



CR193 真空接触器

CR193 Vacuum Contactor

用户手册

User Manual

注意事项

在安装和操作接触器之前请仔细阅读本手册：

接触器的安装和操作必须符合本手册的要求。

接触器应在室内正常工作条件下使用。

对接触器的任何运行和维护都必须由专业电气人员进行。

禁止在超出其额定参数的条件下操作接触器。

始终注意接触器的任何标记。

确保接触器的联锁条件，以及工作规程的适用性和安全性。

不能在柜体及二次控制回路带电的情况下从事检修工作。

确保接触器免受外界的冲击，否则将损坏设备。

任何不规则的操作可能会损坏设备，甚至造成严重的事故。

应把本手册放在可以方便拿到的地方。

应由专业人员负责接触器的安全管理。

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1.概述

本手册提供了CR193真空接触器和熔断器-真空接触器组合电器的维护要求和工作规范，以保证安全和延长其使用寿命。本手册适用于CR193真空接触器（以下简称接触器）和熔断器-真空接触器组合电器（以下简称组合电器）。

2.应用标准

中国国家标准：

GB/T 14808	《高压交流接触器、基于接触器的控制器及电动机起动器》
GB/T 11022	《高压开关设备和控制设备标准的共用技术要求》
GB/T 15166.2	《高压交流熔断器第 2 部分：限流熔断器》
GB/T 50150	《电气装置安装工程电气设备交接试验标准》
GB/T 311.1	《绝缘配合第 1 部分：定义、原则和规则》
GB/T 16927.1	《高电压试验技术 第 1 部分：一般定义及试验要求》
GB/T 13384	《机电产品包装通用技术要求》

国际电工委员会标准：

IEC 60470	《高压交流接触器和基于接触器的电动机起动器》
IEC 60694	《高压开关设备和控制设备标准的共用技术要求》
IEC 60632-1	《高压电动机起动器. 第 1 部分：交流直接（全电压）起动器》
IEC 60282-1	《高压熔断器. 第 1 部分：限流熔断器》
IEC 60071-1	《绝缘配合第 1 部分：定义、原理和规则》

熔断器的尺寸以及撞击器型号符合 DIN 43625 和 BS 2692 标准，电气性能符合 IEC 60282 和 GB/T 15166.2 标准。

3.技术数据

3-1 真空接触器和组合电器技术参数表 (表 1)

表 1

项目		单位	数值			
			真空接触器		组合电器	
额定电压		kV	12		7.2	12
额定绝缘水平	额定短时工频耐受电压 (1min)	kV	42/48		32/34	42/48
	额定雷电冲击耐受电压 (峰值)		75/85		60/70	75/85
额定频率		Hz	50		50	
额定连续电流		A	400		变压器	6.3~355
					电动机	25~355
短时耐受电流 (4s)		kA	4	6.3	/	
峰值耐受电流		kA	10	16	/	
过载耐受电流 (1s)		kA	6	9.5	/	
额定短路开断电流		kA	4	6.3	50	
额定短路关合电流		kA	4	6.3	/	
最大交接电流		kA	/		3.2	
额定工作制			连续工作制		连续工作制	
机械寿命	机械保持	万次	30		30	
	电气保持	万次	30		30	
辅助接点			6a+6b		6a+6b	
每相导电回路电阻		$\mu\Omega$	≤ 150		$\leq 200^*$	
重量		kg	46		98	

注：表中标有*的值不包括熔断器的电阻值

3-2 控制电路技术参数表 (表 2)

表 2

名称	机械保持				电气保持			
额定操作电压	AC110	DC110	AC220	DC220	AC110	DC110	AC220	DC220
合闸操作电流 (A)	9	9	4.5	4.5	9	9	4.5	4.5
合闸保持电流 (A)	/	/	/	/	1	1	0.5	0.5
分闸操作电流 (A)	12	12	6	6	/	/	/	/
额定工作电压范围	合闸: 85%~110%额定操作电压 分闸: 65%~110%额定操作电压 (DC) 85%~110%额定操作电压 (AC)				合闸: 85%~110%额定操作电压			
操作频率 (次/小时)	600				600			

注: 表中数值为近似值

3-3 机械特性参数表 (表 3)

表 3

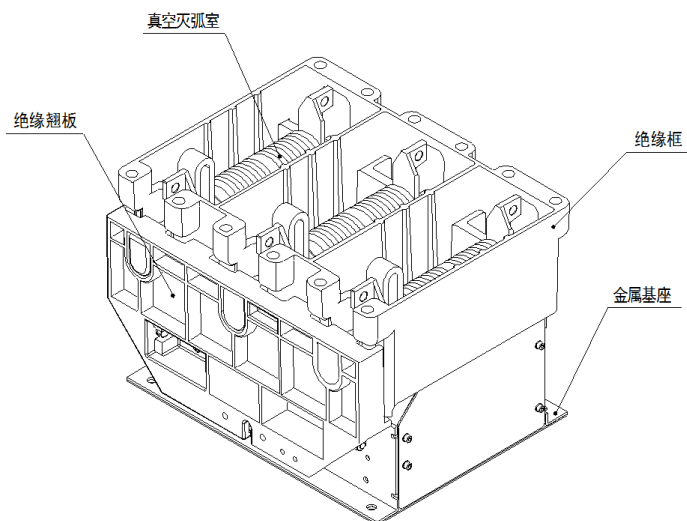
序号	项目		单位	数值	
				真空接触器	组合电器
1	触头开距		mm	6.0±1.0	6.0±1.0
2	超行程		mm	2.5±0.5	2.5±0.5
3	相间中心距		mm	150±1.0	150±1.0
4	三相合闸同期性		ms	≤2	≤2
5	触头合闸弹跳时间		ms	≤2	≤3
6	合闸时间		ms	≤100* (180)	≤100* (180)
7	分闸时间	机械保持	ms	≤70* (160)	≤70* (160)
		电气保持	ms	≤100*	≤130*

注: 表中标有*的值不包括继电器动作时间

4.产品结构

4-1 真空接触器主体结构

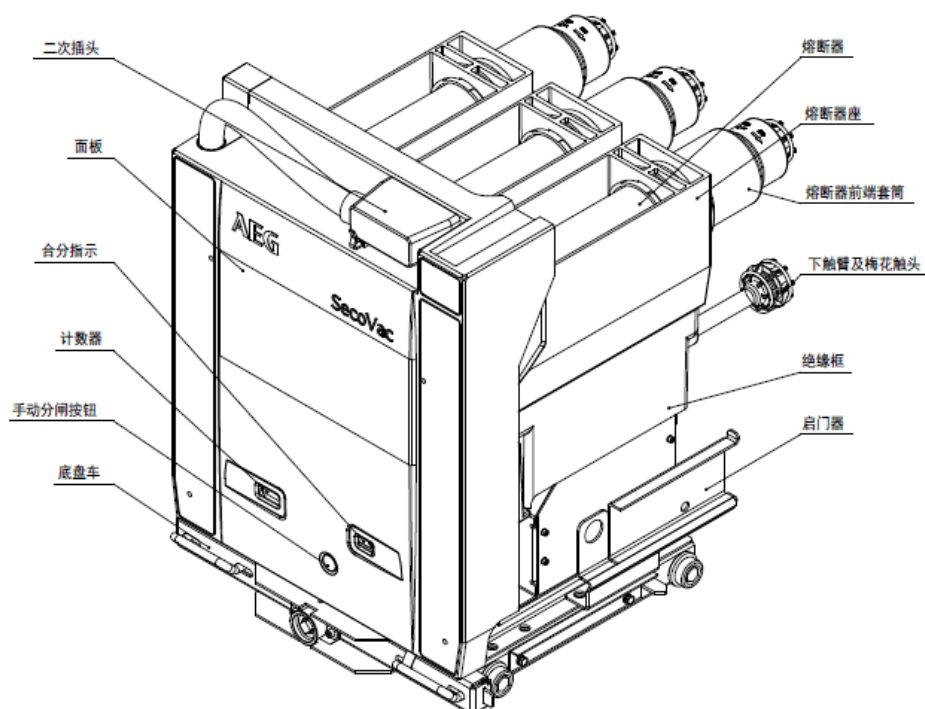
● 固定式



真空接触器主要由真空灭弧室、绝缘框、金属基座、绝缘翘板、电磁操作机构等组成。

4-2 熔断器-真空接触器组合电器的结构主要由熔断器、真空接触器、底盘车等组成

● 手车式



5.工作原理

5.1 熔断器-真空接触器组合电器的工作原理

CR193 真空接触器是一种主要用于开合负载电流的高压电器，通过真空灭弧室来实现接通和分断电力电路。

熔断器-真空接触器组合电器主要由高压限流式熔断器、接触器和底盘车等组成，其基本工作原理是：负载的正常起动和停止都取决于接触器，其中也有开断部分负载电流的任务，充分利用了接触器机械寿命长和可频繁操作等特性能力；而较为严重的负荷电流或短路电流的开断任务是通过高压限流式熔断器来完成，充分利用熔断器的限流特性和预期分断电流大的优势。将这两种部件结合并连接，采用梅花触头配合的方式连接到开关柜，通过二次插头连接开关柜的二次控制回路。它们可以相互合作，发挥优势，避免缺点，使F-C回路具有了额定电流小，开断电流大，可频繁操作和机械寿命长等区别于其他设备的一些特点。

合闸

当接触器接到合闸命令，对于机械保持真空接触器，合闸继电器线圈通电，常开触点闭合，合闸线圈回路通电，操作机构动作，即在电磁力作用下的合闸电磁铁，带动绝缘翘板顺时针转动，通过触头压力弹簧推动真空灭弧室螺杆做直线运动。然后，动触头与静触头闭合，同时触头弹簧产生所需的接触行程（即超程），以保证动、静触头之间产生所需的压力。

对于机械保持真空接触器，有机械的合闸锁扣，使接触器处于合闸状态。

对于电气保持真空接触器，由电保持模块输出稳定电流，保持合闸状态。

对于组合电器，还必须安装三相熔断器，且满足未熔断状态才可以完成合闸动作。

分闸

当接触器接收到分闸命令，对于机械保持真空接触器，分闸继电器线圈通电，常开触点闭合，分闸线圈电路导通，分闸脱扣机构动作，即在电磁力作用下分闸电磁铁，驱动滚子脱离锁扣，分闸弹簧驱动电磁操作机构动作，带动绝缘翘板逆时针旋转。拉动灭弧室螺栓，使动触头在适当的速度下脱离静触头，缓冲垫将在最终分闸位置附近起作用，吸收分闸的剩余动能，从而完成整个分闸过程。

对于电气保持真空接触器，则没有解锁过程，电保持模块失电，接触器分闸。

手动分闸

机械保持的真空接触器和组合电器具有手动分闸操作功能：直接推动真空接触器手动分闸杆，手动分闸杆带动分闸电磁铁，并带动滚子脱离锁扣，实现手动分闸（图1、图2）。

电气保持的组合电器同样具有手动分闸操作功能，但需要通过开关柜来实现此项功能。

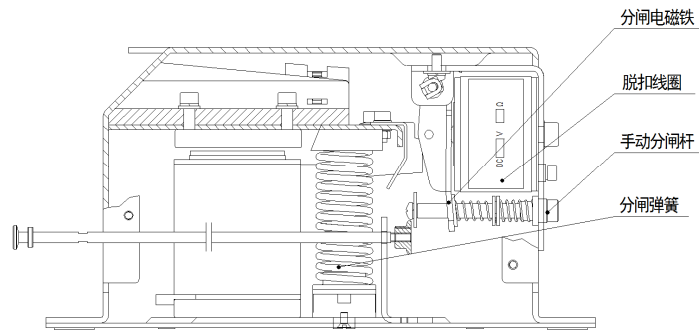


图 1

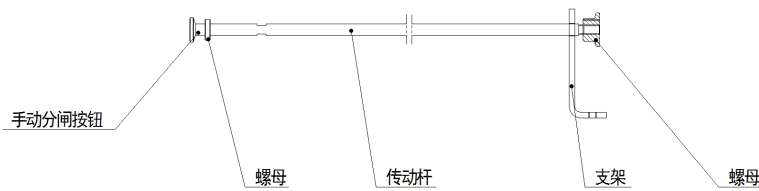


图 2

5.2 熔断器工作原理

熔断器撞击器的工作原理（图 3）

熔断器带有一个弹簧撞针系统。该系统与熔断器连接，当熔断器熔断时，压力弹簧撞针从高压熔断器接触帽的端面顶出。撞针将作为熔断器释放装置的执行部件和视觉显示装置。

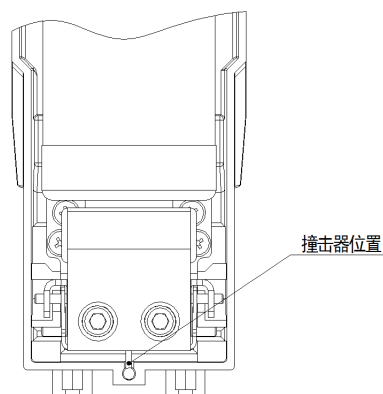


图 3

熔断器联动机构的工作原理 (图 4)

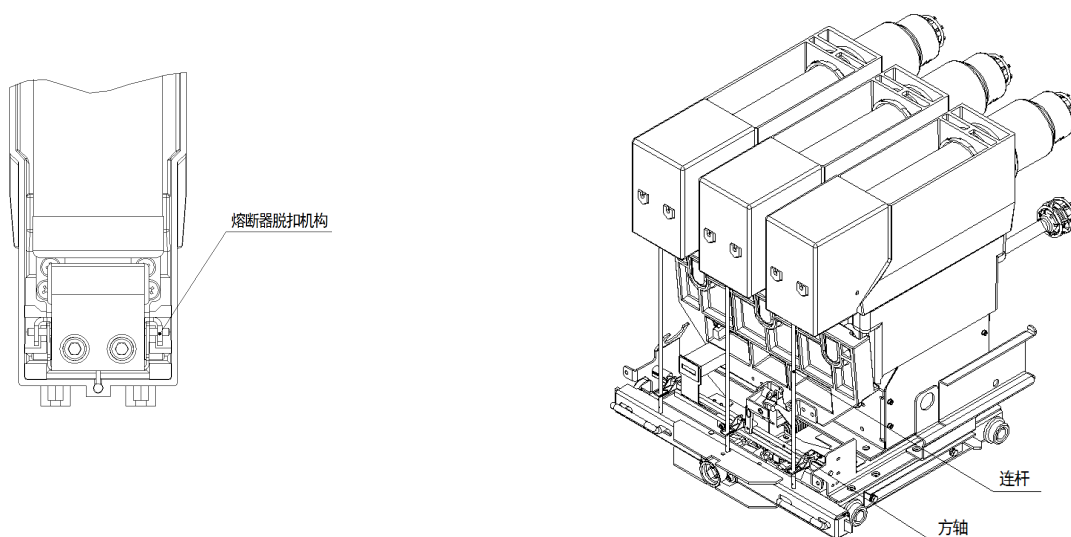


图 4

熔断器联动脱扣机构由挚子，联锁机构的支架，和弹簧等组成。

当熔断器没有安装时，连锁机构支架在弹簧作用下将连杆带动，使得传动杆推动分闸电磁铁，机构不能保持合闸状态。所以如果有一相熔断器没有安装，接触器就不能合闸，可以防止接触器在缺相的情况下合闸。

