WKD-CFX

差动选线及综合接地保护装置

(WKD-CFX Differential Route Selection and Integrated Ground Protection Installation)

产品说明书

(Instruction Manual)

KAIGAO DIANQI

合肥凯高电气设备有限公司

Hefei High-Kay Electric Equipment Co.,Ltd.

公司简介

合肥凯高电气设备有限公司座落在历史文化名城安徽合肥。与南京、上海、武汉毗邻，区域位置优越，工业发达，水、陆、空交通十分便捷。

合肥凯高电气设备有限公司是一家集制造、经营、服务与一体的综合性企业。公司立足于电气领域，凭借优秀的团队、精良的装备、优势的技术和高效的管理，专业生产高低压开关柜、过电压保护器、消弧消谐柜、大容量高速开关装置、小电流选线、电流互感器二次过电压保护器等产品，在供配电及电力保护领域享有较高的声誉。

公司始终秉承“务实、创新、发展、共赢”的主题进行一系列变革，优化资源配置，搭建高效发展平台。产品被国家重点项目和知名企业选用，深受广大客户信赖，被誉为“优质产品”。公司坚持以诚取信、以信立业，并以完整的售前、售中、售后服务体系，切实保证每一位客户都能享受到合肥凯高人高品质的服务。

乘长风破万里浪，21世纪机遇与挑战同在，光荣与梦想共存，让客户满意是凯高人永恒的追求。

面对新未来、面向世界，合肥凯高电气设备有限公司与时俱进、开拓创新，以振兴民族电气工业为己任，让凯高电气誉满华夏，走遍全球。

Company profile

Hefei High-Kay Electronic Equipment Company Ltd is located at Hefei, Anhui province, a famous city with history and culture characteristics. It is not only the city is close for Nanjing, Wuhan and Shanghai, but geographical position is perfect, Industry is developing and the communication of water, land and aviation is convenient.

The company is a comprehensive enterprise with centering manufacture, business and service. The company keeps a foothold in electronics area and professionally produce high and low voltage switch box, protector of overvoltage, box eliminating arc and sock, rapid switch with big capacity, small current line, protector of current transformer during secondary overvoltage. Products from the company are got prestigious in supply & transformer electronics equipment and electronics protection area.

The company always adhere target of 'pragmatic, innovation, development, bi-win' through reformation, optimization of resource configuration, construction of efficient platform. Products of the company have widely being used by Laiyang Steel Factory, Baotou Steel Factory, Baotou Aluminum Group, Tuoketuo Power Co Ltd, Tianjing Alkali Factory, India Steel Group etc. famous enterprises. Our products have got trusted and have being praised for 'Good Quality Products'. The company adheres to 'Honest Getting Trust' and 'Trust taking in enterprise', and Company practically ensure that each consumer can enjoy high-quality service from High-Kai with pre-sale, sale and after-sale service system.

When 'challenge & opportunity' and 'glory & dreams' coexist in 21st century, We will do our best for our consumers and always let our clients satisfaction.

When we face of a new future and a new world, the company will always make ourselves progress, develop and innovate forever. At same time, we will let 'Revitalizing ethnic electronics industry' be our tasks and our products taken in China and whole world.

一、产品概述

随着国民经济的迅猛发展，电力建设突飞猛进，电力是国民经济的大动脉，在我国的现代化建设中起着举足轻重的作用，电网能否高效、安全的运行直接影响国民经济中各行各业的正常运行。电力系统中单相接地故障约占全部故障的80%，而这些单相接地故障中，80%以上是瞬时的和可恢复的。

我国6-35kV中压系统主要采用中性点不接地或经消弧线圈接地的非有效接地方式，小电流接地系统在发生单相接地故障时接地电流很小，三相之间的线电压仍然对称，保护装置不会动作跳闸，这个运行方式在单相接地时允许带故障运行2小时，因而大大提高了供电可靠性。但随着城乡电网的发展及电缆出线的增多，系统对地电容电流急聚增加，单相接地后流经故障点的电流较大，电弧不易熄灭，容易产生间歇性弧光接地过电压，使电网设备绝缘薄弱处放电击穿和设备瞬间损坏。因此在小电流接地系统发生单相接地故障时进行消弧、消谐、准确及时的把故障线路检测出来并直接自动切除故障线路或通过报警由人工远程解除故障线路，这对提高供电可靠性、实现变电站自动化、提高供电电能质量及电网自动化水平具有十分重要的实际意义。

目前市场上广泛使用的小电流选线方式往往受到接地点阻抗变化范围大、工况复杂、零序电流信号弱、电磁干扰强等各种因素的影响，难以快速、准确地选出发生单相接地故障支路，选线准确率较低。

常见的单相接地故障处理方法有消弧线圈补偿法、小电阻跳故障线路法和消弧柜把弧光接地转换成金属性接地法。这三种故障处理方法各有所长：消弧

线圈适用于架空线路，用感性电流补偿接地点的容性电流使故障点电流小于5A,系统可带电运行2小时，对于电缆线路接地点的高频电流无法补偿，容易补偿失败；小电阻与继电保护配合跳故障线路法能准确地切除故障线路，对瞬时性接地故障也切除线路，供电可靠性低，不适合企业用；消弧柜把弧光接地转换成金属性接地法能很好的控制弧光，但是故障点转移后常规选线没办法选出故障线路。

针对6-35kV中性点非有效接地系统的这些问题，WKD-CFX差动选线及综合接地保护装置很好的解决故障选线准确率问题，并提供灵活、快速、有效的故障处理手段。既保持了原有接地系统的高供电可靠性，同时解决了弧光接地过电压带来的电气设备运行的安全性问题。

Product Profile

With the rapid development of the national economy, the construction of electric power has made rapid progress. Power is the main artery of the national economy and plays a pivotal role in China's modernization process. The efficient and safe operation of the power grid directly affects the normal operation of various industries in the national economy. Single-phase ground faults in power systems account for about 80% of all faults. However, more than 80% of these single-phase ground faults are transient and recoverable.

