

88LKXE-17 型循环水泵

Vertical mixed flow Pump of type 88LKXE-17

安 装 使 用 手 册

Operation and Maintenance Instruction Manual



安装使用本产品前请详细阅读本安装使用手册

Please read the installation manual before using & installation this product

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第一章 概述 GENERAL

1. 总体说明 Overall specifications

1.1 本手册包括了水泵机组安装、调试、运行、维护、拆卸等各项工作所必须遵守的基本资料，所以在这些工作开始之前，参入的操作和维护人员都必须仔细阅读本手册，并请始终将本手册放置在泵组操作的场所附近，以便于查阅使用。This manual includes all the basic information about a pump unit installation, commissioning, operation, maintenance, demolition and so on, before starting these work, the operating and maintenance personnel must carefully read this manual and always places it nearby the pump group, to convenient for look up.

1.2 本公司产品严格按最新技术和相关标准制作，所有零件经过精心制作和严格的质量检验。如果能正确安装、使用和维护，就可以保证泵组可靠、无故障运行。Our products are made in strict accordance with the latest technology and standards, all parts carefully produced and strict quality testing. Only if installation, use and maintenance correctly, can ensure reliable pumping systems, trouble-free operation.

1.3 本公司建议由我方专业技术人员来现场进行安装、调试指导，并由我方专业技术人员与施工方、监理方共同签署《立式斜流泵现场安装技术数据记录表》。此数据对于以后泵组维护及故障分析处理非常重要，请妥善存档。We recommend that site installation and debugging by our professional and technical personnel ,and construction、supervisor and we cosign the 《Vertical mixed flow Pump field installation technical data log sheet》. This data is very important for future pumping systems maintenance and fault analysis, please properly filed.

1.4 泵组运行不得在超出《循环水泵技术协议》中所规定的运行工况运行；应确保泵组按照本手册的各项规定运行。否则造成的设备损坏和人员伤害本公司不承担责任。 Pump operation can not exceed the operation condition specified in 《Circulating pump technology agreement》 ;Should ensure pump operation according to specification specified in manual. Otherwise, caused equipment damage and personal injury our company is not liable.

1.5 本手册中的各项说明仅对湖南湘电长沙水泵有限公司供货范围(例如：泵或泵组)，不涉及安装、调试、运行、维护、拆卸过程可能发生的所有事故。 This manual only for HUNAN XEMC CHANGSHA PUMP WORKS CO.,LTD supply scope(eg:pump or pump unit), does not involve any incidents that may occur in the installation, commissioning, operation, maintenance,and demolition process.

1.6 未经本公司授权或公司代表在现场确认，请不要在质保期限内对水泵进行拆卸。 Without the authorization of our company or the company representative do not confirmed in the field,please do not demolish the pump within the warranty period.

1.7 必须严格遵守泵或泵组上的铭牌、标记和警告说明。 Must strictly comply with the nameplate, marking and warning instructions on the pump or pump unit

1.8 泵组安装、调试、运行、维护有任何问题或设备发生故障时，请及时与湖南湘电长沙水泵有限公司售后服务部联系，我公司将竭诚为您服务。 If there is any problems or equipment failure when doing the installation, commissioning, operation, and maintenance to the pump unit, please contact the service department of our company in time, we will offer warm-hearted service to you.

1.9 本手册所有权为湖南湘电长沙水泵有限公司, 未经湖南湘电长沙水泵有限公司许可不得泄露给第三方。The ownership of this manual belong to HUNAN XEMC CHANGSHA PUMP WORKS CO.,LTD, without the permission of HUNAN XEMC CHANGSHA PUMP WORKS CO.,LTD, shall not be divulged to third parties.

2. 现场清理 Clearance of site

2.1 丢弃物应遵守当地的环保规定。The litter should comply with the local environmental regulations

2.2 包装部件必须由收件人处理。Packaging components must be processed by the recipient

2.3 用完后剩余的润滑剂、清洗剂、处理剂以及不用的电器设备等应由用户人员负责处理。The user is responsible for the remainder of the lubricant, the cleaning agent, the treatment agent, as well as the unused electrical equipment, etc.

3. 质保权益 Guarantee rights and interests

3.1 泵组的安装应由具有资质的安装公司及经过培训且熟悉拆装工作的专业人员操作。操作程序、零件配合、安装标记均应符合本手册的相关规定, 否则造成的人员伤害和泵组损坏, 我公司不承担任何责任。The installation of the pump unit should operate by a qualified installation companies and trained and familiar with the disassembly work operations professionals. Operating procedures, parts fit, and installation marking shall be subject to the relevant provisions of this manual, Otherwise our company will not undertake any responsibility for caused injuries and pump unit damage.

3.2 在质保期内泵组首次安装调试和任何组装拆卸工作必须在我公司专业

技术人员指导下进行，否则只有在我公司技术人员对上述工作进行检查并作了记录后，我方才同意质保。Installation and commissioning of pump unit for the first time during the warranty period and any assembly disassembly work must be carried out under the guidance of our professional and technical personnel, or only after our technical staff check and keep record of above work, we will agreed to warranty.

3.3 在质保期内，泵组不得进行拆卸、改装，除非我公司代表在场或经过我公司认可，否则不享受质保权利。Within the warranty period, the pump can not be demolished, modification, unless the presence of company representatives or recognized through my company, Otherwise, do not enjoy the quality assurance rights.

3.4 在质保期内，泵组运行故障造成零件损坏，未经我公司授权或没有我公司代表在场，用户擅自对泵组进行拆卸维修，将视为自动放弃质保权利。Within the warranty period, pump parts damage caused by pump operation fault, without authorization or without the presence of company representatives, the user unauthorized disassembly maintenance to pump unit, it will be deemed a waiver of warranty rights.

3.5 泵组零件正常磨损，超过使用寿命的零件不在质保范围。Warranty does not cover the normal wear pump parts, and the parts which over the service life.

3.6 泵组不在运行范围内运行，造成损失由用户承担。Pump unit operation does not within the scope of operation, thus causing losses are borne by the user.

3.7 用户未按要求对泵组进行保养维护，视为自动放弃质保权利。The user maintain the pumping unit do not according to the maintenance requirement, deemed a waiver of warranty rights.

3.8 由于用户操作不当，造成泵组损坏，将失去索赔权利。Damage due to improper operation of the user, resulting in the pump unit will lose the right to claim

注意：对泵组的任何操作都应符合本手册相关规定，否则不能享受质保权利。

Notice: Any operation of pump unit should conform to the relevant provisions of this manual, otherwise cannot enjoy rights warranty

第二章 安全 SECURITY

1. 人员资格和培训 Personnel qualification and training

安装、运行、维修保养和检查的人员一定要能够胜任其相应的工作，负责人必须明确各人的职责和监管范围。如果相关人员不熟悉岗位技能，应进行适当的培训。如果需要，可以请制造商或供应商进行培训。此外，施工方有责任确保本手册的内容都已被操作人员完全掌握。 Installation, operation, maintenance and inspection personnel must be capable of work, the person in charge must be clear and their duties and scope of regulation. If the person is not familiar with the job skills should be properly trained. If necessary, can ask the manufacturer or vendor training. In addition, the construction side has the responsibility to ensure that the contents of this manual are the operator to fully grasp.

2. 不遵守安全规程的后果 The consequences of non-compliance with safety regulations

如不遵守安全规程，就会危及到人员、财产、环境以及泵组本身的安全。此外，如果发生的损害是由不遵守安全规程所引起，将会丧失提出索赔的任何权利。 If not to observe the safety regulations, it will endanger the security of people, property and the environment, as well as pumping systems.

例如，不遵守安全规程可能会引起（包括但不限于）： For example, non-compliance with safety regulations may cause (including, but not limited to)

a. 不能实现重要的泵组功能 Important function of pumping systems can not be achieved

b. 由电气效应、机械效应、化学效应和热效应引起危及人员和财产安全的事故发
生； Accidents caused by electrical effects, mechanical effects, chemical and thermal

endanger the safety of persons and property;

- c. 由危险物质渗漏引起危害环境。 Harm to the environment caused by the leakage of hazardous substances**

3. 安全意识 Safety consciousness

必须强调指出：一定要遵守本手册中的各项安全规程；遵守相关的国家健康和安全规程；遵守施工方自己的内部工作规程、操作和安全规程。
Must be stressed that: we must comply with the safety procedures in this manual; comply with the relevant national health and safety regulations; comply with the construction side of its own internal working procedures, operations and safety procedures.

4. 施工方的安全规程 The construction side safety regulations

泵组上可能构成危险的任何部件都必须加装防护罩。 Pump unit may constitute a dangerous parts must install protective cover.

泵组的安全防护装置（如：联轴器检查窗、防护栏杆等）应保证完好，不能拆除（除维护检修必须拆除外）。 Should ensure the integrity of security guards of pump unit(such as: coupling inspection windows, protective railings, etc.) and can not be removed (except for maintenance and overhaul must be removed outside).

泵组上所标示的警示标志必须严格遵守，以免造成人员伤亡和设备损坏。 The warning signs marked on the pump unit must be strictly adhered to, so as to avoid casualties and damage to the equipment.

泵组安装完毕，应对泵坑进行清扫，以防止调试泵组时掉落到泵坑的螺钉、砖块及混凝土等杂物吸入水泵，造成破坏。同时应盖好各种安装孔洞，以防人员跌落。 After pump unit installation, should clean the pump pit to

prevent the screws, bricks and concrete debris that falling to the pump pit during debugging intake into the pump, causing damage. Various mounting holes should be covered to prevent personnel falling.

现场钢丝绳、起吊环等起吊工具应能承受泵组最大起吊重量，并留有适当安全余量。The site lifting tools, for example: wire rope, hoist ring, should be able to withstand the maximum lifting weight of the pump unit and leave appropriate safety margin.

5. 在泵组上工作的安全规程 Safety regulations for working in the pumping unit

施工方应确保在泵组的所有工作都由已熟悉本手册内容和要求的合格专业技术人员操作。Construction shall ensure that all work are operated by a qualified professional and technical personnel who familiar with the contents of this manual and the requirements.

在泵组上工作必须在泵组停机状态，开停机步骤必须严格按照本手册规定。Working on the pump unit must be at its shutdown state, starting up and shutting down steps must be in strict accordance with the provisions of this manual.

泵组安装拆卸过程中起吊重物下不能站人。People can not stand under the lifting heavy objects during pump unit installation and removal process.

6. 泵组零部件和备件的修改和制造 Modify and manufacture of pumping unit components and spare parts

在现场不允许对泵组零部件及备件作任何修改，如须修改，需先征得本公司书面同意之后才能进行相应修改。如果使用未经许可修改的零部件造成泵组损坏，本公司将不承担任何责任。Without permission can not make

any changes to pump unit components and spare parts in the field, if changes needed, such as the need to amend the need to first obtain the written consent of the Company in order to make the appropriate changes. If the pump unit damage caused by unauthorized modification parts, the company will not bear any responsibility.

7. 未经许可的运行方式 Unauthorized operation mode

本公司所承担的质保只有在遵守手册操作规程的运行方式时才有效。由于未经许可的运行方式而造成泵组损坏时本公司质保无效。The assumed warranty by our company is valid only operation in compliance with the manual operating procedures .

第三章 装运及临时存放 SHIPMENT & TEMPORARY STORAGE

1. 装运 Shipment

1.1 在运输和启吊水泵之前, 请先查看土建图纸, 检查承载件的载重限度, 特别要注意重力承受点。

Before transport and lifting pumps, please view the civil engineering drawings, check the load limits of the unit load bearing, with particular attention to the gravity withstand point.

1.2 运输时, 最好使用带弹性垫的车。

Transport is preferably used with an elastic pad car.

1.3 注意防止零件松动而掉落。使用吊钩前, 最好先做负载试验检查起吊设备的承载能力。

Attention to preventing parts loosening and falling. it is best to do the load test to inspect the carrying capacity of the lifting equipment before using the hook.

1.4 只允许垂直方向起吊, 不允许有倾角斜吊。

only allowed Lifting in vertical direction, and not allowed inclination oblique hanging.

2. 临时存放 Temporary storage

2.1 检查包装是否完好

Check the packaging is intact.

2.2 检查贮存环境 Check the stock condition:

a. 干燥、通风、温度低于 50℃

Dryness, airy , and temperature below 50℃

b. 没有小动物和昆虫的损坏

No damage from small animals and insects.

c. 存放在室外时，要放在排水好，杂物少的地方。

If deposited outdoors, place in a uncluttered area with good drainage .

2.3 检查电机、电气类设备等，要求存放在室内。

Keep electrical motor and electrical equipments indoors.

2.4 木箱包装的零件必须存放在室内（如标准件箱、主轴等零件箱）

Parts of the wooden packaging must be stored indoors. (eg: standardized parts case、main shaft spare parts case and etc.)

2.5 检查金属类设备表面是否作防潮处理，检查表面锈蚀情况。

The metal surfaces should be kept from moisture, check the surface rust situation.

2.6 如果锈蚀可用汽油或可溶性洗涤剂清洗并涂刷防锈油或防腐剂。

If the rusting is available washed by gasoline or soluble detergent and brushing the rust-proof oil or preservatives

2.7 检查电机、电气的绝缘性，若环境潮湿对电器线圈需定期烘干（详见电机相关资料）。

Check the insulativity of the motors and electrical, if the environment is wet, should periodically drying the electrical coils.

2.8 检查密封件完好情况（如填料、O 形密封圈、橡胶垫等）。

Check the sealing parts intact. (stuffing、O-ring、rubber sheet and etc)

2.9 支撑板的承载必须大于存放物体的重量。

The load bearing of the supporting plate must be greater than the weight of the object storage.

2.10 泵零部件出厂时的封口在安装前应保证完好，直到现场安装需要时再

打开。

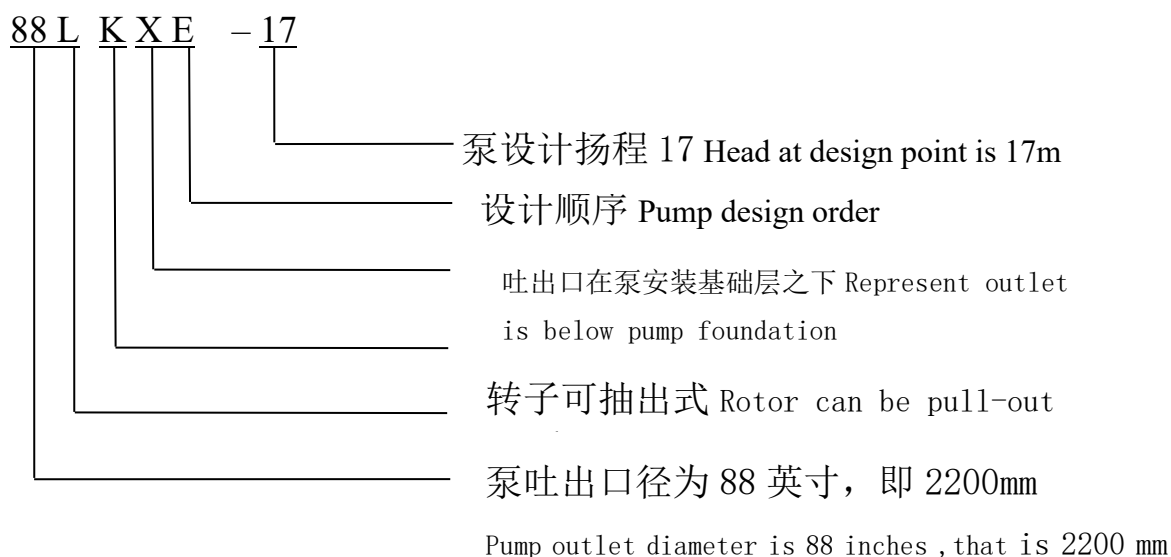
The ex- factory seal of pump parts should ensure their integrity before installation, re-open until the field installation needs.