熔断器熔断时，撞击器将推动挚子连接杆，当连接杆向上拉熔断器连接件时，同时转动分闸连接件，推动分闸杆，脱扣解锁完成分闸。三相熔断器连接件和一个分闸连接件固定在一个方轴上，即使只有一相熔断器熔断，接触器也会联动跳闸。当组合电器遇到三相故障时，应考虑动作误差时间。如果只有一相熔断器熔断其余相熔断器即使外观很好，由于通过过电流，所有的熔断器都应更换，确保不带电更换熔断器。正常工作熔断器应定期检查。

5.3 熔断器的更换 (图 5、图 6、图 7)

当需要安装和更换熔断器时：用螺丝刀插入熔断器，将联锁机构支架向下压到底（如果没有这样的动作，当插入熔断器时，熔断器会碰撞支架，影响联锁机构），把熔断器插入导电座（注意熔断器的安装方向，带撞针端插入导电座）。熔断器安装到位后，将橡胶垫圈套入熔断器套筒，推进熔断器座，顺时针为旋进方向，逆时针为旋出方向。安装到位后，熔断器套筒的打开和关闭的箭头应位于顶部位置。将套筒定位板插进套筒与熔断器座间隙处锁死即可。反之亦然。

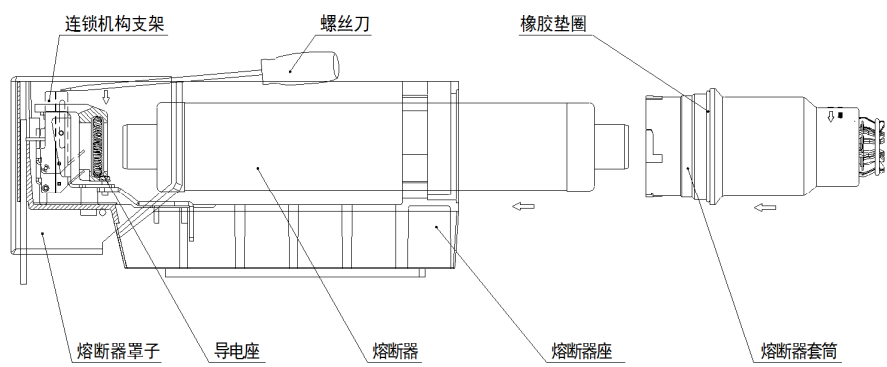


图 5

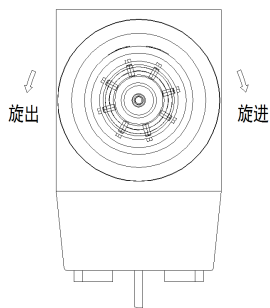


图 6

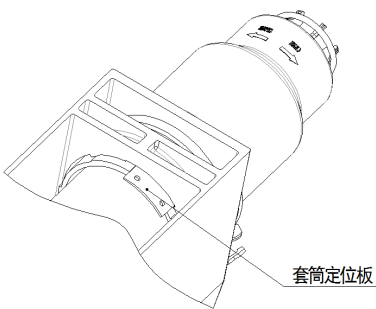


图 7

5.4 底盘车工作原理 (图 8)

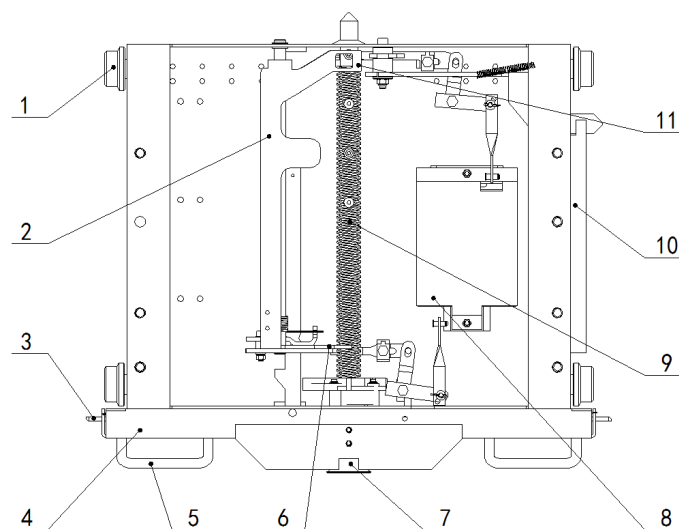


图 8

- | | | |
|-------------|------------|-----------|
| 1. 滚轮 | 2. 翻板 | 3. 固定锁板 |
| 4. 支撑梁 | 5. 手柄 | 6. 工作位置锁扣 |
| 7. 摇柄插孔 | 8. 位置开关 | 9. 螺杆 |
| 10. 接地开关联锁件 | 11. 试验位置锁扣 | |

底盘车的支撑梁（4）通过固定锁板（3）固定在开关柜上，螺杆（9）安装在支梁上，它可以转动，通过螺母与底座连接（螺母固定在底座上）。当旋转螺杆，底盘将沿螺旋方向前后移动，带动接触器本体的推进、退出；在翻板（2）的前端和后端分别是螺杆的锁扣（6 是工作位置锁扣，11 是试验位置锁扣）。

底盘车的推进、退出

当接触器与接地开关都处于分闸状态，接地联锁件处于复位状态，此时可以自由旋转螺杆，带动底盘和接触器本体在行程范围内推进、退出。

将手车式接触器推入开关柜后，应按下面的步骤操作：

将手柄插入插孔中，顺时针旋转手柄为推进（逆时针旋转为退出）。行程约为 200mm，在分闸状态时，应顺利进入工作位置或试验位置。中速旋转手柄 20 圈，当听到“嗒”的位置开关机构动作的声音即为到位。（应避免用力过大损伤机构）。

底盘车的防误操作功能

● 防止带负荷拉动隔离触头

当接触器合闸时，底盘车不能摇动。底盘车的翻板上方有一组合闸联锁装置，联锁装置把底盘车翻板压住。如果接触器在试验位置，试验位置锁扣的方孔（11）将锁住螺杆，底盘车不能摇动；如果接触器在工作位置，工作位置锁扣（6）将顶住螺杆，底盘车不能摇动，以免带负荷拉动隔离触头（图 9）。

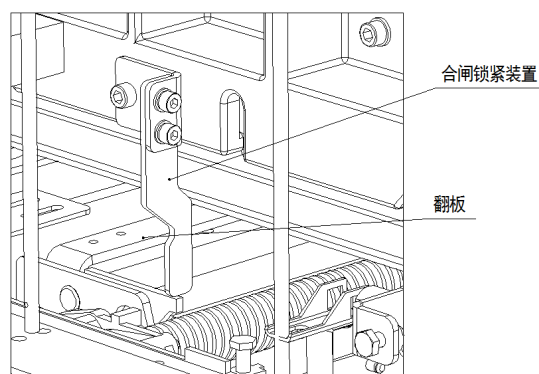


图 9

● 避免接地状态时合闸，避免带负载接地

当开关柜的接地开关合闸时，接地开关联锁机构推动接地联锁件向螺杆方向运动，使联锁件挡住螺杆，底盘车不能从试验位置运行到工作位置；相反，如果接触器处于工作位置时，开关柜的接地开关联锁机构被底盘车的接地开关联锁板挡住，接地开关手柄无法插入操作孔，接地开关不能闭合。从而防止在接地状态合闸和带负载接地（图 10）。

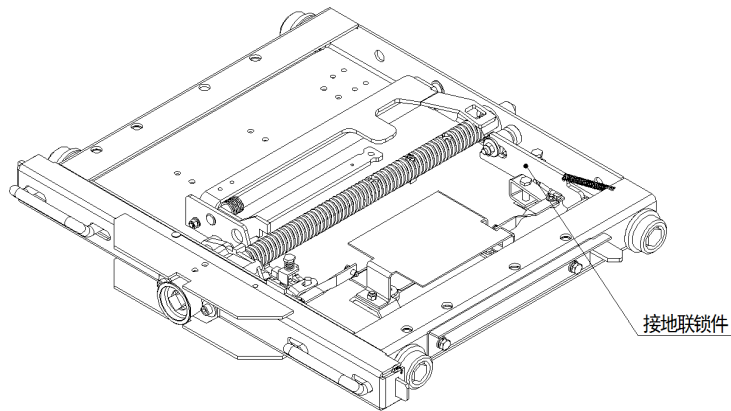


图 10

5.5 计数器工作原理

熔断器-真空接触器组合电器带有六位电磁计数器，它安装在一个闭合电路中。在电气信号输入计数器后，产生电磁力，使电磁驱动机构和驱动数字齿轮转动，进行十进制记数法，可记录组合电器的运行次数（图 11）。

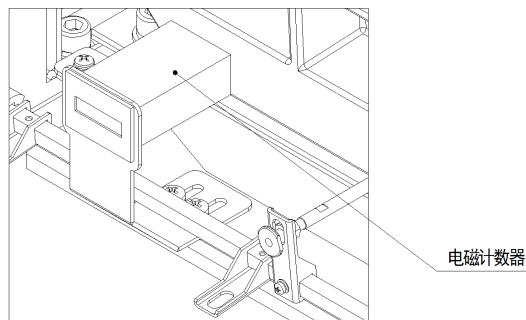


图 11

5.6 合、分状态指示器的工作原理

在熔断器-真空接触器组合电器的每一个合闸或分闸操作后，合分指示将作相应的指示。机械式合分状态指示器用定位销固定在接触器上，当接触器合闸或分闸时翘板将驱动指示杆拨动指示器，其中“O”代表是分闸，“I”代表合闸。

5.7 真空接触器状态辅助开关的工作原理

接触器状态辅助开关通过翘板带动辅助开关连板进行切换动作。当接触器进行合/分操作时，辅助开关的常开和常闭触点会进行切换（图 12）。

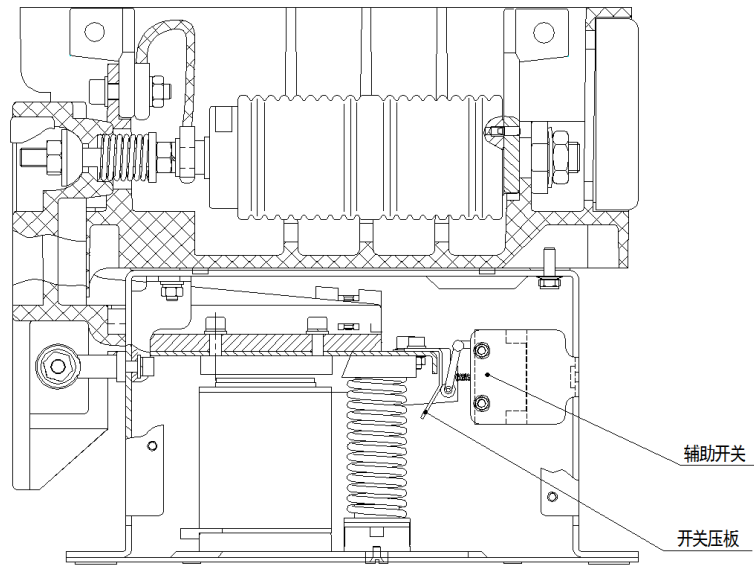


图 12

5.8 熔断器状态辅助开关的工作原理

接触器有两组熔断器辅助开关，两组常开和两组常闭，其中一对供客户使用。当熔断器熔断后，跳闸机构驱动熔断器辅助开关切换。常闭的触点与熔断器具有相同的状态（图 13）。

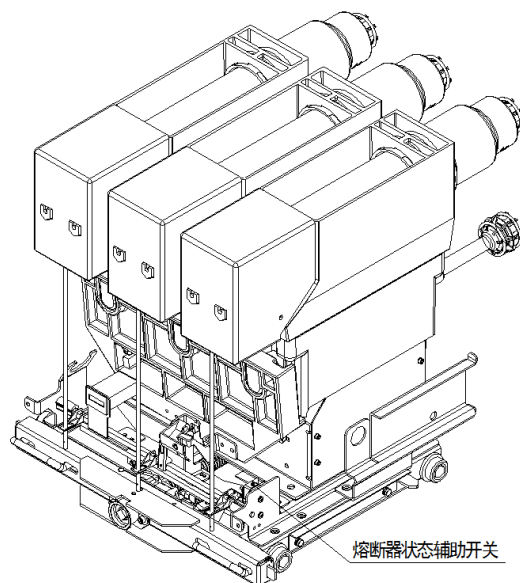


图 13

5.9 底盘车位置辅助开关的工作原理

底盘车装有位置辅助开关。当运行到试验位置，螺杆上的小方块拨动试验位置垫块，使试验位置辅助开关 S8 转变，通过试验位置后 S8 复位；当底盘进入工作位置，螺杆上的小方块拨动拨动工作位置的铜块使辅助开关 S9 的转变，离开工作位置 S9 将复位；所以通过位置开关改变，表明底盘车的位置，二次电路的通断控制（图 14）。

