



SmartEx

MVG高压真空断路器

SmartEx MVG
High-Voltage Vacuum Circuit Breaker

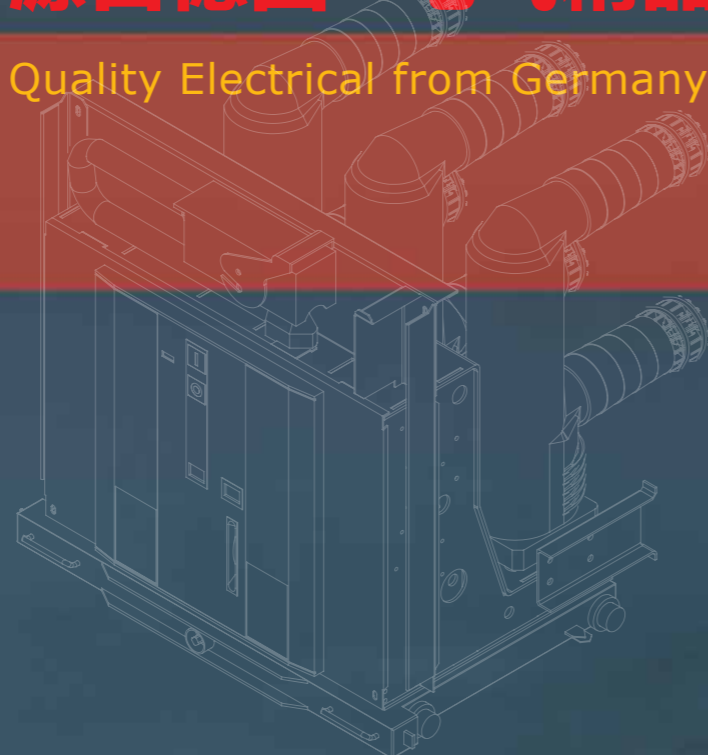


alsburg

阿斯博开关

源自德国 电气精品

Quality Electrical from Germany



SmartEx MVG 系列智能型固封式真空断路器源自德国，系德国ALSBURG公司为满足中国市场对高品质真空断路器的需求，并且兼顾与国内主流开关柜的适配需要，而推出的新一代智能型真空断路器。

SmartEx MVG series intelligent enclosed type high voltage vacuum circuit breaker are from Germany, which specialized for Chinese market on the demand for high-quality vacuum circuit breakers and switchgear both the mainstream and the adaptation of domestic needs, introduce a new generation of intelligent Vacuum circuit breakers.



▶ 公司简介

▶ 智能开关

▶ 中压生产

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SmartEx MVG-40.5 系列高压真空断路器

MVG-40.5 Type High Voltage Vacuum Circuit Breaker

24

- 德国阿斯博荣誉产品，品质卓越。
- 适合未来电网和物联网的智能化发展要求。
- 新一代12kV智能型真空断路器。

Honorable product from Alsburge with premium quality.

Which are suitable for the Grid in the future.

A new generation of intelligent 12kV vacuum circuit breaker.

产品概述

Overview

总则

SmartEx MVG系列真空断路器是具备智能在线监测功能的新型真空断路器，在断路器投入运行的过程中，它可以对断路器的运行状况进行同步实时监控，确保断路器始终如一地安全运行。选用SmartEx，不仅可以主动管理运行风险，而且可以实现真正意义上的免维护，符合智能电网建设对于开关元件的功能要求。

技术特点

- 主导电路采用固体绝缘固封柱或套筒式的结构形式；
- 超长使用寿命，高度可靠的模块化弹簧操动机构；
- 具备SmartEx在线监测功能，能实时反映断路器的运行状态，针对开关设备潜在故障及时报警；
- 满足智能电网对开关元件的功能要求，主动管理运行风险；
- 完全满足GB1984、DL/T403、IEC62271-100、VDE0670及其他先进工业化国家的标准规范要求。

试验

SmartEx MVG系列真空断路器已通过了以下的各种试验，可以确保其在正常使用条件下安全运行。

- 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、短路电流开合能力及电缆充电电流开合试验。
- 出厂试验：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。

General

SmartEx MVG vacuum circuit series are the new ones with real-time monitoring function to ensure safety. With SmartEx, risks can be managed actively and truly maintenance-free can be enjoyed.

Technical Features

- Main circuit uses solid insulation and solid-sealing or sleeve-type structure.
- Ultra-long service life, and highly reliable modular spring operating mechanism;
- Online real-time monitoring function and alarm to latent risks.
- Meet the functional requirement for the switch element by the intelligent grid, and manage operation risks actively;
- Fully meet the requirements of GB1984, DL/T403, IEC62271-100, VDE0670 and standards and codes of other advanced industrialized countries.

Test

SmartEx MVG series vacuum circuit breaker passed following tests, to ensure safe operation under normal operating conditions.

- Type test: power frequency withstand voltage, lightning impulse withstand voltage, temperature rise, short-duration and peak value withstand voltage, short circuit current switching capability and cable charging current switching test.
- Delivery test: mechanical characteristic test, main circuit power frequency withstand voltage test, auxiliary and control circuit insulation performance test, main circuit resistance test, interlocked operation test, mechanical and electrical operation test.

应用场合

- SmartEx MVG系列真空断路器可广泛用于电网、电厂、冶金、石化、城市基础设施建设如机场、楼宇、地铁等项目；
- SmartEx MVG系列真空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。

安全运行

SmartEx MVG系列真空断路器拥有完善的机械和电气联锁装置，同时具有极高的操作可靠性与使用寿命，配合适当的开关柜可完成安全的配电功能，同时可确保操作者及设备的安全。

Applications

- SmartEx MVG series can be extensively applied to the grid, power plant, metallurgy, petrochemical, urban infrastructure construction, such as airport, buildings, subway, etc.
- In the power distribution system, SmartEx MVG series can be applicable to control and protective cable, overhead line, transformer, motor, generator and capacitor bank.

Safe Operation

SmartEx MVG series has complete mechanical and electrical interlocking device, and extremely high operation reliability and long service life, and can work with appropriate switch cabinet to perform safe power distribution function, while ensuring safety of the operators and equipment.



首先是安全，然后才有其他...

The first is security, and then have the other ...



断路器运行状态参数即时向远程传输，运行状态一目了然尽在掌握。
 Real-time remote transmission of operation status of the circuit breaker, operation status一目了然尽在掌握。

SmartEx

Product No.	A011079901		A011079902
Switch cabinet No.	DL00389		DL00390
Application	Heavy plate 1#		Heavy plate 2#
Mblent temperature	41 °C		41 °C
Phase A temperature	95 °C	Normal	97 °C
Phase A temperature rise	44 °C	Normal	46 °C
Phase B temperature	97 °C	Normal	97 °C
Phase B temperature rise	46 °C	Normal	46 °C
Phase C temperature	95 °C	Normal	96 °C
Phase C temperature rise	44 °C	Normal	45 °C
...			
Phase A overtravel	3.5 mm	Normal	3.4 mm
Phase B overtravel	3.4 mm	Normal	3.4 mm
Phase C overtravel	3.5 mm	Normal	3.4 mm
...			
Condition of phase A vacuum degree	Normal	Normal	Normal
Condition of phase A vacuum degree	Normal	Normal	Normal
Condition of phase A vacuum degree	Normal	Normal	Normal
...			
Opening speed	1.17 m/s	Normal	1.13 m/s
Asynchronous opening	0.1 ms	Normal	0.0 ms
Closing speed	0.71 m/s	Normal	0.69 m/s
Asynchronous closing	0.2 ms	Normal	0.1 ms
Phase A closing bounce	0.0 ms	Normal	0.3 ms
Phase B closing bounce	0.0 ms	Normal	0.0 ms
Phase C closing bounce	0.1 ms	Normal	0.0 ms
...			
Secondary control circuit status	Good	Normal	Good
...			
Closing electromagnet current	1.07 A	Normal	1.06 A
Closing electromagnet voltage	220 V	Normal	220 V
Opening electromagnet current	1.09 A	Normal	1.08 A
Opening electromagnet voltage	220 V	Normal	220 V

零风险运行

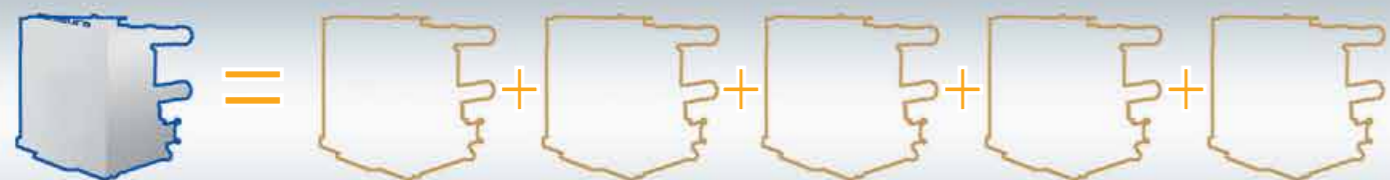
Zero-risk operation

SmartEx MVG智能型真空断路器能够针对潜在故障进行实时在线智能监测，提前发现安全隐患，主动管理运行风险...

SmartEx MVG intelligent vacuum circuit breaker can detect the latent by real-time monitoring and manage the operation risk.

1台 = 5台!

One set = Five sets!



长寿命, 更可靠

Longer life span and more reliable

换个角度, 更能看见品质的价值!

See the value of the quality from another angle



1



模块化设计, 结构简单, 动作可靠

Modular design, simple structure, reliable operation

2



关键零部件源自德国专业制造商

The key components are from professional Germany manufacturer.

3



先进的制造和检测设备

Advanced manufacturing and testing equipment

4



通过从不间断的机械寿命试验来持续优化

Constant optimization by continuous mechanical lifespan test.



没有断断续续，只有始终如一

No intermittence, only consistence



断路器的功能是载流、控制和保护，其职能和价值是确保电力系统和用户设备的安全运行，而不是被维护、被检修……

The function of the breaker is to carry current, to control and protect the safe circulation of the system.



SmartEx智能断路器 SmartEx Intelligent Circuit Breaker



传统普通断路器 Traditional Ordinary Circuit Breaker



真正意义上的 免维护断路器

Truly maintenance-free circuit breaker

SmartEx MVG真空断路器因为具备Smart在线监测技术而成为真正意义上的免维护断路器。该技术能针对性地对真空断路器的运行状态进行在线监测，掌握断路器的实时运行状况，从而可以实现检修维护方式的彻底变革，即由传统的定期检修方式转变为状态检修(CBM)方式。

SmartEx MVG series are the truly maintenance-free breaker with the online-realtime monitoring technology. This technology can realize the revolution of the maintenance from traditional scheduled maintenance to CBM.