The 6-35kV medium voltage system of China mainly adopts the non-effective grounding method that the neutral point is not grounded or grounded through the arc suppression coil. When a single-phase grounding fault occurs, the grounding current of the small-current grounding system is very small, the line voltage between the three phases is still symmetrical, and the protection device will not trip. In the case of single-phase grounding, this operation mode allows a 2-hour operation with failure, thus greatly improving the reliability of power supply. However, with the development of urban and rural power grids and the increase of cable outlets, the system's ground capacitance and current concentration have increased rapidly. After single-phase grounding, the current flowing through the fault point is high, and the arc is not easy to extinguish, so it is easy to produce intermittent arc grounding overvoltage, which will cause discharge breakdown and instant damage to the weak insulation of power grid equipment. Therefore, when a single-phase ground fault occurs in a small-current grounding system, arc suppression, harmonic suppression, accurate and timely detection of the fault line, and automatic cut-off of the fault line directly or by remote alarm to manually remove the fault line can improve power supply reliability. This has very important practical significance for the realization of substation automation, improvement of power supply quality and grid automation level.

The low-current line selection method, which is widely used in the market is

often affected by various factors such as a large range of ground point impedance changes, complex working conditions, weak zero-sequence current signals, and strong electromagnetic interference, so, it is difficult to quickly and accurately select branch with single-phase ground fault. The accuracy of line selection is rather low.

Common single-phase ground fault processing methods include the arc suppression coil compensation method, the low resistance jumper faulty line method, and the method of using an arc suppression cabinet to convert the arc grounding into metal grounding. These three fault handling methods have their own advantages: the arc suppression coil is suitable for overhead lines, and the inductive current is used to compensate the capacitive current of the ground point so that the fault point current is less than 5A. The system can run for 2 hours with electricity. The high-frequency current at the ground point of the cable line cannot be compensated, and it is easy to cause faulty compensation. The small resistance and relay protection combined with the fault line method can accurately remove the fault line, and also cut the line for transient ground faults. The power supply reliability is low and it is not suitable for enterprises. The method of using arc suppression cabinet to convert the arc ground to the metal ground can control the arc well, but the conventional line selection after the fault point is transferred is unable to find out the faulty line.

Aiming at these problems of 6-35kV neutral point non-effective grounding system, WKD-CFX differential line selection and comprehensive ground protection installation can solve the problem of fault line selection accuracy, and provide flexible, fast and effective fault processing methods. It not only maintains the high power supply reliability of the original grounding system, but also solves the safety problem of electrical equipment operation caused by arcing ground overvoltage.

二、工作原理

系统正常运行时，差动选线及综合接地保护装置的电压互感器投入运行，具有PT柜全部功能。

系统有大气过电压和操作过电压时，三相组合式过电压保护器KYB投入工作，将系统过电限制在电气设备绝缘允许的安全范围。

综合接地保护装置微机控制器采集电压互感器提供的三相电压Ua、Ub、Uc、和开口三角电压Uo等信号并通过微机处理器进行计算处理，实时显示母线电压。当系统出现单相接地时，综合接地保护装置微机控制器检测系统电压变化，通过微机处理器进行计算，能准确地判断出接地性质和接地相别，并进行处理。

系统发生金属性接地故障时，综合接地保护装置微机控制器的开关量采集模块在采集接地的相别后，控制单相快速断路器投入过程中通过特制电阻对接地点注入一个阻性电流，故障点电流增大，差动线装置的选线模块通过采样馈线柜零序电流互感器的电流变化，通过计算分析准确的选出故障线路。

系统发生间歇性弧光接地故障时，综合接地保护装置微机控制器的开关量采集模块在采集接地的相别后，控制单相快速断路器投入过程中通过特制电阻对接地点注入一个阻性电流，故障点电流增大，差动线装置的选线模块通过采样馈线柜零序电流互感器的电流变化，通过计算分析准确的选出故障线路。选出故障线路后通过单相快速断路器的快速切换，把不稳定的弧光接地快速转变成稳定的金属性接地，故障相电压降为零，故障点弧光熄灭。

Work Principle

When the system is in normal operation, the voltage transformers of the differential line selection and the integrated ground protection installation are put into operation. The system has all the functions of a PT cabinet.

When the system has atmospheric overvoltage and operating overvoltage, the three-phase combined overvoltage protector KYB is put into operation, limiting the system overcurrent to a safe range permitted by the insulation of electrical equipment.

The microcomputer controller of the integrated ground protection installation collects the three-phase voltages Ua, Ub, Uc, and the open triangle voltage Uo provided by the voltage transformer, and conducts calculation and processing through the microcomputer processor, so as to display the bus voltage in real time. When the system has single-phase grounding, the microcomputer controller of the integrated ground protection installation detects the voltage change of the system and performs calculations through the microcomputer processor, so as to accurately determine the grounding property and phase, and conduct processing.

