BOE

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用心改变生活 Change life with heart

DVB型发电机出口断路器

DVB Generator Vacuum Circuit Breaker

北京京东方真空电器有限责任公司
Beijing Orient Vacuum Electric Co.,Ltd.

公司简介
Company Profile

北京京东方真空电器有限责任公司（简称 BOV），是由京东方科技集团股份有限公司和北京能源集团有限责任公司等共同出资，注册于 1998 年。

BOV 公司是一家掌握触头制造、陶瓷金属化、整管封排三项核心工艺和技术的真空灭弧室提供者；

BOV 公司是一家专业开发和生产高性能真空断路器的产品供应商；

BOV 公司是一家高可靠环保型真空环网柜方案的提供者和产品供应商；

BOV 公司是一家致力于为用户提供优质电器产品及方案的技术合作者。

清晰的自主知识产权，鲜明的产品技术特点，完整的工艺过程控制，深厚的电真空技术底蕴，（这些因素）构成了 BOV 公司的核心竞争力，也是 BOV 公司参与国际竞争的基础，目前 BOV 公司的产品已被国内外多家知名企业列为首选产品。

Beijing Orient Vacuum Electric Co., Ltd (BOV) was founded in 1998 with a joint capital contribution made by BOE Technology Group Co., Ltd and Beijing Energy Investment Holding Co., Ltd.

BOV is a provider of vacuum interrupters with three core technologies, contact manufacturing, ceramic metallization, and whole-tube sealing.

BOV is a professional developer and manufacturer of high-performance vacuum circuit-breaker.

BOV is a solution provider and product supplier of highly-reliable environment-friendly ring main unit.

BOV is a technical cooperator with customers on high-quality electrical products and solutions.

Independent intellectual property, distinctive technical features, complete process control and profound electric vacuum technologies constitute the core competence of BOV and also lay the foundation for its international competition. At present, products made by BOV have become the first choice by many famous enterprises from both domestic and overseas.

公司发展历程
Development history

1990 年：开发真空灭弧室

1993 年：开始生产 ZN12 用真空灭弧室，年产 2000 只 (此年 774 厂改制为京东方)

1997 年：京东方集团与北京能源集团等组建专业生产真空灭弧室的合资公司—北京京东方真空电器有限责任公司 (BOV)

1998 年：正式注册北京京东方真空电器有限责任公司 (BOV)

1999 年：引进国外设备 , 开发、生产样管，通过 ZN12 型式试验

2000 年：真空灭弧室产品通过 VS1、ZN65 等型式试验

2003 年：通过 12kV 固封极柱产品 (31.5kA、40kA、50kA) 等型式试验

2004 年：真空灭弧室产品通过 ZN85（40.5kV/2500-31.5kA）等型式试验

2005 年：完善 12kV 固封极柱产品，实现大批量生产

2006 年：完成 24kV 固封极柱产品等型式试验

2008 年：开始研发生产真空断路器，主要为成套厂家做试验样机，帮其通过型式试验

2008 年：完成 27.5kV 和 40.5kV 固封极柱产品等型式试验

2009 年：真空灭弧室产品完成 72.5kV 产品型式试验、固封极柱产品 40.5kV 产品切电容试验

2010 年：真空灭弧室产品开始大批量生产真空断路器，电压等级包括 12kV，24kV，40.5kV，主要为国网中标单位 OEM

2010 年：真空灭弧室产品完成 126kV/31.5kA 产品试制并批量出口乌克兰市场

2011 年：BOV 公司推出自主品牌 DVB 型真空断路器，并在多个领域得到推广使用

2012 年：推出 ZW32、ZW20、FZW28 等户外柱上开关

2013 年：完成下隔离固体绝缘柜 BVVS1 产品开发并通过型式试验

2014 年：完成 12kV 箱式变电站开发并成功投运

2016 年：推出全新一代 DVB 型高可靠、长寿命固封式真空断路器

1990: Start developing vacuum interrupter

1993: Start producing vacuum interrupter used in ZN12, with the production of 2000 units per year

1997: The establishment of Beijing Orient Vacuum Electric Co., ltd specializing in producing vacuum interrupter By BOE WTechnology Group Co., ltd and Beijing Energy Investment Holding Co., ltd etc.

1998: Officially registered as Beijing Orient Vacuum Electric Co., ltd

1999: Introduced foreign equipment to develop and produce samples and passed the type tests of products used in ZN12

2000: Passed the type test of products used in VS1, ZN65, etc.

2001: Passed the type test of products used in ZN7, ZW32, etc.

2003: Passed the type test of 12kV embedded pole (31.5kA, 40kA, 50kA)

2004: Passed the type test of products used in ZN85 (40.5kV/2500A-31.5kA), etc.

2005: The improvement and mass production of 12kV embedded pole

2006: Passed the type test of 24kV embedded pole (25kA), etc

2008: Start to product VCB, Main market is supply the VCB for switchgear factory to past the type test.

2008: Passed the type test of 27.5kV and 40.5kV embedded pole, etc

2009: Passed the type test of 72.5kV products and the capacitor test of 40.5kV products

2010: Mass production of DVB vacuum circuit-breaker, including 12kV, 24kV and 40.5kV

2010: Completed the trial-production of 126kV (31.5kA) products and exported to Ukraine in batches

2011: Completed the development and production of vacuum load switch tube used at an altitude of 4000m

2012: Completed the development of subminiaturization of 12kV/630A-20kA vacuum interrupter

2013: Completed the development and passed the type test of BVVS1 solid insulated switchgear

2014: Completed the development of 12kV ring main unit and succeeded running for grids

2016: BOV launches the new generation DVB vacuum circuit breaker, which more reliable and longer life.