2.11 建议储存时间： 在 3 个月以内。

The recommended temporary storage time: within 3 months.

第四章 泵说明 PUMP DESCRIPTION

1. 泵型号意义 Pump type significance



2. 泵技术数据

Pump technical dat

流量 Capacity	Q=9.67m ³ /s
扬程 Head	H=17m
效率 Efficiency	η=87%
必需汽蚀余量 NPSH	NPSHr=8.18m
转速 Rotate speed	n=372rpm
轴功率 Shaft power	Pa=1908kW
配套功率 Rated Power	P=2250kW
输送介质 Medium	海水 Seawater
最小淹没深度 Min submergence deep	4.5m
转向	从电机往泵方向看，顺时针旋转

Clockwise rotation from motor to
pump

转子提升高度 6mm

Rotor lifting height

3. 泵使用条件 Pump service conditions

3.1 厂址条件 Site condition

年平均气温 Annual mean temperature: 27.2℃

平均最高气温 Mean maximum air temperature: 36.7℃

平均最低气温 Mean minimum air temperature: 17.4℃

平均相对湿度 Mean RH: 65-80%

3.2 水文特征值 Hydrology eigenvalue

最低水位 Lowest water level: -3.26m

3.3 安装条件 Installation condition

泵房运行层标高 Pump foundation layer elevation: 4.8m

出水管中心线标高 Outlet centre line elevation: 1.8m

吸水池底部标高 Bottom of the water tank elevation: -9.5m

流道宽度 Flow passage width: 6

布置方式 Arrange type: 水泵立式并列布置 vertical arranged side by side

支撑形式 Supporting type: 单基础支撑 Single basic support

3.4 输送介质 Transmission medium: 海水 seawater

3.5 泵冷却润滑水 Pump cooling lubrication water

泵开机前采用外部工业水，泵正常运行后从泵出口引水对水泵导轴承和填料轴封部位进行润滑（泵水量 4m³/h，水压 0.3MPa），并对电机进行冷却。 Before pump starting, using the external industrial water

lubricating, till pump turn to normal operation, using the water from the pump outlet to lubricate pump guide bearing and filling seal parts (flow 4m³ / h, Pressure: 0.3Mpa),also to cool the motor.

3.6 动力电源 Power supply

采用三相立式异步电动机，电机型号：YKSL2250-16/1500-ITH

Large size three-phases vertical two-speed asynchronous motor, motor type: YKSL2250-16/1500-ITH

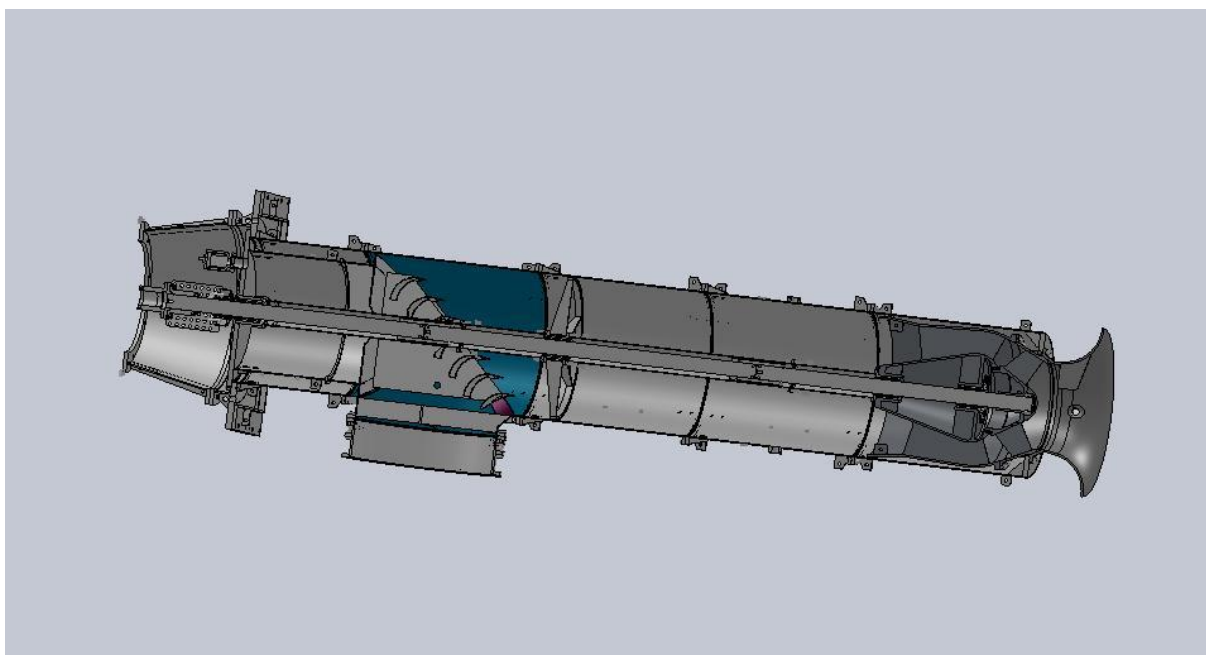
电机技术参数（以电机厂家提供的最终值为准）Motor technical parameters (Subject to final version provided by motor manufacturers)

功率 Power: 2250 kW	转速 Rotate speed: 372rpm	上机架润滑油牌号 Upper bracket lubricant brand: L-TSA46
额定电压 Rated voltage: 6000V	绝缘等级 Class of insulation: F 级	下轴承润滑脂牌号 Brand of lubricating grease: 3 号二硫化钼
额定频率: Rated frequency 50 Hz	效率 Efficiency: 94.2%	冷却器共需水量 Water demand of cooler: 29m ³ /h
防护等级 IP CODE: IP54	功率因素 Power factor: 0.75	冷却水压力不大于 0.5MPa Cooling water pressure not more than 0.5MPa
额定电流 Rated current: 306.5A	冷却方式 Cooling Model: IC81W	

3.7 启动方式 Start method

泵组为全压不顶轴直接启动。Pump unit for total pressure no apical axis directly start.

4. 泵结构说明 Pump structure specification



4.1 泵总体结构 **Pump overall structure**

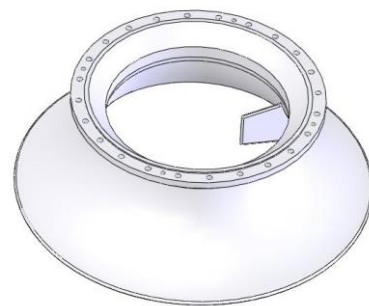
电机与泵直联、单基础安装、吐出口在基础层之下；垂直向下的喇叭口吸水，水平吐出；泵的下部浸没在水中，采用水润滑导轴承，并有轴保护管将清洁的润滑水与泵输送水隔开；泵做成转子可抽出式，即泵维修拆卸时不必拆动外筒体、外部管路和安装基础，将需要维修的转子部件从泵壳中向上抽出；叶轮和叶轮室之间的间隙值通过上部联轴器处的调整螺母予以调节；水泵的轴向推力由电机承受。Motor and pump directly connected, single-base installation, outlet under the base layer; Water intake by vertically downward suction bell, and horizontal spit; The down parts of the pump is submerged in water, using water-lubricated guide bearing, with shaft protective pipe separate the clean lubricating water and pump delivery water. The pump is made the rotor can be pulled out, it means do not have to dismantle external column、external piping and installed base when doing the pump repairment and dismantlement, only to pull out the rotor parts which need repairing from the

pump casing; The gap between the impeller and the impeller house adjust by the adjusting nut on the upper portion of the coupling; the pump axial thrust withstand by the motor.

4.2 主要零部件结构和作用

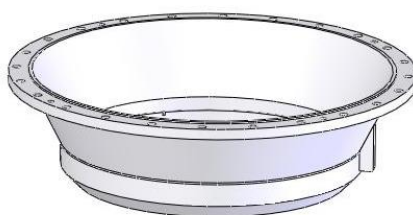
4.2.1 吸入喇叭口 Suction bell

吸入喇叭口的作用是将吸水池中的液体均匀、稳定地导入叶轮，其内部设有 1 块防预旋筋片，可提高泵的吸入效率。The effect of suction bell is sucking up the liquid from the water tank, then guiding into the impeller uniformly and steadily, and its interior has an anti-prerotation rib, can improve the efficiency of the pump suction.



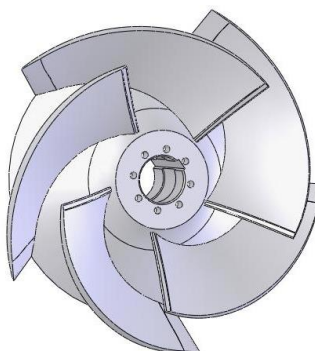
4.2.2 叶轮室 Impeller house

叶轮室为叶轮的工作室，其外锥面与吸入喇叭口内锥面配合。The impeller house is the impeller workroom, its outer cone fit with the inner cone of suction bell.



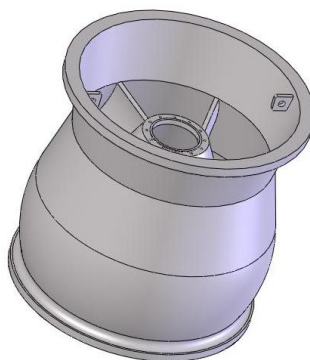
4.2.3 叶轮 Impeller

叶轮对所输送液体做功，高效地将机械能转换成液体的动能。Impeller acting on the transmission fluid, converts the mechanical energy to the kinetic energy of the liquid efficiently.



4.2.4 导叶体 Diffuser casing

导叶体有效地将叶轮排出的液体动能转化为压力能，使之高效地进入泵腔（中间外接管、出水弯管）。The diffuser casing converts the kinetic energy of the liquid discharged from the impeller to pressure energy effectively, so that it can efficiently into the pump casing (the medium external column, discharge elbow).



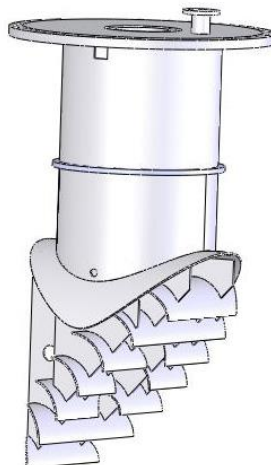
4.2.5 外接管和吐出弯管 External column and discharge elbow

外接管、吐出弯管构成从导叶体至泵出口的流道部分，它们将来自导叶体的具有压力的液体平稳顺畅地排出。External column, discharge elbow constituted the flow channel section from the diffuser casing to the pump outlet, they smoothly discharge the pressured liquid from diffuser casing.



4.2.6 导流片+导流片接管 Guide vane、guide vane column

导流片与导流片接管采用焊接方式相联接，导流片接管悬挂在泵支撑座上。 Guide vane and guide vane column welded to link, the guide vane column hang on the pump supporting plate.

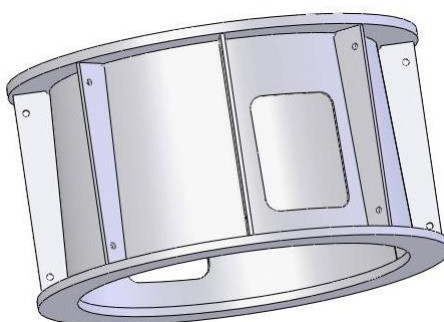


4.2.7 主轴 Main shaft

主轴 a、主轴 b、主轴 c 用于传递扭矩。之间通过套筒联轴器部件联接。 Upper and lower main shaft used for torque transmission. The muff coupling parts linked among two shafts.

4.2.8 电机支座 Motor support

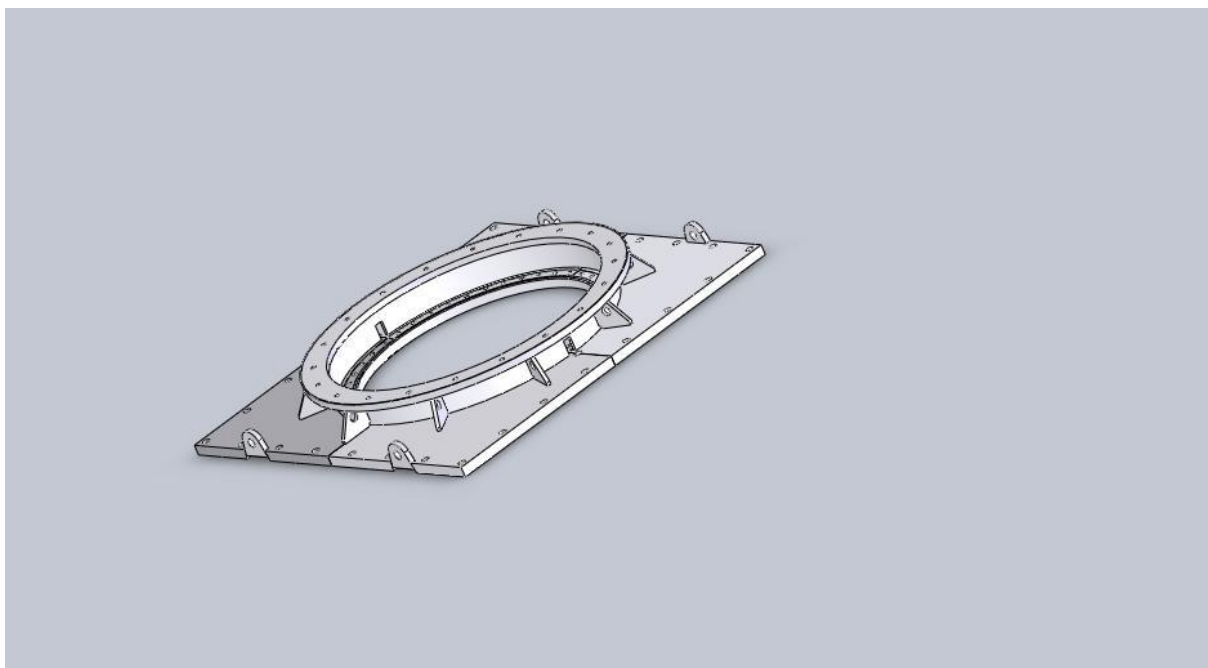
电机支座用于支撑
体对称部位开两个人孔
drive motor and landed
stiffness, column symme



外加直筋增加刚度，筒
used for supporting the
plus straight ribs increase
easy maintenance.

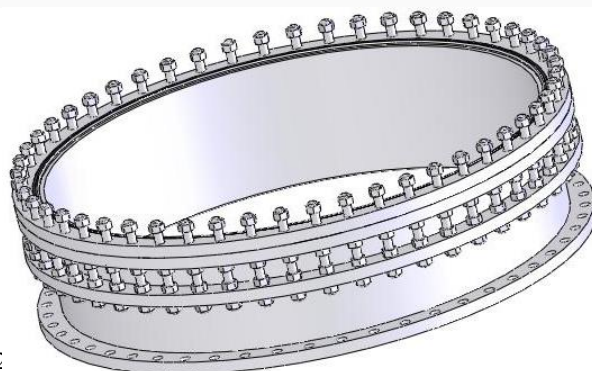
4.2.9 泵支撑座 Supporting plate

泵支撑座用地脚螺栓固定在泵安装垫板上，承受泵外壳体的重量。The supporting plate is anchored on the pump mounting pad by foundation bolt to withstand the weight of the body of the pump casing..