When the system has a metal grounding fault, the switch acquisition module of the microcomputer controller of the integrated ground protection installation collects the phase difference of the ground. In the process of controlling the single-phase fast circuit breaker, it will inject a resistant current to the ground point through the special resistor. The current at the fault point increases, and the line selection module of the differential line installation samples the current change of the zero-sequence current transformer of the feeder cabinet, so as to select the faulty line accurately through calculation and analysis.

When the system has an intermittent grounding fault, the switch acquisition module of the microcomputer controller of the integrated ground protection installation collects the phase difference of the ground. In the process of controlling the single-phase fast circuit breaker, it will inject a resistant current

to the ground point through the special resistor. The current at the fault point increases, and the line selection module of the differential line installation samples the current change of the zero-sequence current transformer of the feeder cabinet, so as to select the faulty line accurately through calculation and analysis. After the fault line is selected, the unstable arc ground is quickly transformed into a stable metal ground through the fast switching of the single-phase fast circuit breaker, the voltage at the fault phase drops to zero, and the arc at the fault point extinguishes.

三、功能特点

1.运行监测：

正常运行时装置面板上显示系统运行电压，取代常规的PT柜向外部回路提供二次电压信号。

2.快速消弧：

系统发生单相接地故障时，装置能在20ms以内将故障相直接接地，熄灭接地电弧，限制弧光接地过电压，有效地控制故障的进一步发展。

3.智能报警：

当系统运行电压超过或低于预先设定的限制时，装置可及时报警，面板显示故障类型和运行电压，并输出接点信号供用户使用。

4.准确选线、快速隔离：

对于非高阻接地故障通过投入特制电阻增大故障点电流，选线装置准确选出故障线路，对于非重要负荷可通过继电保护动作切除接地故障线路。对于高阻接地通过选线装置的轮选功能准确选出故障线路。故障线路选出后在面板上显示故障线路，发出告警信号。

5.动作迅速：

采用特制单相快速真空断路器（合闸时间小于15ms，分钟时间小于5ms）作为接地及特制电阻投切开关，装置可在20ms内动作，大大缩短单相接地电弧的持续时间。

6.适应性强：

装置不受系统电容电流大小的影响，特制单相快速真空断路器可做到1250A电容电流长期流过，保证装置不受系统规模及后期扩容的影响，适用于电缆系统、电缆和架空电路混合系统、架空线路。

7.功能强大：

装置对中压系统经常发生的电压越限、PT断线、单相接地、铁磁谐振等故障都能实现快速检测与控制，并能实时监测系统运行电压，具有极高的性价比，装置所配的抗饱和电压互感器，能够取代原有PT柜，装置通过单相快速断路器控制特制电阻的投退可准确的选出故障线路。

Function and Feature

1. Operation monitoring:

During normal operation, the system operating voltage is displayed on the panel of the device, replacing the conventional PT cabinet to provide a secondary voltage signal to the external circuit.

2. Fast arc suppression:

When the system has a single-phase ground fault, the device can directly ground the faulted phase within 20ms, extinguish the grounding arc, limit the arcing ground overvoltage, and effectively control the further development of the fault.

3. Intelligent alarm:

When the system operating voltage exceeds or falls below a preset limit, the device can give an alarm in time, the panel displays the fault type and operating voltage, and outputs a contact signal for being used by the operator.

4. Accurate line selection and fast isolation:

For non-high-resistance ground faults, a special resistor is used to increase the current at the fault point, and the line selection device accurately selects the fault line. For non-critical loads, the ground fault line can be cut off through relay protection actions. For high-resistance grounding, the faulty line is accurately selected through the round selection function of the line selection device. After the faulty line is selected, the faulty line is displayed on the panel and an alarm signal is issued.

5. Fast action:

A special single-phase fast vacuum circuit breaker (with closing time less than 15ms and separating time less than 5ms) is used as a switching switch for grounding and a special resistor. The device can operate within 20ms, greatly reducing the duration of the single-phase grounding arc.

