



高压共箱封闭母线系列

ENCLOSED BUS-BAR



江苏乐仕电气科技有限公司

JIAGNSU LESHİ ELECTRIC TECHNOLOGY CO.,LTD.

驱动未来的力量！

江苏乐仕电气科技有限公司专业从事电缆桥架、母线槽、高低压开关柜、地面线槽、膨胀节、支吊架、环保设备、电站辅机设备等电力信号设备制造销售的专业公司。在长期的市场经营活动中,企业以严格的管理、优良的质量、贴心的服务、诚信的交往,赢得了众多客户的青睐和信任。企业先后被评为江苏省明星企业、文明单位、镇江市重合同、守信用单位,中国建设银行AAA级信用企业。企业通过了ISO9001质量保证体系认证,并获得了CQC颁发的“CCC”产品安全认证标志。

企业拥有国内外先进的生产和检测设备数台套。生产中采用统一的高精度工装模具,严格执行工艺纪律、完善的质检制度,有效地保证了产品质量。产品质量一直处于同行领先地位,多次被国家重点工程选用。

广泛应用与国防、化工、电力、冶金、交通(地铁)、金融、文教卫生、房地产等相关领域,产品覆盖全国31个省市区,为北京、上海、南京、苏州、杭州、宁波、天津、深圳、广州、昆明、重庆、武汉、沈阳、西安、长沙等地铁行业的重点工程提供了专用优质配套的产品。并出口到东南亚及非洲国家,一直以优异的质量,合理的价格,完善的服务而获得国内外用户的信赖。

企业始终奉行“务实、诚信、开拓、创新”的营销理念,真诚的欢迎社会各界朋友莅临指导、合作、双赢!



封闭母线性能介绍

Introduction to busbar function

封闭母线的卓越性能

Excellent performance of enclosed bus-bar

■ 电能损耗小 Small consumption of electric power

用户选择封闭母线时,电能损耗是一个重要的考虑因素。天源华威设计生产的封闭母线,采用高纯度铝板焊接成形,具有体积小,输电能力强,电能损耗小等优点,甚至可以安装在建筑物有限的空间内。

Consumption of electric power is an important factor when customer choosing enclosed bus-bar. The enclosed bus-bar designed and produced by Tianyuan Huawei, made of high-purity aluminum plates through welding, has such advantages as small volume, string capacity of power transmission and so on, and can be installed in limited space of a building.

■ 保护人员的安全 Ensure safety

封闭母线采用独特设计,外壳具有多点接地结构,在封闭母线正常运行及发电机短路时,外壳电压不超过24V,从而保证了操作人员的人身安全。

The enclosure of enclosed bus-bar adopts the structure of grounding connection, enclosed bus adopts a special design, the enclosure has the structure of multipoints grounding, when short circuit of generator occurs, the housing voltage will not be higher than 24V, which will ensure safety of operators.

■ 适应不同的环境 Suit for different environments

由于封闭母线导体封闭在壳内,免受外界气候的影响,如海洋地区的盐雾腐蚀、风暴、冰雪、潮湿等影响,因而有很高的安全性。

The bus-bar conductors are enclosed in the housing, which can prevent it from influences of salt-fog corrosion, storms, ice, snow and humidity, therefore, the bus-bar is of high safety.

■ 良好的气密性 Good air-tightness

良好的气密性是保证封闭母线安全运行的重要因素。高质量的焊接、可靠的密封措施、微正压设备的安全运行,确保封闭母线内部空气与外部隔绝。

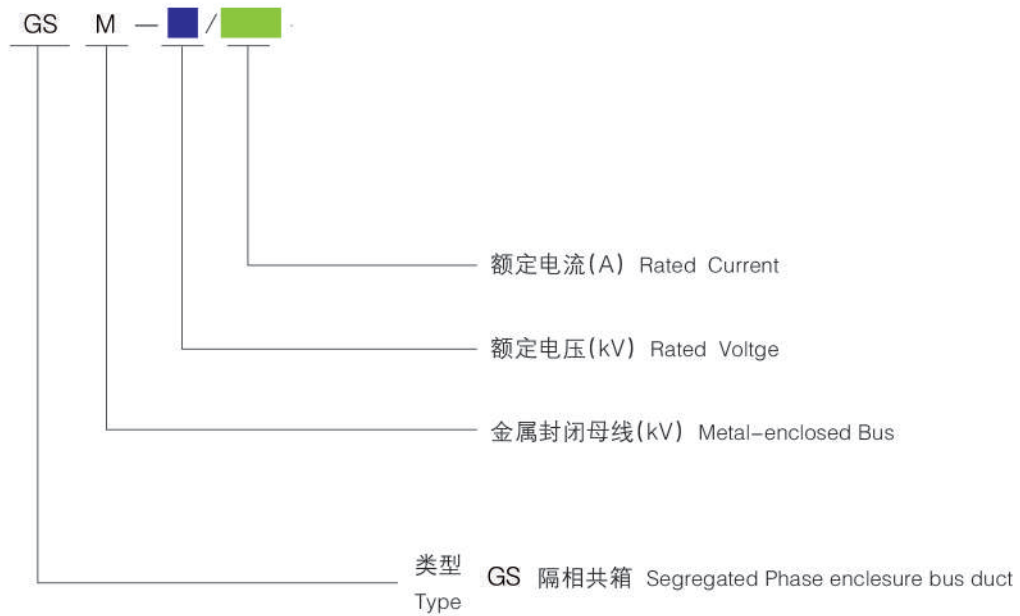
Good air-tightness is the important factor for ensuring safe running. High quality welding, reliable sealing measures, light positive pressure device's safe operation will ensure the inner air to be insulated from outer air.

