20,000 times
- 可提供“TH”型产品。
  The TH styles of products able to be provided
- 开断等级组合齐全。
  Complete opening-class integration

3AF 型(ZN12-12 系列）真空断路器安装使用说明
User Guide on Installation of Type 3AF (ZN12-12 Series) Hi-voltage AC Vacuum Breaker

一、主要内容与适用范围

ZN12-12系列真空断路器为额定电压12kV, 三相交流50Hz 的户内高压开关设备，是引进德国西门子公司技术制造的产品。

本断路器的操动机构为弹簧储能式, 可以用交流或直流操作，亦可用手动操作。

本断路器结构简单，开断能力强，寿命长，操作功能齐全，无爆炸危险，维修简便，适用于作发电厂、变电所等输配电系统的控制或保护开关, 尤其适用于开断重要负荷及频繁操作的场所。

本产品符合 GB1984《交流高压断路器》标准。

二、使用环境条件

海拔高度：不高于 2000m。

环境温度：最高 +40˚C，最低 -25˚C ;(-40˚C)*。

相对湿度：日平均不大于 95%,月平均不大于 90%。

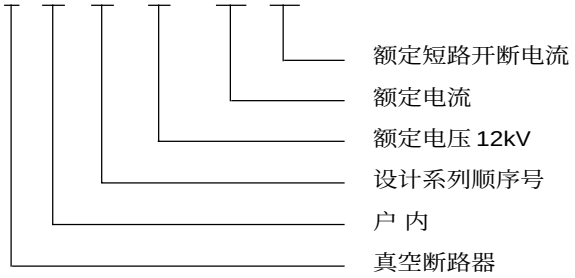
地震烈度：低于 8 度。

无火灾、爆炸危险，无腐蚀性气体及无剧烈振动的场所。(能适用于湿热、盐雾、霉菌的条件下使用。) *

注：* 为超标要求，用户在订货时提出。

三、型号意义

Z N 12 - 12 / □ □



I. Main Content and Use Scope

This breaker is an indoor AC high-voltage switch device of rated voltage 12kV and 3-phase AC 50Hz of ZN12-12 Series, which is made with the technology imported from Germany's Siemens Co.

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

The breaker features good insulation performance as follows: 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 satisfies the standards of GB1984 AC high-voltage breaker.

II. Environment and Conditions of Use

Altitude: Lower than 2,000m

Ambient air temperature: The upper and lower limits are +40˚C and -25˚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. (Available under the conditions of humidity, hest, salt fog and bacteria.)*

Note: * is the over-standard requirement which will be brought forward by the ordering users.

四、技术参数

参数名称 Parameter	单位 Unit	型 号 / Data									
		I	II	III	IV	V	VI	VII	VIII	IX	X
额定电压 / Rated voltage	kV	12	12	12	12	12	12	12	12	12	12
额定电流 / Rated current	A	1250	1600	2000	2500	1600	2000	3150	1600	2000	3150
额定短路开断电流 Rated short-current opening current	kA	31.5	31.5	31.5	31.5	40	40	40	50	50	50
动稳定电流(峰值) Active stable current (peak value)	kA	100	100	100	100	130	130	130	140	140	140
4s 热稳定电流(50kA 为 3s) The 4s thermal stable current (50kA for 3s)	kA	31.5	31.5	31.5	31.5	40	40	40	50	50	50
额定短路关合电流(峰值) Rated short-current closing current (peak value)	kA	100	100	100	100	130	130	130	140	140	140

续

参数名称 Parameter	单位 Unit	型号 / Data									
		I	II	III	IV	V	VI	VII	VIII	IX	X
额定短路电流开断次数 The rated closing times of short-circuit closing current	次 Times	50				30			12		
额定操作顺序 Rated operation order		分-0.3s-合分-180s-合分 o-0.3s-co-180s-co							分-180s-合分-180s-合分 o-180s-co-180s-co		
额定雷电冲击耐受电压 (全波) The thunder-impacting endured voltage (full wave)	kV	75									
额定短时工频耐受电压 (1min) The rated short-time work-frequency endured voltage (1min)	kV	42									
合闸时间 / Closing time	ms	≤ 75									
分闸时间 / Opening time	ms	≤ 60 (50)									
机械寿命 / Mechanical life	次/Times	20000 (I~IV) 10000(V~X)									
额定电流开断次数 / The opening times of rated current	次 / Times	20000 (I~IV) 10000(V~X)									
储能电动机功率 The 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									
合闸电磁铁额定电压 The rated voltage of closing magnet	V	=110 220 DC									
分闸电磁铁额定电压 The rated current of opening magnet	V	=110 220 DC									
储能式分励脱扣器额定电压 The rated current of energy-storage shunt releaser	V	≃110 220 AC、DC									
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：括号数值为用储能式脱扣器分闸时的时间。/ Values in ( ) refer to the time for the breaker being opened with the energy-storage releaser.

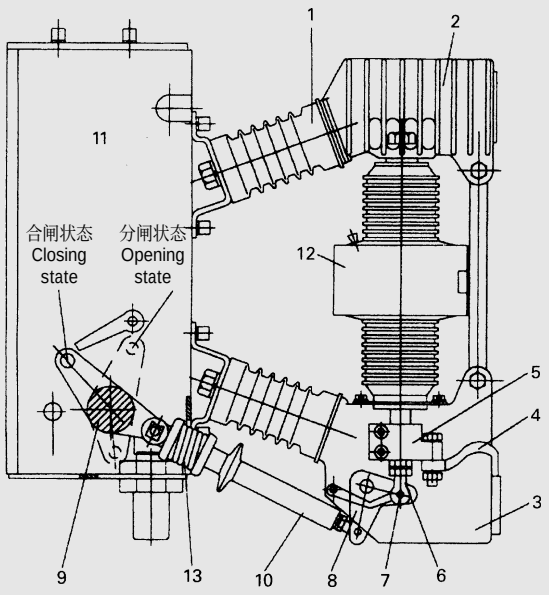
机械特性调整参数 / Adjustment parameters in mechanical performance

参数名称 Parameter	单位 Unit	数据 / Model				
		I,II,III,IV		V,VI,VII		VII,IX,X
触头行程 / The journey of contactor	mm	11 ± 1		11 ± 1		11 ± 1
触头超行程 / The super journey of contactor	mm	8 ± 2		8 ± 2		$4^{+1}_{-0.5}$
合闸速度 / Closing speed	m/s	0.6~1.8				
分闸速度 / Opening speed	m/s	≥ 1				
触头合闸跳闸时间 / The time of contactor's full-brake skip	ms	≤ 2				
相间中心距离 / Distance to center	mm	210 ± 1.5	230 ± 1.5	250 ± 1.5	275 ± 1.5	280 ± 1.5
三相触头合分闸同期性 The same period of three contactors' opening and closing brakes	ms	≤ 2				
每相回路电阻 / The resistance of each loop	μΩ	≤ 35				