概述
Introduction

总 则 General

DVB 型发电机出口断路器是北京京东方自主研发的符合发电机出口标准的断路器。其主要特征是主导电回路采用京东方自主研发真空灭弧室，灭弧室外绝缘采用固封极柱形式，这是采用特殊的嵌入技术，将具有超低电阻值的真空灭弧室和导电零部件浇注在环氧树脂中来实现主导电回路的固体绝缘。操动机构为新型弹簧操动机构，该机构为我公司自主研发，结构简单、动作可靠。

DVB Generator Vacuum Circuit Breaker is the Generator Vacuum Circuit Breaker independently developed by Beijing Orient Vacuum Electric CO.,LTD. The product features that the main circuit adopts vacuum interrupters developed by Beijing Orient Vacuum Electric CO.,LTD, the vacuum interrupters using the solid insulation structure. The pole utilizes the special embedment technology to embed the vacuum interrupter & conductive parts with ultra· low resistance value in the epoxy resin so as to realize the solid insulation of main circuit. The operating mechanism is the new-type spring operating mechanism, independently developed by our company, with simple structure & reliable operation.

技术特点 Technical characteristics

1、核心元件采用京东方具有多项国际专利的真空灭弧室，电阻更小，开断能力更强，绝缘性能更好，目前最大开断电流可达 63kA。

Core component is the vacuum interrupter, which is produced by BOV with several international patents. It has the features of smaller resistance, stronger breaking capacity and better insulation property. The maximum drop-out current can reach 63 kA until now.

2、自主研发的操动机构与自制真空灭弧室完美匹配，机械性能更稳定。

The independent-developed operating mechanism and self-made vacuum interrupter are matched perfectly, which can ensure the mechanical property is more stable.

3、完善的机构与电气联锁，运行更安全可靠。

Perfect mechanism and electric interlock can ensure the safe and reliable operation of the equipment.

标 准 Standards

IEC 60694《高压开关设备和控制设备标准的共用技术要求》
IEC62271-100《高压开关设备和控制设备　第 100 部分：高压交流断路器》
GB14824《高压交流发电机断路器》
GB/T11022《高压开关柜设备和控制设备标准的共用技术要求》
GB/T3309《高压开关设备常温下的机械试验》
JB/T 3855《6~40.5kV 户内交流高压真空断路器》
JB/T 8738《6~40.5kV 交流高压开关设备用真空灭弧室》
GB311.1《高压输变电设备的绝缘配合》
DL/T 402《交流高压断路器订货技术条件》

IEC 60694 Common specifications for high-voltage switchgear and controlgear standards
IEC62271-100 high-voltage switchgear and controlgear - part 100: alternating current circuit-breakers
GB 14824 High-voltage alternating-current generator circuit-breaker
GB/T 11022 Common specification for high-voltage switchgear and controlgear standards
GB/T 3309 Mechanical test at ambient temperature for high-voltage switchgear
JB /T 3855 6~40.5kV indoor AC high-voltage vacuum circuit breaker
JB /T 8738 Vacuum interrupters used in 6V~40.5kV high-voltage alternating-current switchgear
GB311.1 Insulation co-ordination for high-voltage transmission and distribution equipment
DL/T 402 Specification of high-voltage alternating-current circuit-breakers

试 验 Tests

●**型式试验：**工频耐压、雷电冲击耐压、温升、短时和峰值耐受电流、短路电流开合能力、机械寿命、低温 -30℃环境、盐雾等试验。
●**出厂例行测试：**机械特性测试、主回路工频耐压试验、辅助和控制回路绝缘性能试验、主回路电阻测试、联锁操作试验、机械和电气操作试验。
DVB Solid-closure High-voltage Vacuum Circuit Breaker has passed the following tests to ensure the safe operation.
● **Type tests:** Power frequency withstand voltage test, lightning impulse withstand voltage test, temperature rise test, short-time & peak withstand current test, short-circuit current switching test and mechanical life test. low temperature environment: -30℃ test, salt spray test, capacitor switching test.
● **Ex-factory Tests:** Mechanical property test, main circuit power frequency with stand voltage test, auxiliary & control circuit insulating property test, main circuit resistance test, interlock operation test and mechanical & electrical operation test.

应用范围 Application Scope

DVB 型发电机出口断路器可广泛用于电厂、电网、冶金、石化、城市基础设施建设如机场、楼宇、地铁等项目。
DVB 型发电机出口断路器在配电系统中，可适用于控制和保护电缆、架空线、变压器、电动机、发电机和电容器组。
DVB Generator Vacuum Circuit Breaker can be widely used in power plant, power grid, metallurgy, petrochemical and urban infrastructure construction like airport, building, subways and other projects.
DVB Generator Vacuum Circuit Breaker can be suitable for control & protection cables, overhead lines, transformers, motors, dynamos and capacitor sets in the power distribution system.

特殊使用环境 Special Operational Environment

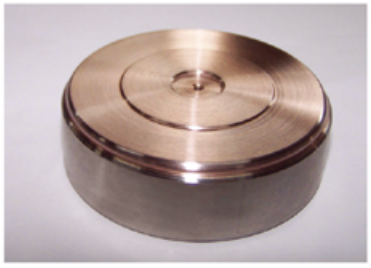
低温：≥ -30℃
盐雾：沿海及高酸高碱场合
切电容：用于无功补偿

Low Temperature: ≥ -30℃
Salt Spray: Coastal, High Alkaline Environment
Capacitor Switching: Used in Wattles Capacitor Auto Compensate Cabinet

