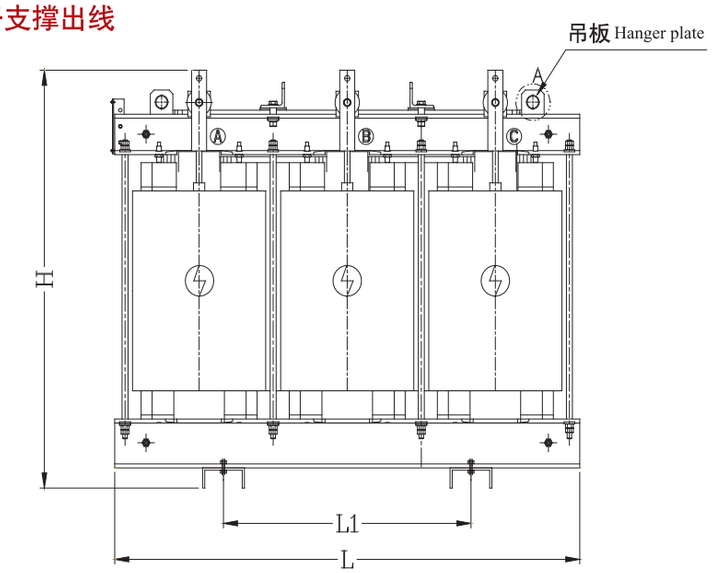
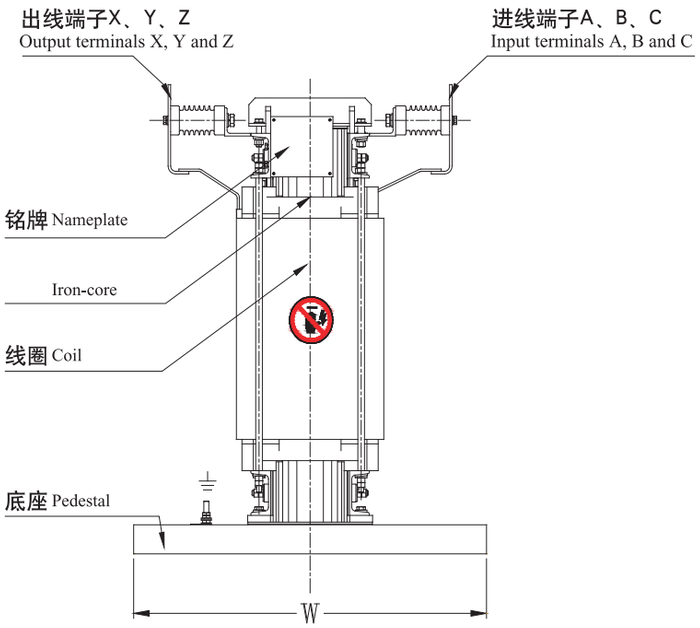
八、干式铁心串联电抗器外形图

两侧绝缘子支撑出线





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哈大电气
HADA ELECTRIC

干式铁心串联电抗器说明书

Dry-type Iron Core Series Reactor Manual

山东哈大电气有限公司
SHANDONG HADA ELECTRIC CO., LTD.

公司简介 Corporation Overview

山东哈大电气有限公司成立于1999年6月9日，专业生产各种高、低压干式空心电抗器和铁心电抗器。主要产品有：TCR相控电抗器、串联电抗器、并联电抗器、限流电抗器、滤波电抗器、平波电抗器、启动电抗器等。于2011年被评为山东省高新技术企业并通过PCCC电能质量认证。

哈大电气拥有22000平米的生产场地，配备高精密的自动化生产设备、检测设备，年生产能力可达3亿元人民币，试验能力可满足各种电压等级的空心电抗器和铁心电抗器的出厂试验。

山东哈大电气有限公司一直服务于：ABB、GE、Cooper、国家电网、南方电网、南瑞继保、中国南车、荣信股份等国际、国内知名公司。曾为德国SK项目、印度钢铁BSP项目、西藏±400kV直流输变电项目、南网贵州500kV福泉变融冰项目、许继集团1100kV换流阀大功率试验中心项目、中国一重、中国二重、宝钢、武钢、鞍钢SVC项目、电气化铁道大包线、成昆线、焦柳线等提供过产品和服务。

哈大电气秉承科技创新的理念，拥有一支强大的研发队伍，先后与哈尔滨理工大学、清华大学、上海交大建立了长期技术战略合作。哈大电气现为国家变压器行业协会会员，并参与修订了电抗器国家标准。在核心技术方面，拥有完全自主知识产权.目前，拥有国家发明专利、实用新型专利数十项。

展望未来，哈大电气将始终以提高电能质量，保护人类资源为使命，为社会可持续发展做出贡献。

Shandong Hada Electric Co., founded in June, 9.1999, specialized in producing all kinds of dry-type air-core reactors and ironcore reactors. Main products: TCR shunt reactor， series reactor, current-limiting reactor, filter reactor, smoothing reactor, starting reactorand etc. In 2011, Hada was awarded the High and New Technology Enterprise by Shan Dong government and obtained PCCC certification.