	传统普通断路器 Traditional normal circuit breaker	SmartEx MVG智能断路器 SmartEx intelligent circuit breaker
检修维护方式 Inspection and maintenance method	定期检修：只能采用人为制定检修周期、没有针对性的盲目检修 Regular inspection: only the inspection cycle established by people can be adopted, and the inspection is aimless without any target.	状态检修(CBM): Condition Based Maintenance 是指根据状态监测和诊断技术提供的信息，对设备的运行状态进行自动评估，正常状态下免于维护，只在故障发生前才进行检修的维护方式。 Condition based maintenance(CBM): refers to the maintenance method in which automatic evaluation is made on equipment running condition based on the information provided by condition monitoring and diagnostic techniques, and maintenance can be exempted under normal status and the inspection is carried out only before occurrence of fault.
检修维护的主要项目 Main items of inspection and maintenance	<ul style="list-style-type: none"> 绝缘试验检测灭弧室真空度完好状况； 超行程检测； 导电连接检测； 操动机构检测 	不需要 No need
弊端 Disadvantages	<ul style="list-style-type: none"> 定期检修是采用离线方式进行，从而增加了不必要的停电时间，降低了设备使用效率； 定期检修是没有针对性的盲目检修，势必造成人力物力的浪费； 定期检修无法完全排除故障隐患； 定期检修甚至会因为过度维修引入新的故障隐患； 	-
优势 Advantages	<ul style="list-style-type: none"> Regular inspection is carried out in off-line mode, thus increasing unnecessary outage period, and reducing equipment service efficiency; Regular inspection is aimless without any target, bound to cause waste of manpower and material resources; Regular inspection cannot fully eliminate potential failure; Regular inspection can even bring in new potential failure due to excessive repair; 	<ul style="list-style-type: none"> 实施状态检修是依据开关设备运行状态信息，在线评估设备的运行状况，大大提高设备运行效率； 实施状态检修可以实时监测开关设备运行状态，提前发现可能的故障隐患，确保设备安全可靠运行； 实施状态检修避免了不必要的维修对开关设备的损坏，增加了设备使用年限； 实施状态检修可以减少检修的人力物力投入，从而大幅降低运行维护费用；

SmartEx 智能在线监测

SmartEx online monitoring



4大在线监测/检测功能

Four online monitoring/detecting functions

断路器常见且无法预报的故障

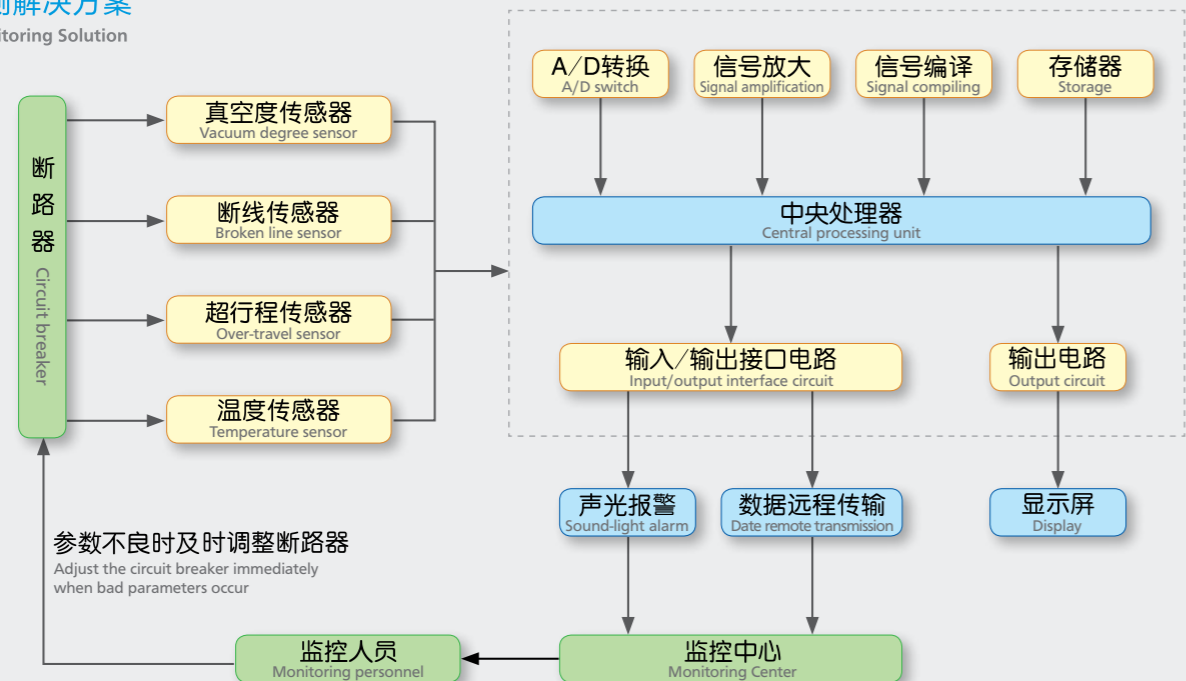
Common but Unpredictable Failure of Circuit Breaker

- 二次控制回路故障，最常见的是跳闸线圈烧损，在故障来临时无法跳闸；
- 主回路温度过高，引发绝缘材料老化、失效，进而造成设备烧损；
- 真空灭弧室漏气丧失分断能力；
- 断路器在运行一段时间开断短路电流能力下降，同时电寿命下降。

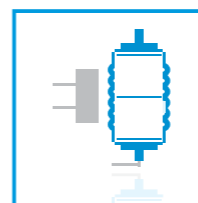
- Failure of secondary control circuit; the most common cause is the burn-out of trip coil, making the breaker unable to trip in the event of failure;
- The high temperature of the main circuit causes the insulation materials to be aging and ineffective, resulting the burn-out of the equipment;
- The vacuum arc-extinguishing chamber leaks gas, resulting the loss of analytical ability;
- After a period of operation, the breaker has weakened ability to disconnect the short-circuit current, and the electrical durability is shortened.

在线监测解决方案

On-line Monitoring Solution



1



灭弧室真空度

Vacuum degree of arc distinguishing chamber

原因 Cause

- 由于制造工艺和材料原因导致的慢性漏气
- 灭弧室波纹管在机械动作过程中产生裂纹导致漏气
- 触头材料内部气体缓慢释放

后果 Consequence

灭弧室真空度的降低不仅会导致绝缘性能的恶化，而且会使灭弧室的开断能力下降甚至丧失，使得断路器不能切断短路故障，从而引发设备爆炸等严重事故。

功能 Function

- SmartEx可以对灭弧室的真空度状况在线实时监测。
- SmartEx在断路器上装有用于监测灭弧室真空度的传感装置，当灭弧室的真空度发生异常并超过允许值时，该装置会自动发出警告信号，提醒运行人员及时作出检查。确保断路器不会在已丧失分断能力的状态下长期运行，杜绝分断失败故障的发生。

意义 Significance

目前针对灭弧室真空度是否完好的检测方法，通常采用的是工频耐压试验法，其存在突出的不足：

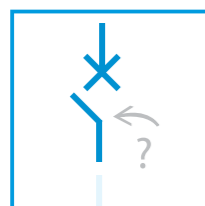
1. 只能断电离线时才能进行试验检测，因此不仅增加人力物力、降低设备运行效率，而且并不能及时发现故障；
2. 这种间接检验的方法对断路器本身是有一定损害的。



选用SmartEx则可对灭弧室真空度进行实时在线监测，彻底杜绝因为真空度降低而导致的短路开断失败故障。

Selecting SmartEx can perform real-time on-line monitoring for the vacuum degree of the arc extinguishing chamber, putting an end to short circuit breaking failure due to reduction of vacuum degree.

2



断路器分闸回路 Circuit breaker opening loop

功能 Function

SmartEx真空断路器跳闸控制回路监测系统可以在断路器运行过程中连续自动检测回路的完好性，一旦发生断路就会自动发出告警信号，确保断路器在故障来临时可靠跳闸。

SmartEx vacuum circuit breaker tripping control circuit monitoring system can detect the circuit integrity continuously automatically during circuit breaker operation. Once the circuit break occurs, it will give alarm signal automatically to ensure reliable tripping of the circuit breaker when the failure occurs.



3



主导电回路温升 Temperature rise of main conductive circuit

原因 Cause

- 一次动静触头配合误差
- 在设备运行中导电固定连接松动
- 真空灭弧室动静触头接触压力减小
- 一次动触头压力弹簧稳定性不够
- 设备过载运行
- 开关柜散热条件不好
- ... 等等原因

- Fit error between primary moving and fixed contacts
- Loosened conductive fixed connection during equipment operation
- Reduction of contact pressure of moving and fixed contacts of the vacuum arc extinguish chamber
- Insufficient stability of the pressure spring of the primary moving contact
- Overload operation of the equipment
- Poor heat dissipation condition of the switch cabinet
-other causes

后果 Consequence

一次主导电回路产生过热现象，从而损害开关设备的绝缘强度和机械强度，极易引发短路或者烧毁事故。

Primary main conductive circuit overheats, thus damaging the insulation strength and mechanical strength of the switchgear, causing short circuit or burnout accident easily.

功能 Function

- SmartEx可以对一次主导电回路的温升状况在线实时监测
- SmartEx在断路器的动触头侧安装有温度传感器，可以在断路器通电运行的状态下，监测各回路温度，并通过无线传输的方式传递给接收显示装置；接收到的数据经处理后于环境温度进行比较，从而得到断路器的实时温升数据。
- 当温升超过用户设定数值时，装置会及时自动报警，提醒运行人员进行检修维护。
- 记录一段时间运行的温升历史数据，通过分析可以进一步准确分析断路器的运行状况

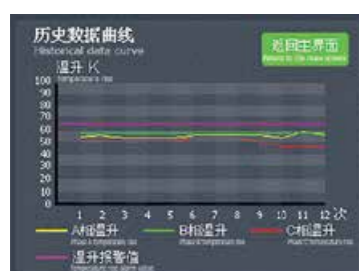
- SmartEx can perform on-line real-time monitoring for temperature rise condition of the primary main conductive circuit.
- SmartEx is provided with the temperature sensor on the moving contact side of the circuit breaker, which can monitors temperature of each circuit while the circuit breaker is energized and operating, and transmit to the receiving and display device through wireless transmission mode; the received data after treated will be compared with ambient temperature, thereby obtaining real-time temperature rise data of the circuit breaker.
- When the temperature rise exceeds the data set by users, the device will alarm automatically in time to alert operating personnel to carry out inspection and maintenance.
- Record the temperature rise historical data of a period of operation, and further analyze accurately the operating condition of the circuit breaker through analysis.

意义 Significance

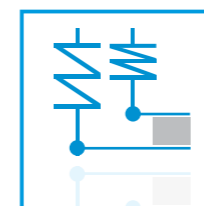
通过对主导电回路的在线实时监测，能准确获取并直观显示各测温点的即时温升及历史变化趋势，并且能对过热位置进行提前准确报警，从而实现了：

针对设备过热的早期预防，确保设备安全运行，并能指导检修工作。

Through on-line real-time monitoring for the main conductive circuit, it can obtain and display intuitively instant temperature rise and historical change trend of each temperature measurement point accurately, and can carry out accurate alarm in advance for overheating positions, thereby achieving: Early prevention of equipment overheating, ensuring safe equipment operation and guiding maintenance.



4



断路器超行程 Circuit breaker overtravel

原因 Cause

- 动静触头在合分过程中的电磨损
- 动静触头在操作过程中的机械变形
- 连接紧固件松动

- Electrical wear of the moving and fixed contacts during closing and opening process
- Mechanical deformation of the moving and fixed contacts during operation process
- Loosening of the connecting fasteners

后果 Consequence

超行程的过度变化会导致：

1. 动静触头接触压力下降，引起主回路过度发热；
2. 导致合闸弹跳加大，分闸速度降低，从而影响断路器的关合和分断能力

Excessive overtravel will lead to:

1. Reduction of contact pressure of the moving and fixed contacts, causing excessive overheating of the main circuit;
2. Increase of closing bouncing, and reduction of opening speed, thus affecting the closing and breaking capacity of the circuit breaker.