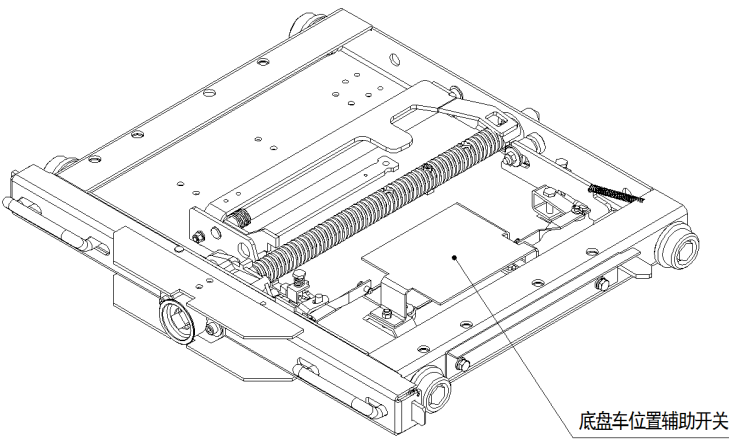
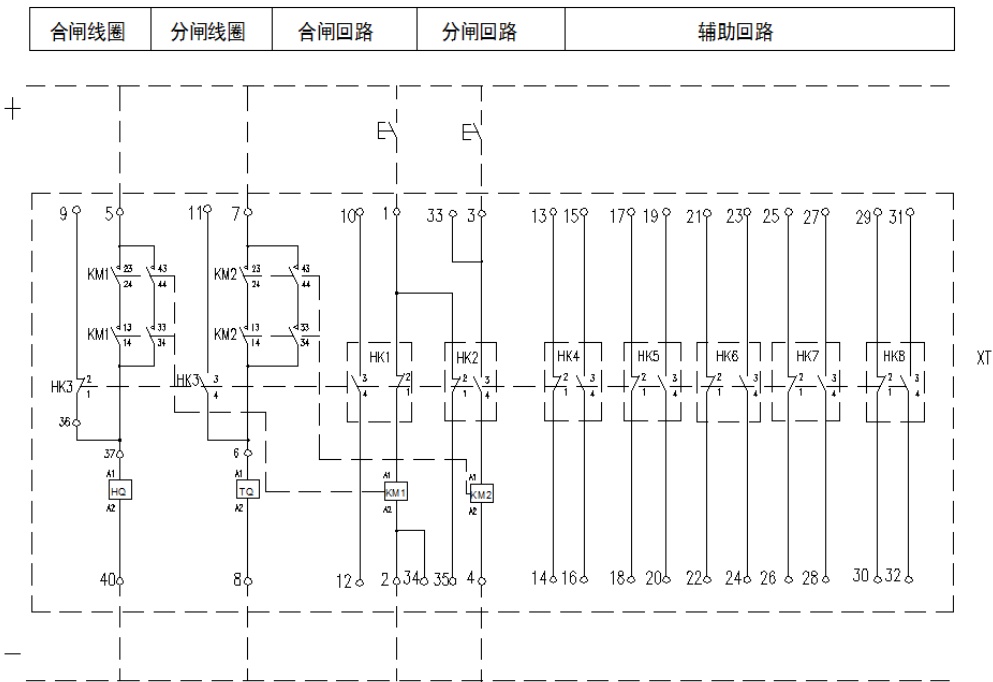