Hada's workshop covers 22000 square meters which be equipped with high precision auto winding machines and inspection equipments, currently annual capacity reaches to 300M RMB. Be able to do routine test for all kinds of air-core reactor and iron core reactor.

Hada reactors have been widely used in power transmission and distribution，metallurgy，electric railway and municipal engineering. Most famous companies like State Grid，Southern Grid，ABB，GE，Cooper，NR，CSR and RXPE always take Hada as their main dry-type reactor supplier. Ever produced for Germany SK project, India steel plant BSP project ,Xizang ±400kV Dc power transmission and transformation project ,South Grid Guizhou 500kV Fuquan substation ice melting project,1100kV high-power converter valve test center of Xuji group，CFHI，Baosteel，Wuhan Iron and Steel Corp，Anshan Iron and Steel Group，Electric railway-Dabao，Chengkun，Jiaoliu.

Adhering to the scientific and technological innovation concept, Hada keeps long-term technology cooperation with Harbin University of Science and Technology， Qinghua University and Shanghai Jiaotong University. As one member of Transformer Industry Association, Hada ever joined in revising the National Standards. Currently obtained more than 10 international invent patents and utility model patents

In future, Hada will always devote to power quality improving and human resources protecting, makes a contribution to social sustainable development.

一、产品用途 Product Application

本系列产品与电力电容器组配套，改善电力系统的功率因数，降低电力电容器组投切过程中的涌流和抑制电网的高次谐波，减轻电容器由谐波引起的过载，降低操作过电压，对电容器的安全运行，改善网络电压波形，提高供电质量和电网安全经济运行起良好的作用。

本系列电抗器铁心均为三柱芯式结构，芯柱截面为圆形，采用优质冷轧取向硅钢片，铁芯柱有若干个小气隙分段组成，上下铁轭为矩形，靠拉杆拉紧组合，线圈用高强度电磁线绕制，采用环氧树脂浇注；具有绝缘性能好、局放小、机械强度高、体积小、噪音低、损耗小、耐湿、阻燃、过载能力强、可靠性高、漏磁小等优良性能。可广泛应用于输变电系统、电气化铁道、冶金、石化等领域，特别适合于安装空间有限和具有特殊防火要求的城网变电站、地下变电站以及对电磁干扰有特殊要求的微机控制站等场所。外露部分采用防腐蚀处理，引线端子均经过镀锡处理。

Combined with power capacitors, this series of products will improve the power factor of electric power system, reduce the switching inrush current and control higher harmonic of power grid, ease the overload resulting from harmonic waves of capacitor, reduce switching overvoltage, ensure a favorable function over the safe running of capacitor, improve voltage waveform of power grid, and upgrade power supply quality and maintain safe and economic operation of power grid as well.

The iron cores are all three-stem structure, with circular core-limb section. Adopting high quality cold rolling orientation silicon steel plate, the core limbs are composed of a number of small air gap sections, with rectangular upper and lower iron-yokes, integrated by pulling tight the tie bar. With winding of high-strength electromagnetic wires, the coils are teemed with epoxy resin, thus processing such favorable features as good insulating property, small partial-discharge, high mechanical strength, small volume, low noise and loss, moisture and flame resistance, strong overload capacity, high reliability, and small flux leakage. They are widely used in power transmitting and transforming systems, electrified railways, metallurgy and petrochemicals sectors. They can find their protection requirements, and microcomputer controlled stations with special requirements on electromagnetic interference. Anticorrosive treatment is adopted for the part exposed and all lead terminals are tin coated.

二、型号含义 Model Definition

CK S C L –□/□-□

- 额定电抗率（%） Rated Reactance Rate (%)
- 系统电压(kV) / System Voltage（kV）
- 三相额定容量(kVar) 3–phase rated capacity
- 铝质材料（铜质材料不表示）/ Aluminum (no indication for copper)
- 浇注式线圈 Teeming coil
- 三相（单相用“D”表示）3–phase（“D” for single phase)
- 串联电抗器 Series Reactor