功能 Function

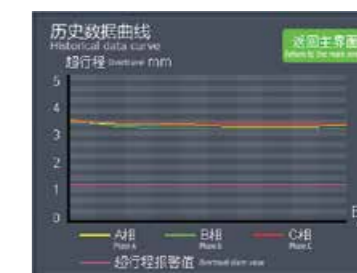
- SmartEx超行程在线检测装置在断路器主回路侧安装有传感器
- 可记录断路器超行程的变化情况，合闸一次记录一次
- 检测精度高：精度可达0.1mm；
- 随时报警：检测数据超出用户设置的报警值时，会发出警告，提醒运行人员及时调整。

- SmartEx overtravel on-line detection device is provided with the sensor on the main circuit side of the circuit breaker
- Overtravel change condition of the circuit breaker can be recorded, recording at each time of closing
- High detection accuracy: accuracy up to 0.1 mm;
- Alert always: when the detected data exceeds the alarm value set by users, it will give alarm to alert operating personnel to adjust in time.

意义 Significance

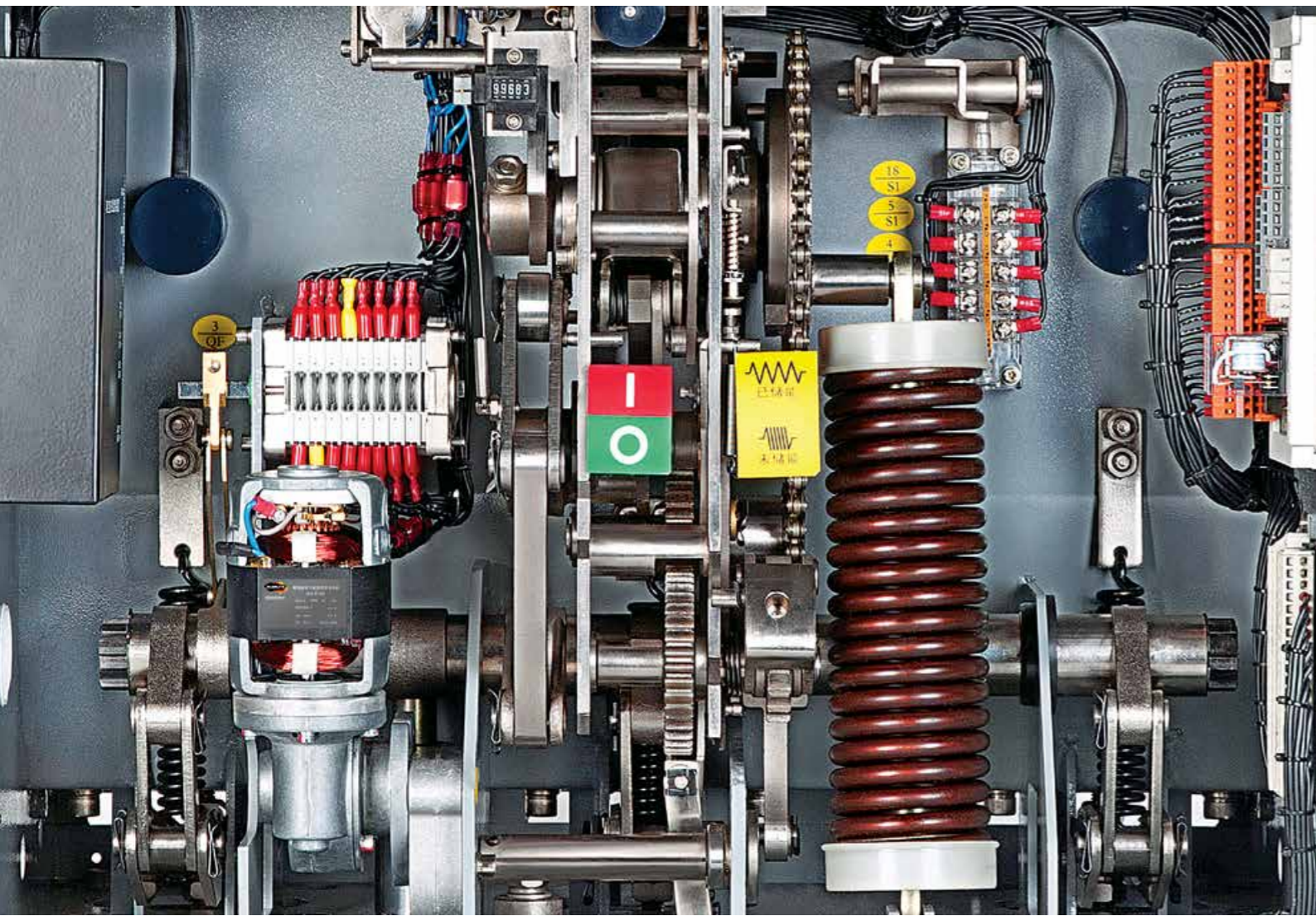
超行程是断路器的重要参数，直接关系到断路器主回路接触电阻、开断和关合能力。选用SmartEx可对断路器的超行程进行实时在线监控，彻底杜绝因为超行程异常而导致的各种故障。

Overtravel is an important parameter of the circuit breaker, and directly related to the contact resistance, breaking and closing capacity of the circuit breaker's main circuit. Selecting SmartEx can perform real-time on-line monitoring for overtravel, putting an end to various failures due to abnormal overtravel.



一体化模块式弹簧操动机构

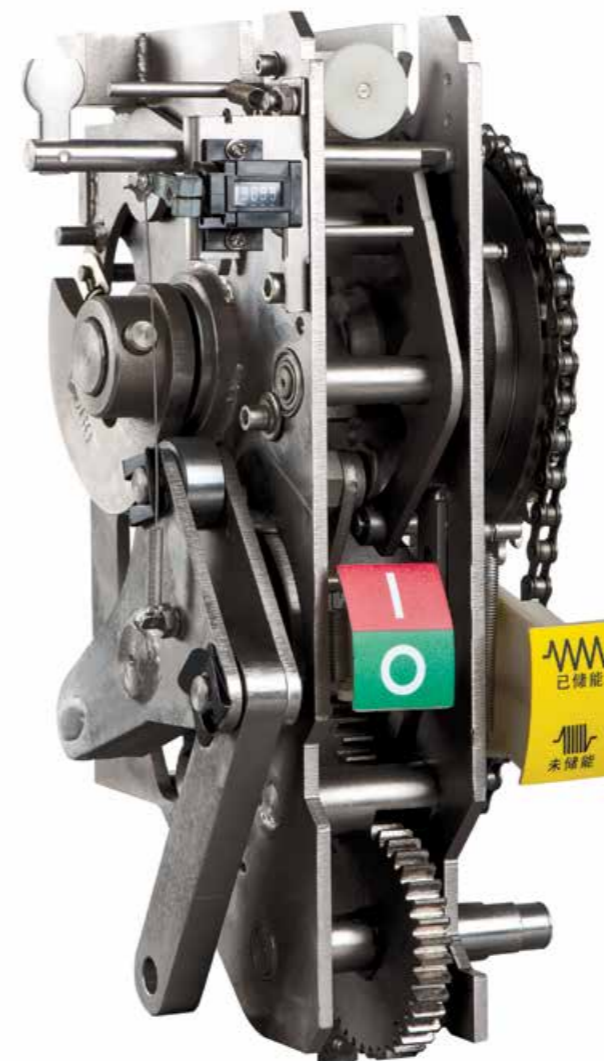
Intergrated modular spring operating mechanism



SmartEx MVG断路器采用一体化、模块式弹簧操动机构，该操动机构结构简单、动作可靠，产品系列化完整，该产品的全套技术由德国Alsborg提供，关键零部件原装进口。

该弹簧操动机构的输出特性完全符合真空灭弧室开断性能的要求，产品的每一细节力求做到精益求精，注重过程控制，大部分机构零件采用镀镍磷合金处理，大大提高了零部件的防腐能力，确保断路器始终如一的稳定品质。

SmartEx MVG series circuit-breaker uses intergrated modular spring operating mechanism, which is simple, reliable with a complete seriation. The whole technology is provided by Alsborg in Germany, and the key components are all imported originally. The spring operating mechanism totally conforms to the breaking phenomena of the vacuum interrupter. Every detail of the product is endeavored to the best by strictly control of the manufacturer. And almost all the components are dealt with nickel-phosphorus alloy that strongly improves the resisibility of corrosion to ensure the stability of the breaker.



一体化模块式弹簧操动机构

Intergrated modular spring operating mechanism



微动开关

结构简单，动作可靠，开断电流能力强。

Micro Switch

Simple and reliable structure, Outstanding breaking



凸轮机构

特殊设计的凸轮曲线，通过能量分配，较好的实现了合闸能量与主回路负载两者特性的完美匹配。

Cam

Specially designed cam curve. Perfectly matching of the closing energy and the main circuit load by distribution of the energy.

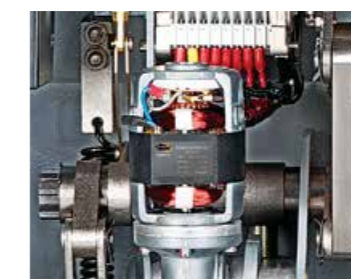


线路板

模块化二次控制线路板，采用带自扣紧的插接头，既方便更换，也保证了电气连接的可靠性。

PCB

Modular double-control board uses self-clinching coupling that is convenient and reliable.



储能电机

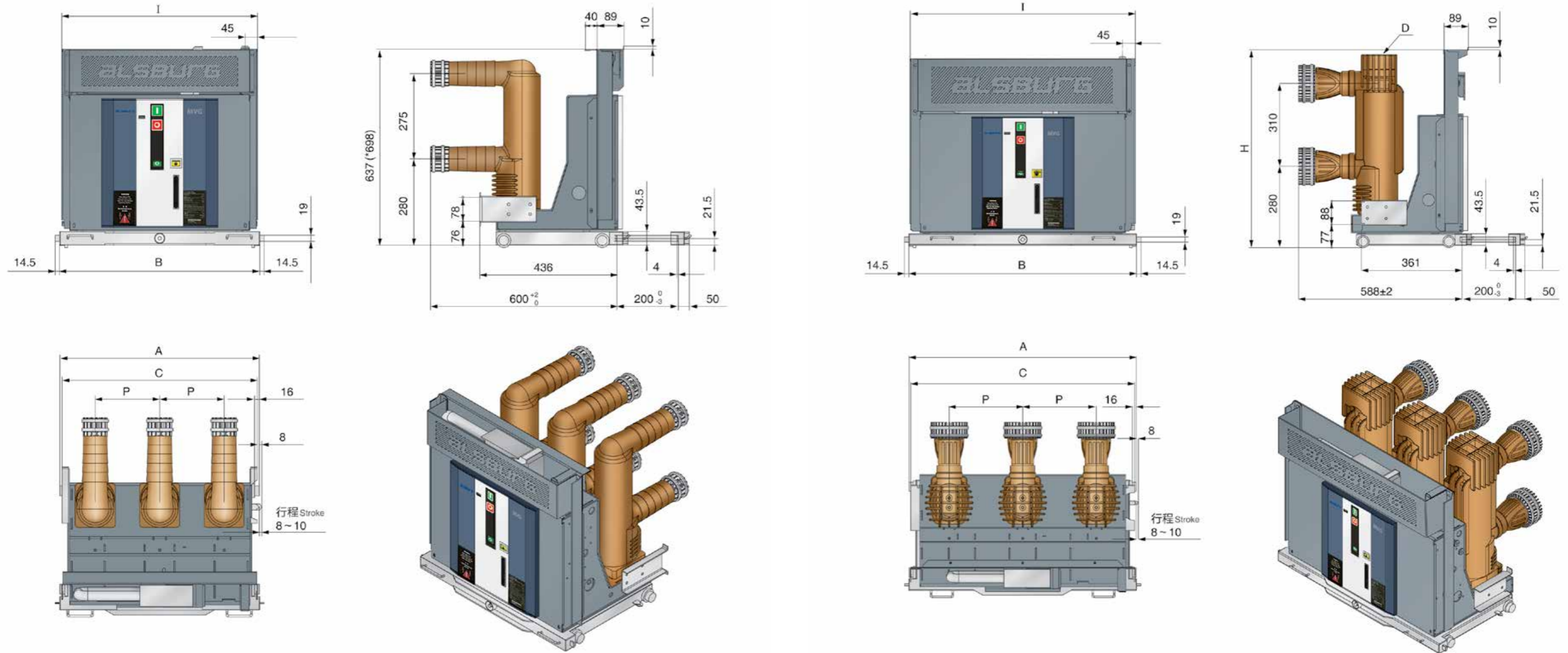
通过蜗轮蜗杆变速，可以得到很大的传动比，具有自锁性。

Electrical energy storage

Gain high transmission ratio by controlling speed with worm gear, and the device possesses self-locking function.