当使用特殊环境条件为高海拔、高湿度、温度变化较大的气候环境伙食其他特殊环境条件时，请一定要与制造商协商相关技术条件。

技术优势
Technical Advantages

性能优异的真空灭弧室
Vacuum Interrupter with Excellent Performance



集成化多级纵向磁场电力开关触头
ZL01 1 29554.6
国际专利主分类号HO1H33/664

与陶瓷封接的新型金属构件
ZL01.1.10412.0

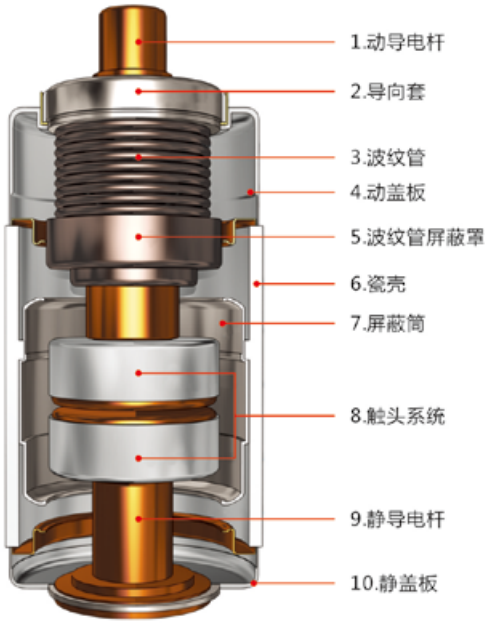
INTEGRATED CONTACT FOR POWER SWITCHGEAR
US6,891,121 B2

MULTPOLAR INTEGRATED CONTACT FOR POWER SWITCHGEAR
US6,891,120 B2

主要专利

集成化电力开关触头
ZL01 1 09233.5
国际专利主分类号HO1H33/664

集成化电力开关触头的制造方法
ZL01 1 09232.7
国际专利主分类号HO1H11/00



DVB 型发电机出口断路器的核心元件真空灭弧室是新型真空灭弧室，该真空灭弧室具有以下特点：

● 独特的 R 触头设计：

目前国内真空灭弧室厂家生产的灭弧室大多数使用杯状纵磁结构。DVB 型真空断路器使用具有自主知识产权的国际上独一无二的纵磁结构的 R 触头，使用 R 触头并经过电磁场优化设计的真空灭弧室具有以下优点：

1）分断短路电流时形成的纵向磁场强，热容性好，因而分断短路电流能力强、重燃率低、可靠性高，能满足首次 100% 额定短路电流的开断要求；

2）R 触头为集成化制造，结构强度高，分合闸过程中不会变形，短路分断性能稳定；

3）R 触头无引弧槽，外形完美，浑然一体，耐电压水平高；

4）回路电阻小：额定触头压力下 In = 1250A 时，R = 9±1μΩ；In = 3150A 时，R = 7±1μΩ；

5）具有高可靠的容性负载及感性负载开断能力；

6）具有高可靠的异向接地故障电流开断能力；

7）在正常工作条件下具有极低的 X 射线辐射量，可满足环境保护的要求。

● 完全一次封排工艺

● 高稳定质量的陶瓷金属化工艺

● 不锈钢直接钎焊工艺

As the core component of DVB Vacuum Circuit Breaker, the vacuum interrupter is the new-type vacuum interrupter with the following features:

●Unique R-shaped Contact Terminal Design:

At present, the majority of vacuum interrupters made by the domestic manufacturers can adopt the cup-shaped axial magnetic structure.

DVB vacuum circuit breaker can use the R-shaped contact terminal which adopts the unique axial magnetic structure in the world, with independent intellectual property rights. Through the electromagnetic field optimization design, the vacuum interrupter using the R-shaped contact terminal can have the following features:

1) When breaking the short-circuit current, the strong axial magnetic field is formed. The product can have good heat welding with a strong capacity to break the short-circuit current. With low restriking rate & high reliability, the product can meet the breaking requirements of 100% rated short-circuit current.

2) The R-shaped contact terminal can be made by adopting the integration form, with high structure strength. In the process of closing & breaking brake, the product cannot be deformed, with stable short-circuit breaking performance.

3) The R-shaped contact terminal has no striking arc groove with perfect appearance. All blend into one. The product has the high withstand voltage.

4) Small circuit resistance: under the rated contact terminal pressure, when In=1,250A, R=9±1pQ;when In=3,150A, R=7±1pQ .

5) With high & reliable capacitive loading and inductive loading breaking capacity.

6) With high & reliable ground fault current breaking capacity.

7) Under the normal conditions, with low X-ray radiation quantity, the product can meet the requirement of the environment protection.

● Complete One-Time Sea-Exhaust Technology.

● High & Stable Quality Ceramic Metallization Technology.

● Stainless Steel Direct Rivet Weld Technology.

固封极柱的主要特点
Main Features of the Embedded Pole

高可靠性 High Reliability

与传统组装式极柱相比，固封极柱的零部件、导体搭接面、连接用紧固件的数量都大大减少，从而简化了主回路的装配环节、降低了回路电阻、提高了主导电回路连接的可靠性；

Compared with the traditional assembled pole, the number of parts, conductor connection surface, connecting fasteners used for the Embedded Pole can be reduced by a big margin so as to simplify the assembly procedure of the main circuit, lower the circuit resistance and enhance the reliability of the main circuit connection;

稳定的绝缘性能
Stable Insulating Property

真空灭弧室被嵌入环氧树脂固体材料后，极柱的外界环境对真空灭弧室的影响被降到最低，其外绝缘能力可以免受灰尘、潮气、小动物、凝露和污秽的影响，完全满足GB/DL标准规定的二级污秽地区爬距要求；

After the vacuum interrupter is embedded in the solid epoxy resin material, the external environment of the pole can make the lowest effect on the vacuum interrupter. With the external insulating capacity, the pole can not be affected by dust, humidity, small animals, condensation and pollutions. It can completely meet the creepage distance requirements of the II-grade polluted region specified in the GB/DL Standard;

结构更坚固 Firm Structure

可以为真空灭弧室提供更加充分的保护，使其在装配或运输过程中免受意外机械冲撞；

Provide the sufficient protection for the vacuum interrupter so that it can not suffer the accidental mechanical collision in the process of assembling or transportation;