4.2.10 伸缩节 expansion joint

刚性伸缩节安装在吐出弯管与外部管道之间，在管路法兰与伸缩节法兰对接时，可有 15mm 的最大调整间隙，通过调整该间隙可以实现泵吐出口与外部穿墙管的自然联接，消除张口；减少或消除穿墙管与泵吐出弯管相联接后管路焊接应力对泵组水平度的影响，消除引起泵组振动的主要因素，确保泵组的平稳运行。可以通过调整伸缩节的间隙，部分地避免由于泵基础下沉或者安装精度未达到要求造成的泵出口中心与外部管路中心不对中的现象，确保安装达到要求。



Expansion joint between Discharge Elbow and outer pipe installation, in the dock with the expansion joint flange pipe flange, clearance can be adjusted with 15 mm maximum, can be achieved by adjusting the clearance pump discharge nozzles natural connection with external wall tube, eliminate mouth; To reduce or eliminate wall pipe and pump out bend after the connected piping welding stress influence on pump group levelness, eliminate the main factor causing vibration pump group, to ensure the smooth running of pump group. Can by adjusting the slip joint clearance, partly to avoid due to foundation sinking pump or installation accuracy does not meet the requirements of pump outlet center with external line in the wrong phenomenon, to ensure that the installation up to par.

在泵组拆卸后回装时，伸缩节能方便地连接泵与出口管道 The pump set is returned it after removal, scale easily connected to the pump and energy-saving export pipeline

4.2.11 刚性联轴器部件 Rigid coupling parts

由电机联轴器、泵联轴器、调整螺母和联接螺栓等零件组成，用来传递扭矩，并将转子的重量和轴向力传递给电机。Consist of motor couplings, pumps couplings, adjustment nut and coupling bolts and other parts, used for used to transmit torque and transmit the weight of the rotor and the axial force to the motor.

4.2.12 填料密封部件 Packing seal parts

由填料函体、分半填料压盖、填料等组成。填料函体内安装填料对泵进

行轴向密封，填料必须外接水冲洗。Consist of stuffing box, stuffing cover in half and stuffing. Set up stuffing in stuffing box to axial seal the pump, filler must be an external water rinse.

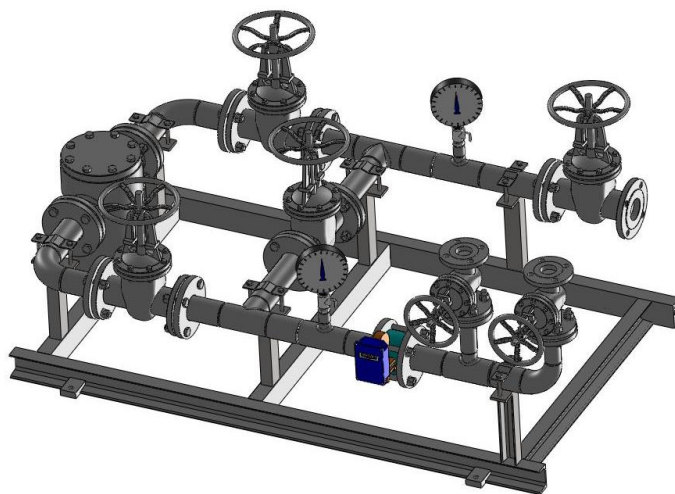
4.2.13 套筒联轴器部件 Muff coupling parts

由套筒联轴器、联接卡环、止推卡环和螺栓组成，它使上、下主轴牢固地联接成一体，具有足够的刚度用于传递扭矩。Consist of muff coupling、Muff coupling connect clasp、Muff coupling stop clasp and bolt, it makes upper an lower shaft tightly linked together, and get enough rigidity to transmit torque.

4.2.14 润滑冷却水系统 Lubricating cooling water system

润滑冷却水系统包括泵填料冲洗水、轴承润滑水及电机冷却水。其水源先用外接清洁工业水，等泵正常运行后采用泵出口引水。泵润滑水经各导轴承后，从下导轴承处排出。电机冷却水分两路，一路接推力轴承冷却腔，一路接电机冷却器。冷却水量由流量报警开关进行监测，当流量低于规定值时报警。Lubricating cooling water system includes stuffing rinse water, bearing lubrication water and motor cooling water. Its water use external cleaning industrial water. After pump lubricating water pass through each guide bearing, discharged from the lower guide bearing. Motor cooling water divides into two routes, one route connected to the thrust bearing cooling chamber, another route connected to the motor cooler. The cooling water flow monitored by Flow alarm switch, alarm when flow below the specified value.

润滑冷却水在泵组的安全稳定运行中起到至关重要的作用，必须对润滑冷却水在进入泵组之前实行严格的把关，对水量、水压、水质进行监控，并设立报警装置。



Lubricating cooling water system has played a vital role in the safe and stable operation of the pumping unit, strictly hold the pass before lubricating cooling water access into the pump unit, monitoring flow, water pressure, water quality, and set up the alarm device.

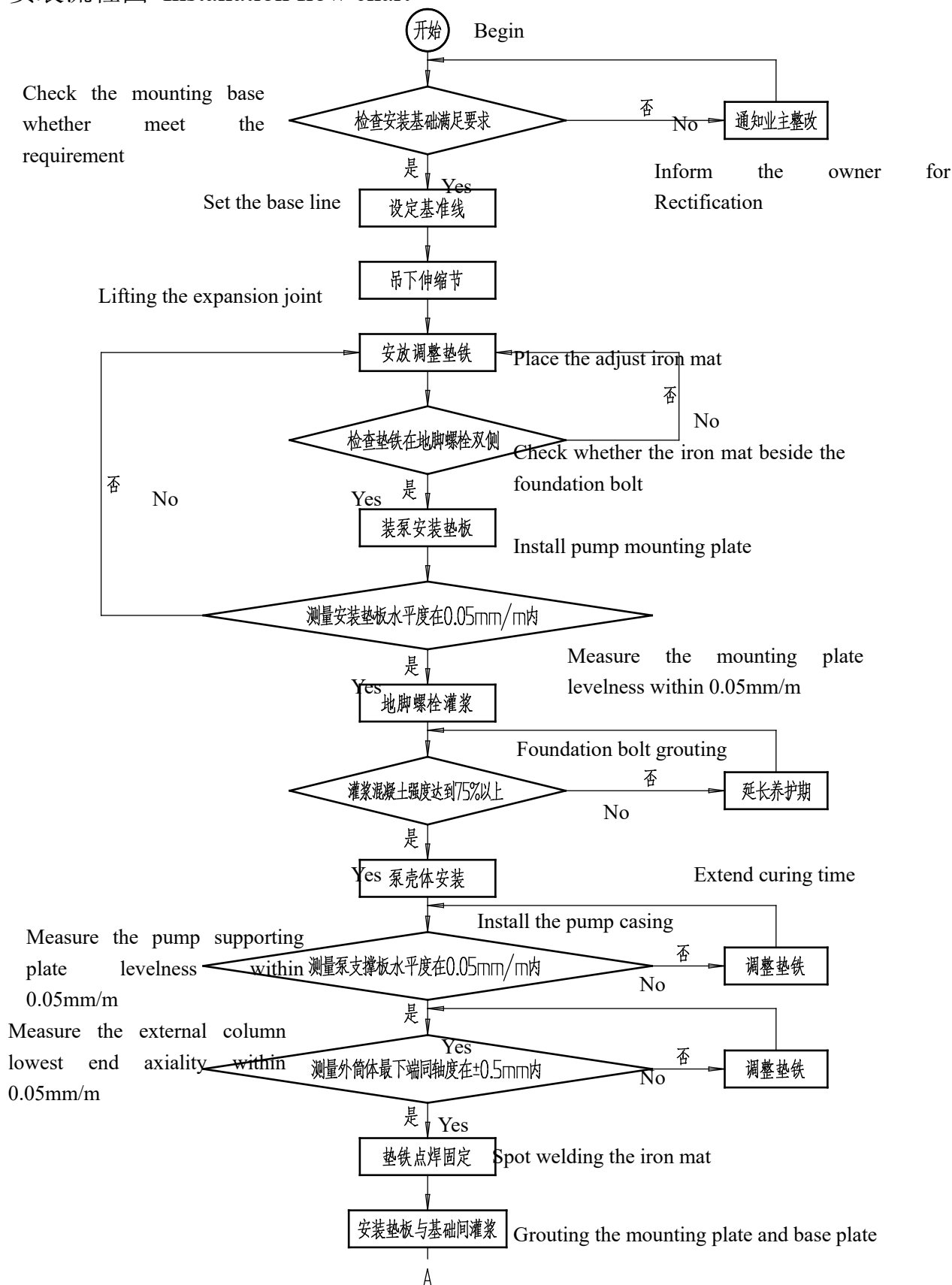
4.5 主要零部件重量(kg)

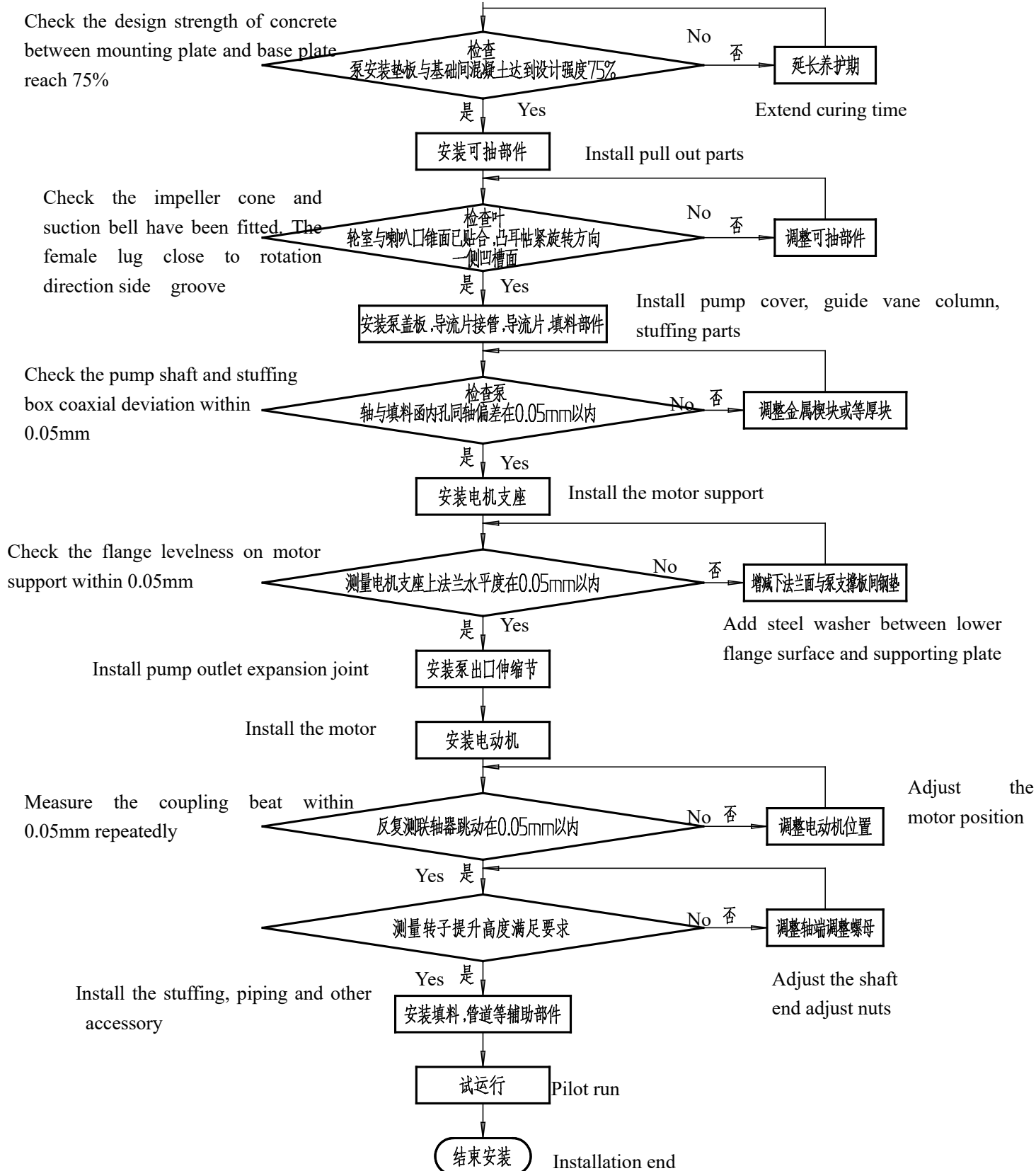
吸入喇叭口 Suction bell	1887	主轴 a Main shaft a	1341
叶轮室 Impeller house	1082	主轴 b Main shaft b	1606
导叶体 Diffuser casing	7666	主轴 c Main shaft c	1242
外接管 a External column a	4238	叶轮哈夫锁环 Impeller half loop	18.4
外接管 b External column b	2587	叶轮 Impeller	1178
外接管 c External column c	2680	套筒联轴器 Muff coupling	264
外接管 d External column d	2290	套筒联轴器连接卡环 Muff coupling Clamp ring	19
吐出弯管 Discharge elbow	3720	套筒联轴器止推卡环 Muff coupling Clamp ring	10.7
泵安装垫板 Pump mounting plate	2206.1	电机联轴器 Motor coupling	234
泵支撑板 Pump supporting pate	8500	泵联轴器 Pump coupling	241
电机支座 Motor support	3392	轴端调整螺母 Shaft end adjust nuts	75

导流片+导流片接管 Guide vane+guide vane column	5647	导轴承(共 4 件) Guide bearing(4 pieces)	共重 350
内接管 a(共 2 件) Internal column a	332	轴套(共 4 件) Shaft sleeve(4 pieces)	共重 83
内接管 b Internal column b	372	伸 缩 节 Expansion joints	2580
内接管 c Internal column c	374	填料压盖 Stuffing cover	24
填料函体 Stuffing box	278		
泵总重	64000		
电机重	23050		
机组总重	87050		
最大起吊重量	30000		

第五章 现场安装 FIELD INSTALLATION

1. 安装流程图 Installation flow chart





安装时原则上要按流程图来进行施工，也可根据设备大小和现场条件，对

安装过程做适当的变更。

In principle, installation should in accordance with the flow chart for construction, also according to the size of the device and on-site conditions, make the appropriate changes to the installation process.

2. 安装需要准备的设备 Installation equipment

2.1 无伸缩水泥 No inelastic cement

2.2 垫块：矩形垫块、斜垫铁（由临时垫块和最终垫块组成）。垫块需经机加工，使表面水平，以免局部接触。

Cushion block: rectangular cushion block、sloping iron mats (consist of temporary cushion block and final cushion block). The cushion block must be mechanically finished to leave the surface level in order to prevent partial connection.

2.3 常用工具：扳手、螺丝起、锤子、套筒扳手、直尺等。

Common tools: wrench, screw driver, hammer, pipe-wrench, straight scale etc.

2.4 专用工具：楔形对中块、吊环螺钉、转子起吊工具等。

Professional tools: wedge-shape aligning plates, eye bolts, rotor lifting tools, etc.

2.5 起吊部件所需的垫块：木垫块、软垫块、工字钢或槽钢等。

Cushion block required for lifting parts: wood padding block, soft plate, joist steel or U-steel etc.

2.6 检测仪器：水平仪、经纬仪、千分表、测厚规、直尺、塞尺，线锤等。

Measuring instruments: gradienter, theodolite, amesdial, thickness-measure compasses, straight scale, feeler gauge, Line hammer etc.

2.7 起吊装置：行车、钢丝绳、链子葫芦等。

Lifting device: traveling crane, steel wire rope and level and chain hoist etc.