SmartEx MVG 智能型固封式真空断路器 (手车式) 外形尺寸

SmartEx MVG intelligent solid-sealing vacuum circuit breakers (handcart type) Dimensions



额定电流 (A) Rated current	额定短路开断电流 (kA) Rated short-circuit breaking current	P (mm)	A (mm)	B (mm)	C (mm)	I (mm)	配套柜宽 (mm) Supporting cabinet width	动静触头配合尺寸 Fit dimension of dynamic and static contacts	额定电流 (A) Rated current	梅花触头 Tulip contact	静触头尺寸 Static contact dimension
630 ~ 1250	20...*50	150	502	503	492	492	650		630	CT-24	Ø35
630 ~ 1600		210	650	653	640	638	800		1250	CT-30	Ø49
		275	850	853	838	842	1000		1600	CT-36	Ø55

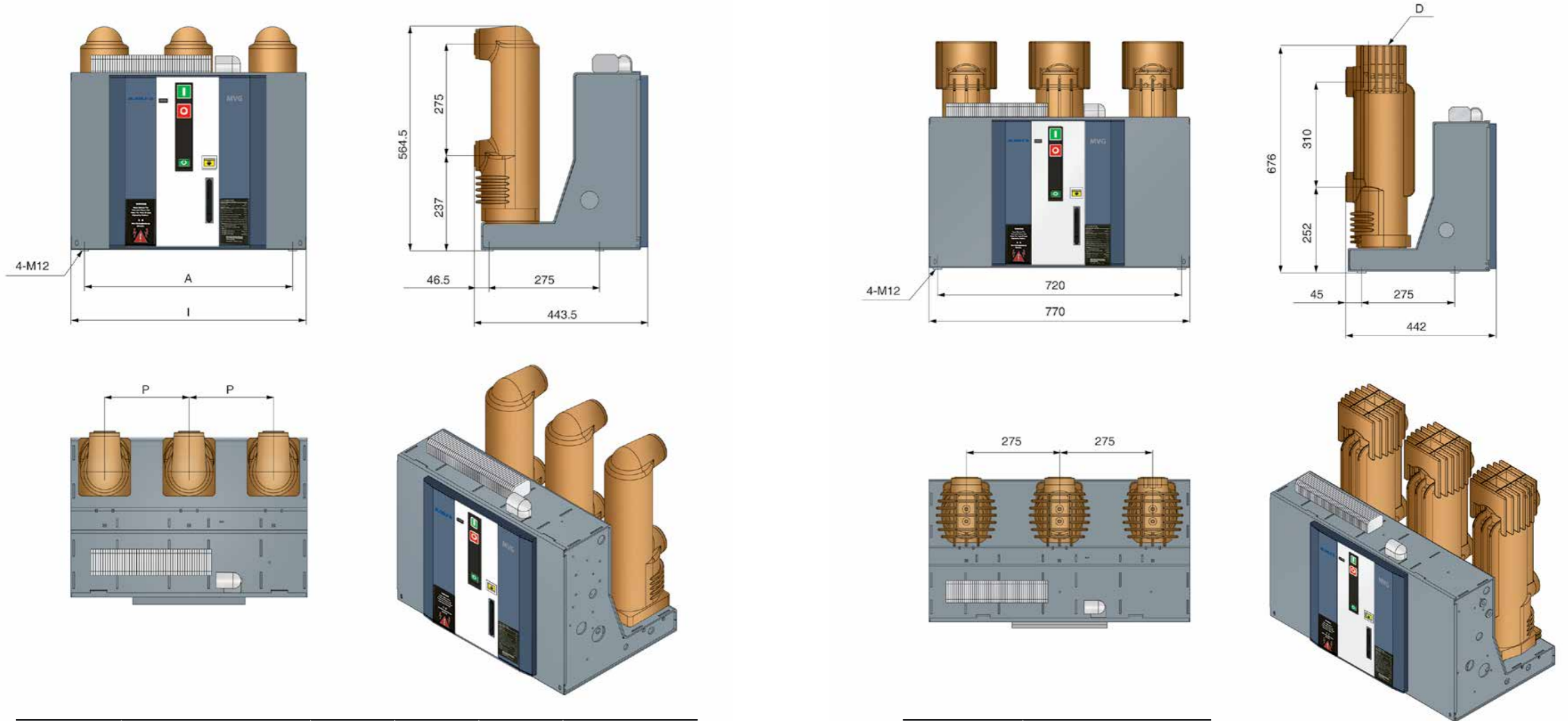
- 主回路采用固封极柱
Main circuit adopts solid-sealed post terminal
- 图示中 (*698) 为相间距275的封板高度的可选方案
(*698) in the drawing is the alternative of the sealing plate height with the phase spacing 275
- *此规格为特殊型号, 订货前请与本司技术人员联系
*This specification is the special model, please contact our technical personnel before placing orders

额定电流 (A) Rated current	额定短路开断电流 (kA) Rated short-circuit breaking current	P (mm)	A (mm)	B (mm)	C (mm)	H (mm)	I (mm)	配套柜宽 (mm) Supporting cabinet width	动静触头配合尺寸 Fit dimension of dynamic and static contacts	额定电流 (A) Rated current	梅花触头 Tulip contact	静触头尺寸 Static contact dimension
1600 ~ 2000	31.5...*50	275	850	853	838	698	842	1000		1600 ~ 2000	CT-48	Ø79
2500 ~ 4000		275	850	853	838	735	842			2500 ~ 3150	CT-64	Ø109
*4000		50								4000	CT-82	

- 主回路采用固封极柱
Main circuit adopts solid-sealed post terminal
- 当额定电流2500A及以上时, 断路器须带冷却罩D
When the rated current is 2500A and above, the circuit breaker shall be provided with cooling shroud D
- 采用强迫风冷时, 额定电流可达4000A
When forced air cooling is adopted, the rated current is up to 4000A
- *此规格为特殊型号, 订货前请与本司技术人员联系
*This specification is the special model, please contact our technical personnel before placing orders

SmartEx MVG 智能型固封式真空断路器（固定式）外形尺寸

SmartEx MVG intelligent solid-sealing vacuum circuit breakers (handcart type) Dimensions



额定电流 (A) Rated current	额定短路开断电流 (kA) Rated short-circuit breaking current	P (mm)	A (mm)	I (mm)	配套柜宽 (mm) Supporting cabinet width
630 ~ 1250	20...*50	150	410	460	650
630 ~ 1600		210	520	588	800
		275	720	770	1000

额定电流 (A) Rated current	额定短路开断电流 (kA) Rated short-circuit breaking current
1600 ~ 4000	31.5...*50
*4000	50

- 主回路采用固封极柱
Main circuit adopts solid-sealed post terminal
- *此规格为特殊型号，订货前请与本司技术人员联系
*This specification is the special model, please contact our technical personnel before placing orders

- 主回路采用固封极柱
Main circuit adopts solid-sealed post terminal.
- 当额定电流2500A及以上时，断路器须带冷却罩D
When the rated current is 2500A and above, the circuit breaker shall be provided with cooling shroud D.
- 采用强迫风冷时，额定电流可达4000A
When forced air cooling is adopted, the rated current is up to 4000A.
- *此规格为特殊型号，订货前请与本司技术人员联系
*This specification is the special model, please contact our technical personnel before placing orders

主要技术参数

Main Technical Parameters

项 目 Item	单位 Unit	技术数据 Technical data				
额定电压 Rated voltage	kV	12				
额定绝缘水平 Rated insulation level	额定短时工频耐受电压 (1min) Rated power-frequency short-duration withstand voltage(1min)	kV	42			
	额定雷电冲击耐受电压 (峰值) Rated lightning impulse withstand voltage (peak value)	kV	75			
额定频率 Rated frequency	Hz	50				
额定电流 Rated current	A	630	630	1250	1250	3150 4000
		1250	1250	1600	1600	
额定短路开断电流 Rated short-circuit breaking current	kA	20	25	31.5	40	50
额定短时耐受电流 Rated short-time withstand current	kA	20	25	31.5	40	50
额定峰值耐受电流 Rated peak withstand current	kA	50	63	80	100	125
额定短路关合电流 (峰值) Rated short-circuit making current (peak value)	kA	50	63	80	100	125
4s热稳定电流 4s thermal stability current	kA	20	25	31.5	40	50
额定动稳定电流 Rated dynamic current	kA	50	63	80	100	125
额定电容器组合涌流 Rated capacitor bank inrush making current	kA	12.5 (频率不大于1000Hz/frequency not more than 1000Hz)				
额定单个/背对背电容器组开断电流 Rated single/back-to-back capacitor bank breaking current	A	630 / 400				
额定短路持续时间 Rated duration of short-circuit	S	4				
二次回路工频耐受电压 Power-frequency withstand voltage of secondary circuit	V	2000				
额定操作电压 Rated operational voltage	合闸线圈 Closing coil	V	AC 110 / 220 DC 110 / 220			
	分闸线圈 Opening coil	V	AC 110 / 220 DC 110 / 220			
	储能电机 Energy-storage motor	V	AC 110 / 220 DC 110 / 220			
分闸时间 (额定电压) Opening time (rated voltage)	ms	20 ~ 50				
合闸时间 (额定电压) Closing time (rated voltage)	ms	30 ~ 70				
动、静触头允许磨损累计厚度 Permit abrasion total thickness of dynamic and static contacts	mm	3				
储能时间 Energy storage time	s	≤ 15				
触头开距 Clearance between open contacts	mm	9 ± 1				
接触行程 Contacting travel	mm	3 ~ 4				
触头合闸弹跳时间 Jump time of contact close brake	ms	≤ 2				
三相分、合闸不同期性 Three-phase opening, closing non-synchronism	ms	≤ 2				
平均分闸速度 ¹ Average opening speed ¹	m/s	0.9 ~ 1.3				
平均合闸速度 ² Average closing speed ²	m/s	0.4 ~ 1.0				
触头分闸反弹幅值 Contact opening rebound amplitude	mm	≤ 2				
主导回路电阻 Main galvanic circle resistance	μΩ	≤ 55 (630A)				
		≤ 45 (1250A)				
		≤ 35 (1600A ~ 2000A)				
		≤ 25 (2500A以上 / above 2500A)				
触头合闸接触压力 Contact closing rebound amplitude	N	2000 ± 200 (20kA)				
		2400 ± 200 (25kA)				
		3100 ± 200 (31.5kA)				
		4750 ± 200 (40kA)				
额定操作顺序 ³ Rated operating sequence ³		分 Opening - 0 - 合分 Closing opening - 180s - 合分 Closing opening				
机械寿命 Mechanical life	次	50000 (31.5kA及以下 / 31.5kA and below)				
		20000 (40kA及以上 / 40kA and above)				

1. 平均分闸速度是指断路器触头刚分后6mm的平均速度;
The average opening speed refers to the average speed of 6mm after the circuit breaker contact is just opened;

2. 平均合闸速度是指断路器触头全开距平均速度;
The average closing speed refers to full clearance average speed of the circuit breaker contact;

3. 当额定短路开断电流 < 40kA时, θ = 0.3s; 当额定短路开断电流 ≥ 40kA时, θ = 180s。
When the rated short-circuit breaking current is < 40kA, θ = 0.3s, when the rated short-circuit breaking current is ≥ 40kA, θ = 180s.