■ 维护简单 Easy maintenance

封闭母线检修十分方便。在设计中采用优化设计,增设检修孔、可拆断口、并可更换绝缘部件,并可增设其他设备。

Easy maintenance of enclosed bus-bar. It is very convenient to maintain.

 结构尺寸 Construction and dimension




 No. XG19111263






180021253110

检 验 报 告

TEST REPORT

图本

样品名称: 共箱封闭母线

型 号: CCX-12/6300-50

委托单位: 江苏乐仕电气科技有限公司

试验类别: 型式试验

国家高低压电器质量监督检验中心
 National High-voltage Electrical Apparatus Quality Supervision and Inspection Center
 甘肃电器科学研究院
 Gansu Electric Apparatus Research Institute

报告编号: XG19111263
 第 2 页 共 19 页

国家高低压电器质量监督检验中心	检 验 报 告	委托编号: WG19111140
检 验 结 论		
样品型号、名称: GM-12/6300-50 高压共箱母线 委托单位: 江苏乐仕电气科技有限公司 委托单位地址: 扬州市新坝镇南自路29号 制造单位: 江苏乐仕电气科技有限公司 制造单位地址: 扬州市新坝镇南自路29号		
检验项目: 绝缘电阻测量 [相间, 对地 > 100MΩ] 绝缘试验 [工频电压: 相同, 相对地 42kV/1min (干试), 雷电冲击电压: 相同, 相对地 75 kV] 局部放电试验 [≤10pC] 温升试验 [6300A] 短时耐受电流和峰值耐受试验 [峰值耐受电流 (峰值): 125kA, 0.3s; 短时耐受电流 (有效值): 50kA, 4s] 外壳防护等级 [IP54]		
检验依据: GB/T8349-2000《金属封闭母线》		
检验结论: 所检项目的检验结果符合标准及技术文件的规定, 试品相应性能合格。		
编制: 李 勇	校核: 郭成芳	审定: 刘 伟
签名: 李 勇	签名: 郭成芳	签名: 刘 伟
日期: 2019.11.22	日期: 2019.12.2	日期: 2019.12.2


 No. XG19111262






180021253110

检 验 报 告

TEST REPORT

图本

样品名称: 共箱封闭母线

型 号: CCX-12/4000-50

委托单位: 江苏乐仕电气科技有限公司

试验类别: 型式试验

国家高低压电器质量监督检验中心
 National High-voltage Electrical Apparatus Quality Supervision and Inspection Center
 甘肃电器科学研究院
 Gansu Electric Apparatus Research Institute

报告编号: XG19111262
 第 2 页 共 19 页

国家高低压电器质量监督检验中心	检 验 报 告	委托编号: WG19111140
检 验 结 论		
样品型号、名称: GMC-12/4000-50 共箱封闭母线 委托单位: 江苏乐仕电气科技有限公司 委托单位地址: 扬州市新坝镇南自路29号 制造单位: 江苏乐仕电气科技有限公司 制造单位地址: 扬州市新坝镇南自路29号		
检验项目: 绝缘电阻测量 [相间, 对地 > 100MΩ] 绝缘试验 [工频电压: 相同, 相对地 42kV/1min (干试), 雷电冲击电压: 相同, 相对地 75 kV] 局部放电试验 [≤10pC] 温升试验 [4000A] 短时耐受电流和峰值耐受试验 [峰值耐受电流 (峰值): 125kA, 0.3s; 短时耐受电流 (有效值): 50kA, 4s] 外壳防护等级 [IP54]		
检验依据: GB/T8349-2000《金属封闭母线》		
检验结论: 所检项目的检验结果符合标准及技术文件的规定, 试品相应性能合格。		
编制: 李 勇	校核: 郭成芳	审定: 刘 伟
签名: 李 勇	签名: 郭成芳	签名: 刘 伟
日期: 2019.11.22	日期: 2019.12.2	日期: 2019.12.2

■ 共箱封闭母线应用范围 Application scope of non-segregated phase enclosed bus-bar



由导体、绝缘组件与保护外壳组成的封闭母线,三相导体由共同外壳保护,共箱封闭母线回路外壳两端接地或多个接地点。广泛应用于变电站、太阳能电站、火电站、核电站输配电领域,安装于变压器与开关柜及小型发电机至主变压器、厂变压器、励磁变压器、PT回路中,具有安全可靠、电磁屏蔽效果好、维护简单等优点。

本公司可提供额定电压 10.5kV~35kV 电压等级,额定电流 600A~8000A 系列共箱封闭母线,特殊结构封闭母线,本公司可按照用户要求设计制作。

The enclosed bus-bar is consisted of conductors, insulating assemblies and protective enclosure, 3-phase conductor is protected by a common enclosure, the two ends of isolated-phase enclosed bus-bar's circuit enclosure is grounded or by many grounding points. The bus-bars are widely used in power transmitting and distributing fields of substations, solar energy power stations, thermal power stations, hydroelectric stations and nuclear power stations, the enclosed bus-bars installed in transformers and cabinets and small generators to main transformer, plant transformer, excitation transformer and PT circuit have such advantages as transmitting high-current, strong capacity of withstanding short circuit, good effect of electromagnetic screen and simple maintenance.