注：合闸速度指触头最后 6mm 时的平均速度，分闸速度指触头刚分 6mm 时的平均速度。

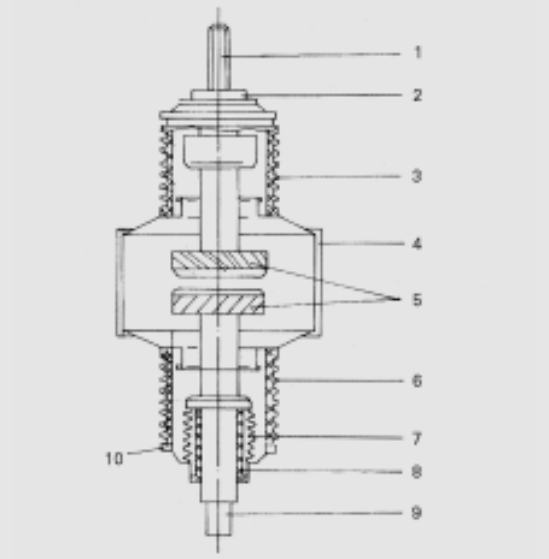
进口灭弧室的触头开距西门子公司为 8 ± 1mm (31.5kA、40kA) ；美国西屋公司为 8^{+1}_{0}mm (31.5kA); 8 ± 1mm(40kA)。

Note: The closing speed refers to the average speed of contactor's last 6mm, and the opening speed is that of contactor's first 6mm. The opening distances of imported arc-quenching chambers' contactors are as follows: Siemens -8±1mm (31.5kA, 40kA), and America Westhouse - 8^{+1}_{0}mm(31.5kA), 8±1mm (40kA)



1. 绝缘子/ Insulator 2. 上出线端/ The upper wiring end
3. 下出线端/ The lower wiring end 4. 软联接/ Soft connection
5. 导电夹/ Inducting clamp
6. 万向杆端轴承/ Bearing for the ends of universal clamps
7. 轴销/ Axial pin 8. 杠杆/ Level 9. 主轴/ Main axis
10. 绝缘拉杆/ Insulated pull rod 11. 机构箱/ Mechanism box
12. 真空灭弧室/ Vacuum arc room
13. 触头弹簧/ The spring of contactor

图 1. 总体结构图
Fig 1.The whole mechanism diagram



1. 静导电杆/ Static inducting rod 2. 上法兰盘/ The upper flange
3. 瓷管/ Porcelain shell 4. 屏蔽罩/ Shielding cover
5. 触头/ Contactor 6. 瓷管/ Porcelain shell
7. 波纹管/ Corrugate pipe 8. 导向管/ Pipe guide
9. 动导电杆/ Active inducting rod
10. 下法兰盘/ Lower flange disc

图 2. 灭弧室剖面图
Fig.2. Sectional drawing of arc quenching chamber

III. Significance of Type

Z N 12 - 12 / □ □

- Rated short-circuit opening current
- Rated current
- Rated voltage 12kV
- Design serial number
- Indoor
- Vacuum breaker

IV. Technical Parameters

V. Structure

1. 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 upper and lower 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 130kg.

2. Vacuum arc-quenching chamber

The arc-quenching chamber of breaker consists of a metal cylinder shielding cover and 2 porcelain pipes together 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 static rod is on the flange. 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 1.33×10^{-3}pa. When the closing and opening operation is made, the active

五、结构

1、整体结构

断路器主要由真空灭弧室(12)、操作机构及支撑部分组成。在用钢板焊接而成的机构箱(11)上固定六只环氧树脂浇注的绝缘子(1)。三只灭弧室通过铸铝的上、下出线端(2) (3)固定在绝缘子上。下出线端上装有软联接，软联接(4)与真空灭弧室动导电杆上的导电夹(5)相联。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，使断路器实现合、分闸动作(见图 1)。断路器总重量为 130kg。

2、真空灭弧室

断路器的灭弧室是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；静导电杆在上法兰盘上，动导电杆上焊一波纹管，波纹管的另一端焊在下法兰盘上，由此而形成一个密封的腔体。该腔体经过抽真空，灭弧室气体压力不大于 1.33×10^{-3}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)

3、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, 真空的绝缘强度比大气的绝缘强度要高得多。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，在电流通过时产生一磁场，电弧在此磁场力的作用下快速运动。在金属圆筒(即屏蔽罩)上凝结部分金属蒸气。电弧在自然过零时熄灭了，触头间的介质强度又迅速恢复起来。

本断路器采用了特殊的触头材料, 使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、断路器主轴、缓冲器及控制装置组成。

● 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，此轴套用键连在大蜗轮上，轴套上有一轴销，上面装一棘爪；在储能轴的右端有一凸轮，凸轮上有一缺口，棘爪通过此缺口来带动凸轮转动。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, 杠杆上装有一滚针轴承，凸轮将合闸弹簧的能量传给此轴承上。三角形杠杆的另一个孔，用轴销连接一连杆，该连杆的另一端装在主轴拐臂上，形成四连杆机构，合闸力通过该机构传

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)

3. 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 art 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 act 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.

● 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-

给开关主轴。减速箱的轴销上还装有一滚针轴承，作为锁住合闸掣子用。

在断路器主轴的拐臂上装有分闸弹簧，主轴上还有三对弹簧，主轴上还有三对拐臂，其中两对分别作用在合闸橡皮缓冲器和分闸油缓冲器上，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。(见图 3)

● 本断路器可根据用户要求安装不同规格数量的控制部件。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	1.1A

储能式脱扣器：该脱扣器具有一储能机构，在断路器合闸时，脱扣器铸铝壳内的弹簧被储上能，掣子被锁住。断路器需要分闸时，线圈带电，电磁铁动作，掣子解脱，脱扣器内的冲击杆在弹簧力作用下弹出，冲击机构的分闸掣子使断路器分闸。(见图 4)

储能式脱扣器有分励、过流和失压三种。分励与过流脱扣器结构相同，失压脱扣器结构略有不同。(见表 1,2)