2.8 焊接设备 Welding equipments

2.9 润滑油和油脂 lubricant and grease

2.10 其它：转子部件装配架等。

Others: Rotor parts assembly supporting etc.

3. 安装注意事项 Setting note

3.1 安装前注意看清图纸，了解泵结构，并制定现场安装的初步方案。

Read the drawing before installation to understand the pump structure and decide the initial installation scheme.

3.2 仔细检查各零件有无损伤，将各零件配合面揩试干净，在不使用密封胶的配合面重新涂上防锈油。准备好安装所需的各种工具、索具和起重器械。

Carefully check parts for damage wipe clean matching surfaces of each parts and re-paint anti-rusting oil on the matching surface of parts that do not use seal glue. Prepare all the required installation tools, rigging and lifting equipment

3.3 开箱、吊运时，请注意以下几点：

Pay more attention to the following points while unpacking and hoist:

- a. 起吊泵的转子部件时，用布或类似物将轴的起吊部分包扎好，以便保护轴。

Bind the lifting part to the shaft with cloth or similar materials to protect it while lift the rotor.

- b. 吊运泵及其零部件时，应特别注意吊环的位置，以防吊运的零部件重心偏移。

Special attention should be paid to the position of the lifting ring while lifting the pump and parts to prevent the shifting of the center of gravity.

c. 当将零部件放置在地上时，应在零部件的下面放置垫块，以保护部件的油漆，并防止滚动。

When the parts placed on the ground should be placed cushion block under the parts to protect paint and prevent rolling.

d. 防锈：开箱后，应注意防锈。如果零件损坏或遗失，请与本公司联系。

Protect the parts from rusting after unpacking. In case of damage or loss, please contact us.

4. 泵基础的灌浆及安装垫板的校水平

Grouting of pump foundation and leveling of the mounting plate

a. 检查吸水池流道的各尺寸是否符合设计图纸要求，填写流道尺寸检查数据表（见附件）。

Firstly check that the size of the channel of intake sump coincides with the requirements of drawing before installation. Then fill the flow pass dimensional inspection data sheet.

注意吸入水池泵中心线距离最近拐弯处的距离必须大于泵吸入喇叭口直径的 6 倍（6D），且最近拐弯处斜坡的角度必须小于 15°，否则会严重影响泵组的稳定运行。

The distance between the centerline of the pump in the sump and the nearest bend should at least 6 diameters of the suction bell and angle of slope of the nearest bend should be less than 15 degrees. Otherwise it will result in irrecoverable lose to the operation of the pump.

b. 检查泵安装基础的稳定性、安装基础水平度和尺寸。

Check the stability, horizontality and size of the installation foundation

泵安装基础稳定性指泵房土建结构不均匀沉降问题，新建的泵房有时会发生下沉和倾斜，希望泵房土建结构完成后，滞后一段时间再装机电设备。

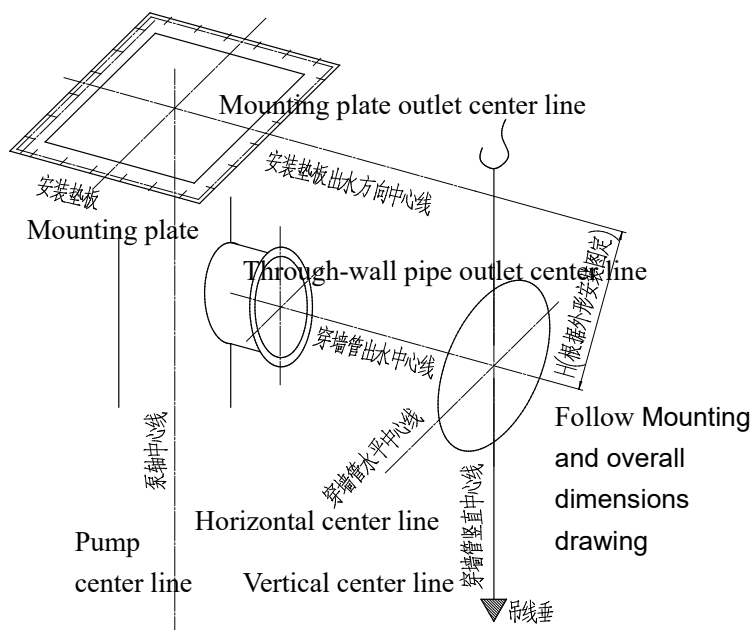
泵机组安装前，要检查安装基础水平度和尺寸（确认基础水平度控制在 0.3mm/m 内）。

Stability indicates the uneven subsidence of the foundation of the pump, house, as the signage the tilting sometimes will occur in new buildings. It is suggested that installation of the pump, the motor and electrical equipments should begin a period of time after the pump house is buildings. It is suggested that installation of the pump, the motor and electrical equipment should begin a period of time after the pump house is built. Leveling and size confirmation of the foundation is required before pump installation (Confirm the foundation levelness control in 0.3mm/m) .

4.1 设定基准线 Set the level

4.1.1 检查安装基础的水平度及地脚螺栓预留方坑两侧平垫铁的水平度（每块平垫铁水平度要求 0.05mm/m),检查泵的地脚螺栓孔是否与图纸要求的一致。用压缩空气清除混凝土地面和地脚螺栓孔，将基础面上无关的物品清理干净。

Check the horizontality of the installation and flat iron mats in the pit for foundation bolts(each flat iron mat request 0.05 mm/m). Check that the position of the holes for the foundation bolts coincide with the requirements of the blueprint. Clear the floor surface



and the holes for the foundation bolts with compressed air, moving all unnecessary things from the foundation surface.

4.1.3 根据外形安装图在安装基础和穿墙管位置用吊线及墨线等方式标记泵吐出口方向中心线及泵中心线，见右图。

Mark the centerlines of the pump and outlet direction with a plump-line or ink marker at the location of the installation foundation and wall-through pipe according to the external diagram. Please see the right drawing.

重点检查 Key inspection:

穿墙管中心线、安装基础位十字线、泵吐出口中心至泵安装层的高度。

The centerline of the wall-through pipe, the reticle of the installation foundation, the height of outlet center and the mounting plate of the pump.

4.2 吊下伸缩节到预定位置

Put the expansion joint to the prearranged position.

4.3 设置垫铁 Installing the iron mat

4.3.1 所谓垫铁是插入被安装的机械设备和基础之间以调整设备水平，同时承受设备自重和运行荷重的零件。

The iron mat is inserted between the equipment and the foundation to adjust the level of the equipment and take the weight of the equipment itself and the load.

4.3.2 一组垫铁包括一个平垫铁与一对斜垫铁(我公司只提供斜垫铁,平垫铁需用户自备),也有以三个平垫铁为一组的。原则上使用前者,若使用后者的平垫铁,包括辅助垫铁在内总数不得超过 5 片。如果在初始安装时有难度的情况下,可先用临时垫铁。正式垫铁放置后,拿走临时垫铁,拧紧地脚螺栓。

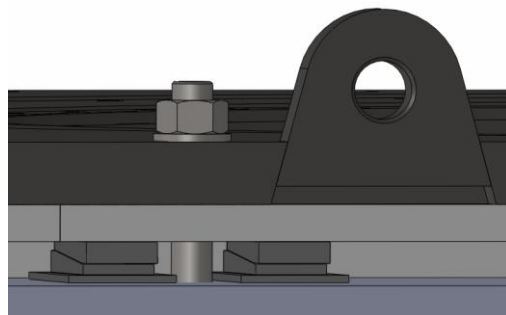
A set of iron mat includes one flat iron mat and a pair of sloping iron mats(we only supply the sloping iron mats, flat iron mat is user-owned), as well as a set of three flat iron mats. If also using the latter set, the total amount of mats including the supplementary mats should not exceed 5 pieces. If it is difficult during installation, please use the temporary iron mat. After setting the formal iron mat, take the temporary mat and screw down the foundation bolt.

4.3.3 设置垫铁注意事项:

Note of the iron mat Installing

a. 斜垫铁的锥度控制在 1/25-1/50。

The taper of sloping iron mat should control in 1/25-1/50.



b. 斜垫铁的位置应尽量靠近地脚螺栓两侧。斜垫铁主要目的是用于泵安装垫板的校水平。

Sloping iron mat should close with feet bolt. In order to setting the pump plate.

4.4 泵安装垫板第一次校水平

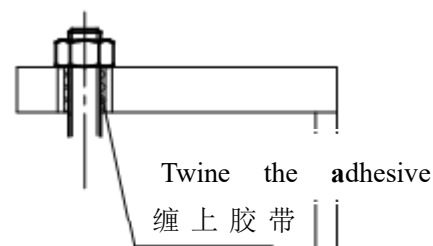
First leveling of the mounting plate

4.4.1 以基础位置的墨线为准,在描准方向的同时,将泵支撑板与泵安装垫

板（以下简称泵座）合在一起安放在预定位置。泵支撑板与泵安装垫板中心线与基础位置墨线对中。

Set the pump supporting plate and the mounting plate(hereinafter called as bedplate) successfully at the predetermined place in turn subject to the foundation ink line while lining up the direction. The centerlines of the supporting plate and mounting plate should coincide with the ink line.

4.4.2 固定地脚螺栓前为了防止地脚螺栓与泵座地脚螺栓孔错位，把泵座悬空吊起来，将地脚螺栓插入泵座螺栓孔再原样放下，同时将地脚螺栓置于箱框孔内，然后将泵座放在垫铁上。这时将螺纹旋进到设定位置，即在紧固螺母与螺栓的泵安装垫板相接的位置，按照以后可以拆除的要求绕上纸或胶带，以后泵安装垫板仍能稍作水平移动（如右图）。



In order to prevent dislocation of the foundation bolt and bolt holes, before fixing the foundation bolts, suspend the mounting plate and insert the foundation bolts plate on the iron mat, same time put the foundation bolts in case frame hole, then put pump mounting plate on iron mat. When screwed the thread into the setting position, that is the pump mounting plate contacting position of the fastening nut and bolt, wire on paper or tape convenient for removing later, the pump mounting pad still can slightly horizontal scroll in the future.

4.4.3 将水平尺放在泵支撑板精加工上面，通过水准器控制泵支撑板的水平度偏差直小于 0.05mm/m，并填写泵安装垫板水平度检测数据表（见附件），而泵座的水平度是通过垫铁来进行调整的。

Put leveling instrument on the pump support plate finish machining surface, control the pump support plate levelness deviation less than 0.05m

m / m by spirit level, and fill the “pump mounting plate levelness test data table” (see Annex), the pump seat levelness to be adjusted by iron mat.

4.4.4 用发泡苯乙烯代替预埋地脚螺栓箱框不够理想，需要使用时必须特别小心，注意不要让发泡苯乙烯残留在框内。因为用氧气、煤气等烧除发泡苯乙烯时残存有燃烧废气，会使一期混凝土的粘接性恶化。

Replace the pre-laid casing of the foundation bolts with effervesce styrene is not ideal, so be specially carefully when it is in used and do not leave any effervesce styrene remnants in the casing. This is because waste gas might collect when using oxygen or coal gas burning the effervesce styrene, which will deteriorate the viscosity of the concrete.

重点检查 Key inspection :

- 1、对准墨线 Align with the ink line
- 2、水平度 0.05mm/m Horizontally within 0.05mm/m
- 3、泵安装垫板底面与斜垫铁完全接触。
Absolute contiguity of the mounting plate and the sloping iron mat.

4.5 地脚螺栓灌浆 Grouting the foundation bolt

4.5.1 地脚螺栓插入箱框孔，拧紧螺母直至留出垫片厚度再加上2—3个螺纹；

Insert the foundation bolts in the foundation holes, and fasten the nuts will only the thickness of the spacer and 2-3 screw threads left.

4.5.2 在地脚螺栓箱框孔内浇注混凝土的过程中，注意地脚螺栓不要倾斜；

Do not tilt the foundation bolts while grout concrete into the foundation holes.

4.5.3 当地脚螺栓与配置钢筋有可能焊接时将其焊接或绑扎。

Weld or tying them as soon as the bolts and reinforcing bars are able to be welded.

4.5.4 在地脚螺栓箱框孔内浇注混凝土并捣固，灌浆至地脚螺栓预留坑高度齐平，待混凝土达到硬化周期后，地脚螺栓需能承受紧固其螺母时所受的拉力而不至于向上移动。

Grout concrete into the casing holes and tamp it. After the concrete has hardened and can endure the tensile force of nut fastening then commence the secondary grouting.

5. 泵、电机和其它部件的安装 **Installation of the pump, the motor and other parts**

5.1 泵组装注意事项 **Notes of the pump assembling**

5.1.1 组装前应对零件作全面检查。Make a complete inspection of the pump and accessories before assembling.

5.1.2 新组装时，用压缩空气吹干净螺丝孔中的遗留物，并检查法兰面是否有缺陷或脏物和毛刺。Clear any external objects from the screw holes with compressed air, check the surface of the flanges for defect, dirt and burrs before re-assembling.

5.1.3 重新组装前，检查锈蚀和损坏。Remove rust and check for corrosion and damage before re-assembling.

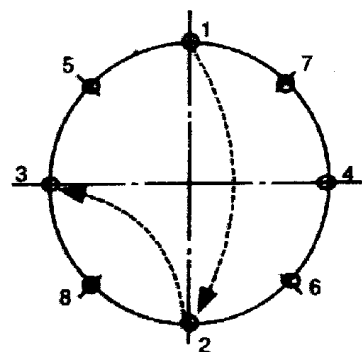
5.1.4 安装时，注意不要损坏

“O”形圈和橡胶圈。Do not damage the o-ring during installation.

5.1.5 轴和螺栓等零件上的螺纹应全部清理干净，并涂上滑润油，以防磨损。Clear the screw thread on the shaft and the bolts and lubricate their place to prevent abrasion.

5.1.6 安装过程中，外筒体结合面上要均匀涂上密封胶。Apply seal-glue evenly on matching surfaces of the external columns during assembling.

5.1.7 为防止受力不均匀，拧紧法兰螺栓时，一定要按如图所示的方法，对称拧紧螺母（达到规定螺栓）。



Fasten the nuts symmetrically as the figure shows in order to prevent uneven stress when fastening flange bolts.

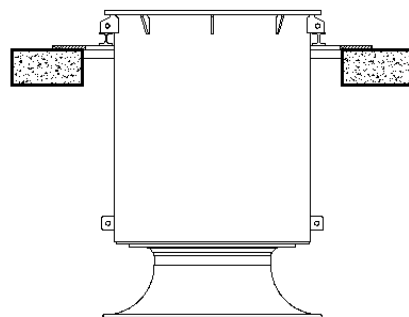
5.2 泵的安装过程 Pump installation procedure:

5.2.1 泵壳部件的安装 Installation of the pump casing

警惕：在任何情况下都不能用吸入喇叭口作为泵的支撑或类似的用途。**Warning:**
Never use the suction bell for supporting the pump or for any other such usage.