Our company will provide such isolated-phase enclosed bus-bars with rated voltage 10.5kV~35kV, rated current 600A~8000A, as to special enclosed bus-bars, our company can design and make based on user's requirements.

■ 共箱封闭母线规格表 Specifications table of non-segregated phase enclosed bus-bar

额定电压(kV)rated voltage(kV) / 额定电流(A)rated current (A)	10.5	15.75	24	35
600	800 × 540	900 × 550	1100 × 600	1550 × 750
1000	800 × 540	900 × 550	1100 × 600	1550 × 750
1250	800 × 540	900 × 550	1100 × 600	1550 × 750
1600	800 × 540	900 × 550	1100 × 600	1550 × 750
2000	850 × 540	950 × 550	1200 × 650	1650 × 750
2500	850 × 540	950 × 550	1200 × 650	1650 × 850
3150	850 × 540	950 × 600	1200 × 650	1650 × 800
3500	900 × 540	1000 × 600	1200 × 650	1650 × 800
4000	900 × 540	1000 × 600	1200 × 700	1650 × 800

■ 封闭母线附件 Accessories of enclosed bus



PT+LA 柜
PT+LA Cabinet



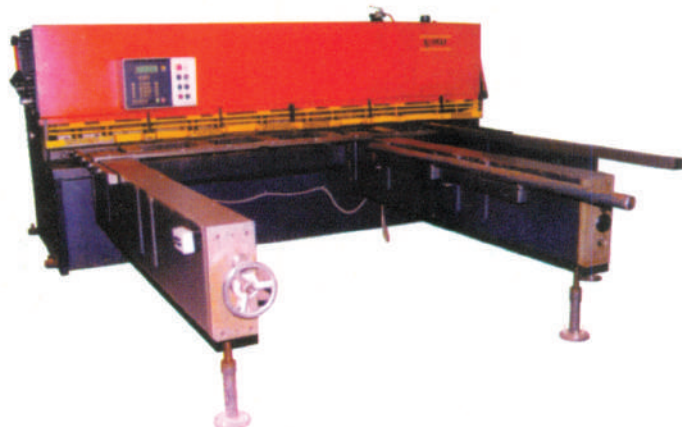
金具
Harl ware tool



镀银铜编织线
Copper wire braid plated with silver



封闭母线加工设备
Bus-bar processing equipment





◆ 铜排高速圆盘锯



◆ 铜牌压弯系统



◆ 数控冲床



◆ 数控折弯机

 质量检测 Quality inspection



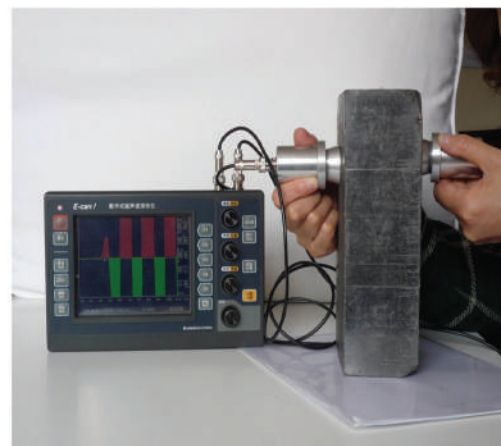
试验变压器
Testing transformer



5000V 绝缘电阻测量仪 BY2671A
5000V insulation resistance tester BY2671A



绝缘电阻测量
Insulation resistance tester



超声波探伤仪
Supersonic flaw detector

共箱封闭母线安装维护说明书

Non-segregated Phase Bus Installation and Maintenance Specification

一. 共箱封闭母线安装说明:

Installation specification of non-segregated phase bus:

1.1 本说明适合于我厂生产的各种型号的共箱封闭母线的安装与使用。

This installation specification is applicable to all kinds of non-segregated phase bus Daqo manufactures.

1.2 编制依据

Compilation basis

1.2.1 设计院设计的电气设备布置图册以及共箱封闭母线的安装图册。

-Layout drawings of electric equipments from design institute.

-Installation drawings of non-segregated phase bus.

1.2.2 电气装置安装工程母线装置施工及验收规范。

Erection and acceptance specification of bus duct for electric equipment installation project.

1.2.3 共箱封闭母线技术协议或技术要求。

Technical agreement or technical requirements of non-segregated phase bus.

1.3 遵循标准

Applicable standards

1.3.1 封闭母线

Enclosed bus duct JB/T9639-1999.

1.3.2 高压输变电设备的绝缘配合高电压试验技术

GB311.1~6《Insulation co-ordination for high voltage transmission and distribution equipment》.

1.3.3 交流高压电器在长期工作时的发热

GB763-90《Heating of A.C. high-voltage apparatus under long runs》.

1.3.4 高压电感动热稳定

GB2706-89《The testing methods of peak withstand current and short-time withstand current for high-voltage apparatus》.

1.3.5 包装贮运标志

GB191《Rules for packing, storing and transporting》.

1.3.6 电气装置安装工程装置母线装置施工及验收规范

GBJ149-90《Code for construction and acceptance of busbar installation of electric equipment installation engineering》.