断路器装有失压脱扣器时，在调试过程中，需将失压

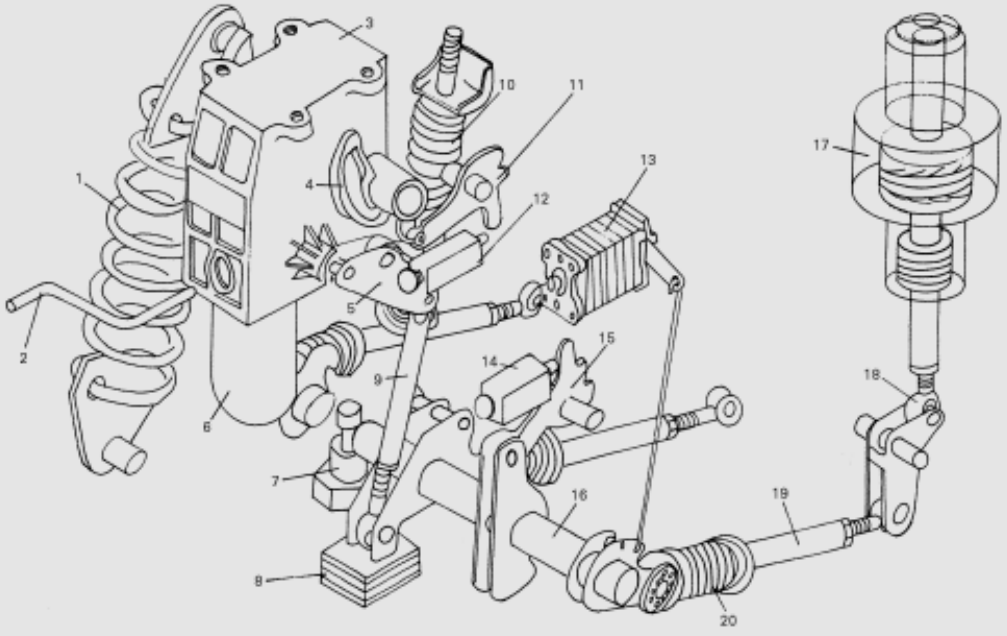
connecting-pod mechanism. With this mechanism, the closing force is transmitted for the main axis of switch. The axial pin of decelerator box is equipped with a needle bearing, which is used to lock the closing block.

The arm of switch's main axis is equipped with the opening spring, as well as 3 pairs of 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 equipped with a needle bearing for locking the opening block. The breaker's closing and opening blocks are same. (See Fig.3.)

● The breaker can be assembled with the control components of different specification and quantity up to the requirement of users. 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	1.1A

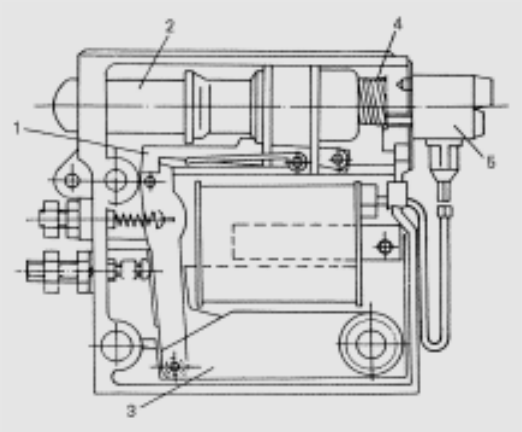
The energy-storage releaser: This releaser features an energy-storage mechanism. When the switch is closed,



1. 合闸弹簧 / Closing spring　2. 手动摇把 / Manual crank　3. 减速箱 / Decelerator box　4. 凸轮 / Cam　5. 杠杆 /Level　6. 电机 / Electromotor
7. 油缓冲器 /Oil buffer　8. 橡皮缓冲器 / Rubber buffer　9. 连杆 / Connecting rod　10. 分闸弹簧 / Opening spring　11. 合闸擎子 / Closing block
12. 合闸电磁铁 / Closing magnet　13. 辅助开关 / Auxiliary switch　14. 分闸电磁铁 / Opening magnet　15. 分闸擎子 / Opening block
16. 主轴 / Main axis　17. 真空灭弧室 / Vacuum arc-quenching chamber　18. 万向杆端轴承 / Bearing for the ends of universal clamps
20. 触头弹簧 / The spring of contactor

图 3. 操动机构动作原理图

Fig.3.The principal diagram of operating mechanism's action



1. 擎子 / Block　2. 冲击杆 / Impacting rod
3. 铁芯 / Iron core　4. 储能弹簧 / Energy-storage spring
5. 操线座 / Wiring seat

图 4.储能式脱扣器
Fig.4. Energy-storage releaser

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 three varieties, the shunted, over-current and the no-voltage. The structures of first two varieties are same, but the structure of no-voltage releaser is different. (see Tab.1,2)

When the breaker is equipped with the no-voltage releaser, 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 3 releasers at most, with the solution in the Tab.3;

表 1./Tab 1.

名　称 Name	代　号 Code	额定电压 Rated voltage	额定电流 Rated current	额定消耗功率 Rated consumed power
分励脱扣器 Shunt releaser	5JK.295.084	=110V		60W
	5JK.295.085	=220V		60W
	5JK.295.086	~110V		100VA
	5JK.295.087	~220V		100VA
过流脱扣器 Over-current releaser	5JK.295.088		5A	20VA
失压脱扣器 No-voltage releaser	5JK.295.089	=110V		18W
	5JK.295.090	=220V		18W
	5JK.295.091	~110V		27VA
	5JK.295.092	~220V		27VA

表 2./Tab 2.

脱扣器 Releaser	交流电压工作范围 Work scope of AC voltage	直流电压工作范围 Work scope of DC voltage
分励脱扣器 / Shunt releaser	85~110%UH	70~110%UH
过流脱扣器电流整定范围 / Current rectification scope of over-current releaser	90~110%IH	
失压脱扣器 / No-voltage releaser	0~35%UH	0~35%UH

表 3./Tab 3.

基本件 / Essential parts	附加件 / Added parts		
分闸电磁铁 Opening magnet	分励脱扣器 Shunt releaser	过流脱扣器 Over-current releaser	失压脱扣器 No-voltage releaser
5JK.647.032	5JK.295.084-087	5JK.295.088	5JK.295.089-092
1			
1	1		
1		1 (2) (3)	
1			1
1	1	1 (2)	
1		1 (2)	1

表 4./Tab 4.

符号 / Symbol	名　称 / Name	型 号 规 格 / Type and Specification	数量 / Quantity
YA2	分闸电磁铁 / Opening magnet	5JK.647.033-034	1
YA1	合闸电磁铁 / Closing magnet	5JK.647.033-034	1
S4-6	微动开关 / Ms switch	LXW20-11	3
S1-2	微动开关 / Ms switch	LXW20-11	2
S	辅助开关 / Auxiliary switch	F10-22	1
M	储能电机 / Energy-storage motor	HDZ-11-1; HDZ-21-1	1
XT	接线端子 / Connection end	JH24	1

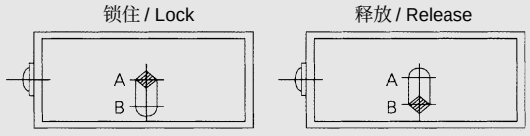


图 5. 失压脱扣器冲击杆锁定位置
Fig.5.The locking position of no-voltage releaser's impacting rod

脱扣器的冲击杆锁住，方能进行手动分、合闸操作。(见图5)

断路器可最多安装三个脱扣器，其组合方案见表 3；

二次回路电器元件名称及规格见表 4(见图 6、图 8)

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。

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。

断路器具有手动合闸功能，手动方式有两种：

第一种：就地手动不带保护合闸(即：合闸长杆)，靠机械完成手动合闸。

第二种：就地手动带保护合闸(即：合闸短杆)，靠电动完成手动合闸。

以上两种手动方式供用户选择，由用户订货时提出，断路器在运行位置禁止手动合闸。

5、操 作

(1) 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转动，当棘爪进入凸轮上的缺口时，带动储能轴转动，合闸弹簧被拉起而储上能，当合闸弹簧拉到最高点后被合闸掣子锁住，曲柄上的小连杆传动一小弯板压下微动开关，电机电源被切断，“ 储能指示 ”显示在面板孔中。整个储能时间约为 15 秒。
- 手动储能：将手摇把插入减速箱前方孔中，顺时针摇转约25圈，棘爪进入了凸轮缺口带动储能轴转动，继续用力摇转手把 25 圈，合闸簧储能完毕，卸下手把。

(2) 合 闸：

See the electric components and parameters of second loops (Tab.4) (Fig.6 and Fig.8).