储能电机技术参数

Energy Storing Motor

型号 Model	额定电压 (V) Rated voltage	额定输入功率 (W) Rated power input	正常工作电压范围 The range of normal working voltage	额定电压下的储能时间 (S) Energy storage time under rated voltage
HDZ-70-300P	DC110V	55	85% ~ 110% 额定电压 85% ~ 110% Rated voltage	≤ 15
	DC220V			

合、分闸电磁铁及相关电气元件技术参数

Technical Parameters of the Closing and Opening Electromagnet and Related Components

项目 Item	类别 Category	合闸电磁铁 Closing electromagnet		分闸电磁铁 Opening electromagnet		闭锁电磁铁 Latching electromagnet		防跳继电器 Anti-trip relay	
		DC220	DC110	DC220	DC110	DC220	DC110	DC220	DC110
额定工作电压 (V) Rated operational voltage		DC220	DC110	DC220	DC110	DC220	DC110	DC220	DC110
额定工作电流 (A) Rated operational current		0.53	1.06	0.73	1.47	25 mA		9.1 mA	
额定电功率 (W) Electrical rating		115	115	162	162	2.7		1.0	
正常工作电压范围 The range of normal working voltage		85% ~ 110% 额定电压 85% ~ 110% rated voltage		65% ~ 120% 额定电压低于 30% 额定电压时, 开关不能分闸 When the 65% ~ 120% rated voltage is less than 30% rated voltage, the switch cannot be opened.		-		-	

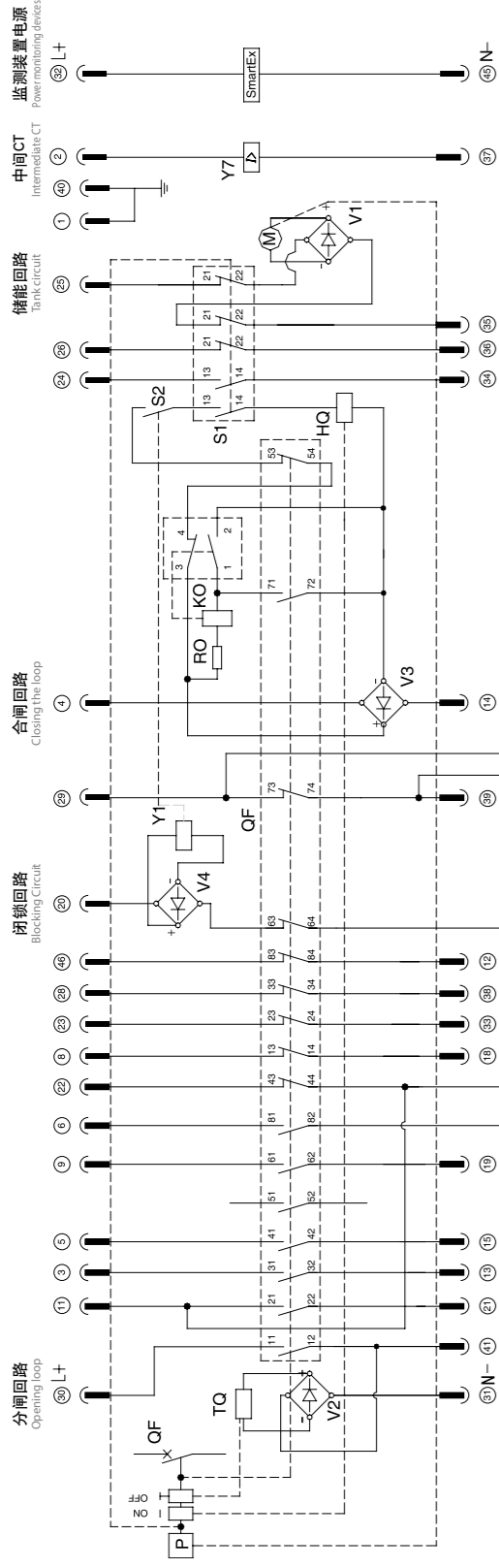
二次控制回路方案组合

Scheme of the Double-control Circuit

控制电压 Control voltage	闭锁方案 Blocking scheme	防跳方案 Anti-trip scheme	欠压脱扣方案 Undervoltage tripping scheme	过流脱扣方案 Overcurrent tripping scheme
AC 220V	带电气闭锁 With electric blocking	带防跳继电器 With anti-trip relay	带欠压脱扣 With undervoltage tripper	采用中间CT Action current value 3.5 / 5
DC 220V				
AC 110V	不带电气闭锁 Without electric blocking	不带防跳继电器 Without anti-trip relay	不带欠压脱扣 Without undervoltage tripper	不带过流脱扣器 Without overcurrent tripper
DC 110V				

SmartEx MVG 智能型固封式真空断路器（手车式）电气原理图

SmartEx MVG Intelligent Enclosed Type Circuit Breaker (handcart type) Schematic



SmartEx智能型固封式真空断路器（手车式）电气控制原理图

SmartEx Intelligent Enclosed Type Circuit Breaker (handcart type) Schematic

断路器状态为分闸、未储能、工作位置

The circuit breaker status is opening, no energy storage, work location

代号	Codename	元件名称	Component name
V1 ~ V4	V1 ~ V4	整流元件	Rectifying element
HQ	HQ	合闸脱扣器	Closing tripping device
TQ	TQ	分闸脱扣器	Shunt tripping device
P	P	手动储能	Manual storage
S1	S1	储能电机用微动开关	Charging motor with micro switch
KO	KO	机构内部防跳继电器（可选件）	Inside anti-hop relay (optional)
Y1	Y1	闭锁电磁铁（可选件）	Latching solenoid (optional)
QF	QF	断路器主轴的辅助开关	Auxiliary switch of spindle breaker
S8	S8	用于试验位置的辅助开关	Auxiliary switch used at the test position
S9	S9	用于工作位置的辅助开关	Auxiliary switch used at the operating position
M	M	储能电机	Charging motor
Y7	Y7	中间CT装置（可选件）	Intermediate CT device
RO	RO	串联电阻	Series resistance
S2	S2	闭锁电磁铁的微动开关（可选件）	Locking electromagnet on the micro-switch (optional)
SmartEx	SmartEx	监测装置模块电源	Monitoring device module power supply

注：分闸回路和智能化驱动电源需为同一路接入电源，接线极性必须按图纸要求。

说明：

若桥式整流回路的输入是交流电压，则该桥式整流回路必须具有；若为直流输入电压，则桥式整流回路可以取消。

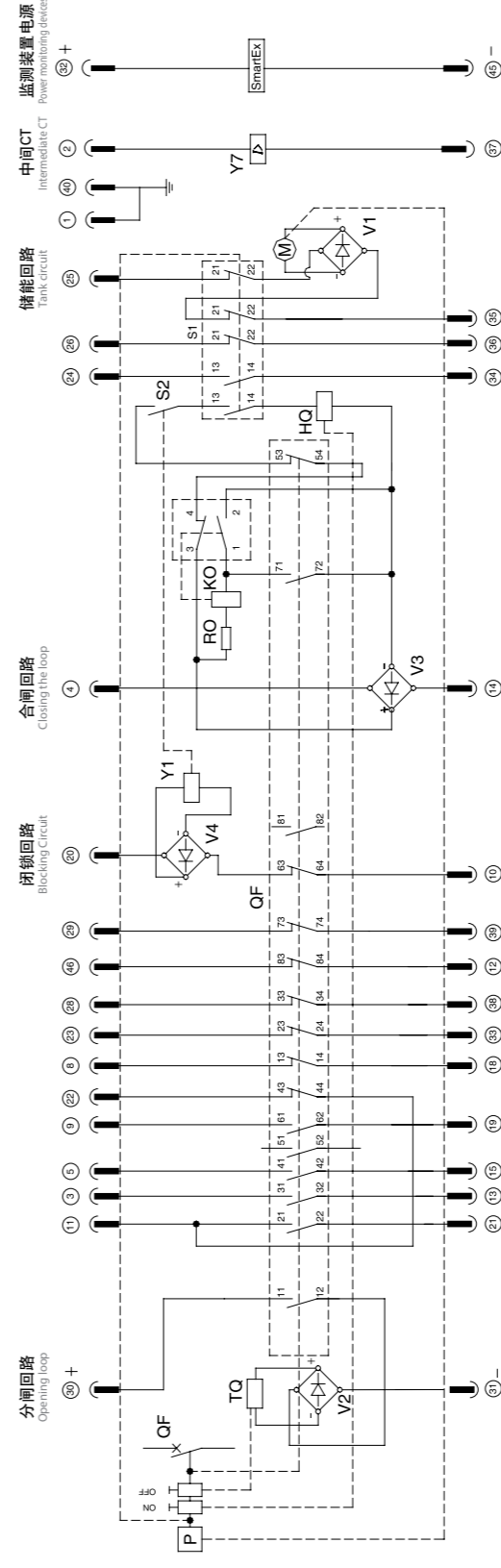
Note: The opening circuit and intelligent driving power shall be the same circuit access power supply, and the wiring polarity shall be as per the drawing requirements.

Instruction:

if the input of the bridge rectifier is A.C. current, this bridge rectifying circuit shall be available; if it is D.C. input voltage, the bridge rectifying circuit can be cancelled.