5.2.1.1 吸入喇叭口与外接管 a 联接（法兰面用密封胶密封，下同），然后在泵安装垫板上放置工字钢或槽钢（用户自备）

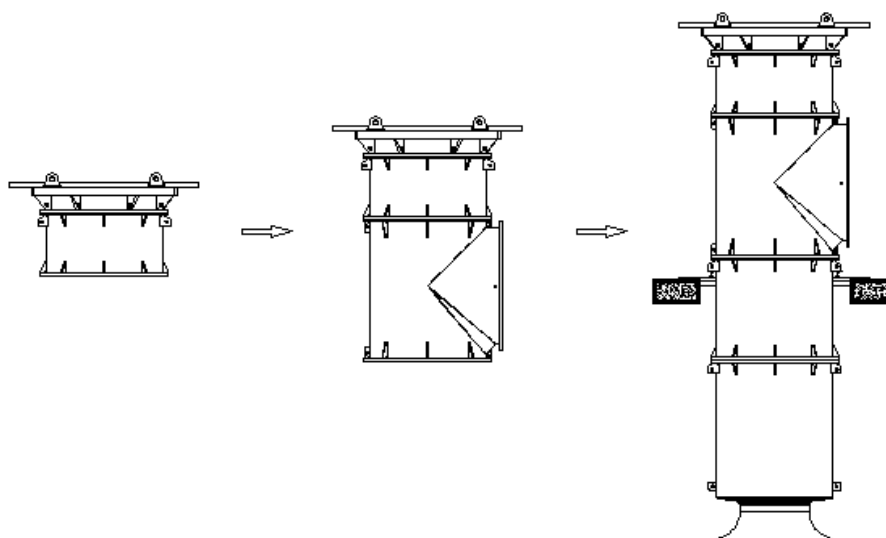
且其强度必须能承受泵的最大起吊重，注意不要损坏泵安装垫板结合面（以后的安装过程同），将联接好的这一段泵体用外接管 a 的支撑耳支放在工字钢或槽钢上，为防止受力不均，拧紧法兰螺栓时，一定要对称拧紧螺母。



注意壳体部件所有零件均有标识，装配时将标识相同的壳体选配在同一台泵,且标识均应在同一方向。Connect suction bell and external column a (flanges surface is sealed with sealing glue, the same below).then place the joist steel or U-steel (provided by user) on the mounting plate whose strength must be able to bear the maximum lifting weight of the pump. Don' t damage the joint surface of pump installation plate (later installation processes are the same), and

put this part of the pump on the joist steel or U-steel by supporting lug of external column a. Fasten the nuts symmetrically in order to prevent uneven stress when fastening flange bolts. Note that all parts of the casing have identification, assembly the same identification parts matching in the same pump, and identification should be in the same direction.

5.2.1.3 吊起外接管 b 与外接管 a 用螺栓连接，再将联接好的这一段泵体用外接管 b 的支撑耳支放在工字钢或槽钢上，同样，吊起外接管 c 与外接管 b 用螺栓连接，再将联接好的这一段泵体用外接管 c 的支撑耳支放在工字钢或槽钢上，用泵支撑座上的四个吊耳吊起泵支撑座与外接管 d 上法兰联接好，再一起吊起泵支撑座和外接管 d 与吐出弯管上法兰联接，同时注意泵支撑座、外接管 d、吐出弯管的方向（三者均有定位销孔，安装时销孔应在同一方向），最后将三者一起吊起与外接管 c 法兰联接好；Lift external column b and external column a with bolted connection, then this section of the pump body connection with outside taking external column b support-ear on the beams and channels, in the same way, lift the external column c and external column b by bolt connection, then this section of the pump body with good connection outside external column c support ear on the beams and channels, with four lifting lugs on the turning pump lift pump outside the brackets and external column d on the flange connection is good, again lift pump outside the brackets and take over d and spit on bent pipe flange connection, at the same time pay attention to the pump design, outside to external column d, spit out bend in the direction of the (three are positioning pin hole, pin hole should be in the same direction when installation), finally will whole lift and external column c flange connection.



5.2.1.4 最后整体吊起泵壳部件，撤去工字钢或槽钢，清理好安装垫板结合面，放下泵壳体部件，使泵支撑座就位。记下外接管 a 内防转凹槽的位置，在泵壳内做标记。At last lifts pump casing integrally, removes the joist steel or U-steel, clears installation gasket plate interface, put down pump casing, support plate shall be suitable, mark the position of external column a inside prevent rotate concave groove, remark inside at the pump casing.

重点检查 Key inspection:

1、标识相同的壳体选配在同一台泵，配对标记均应在同一方向；

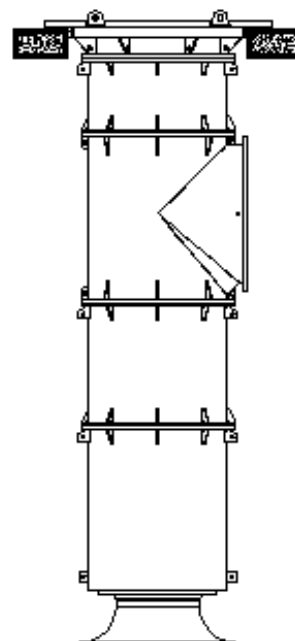
Put the casings with same number in one pump and all marks should point in the same direction.

2、外接管 a 内防转凹槽的位置，在泵壳内做标记；

External column a inside prevent rotate concave groove, remark at the pump inside casing.

3、吐出口中心线与穿墙管中心线对中。

Mark the location of the groove of external column a in the casing.



5.2.2 第二次校水平 The second level adjustment

确定第二次校水平达到要求后，检测外筒体对轴承支架(如有)、导叶体及叶轮室支撑处的同轴度，并通过调整斜垫铁确保外筒体同轴度在 $\pm 0.5\text{mm}$ 以内。

Make sure the second level adjustment meet the requirements, check the external column concentricity to the bearing bracket (if any), diffuser casing and impeller house supporting place, and ensure concentricity of the external column keep in $\pm 0.5\text{mm}$ by adjusting the sloping iron mats .

当筒体同轴度满足要求，并且地脚螺栓箱框孔内的第一次混凝土彻底硬化后，拧紧地脚螺栓的螺母，将泵座固定，将每组垫铁点焊，同时把每组垫铁与泵安装垫板点焊在一起（建议采用环氧树脂沙浆，养护 2—3 天即可具有快干密封等特性）。

When the column concentricity satisfy the requirements, and the first concrete anchor bolts - box hole completely hardened, tighten the anchor bolts nuts, fasten the pump base, spot weld the each set of iron mat, at the same time, spot weld the each group of iron mat with pump mounting plate (Recommend epoxy resin mortar, conservation 2-3 days t can have a quick-drying sealing characteristics).

5.2.4 灌浆 Grouting

泵座固定后，在泵安装垫板与基础层之间灌入沙浆，但此时为了防止沙浆流落里面，事先插入一个泵安装垫板固定框架，以防泥浆流入泵坑中。（注意：垫板上表面至水泵吐出中心的垂直高度为必须保证尺寸，以免影响吐出管路的安装）。

After fixing the bedplate, grout mortar between the install plate and the

foundation. Before grouting, first insert a fix frame to prevent the mud and sand flowing into the pump pit.(Note: the vertical height of plate surface to pump discharge center must ensure the size in case of effect discharge elbow installation).

上述方法为常规方法,用户亦可采用其他的方法,但必须保证筒体各部位同轴度要求在 $\pm 0.5\text{mm}$ 以内。保证垫板上表面至水泵吐出中心的垂直高度符合图纸要求。

The above-mentioned method is the regular one, but the customer also could adopt other ways. However the horizontality of the bedplate(within 0.05mm/m) and the vertical height from the upper-surface of the bedplate to the outlet center should be guaranteed.

待基础的沙浆彻底干固后, 装配可抽出部件。

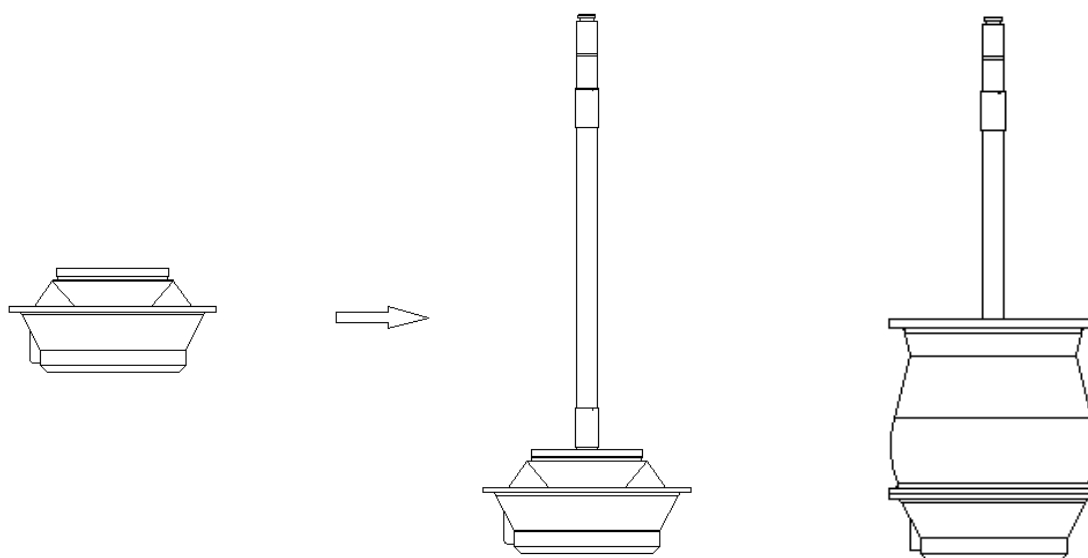
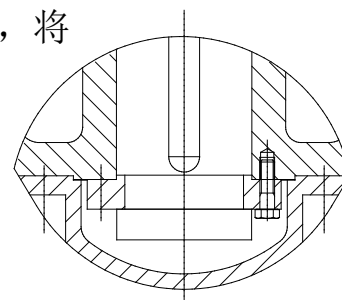
After the mortar of the foundation completely dry and hard, assemble the pull-out parts.

5.2.5 可抽部件的安装

5.2.5.1 将主轴 a 置于 V 形枕木上 (以防滚动), 然后在主轴 a 上装进二个轴套, 并滑过短键槽处, 在短键槽处装上二根短键, 将轴套退回至键位顶住, 在轴套上三螺孔处各拧上三个紧定螺钉, 钉头不得高出轴套外表面。注意: 在装紧定螺钉前须先在轴上花三个深 3mm 锥形孔作为轴套定位用。(注: 通常轴套在出厂前已在主轴上装好, 装配前尽可能检查) Put the shaft a on V-type sleeper (for prevent rolling), then installs two sleeves on shaft a, and slips short to short key groove, install two short key on short key groove, unthread sleeve to key groove and hold, screw three fixed nuts in sleeve, nuts head cannot height sleeve interface. Note: Before install tight set screw must first take three

deep 3mm tapered hole in the shafts with sleeves positioning. (**Note: usually shaft sleeves before delivery has been installed, please check before installation**)

5.2.5.2 将叶轮室、叶轮放置在一人高左右的梁架上或安装座上，在主轴 a 下端装上叶轮键，在主轴 a 的另一端拧上吊环螺钉，将轴吊至已装好密封环的叶轮上方，放主轴 a 使主轴穿过叶轮的主轴孔，装上叶轮哈夫锁环、螺栓、垫圈等（注：叶轮哈夫锁环正反方向，止口朝上），然后吊起组装好的部件放入叶轮室中。Put impeller house、impeller on about one man height beam mount or soleplate, installs an impeller key on shaft a below end, screws flying rings nuts on anther side of shaft a then lifts shaft to impeller top which installed sealing ring, put down shaft for shaft a go through shaft hole of impeller then install impeller half lock ring, impeller head, bolts, etc(Notes: impeller half lock ring forward and reverse directions, the mouth upward), then lifts parts of setting put in impeller house.



5.2.5.3 将已装好导轴承和密封环的导叶体吊至组装好的主轴 a 上方,慢慢放下,使导叶体穿过轴与叶轮室配合面接触,将导叶体与叶轮室联接好, 接合面涂密封胶。Lifting Installed diffuser casing with guide bearing and sealing ring to top of assembled lower shaft, slowly put down make the diffuser casing go through shaft and contact with the impeller house interface, link the diffuser casing and impeller house, interface paint sealing glue.

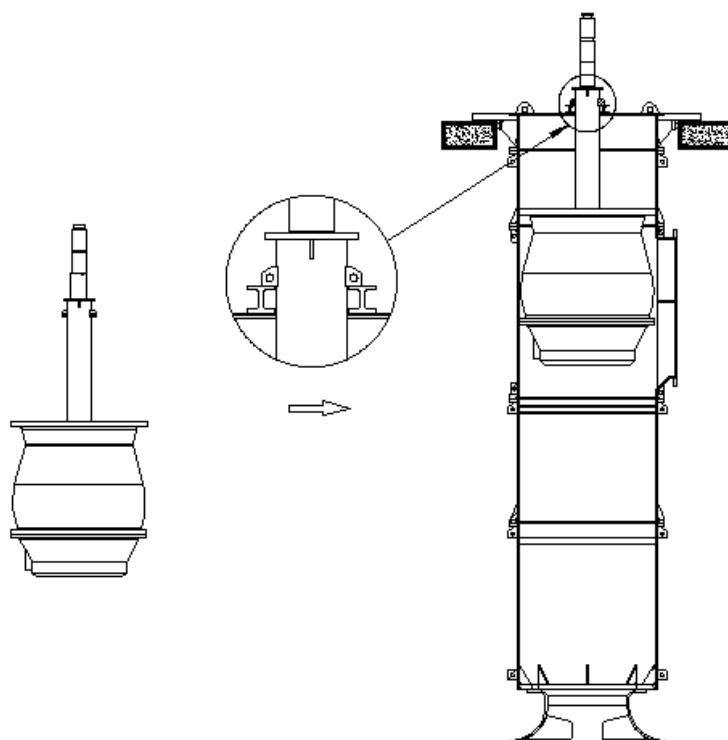
5.2.5.4 将内接管 a 垂直吊起, 穿轴与导叶体联接好, 主轴 a 上方装上吊环螺钉将主轴 a 部件放入泵壳内, 并用内接管 a 上的吊耳支撑在工字钢或槽钢上 (卸吊环螺钉)。Packed guide bearing of bearing support a and internal column a, lifting perpendicularity internal column a then go through shaft and connect with the diffuser casing. Install lifting bolt on shaft a upper parts then put in pump casing, and support on joist steel or U-steel by lifting lug on bearing support a(unlade the lifting bolt).

5.2.5.5 主轴 b 下端装上传递扭矩的键, 装轴承处装上轴套及短键, 套筒联轴器直立于一平台上, 使带有 4 个螺孔的一端朝下; 在主轴 b 上方装上吊环螺钉, 将轴吊起至套筒联轴器上方, 慢慢放下, 使轴从套筒联轴器内孔穿过, 将套筒联轴器顺轴上推, 直至露出键为止, 并在联轴器外圆上拧上两个 M16 固定螺钉 (用户自备) 将其固定于轴上; Place main shaft b on a V-shaped sleepers to prevent rolling, then install short key on main shaft b sleeve site, install the sleeve ,screw holes in the sleeve nut screwed on three set screws, Note: before install the set screws, as a sleeve positioning must first spend three deep 3mm tapered hole in the shaft, the screw head shall not be higher than the sleeve outer surface. And install the torque transmission key in the lower end of the shaft b. The muff couplings upright on a platform, make the four screw holes end down; Install lifting bolt on upper part of the upper shaft, lift shaft to the top of the muff couplings, slowly down the shaft ,make it through the sleeve couplings inner hole. Push the muff couplings along the shaft until the key exposed. And screw two M24 set screws (user-owned) on the coupling excircle and fixed to the shaft.