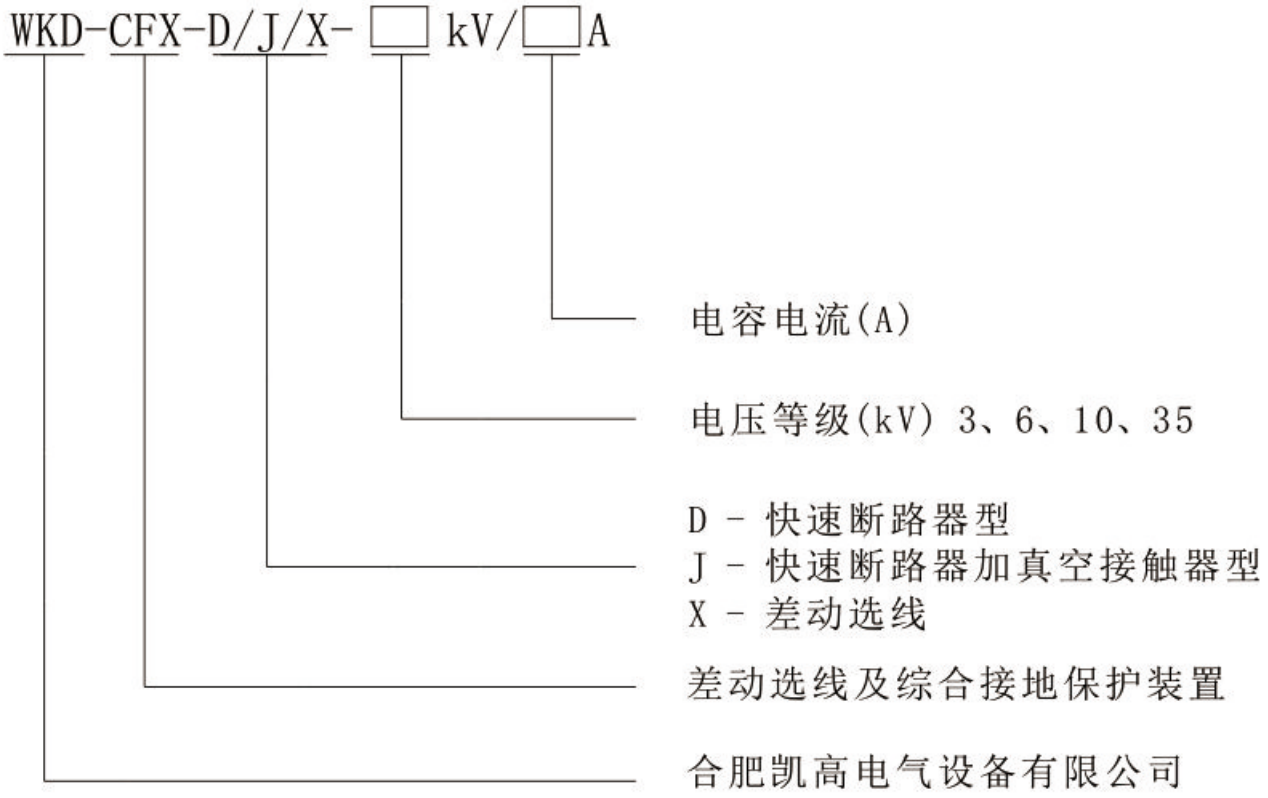
6. Strong adaptability:

The device is not affected by system capacitance and current. The special single-phase fast vacuum circuit breaker can achieve a long-term flow of 1250A capacitor current to ensure that the device is not affected by the system scale and subsequent expansion. Therefore, it is suitable for cable systems, mixed systems of cables and overhead circuits, and overhead lines.

7. Powerful function:

The device can quickly detect and control faults such as voltage over-limits, PT disconnection, single-phase grounding, and ferromagnetic resonance that often occur in medium-voltage systems, and can monitor the operating voltage of the system in real time. The anti-saturation voltage transformer equipped in the device can replace the original PT cabinet. Because its single-phase fast circuit breaker controls the turning of the special resistor, the device can accurately select the faulty line.