1.3.7 户外防腐电工产品的涂漆

JB2420《Painting for outdoor anti-corrosion electric products》.

二、共箱封闭母线安装顺序

Erection procedure for non-segregated phase bus

原则为先户内后户外,户内为先里后外,即按照母线总装配图安装就位,并进行尺寸调整,最后进行断口处连接。

Install bus ducts indoors firstly and outdoors later, construction sequence for indoor bus ducts is that inside first and outside late. That is installation should be in place according to general assembly drawing, adjusting corresponding dimensions, and connect sections at last.

三、现场共箱封闭母线施工具备的条件：

Erection conditions for non-segregated phase bus at site

安装前必须进行母线检查，目测支持绝缘子是否有损坏、破裂现象，母线是否有箱体变形，捺划伤，母线导体是否移位等现象，如发现以上问题需及时处理以便母线安装后造成不必要的返工。

Inspect bus ducts before installation, check if bus ducts damaged, deformed, and conductors translocated. Solve in time if meeting above issues, prevent unnecessary reworking.

3.1 共箱封闭母线安装前须准备以下工具：

Prepare following tools before installing non-segregated phase bus:

吊车，葫芦，软质绳具或套有橡胶管的钢丝绳，力矩扳手，螺丝刀，木锤，铁锤，卷尺，水平仪，线坠，纱布，吸尘器清洗溶剂，干净的白软布，防水布，锉刀，安全带，安全帽，弹丝，电源等各种必备件。

Crane, calabash, soft rope or steel wire with rubber tube, torque spanner, screw driver, wooden hammer, iron hammer, tape, gradienter, bobbin, gauze, cleaner, clear and soft cloth, waterproof cloth, grater, safety belt, safety helmet, elaters, power supply and so on.

3.2 土建工程、变压器与开关柜的尺寸和高程检查：

Dimension and elevation inspection for civil works, transformer and switch cubicle

在开始安装前，检查土建工程、变压器的尺寸和高程是必不可少的，因为它是顺利进行共箱母线安装的基础，可以了解它与合同中土建和布置图间的差异，基础中心标高测量及修正，以设计院共箱母线图及生产厂家封闭母线的总装配图为依据，变压器低压套管和墙预留孔为基础，校对以下尺寸，不符合时需进行修正，修正误差为 $\pm 3\text{mm/m}$ ，整体不大于 $\pm 5\text{mm}$ 。

It's necessary to check dimension and elevation of civil works and transformer before installation, because it is the basis for installation. We can know the differences between layout drawing and civil works in contract, measure elevation of basic centerline and then revise. Check following dimensions, on the basis of prepared hole and lower voltage bushings of transformer, according to NSPB drawings from design institute and general layout drawing from manufacturer, correct inconformity dimensions, correction tolerance is $+ 3\text{mm/m}$, overall is not more than $+5\text{mm}$.

3.2.1 测定发电机纵向、横向的中心线以及发电机组的中心线；

Check vertical and horizontal centerlines of generator and centerline of generator units.

3.2.2 测定发电机纵向、横向的中心线；

Check vertical and horizontal centerlines of generator

3.2.3 测定共箱封闭母线基础构架的基础及标高；

Check basis and elevation of NSPB's framework.

根据设计院、制造厂家的共箱封闭母线总装配图进行基础构架及标高等尺寸是否符合设计图纸要求。

Check dimensions of framework and elevation according to general assembly drawing from design institute and manufacturer.

3.3 共箱封闭母线安装前的清点、外观检查并清缺：

封闭母线安装前的清点是封闭母线到货情况的检验依据；外观检查是封闭母线安装的基本条件，同时可以减少母线在安装过程中的工作量。

Checking and visual inspection NSPB before installation.

Checking NSPB before installation is inspection evidence for delivery. Visual inspection is basic condition for installation, reducing work load in installation process.

3.3.1 共箱母线的清点：

按照制造厂详细的发货清单清点共箱封闭母线及配件数量是否与发货清单相吻合。

由于共箱封闭母线属于大、中件产品，配件价格较贵，因此，封闭母线在到达现场后，配件必须逐箱清点；发货清单须经业主、监理、生产厂家、安装单位等几方共同签字确认；如未经几方签字开箱使用，最终发现配件短少，与发货清单不符，一切责任均由业主或开箱使用方承担。

共箱封闭母线清点完毕后，应将母线的备品备件移交给业主仓库，发货清单与资料交业主档案部门存档，以备查验。

Check NSPB.

Check NSPB and accessories according to detailed packing list from manufacturer.

Due to size of NSPB is great and accessories are expensive, so it's necessary to check once NSPB and accessories arrive at site. Packing list must be confirmed and signed by client, supervisor, manufacturer and Installation Company. If user opens packages without signatures of above members, and find shortage or unconformity at last, client or user should undertake full responsibility.

After checking, deliver spare parts to client's warehouse, submit packing list and documents to client's document control department.