图 14

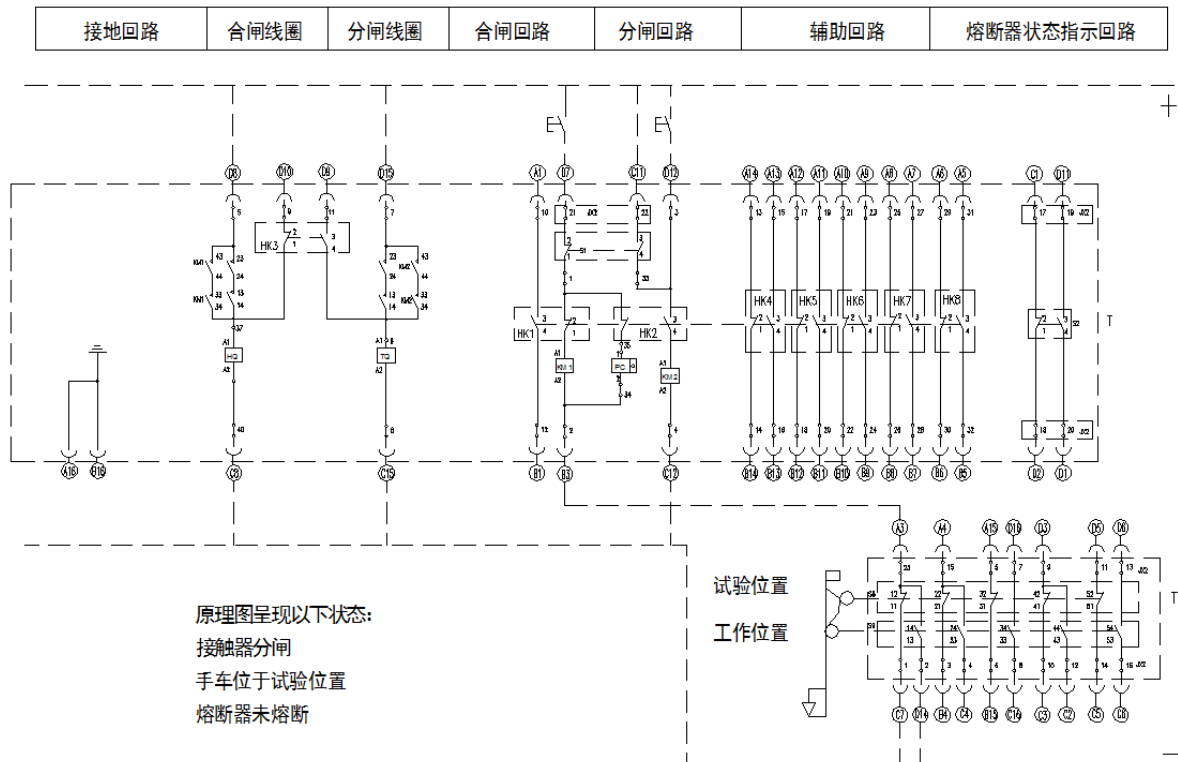
6.电气原理图

- 固定式接触器，直流机械保持

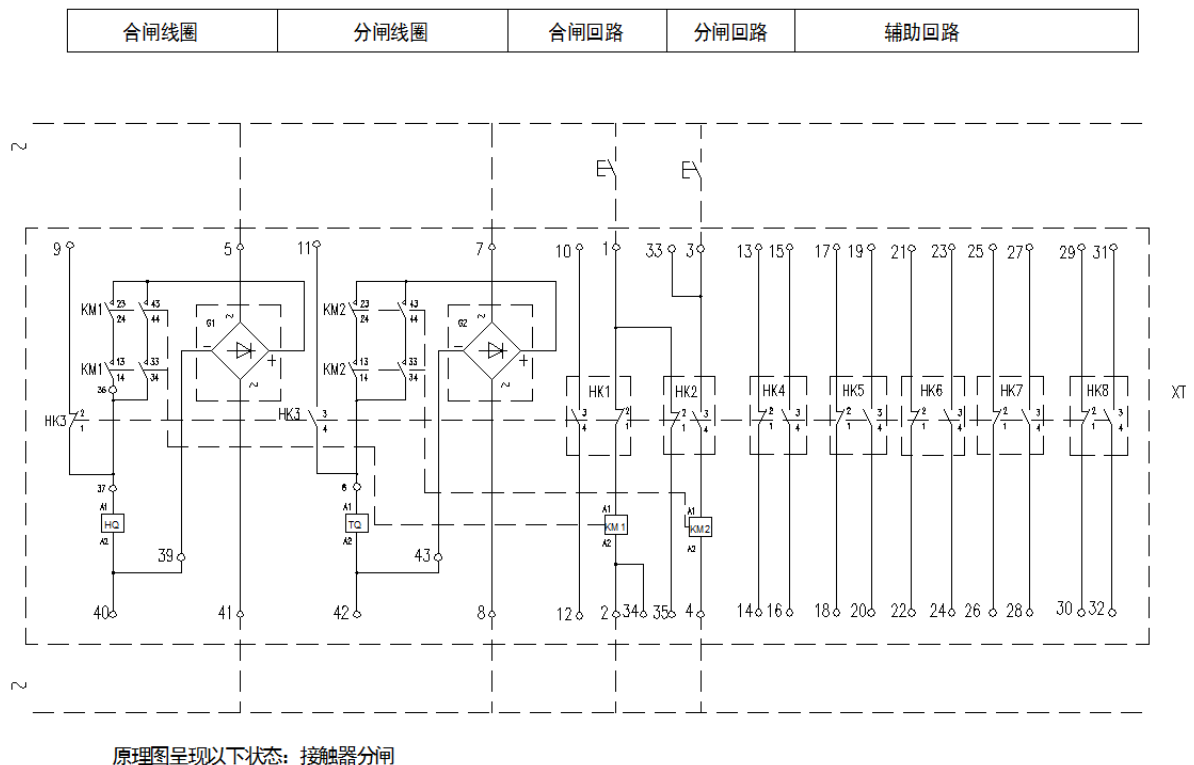


原理图呈现以下状态：接触器分闸

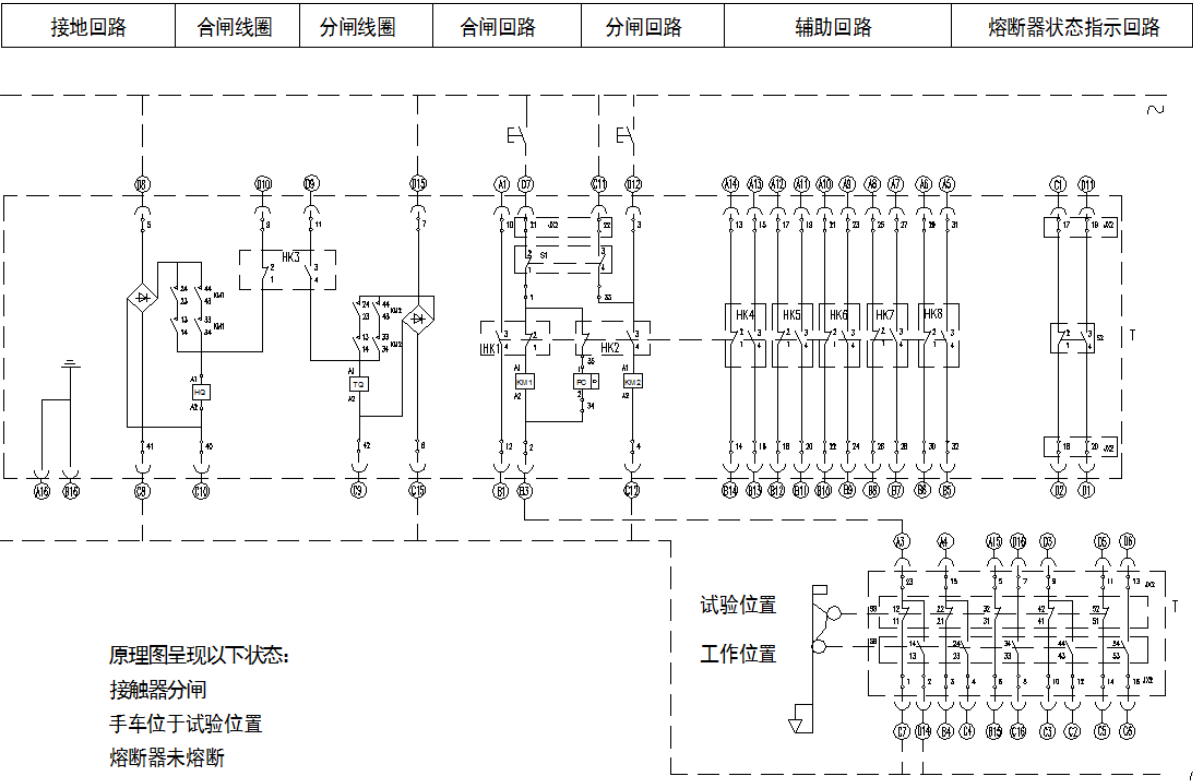
● 中置手车式熔断器-真空接触器组合电器，直流机械保持



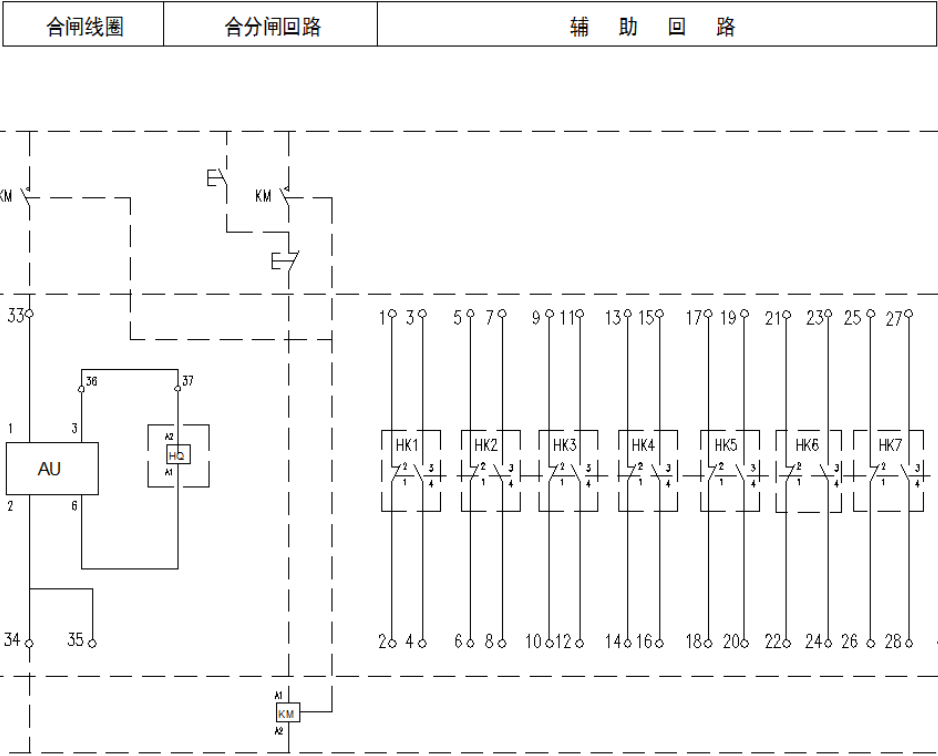
● 固定式接触器，交流机械保持



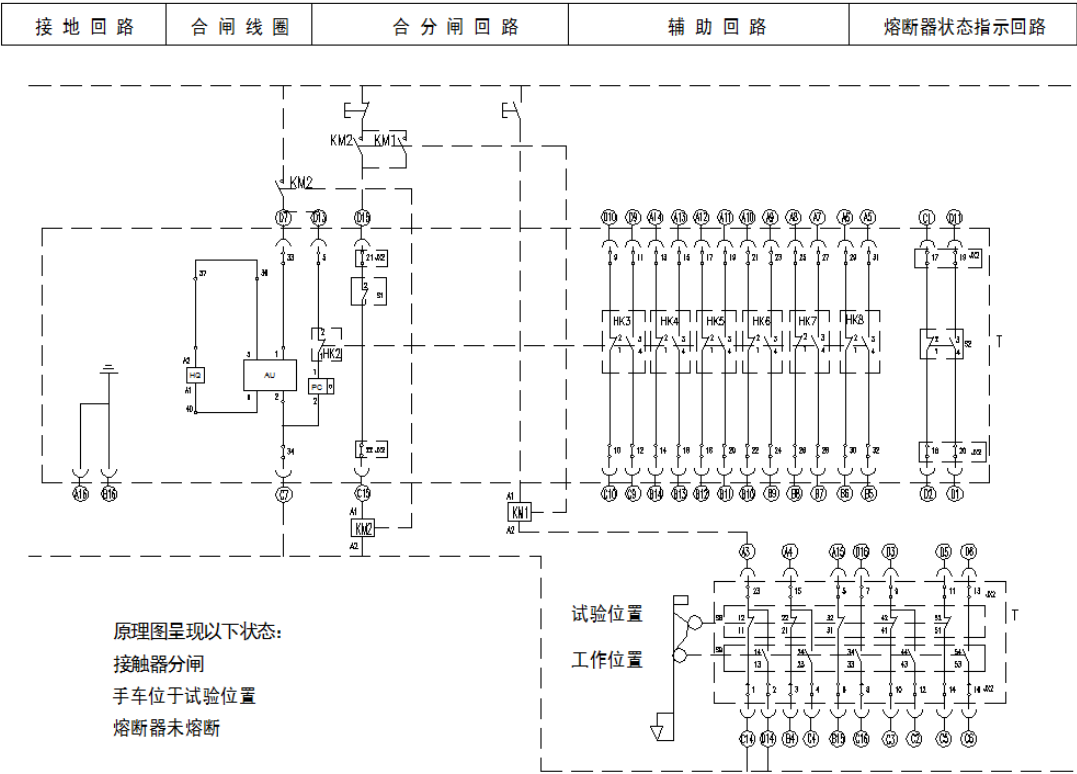
● 中置手车式熔断器-真空接触器组合电器，交流机械保持



● 固定式接触器，交直流电气保持

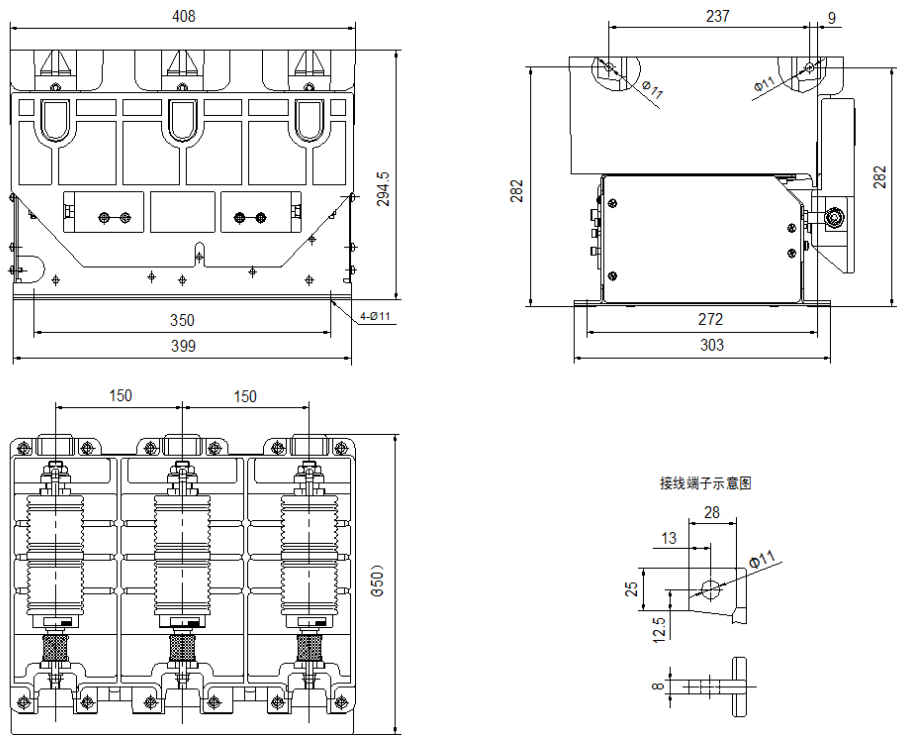


● 中置手车式熔断器-真空接触器组合电器，交直流电气保持

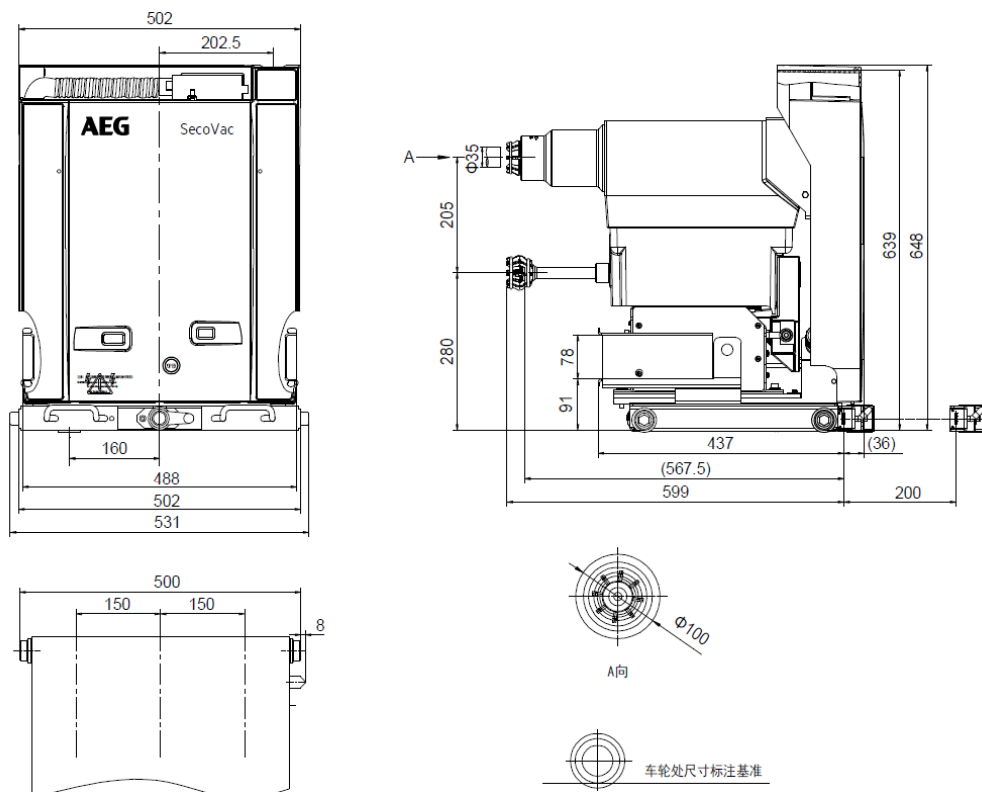


7.外形尺寸

● 固定式接触器



● 手车式接触器



注：1. 配合静触头尺寸 $\phi 35$ ，动、静触头啮合尺寸不小于15mm。

2. 插入式熔断器安装触头盒最小内径为 $\phi 108$

8.维护周期

- 正常运行的接触器应定期检查，每 2-3 年或操作次数满 6000 次进行一次。
- 出现绝缘部件损坏，拒分，拒合或其他异常时应检查和测试。测试项目包括：工频耐压试验、机械特性试验、机械动作试验、紧固件检测。
- 真空灭弧室操作满 300000 次应进行更换；运行满 10 年的接触器应进行评估，以确定是否需要更换。

9.维修和检查

9.1 操作部件的维护和检查

CR193 真空接触器是电磁操作机构，维护和检查应分为机械部分和电气部分。

9.1.1 机械部分的维护和检查

- 目视检查所有零件，有损坏的及时更换。
- 检查各连接件的紧固螺栓是否松动，或是否螺母、开口销、和挡卡有损坏、脱落。
- 检查机构的运动部件，运动部件应润滑。

9.1.2 电气部分的维护和检查

- 检查计数器动作正常。

- 检查辅助开关、行程开关触点是否良好，操作是否正常，螺栓是否紧固。
- 检查合分闸线圈是否完好，否则予以更换。
- 检查合分闸中间继电器是否完好，否则予以更换。
- 检查回路中接线端子是否松动，紧固螺栓。
- 检查航空插头中插针是否松动，安装是否符合规定。

9.2 手动分闸操作检查

9.2.1 对于接触器，可以直接拉分闸杆，检查它是否操作正常。

9.2.2 对于组合电器，可以按下分闸按钮，检查是否操作正常。

9.3 熔断器联动脱扣机构的检查

9.3.1 检查联动脱扣机构的销是否脱落。

9.3.2 检查联动脱扣机构操作是否正常。

9.3.3 检查联动脱扣机构运行中的熔断器的辅助开关的切换是可靠。

9.4 主要导电部件的维护和检查

9.4.1 检查连接部分的紧固件是否松动。

9.4.2 对于特定的扭矩要求紧固件，应使用力矩扳手紧固。

9.5 底盘车的维护和检查

9.5.1 检查联锁板操作是否正常。

9.5.2 检查接地联锁板操作是否正常。

9.5.3 检查合闸闭锁板操作是否正常。

9.5.4 检查底盘车的推进和拉出操作是否正常。

9.6 接触器本体

9.6.1 检查并擦拭真空灭弧室壳体、绝缘框。

9.6.2 对接触器进行机械操作试验，在额定工作电压，高电压，低电压下重复合分 5 次，应正常动作。

9.6.3 对接触器进行机械特性测试，测量合分闸时间、同期性、弹跳时间等。

9.6.4 导电回路连接螺栓紧固，测试电路的电阻。

9.6.5 测量接触器的绝缘性能，进行工频耐压试验。

9.6.6 对接触器进行继保整组试验。

9.7 结尾工作

9.7.1 清理现场，整理工具。

9.7.2 填写维修报告并完成交接手续。

如果在运行中出现一些问题，首先按照故障失效分析表确定原因。如果不能解决，请与厂家联系，请勿自行拆卸接触器。

在调试和操作过程中的每项工作都应由受过专门训练的人员或熟悉该接触器的人员进行。在工作中，必须考虑到保护和预防措施。

无故障运行的前提之一是根据 IEC60470 和 GB/T14808 和本手册的规定, 在正常操作条件下使用接触器。

检查接触器的完整性以避免机械部件、紧固件、外部接口、绝缘部件、操作按钮的损坏。仔细阅读显示在产品铭牌上的数据和技术参数, 确保正确的参数, 保护它免受任何破坏性的环境影响。如果有, 在通电之前, 应恢复到正常的操作条件。

清洁污垢, 特别是绝缘件表面上的污垢。由运输和储存过程所造成的污垢可能会影响产品的绝缘性能。

连接试验位置的二次插头, 进行接触器合分闸操作, 并仔细观察合分闸位置指示和计数器的动作情况。

10.故障分析及处理方法

故障现象	产生原因	判	处理方法
1.不能合闸	1.接触器已处于合闸状态	观察合/分指示窗口, 看它是否显示合闸状态, 合闸状态为红色指示。	先做一个手动分闸, 然后进行合闸操作。
	2.手车不能完全进入工作位置或试验位置	观察状态指示 S8, S9。检查指示状态是否符合实际状态。	顺时针转动手柄, 底盘车前进到 S8、S9 接触正确的开关, 然后保证手车在工作位置。逆时针转动手柄, 底盘车前进到 S8、S9 接触正确的开关, 然后确保手车在试验位置。
	3.熔断器已熔断	观察熔断器指示状态, 熔断器是否熔断。 按下手动分闸按钮, S1, S2 没有微动开关切换的声音。	拆下面板 (拆下面板安装螺母), 检查连杆是否向上, 如果是, 则意味着熔断器已熔断, 请更换。
	4.二次线路断线	观察开关柜的状态指示。 检查二次接线是否安全可靠 (航空插针、底盘车的二次接插件、端子板上的接头是否松动或脱落)	拉出手车在试验位置, 拔下二次插头并根据原理图, 测量二次回路是否断线。如果有断开连接, 则应连接。 如果有掉线, 则应连接。请注意螺丝刀的刀口尺寸, 过大的刀口可能会损坏接线端子。
2.合闸不能保持	1.辅助开关切换过早	接触器有连续合分现象	可将辅助开关位置靠底盘车方向调整
3.手车不能推进或退出	1.接触器处于合闸状态	观察合/分指示窗口和接触器指示牌是否指示合闸状态	将接触器分闸
	2.推进手柄未完全插入推进孔	推进手柄未完全插入推进孔	
	3.接地联锁板变形, 开关柜接地释放锁后不能复位	手电筒查看接地联锁板是否变形	更换变形的联锁板
	4.开关柜接地联锁未解除	查看开关柜接地开关是否分闸	将接地开关分闸

11. 备件

当用户需要时，可按照下述清单确定所需备件，并在订货时提出，以备不时之需。

订货号 (SAP)	产品型号
26410115	接触器绝缘盖板 A
26410116	接触器绝缘盖板 B
26410117	接触器绝缘盖板 C
26490541	宽电压模块 110V
26490544	宽电压模块 220V
26490584	中间继电器 AC110V
26490585	中间继电器 AC220V
26490605	中间继电器 DC110V
26490639	中间继电器 DC220V
26490455	合闸线圈 (机械保持)
26490456	合闸线圈 (电气保持)
26490459	分闸线圈 (110V)
26490460	分闸线圈 (220V)
26490532	底盘车辅助开关
26490045	辅助开关 HK1~8
26490046	辅助开关 HK9~10
26490309	熔断器辅助开关 S1, S2
26441779	一次动触头
26490047	六位电磁计数器 AC110V
26490048	六位电磁计数器 DC110V
26490049	六位电磁计数器 AC220V
26490050	六位电磁计数器 DC220V
26490349	摇进手柄

Caution!

Please read the manual carefully before installation and operation of the contactor:

Installation and operation of the contactor must comply with the requirements of this manual.

The contactor shall be applied under normal operating conditions indoors.

Any operation and maintenance to the contactor must be performed by well-trained professional electricians.

Operating contactor in the conditions beyond its rated parameters is forbidden.

Always pay attention to any markings of the contactor.