四、型号含义（Model Connotation）

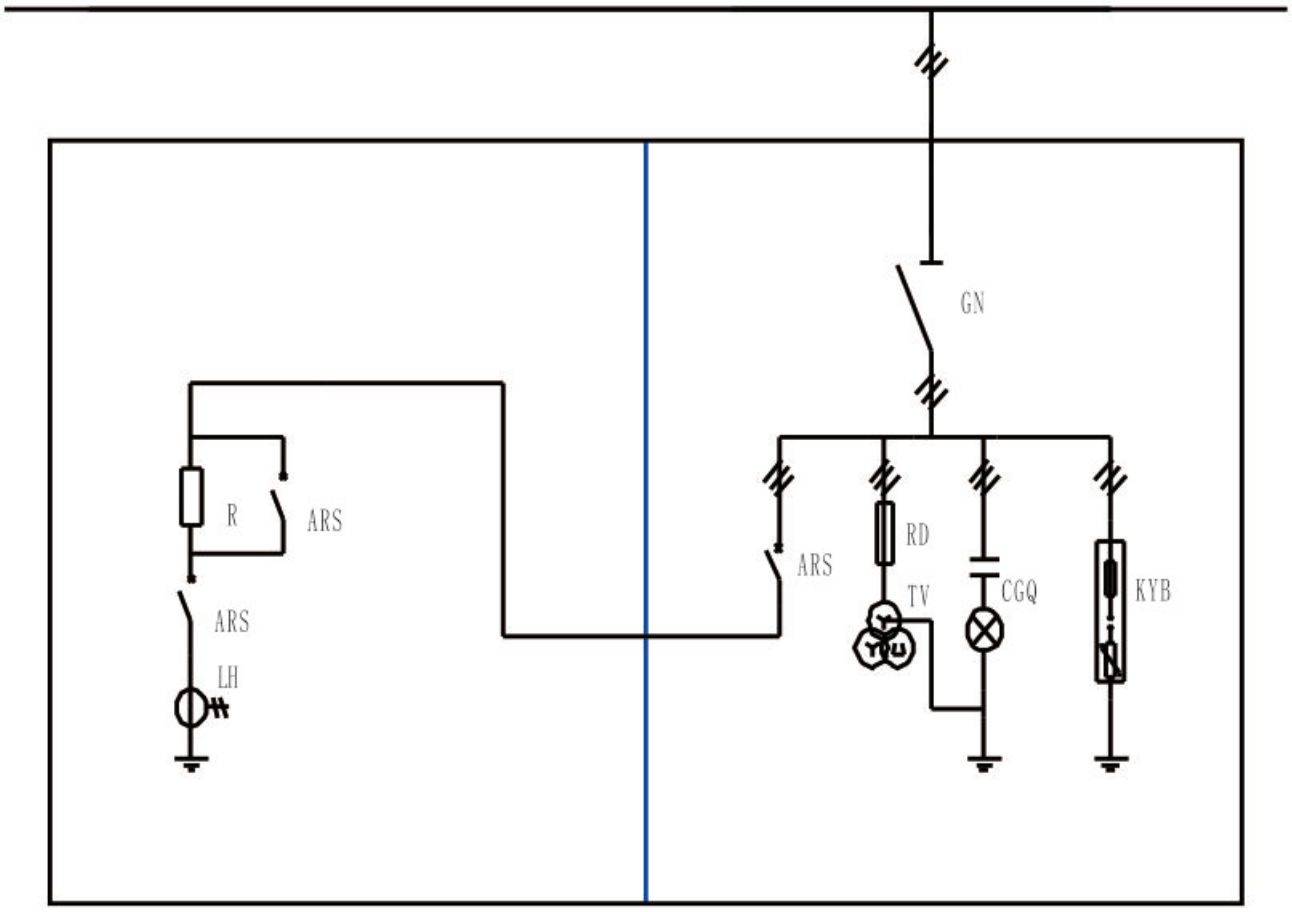


五、适用范围（Application）

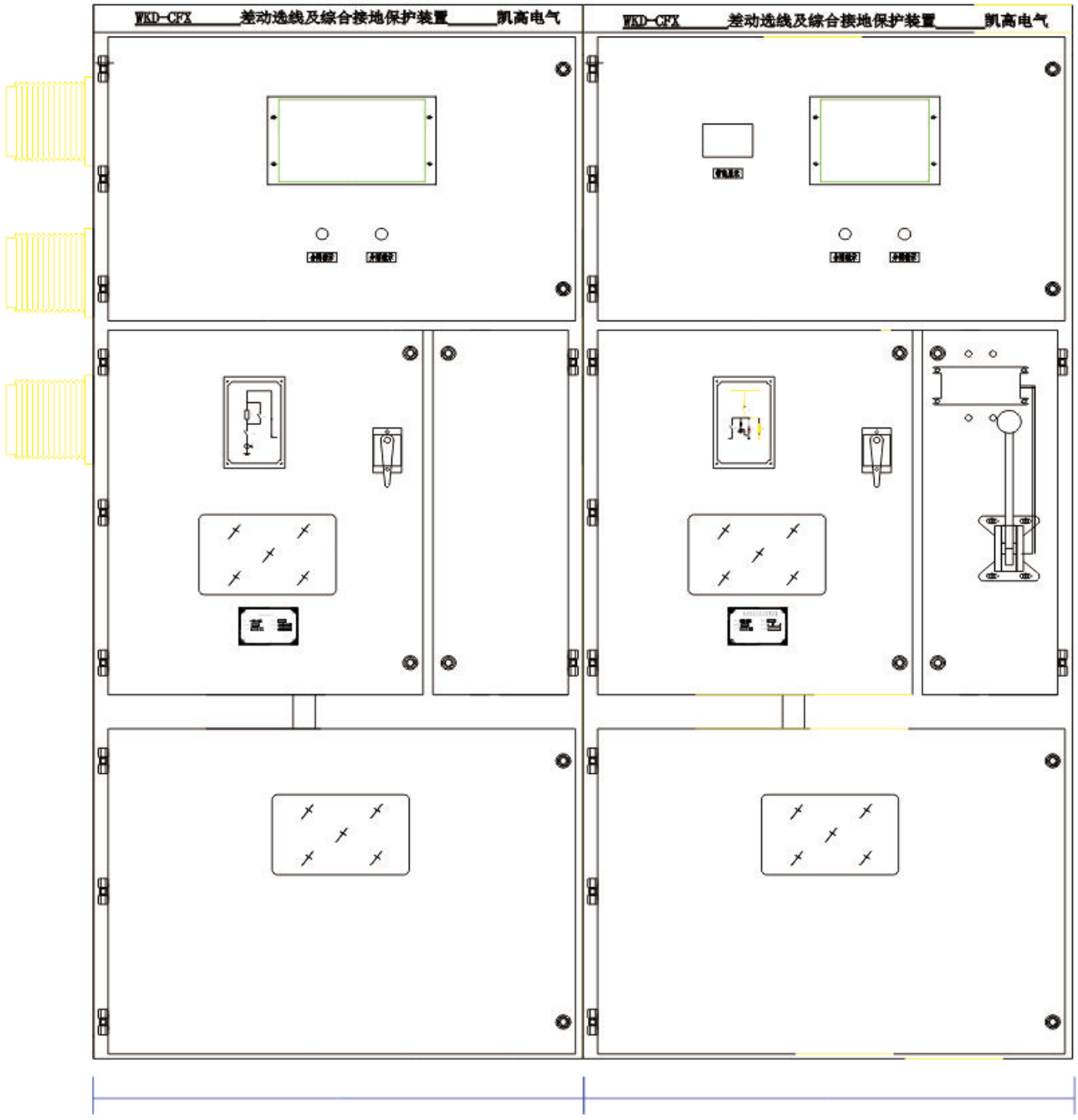
差动选线及综合接地保护装置适用于3-35kV中性点不接地、中性点经消弧线圈接地的电力系统中。

Differential line selection and integrated ground protection devices are suitable for 3-35kV power systems. The neutral point of the power system is not grounded, and the neutral point is grounded through the arc suppression coil.