5.2.5.6 主轴 b 吊至主轴 a 上方, 将主轴 b 下放, 两轴对中, 将连接卡环装于轴上, 松开套筒联轴器上的固定螺钉并用钢丝绳吊住固定螺钉使其缓缓

下落，同时主轴 a 连接键槽处放上键，然后套筒联轴器滑过连接卡环至止推卡环位置，用螺栓和垫圈与止推卡环联接起来。吊起内接管 b 穿过主轴 b 下放，与内接管 a 相连。**注意：**如果现场安装高度不够高，在主轴 b 与主轴 a 装配前，用副钩吊住内接管 b 穿过主轴 b。**小心：**在内接管穿轴安装过程中，不要碰伤轴加工表面，并设法保持泵主轴垂直。注：轴套在出厂前已装配在轴上。 Lifts shaft b to the top of shaft a, put down shaft b, adjustment the shaft line, joint lock ring installs on the shaft, loosens set screw of coupling , lifting the set screw by steel wire rope and slowly put down, at the same time, place the key on the joint of shaft a, then slip the connect clasp to thrust clasp position, connect the thrust clasp by bolt and gasket.

5.2.5.7 吊起轴承支架（已装好轴承）穿过主轴 b 与内接管 b 相连，将联接好的这一段泵体用内接管 b 的支撑耳或轴承支架支放在工字钢或槽钢上。 Packed guide bearing of bearing support b and internal column b, lifting perpendicularity internal column b with bearing support b and then go through shaft and connect with the bearing support a. Install lifting bolt on shaft bupper parts then put in pump casing, and support on joist steel or U-steel by lifting lug on bearing support b(unlade the lifting bolt).

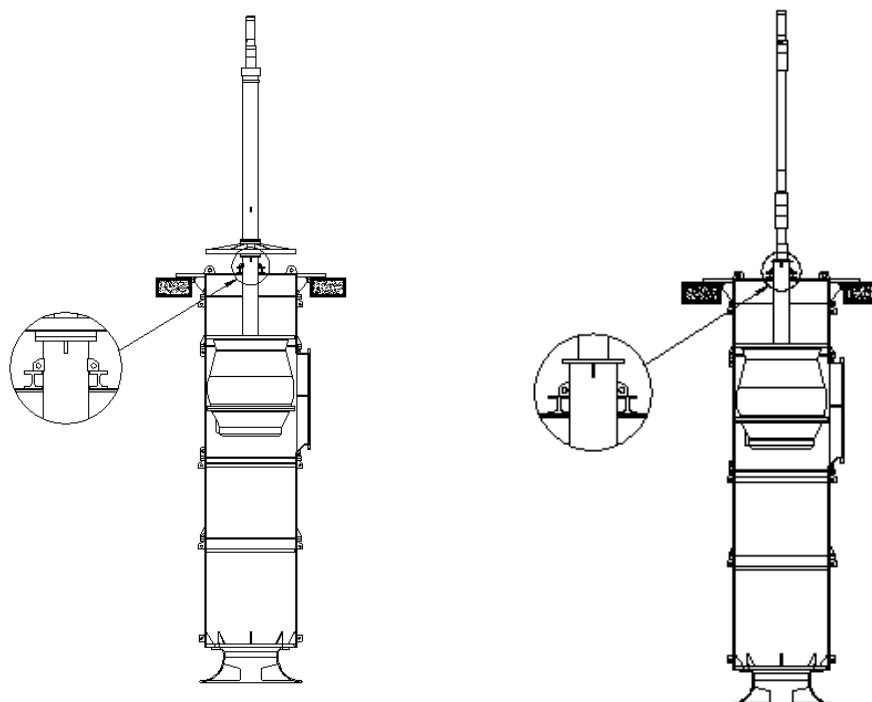


5.2.5.8 吊起另一内接管 a 与轴承支架相连, 将联接好的这一段泵体用内接管 a 的支撑耳支放在工字钢或槽钢上. Lift another internal column a connected to the bearing support, within this section of the pump body with good will join in internal column a support ear on the beams and channels.

5.2.5.9 将主轴 c 置于 V 形枕木上以防滚动, 然后在主轴 c 装轴套部位处装短键, 装上轴套并在填料轴套部位装上短键, 并装上填料轴套、“O”形密封圈、轴套螺母, 在轴套螺母左的三螺孔处拧上三个紧定螺钉, **注意:** 在装紧定螺钉前须先在轴上花三个深 **3mm** 锥形孔作为轴套定位用, 螺钉头不得高出轴套外表面。并在主轴 c 下端装上传递扭矩的键。套筒联轴器直立于一平台上, 使带有 4 个螺孔的一端朝下; 在主轴 c 上方装上吊环螺钉, 将轴吊起至套筒联轴器上方, 慢慢放下, 使轴从套筒联轴器内孔穿过, 将套筒联轴器顺轴上推, 直至露出键为止, 并在联轴器外圆上拧上两个 M24

固定螺钉（用户自备）将其固定于轴上。Place main shaft c on a V-shaped sleepers to prevent rolling, then install short key on main shaft c sleeve site, install the sleeve b and the site of the packing sleeve fitted with a short key, and fitted with filler sleeve, "O" ring seal, sleeve nut, screw holes in the sleeve nut screwed on three set screws, Note: before install the set screws, as a sleeve positioning must first spend three deep 3mm tapered hole in the shaft, the screw head shall not be higher than the sleeve outer surface. And install the torque transmission key in the lower end of the shaft c. The muff couplings upright on a platform, make the four screw holes end down; Install lifting bolt on upper part of the upper shaft, lift shaft to the top of the muff couplings, slowly down the shaft ,make it through the sleeve couplings inner hole. Push the muff couplings along the shaft until the key exposed. And screw two M24 set screws (user-owned) on the coupling excircle and fixed to the shaft.

5.2.5.10 将主轴 c 吊至主轴 b 上方，将主轴 c 下放，两轴对中，将连接卡环装于轴上，松开联轴器上的固定螺钉并用钢丝绳吊住固定螺钉使其缓缓下落，同时主轴 b 连接处键槽处放上键，然后滑过连接卡环至止推卡环位置，用螺栓和垫圈与止推卡环联接起来；Lifts shaft c to the top of shaft b, put down shaft c, adjustment the shaft line, joint lock ring installs on the shaft, loosens set screw of coupling , lifting the set screw by steel wire rope and slowly put down, at the same time, place the key on the joint of shaft b, then slip the connect clasp to thrust clasp position, connect the thrust clasp by bolt and gasket.



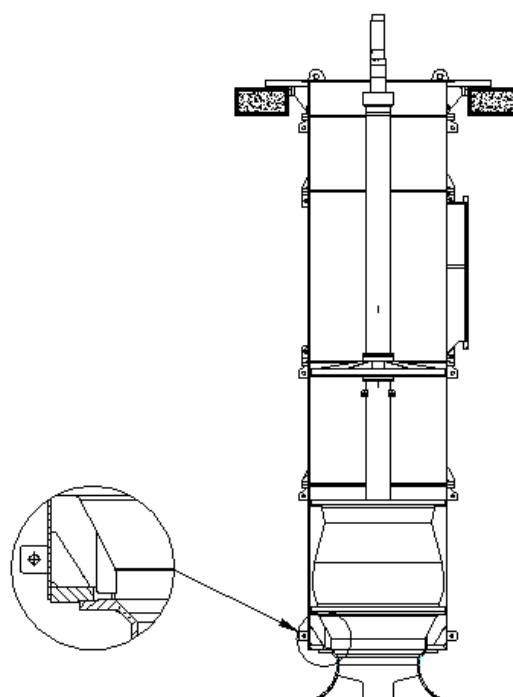
5.2.5.11 吊起内接管 c 与内接管 a 连接好。Lifting internal column c and connect with internal column a.

小心:

在内接管穿轴安装过程中, 不要碰伤轴加工表面, 并设法保持泵主轴垂直。
When internal column go through shaft, cannot damages shaft produce

5.2.5.12 吊起可抽部件, 移开枕木, 放入泵壳体内。叶轮室外圆周上的凸耳是防止可抽出转子部件在泵运行过程中旋转的, 凸耳应卡入外接管 a 的防转凹槽中。凸耳位置的标记延伸到便于观察的地方, 如导叶体上方。

注: 轴套在出厂前已装配在轴上



Lift pull out parts, remove the sleepers, place into pump casing, make impeller house below finishing cone completely joint with suction bell finishing cone. The impeller house outside circle lug is to prevent pull out parts rotate during pump operating, lug should snap into the groove of external column a. Lugs position mark extending to convenient for observation places, such as diffuser casing top.

重点检查 Key inspection:

- 1、叶轮室下端精加工锥面与吸入喇叭口精加工锥面是否完全贴合。

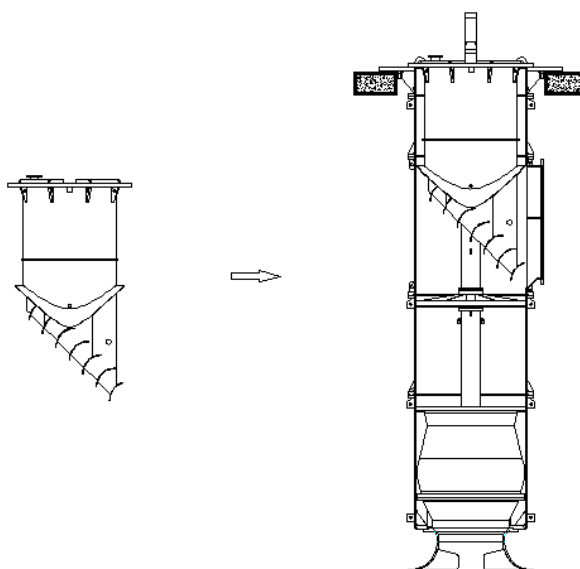
Whether impeller house below finishing cone with suction bell finishing cone completely joint.

- 2、叶轮室外圆周上的凸耳是否卡入外接管 a 的防转凹槽中，并帖紧机组旋转方向一侧凹槽面。

Lugs of impeller house outside circle whether snap into the groove of external column a, also snap the side of the groove surface of unit rotation.

5.2.6 导流片+导流片接管、填料部件的安装 Installation of guide vane、guide vane column、stuffing parts

5.2.6.1 用行车将导流片+导流片接管吊至主轴 c 上方，调整好导流片的方向，并在导流片接管与泵支撑座结合面上刷密封胶，穿轴放下与泵支撑座连接起来（注意两零件定位销孔方位）。Lifts the parts of guide vane+guide vane column to the top of upper shaft by travelling crane.



At the same time adjust guide vane direction, and brush seal glue on bond

surface of guide vane column and pump supporting plate. Go through shaft and put down and joint supporting plate. (Note: two parts pin hole position).

5.2.6.2 将导轴承装入填料函体的轴承腔中，并在填料函体外圆装上“O”形密封圈，在填料函体与导流片接管上法兰联接处装上纸垫，用行车将填料函体部件吊起至主轴 c 上方，穿轴放下，用螺柱、螺母将填料函体连接在导流片接管上法兰上。Install guide bearing into bearing chamber of stuffing box, and install O-ring on stuffing box excircle, install gasket on the connection of stuffing box and guide vane column flange. Then lifting stuffing box to upper shaft top by travelling crane, go through shaft and connects the stuffing box with guide vane column flange by bolts and nuts.

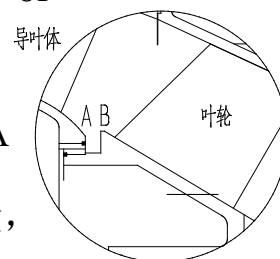
注意：不要将工具、零件掉到泵坑或转子部件内，如果这些东西掉到泵坑或转子部件内，转子部件、导叶体、叶轮就可能会被损坏，更严重会造成机组停机。

Note: Tools, parts do not fall into the pump pit or rotor parts, if these things falling into pump pit or rotor parts, rotor parts, diffuser casing and the impeller may be damaged, the more serious will cause the unit shut down.

5.2.7 测量转子窜动量、盘车、泵轴中心位置调整 Measuring the displacement of the rotor, rotating the rotor and adjusting the location of the center of the shaft

5.2.7.1 测量转子窜动量、盘车 **Measuring the displacement of the rotor, rotating the rotor**

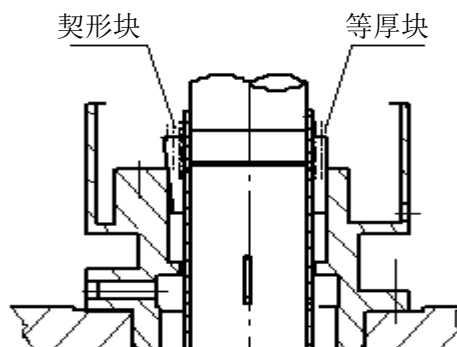
在主轴 c 上端安装起吊工具，吊起转子，使导叶体端面 A 与叶轮上端面 B 贴合，此时在轴上端测量转子最大窜动量，窜动量必须大于转子提升高度。然后再将转子落至极下位置，再提升转子 6mm，盘车检查转子是否灵活。然后再放下转子到极下位置（如右图）。Install hoisting tools on upper parts of the upper shaft and lift the rotor to let end face A



of the diffuser casing fit the upper end face B of the impeller, measure the maximum displacement of the rotor at the upper end of the shaft. The displacement should be big than the elevation of the rotor. Then lower the rotor to the lowest position and raise it to the 6mm of the rotor. Check the flexibility of the rotor by rotating then once more lower the rotor to the lowest position(as in the right-hand figure).

5.2.7.2 泵轴中心位置调整。Adjusting the location of the center of the shaft

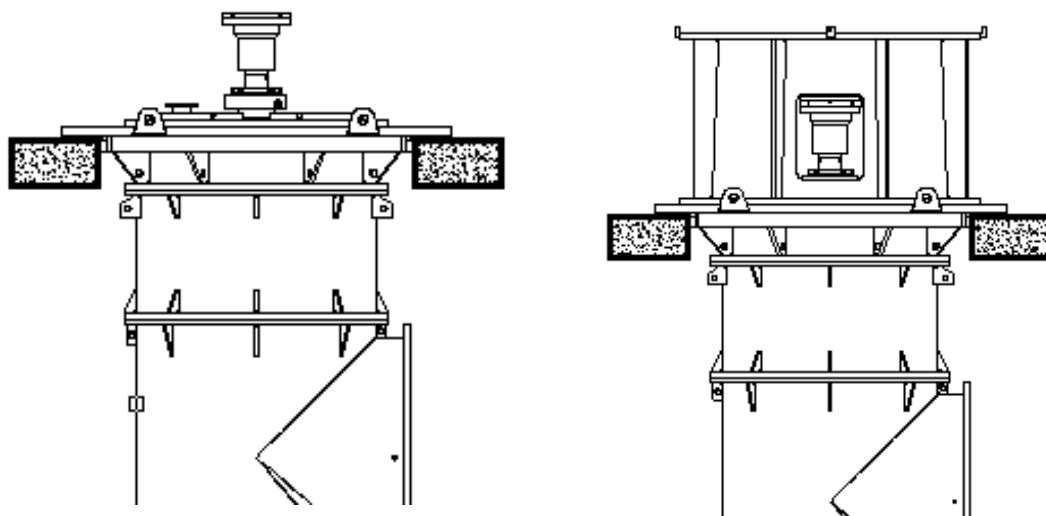
采用填料函内孔与泵轴对中的方法，在填料函内用四块金属楔形块或等厚块调整泵轴中心与泵中心重合，径向允差在 0.05mm 以内，并将数据填至联轴器对中数据表（见附件）。调好后不要拆除垫块（见图）。Use the method of centering the stuffing box inner hole and the pump shaft, adjust the pump shaft center by four pieces of metal wedge blocks or uniform thickness block in the stuffing box and superposed with pump center, Radial allowance tolerance within 0.05mm, and fill the date into coupling centering data sheet. Don't dismantle cushion block after adjusted (see right).



除垫块（见图）。Use the method of centering the stuffing box inner hole and the pump shaft, adjust the pump shaft center by four pieces of metal wedge blocks or uniform thickness block in the stuffing box and superposed with pump center, Radial allowance tolerance within 0.05mm, and fill the date into coupling centering data sheet. Don't dismantle cushion block after adjusted (see right).