小型化 Miniaturization

采用环氧树脂作为绝缘介质，相间距可以缩小，减少了真空断路器及其配用的开关柜体积；

Adopt the epoxy resin as the insulation medium to reduce the phase distance and decrease the volume of the vacuum circuit breaker & its matching switch cabinet;

免维护 Free Maintenance

由于整个极柱被浇注成整体部件，真空灭弧室得到了充分保护，真空灭弧室的免维护为断路器的免维护提供了条件；

As the whole pole is poured into the integral component, the vacuum interrupter can get the sufficient protection. The free maintenance of the vacuum interrupter can provide the condition for the free maintenance of the circuit breaker;

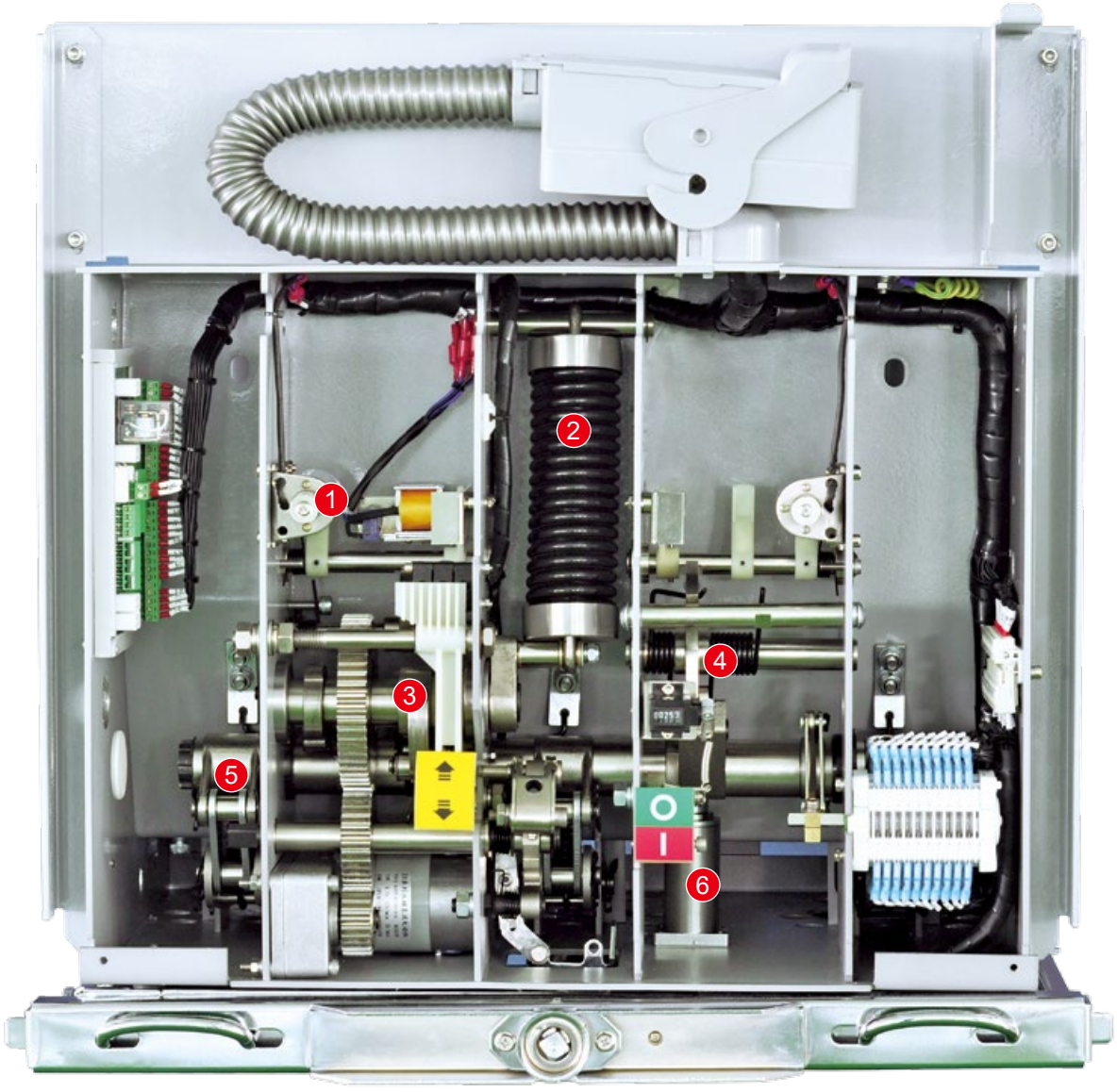
更环保
More Environmental Protection

固封极柱式断路器可在一定程度上替代SF6气体作为外绝缘的需要，因而更加环保。

The circuit breaker with the Embedded Pole can substitute for the SF6 gas as the external insulation to some extent, with more environmental protection.

技术优势
Technical Advantages

DVB 型发电机出口断路器弹簧操动机构
Embedded Circuit Breaker Drive Mechanism



电气控制
Electrical control

模块化线路板，采用带自扣紧的插接头，电气连接可靠；具有防跳及监视功能；

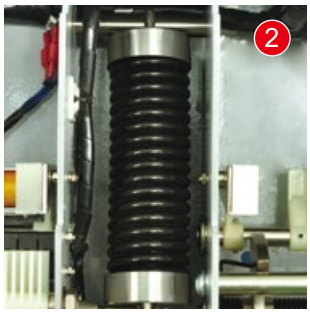
The modular control circuit board adopts the connection plug with the self fastening function, which can ensure the reliability of the electrical connection. It also has the function of trip-proof and monitoring.

分合闸线圈全密封结构，抗湿性强；外壳为金属，电磁屏蔽性好；

Tripping and closing coils adopt fully sealed structure to reach strong humidity resistance. The metal shell can ensure the good electromagnetic shielding.