The auxiliary switches are oppositely opened and closed with 5 or 11 pairs for usual state, where the maximum passing current is AC 10A and DC 5A, respectively.

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.

The manual closing function breaker sees 2 manual-operating methods:

The first one: Locally make the manual closing without protection tool (i.e., with long closing rod). The closing is made mechanically.

The second one: Locally make the manual closing without protection tool (i.e., with short closing rod). The closing is made electrically.

The user can select any of the above methods and mention it in the order. It is prohibited to make the manual closing for breaker on the operating state.

5. Operation

(1) 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

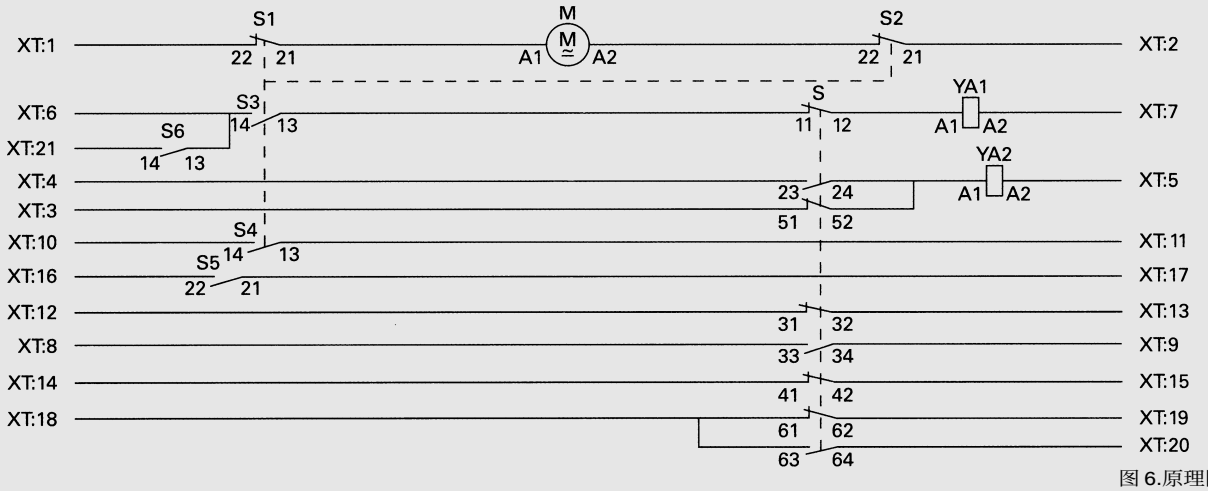


图 6.原理图

Fig.6. Principle diagram (commonly-used method)