5.2.8 泵联轴器的安装 Installation of the pump coupling

在主轴 c 的上部装上传递扭矩的键，将泵联轴器和轴端调整螺母装上；Install the key for torque transferring on the shaft c, then install the pump coupling and adjustable bearing end nut.

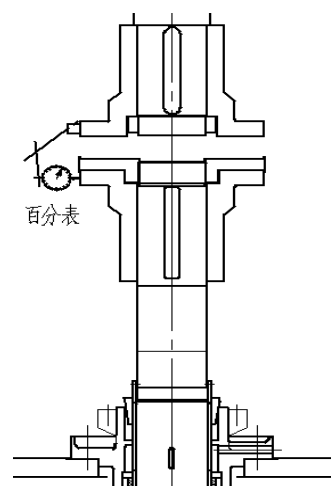


5.2.9 电机支座的安装 **Installation of motor support**

5.2.9.1 将电机支座吊至泵支撑座上方，用螺柱、螺母将其与泵支撑座连接起来； Lifting the motor support to pump supporting plate top, connects it with pump supporting plate by bolts and nuts.

5.2.9.2 校电机支座上法兰的水平度，水平度应保证在 0.05mm/m，并填写电机支座上法兰面水平度检测数据表（见附件）。如果达不到要求，则在电机支座下法兰面与泵支撑座之间加钢垫片。

Inspect the levelness of flange of motor support, keep levelness within 0.05mm/m, and fill the motor support upper flange levelness test data sheet (see appendix). If can not meet the requirements, add steel cushion block between motor support lower flange and pump supporting plate.



重点检查 Key inspection:

1、电机支座上法兰面水平度为 0.05mm/m。

Levelness of flange of motor support is 0.05mm/m.

2、泵上轴轴端面到电机支座上法兰面的距离。

The distance between pump upper shaft surface to flange of motor support.

5.2.10 电机的安装 Installation of the motor

5.2.10.1 在对电机做任何安装或处理工作之前，先仔细阅读电机安装使用说明书，在安装过程中参照电机安装检测数据表（见附件）检测相关数据并填写。

Read the motor installation and operation instruction manual before any installation or handing work, Refer the “motor installation and test data” (see appendix) to test related data and fill it during the installation.

5.2.10.2 认真检查电机的气隙和油隙是否符合安装要求；

Check whether the air gap and oil gap of the motor match the installation requirement or not.

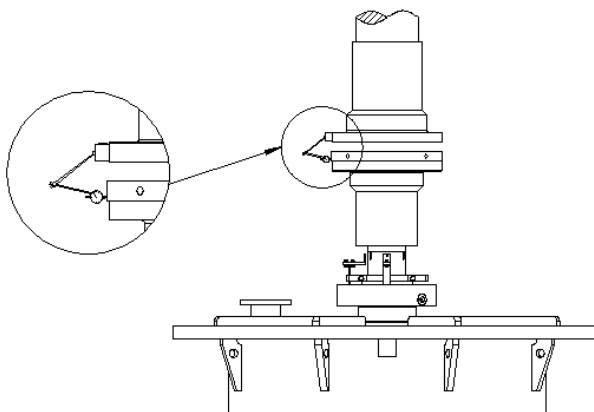
5.2.10.3 装好电机联轴器及紧定螺母。注意电机联轴器采用热装。

Assemble the motor coupling and locking nuts. Note that the motor coupling uses heating-installation.

5.2.10.4 将电机吊至电机支座上

Lifting the motor on motor support

泵和电机的对中:在电机联轴器上



安放检测仪表托架，并调整检测仪表，使其针端落在泵联轴器的最大外圆上。用电机盘车工具盘动电机轴，并调整电机的位置直至指针读数在 0.05mm 以下为止，并将数据填至联轴器对中数据表（见附件），拧紧电机与电机支座的联接螺栓，并反复测跳动值。

Centering the pump and motor (see right-hand figure): set instrumentation tray rack on the motor coupling and adjust the instrumentation to let the needle fall on the maximum periphery of the pump coupling. Use the motor rotating tools to rotate the shaft and adjust the locating of the motor till the needle figure settles below 0.05mm, and fill the data into “coupling centering data sheet” (see appendix). Fasten the nuts connecting the motor and motor support, and measure the pulsation value repeatedly.

5.2.10.5 将轴端调整螺母上旋，使之与电机联轴器法兰面贴配。拧紧电机与电机支座的联接螺柱，并反复测跳动值。确保电机轴和泵轴的同轴度小于 0.05mm。

Screw up the shaft ends adjusting nut, make sure that it is tightly matched with

注意：在起动电机检查转向前，电机与电机支座法兰的联接螺栓一定要上好，看清楚标在泵、电机转向牌上的旋转方向。

Attention: When check the rotation before starting the motor, the nuts for connecting the motor and the flange of the motor support must be properly installed, check the rotation direction of the marks rotation nameplate of the pump and the motor.

1、在给电机通电的一瞬间，判断转向。

Judge the rotation direction at the moment of power connection.

2、若转向不对，需将接线更正。

If the rotation direction is not correct, correct the wiring.

警惕：在合装联轴器之前，必须检查电机转向，一定要使电机与泵转向一致，才能启动设备，因为错误的转向可能导致设备损害或人身伤害。

Warning: It is crucial to check that the rotation direction of the motor is identical with the pump before installation the pump coupling and the motor. Only when identical can start the pump, because the wrong rotation might result in damage to equipment or people.

5.2.10.7 泵运行前，先进行电机的空载试验。试验时间不得少于四小时，测量电机振动并做好电机推力瓦、导瓦及下基架轴承温升和定子温升的记录，如有异常，空载时间可延长至 12-24 小时。

Before Pump running, firstly do the motor no-load test. Test time shall not be less than four hours, measuring motor vibration and keep record of the motor thrust pad ,guide watt and lower pedestal bearing temperature and stator temperature rise, if abnormal, no-load time may be extended to 12-24 hours.

注意：进行电机的空载运行前，必须确认电机及泵联轴器轴端调整螺母处的螺栓螺母及止动垫圈拆除、轴端调整螺母上端面与电机联轴器下端面的距离必须大于 10mm；若因以上原因所导致的设备事故，制造厂商概不存担责任。

Note: before the No-load operation of the motor, must confirming demolition of the bolts, nuts and stop washer at the motor and pump coupling and shaft end adjusting nut, the distance between shaft end adjusting nut upper surface and the motor coupling lower surface must be greater than 10 mm; If the equipment accidents caused by the above reasons, the manufacturer shall not be kept for responsibility.

重点检查 Key inspection:

1、泵和电机的对中，电机轴和泵轴的同心度为 0.05mm。

Centering of the pump and motor, concentric of the motor shaft and pump shaft being 0.05mm.

2、联轴器与轴端调整螺母之间不平行度小于 0.02mm。

Nonparallelism between coupling and shaft end adjustment nut less than 0.02mm.

3、电机空载运行的振动及摆度值。

The vibration and runout value of the motor no-load operation.

5.2.11 转子调整 Adjustment rotor

泵转子的提升高度符合总装图的要求。

Pump rotor hoisting height should meet the requirements of the general assembly drawing.

转子提升步骤如下 the rotor hoist procedure is as follows:

1. 判断泵转子是否已落到极下位置；必须有人下去至吸入水池底面观察三个问题（注意人身安全）：

Judge whether the rotor is down to lowest point; need someone must go to inhalation pool underside observed three issues (pay attention to their personal security):

a. 叶轮室下端精加工锥面与吸入喇叭口精加工锥面是否完全贴合。

Whether impeller house below finishing cone with inhaled bellbottom finishing cone completely joint

b. 叶轮室上的防转块是否插入外接管 a 的防转槽内，并帖紧机组旋转方向一侧凹槽面

Anti-rotating block of impeller house whether insert into the anti-rotating groove of external column a. and whether close to unit rotate part groove.

c. 吸入喇叭口至水池底面的高度是否符合外形安装图的要求。

Whether the height from the suction bell to the bottom of the pool is met the requirements of the general and installation diagram;

2. 旋转轴端调整螺母直至上端面与电机联轴器端面贴合；

Rotor shaft end adjustment nuts to upward end connect with motor coupling end.

3. 在电机联轴器及轴端调整螺母外圆上用粉笔或笔画一条竖线作为记号；

At motor coupling and shaft end adjustment nut outer use a chalk marks a line;

4. 向下旋转轴端调整螺母一圈直至竖线再次对齐，表明转子提升了 3mm，向下总个旋 2 圈则说明转子共提升了 6mm

Revolve downward shaft end adjustment nut a circle till line aligning again, it indicate the rotor lift 3mm , revolve downward two circles mean lift 6mm.

注意：当向下旋转轴端调整螺母下降 12mm 以后，如果它与泵联轴器的螺栓孔不对，则继续向下旋转，直至与最靠近的螺孔对正为止。

Note: Rotate the shaft when the adjusting nut down 12mm, if it is not the pump coupling bolt hole, then continue down the rotation, until the screw holes with the nearest date on the positive.

5. 装上联轴器联接螺栓、止动垫圈、螺母，交替对称地逐渐拧紧螺母。一定要按总装图上的拧紧力矩拧紧螺栓、螺母及止动垫圈。

Assemble the connecting bolts of pump coupling, locking gaskets and nuts, gradually fastening the nuts alternatively and symmetrically tightening the torque gradually. According to general assembly drawing to tighten bolts, nuts and stop gasket.

重点检查 Key inspection:

1、叶轮室下端精加工锥面与吸入喇叭口精加工锥面是否完全贴合。

Whether impeller house below finishing cone with inhaled bellbottom finishing cone completely joint

2、叶轮室上的防转块是否插入外接管 a 的防转槽内，并帖紧机组旋转方向一侧凹槽面。

Anti-rotating block of impeller house whether insert into the anti-rotating groove of external column a. and whether close to unit rotate part groove.

5.2.12 填料的安装 Installation of stuffing

泵发货运输时，填料并不装入填料函体内，而是将一整组填料装在一个小箱内和泵一起发运。正确地安装填料是泵高效运行的必要条件，请注意下面的说明：

When pump shipment and transport, stuffing is not installs stuffing box. A group of stuffing installs into a small box together with pump. Correctly install stuffing is an important condition of pump high efficiency operation. Please note as follows:

a. 拆下对中块,清理干净填料函;

Pull out the aligning plate and clear the stuffing box;

b. 依次将一环填料装进填料函内，以确保填料落到正确的位置；

Insert the packing into the box one ring per time to ensure the packing falls into the right place.

c. 如果使用石棉绳填料，每环填料的切口要错开 180° 放置，当最后一环填料装进后，再装上分半填料压盖，均匀地拧紧螺母，然后松开，再复到“指紧”程度。泵启动前通润滑冷却水后，缓慢、均匀地调节两螺母，调整到有填料处有水滴状的泄漏量为止。泵起动之后，继续观察泄漏量变化，始终保持水滴状的泄漏量。

If use asbest rope stuffing, the cut of each ring of packing must be staggered at an angle of 180 degrees, after the last ring is inserts, install the half packing gland, fastening the nuts symmetrically then loosening them, and return “finger tight” degree. After starting the pump, adjust two nuts slowly and symmetrically till a suitable water-drop leakage is achieved. After the pump start, observe the change of leakage rate, always keep a water-drop leakage rate.

d. 如果使用液体填料，先在填料函腔体的底部及上端各装一根碳素纤维填料，再装上填料压盖，用注射枪将液体填料注入填料函腔体内（注意不要完全注满，只注入 2/3 左右，待泵开车后再将液体填料完全注满）。

If using liquid filler, first install a carbon fiber filler in the bottom of the stuffing box cavity and the upper end of the tube, and then loaded the packing gland injection gun liquid fillers injected into the cavity of the stuffing box (be careful not to completely filled, only poured into about 2/3, and fill the liquid completely filled after pump start).

小心：对于油浸石棉绳填料，填料压盖决不能将填料压紧到无水从填料函处泄漏的程度，填料的润滑是需要一定的泄漏量的，否则将导致填料烧坏，擦伤轴套，并可能卡死转子。而对于液体填料则可以做到完全没有水泄漏。

Caution: For oil-marinated asbestos cord packing, the packing gland mustn't impact the packing so tightly as to prevent any leakage from the stuffing box. Lubrication of the packing needs a certain leakage otherwise the result will be burnout of the packing, abrasion or the sleeve and even blocking of the rotor. As for liquid stuffing can to be no leakage completely.

5.2.13 完成其他安装工作 Other installation

5.2.13.1 安装双口排气阀 Installation double-meatus discharge gas valve. ;

5.2.13.2 安装出口伸缩节：将伸缩节本体与泵出口法兰预留出 15mm 间隙，拧紧密封压板处和吐出弯管处的两个螺母，再拧紧中间法兰处的两个螺母，另一端法兰与管路联接。正确方式为：吐出弯管→伸缩节→穿墙→蝶阀。安装完毕后检查伸缩节与外部管道的张口，并填写电机支座上法兰面水平度检测数据表（见附件）中外部管道与伸缩节联接后张口值。

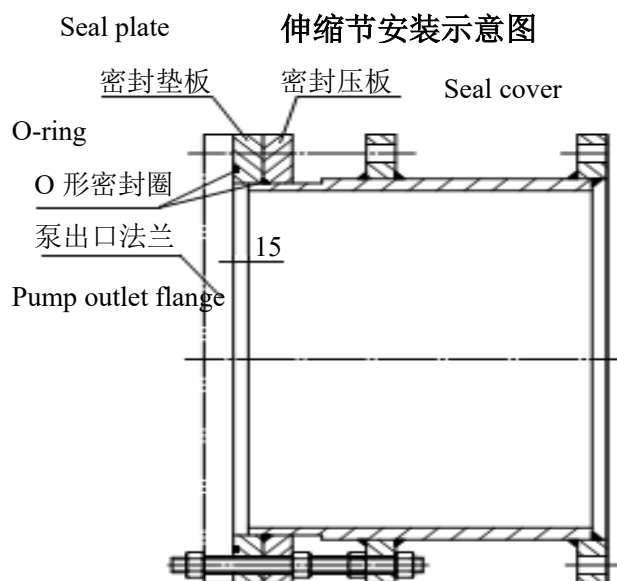
Expansion joint installation: Reserve 15mm gap for expansion joint and pump outlet flange, tighten the connecting nut between seal plate and discharge elbow flange, another end flange connect with pipe, then tighten middle flange two nuts. Right way: discharge elbow→expansion joint→wall through→butterfly gate. After installation, check the mouth of expansion joints and external pipeline, and fill in the the motor bearing flange surface level detection data table (see Annex) the external piping and expansion joint connection open

Expansion joint installation drawing

mouth value.

警告：出口伸缩节必须与泵出口法兰直接联接，严禁装在穿墙外；且出口伸缩节须与管道刚性联接。穿墙管必须做固定，管路上的力不能传给泵机组。

Warning: Outlet expansion joint must direct connection with pump outlet flange. Install outside the wall is prohibited. and outlet expansion joint rigid coupling with piping. wall liner tube must fixed, force from pipe should not pass to pump unit.



5.2.13.3 安装出口压力表部件 Install the outlet gauge components.

5.2.13.4 安装润滑水系统：对于橡胶导轴承由外接工业清洁水润滑，将润滑水系统引入填料函体，检查润滑水压力是否符合要求。

Lubrication water system: Rubber guide bearing is lubricated by external industrial clean lubrication water which is introduced into pump stuffing box , check whether the lubrication water pressure meets requirements.

重点检查：泵出口伸缩节、管道上其它伸缩节和管道均须刚性联接。

Key inspection: The Outlet expansion joint and other expansion joint on piping also the piping needs a rigid connection.