三、使用环境条件 Service Conditions

以下列出了设备的正常使用条件，如需要满足规定的正常使用条件之外的特殊使用条件，应在订货时说明。

- 安装位置：户内
- 环境温度：−25℃～ 45℃，相对湿度不超过 90%
- 海拔高度：不超过 1000 米；
- 冷却方式：AN；
- 耐热等级：F 级；
- 周围无有害气体，无易燃、易爆物品
- 周围环境应有良好的通风条件，如装在柜内，需安装通风设备，一般每千瓦损耗应有不小于 $2m/min^3$ 的空气通风。

特殊使用条件

- 运行环境温度超过 +40℃时，则线圈的允许温升应按下述情况分别降低：当在 +40℃～ +45℃（含 +45℃）时，应降低 5K；当在 +45℃～ +50℃（含 +50℃）时，应降低 10K；当高于 +50℃时，应由制造厂与用户协商。
- 运行地点海拔超过 1000m 时，超出的部分以每 500m 为一级，温升按 2.5% 减少，额定工频耐受电压一级增加 6.25%。

Following are nominal conditions, if there are any special requirements, pls indicate clearly when ordering.

- Installation site: indoors
- Ambient temperature:-25℃～45℃, relative humidity is not surpass 90%.
- Altitude: ≤1000m
- Cooling mode: AN
- Thermal endurance class: F
- No harmful gas, explosive and combustibles around. Good ventilation around. Ventilator is required if installed inside a cabinet.normally per kilowatt shouldn't less than $2m^3/min$.

Special service conditions:

- If the operating ambient temperature is more than 40℃, then the allowable temperature rise of coil should bring down accordingly: a.+40℃～+45℃(+45℃ included), lower 5K; b.+45℃～+50℃(+50℃ included), lower 10K; c.＞+50℃, the manufacturer should communicate with user.
- If the altitude is higher than 1000m, every 500m beyond part is one level. Accordingly the temperature rise should also reduce 2.5% per level, rated power frequency withstand voltage increase 6.25% per level.

四、安装使用说明 Installation Instruction

- 1.交接试验项目外观检查
  绕组直流电阻测量
  绝缘电阻测定
  电抗值测量
  外观检查
  绝缘试验

Installation Instruction

Appearance inspection for handover testing project
Winding DC resistance measurement
Insulation resistance measurement
Reactance value measurement
Appearance inspection
Insulation test

- 2.产品吊装

起吊串联电抗器时，如有包装箱，应在包装箱下面的垫木处挂钢丝绳起吊；如没有包装箱或电抗器从包装箱中吊出时，应同时使用电抗器上部所有吊环起吊，且起吊钢丝绳之间夹角不得大于60°。

- 3.检查验收

检查产品的铭牌数据与订货合同是否相符，如产品型号、额定容量、额定电压、额定电抗率等。
根据发货清单检查出厂文件和零部件是否齐全。
检查产品和零部件在运输过程中有无损伤，接线是否松动、断裂，绝缘是否有破损，是否有异物等。
产品开箱检查完毕，如不立即投入运行，则必须重新包装好，并放在户内。

Hoisting

When hoisting a series reactor with packing case, use steel wires for the bed timber; if there is no packing case or a reactor is hoisted out of packing case, all the hoisting rings of the reactor should be used at the same time, and the included angle between hoisting steel wires shall not exceed 60°.

Inspection and Acceptance

Check if the data on the nameplate complies with order contract, like product model, rated power, rated voltage and rated reactance rate.
Check if documents and spare parts delivered are complete against the shipping list.
Check if there is any damage to the products and spare parts during transportation, if the wiring is loose or broken, if insulation gets worn out or if there is any foreign substance.
If the product is not put into use immediately after package opened, it must be packed again, and placed indoors.

五、串联电抗器的安装与运行 Installation and operation

- 将串联电抗器安装于预置有地脚螺栓的平面基础上，地脚螺栓数量要和底座安装孔内的数量相同，将地脚螺栓穿在底座螺孔中，螺母紧固后应采取防松动措施。
- 将串联电抗器底座上的接待螺栓与接地母排可靠连接，并检查是否接通。
- 将串联电抗器的接线端子与系统母排相连接，连接线应有一定的弹性余地。
- 对于有分接的产品，将分接头按规定要求调到需要的位置。
- 检查上述操作，如无问题，串联电抗器可投入试运行。
- 试运行60分钟无异常后，串联电抗器可正式投入使用。
- 电抗器应能在工频电流为1.35倍额定电流的最大工作电流下连续运行。

- Fix the series reactor on a plane foundation with anchor bolts preset. The number of anchor bolts should correspond to that of pedestal mounting holes. Thread anchors bolt into pedestal bolt- holes. Anti-loose measures must be taken after nuts are tightened.
- Make reliable connection of earth studs on the pedestal of series reactor with ground bus bar, and check if a successful connection is achieved.
- Connect the connection terminal of series reactor with the system's bus bar, with certain flexible space for connecting wire. Set tap joint to the desired position for product with tapping.
- Check the above operations, if everything is normal, then put into commissioning.
- The series reactor can be put into use formally after a smooth 60 minutes test run.
- The reactor should be able to make continuous running at top working current when power current is 1.35 times of the rated current.