Ensure the interlocking conditions of the contactor, as well as the applicability and safety of the working regulation.

Any maintenance with Switchgear or Secondary circuit powered-on is strictly forbidden.

Ensure protecting the contactor from any external impact, otherwise the device will be damaged.

Any irregular operation may damage the device, and even cause serious accident.

This manual should be placed in a convenient place.

Professional personnel should be responsible for the safety management of circuit breakers.

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1. Overview

This manual provides the maintenance requirements and working specifications of CR193 vacuum contactor and fuse vacuum contactor combination apparatus to ensure safety and extend its service life. This manual is applicable to CR193 vacuum contactor (hereinafter referred to as contactor) and fuse vacuum contactor combination apparatus (hereinafter referred to as combination apparatus).

2. Application standard

China national standards:

GB/T 14808	High-voltage alternating current contactors and contactor-based motor-starters
GB/T 11022	Common specifications for high-voltage switchgear and controlgear standards
GB/T 15166.2	High-voltage alternating-current fuses Part 2: Current-limiting fuses
GB/T 50150	Electric equipment installation engineering standard for hand-over test of electric equipment
GB/T 311.1	Insulation co-ordination-Part 1: Definitions, principles and rules
GB/T 16927.1	High-voltage test techniques Part 1. General test requirements
GB/T 13384	General specifications for packing of mechanical and electrical product

IEC standards:

IEC 60470	High-voltage alternating current contactors and contactor-based motor-starters
IEC 60694	Common specifications for high-voltage switchgear and controlgear standards
IEC 60632-1	High-voltage motor starters Part1:Direct-on-line(full voltage) a. c. starters
IEC 60282-1	High-voltage fuses Part 1: Current-limiting fuses
IEC 60071-1	Insulation co-ordination. Part 1 : Definitions, principles and rules

Fuses size and Impactor type shall comply with DIN 43625 and BS 2692 standards. Fuse electrical properties shall comply with IEC 60282 and GB/T 15166.2 standards.

3. Technical data

3-1 The technical parameters of Vacuum contactor and combination apparatus (table 1)

Table 1

Item		Unit	Numerical value		
			Vacuum contactor	Combination apparatus	
Rated voltage		kV	12	7.2	12
Rated insulation level	Power frequency Withstand voltage(1min)	kV	42/48	32/34	42/48
	Lightning impulse withstand voltage (peak)		75/85	60/70	75/85
Rated frequency		Hz	50	50	
Rated normal current	Transformer	A	400	6.3~355	6.3~224
	Motor			25~355	25~250
Short-time withstand current (4s)		kA	4	6.3	/
Rated peak withstand current		kA	10	16	/
Current overload tolerance(1s)		kA	6	9.5	/
Rated short-circuit breaking current		kA	4	6.3	50
Rated short-circuit making current		kA	4	6.3	/
Rated junction current		kA	/		3.2
Rated service mode			Continuing service		Continuing service
Mechanical endurance	Mechanical holding	10000 cycles	30		30
	Electrical holding	10000 cycles	30		30
Auxiliary contact			6a+6b		6a+6b
Loop resistance (each phase)		$\mu\Omega$	≤ 150		$\leq 200^*$
Weight		kg	46		98

Note: * fuse resistance not included.

3-2 Technical parameters of control circuit (table 2)

Table 2

Item	Mechanical holding				Electrical holding			
Rated operating voltage	AC110	DC110	AC220	DC220	AC110	DC110	AC220	DC220
Closing operating current (A)	9	9	4.5	4.5	9	9	4.5	4.5
Closing holding current (A)	/	/	/	/	1	1	0.5	0.5
Opening operating current (A)	12	12	6	6	/	/	/	/
Rated working voltage range	Closing: 85%-110% rated operating voltage Opening: 65%-120% rated operating voltage				Closing: 85%-110% rated operating voltage			
Operating frequency (cycles/h)	600				600			

Notes: the value in this table is approximate value.

3-3 Mechanical characteristic parameters (table 3)

Table 3

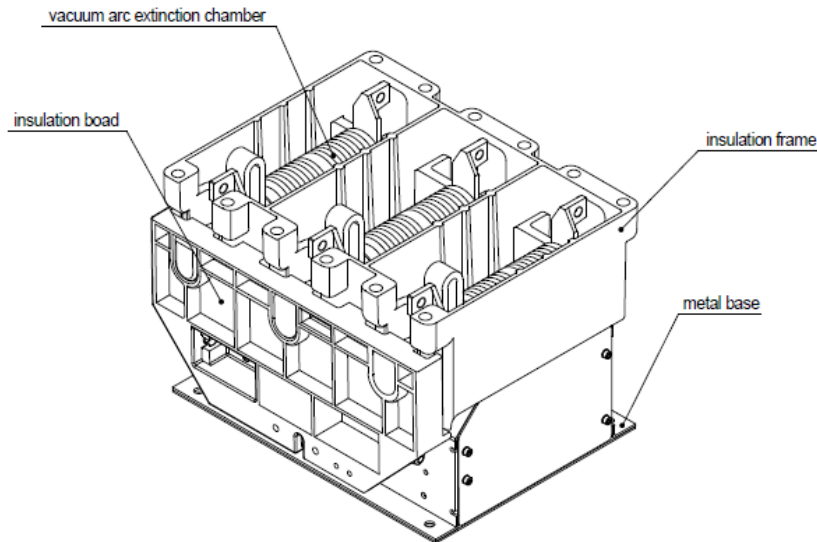
No.	Item		Unit	Value	
				Vacuum contactor	combination apparatus
1	Contacts gap		mm	6.0±1.0	6.0±1.0
2	Over travel		mm	2.5±0.5	2.5±0.5
3	Interphase center distance		mm	150±1.0	150±1.0
4	Synchronization of 3-phase contact		ms	≤2	≤2
5	Contact closing bounce time		ms	≤2	≤3
6	Closing time		ms	≤100* (180)	≤100* (180)
7	Opening time	Mechanical holding	ms	≤70* (160)	≤70* (160)
		Electrical holding	ms	≤100*	≤130*

Notes: * actuation time of relay not included.

4. Product structure

4-1 Main structure of vacuum contactor

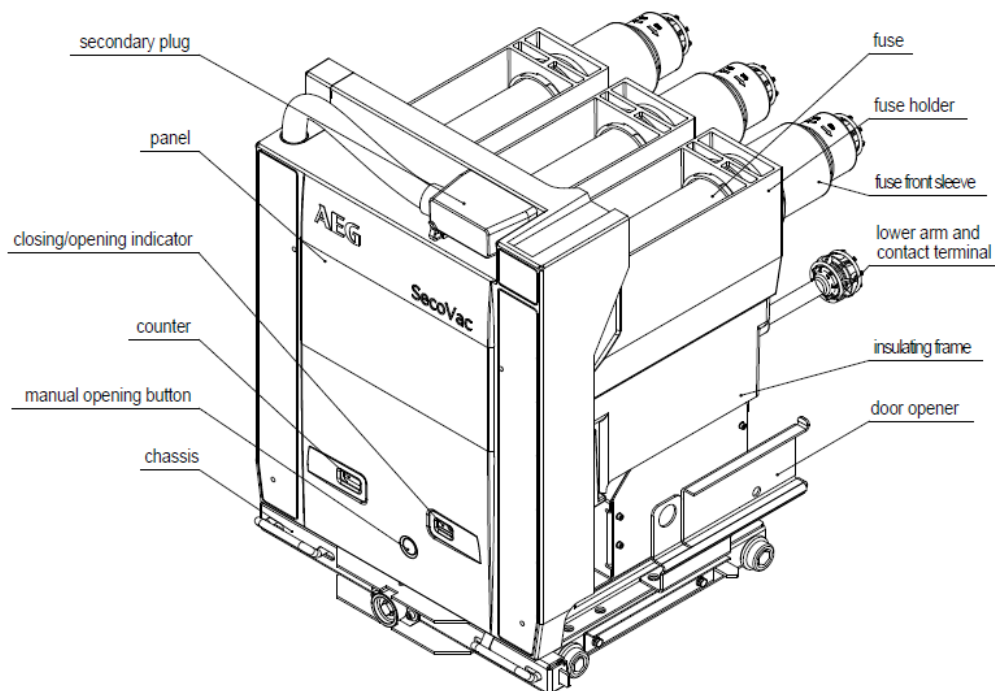
● Fixed



The vacuum contactor (insulated frame) is mainly composed of vacuum interrupter, insulating frame, metal base, insulating warping plate, electromagnetic operating mechanism, etc.

4-2 The structure of combined electrical apparatus is mainly composed of fuse, vacuum contactor and chassis car

● Handcart



5. Working principle

5.1 Working principle of fuse vacuum contactor combination apparatus

CR193 vacuum contactor is a kind of high voltage electrical apparatus which is mainly used to switch on and off the load current. The power circuit can be connected and broken by vacuum interrupter.

The fuse vacuum contactor combination device is mainly composed of high-voltage current limiting fuse, contactor and chassis car. Its basic working principle is: the normal start and stop of load depends on the contactor, which also has the task of breaking part of load current, making full use of the long mechanical life and frequent operation of the contact, and the more serious load current or short circuit. The current breaking task is completed by high voltage current limiting fuse, which makes full use of the current limiting characteristics of fuse and the advantage of large expected breaking current. Combine and connect the two parts, connect them to the switch cabinet in the way of plum contact, and connect the secondary control circuit of the switch cabinet through the secondary plug. They can cooperate with each other, give full play to their advantages and avoid disadvantages, so that the F-C circuit has some characteristics different from other equipment, such as small rated current, large breaking current, frequent operation and long mechanical life.

Closing

When the contactor receives the closing command, for the mechanical vacuum contactor, the coil of the closing relay is energized, the normally open contact is closed, the circuit of the closing coil is energized, and the operating mechanism acts, that is, the closing electromagnet under the action of electromagnetic force drives the insulation rocker to rotate clockwise, and the screw of vacuum interrupter is pushed to make linear motion through the contact pressure spring. Then, the moving contact and the fixed contact are closed, at the same time, the contact spring generates the required contact stroke (i.e. overtravel), so as to ensure the required pressure between the moving contact and the fixed contact.

For the mechanical vacuum contactor, there is a mechanical closing latch to make the contactor in the closing state.

For the electric vacuum contactor, the electric holding module outputs stable current to keep the closing state.

For combined electrical apparatus, three-phase fuse must be installed, and it can complete the closing action only when it meets the unfused state.

Opening

When the contactor receives the opening command, for the mechanical vacuum contactor, the opening relay coil is energized, the normally open contact is closed, the opening coil circuit is on, and the opening tripping mechanism acts, that is, under the action of electromagnetic force, the opening electromagnet drives the roller out of the lock, the opening spring drives the electromagnetic operation mechanism to act, and drives the insulation rocker to rotate anticlockwise. Pull the bolt of the arc extinguishing chamber to separate the moving contact from the static contact at a proper speed. The buffer pad will work near the final opening position and absorb the residual kinetic energy of the opening, thus completing the whole opening process.

For the electrical holding vacuum contactor, there is no unlocking process, the electric holding module loses power and the contactor opens.

Manual opening

The mechanical vacuum contactor and combined electrical apparatus have the function of manual opening operation: directly push the manual opening lever of vacuum contactor, and the manual opening lever drives the opening electromagnet, and drives the roller to break away from the lock, so as to realize the manual opening (Fig. 1 and Fig. 2).

The combined electrical apparatus with electrical holding also has the function of manual opening operation, but it needs to be realized through the switch cabinet.

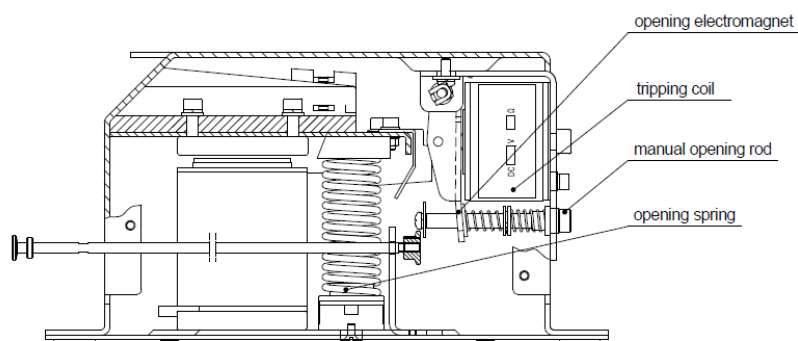


Fig. 1

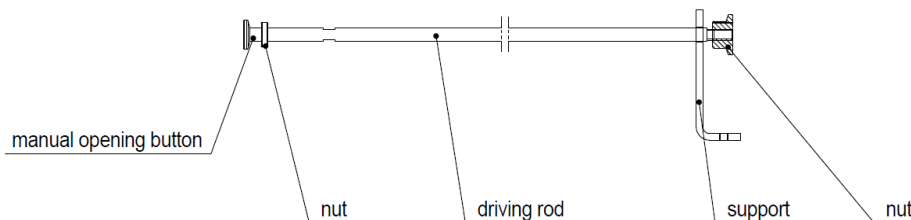


Fig. 2

5.2 Working principle of fuse

Working principle of Fuse impactor (Fig. 3)

The fuse has a spring striker system. The system is connected with the fuse. When the fuse is fused, the pressure spring striking pin is ejected from the end face of the contact cap of the high-voltage fuse. The striker will act as the actuating part and visual display device of the fuse release device.