六、一次图（Primary Drawing）



七、正视图（Front View）

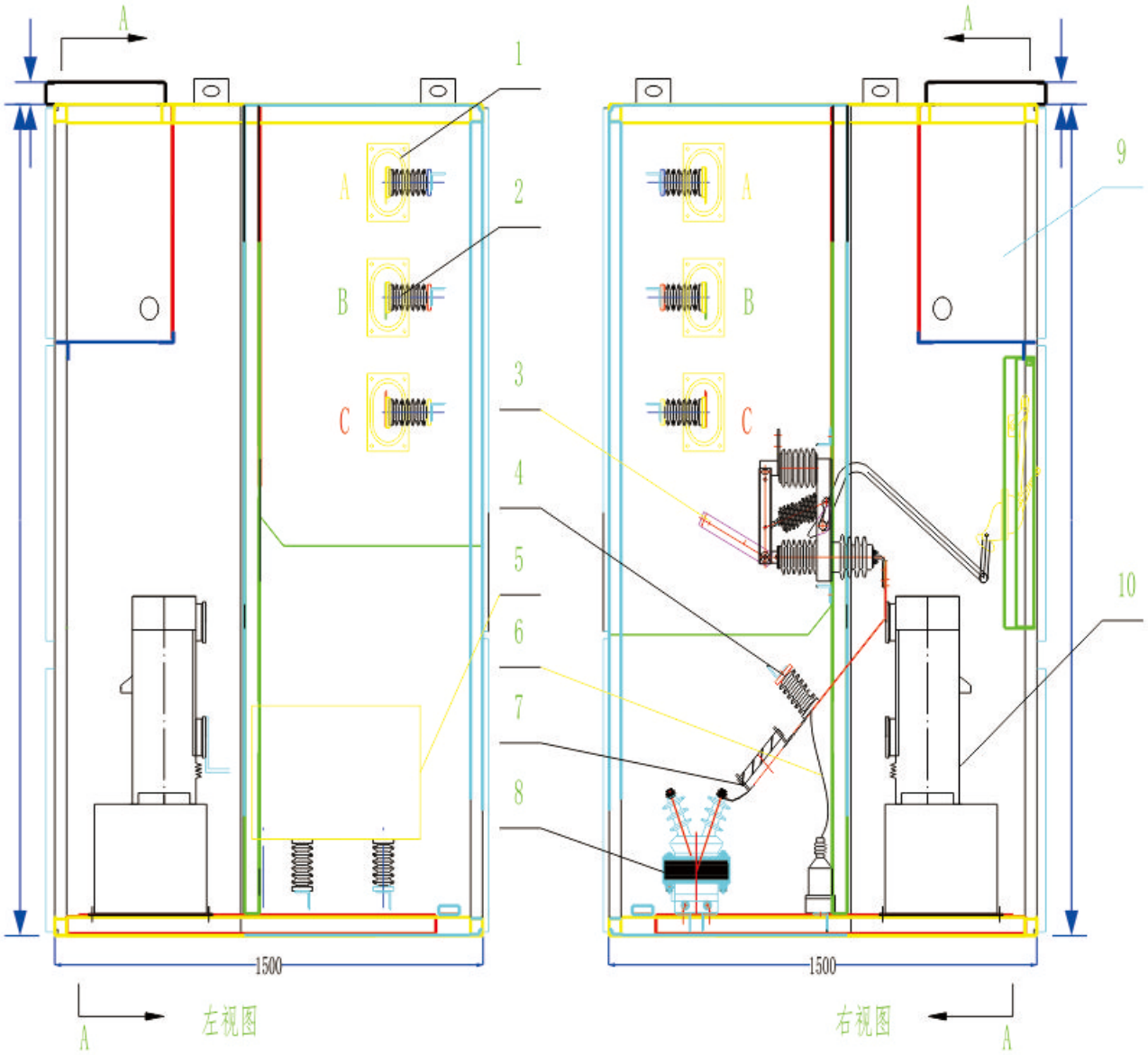


正视图

注：3、6和10kV标准柜体为宽1000*深1500*高2300的两台柜体组合
35kV标准柜体为宽1800*深2800*高2600的两台柜体组合
可根据用户要求特殊制作生产

Note: 3, 6 and 10kV standard cabinet is a combination of two cabinets in the size of 1000 (width)* 1500(depth) * 2300(height);
The 35kV standard cabinet is a combination of two cabinets in the size of 1800 (width)* 2800(depth) * 2600(height);
Special production can be produced according to user requirements.