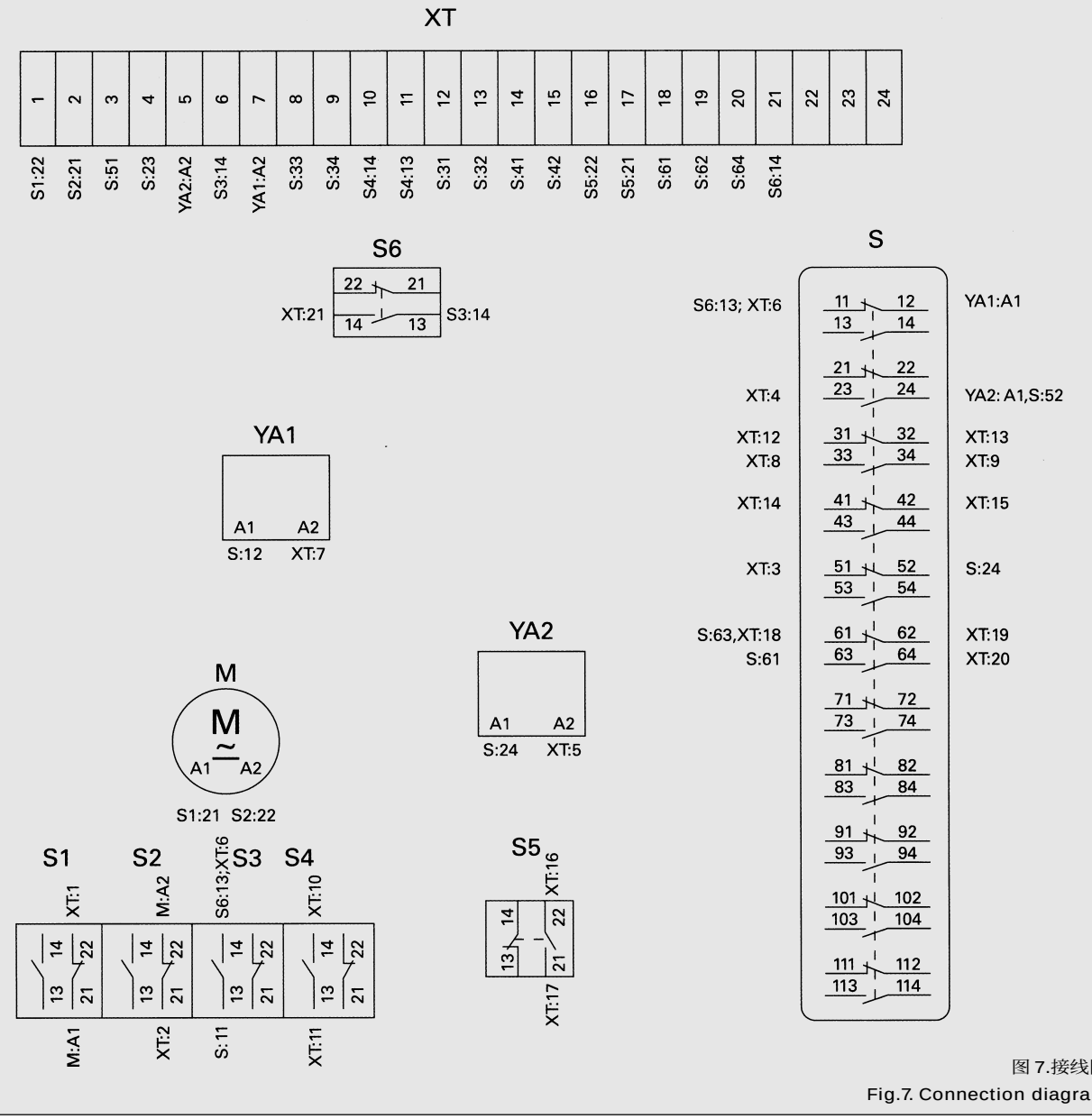


图 7.接线图

Fig.7. Connection diagram

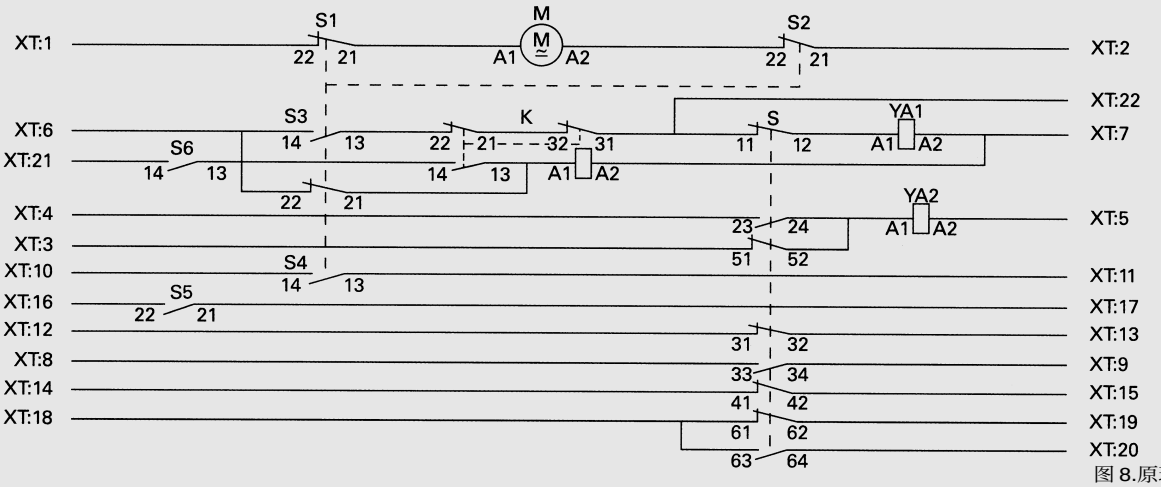


图 8.原理图

Fig.8. Principle diagram

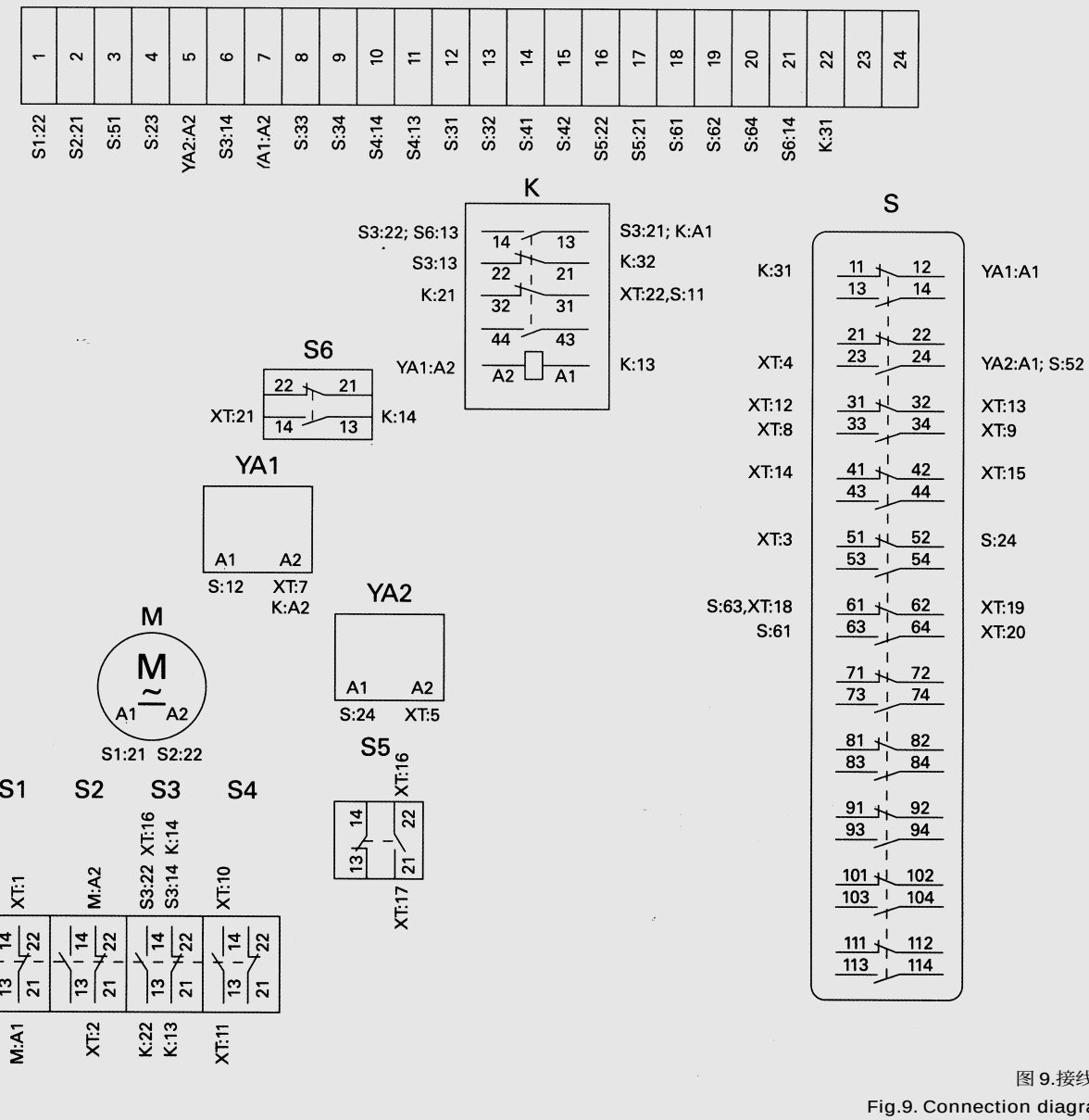


图 9.接线图

Fig.9. Connection diagram

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反向转动，凸轮压在三角杠杆上的滚针轴承，杠杆上连杆将力传给断路器主轴，导电杆向上运动，主轴转动约60度时被分闸掣子锁住，断路器合闸。在此过程中，分闸弹簧被储上能，绝缘拉杆上触头弹簧亦被压缩，给触头施加了一压力。“ 合闸指示 ” 显示在面板孔中。

(3) 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反向旋转，断路器分闸。“ 分闸指示 ” 显示在面板孔中。

断路器在分闸后，电动机立即给合闸弹簧储能，亦可手动再次储能。

六、过电压保护措施

本断路器灭弧室采用性能优良的Cr-Cu 合金材料，不仅具有较好的开断性能，其截流水平也相当低，平均为3安培，因而截流过电压比老一代产品有大幅度降低，但截流值是在一定条件下测得的，开断状态不同，其值亦异，同时其值是大量测得的平均值，不排除较大截流值偶尔出现的可能，加上还有多次重击穿过电压尚未防范，因而在操作小电流电感负载及切合电容器组时还需分别设置R-C及 ZnO 防过电压装置。

七、运输、验收及储存

断路器安装在手车上时与开关柜一起包装，如果单独供货则按其包装规范包装。

断路器在运输时不得倾翻及受强烈振动或雨淋。

用户收到断路器时应进行以下工作，并注意以下事项：

1. 检查包装是否损坏和受潮。
2. 开箱取出装箱单，并对照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. 检查附件及备品是否齐全。
5. 检查断路器是否受潮，如果已受潮则需将绝缘板与绝缘拉杆拆下放入 70-80°C 的烘烤箱中烘烤 48 小时。
6. 断路器长期不用时需在导电面涂以工业凡士林油，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。
8. 在机构箱的两侧带有起吊用的孔洞，作为起吊时挂勾用。不得勾住绝缘子或断路器的其它部位起吊。

八、安 装

断路器在出厂时为合闸状态，合闸弹簧不能储能，安装时按以下顺序进行：

1. 导电部分用钢刷刷出金属光泽后用干布擦净涂上工业凡

indication” is shown on the penal hole. The whole energy-storage time is less than 15s.