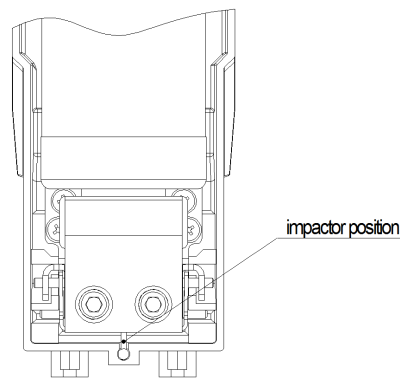


Fig. 3

Working principle of fuse linked tripping mechanism (Fig. 4)

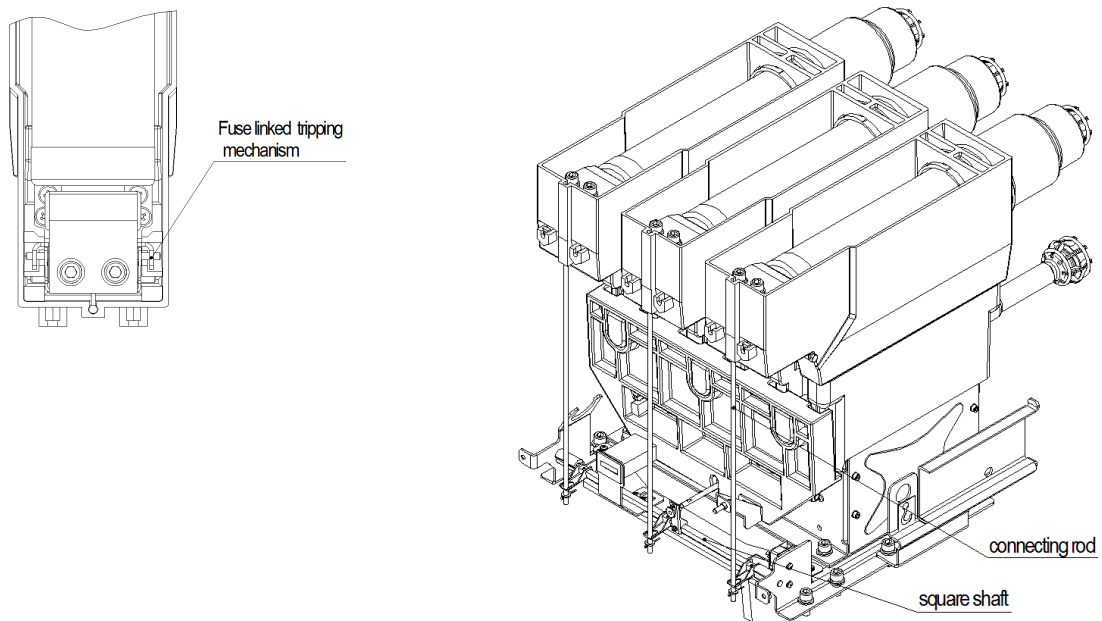


Fig. 4

The linkage tripping mechanism of fuse is composed of a pin, a bracket of interlocking mechanism, and a spring.

When the fuse is not installed, the linkage mechanism bracket will drive the connecting rod under the action of spring, which makes the transmission rod push the opening electromagnet, and the mechanism cannot keep closing state. Therefore, if one phase fuse is not installed, the contactor cannot be closed, which can prevent the contactor from closing in the case of lack of phase.

When the fuse is blown, the impactor will push the connecting rod. When the connecting rod pulls up the fuse connector, it will rotate the opening connector and push the opening rod to release and unlock the

switch. The three-phase fuse connector and one opening connector are fixed on a square shaft. Even if only one phase fuse is blown, the contactor will trip in linkage. When three-phase fault occurs, the action error time should be considered. If only one phase fuse is fused, even if the appearance of the other phase fuses is very good, all fuses should be replaced due to over-current, so as to ensure that the fuses are not replaced with electricity. The fuse in normal operation shall be inspected regularly.

5.3 Replace Fuse(Fig. 5,6,7)

When it is necessary to install and replace the fuse: insert the fuse with a screw driver, press down the support of the interlocking mechanism to the bottom (if there is no such action, when inserting the fuse, the fuse will collide with the bracket, affecting the interlocking mechanism), and insert the fuse into the conductive base (pay attention to the installation direction of the fuse, and insert the contact pin end into the conductive base). After the fuse is installed in place, put the rubber washer into the fuse sleeve and push the fuse holder forward. Clockwise is the rotation direction and counterclockwise is the rotation out direction. When installed in place, the opening and closing arrows of the fuse sleeve shall be at the top position. Insert the sleeve positioning plate into the gap between the sleeve and the fuse holder and lock it. vice versa.

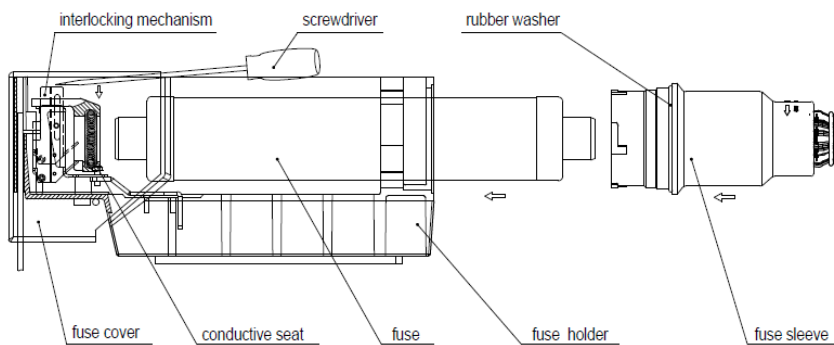


Fig. 5

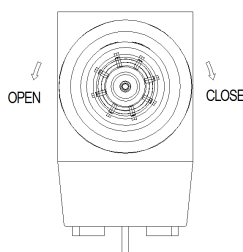


Fig. 6

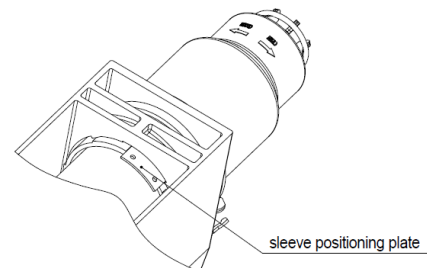


Fig. 7

5.4 Working principle of the chassis (Fig. 8)

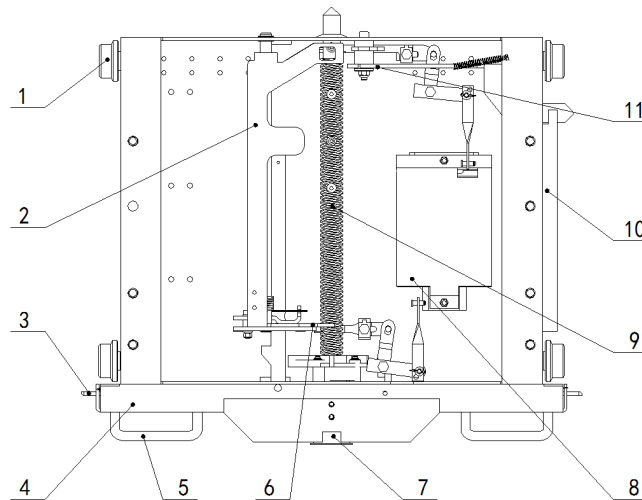


Fig.8

- | | | |
|--|-------------------------------|----------------------------|
| 1. roller | 2. closing interlocking plate | 3. fixed locking plate |
| 4. supporting beam | 5. handle | 6. operation position lock |
| 7. handle socket | 8. position switch | 9. screw |
| 10. earthing switch interlocking piece | | 11. test position lock |

The support beam (4) of the chassis truck is fixed on the switch cabinet through the fixed lock plate (3), and the screw (9) is installed on the support beam, which can be rotated and connected with the base through the nut (the nut is fixed on the base). When the screw is rotated, the chassis will move forward and backward along the screw direction to drive the contactor body to advance and exit; at the front end and rear end of the turnover plate (2), there are lock locks of the screw (6 is the working position latch, and 11 is the test position latch).

Push-in and pull-out of the chassis

When the contactor and grounding switch are in the opening state and the grounding interlock is in the reset state, the screw can be freely rotated to drive the chassis and the contactor body to advance and exit within the stroke range

After pushing the handcart type contactor into the switch cabinet, the following steps shall be followed:

Insert the handle into the socket and rotate the handle clockwise to push in (counter clockwise to exit). The stroke is about 200 mm, and it should enter the working position or test position smoothly when it is opened. Rotate the handle at medium speed for 20 turns. When you hear the "click" position switch mechanism action sound, it is in place. (avoid damaging the mechanism by excessive force).

Anti misoperation function of chassis

● Avoiding pulling the insulation contact on-load

When the contactor is closed, the chassis car cannot shake. There is a combined brake interlocking device above the turnover plate of the chassis truck, which presses the turnover plate of the chassis car. If the contactor is in the test position, the square hole (11) of the lock in the test position will lock the screw rod, and the chassis vehicle cannot shake; if the contactor is in the working position, the working position latch (6) will resist the screw, and the chassis vehicle cannot shake, so as to avoid pulling the isolation contact with load (Fig. 9).

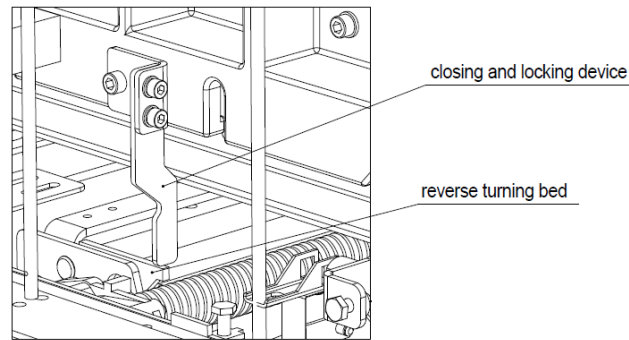


Fig. 9

● Avoiding closing in earthing position, avoiding on-load earthing

When the grounding switch of the switch cabinet is closed, the interlocking mechanism of the grounding switch pushes the grounding interlocking parts to move towards the screw, so that the interlocking parts block the screw, and the chassis vehicle cannot run from the test position to the working position; on the contrary, if the contactor is in the working position, the grounding switch interlocking mechanism of the switch cabinet is blocked by the grounding switch related locking plate of the chassis vehicle, and the grounding switch handle cannot be inserted Operation hole, grounding switch cannot be closed. So as to prevent closing in the grounding state and grounding with load (Fig. 10).

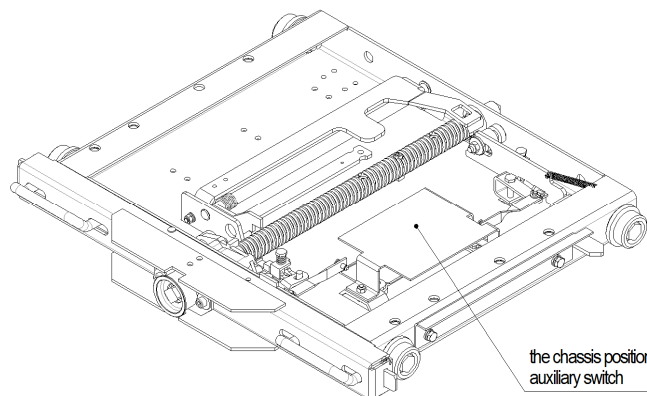


Fig. 10

5.5 Working principle of the counter

The fuse vacuum contactor combination has a six position electromagnetic counter, which is installed in a closed circuit. After the electrical signal is input into the counter, the electromagnetic force is generated to make the electromagnetic drive mechanism and the driving digital gear rotate. The decimal counting method is used to record the operation times of the combined electrical apparatus (Fig. 11).

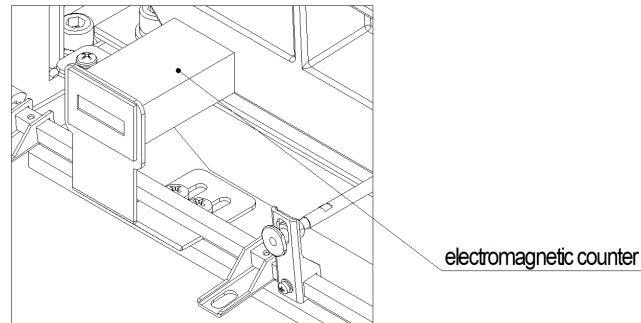


Fig.11

5.6 Working principle of closing/opening indicator

After each closing or opening operation of fuse vacuum contactor combination apparatus, the closing and opening indication will make corresponding indication. The mechanical on-off state indicator is fixed on the contactor with locating pin. When the contactor is closed or opened, the rocker will drive the indicator rod to move the indicator, where "O" represents opening and "I" represents closing.

5.7 Working principle of state auxiliary switch

The auxiliary switch of the contactor state drives the connecting plate of the auxiliary switch to switch through the warping plate. When the contactor is closed / opened, the normally open and normally closed contacts of the auxiliary switch are switched (Fig. 12).

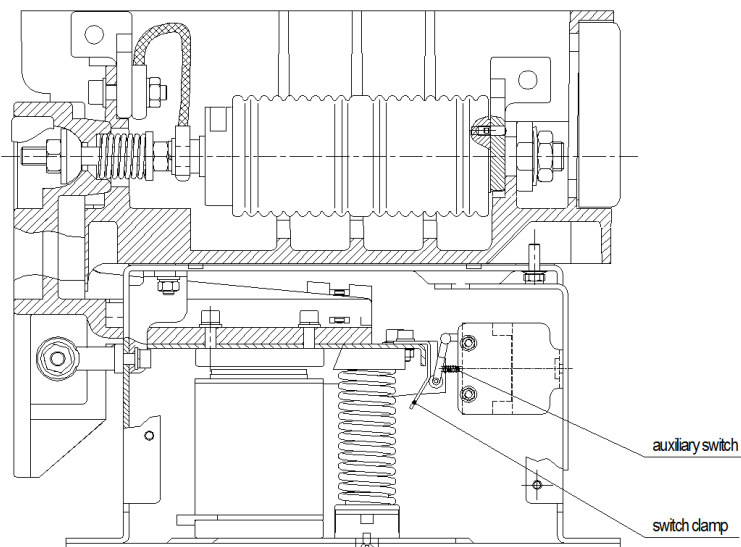


Fig.12

5.8 Working principle of the fuse state auxiliary switch

The contactor has two sets of fuse auxiliary switches, two groups of normally open and two groups of normally closed, one of which is used by customers. When the fuse is fused, the trip mechanism drives the fuse auxiliary switch to switch. Normally closed contacts have the same status as fuses (Fig. 13).

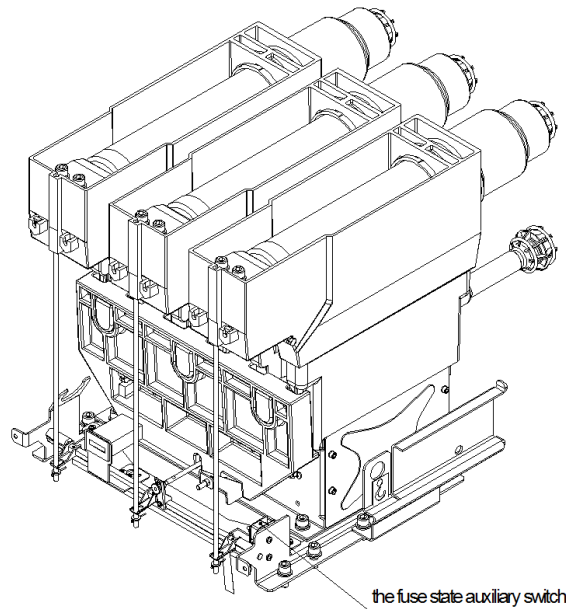


Fig. 13

5.9 Working principle of chassis position state auxiliary switch

The chassis is equipped with position auxiliary switch. When running to the test position, the small block on the screw moves the test position cushion block to change the auxiliary switch S8 of the test position and reset S8 after passing the test position; when the chassis enters the working position, the small square on the screw moves the copper block of the working position to change the auxiliary switch S9 and reset when it leaves the working position S9; therefore, the position of the chassis vehicle is indicated by the change of the position switch On off control of secondary circuit (Fig. 14).