采用磁吹式微动开关，确保准确的信号指示。

Magnetic blow-out micro-switch is adopted to ensure the accurate signal indication.



合闸系统
Closing system

特殊钢制拉簧，力学性能持久、稳定；

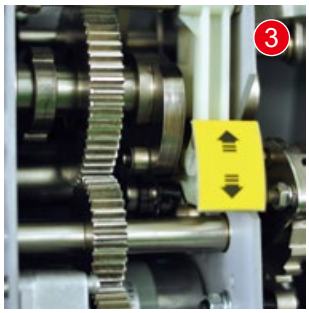
Special steel tension spring can ensure the persistence and steady of the mechanical property.

应用自润滑轴套，具有 5 万次以上的使用寿命；

Self-lubrication beating is adopted to ensure the mechanical life can reach more than 50 thousand times.

凸轮形状经过严密的工程优化，确保优良的出力性能。

The cam shape is optimized through rigorous engineering to ensure the excellent output performance.



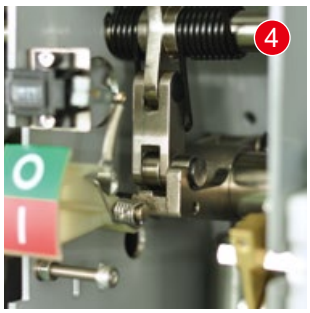
储能系统
Energy storage system

高品质电机，连续运转寿命长达 100,000 小时以上；

High quality motor can ensure that the continuous operating life is up to 100 thousand hours or more.

齿轮传动结构，无断裂风险。

The gear transmission structure can avoid the risk of fracture.



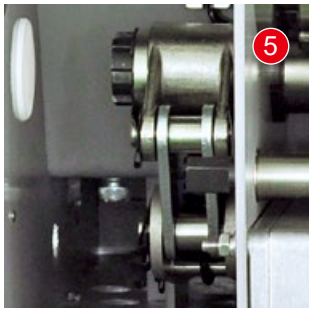
合分闸保持结构
Holding structure

合闸保持与分闸脱扣装置一体化设计，结构简单、可靠，杜绝合分故障；

The integral design of closing holding and separating brake release can ensure that the structure is simple and reliable, which can stop the fault of opening and closing.

挚子采用高性能钢材精密铸造，匹配精准热处理工艺，确保长寿命保持性能。

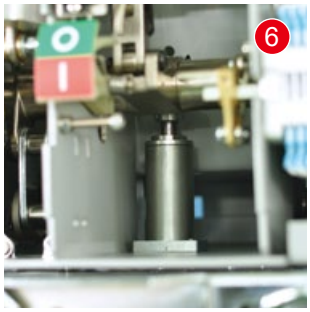
The latch is casted with high performance steel and matched with accurate heat treatment process to ensure its long life.



表面处理
Surface treatment

90% 以上零件采用镀镍磷工艺，标准件采用不锈钢材质，显著提高了防腐性能，盐雾试验达 500 小时以上。

More than 90% of the component adopt the electroless nickel-phosphorus plating process and the standard items are taken stainless steel to enhance the corrosion resistance, the salt spray test exceed 500 hours.



高性能分闸缓冲器
Breaking brake buffer

特殊的缓冲结构设计，有效缓冲分闸冲击；

Special cushioning mechanism design can buff the impact of the opening operation effectively.

精准阻尼控制，确保完美的分闸特性；

Accurate damping control can ensure the perfect performance of the opening operation.

采用航空液压油，具有极佳的低温黏度，确保断路器低温可靠运行。

The aircraft hydraulic oils have excellent low-temperature viscosity,which can ensure the reliable operation of the circuit breaker.