八、侧视图（Side View）



1、穿墙套管，2、绝缘子，3、高压隔离开关，4、高压带电传感器，5、特制电阻，
6、三相组合式过电压保护器，7、PT高压熔断器，8、抗饱和电互感器，9、仪表室
10、单相快速断路器

九、一次系统图设计案例（Design Case of First Systematic Diagram）

开关柜尺寸(宽*长*高)	1000*1500*2300	1000*1500*2300	1000*1660*2300	800*1500*2300	800*1500*2300	800*1500*2300	1000*1500*2300	1000*1500*2300	800*1500*2300	800*1500*2300	800*1500*2300	1000*1500*2300	1000*1500*2300
开关柜编号	+AH107	+AH106	+AH105	+AH104	+AH103	+AH102	+AH101	+AH201	+AH202	+AH203	+AH204	+AH205	+AH206
主母线 TMY-3*(125*10) 控制电源:DC220V 交流电源:AC220V 一次系统图							Ⅱ段	Ⅰ段					
接地开关	WKD-CFX-D-10kV/1250A 差动选线及综合接地保护装置 合肥凯高电气设备有限公司配套											WKD-CFX-D-10kV/1250A 差动选线及综合接地保护装置 合肥凯高电气设备有限公司配套	
熔断器													
固封式真空断路器													
电流互感器 型号、变比 准确级 容量 热稳定电流													
电压互感器 型号、变比 准确级 容量													
过电压保护装置													
状态显示器													
小电流选线装置													
零序电流互感器													
综合测控保护装置													

注：WKD-CFX-D-10kV/1250A 差动选线及综合接地保护装置，设计在总降变电室，分配室只需安装差动选装置与主装置配合，可准确选出接地线路。

快速断路器型，正常设计建议用此型号。

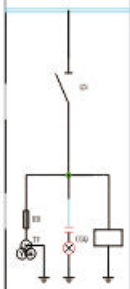
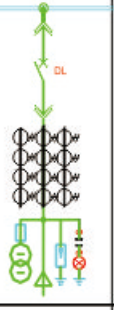
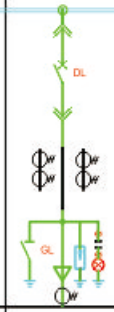
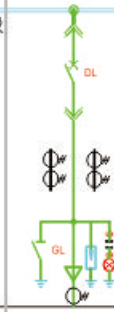
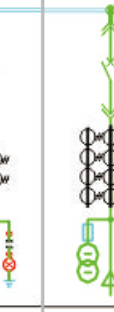
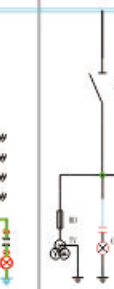
总降每段母线安装一套，两段需并列运行时需提供母联接点信号。

开关柜尺寸(宽*长*高)	1000*1500*2300	1000*1500*2300	1000*1660*2300	800*1500*2300	800*1500*2300	800*1500*2300	1000*1500*2300	1000*1500*2300	800*1500*2300	800*1500*2300	800*1500*2300	1000*1500*2300	1000*1500*2300
开关柜编号	+AH107	+AH106	+AH105	+AH104	+AH103	+AH102	+AH101	+AH201	+AH202	+AH203	+AH204	+AH205	+AH206
主母线 TMY-3*(125*10) 控制电源:DC220V 交流电源:AC220V 一次系统图							Ⅱ段	Ⅰ段					
接地开关	WKD-CFX-J-10kV/630A 差动选线及综合接地保护装置 合肥凯高电气设备有限公司配套											WKD-CFX-J-10kV/630A 差动选线及综合接地保护装置 合肥凯高电气设备有限公司配套	
熔断器													
固封式真空断路器													
电流互感器 型号、变比 准确级 容量 热稳定电流													
电压互感器 型号、变比 准确级 容量													
过电压保护装置													
状态显示器													
小电流选线装置													
零序电流互感器													
综合测控保护装置													