四、共箱封闭母线的搬运与起吊：

Carrying and lifting of NSPB

4.1 结构概述：

共箱封闭母线是指各相导体在一个公共的金属壳内，相间没有隔板隔开的母线。

共箱封闭母线主要由箱体、母线导体、绝缘子、金具、连接或紧固螺栓等部分构成。

由于共箱封闭母线整体较长，一般在制造厂做若干分段，到现场后将各母线分段用螺栓连接起来，三相母线导体均置于铝制外壳内，导体用绝缘子支撑，绝缘子上部装有相应的金具，导体可在金具上滑动或固定，绝缘子下部固定于支撑板上，支撑板焊接于箱体内部。

箱体的支持采用支撑或吊装。钢横梁则支持或吊装于工地预埋件钢架上。

各段母线间或各段箱体间采用螺栓连接。共箱封闭母线在一定长度范围内，设置温度补偿装置，其能满足箱体在一定范围内的误差，导体亦能满足由于温度差或安装带来的误差，母线导体采用多层薄铝片或铜片做成的伸缩节与两端母线导体连接，外壳则用伸缩节连接。

共箱封闭母线与设备连接处采用螺栓连接，母线导体与设备端子导电接触面镀银或搪锡，其间用带接头的多层薄铝片或铜片软连接或铜编织线作为伸缩连接件。

Structure specification:

Conductors of NSPB are mounted in a common metal box without segregated plates between phases.

NSPB consist of enclosure, conductor, insulators, metal clamp connection structures and fastening bolts, etc.

Due to NSPB is long, so manufacturer separates NSPB into many sections, and then connect them with bolts at site. Conductors of three-phase locate inside aluminum enclosure, supported with insulators. There are metal clamps on the top of insulators, and conductor can be therefore fixed or slip. Bottom of insulators are fixed on support plates, and support plates are welded inside enclosure.

Enclosure is supported through supporting or lifting. Steel beam are supported or lifted on embedded steel frame at site.

Bus bar sections and enclosure sections are both connected with bolts. Temperature compensation devices are mounted inside NSPB of specific length, and they can meet tolerance of enclosures within specific range, and tolerance caused by temperature difference or installation. Conductors are connected by multiplayer thin aluminum sheets with adaptors, and enclosures are connected with flexible connections.

NSPB are connected with equipments with bolts, conductors and conductive surface of equipment terminal should be plated with silver or tin, and connected with multiplayer thin aluminum sheets with adaptors or copper flexible connection or copper braided wires.

4.2 共箱封闭母线的搬运与起吊

由于共箱封闭母线有承担电力传输的功能，在短路故障时母线还有承受电动应力的机械功能。因此共箱封闭母线在搬运、储藏、清扫、安装时必须考虑几个主要功能不受影响，所以搬动共箱封闭母线时应极度小心，在搬运时避免由于吊车动作过快而引起振动，使绝缘子破裂或箱体变形，另外选择吊挂点时以免弯曲过大损坏共箱封闭母线；以避免碰坏共箱封闭母线表面油漆或擦伤母线箱体表面，因此必须用软绳进行起吊。共箱封闭母线必须放在平整的地方，但绝不能将共箱封闭母线直接放

在地面上,应在共箱封闭母线与地面放置木块。

Carrying and lifting of NSPB.

Due to NSPB can transmit electric power and undertake mechanical force short circuit causes, so NSPB should be protected in carrying, storing, cleaning, and installation process, preventing from vibration, damage, and deformation when carrying, avoiding to bend lifting point exceedingly and damage NSPB. Do not scratch painting and enclosure surface, and lift NSPB with soft rope. NSPB should be placed on flat ground, and there should be wooden blocks between NSPB and ground.

4.3 共箱封闭母线的就位

支架必须准确地安装就位,根据共箱封闭母线的总装配图或段装配等确定支撑架或吊架的焊接位置,焊接支撑架及槽钢(角钢)横梁,并调整其标高,确保其标高计算与设计图纸完全一致,其误差不超过 $\pm 5\text{mm}$,根据共箱封闭母线支撑架安装图焊接支撑架(必须焊接牢固,防止母线就位后不安全的事情发生)。

待上述工作结束后,按照设计院图纸或厂家提供的图纸将共箱封闭母线按次序吊装在槽钢(角钢)支撑架上,然后由发电机、变压器侧、开关柜连接处开始进行尺寸方向调整,误差一般由伸缩节来满足配合;

注:共箱封闭母线在安装就位至穿墙处,请将穿墙隔板框架点焊在基础埋件上,以防止共箱封闭母线安装后,穿墙框架未就位,而造成返工或切割框架等工作;如无穿墙隔板,洞口的封堵一般由业主或安装单位进行,材料为业主或安装单位自备,一般采用石棉泥封堵。

共箱封闭母线在就位后,在尺寸调整过程中,同时进行母线清扫工作,用酒精、棉布、吸尘器等将母线箱体内部表面、绝缘子表面清扫干净后并盖上箱盖进行封闭,以减少共箱封闭母线调试前的工作量。

Take NSPB's place.

Support structures must be installed exactly, confirm the location of support structure and lifting structure according to general assembly drawing or sections assembly drawing. To weld support structures and channel steel (angle steel) beams, and then adjust corresponding elevation, making sure elevation calculation exactly complies with design drawing, the tolerance should not exceed $+5\text{mm}$. Welding support structures according to assembly drawing of support structures (to weld firmly, prevent accident after NSPB taking its place).

After completing above work, lift NSPB up to support structures of channel steel (angle steel) according to drawings from design institute or manufacturer. Adjusting dimensions from connection sections of generator, transformer side and switch cubicle, and the tolerance should be met and cooperate by expansion joint.