SmartEx MVG 智能型固封式真空断路器（固定式）电气原理图

SmartEx MVG Intelligent Enclosed Type Circuit Breaker (fixed type) Schematic



SmartEx智能型固封式真空断路器（固定式）电气控制原理图

SmartEx Intelligent Enclosed Type Circuit Breaker (fixed type) Schematic

断路器状态为分闸、未储能、工作位置

The circuit breaker status is opening, no energy storage, work location

代号	Codename	元件名称	Component name
V1 ~ V4	V1 ~ V4	整流元件	Rectifying element
HQ	HQ	合闸脱扣器	Closing tripping device
TQ	TQ	分闸脱扣器	Shunt tripping device
P	P	手动储能	Manual storage
S1	S1	储能电机用微动开关	Charging motor with micro switch
KO	KO	机构内部防跳继电器（可选件）	Inside anti-hop relay (optional)
Y1	Y1	闭锁电磁铁（可选件）	Latching solenoid (optional)
QF	QF	断路器主轴的辅助开关	Auxiliary switch of spindle breaker
M	M	储能电机	Charging motor
Y7	Y7	中间CT装置（可选件）	Intermediate CT device
RO	RO	串联电阻	Series resistance
S2	S2	闭锁电磁铁的微动开关（可选件）	Locking electromagnet on the micro-switch (optional)
SmartEx	SmartEx	监测装置模块电源	Monitoring device module power supply

注：分闸回路和智能化驱动电源需为同一路接入电源，接线极性必须按图纸要求。

说明：

若桥式整流回路的输入是交流电压，则该桥式整流回路必须具有；若为直流输入电压，则桥式整流回路可以取消。

Note: The opening circuit and intelligent driving power shall be the same circuit access power supply, and the wiring polarity shall be as per the drawing requirements.

Instruction:

if the input of the bridge rectifier is A.C. current, this bridge rectifying circuit shall be available; if it is D.C. input voltage, the bridge rectifying circuit can be cancelled.

- 德国阿斯博荣誉产品，品质卓越。
- 适合未来电网和物联网的智能化发展要求。
- 新一代40.5kV系列真空断路器。

Honorable product from Alsburge with premium quality.

Which are suitable for the Grid in the future.

A new generation of 40.5kV vacuum circuit breaker.

产品概述

Overview

总则

MVG-40.5系列高压真空断路器为我公司自主研发的具有行业内竞争力的新一代40.5kV真空断路器。其主要特征是主导回路安装在全封闭的三相绝缘筒内，操动机构与主导回路前后布置。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。

标准

MVG-40.5系列高压真空断路器各项技术参数完全符合GB1984、GB/T11022和中国电力行业标准DL403，同时还满足IEC62271-100、IEC56标准规范以及其他主要工业化国家相关标准的规定。

试验

MVG-40.5系列高压真空断路器已经通过了以下的各种试验，可以确保其安全运行。

- 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。

General

Independently developed by our company, MVG-40.5 series HV vacuum circuit breaker is a new-generation 40.5kV vacuum circuit breaker which is industrially competitive; its main features are that the main conducting circuit is installed in the totally-enclosed three-phase insulating cylinder, and the actuating mechanism and main conducting circuit are in front and back arrangement. The actuating mechanism is the new type spring actuator which is researched and developed by our company, with simple structure and reliable actuation.

Standard

Various technical parameters of the MVG-40.5 series high-voltage vacuum circuit breaker are completely in conformity with GB1984, GB/T11022 and Chinese power industry standard DL403, and standard specification IEC62271-100, IEC56 and other relevant standards of major industrialized countries.

Test

MVG-40.5 series high-voltage vacuum circuit breaker passed the following tests to ensure its safe operation.

- Type test: power frequency withstand voltage, lightning impulse withstand voltage, temperature rise, short-duration and peak value withstand voltage, short-circuit current switching capability, mechanical life and other tests.
- Delivery routine test: mechanical characteristics test, main circuit power frequency withstand voltage test, auxiliary and control circuit insulation performance test, main circuit resistance test, interlocked operation test, mechanical and electrical operation test.

应用范围

- MVG-40.5系列高压真空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。
- MVG-40.5系列高压真空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。

安全运行

MVG-40.5系列高压真空断路器拥有完善的机械和电气联锁装置，同时具有极高的操作可靠性与使用寿命，配合相适应的开关柜可完成安全的配电功能，确保操作者和设备的安全。

Applications

- MVG-40.5 series high-voltage vacuum circuit breaker can be extensively applied to the power plant, grid, metallurgy, petrochemical, urban infrastructure construction, such as airport, buildings, subway, etc.
- In the power distribution system, MVG-40.5 series high-voltage vacuum circuit breaker can be applicable to control and protective cable, overhead line, transformer, motor, generator and capacitor bank.

Safe Operation

MVG-40.5 series high-voltage vacuum circuit breaker has complete mechanical and electrical interlocking devices, and extremely high operation reliability and long service life, and can work with appropriate switch cabinet to perform safe power distribution function, while ensuring safety of the operators and equipment.



MVG-40.5系列高压真空断路器技术特点

Technical Features of MVG-40.5 Series HV Vacuum Circuit Breaker

断路器结构采用整体型布局

弹簧操动机构与断路器本体部分采用一体化结构设计。一次主导电回路与机构采用上、下布局的形式，主导电回路部分位于机构上部，弹簧操动机构及手车推进机构位于断路器的下部，结构紧凑、布局合理。

Breaker adopts overall type layout structure

The spring operating mechanism and the main part of the circuit breaker adopts the integrated design structure. Primary electrical circuit and mechanism adopts the up-down layout. Primary electrical circuit section is located in the upper body. The spring operating mechanism and handcart-driving mechanism are in the lower part of the circuit breaker, all representing compact structure and reasonable layout.

较好的手车互换性和适应性

MVG-40.5系列高压真空断路器的外形尺寸与ZN85-40.5真空断路器完全一致，可实现手车之间的方便互换，从而其适应性强、适用范围广。MVG-40.5断路器手车采用落地式结构设计，不用转运小车，可以方便用户进行现场的检修和定期维护，MVG-40.5系列真空断路器适配柜型为KYN61-40.5高压成套开关柜。

Better hand-cart interchangeability and adaptability

The external dimensions of MVG-40.5 series of high-voltage vacuum circuit breakers are exactly the same as those of the ZN85-40.5 vacuum breakers. It enables easy hand-cart interchange, thereby strengthening the adaptability and enabling wider range of application. MVG40.5 circuit breaker adopts the floor-standing structure. With no requirement of trolley transport in the design, users can easily conduct on-site maintenance and regular maintenance. MVG-40.5 Series vacuum breaker uses KYN61-40.5 High Voltage Switchgear as its storage cabinet.

可靠的一体化弹簧操动机构

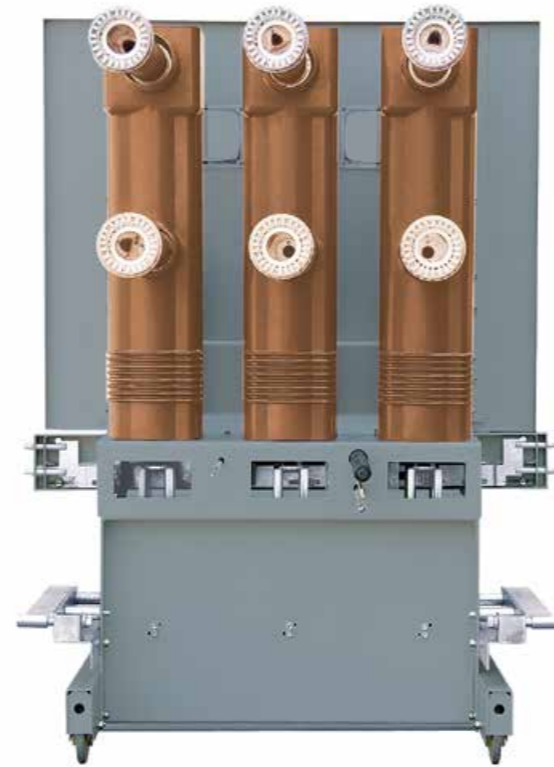
MVG-40.5系列高压真空断路器的弹簧操动机构为平面布置的弹簧操动机构，具有手动储能和电动储能功能，操动机构置于灭弧室前的下侧，这种结构设计，不仅可使整机外形尺寸小，而且可使操作机构的操作性能与灭弧室开合所需性能更为吻合，减少了不必要的中间传动环节，降低了能耗和噪声，使其操作性能更为可靠。

MVG-40.5系列高压真空断路器的操动机构主传动结构为成熟的12kV MVG系列操动机构的延伸，主传动的可靠性有上万台的生产、运行经验，断路器的整机动作稳定性、可靠性高。

Reliable integrated spring operating mechanism

The spring operating mechanism of the MVG-40.5 series high-voltage vacuum circuit breaker is a spring operating mechanism with plane layout, which has both manual storage and electric energy storage functions and the operating mechanism, is placed under the front side of the arc chamber. Such a design not only can reduce the overall size but also make the performance of the operating mechanism more consistent with the desired properties for the interrupter chamber. As a result, such design may reduce unnecessary intermediate transmission links and reduce energy consumption and noise, making the operations more reliable.

Main transmission structure of the operating mechanism in MVG-40.5 series of high-voltage vacuum circuit breaker is the extension of the already matured 12kV MVG series operating mechanism. With production and operating experience through tens of thousands of units, the operation of the circuit breaker is highly stable and reliable.



主导电回路采用套筒式或固封式结构

MVG-40.5系列高压真空断路器的主导电回路有套筒式和固封式两种结构形式可供用户根据不同的使用场所进行方便地选择。

套筒式结构：断路器的一次主导电回路的真空灭弧室布置在封闭的绝缘筒内，绝缘筒选用机电性能可靠的环氧树脂材料，并采用先进APG的工艺成型，该绝缘筒既起安装支撑作用，又起相间、相对地绝缘作用。该绝缘筒的设计充分考虑了国家标准及严酷工作条件的使用要求，不仅可以防止真空灭弧室不受外界环境的影响，防止灰尘和异物进入主回路的部分，而且可以确保即使在湿热及严重污秽的环境下，也可以对电压效应呈现出高阻态。

Primary electrical circuit adopts sleeve-type or solid sealing structure

Primary electrical circuit of MVG-40.5 series high-voltage vacuum circuit breaker adopts both sleeve-type and solid sealing structure to facilitate the selection of users depending on premises of usage.

Sleeve-type structure. The vacuum interrupter of the Circuit Breaker's 1st primary electrical circuit is located in a closed insulating cylinder, which is made of epoxy resin material with reliable mechanical and electrical performance and by using advanced APG molding technology. The insulating cylinder can support the installation and have the effect of interphase and relative insulation. The design of the insulating cylinder takes full account of the national standards and the use requirements under harsh working conditions, for not only protecting the vacuum chamber from the impact of the external environment, but also preventing dust and foreign matters from entering the main circuit section as well as ensuring that there will be high impedance state against the voltage effect even in hot and humid environment with severe contaminations.