● Manual energy storage: Insert the crank into the front square hole of deduction box and then rotate this handle for 25 circles in clockwise. Therefore, the claw enters the gap of cam to rotate the energy-storage axis. Continue to energetically rotate the crank for 25 circles. After the closing energy storage is finished, dismantle this crank.

(2). Closing

After the closing magnet is turned on or the closing button (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.

(3). 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.

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.

VI. Over-current Protection Method

Of the breaker, the arc-quenching chamber is made from the Cr-Cu alloy material, because it not only features good opening performance, but also sees a quite low current-cutting level. The average cutting current is 3 amp. Therefore, the cutting over-voltage is considerably lower than the old generation of breakers. However, the current cutting value was measured under certain conditions, so this value will be varied due to different opening state. Also, the value was measured with a lot of samples averagely. It is possible that the bigger cutting current comes into being occasionally. In addition, a great deal of

士林油。

2. 带失压脱扣器的断路器需放松脱扣器的自锁螺母。(见图 5)

3. 将机构箱侧面的接地孔锉出金属光泽并涂以工业凡士林油再接地线。如果断路器系安装在有接地点的小车或钢架上就不必单独接地。

4. 用手动使断路器分、合闸。检查“储能”、“合闸”、“分闸”指示是否正确。

5. 用机构箱上的安装孔或断路器底板上的安装孔安装。外形图见附图 1。

九、运行前的准备

- 运行前用户无需对断路器进行任何调整，仅需检查备部位螺钉有无松动现象，若有，则紧固。
- 断路器各转动部位涂以润滑油。
- 绝缘件表面擦拭干净。
- 给断路器通电进行试操作，无异常现象时即可投入运行。

十、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

$$Ka=\frac{1}{1.1\text{-}H\times 10^{-4}}$$

式中：H —安装地点的海拔高度 m。

- 断路器额定电流和短路开断电流不同时，其电寿命不同。
- 断路器操作达到 1000 次后应上润滑油一次，并紧固各部位螺钉。
- 真空灭弧室达到技术参数中规定的短路电流开断次数后即需要更换灭弧室。
- 更换灭弧室时首先将断路器分闸，然后按以下顺序进行：
  1. 拧松上出线端螺钉卸下上出线端(见图 10);
  2. 卸下轴销(1)，拧松导电夹螺钉(2)及固定板(4)螺钉(3)(见图 11);
  3. 双手握住灭弧室往上提即可卸下；
  4. 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；
  5. 双手握紧新灭弧室往下装入固定板大孔中，导电杆插入导电夹；
  6. 装好上出线端，注意三相垂直及水平值不超过1mm，拧紧螺钉；
  7. 装上轴销；
  8. 拧紧固定板及导电夹螺钉。
- 灭弧室更换后应测量触头行程，量出分、合闸位置时的$X_{分}$、$X_{合}$，$X_{分}-X_{合}=X$，触头行程 X 应为 11 ± 1mm。量出分、合闸位置时的$L_{分}$，$L_{合}$，$L=L_{分}-L_{合}$。L 为触头

heavy-breakthrough over-voltage is not safeguarded. In this case, the operator ought to set the R-C and ZnO over-voltage protecting devices while he or she operates the small-current inductance load and the cutting capacitor.

VII. Transportation, Acceptance and Storage

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 dismounted 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.

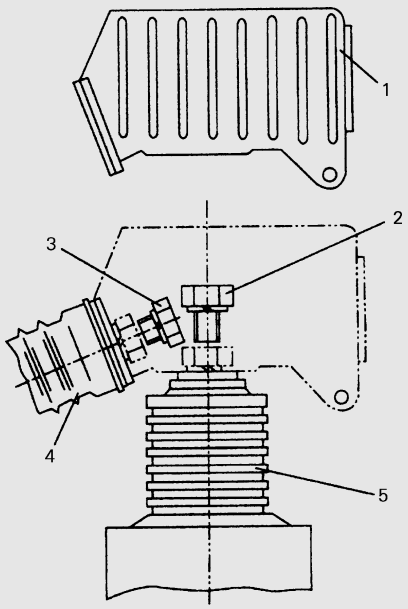
7. The breakers ought to be stored in dry fanned rooms where they the breakers are vertically placed without overlay.

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.

VIII. Installation

While being delivered from the factory, the breakers stay at the closing state where no energy is stored on the closing spring. The operator ought to make the installation in accordance to the following:

1. The users ought to polish the electrically inducting parts



1. 上出线端 / The upper wiring end
2. 螺钉 /Screw 3. 螺钉 /Screw 4. 绝缘子 / Insulator
5 .灭弧室 / Arc-quenching room

图 10.卸下上出线端示意图
Fig.10.The sketch map of upper wiring end being disassembled

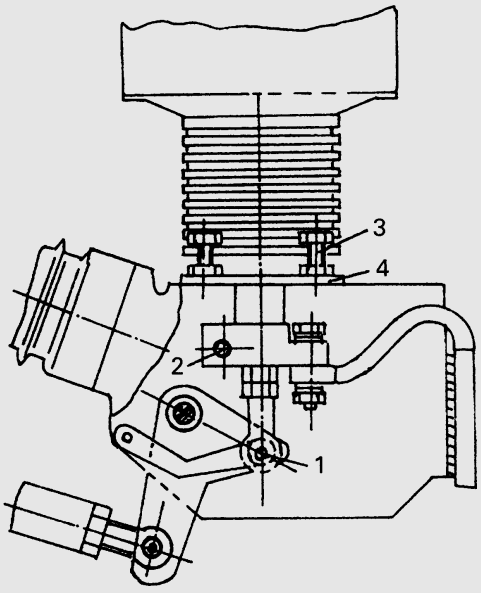


图 11. 卸轴销松螺丝钉示意图
Fig.11.The sketch map of axial pin and screws being disassembled

for metal luster with steel brushes and then wipe these parts for cleaning and coat them the industrial petroleum jelly.