DVB 型发电机出口断路器
DVB Generator Vacuum Circuit Breaker

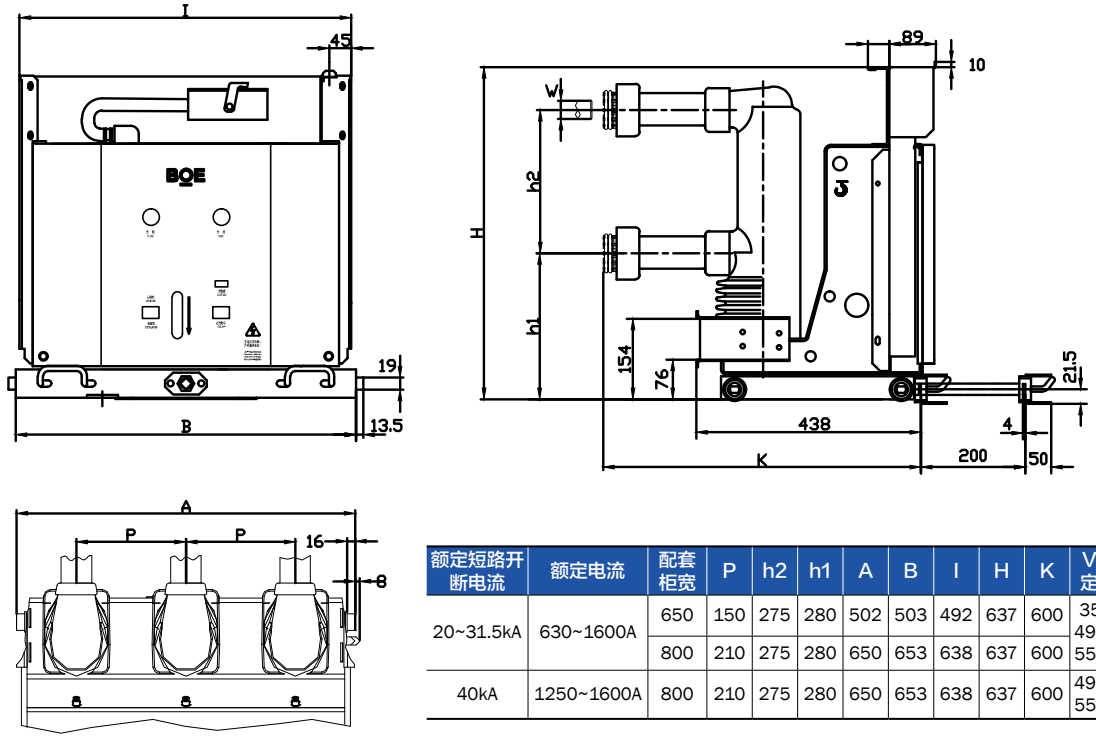
主要技术参数　Main Technical Parameters

序号	参数名称	单位	参数值 Parameters			
1	额定电压 Rate voltage	kV	12			
2	额定频率 Rate frequency	Hz	50/60			
3	短时工频耐受电压（1min） Short-time(1min) power-frequency withstand voltage	kV	相间及对地 42/ 断口 50 Between phases and to the ground 42/ fracture 50			
4	雷电冲击耐受电压 Lightning impulse withstand voltage	kV	相间及对地 75/ 断口 85 Between phases and to the ground 75/ fracture 85			
5	额定电流 Rated current	A	630 1250	630 1250 1600 2000 2500 3150	1250 1600 2000 2500 3150 4000*	1250 1600 2000 2500 3150 4000* 5000*
6	额定短路开断电流 Rated short-circuit breaking current	kA	25	31.5	40	50
7	额定短路关合电流 Rated short-circuit making current	kA	75	95	120	140
8	额定短时耐受电流（4S）Rated short-time withstand current(4s)	kA	25	31.5	40	50
9	额定峰值耐受电流 Rated peak withstand current	kA	75	95	120	140
10	额定短路持续时间 Rated duration of short-circuit	s	4			
11	额定失步开断电流 Rated out-of-phase breaking current	kA	25			
12	额定操作顺序 Rated operating sequence		CO—30min—CO			
13	额定短路开断电流开断次数 Operations of short-circuit breaking current interruption	次	8		5	5
14	机械寿命 Mechanical life	次	10000			
15	直流分量 DC component	%	82			
16	分闸速度 Opening speed（0-6mm）	m/s	0.8 ～ 1.7			
17	合闸速度 Closing speed（6mm-closed）	m/s	0.4 ～ 1.3			

注： 额定电流 4000A 及以上的断路器需增加强制风冷*
▷订货时需与本公司协商

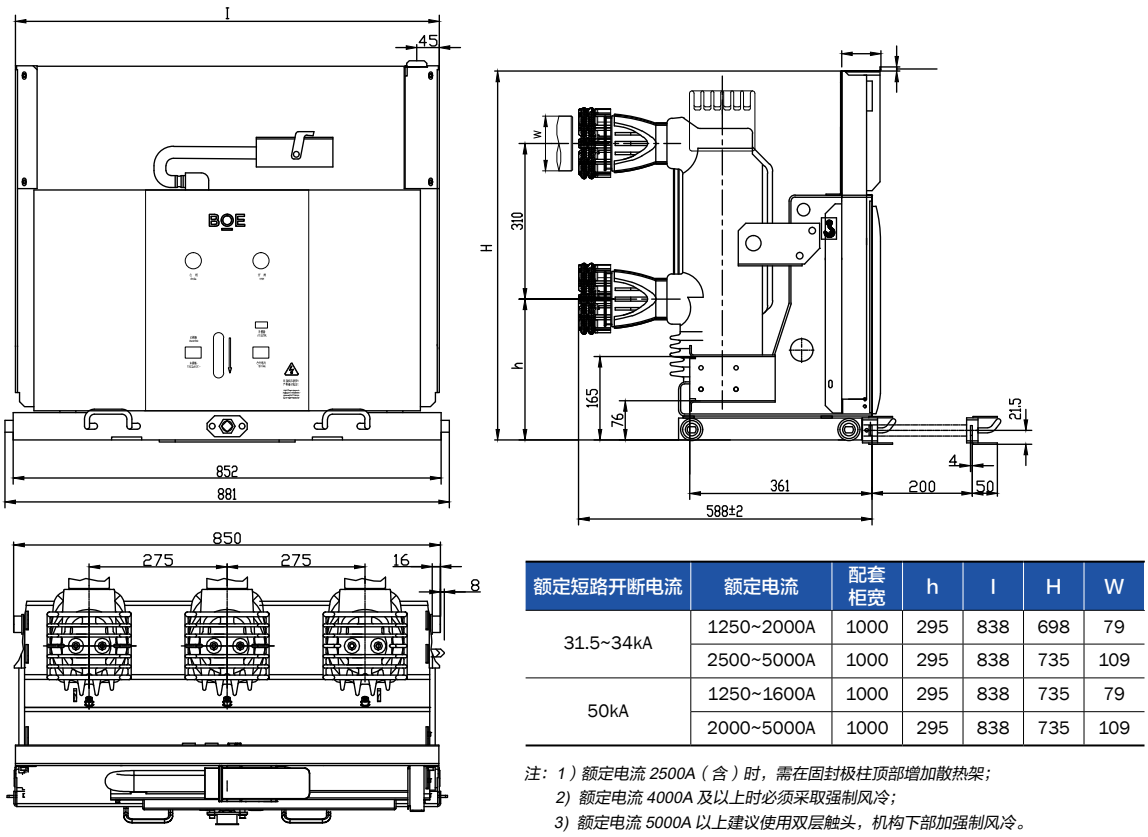
安装尺寸图 Dimension

DVB 型发电机出口断路器外形尺寸，适用于 800mm 柜宽（手车式）Withdrawable circuit-breakers



额定短路开断电流	额定电流	配套柜宽	P	h2	h1	A	B	I	H	K	V（按额定电流）
20~31.5kA	630~1600A	650	150	275	280	502	503	492	637	600	35(630A) 49(1250A) 55(1600A)
		800	210	275	280	650	653	638	637	600	
40kA	1250~1600A	800	210	275	280	650	653	638	637	600	49(1250A) 55(1600A)