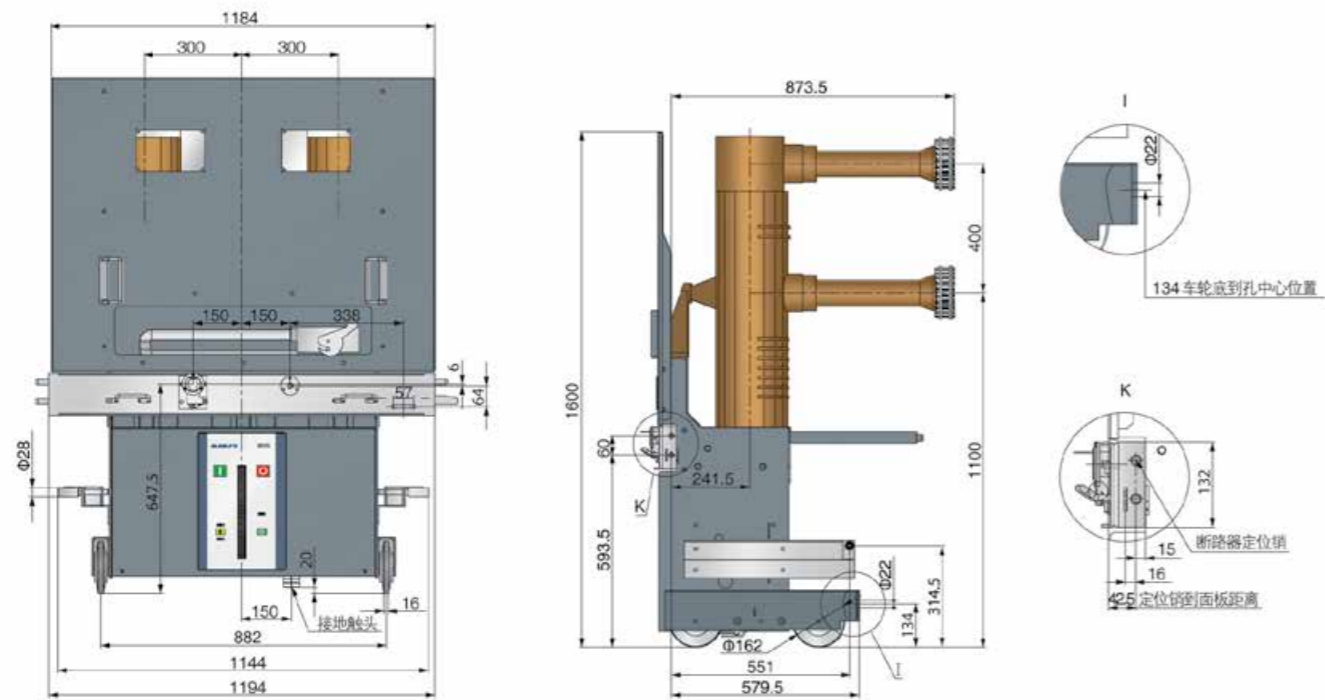


固封式结构：断路器的一次导电回路采用固体绝缘技术的固封极柱，该固封极柱通过先进的自动压力凝胶APG工艺将真空灭弧室和一次导电回路的其它零件直接固封在特种环氧树脂材料里，形成一个主导电回路模块。固封极柱安装端进行了内外双裙边的设计，该极柱具有大爬电比距、高机械强度、高零部件精度、零部件数量少、无需二次调整、搭接面少的特点。极柱电场分布均匀，避免了局部电场集中对有机绝缘的破坏。同时采用此种结构设计，可大大地简化一次主导电回路的装配工艺，彻底避免了主导电回路连接螺栓由于运行中的振动而松动的问题，保证了主导电回路电联结的高可靠性，使断路器的一次主导电回路的实现免维护成为可能。

Solid sealing structure: The 1st conductive loop of the circuit breaker uses solid seal pole with solid insulating technology. The solid seal pole adopts advanced automatic pressure APG sectional glue processes to have other parts of the vacuum interrupter and 1st conductive loop directly enclosed in specialty bad epoxy resin material in special epoxy resin materials to form a primary electrical circuit module. The mounting end of the solid seal pole adopts double skirt design (inside and outside) and the seal pole has features such as long leakage distance, high mechanical strength, high precision parts, smaller number of parts, no secondary adjustment, smaller overlapping surface and so on. The electric field of the pole is evenly distributed, which may avoid destruction of the organic insulating by concentration of local electric field. At the same time such a structure design can greatly simplify the assembly process of the 1st primary electrical circuit, thereby completely avoiding loosening of the bolts connecting the primary electrical circuit due to operational vibration, which ensures the high reliability in the electrical coupling of the primary electrical circuit, making possible the maintenance-free operation of the 1st primary electrical circuit breaker.

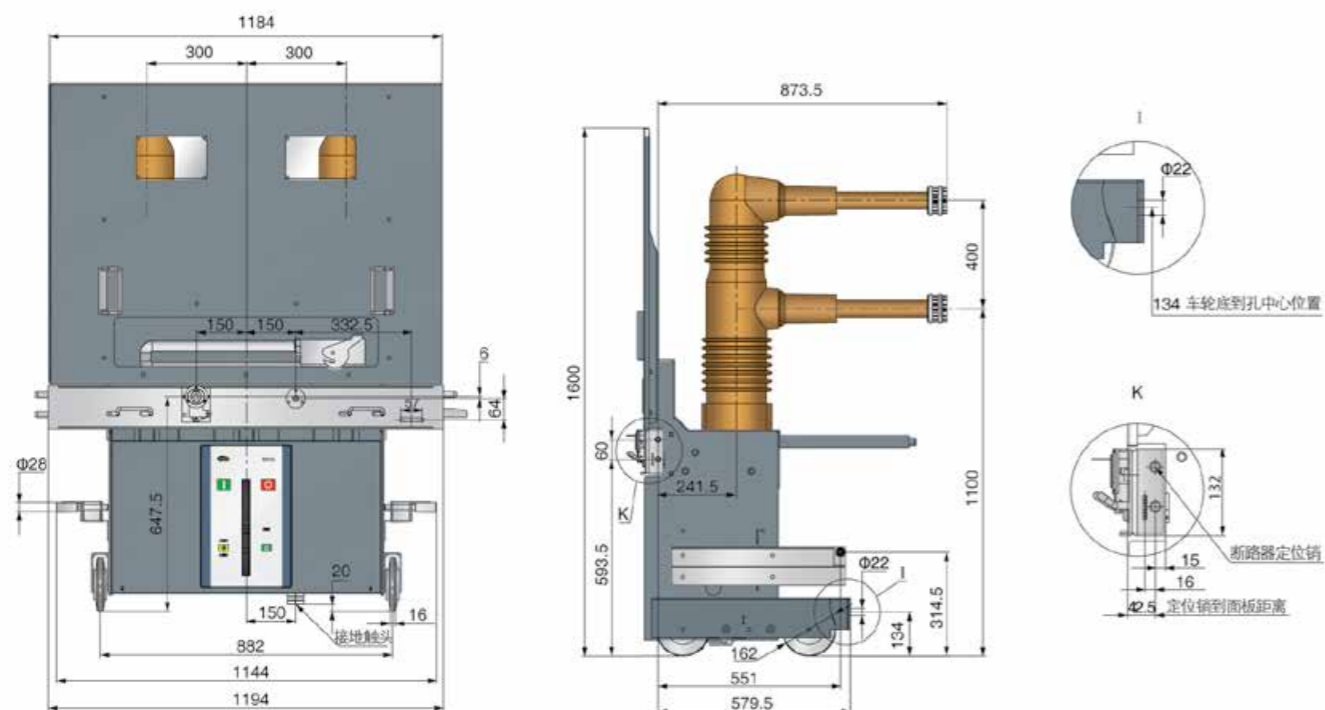
MVG-40.5 套筒式高压真空断路器外形尺寸

Outline Dimension of Sleeve Type HV Vacuum Circuit Breaker



MVG-40.5 固封式高压真空断路器外形尺寸

Outline Dimension of Enclosed Type HV Vacuum Circuit Breaker



每一细节都精益求精

Every detail is better



主要技术参数 Main Technical Parameters

项目 Item	单位 Unit	技术数据 Technical data		
额定电压 Rated voltage	kV	40.5		
额定绝缘水平 Rated insulation level	额定短时工频耐受电压 (1min) Rated power-frequency short-duration withstand voltage (1min)	kV	95	
	额定雷电冲击耐受电压 (峰值) Rated lightning impulse withstand voltage (peak value)	kV	185	
额定频率 Rated frequency	Hz	50		
额定电流 Rated current	A	630	630	1250
		1250		1600
				2000
				2500
				3150
额定短路开断电流 Rated short-circuit breaking current	kA	20	25	31.5
额定短时耐受电流 Rated short-time withstand current	kA	20	25	31.5
额定峰值耐受电流 Rated peak withstand current	kA	50	63	80
4s热稳定电流 4s thermal stability current	kA	20	25	31.5
额定动稳定电流 Rated dynamic current	kA	50	63	80
额定短路关合电流 (峰值) Rated short-circuit making current (peak value)	kA	50	63	80
额定短路持续时间 Rated duration of short-circuit	s	4		
机械寿命 Mechanical life	次	10000		
额定电容器组合涌流 Rated capacitor bank inrush making current	kA	12.5 (频率不大于1000Hz/frequency not more than 1000Hz)		
额定单个/背对背电容器组开断电流 Rated single/back-to-back capacitor bank breaking current	A	630 / 400		
短路开断电流开断次数 Breaking times of short-circuit breaking current	次	20		
二次回路工频耐受电压 Power-frequency withstand voltage of secondary circuit	V	2000		
额定操作电压 Rated operational voltage	V	AC110 / 220 DC110 / 220		
额定操作顺序 Rated operating sequence		O-0.3s-CO-180s-CO		
储能时间 Energy storage time	s	≤15		
触头开距 Clearance between open contacts	mm	20 ± 2		
接触行程 Contacting travel	mm	6 ± 1		
相间中心距 Phases center distance	mm	300 ± 1.5		
触头合闸弹跳时间 Jump time of contact close brake	ms	≤ 3		
三相分、合闸不同期性 Three-phase opening, closing non-synchronism	ms	≤ 2		
平均分闸速度 ¹ Average opening speed ¹	m/s	1.4 ~ 2.0		
平均合闸速度 ² Average closing speed ²	m/s	0.6 ~ 1.3		
合闸时间 Closing time	ms	30 ~ 70		
分闸时间 Opening time	ms	20 ~ 45		
触头分闸反弹幅值 Contact opening rebound amplitude	mm	≤ 3		
动、静触头允许磨损累计厚度 Permit abrasion total thickness of dynamic and static contacts	mm	3		
主导回路电阻 Main galvanic circle resistance	μΩ	≤ 75	2000A及以下 2000A and below	
		≤ 50	2500A及以上 2500A and above	

1. 平均分闸速度是指断路器触头刚分后12mm的平均速度;
The average opening speed refers to the average speed of 12mm after the circuit breaker contact is just opened;
2. 平均合闸速度是指断路器触头合前12mm的平均速度。
The average closing speed refers to average speed of 12mm before the circuit breaker contact is closed.