六、维修与保养 Service and maintenance

在干燥清洁场所，每年进行一次检查，在其它污秽比较严重的场所，每三或六个月检查一次。

检查时，如发现过多的灰尘聚集，则必须清除，以保证空气流通和防止绝缘击穿，特别要注意清洁串联电抗器的绝缘子，绝缘垫块以及绕组的顶部和底部，使用压缩空气对通风气道进行除尘。

检查紧固件和连接件是否松动，导电零部件以及其他零部件有无生锈和腐蚀的痕迹，并且观察绝缘表面有无爬电的痕迹。

Check once annually in a dry and clean place but check once every three or six months if the site is very filthy.

Too much dust collection must be removed during inspection to ensure proper ventilation and prevent insulation breakdown.

Special attention should be paid to clean insulator and crossover block of the series reactor and top and bottom of the coils. Compressed air is used to remove dust inside ventilation air duct.

Check if the fasteners and junction pieces are loose, if conductive parts and other parts are rusted and corroded. Check if there is any trace of creepage on insulation surface.

七、安全 Safety

串联电抗器安装完毕投入运行之前，一般应在串联电抗器的周围1.5m 以外安装隔离栅栏，以确保工作人员人身安全。

串联电抗器如安装于柜内，应按其电压等级留足对地安全距离，并应满足通风要求。

串联电抗器投入运行以后，禁止触摸串联电抗器主体，以防止事故发生。

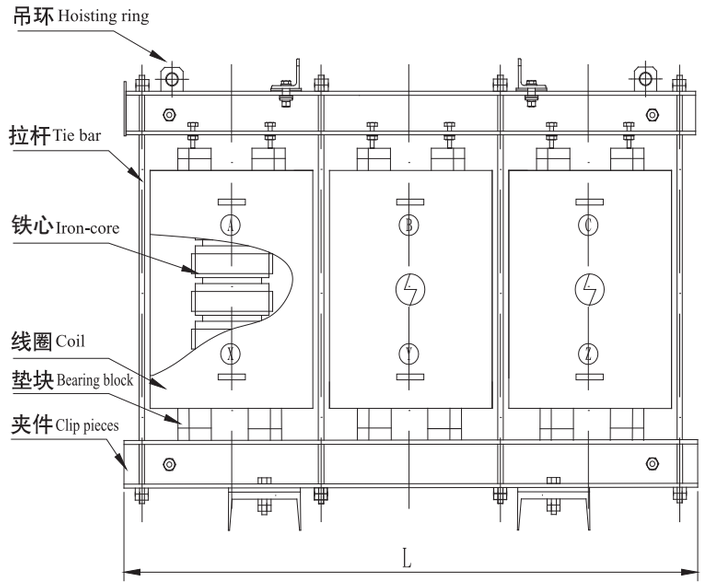
To ensure working personnel are safety, before the reactors are put into use, the separation fence should be installed 1.5m away from the series reactor.

When the series reactors are installed inside a cabinet, sufficient safety distance to earth should be reserved and keep well ventilation.

To prevent accident occurrence, it is forbidden to touch the reactor body reactor when series reactors are put into service.

八、干式铁心串联电抗器外形图

一侧上下出线



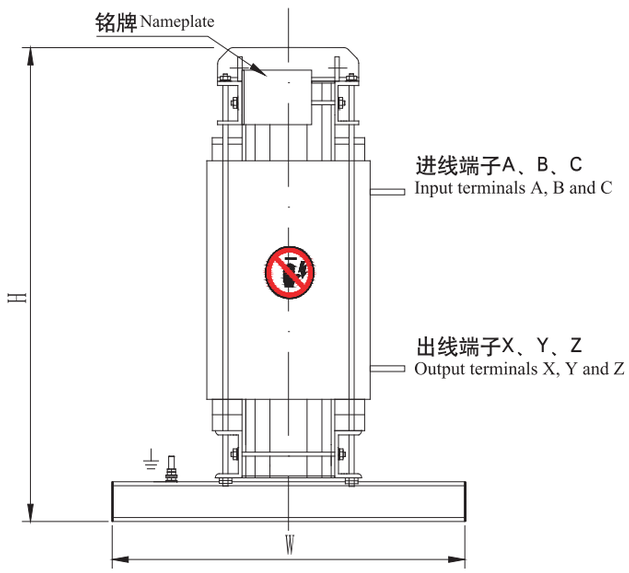


图1(Fig 1)