DVB 型发电机出口断路器外形尺寸，适用于 1000mm 柜宽（手车式）Withdrawable circuit-breakers



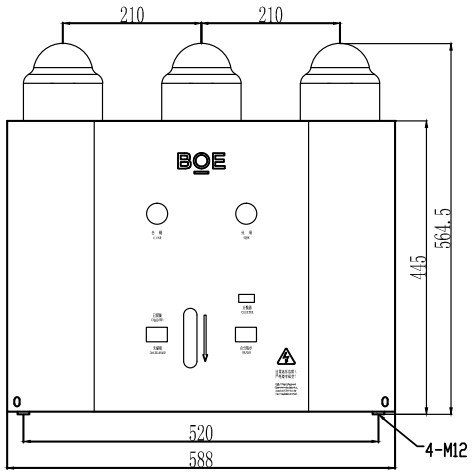
额定短路开断电流	额定电流	配套柜宽	h	I	H	W
31.5~34kA	1250~2000A	1000	295	838	698	79
	2500~5000A	1000	295	838	735	109
50kA	1250~1600A	1000	295	838	735	79
	2000~5000A	1000	295	838	735	109

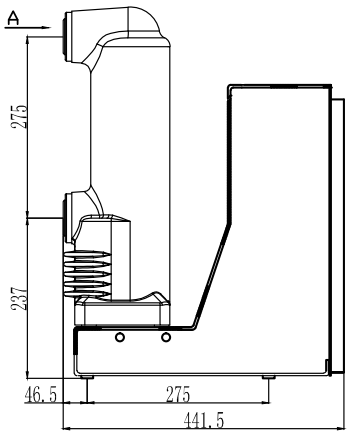
注：1）额定电流 2500A（含）时，需在固封极柱顶部增加散热架；
2）额定电流 4000A 及以上时必须采取强制风冷；
3）额定电流 5000A 以上建议使用双层触头，机构下部加强制风冷。

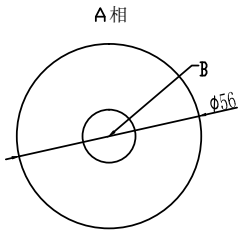
DVB 型发电机出口断路器
DVB Generator Vacuum Circuit Breaker

安装尺寸图 Dimension

DVB 型发电机出口断路器外形尺寸，适用于 800mm 柜宽（固定式）Circuit-breakers for fixed installations

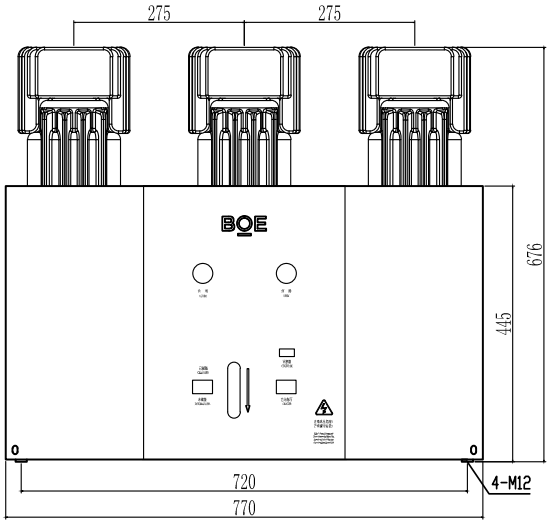


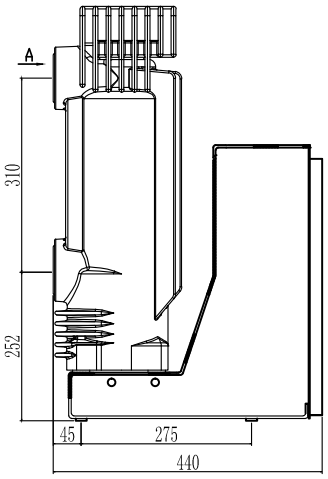


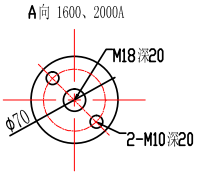


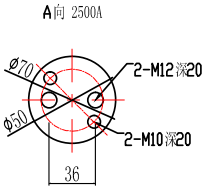
额定电流（A）	开断电流（kA）	B
630~1600A	20、25、31.5	M16 深 22
630~1600A	40	M18 深 22

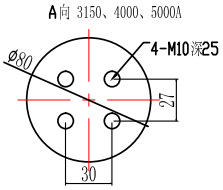
DVB 型发电机出口断路器外形尺寸，适用于 1000mm 柜宽（固定式）Circuit-breakers for fixed installations