储能电机技术参数 Energy Storing Motor

型号 Model	额定电压 (V) Rated voltage	额定输入功率 (W) Rated power input	正常工作电压范围 The range of normal working voltage	额定电压下的储能时间 (S) Energy storage time under rated voltage
ZYJ55-1	DC110V	100	85% ~ 110% 额定电压 85% ~ 110% Rated voltage	≤ 15
	DC220V			

合、分闸电磁铁及相关电气元件技术参数 Technical Parameters of the Closing and Opening Electromagnet and Related Components

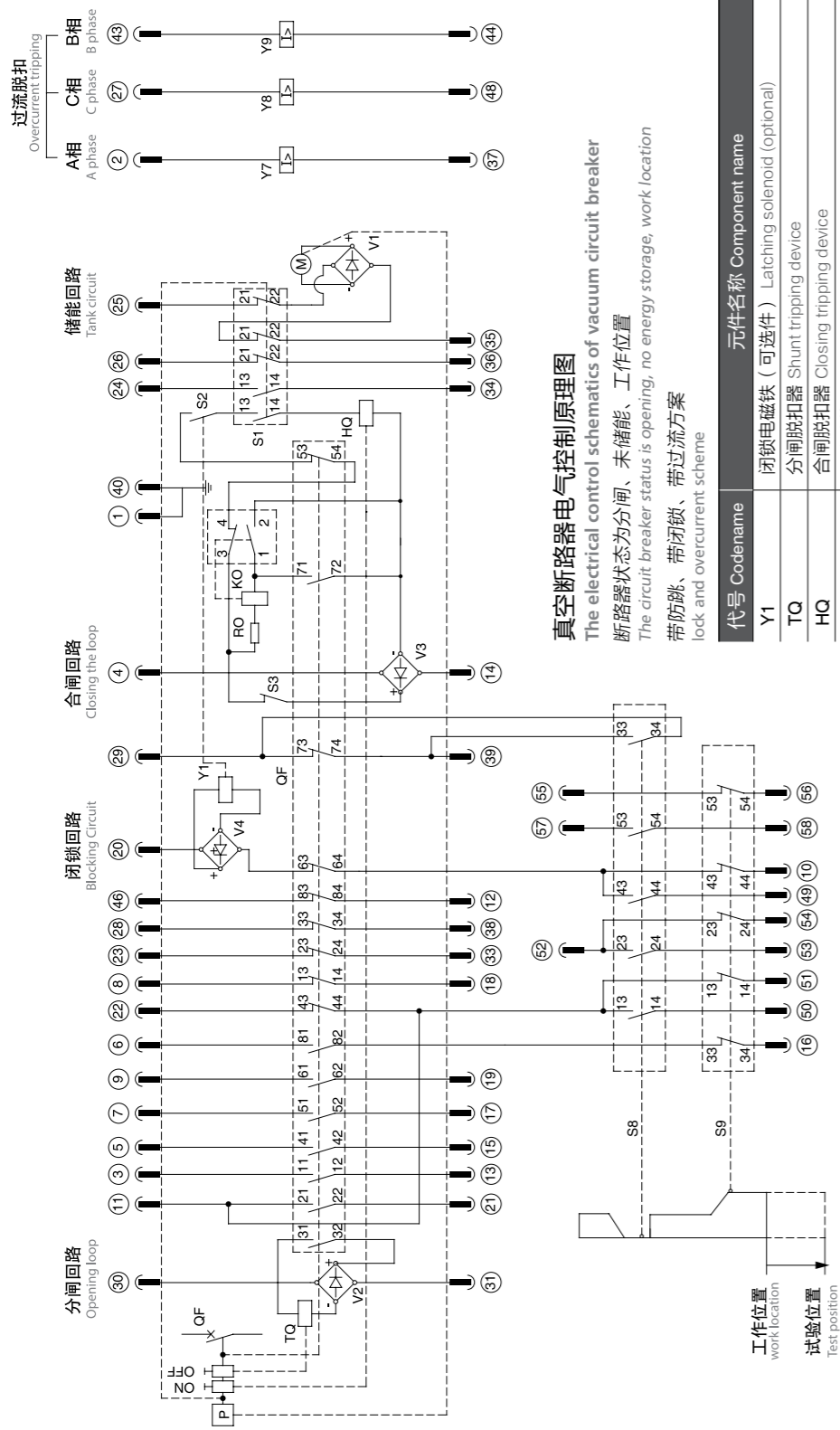
项目 Item	类别 Category		合闸电磁铁 Closing electromagnet		分闸电磁铁 Opening electromagnet		闭锁电磁铁 Latching electromagnet		防跳继电器 Anti-trip relay	
	合闸电磁铁 Closing electromagnet	分闸电磁铁 Opening electromagnet	合闸电磁铁 Closing electromagnet	分闸电磁铁 Opening electromagnet	闭锁电磁铁 Latching electromagnet	防跳继电器 Anti-trip relay	闭锁电磁铁 Latching electromagnet	防跳继电器 Anti-trip relay	闭锁电磁铁 Latching electromagnet	防跳继电器 Anti-trip relay
额定工作电压 (V) Rated operational voltage	DC220	DC110	DC220	DC110	DC220	DC110	DC220	DC110	DC220	DC110
额定工作电流 (A) Rated operational current	1.3	2.6	1.3	2.6	25 mA		9.1 mA			
额定电功率 (W) Electrical rating	288	288	288	288	2.7		1.0			
正常工作电压范围 The range of normal working voltage	85% ~ 110% 额定电压 85% ~ 110% rated voltage		65% ~ 120% 额定电压低于30% 额定电压时, 开关不能分闸 When the 65% ~ 120% rated voltage is less than 30% rated voltage, the switch cannot be opened.		-		-			

二次控制回路方案组合 Scheme of the Double-control Circuit

控制电压 Control voltage	闭锁方案 Blocking scheme	防跳方案 Anti-trip scheme	欠压脱扣方案 Undervoltage tripping scheme	过流脱扣方案 Overcurrent tripping scheme		
				带过流脱扣器 With overcurrent tripper	过流脱扣器数量 Quantity of overcurrent trippers	动作电流值 Action current value
AC 220V	带电气闭锁 With electric blocking	带防跳继电器 With anti-trip relay	带欠压脱扣 With undervoltage tripper	带过流脱扣器 With overcurrent tripper	2过流 / 3过流 2 overcurrent / 3 overcurrent	3.5 / 5 / 7.5 / 10
DC 220V						
AC 110V	不带电气闭锁 Without electric blocking	不带防跳继电器 Without anti-trip relay	不带欠压脱扣 Without undervoltage tripper	不带过流脱扣器 Without overcurrent tripper		
DC 110V						

高压真空断路器电气原理图

Electrical Schematic Diagram of HV Vacuum Circuit Breaker



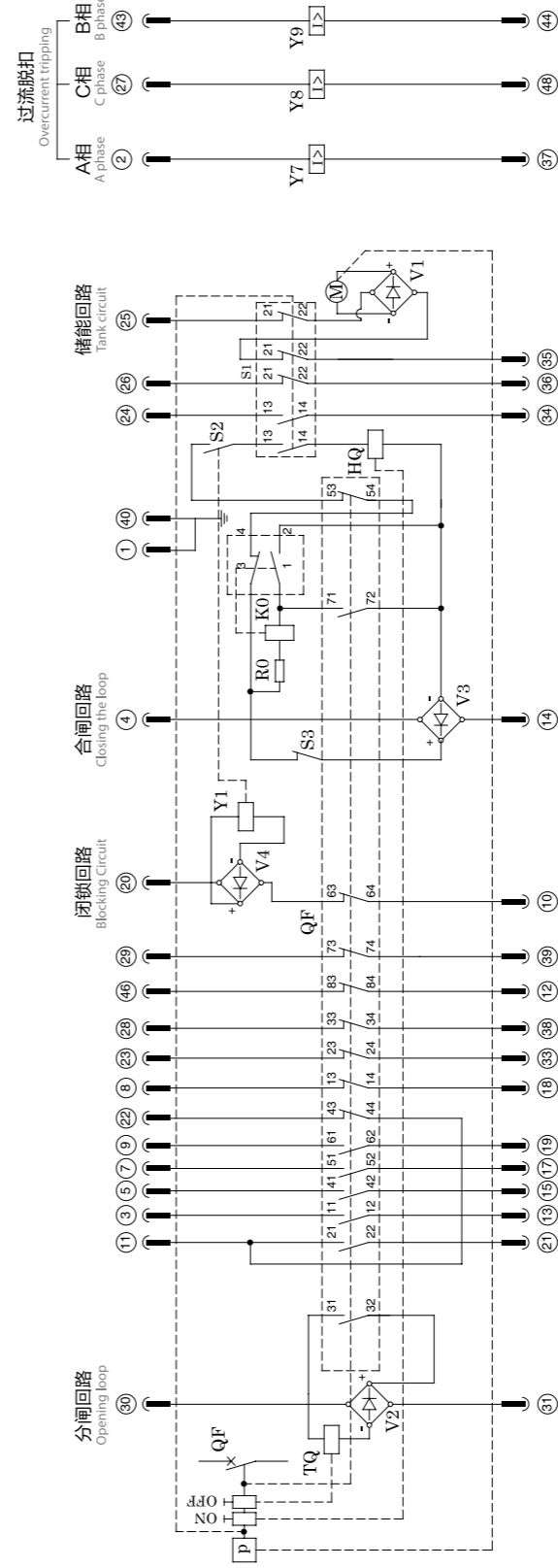
真空断路器电气控制原理图

The electrical control schematics of vacuum circuit breaker
 断路器状态为分闸、未储能、工作位置
 The circuit breaker status is opening, no energy storage, work location
 带防跳、带闭锁、带过流方案
 lock and overcurrent scheme

代号	Codename	元件名称	Component name
Y1		闭锁电磁铁 (可选件)	Latching solenoid (optional)
TQ		分闸脱扣器	Shunt tripping device
HQ		合闸脱扣器	Closing tripping device
P		手动储能	Manual storage
Y7 ~ Y9		间接式过流脱扣器 (可选件)	Indirect overcurrent tripping device (optional)
S1		储能电机用微动开关 (可选件)	Charging motor with micro switch
S2		闭锁电磁铁的微动开关 (可选件)	Locking electromagnet on the micro-switch (optional)
QF		断路器主触头的辅助开关	Auxiliary switch of spindle breaker
S8		用于试验位置的辅助开关	Auxiliary switch for test position
S9		用于工作位置的辅助开关	Auxiliary switch for the working position
M		储能电机	Charging motor
KO		机构内部防跳继电器 (可选件)	Inside anti-hop relay (optional)
RO		串联电阻	Series resistance
V1 ~ V4		整流元件	Rectifying element

说明：
 过流脱扣器 (Y7 ~ Y9)：原理图中采用过流脱扣 (Y7即：选用中间CT) 时，
 则原理图中Y8、Y9回路取消；原理图中采用2过流脱扣 (即选用Y7、Y8) 时，
 则原理图中Y9回路取消，不带过流时，则Y7、Y8和Y9回路均取消。

Test position
 Overcurrent tripping (Y7 Y9)：Where overcurrent tripping is shown in schematic (Y7 i.e. to select intermediate CT), the Y8, Y9 loop in the schematic shall be cancelled; where two overcurrent trips (ie to select Y7, Y8) are shown in schematic, the circuit Y9 in the schematic shall be cancelled; where no overcurrent is present, Y7, Y8 and Y9 circuit shall be cancelled.



真空断路器电气控制原理图

The electrical control schematics of vacuum circuit breaker
 断路器状态为分闸、未储能
 Breaker status, including separating brake, no energy storage
 带防跳、带闭锁、带过流方案
 lock and overcurrent scheme

代号	Codename	元件名称	Component name
Y1		闭锁电磁铁 (可选件)	Latching solenoid (optional)
TQ		分闸脱扣器	Shunt tripping device
HQ		合闸脱扣器	Closing tripping device
P		手动储能	Manual storage
Y7 ~ Y9		间接式过流脱扣器 (可选件)	Indirect overcurrent tripping device (optional)
S1		储能电机用微动开关	Charging motor with micro switch
S2		闭锁电磁铁的微动开关 (可选件)	Locking electromagnet on the micro-switch (optional)
QF		断路器主触头的辅助开关	Auxiliary switch of spindle breaker
M		储能电机	Charging motor
KO		机构内部防跳继电器 (可选件)	Inside anti-hop relay (optional)
RO		串联电阻	Series resistance
V1 ~ V4		整流元件	Rectifying element

说明：
 过流脱扣器 (Y7 ~ Y9)：原理图中采用过流脱扣 (Y7即：选用中间CT) 时，
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