Notes: Take NSPB's place and expand to wall-passing section, weld the frame of wall-passing plate on embedded parts of foundation, preventing wall-passing frame being not in place after installation of NSPB, and thus result in rework. Client or installation company should block off holes if there aren't wall-passing plate, client or installation company should prepare the materials, and the materials usually are asbestos clay.

Cleaning internal surface of enclosure and insulators' surface with alcohol, cotton cloth, and dust collector while adjusting dimensions after installation of NSPB, then closing the covers and seal off to reduce the work before debugging.

4.4 共箱封闭母线调整与清扫:

共箱封闭母线安装完毕后,应清扫、封闭。

共箱封闭母线箱体内部、绝缘子表面、内部导体均应用干净的棉布擦除灰尘和杂物,绝不可遗留杂物在母线内部,必要时可用吸尘器,使之清洁无尘。

当在共箱封闭母线内部进行清扫时,切勿损坏内部绝缘子等部件,安装工具等决不可以遗留在箱体内。

共箱封闭母线进行最后清扫检查,应请业主、监理、施工单位等有关部门共同检查确认后,方可进行最后的连接,连接后不得擅自打开箱盖。

Adjustment and cleaning of NSPB.

NSPB should be cleaned and sealed after installation.

Internal surface of enclosure, insulators' surface and conductors should all be cleaned with cotton cloth, do not leave

any sundries inside NSPB, to use dust collector if applicable.

Client, supervisor, erection company should check and confirm together after completing cleaning, then last connection can be done, do not open the covers without reason after connection.

4.5 共箱封闭母线的安装

共箱封闭母线是承担电力传输的重要导电部件。它需要保证导体的电气和机械连接,电气和机械性能应是高质量的;同时,共箱封闭母线箱体段间连接还必须达到防雨(主要是户外),采用防雨罩。伸缩节处采用防雨罩进行防雨,因此,共箱封闭母线的安装人员需具有一定的电气理论知识和实践经验的能力,确保安装一次性完成。

安装之前或之后,应检查导体相间和相对地以及带电体对地空气近距,应不小于表之规定:

表:

Table:

额定电压(kV) rated voltage(KV)	最小安全距离(mm) minimum safe distance(mm)
1	40
3.15	80
6.6	100
10.5	125
13.8	160
15.75	180
18	200
20	220
24	240
35	290

其安装方法请参见我厂提供的安装图册或断口连接图。

Installation of NSPB.

NSPB is important electric conduction parts to undertake power transmission. NSPB should guarantee mechanical and electrical connection of conductors, and mechanical and electrical performance should be high quality. Meanwhile, expansion joints and connection sections of enclosures should use rain shields for protection (especially outdoors). Therefore, erection worker should have related knowledge of electrical principle and practical experience, making sure to complete installation one time.

Before or after installation, we should check air clearance distance between phases of conductors, phases and ground, charged parts and ground, and the values of air clearance distance should not be less than the values show below.

For detail installation method, please refer to installation drawings and connection drawings of interfaces Daqo provides.

五. 共箱封闭母线的检查

共箱封闭母线在安装完毕后,应对其进行清扫、封闭。

共箱封闭母线箱体内壁、瓷瓶表面、导体外表面均应用干净的棉布及酒精或不含油剂的清洁剂擦除油污和杂物,绝不可以遗留杂物在共箱封闭母线的内部,应使之清洁无尘。

当人在共箱封闭母线内部进行清扫时,应注意瓷瓶有无损伤,如有需进行更换。

共箱封闭母线进行最后的清扫、封闭检查时,应请业主、监理、施工单位等有关部门共同检查确认后,方可盖上箱盖进行封闭;封闭后,不得擅自打开箱盖,以防止灰尘、杂物进入封闭母线内部,而影响封闭母线的运行。

Inspection of NSPB.

NSPB should be cleaned and sealed after installation.

Internal surface of enclosure, insulators' surface and conductors should be all cleaned with cotton cloth or cleaning solvent without oil solvent, do not leave any sundries inside NSPB. Check insulators when cleaning, replacing with new insulators when find damaged ones.

Client, supervisor, erection company should check and confirm together after completing cleaning, then last connection can be done, do not open the covers without reason after connection, to prevent dust and sundries enter into NSPB and affect the operation.

六、共箱封闭母线的表面处理：

共箱封闭母线在内部清扫完毕后，如表面有涂层剥落、腐蚀等现象，表面油漆层需补处理，箱体的表面也应该清除灰尘、杂物等，确保其干净。

Surface treatment of NSPB.

After cleaning inside of NSPB, surface need repainted if obscission or corrosion is found. Dust and sundries on surface of enclosures should also be cleaned.

七、共箱封闭母线与各设备的连接：

具体请参见我厂提供的安装图册或与设备接口连接图。

Connection between NSPB and other equipments:

For detail information, please refer to installation drawings and connection drawings of equipments interfaces Daqo provides.

八、配合试验：

Cooperation test

8.1 绝缘电阻试验：

应用 2500V 兆欧表，共箱封闭母线整体测试值不低于 50 兆欧，在相-地，相-相之间进行。

Insulation resistance test:

Use tramegger of 2500v, test value of NSPB should not be less than 50 M ohm, measuring between phase and ground, or phase and phase.