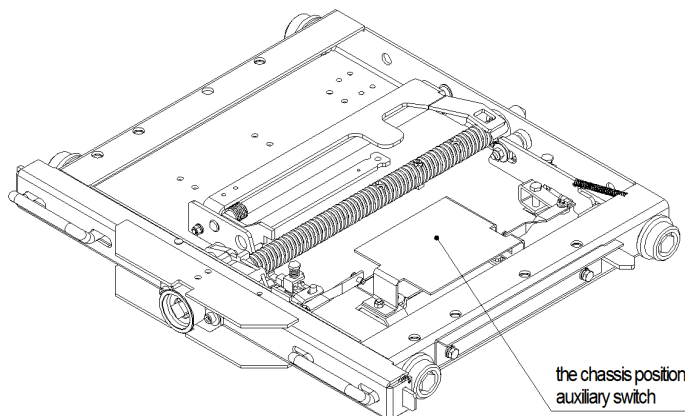
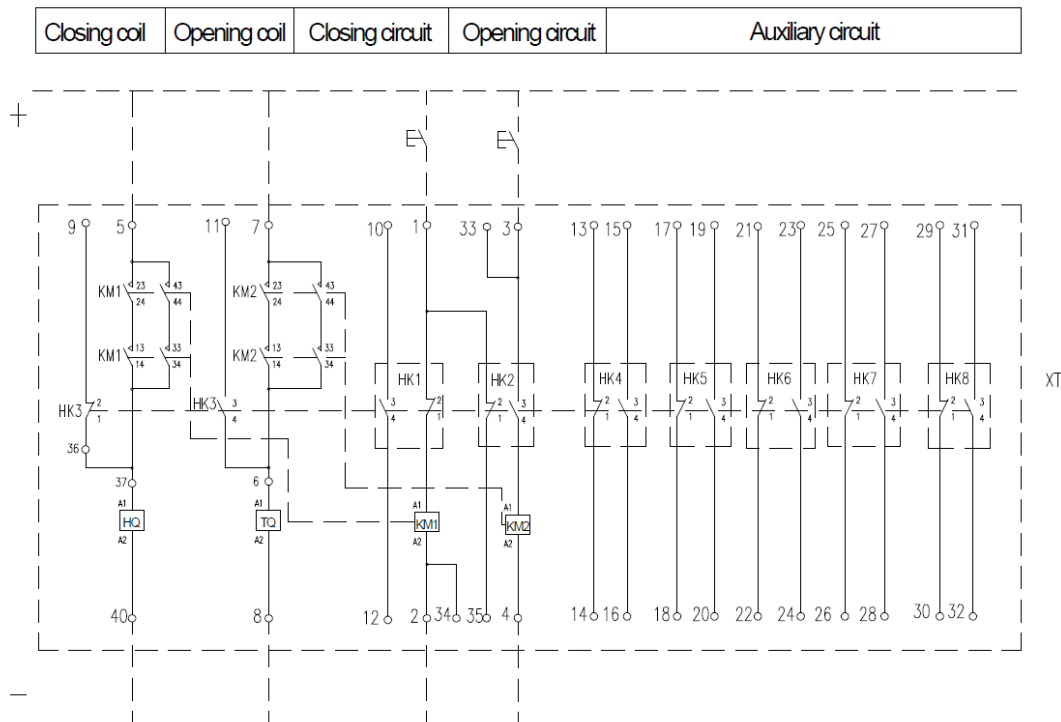