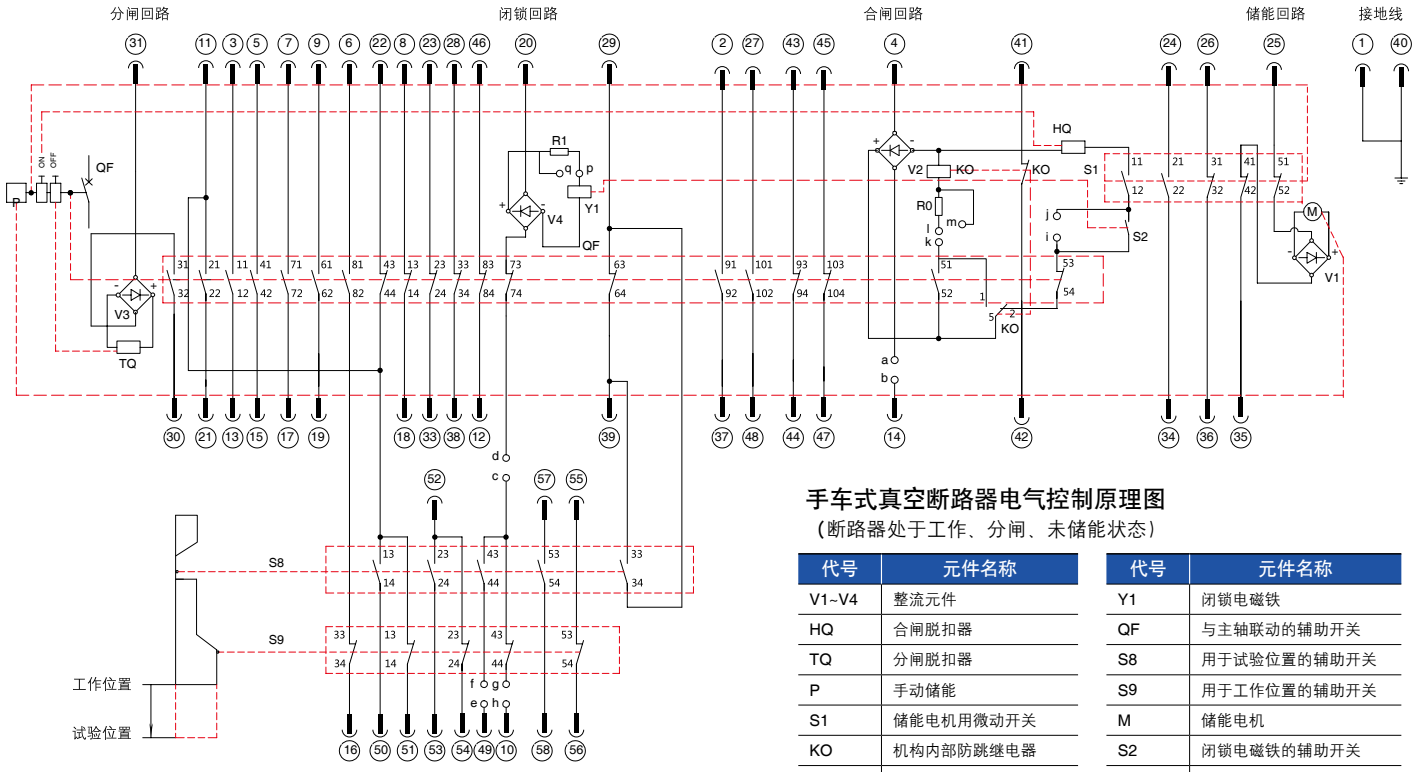








DVB 型发电机出口断路器电气原理图（手车式）Electrical wiring diagram of DVB(withdrawable)



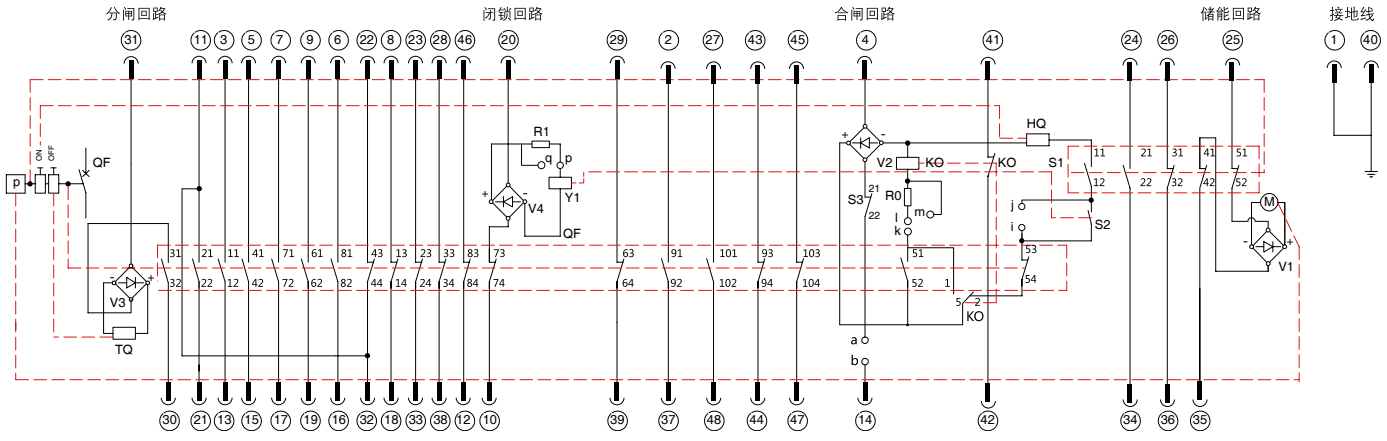
手车式真空断路器电气控制原理图

（断路器处于工作、分闸、未储能状态）

代号	元件名称
V1~V4	整流元件
HQ	合闸脱扣器
TQ	分闸脱扣器
P	手动储能
S1	储能电机用微动开关
KO	机构内部防跳继电器
R0、R1	串联电阻

代号	元件名称
Y1	闭锁电磁铁
QF	与主轴联动的辅助开关
S8	用于试验位置的辅助开关
S9	用于工作位置的辅助开关
M	储能电机
S2	闭锁电磁铁的辅助开关

DVB 型发电机出口断路器电气原理图（固定式）Lectrical wiring diagram of DVB(fixed)



固定式真空断路器电气控制原理图

（断路器处于分闸、未储能状态）

代号	元件名称
S3	联锁辅助开关
V1~V4	整流元件
HQ	合闸脱扣器
TQ	分闸脱扣器
P	手动储能
S1	储能电机用微动开关

代号	元件名称
KO	机构内部防跳继电器
R0、R1	串联电阻
QF	与主轴联动的辅助开关
M	储能电机
Y1	闭锁电磁铁
S2	闭锁电磁铁的辅助开关

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