8.2 耐压试验：

根据 GB311.1-6 标准中规定进行，现场试验的工频耐压试验值应符合表格的规定值和 75% 进行，或根据合同要求试验值进行现场工频耐压试验。

表：

Table:

额定电压(kV) Rated Voltage(kV)	最高工作电压(kV) Maximum work voltage(kV)	额定短时工频耐压 (有效值)(kV) 1min	
		湿试 Wet test	干试 Dry test
1	1.2		5
3.15	3.5	18	25
6.6	6.9	23	30
10.5	11.5	30	42
13.8	15.5	36	50
15.75	17.5	40	55
18	20	45	60
20	23	50	65
24	26.5	60	75
35	40.5	80	95

Withstand voltage test.

According to standard GB311.1~6, power frequency withstand voltage at site should be 80% of value in following table, or complies with required value in contract.

九、安全注意事项：

Cautions:

9.1 共箱封闭母线吊装必须使用软绳具，吊运必须由有合格证的起重工来承担；

Lifting NSPB with soft rope, the worker who operates the crane should have qualified certificate.

9.2 共箱封闭母线安装和调整时应特别注意不得损坏瓷件，特别是在发电机出线及主变、厂变等处，要千万小心，严禁损坏发电机、变压器瓷件；

Do not damage porcelain parts when installing and adjusting NSPB, pay special attention to generator outlet terminal, main transformer, and auxiliary transformer, do not damage porcelain parts of generator and transformer.

9.3 搭设牢固的脚手架，使施工人员在高空有一个安全的施工平面；

Fixing steady scaffolding platform, to make sure the safety of erection worker at height.

9.4 在施工现场准备充足的照明，在母线内部施工时必须注意安全照明；

Preparing enough lighting at site, pay attention to safety lighting when constructing inside bus ducts.

9.5 在施工现场准备一定的防火器具，防止火灾发生；

Preparing fire protection tools at site, to prevent fire.

9.6 安装地点应打扫干净，避免灰尘进入母线内部；

Cleaning installation site, to avoid dust enters into NSPB inside.

9.7 户外部分工作应尽量避免在雨天进行，防止母线内部受潮；

Do not do outdoor work in rainy day, to prevent moisture enters into NSPB.

9.8 共箱封闭母线尺寸较大，但钢性不大，故应避免碰撞，吊装时起吊工具及起吊点应加以注意；

Size of NSPB is much large, but the rigidity is poor, so we should pay more attention to lifting tools and lifting points to avoid collision.

9.9 使用的倒链必须经过负荷试验并合格，不得超载使用。

Reversible chain should pass load test and be qualified, overload is not allowed.

十、共箱封闭母线的维护

Maintenance of NSPB.

在共箱封闭母线运行时，技术人员应对运行情况和声音进行监督

Technicians should monitor operation situation and sounds when NSPB running.

但近几年,封闭母线的维护与运行工作在某些电厂在机组检修工作中得不到应有的重视,一旦出现如因外界潮气侵入影响母线的绝缘、漏氢、外壳过热的现象时,企业多以临时故障处理,即造成大量人力和物力资源的浪费、又增加了维护成本,却不能从根本上解决问题。因此封闭母线的定期维护就成为重中之重。

常规维护

考虑到检修时间不同,针对电厂在运行过程中出现频率较高的现场进行一一分析,并提出相应的解决方案。

1 封闭母线内因结露导致绝缘下降现象

由于封闭母线是一种密闭的管道,当运行条件改变或气候条件变化时,内部易产生结露现象,从而降低母线的绝缘性能。严重时可引发单相接地事故,给发电企业的安全运行带来隐患。

1.1 封闭母线结露的原因

A:温差效应

机组运行时,母线内导体和外壳的温度较高。而机组停机后,母线内导体和外壳的温度将快速下降。正常运行时,母线内空气的温度为70℃左右,每立方米空气中饱和水蒸气密度为196.8克,而机组停机后(以环境温度20℃为例),母线内的空气温度则降为20℃,每立方米空气饱和水蒸气密度为17.28克。也就是说,母线内的空气温度由正常运行时的70℃下降至20℃时,每立方米空气中将有179.52克液态水析出。这些水将严重的影响母线和外壳之间的绝缘。冬季时这种现象更为严重。(以上数据由饱和湿空气表得出)

B:环境因素

发电机每次停机检修或临修,封闭母线易被空气中的潮气、雨水、浓雾等侵入,造成停机受潮,每次开机均需处理封闭母线的绝缘,严重时影响按时开机。阴雨天开机时封闭母线的绝缘往往更是不合格。严重时会造成开机时间拖延。如不能按时正常开机,每推迟一天,发电企业都将会受到很大的经济损失。为了保护母线和外壳之间的绝缘,在机组运行和停机时要采取相应的措施防止空气结露,造成绝缘下降。

1.2 防止母线内空气结露,建议采取以下几种防结露措施:

A:封闭母线外壳内经过充微正压系统的干燥空气

对封闭母线充入经过微正压装置过滤后的干燥、洁净的空气。并使封闭母线外壳内的空气压力略高于外界大气压,一般为300-2500Pa,形成一种气封的作用,这样,外界潮湿的空气及灰尘就不能进入封闭母线外壳,从而保证了封闭母线的绝缘要求。这种方法可有效提高封闭母线绝缘,尤其是在机组停机后,是封闭母线防止绝缘降低的最佳方法之一其作用是向三相封闭母线提供干燥洁净的空气,使封闭母线内部始终保持在微正压状态。因为当外界温度下降或负荷电流降低引起母线温度下降时,会引起封闭母线内气压降低,微正压装置将提供干燥洁净的空气以维持当温度降低时的预置剩余压力,从而阻止外界潮气及粉尘的进入。微正压装置一般是由空压机(也可利用厂内气源)、空气干燥器、过滤器、储气罐(可不用)、压力控制柜、过压保护系统、及管路等几部分组成。