Fig. 14

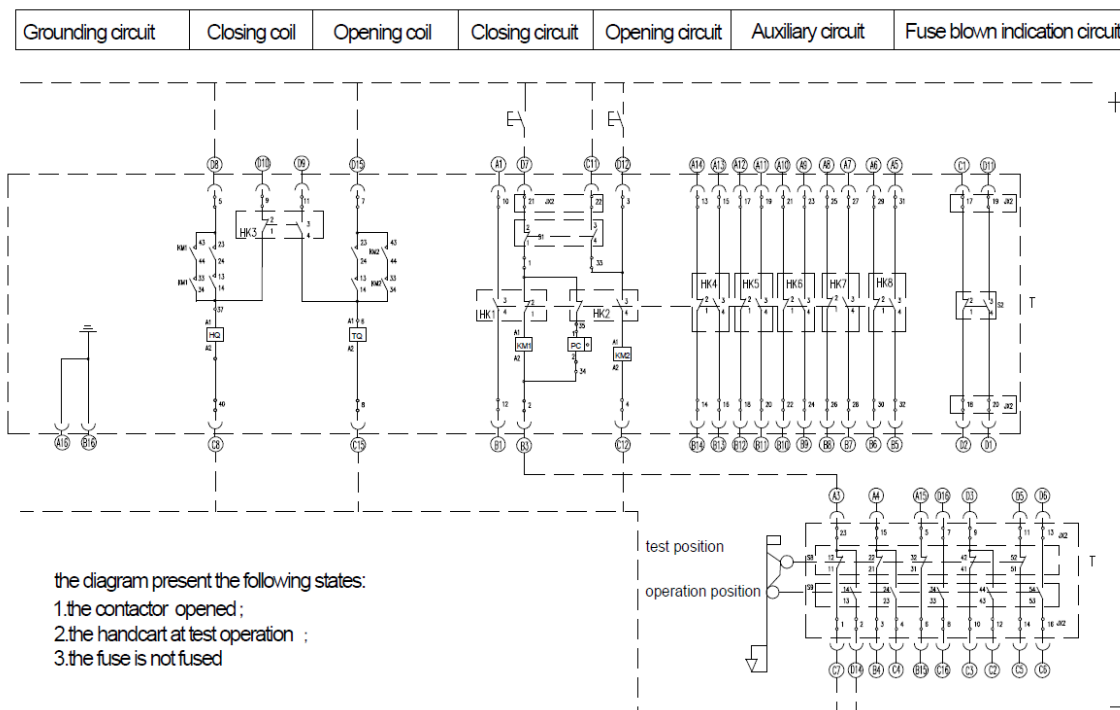
6. Electrical schematic diagram

● Fixed contactor, DC, mechanical holding

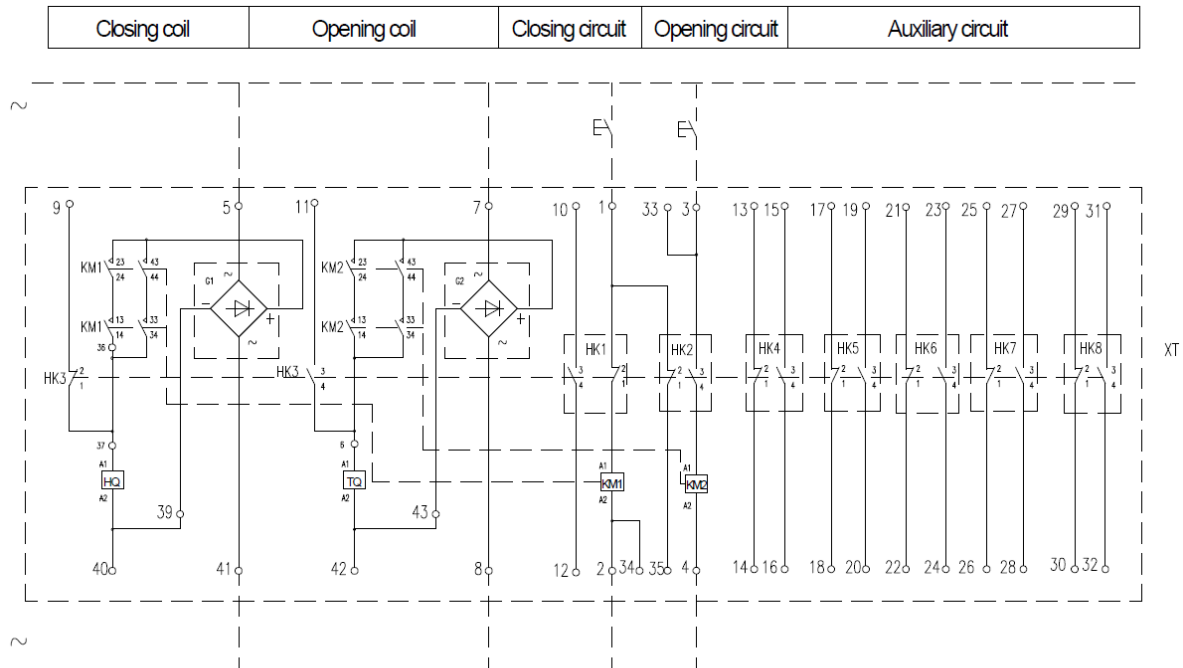


the diagram present the following states: the contactor opened

● F-C combination, DC, mechanical holding

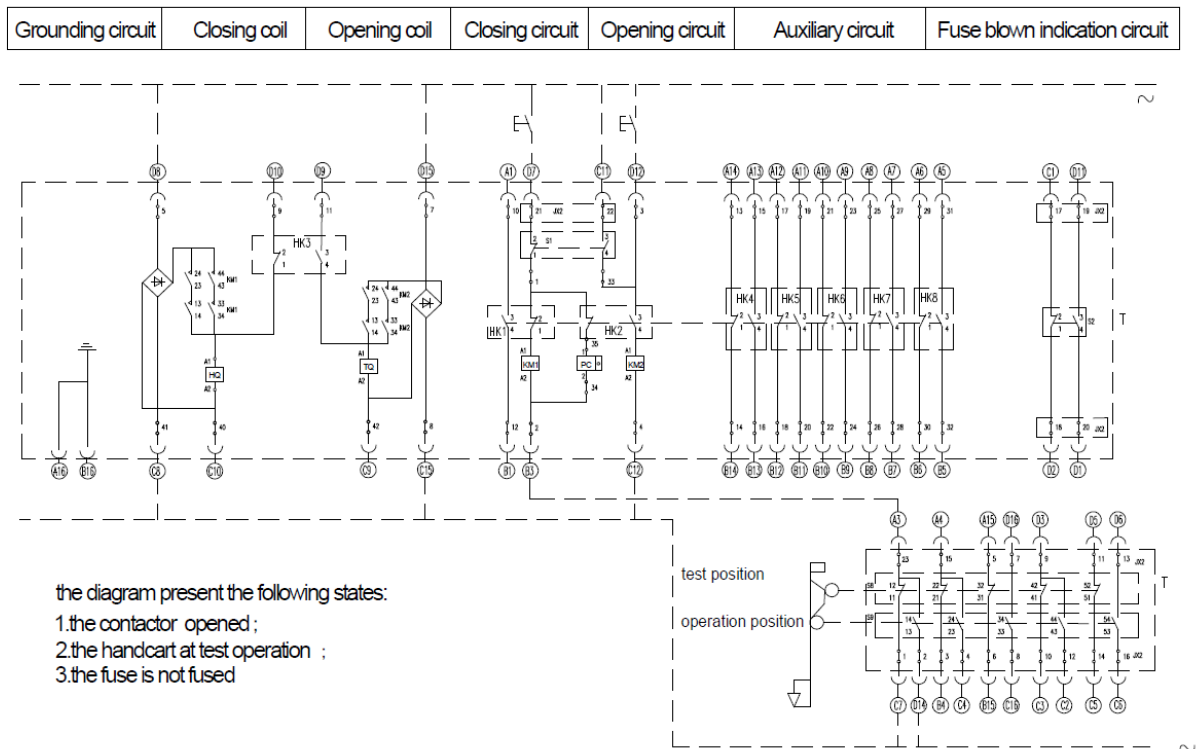


● Fixed contactor, AC, mechanical holding

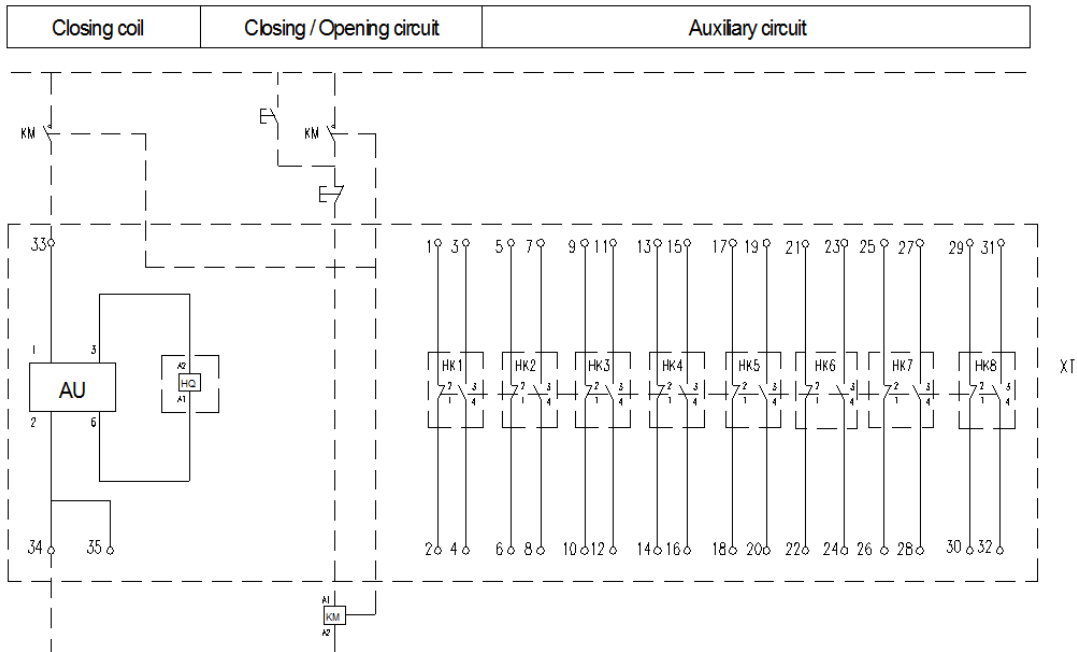


the diagram present the following states: the contactor opened

● F-C combination, AC, mechanical holding

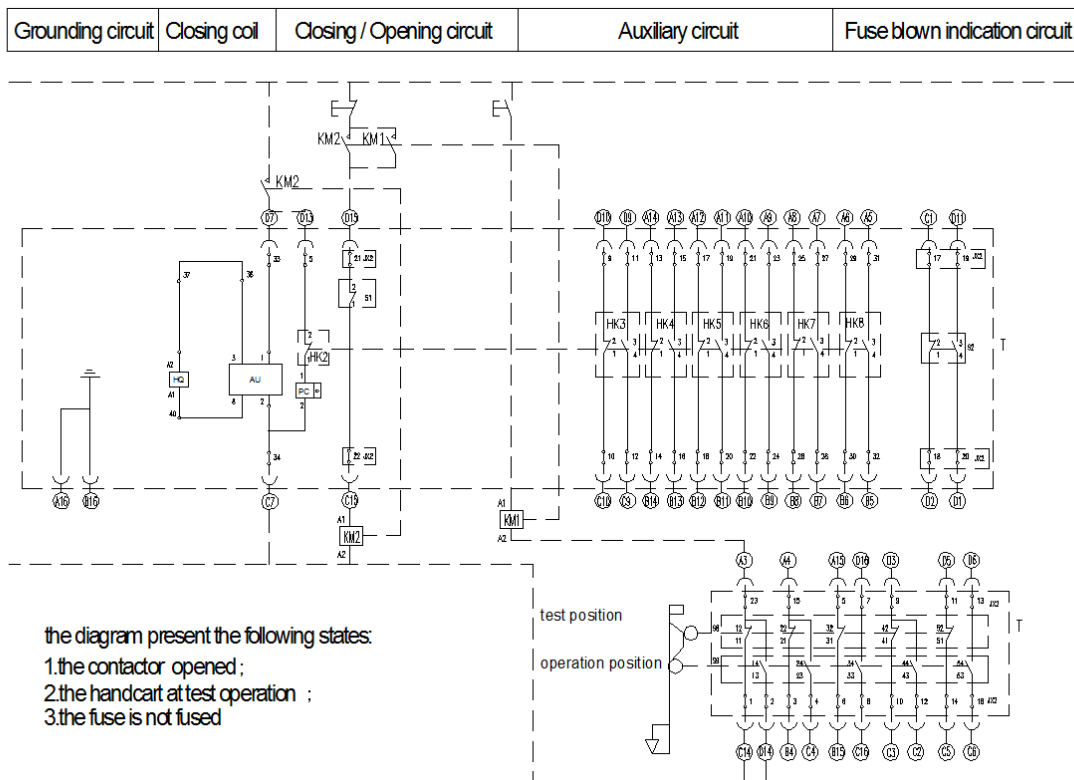


● Fixed contactor, AC-DC, electrical holding



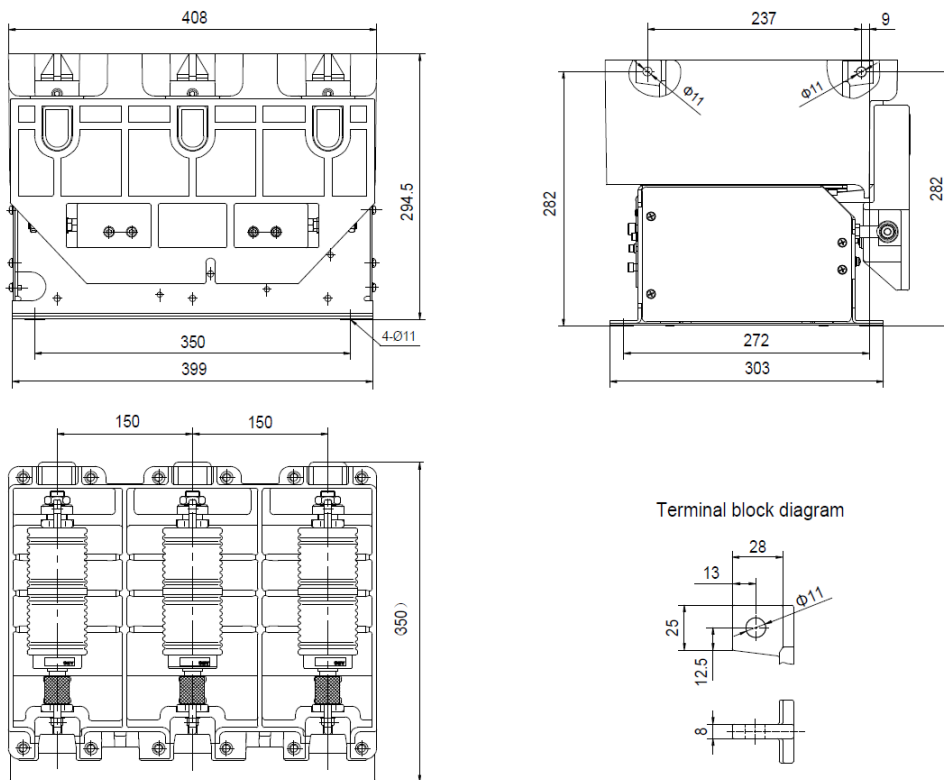
the diagram present the following states: the contactor opened

● F-C combination, AC-DC, electrical holding

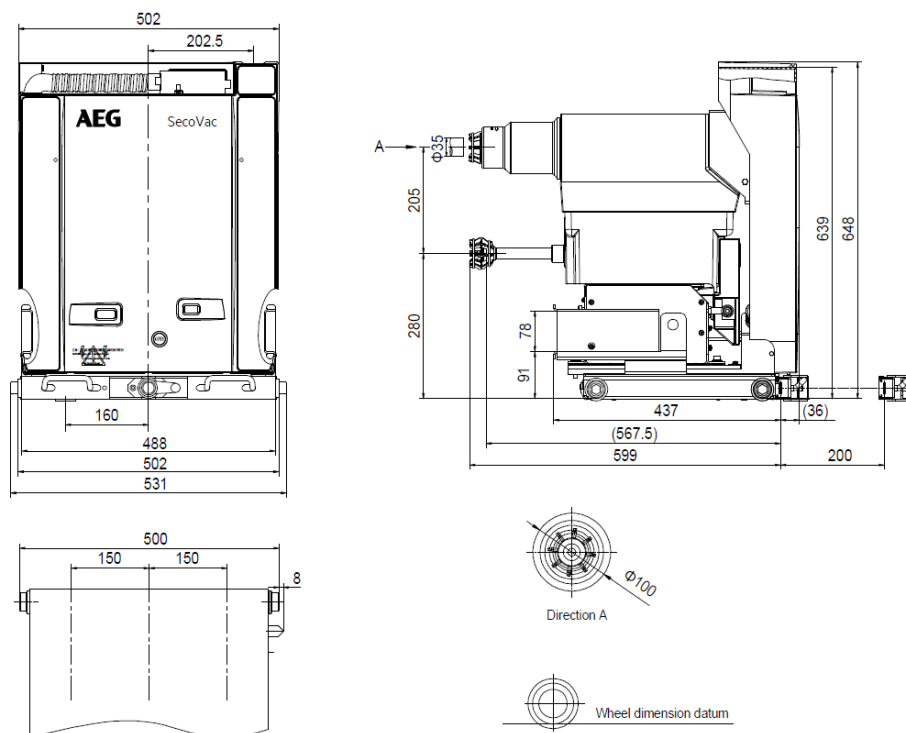


7. Dimensions

● Fixed



● Handcart



Note: 1. the size of matching fixed contact is $\Phi 35$, and the meshing size of moving contact and fixed contact is not less than 15mm;
2. The minimum inner diameter of contact box for plug-in fuse installation is $\Phi 108$

8. Maintenance period

- Contactor shall be inspected regularly, for every 3-5 years, or 6000 cycles operations.
- If insulation components damaged, fail to open, fail to close, or any other failures, contactor shall be inspected and tested. Testing items shall include: power frequency withstand test, mechanical characteristic test, mechanical operation test, and fastener inspection.
- Vacuum arc extinction chamber shall be replaced after 300000 cycles of operation. After 10 years operation, contactor shall be re-evaluated to determine if replacement is required.

9. Maintenance and inspection

9.1 Maintenance and inspection for operation parts

CR193 vacuum contactor is an electromagnetic operated mechanism. Both mechanical and electrical maintenance and inspection shall be conducted.

9.1.1 Maintenance and inspection for mechanical part

- Visually check all components. Replace parts if damaged.
- Check fastening bolts of all connecting parts. Check if all nuts are tightened. Check if any cotter pin or stopper is broken or dropped.
- Check the moving parts of the mechanism. Lubricate all the motion parts.

9.1.2 Maintenance and inspection for electrical part

- Check the counter is working.
- Check auxiliary switch and travel switch contacts work well. Fasten the bolts.
- Check closing/opening coil. Replace if damaged.
- Check closing/opening intermediate relay. Replace if damaged.
- Check all the secondary circuit terminals. Fasten them.
- Check all the contact pins in air plug.

9.2 Manual opening operation

9.2.1 For contactor, pull opening rod directly to check open operation.

9.2.2 For combination, press opening button to check open operation.

9.3 Inspection for fuse link-tripping mechanism

9.3.1 Check the link-tripping pin is in right position.

9.3.2 Check the link-tripping mechanism operates well.

9.3.3 Check fuse auxiliary switch is reliable during the operation of the link-tripping mechanism.

9.4 Maintenance and inspection for the primary conductive part

9.4.1 Check the fastener in the connecting part.

9.4.2 Fasten all the fasteners to required torque with torque wrench.

9.5 Maintenance and inspection for the chassis

9.5.1 Check whether the left and right interlocked plate operates normally.

9.5.2 Check whether the earth lock plate operates normally.

9.5.3 Check whether the closing locked plate operates normally.

9.5.4 Check whether the push-in and pull-out operation of the chassis is normal.

9.6 Contactor body

9.6.1 Check and wipe the shell of vacuum arc extinction chamber, insulation frame.

9.6.2 Make mechanical operation test to the contactor, repeat closing and opening 5 times under rated operation voltage, high voltage, low voltage, it shall operate normally.

9.6.3 Make mechanical characteristic test to the contactor. Measure the closing and opening time, synchronism, bounce time etc.

9.6.4 Fasten all the bolts in conductive circuit. Test the loop resistance.

9.6.5 Measure the contactor insulation. Conduct power frequency withstand test.

9.6.6 Make relay protection full group test

9.7 End work

9.7.1 Clear the site and put tools in order.

9.7.2 Fill in the servicing test report and finish the handing-over procedure.

If any question during operation, first check the FAQs. If cannot be solved, please contact with the manufacturer. Disassembling the contactor is strictly forbidden.

Commissioning or operation shall be carried out by specially trained personnel. Protective and preventive measures must be taken into consideration.

Use the contactor under normal operation conditions according to IEC63201, GB/T14808 and this manual. Carefully read the data and technical parameters indicated on the product nameplates to ensure the correct parameter. Secure contactor from any damaging environment.

Clean dirt, especially dirt on insulation parts' surface. Dirt maybe introduced by transportation or storage process. Dirt may influence insulation properties.

Connect the secondary plug on the test position. Make trial operation to close and open the contactor. Carefully observe the closing and opening position indicator, as well as the counter.

10. Failure analysis and treatments

Phenomenon	Reasons	Judgment	Treatment
Failure to closing	1. The contactor is in closing position.	Check the closing/opening indicator to see if contact is in closing position.	Make a manual opening, and then close the contactor.
	2. Handcart does not fully come into operation position or test position.	Check the state indication of S8, S9. Check if the indicated result is complying with the actual state.	Turn the handle clockwise, push the handcart forward till S8, S9 contact correctly. Ensure the handcart in operation position. Turn the handle counterclockwise, pull the handcart out till the S8, S9 contact correctly. Ensure the handcart in test position.
	3. Fuse is fused.	1. Check the fuse indication state, to see if the fuse is fused. 2. Press the manual opening button, no sound from S1, S2.	Remove the panel; check if the connecting rod comes up. If yes, fuse is fused. Replace them.
	4. Secondary circuit is not connected.	Check the state indication of switchgear. Check if the secondary plug-in wiring is connected reliably (whether the connect pins of air plug, connectors of chassis, connectors on the terminal line are tighten correctly.)	Pull the handcart to test position, pull down the secondary plug, and check the conductivity of secondary circuit according to schematic diagram. Connect it if disconnection. Please pay attention to the size of screwdriver. Screwdriver with wrong size may damage the terminal.
Closing can not be maintained	Auxiliary switch shift too early.	Continuing closing and opening will be detected.	Adjust the auxiliary switch toward the metal base of chassis.
The handcart can not be pushed-in or pulled-out	1. The contactor is in closing position.	Check the closing/opening indication window to see if in closing position.	Open the contactor
	2. The handle does not insert into the pushing hole correctly.	The handle does not insert into the pushing hole correctly.	Insert the handle into the pushing hole.

	3.The earthing lock plate is deformed. After the earthing lock release, the switchgear cannot reset.	Check if the earthing lock plate is deformed.	Replace the earthing lock plate.
	4.The switchgear earthing interlocking is not released	Check whether the earthing switch is opened.	Open the earthing switch.

11. Spare parts

When the user needs, the spare parts can be determined according to the following list, and put forward when ordering, so as to meet the needs.

Order number (SAP)	Product model
26410115	Insulation cover plate of contactor A
26410116	Insulation cover plate of contactor B
26410117	Insulation cover plate of contactor C
26490541	Wide voltage module 110V
26490544	Wide voltage module 220V
26490584	Intermediate relay AC110V
26490585	Intermediate relay AC220V
26490605	Intermediate relay DC110V
26490639	Intermediate relay DC220V
26490455	Closing coil (mechanical holding)
26490456	Closing coil (electrical retention)
26490459	Opening coil (110V)
26490460	Opening coil (220V)
26490532	Chassis auxiliary switch
26490045	Auxiliary switch HK1~8
26490046	Auxiliary switch HK9~10
26490309	Fuse auxiliary switch S1, S2
26441779	Primary moving contact
26490047	Electromagnetic counter AC110V
26490048	Electromagnetic counter DC110V
26490049	Electromagnetic counter AC220V
26490050	Electromagnetic counter DC220V
26490349	Swing in the handle

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