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

3. On the sides of mechanism boxes, the grounding holes ought to be rasped for metal luster and coated with the industrial petroleum jelly. If it is mounted on the car or steel frame with grounding points, the breaker does not need to be singly grounded.

4. 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.

5. The users ought to mount the breakers with the installation holes on the switch bottom. For the appearance drawing, see Attached Fig. 1.

IX. 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.

X. 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.

$$Ka = \frac{1}{1.1\text{-}H \times 10^{-4}}$$

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.
- If it has been operated for 1,000 times, the breaker ought to be maintained with lubricant oil and the screws on all of its parts are tightened up.
- Vacuum arc-quenching room ought to be replaced immediately if it has used or seen the short-circuit current

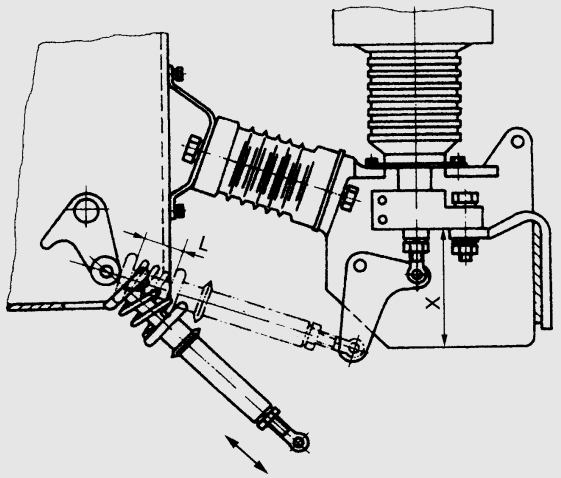


图 12.调整触头行程示意图
Fig.12.The sketch map of contactor's journey being adjusted

超行程，数值应为 8 ± 2mm($4^{+1}_{-0.5}$)。X、L 测量部位见图 10。

- 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；行程偏大时将特殊螺钉往外拧出，使拉杆变长(见图 12)。
- 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。

十一、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；辅助开关点对数；分、合闸电磁铁电压。

用户如果需要备品须在订货时提出。

十二、备品及附件

名称	手摇把	护套	压接簧片
数量(个)	1	24	24

备注：只有外供单机带护套及压接簧片。

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！

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:

a) 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).

b) Disassemble the axial pin (1) which connects the insulated pulling rod with the arm. Twist off the bolts (2) (3) which connect the soft connection with the lower wiring end and inducting clamp. Then, take down the fixing plate (4) 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)

c) 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.

d) Firmly hold the chamber with two hands to place it in the bundle of fixing plate and inducting clamp.

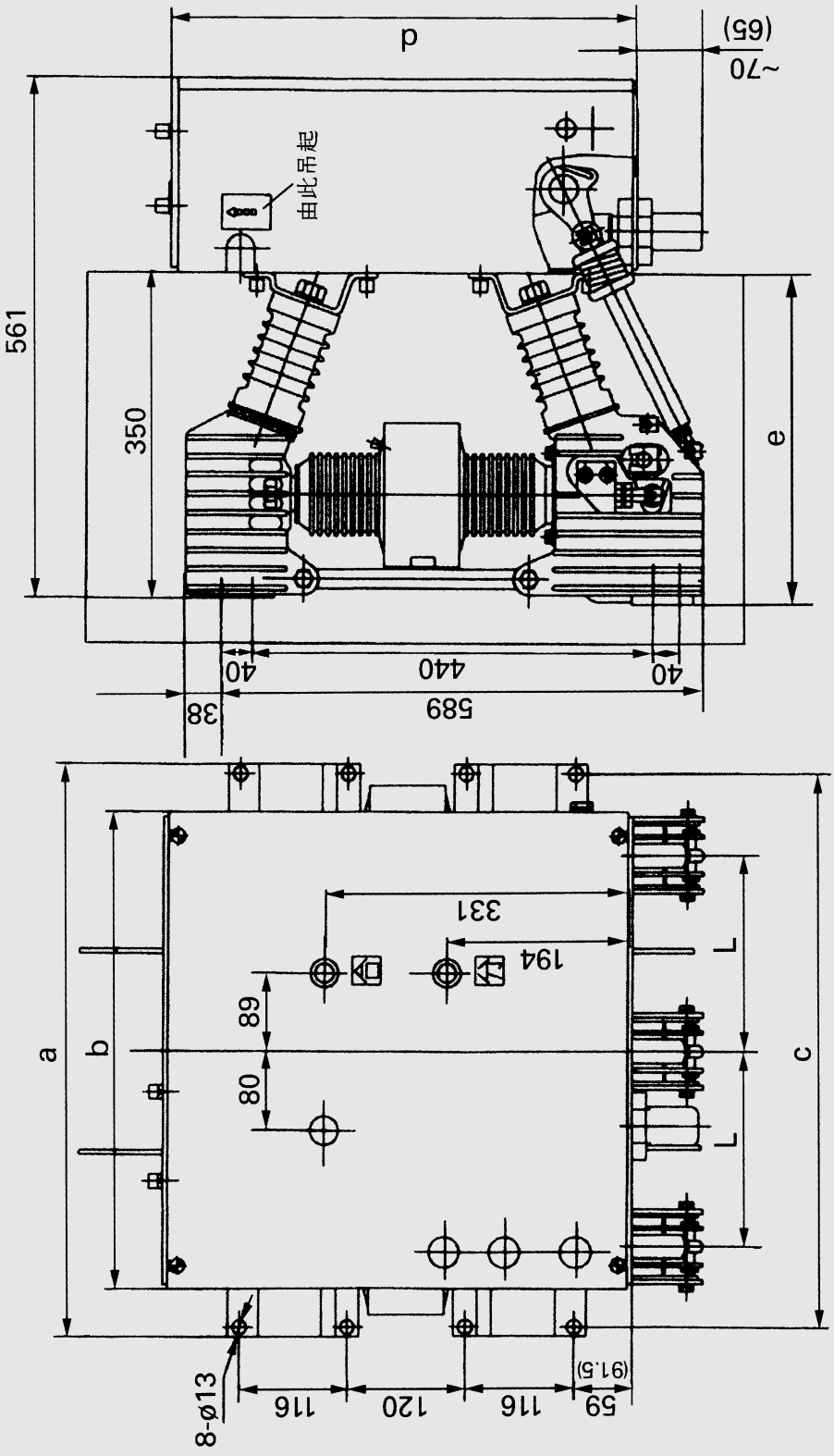
e) Assemble the upper wiring end. Pay attention to the three-phase vertical and horizontal position is no more than 1mm. Then, screw down the bolts and nuts.

f) Assemble the axial pin.

g) Screw down the bolts of fixing plate and inducting clamp.

h) 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, Xc - Xo = Xj (the journey of contactor). X should be 11 ± 1mm. For the positions Lc - Lo = Lj (the super journey of contactor). L should be the super journey whose value is 8±2mm (4+1-0.5). For the measured parts of X and L, see Fig.10
- 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