注：WKD-CFX-J-10kV/630A 差动选线及综合接地保护装置，设计在总降变电室，分配室只需安装差动选装置与主装置配合，可准确选出接地线路。

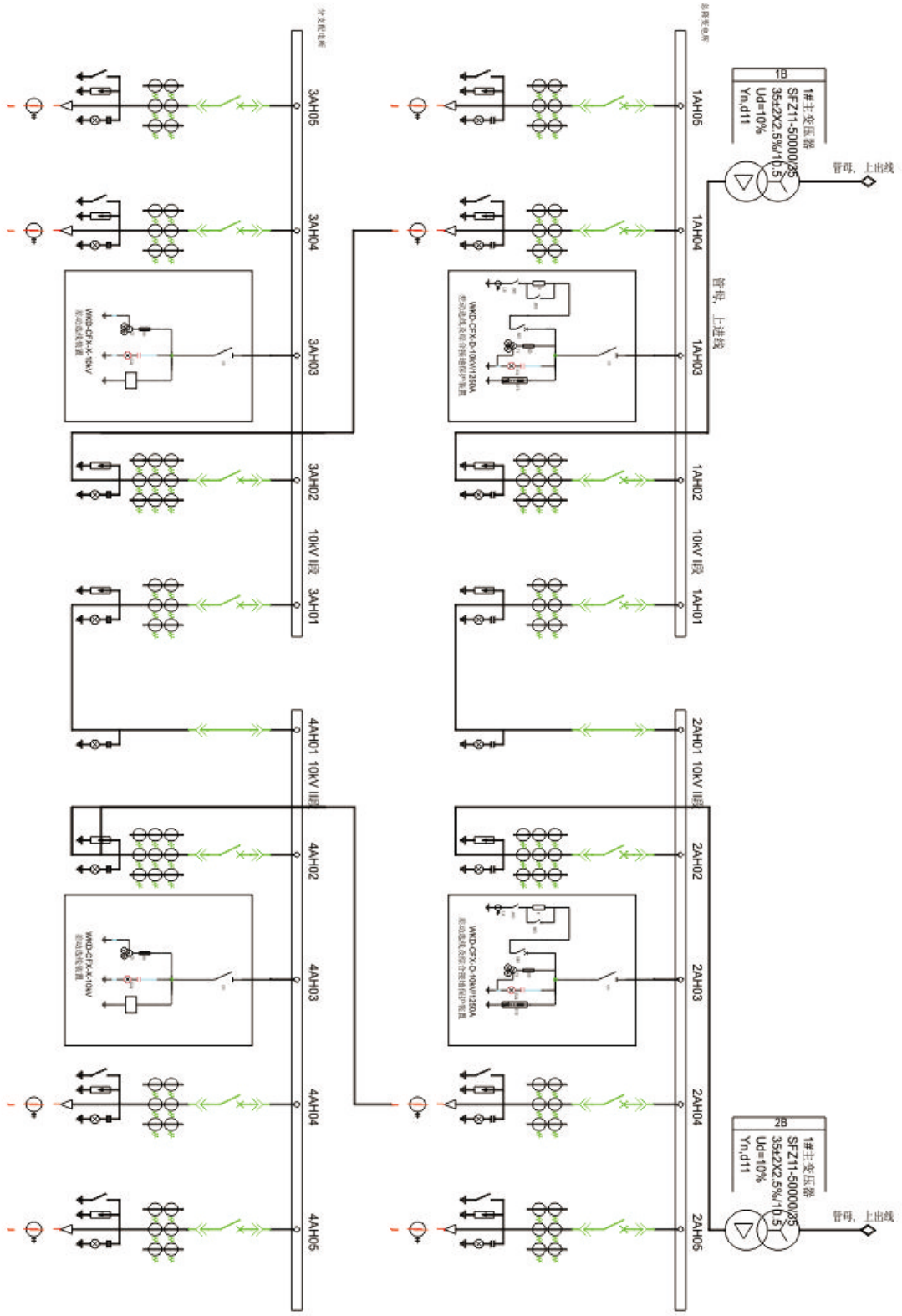
快速断路器加真空接触器型，建议用在小系统中。

总降每段母线安装一套，两段需并列运行时需提供母联接点信号。

开关柜尺寸(宽*长*高)	1000*1500*2300	1000*1660*2300	800*1500*2300	800*1500*2300	800*1500*2300	1000*1500*2300	1000*1500*2300	800*1500*2300	800*1500*2300	800*1500*2300	1000*1500*2300
开关柜编号	+AH106	+AH105	+AH104	+AH103	+AH102	+AH101	+AH201	+AH202	+AH203	+AH204	+AH205
主母线 TMY-(100*10) 控制电源:DC220V 交流电源:AC220V 一次系统图											
接地开关	WKD-CFX-X-10kV 差动选线装置 合肥凯高电气 设备有限公司配套										WKD-CFX-X-10kV 差动选线装置 合肥凯高电气 设备有限公司配套
熔断器											
固封式真空断路器											
电流互感器 型号、变比 准确级 容量 热稳定电流											
电压互感器 型号、变比 准确级 容量											
过电压保护装置											
状态显示器											
小电流选线装置											
零序电流互感器											
综合测控保护装置											

注：WKD-CFX-X-10kV 差动选线装置，设计在高配室，取代PT柜与总降的\W0.67;差动选线及综合接地保护装置配合完成选线。

十、主接线图设计案例（Design Case of Wiring Diagram）



十一、订货须知

额定电压

额定电流

安装方式

使用条件

其他数据要求在合同中注明

十二、使用环境条件

环境温度　-40℃- 50℃

海拔高度　一般不大于2000米，大于2000米特殊设计

使用场所　无酸碱腐蚀处

安装地点　户内

相对湿度　日平均相对湿度不大于95%

污秽等级　不超过II级

十三、包装、运输、储存

一般采用木箱包装，装置底座应固定在包装箱底板上。

不要在三级以下公路上长距离运输，必要时可分解包装。

长期不用时，应储存在干燥、通风的仓库内，不宜长期在户外储存。

运输过程中装置应避免碰撞、受潮及暴晒。

Ordering Instruction

Rated voltage

Rated current

Installation method

Conditions of Use

Other data requirements specified in the contract

Operating Environment

Ambient temperature: -40 ℃-50 ℃

Altitude: Generally not more than 2000 meters, if the altitude is more than 2000 meters, special design is required

Use place: no acid and alkali corrosion

Installation location: indoors

Relative humidity: daily average relative humidity is not greater than 95%

Pollution level: not exceeding level II

Package, Transportation and Storage

The product is generally packed in a wooden box, and the base of the device should be fixed on the bottom of the box.

This product should not be transported over long distances on roads below Level 3, and can be disassembled and packaged if necessary.

When it is not used for a long time, it should be stored in a dry and ventilated warehouse, and it should not be stored outdoors for a long time.

During transportation, the device shall take measures to avoid collision, moisture and exposure.

合肥凯高电气设备有限公司
Hefei High-Kay Electric Equipment Co.,Ltd.

地址：合肥市双凤开发区梅冲湖路与凤霞路交口
Addrss:Meichong lake Road and Fengxia Road junction,
Shuangfeng Development Zone,Changfeng County,Hefei
邮编：231131
Post Code: 231131
电话：0551-65333791
Tel: 0551-65333791
传真：0551-65355147
Fax: 0551-65355147
网址：http://www.hfkaigao.com
http://www.hfkaigao.com