B:封闭母线外壳内充热风

在发电机开机前1-2小时投入热风保养装置,将干燥的热风通入母线夹层,快速的置换出母线内的潮湿空气,50-110分钟后关停热风保养装置启动发电机。这种方法比通自然风有所改进,通入的热风能驱走一部分潮湿空气,还能提高母线内空气的饱和含湿量值,降低相对湿度,使封闭母线的绝缘很快建立起来。但是,由于母线内导体及外壳均为铝制,传热效果好,散热快,故一旦停止加热或沿母线长度方向距加热点较远时会出现降温。随着温度的降低,空气中的水蒸汽将重新凝结成液态水;另一方面,当母线内部湿度很大时,在外部气温降低的过程中,由于内部温度的升高,就会出现外壳内壁表面空气降低到露点温度的逆效应。母线内壁表面会有水滴凝结,严重影响母线的绝缘。这种情况在水电站的封闭母线保护中尤为常见。

C:风循环式空气干燥、净化装置

将封闭母线在适当的位置连通,使干燥、净化的空气在封闭母线中形成闭路循环,在空气循环过程中,母线内的空气被连续干燥、净化,不断的除湿。当母线内空气达到一定洁净度时,设备停止循环。这种方法可有效除湿,但运行成本较高,并且在制造、生产和现场安装中必须保证封闭母线外壳的气密性。可适用于各种大型临界、超临界、超超临界机组的封闭母线保护中。

2 封闭母线漏氢现象

A:发电机出线套管漏氢现象

发电机运行过程中由于振动等原因造成定子线圈和出线套管的损坏,引起氢气泄漏,这是一种频发的可能造成严重事故

的缺陷。发电机出线套管漏氢,氢气直接进入母线,这种情况极为严重。由于发电机内的氢气压力在3公斤左右,当发电机套管因老化或其他原因造成密封不严时,氢气就会由此进入母线。当母线的氢气压力达到一定比例时,就会发生“自鸣”反应,造成母线爆炸。出现重大设备事故。另外,各个发电企业的情况也不尽相同。有些发电企业,发电机与封闭母线连接处没有排氢孔,且无氢气监测设备,一旦出现漏氢情况,后果将极为严重;有些发电企业,发电机与封闭母线连接处设有排氢孔,当套管出现漏氢情况时,大量的氢气会由排氢孔排出,由于氢气有很强的渗透能力,少量的氢气会通过盘式绝缘子而渗入到封闭母线内。

解决方案:布置漏氢检测装置,做到时时监控,第一时间预防漏氢,坚持投运微正压装置,因为封闭母线内经微正压装置处理的干燥、洁净的空气便起到了气封的作用,防止氢气渗入母线外壳。

B:封闭母线现场其他途径漏氢

封闭母线现场其他途径漏氢,导致母线现场周围存在大量氢气。有些发电企业,封闭母线现场周围设有很多氢气设备。如氢干器、氢气循环设备、氢气监测设备等…,这些设备如一旦出现故障而没有及时发现并排除,就会出现现场漏氢事故。由于氢气的渗透能力很强,会有部分氢气透过母线上的缝隙、焊缝的沙眼及密封不严的法兰等处,进入母线外壳。这时,如遇到封闭母线瓷瓶脏污,产生微弱的放电,将会对母线造成安全隐患。

解决办法,投入使用微正压装置,经微正压装置处理的干燥、洁净的空气可起到气封的作用,可有效的防止氢气渗入母线。

上诉现象的产生以及解决措施都最终取决于封母设备的密封性,特别是微正压系统的正常投运。然而由于密封制品(主要是橡胶制品)的时效性较低,这些材料经不长时间会失去密封效果;微正压过滤柜中的器件存在易损现象。因此利用检修时期定期更换可以有效保护机组运行可靠性,降低母线结露的可能性。建议对封闭母线的上的所有密封制品予以统一更换,具体:更换母线支持绝缘子底座密封圈(环)、弹力块、球冠形金具;更换密封盘套(盘式绝缘子);更换设备连接处的橡胶波纹管;更换窥视窗密封胶垫;更换微正压系统中的.过滤减压阀、电磁阀、交流接触器、智能压力控制器… …等(见附表)。可有效提高母线的密封性,降低结露的可能性,加大运行可靠性。

共箱母线

序号	名 称	规格型号	推荐数量	备 注
1.	支撑绝缘子		50 只	根据长度而定
2.	导体支撑上下金具		50 套	根据长度而定
3.	箱盖密封垫	整体氯丁橡胶	全部	
		橡胶密封条	全部	
4.	段间密封垫	整体氯丁胶	全部	



江苏乐仕电气科技有限公司

JIAGNSU LESHU ELECTRIC TECHNOLOGY CO.,LTD.

地址：江苏扬中市新坝镇南自路 29 号

电话：0511-88413869

传真：0511-88410869

邮编：212200