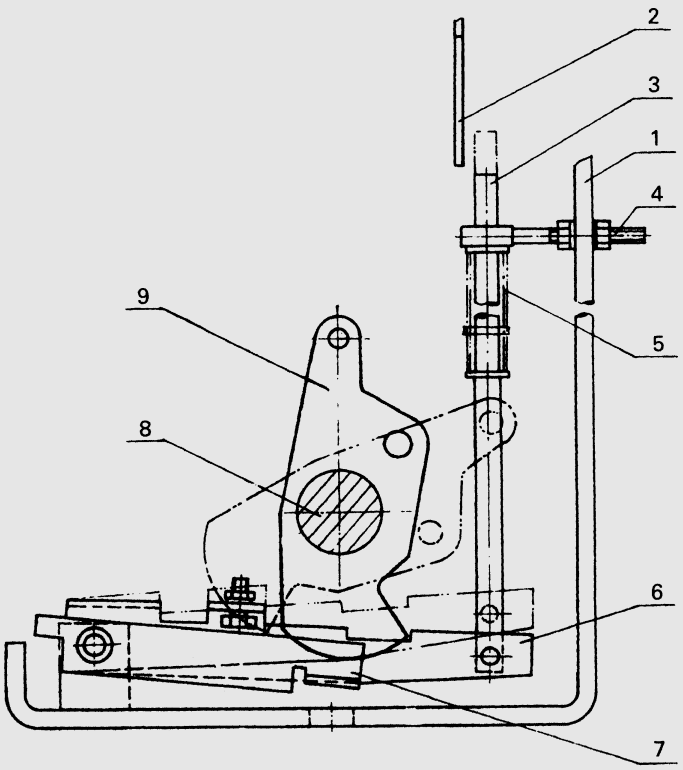


附图 1. 外形图
Attached Fig.1.Outline drawing

注 2：图中 e 为 2000A 为 360；2000A 及 2000A 以下为 350。
图表中()内尺寸为 40 和 50kA
Note 2: At e in the drawing, the current 2,000A or more is 350 and the current no more than 2,000 A is 350.
The sizes within ( ) in the drawing are 40 and 60kA.

注 1：图中 a、b、c、d、L 见下表：
Note 1: For a, b, c and d in the drawing, see the following table

相间距(L) Phase distance	a	b	c	d
210mm	610	514	586	494
230mm	610 (650)	554	586 (625)	500
250mm	690	594	666	500
275mm	750	514	725	494
280mm	750	514	725	494



1. 框架 / Frame
2. 合闸掣子弯板 / The bent plate of closing block
3. 顶杆 / Top rod
4. 螺栓 / Bolt
5. 压簧 / Pressure spring
6. 连杆 / Connection rod
7. 弯板 / Bent plate
8. 主轴 / Main axis
9. 拐臂 / Arm

附图 2.机械连锁示意图
Attached Fig.2.The sketch map of mechanical lockage

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.

XI. 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 phase.

XII. Accessories and Spare Parts

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

Note: Only a single machine is provided with extra protective sleeves and the pressing and connection springs.

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

成果登记	登记号	
	批准日期	

科学技术成果鉴定证书

机鉴字〔JC〕第9606135号

成果名称：ZN□-10/3150-50型真空断路器

完成单位：北京开关厂

鉴定形式：会议鉴定

组织鉴定单位：机械工业部　　电力工业部(盖章)

鉴定日期：一九九六年七月二十日

鉴定批准日期：一九九六年　月　日

国家科学技术委员会

一九九四年制

鉴定意见

北京开关厂承担的机械部下达的国家重点科技项目(攻关)计划85-213--02-08中的高压真空断路器现已完成，受机械部重大装备司、电力部安全监察及生产协调司的委托〔机重电(96)便字第073号〕北京市机械工业管理局、北京市电力工业局于1996年7月19日~20日主持了ZN□－10/3150－50型真空断路器的产品鉴定会。鉴定意见如下：

1. 北京开关厂提交鉴定的ZN□－10/3150型真空断路器(配4401厂TD350A型灭弧室)的图纸技术文件完整、正确、统一、清晰，符合有关国家及行业标准的规定，可以指导生产。
2. 型式试验报告项目齐全，结果符合GB1984-89的国家标准，并满足IEC56的国际标准，试验报告合格有效。
3. 对提交鉴定的产品按出厂试验进行了抽测，项目全部合格，达到了产品技术条件的要求，具备投入生产的条件。
4. 该产品试运行已达一年，运行情况良好，用户满意，试运行报告有效。
5. 该产品额定短路开断电流为50kA，直流分量达43%，属国内领先水平。
6. 鉴定委员会认为该产品已达到了规定的要求，同意通过产品鉴定，可以进行批量生产。

鉴定委员会主任：　　副主任：

1996年7月19日

Achievement Registration	Registration No. Date of Approval	

Evaluation Certificate of Scientific and Technological Achievement

Ji Jian Zi [J C] Di 9606135 Hao

Name of the Achievement: ZN □ -10/3150-50 Vacuum Circuit Breaker
Unit of Achievement: Beijing Switches Factory
Evaluation Model: Meeting
Evaluation Organizing Agency: Ministry of Machine-Building Industry
Date of Evaluation: July, 20, 1996
Date of Evaluation Approval: , 1996
Ministry of Machine-Building Industry
Ministry of Machine-Building Industry
Special Seal for Scientific and Technological Achievement Evaluation (Seal)
Ministry of Power Industry
Ministry of Power Industry
Department of Safety Inspection and Production Coordination (Seal)

State Science & Technology Committee
Certificate made in 1994

Suggestion on Appraisal

Beijing Switch Factory has finished the state key science-&-technology project (tackle key problem) of Ministry of Machine-Building Industry, the 85-213-02-08 High-voltage Vacuum Breaker. As entrusted by the key equipment department of the ministry as well as the safety-supervision and production-coordination department of Ministry of Power, both Beijing Machine-Building Industry Administration and Beijing Power Industry Administration jointly held the product appraisal meeting of Type ZN-10/3150 Vacuum Breaker from July 19-20, 1996. The related suggestions are as follows:

1. The submitted drawings and technical document of Beijing Switch Factory's product 85-213-02-08 High-voltage Vacuum Breaker (equipped with the Type 350A arc-quenching chamber of No.4401 Factory) are complete, correct, uniform and definite in conformity to the related state and industry-class regulations. Therefore, this product can be manufactured under directions.
2. The testing report of the type of product is complete with the results up to the state standard GB1984-89. Also, this product satisfies the IEC56 International Standard, so the report is quality and available.
3. The spot check of submitted product has been made according to the factory's test. All the checking points are quality up to the requirements of product technology condition. Therefore, the product can be put into production.
4. The product has run on trial for one year. The running state is good and makes the users satisfied, so the trial-operation report is available.
5. The rated short-circuit breaking current of the product is 50kA. DC% is 43%. All these highly above the same products in China.
6. The appraisal commission thinks that the product has met the regulated requirements, so it agrees that thee product has passed the appraisal procedure and can be produced with a batch.

Director of appraisal commission (signature)
Vice Directors (signatures)

July 19, 1996