第六章 运行 OPERATION

1. 运行前的检查 Preparation Before Operation

泵组起动前必须按以下项目仔细地进行检查，看是否满足启动和运行条件。如果条件不满足，决不允许启动。

Before start the pump set must carefully check the following items to see whether or not to meet the start-up and operating conditions. If the conditions do not met, never allow starting.

1.1 检查确认是否满足泵使用条件（第四章第三节）。

Verify whether to meet pump use conditions (Chapter IV Section III).

1.2 第一次起动，在联轴器联接之前，先让电机单独试运行，检查电机的旋转方向是否正确，确认无误后方可将电机联轴器和泵联轴器联接。

Starting for the first time, let motor trial run separately, check the motor rotation direction is correct before coupling connection, confirm correct before the motor coupling and pump coupling connection.

1.3 检查泵的安装是否可靠，供水、供电和电控系统是否完善、正确。

Check the installation of the pump whether reliability, water supply, electricity and electric control system whether perfect, right.

1.4 用手转动泵轴，检查旋转是否均匀。注意不要使泵轴反方向旋转。

Hand rotating pump shaft, check the rotation is uniform. Be careful not to make the shaft opposite direction of rotation.

1.5 检查润滑冷却水系统主管路上的非电控阀是否全开通水（旁通管上的阀关闭）。

Check the lubrication cooling water system main pipeline non-electric control valve is full open water (the valve on bypass pipe keep closed).

1.6 检查各类仪表功能是否正常，设置好仪表的报警值和停机值。

Check all kinds of instruments function is normal, set the alarm value of a

good instrument and stop values.

1.7 检查排气阀处于正常状态。

Check the exhaust valve is in the normal state.

1.8 检查填料的压紧程度，不要太紧或太松，同时，注意填料压盖是否压得均匀。

Check the tight degree of stuffing, it can not be too tight or too loosen. At the same time note whether packing gland impact evenly.

1.9 清除泵吸水池内所有杂物，如木块、砖头、纤维、织品、金属丝等，并在泵运行时，防止有新的杂物继续进入泵的吸水池。

Clean out all the foreign materials in suction sump such as wood, brick, fibrils, cloth, wire etc. Take care to prevent new foreign materials form entering the sump during pump operation.

重点检查 Key inspection::

泵吸水池内的水位是否在最小淹没深度以上，若小于规定值，则泵运行时可能会产生旋涡并将空气带入泵内，引起振动和泵汽蚀，此时应增加泵淹没深度。

Check if the water level in suction sump above the Min submergence depth, if it is below the permissible level, it will result in vortex or air entrance into pump, so pump will occur cavitations, vibration and etc. so should increase the submergence depth.

2. 启动 Start-up

经过运行前检查，确认一切设备完好正常，启动前条件满足，则可正式启动。

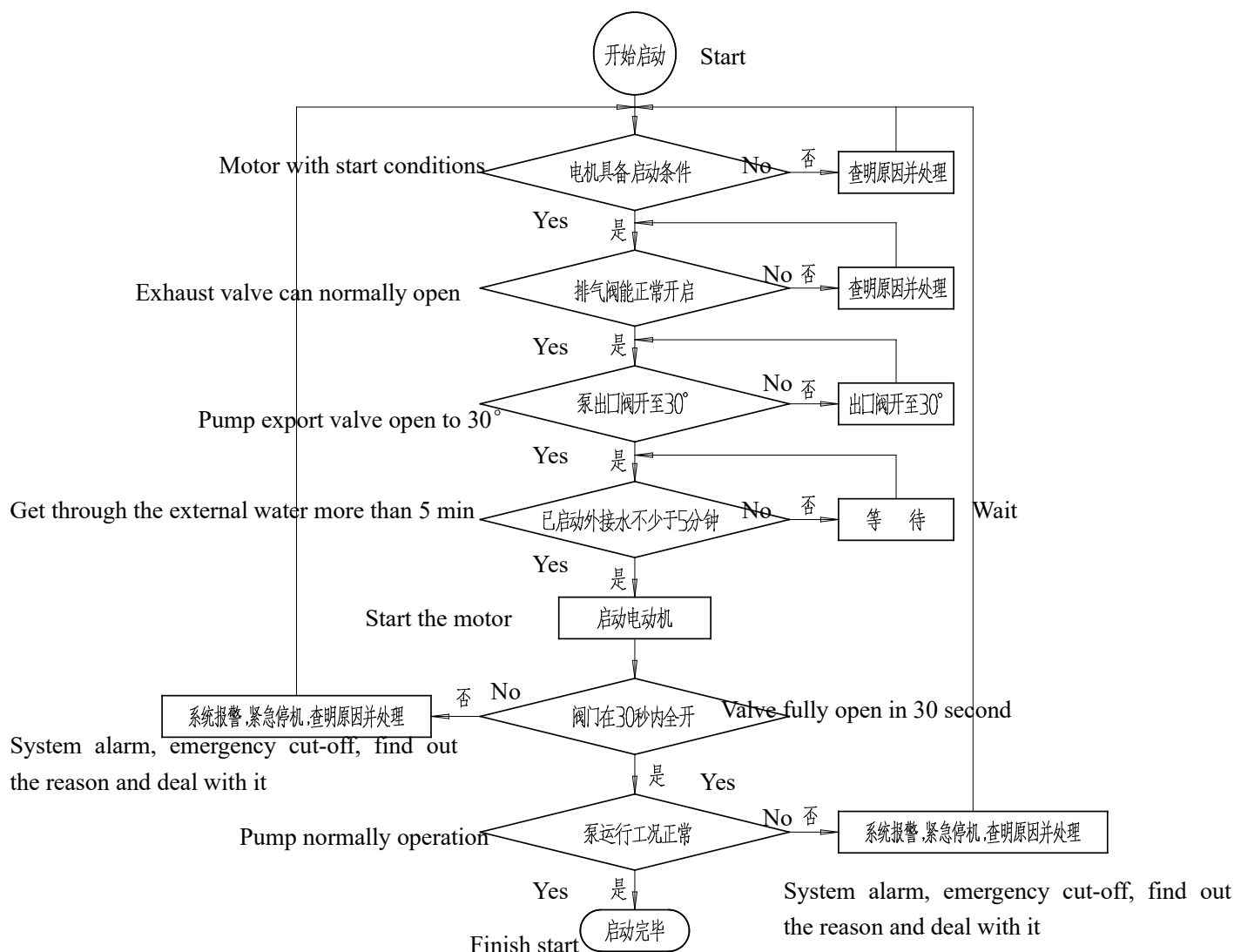
Make sure all equipment is in good condition and properly pre-operational checks before the start, if conditions are met, then can officially start.

2.1 启动方法 Method of start-up

2.1.1 排出阀打开状态下 Discharge valve in opened state

开启冷却润滑水系统阀门，让水流对泵导轴承进行润滑、对填料函体进行冷却润滑和密封并对电机冷却器供水 5 分钟，将排出阀门开至 30°位置，电机通电，泵启动，阀门继续开启在 30 秒内到全开，启动完毕。

Open the valve of the cooling and lubricating water system to lubricate the pump guide bearing, cooling and lubrication the stuffing box and the seal ,also supply cooling water motor for 5 minutes, opening the exhaust valve position to 30 °, make the motor power on, start the pump, the valve continue to open to fully open within 30 seconds, the start-up procedure is completed.

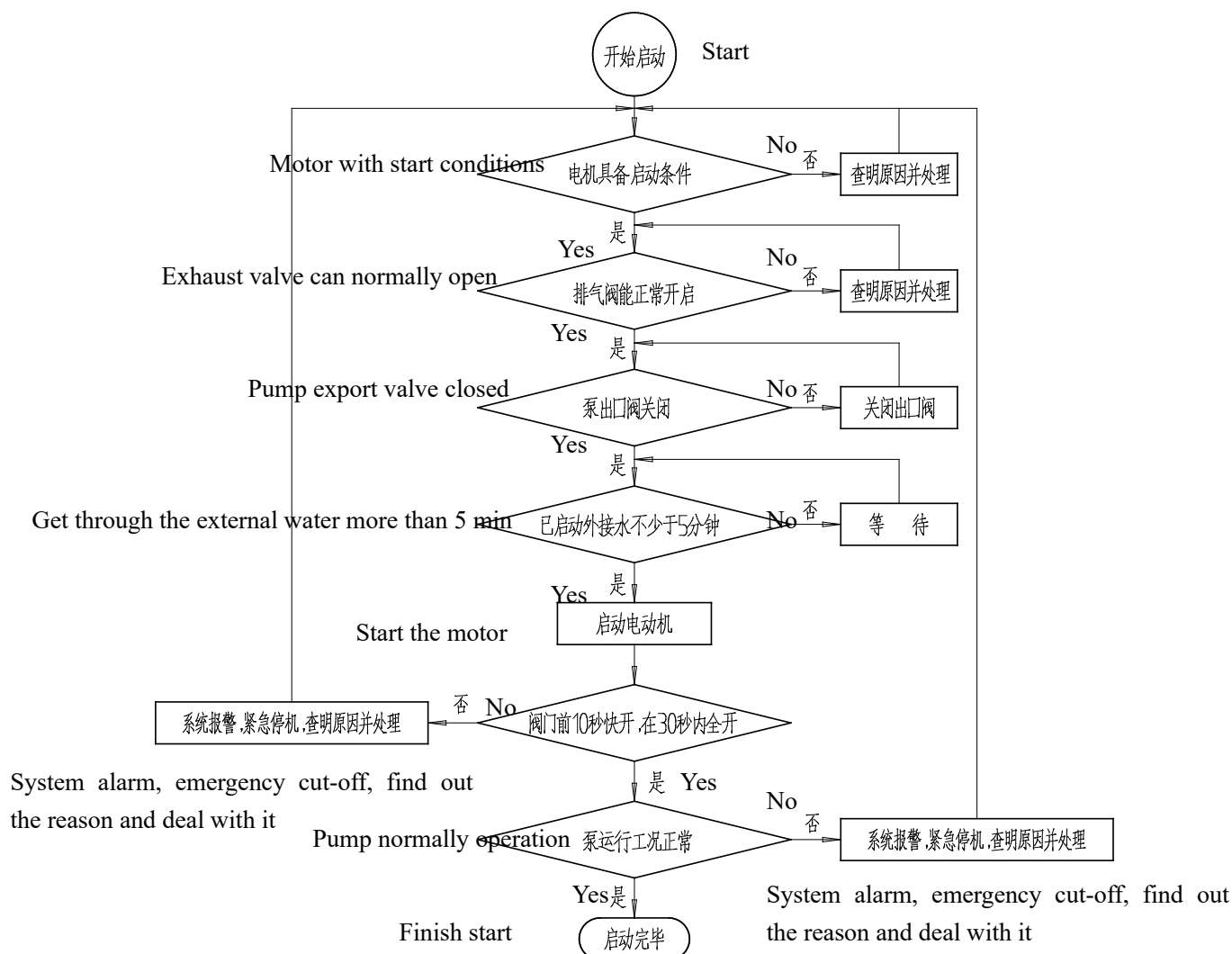


2.1.2 排出阀关闭状态下 Discharge valve in closed state

开启润滑冷却水系统阀门，让水流对泵导轴承进行润滑、对填料函体进行润滑冷却和密封并对电机冷却器供水 5 分钟，电机通电和排出阀门同时启动，排出阀门前 10 秒快开，阀门在 30 秒内由开启至全开，启动完毕。

Open the valve of the cooling and lubricating water system to lubricate the pump guide bearing, cooling and lubrication the stuffing box and the seal ,also supply cooling water motor for 5 minutes, the motor power on and discharge valves start at the same time, discharge valve quick open 10 seconds before , the

valve continue to open to fully open within 30 seconds, the start-up procedure is completed.



注意：首台泵启动采用排出阀打开状态方法启动，当共母管的多台泵中有一台泵已投入运行，其余泵亦需投入运行时，则采用排出阀关闭状态方法启动其余水泵。

Note: The first pump is started by the discharge valve is opened the state method to start, when the bus multi pump has a pump has been put into operation, the pump should also put into operation, the exhaust valve closed method to start the other pumps.

3. 运行 Operation

3.1 运行控制 Operational control

泵组只有在润滑冷却水量满足的情况下才允许连续运行。当泵组处于运行状态时，流量报警开关检测出冷却润滑水量不足时发出报警信号，运行人员应迅速做出处理。

Pump unit only the lubrication cooling water to meet the case is allowed to run continuously. When the pump unit is running, flow alarm switch will detect cooling and lubricating water shortage is not enough and send an alarm signal, the operating personnel shall promptly make a deal.

小心 Cautious:

1、不能让橡胶导轴承无润滑运转时间超过 1 秒钟；赛龙导轴承无润滑运转时间超过 2 分钟

Can not allow the rubber guide bearing lubrication-free operation for more than 1 second; and Thordon guide bearing lubrication operation for more than two minutes

2、不能让填料腔无润滑运转时间超过 1 分钟。

Stuffing chamber can not allow non-lubricated operation longer than 1 minute.

3.2 运行注意事项 Note of operation

3.2.1 泵无吐出（即排出阀关闭）不能运行，运行时间不能超过 1 分钟。

Operation is prohibited when the pump is not discharging (i.e. the discharge valve is closed) and the operation time of no discharging should not exceed one minute.

3.2.2 观察和测量泵的振动和噪音，测量值不应超过以下规定值：

Observation and measurement of the vibration and noise of the pump, the measurement values should not exceed a predetermined value below:

在电机上部轴承部位测得的振动允许值为 0.076mm;

Measured vibration of the motor upper bearing parts allowable value is 0.076mm;

泵组噪声值为 80-90dB(A)。

Pump unit noise value of 80-90dB (A).

如果听到有水击的噪声，则可能是由于以下原因引起的：

If you heard water hammer noise may be due to the following reasons:

——泵在大流量工况外运行，即装置扬程低于设计扬程；

Pump operation on large flow conditions, that means the device head is lower than the design head;

——吸入池水位低于允许的最低吸入水位，泵发生汽蚀；

Inhalation of the pool water level is lower than the minimum inhaled water level allowed, pump cavitation;

——进水流态恶劣，水流紊乱，流速过快。

The poor state of the Inlet flow disorders, flow rate too fast.

3.2.3 检查电机运行功率和泵运行工况是否偏离泵的性能规定范围，如果偏离，则泵运行不经济，或者电机超负荷。

Check the motor running power and pump running conditions whether deviate from the specified range of pump performance, if there is deviation, the pump does not run the economy, or motor overload.

3.2.4 不允许在所规定的最低吸入水位以下运行。

Do not allowed to run in the water level below the stipulated minimum inhalation.

3.2.5 观察填料密封处水的泄露是否过量，可调整填料压盖紧固螺母的松紧进行控制，以有少量的水连续不断地从填料函处冒出为准。

Observe the water leak at the packing seal is excessive or not, can adjust the tightness of the fastening nut of the packing gland to control, subject to have a small amount of water continuously emerge from the stuffing.

3.2.6 经常检查冷却润滑水情况，切不可中断。

Always check the cooling and lubricating water situation must not be interrupted.

3.2.7 作好运行日记，如有故障,须详细记录。

Keep the operation log as detailed as possible, especially if any malfunction occurs.

3.2.8 备用机组应定期投入运行。建议同一台发电机组配用的 2 台循环水泵在 30~40 天轮换运行一次，并确保备用泵经常处于正常状态。

Spare unit should be put into operation on a regular basis. Suggest the same set generating set adapt with 2 sets of circulating pump in 30 ~ 40 days rotation operation time, and ensure the standby pump often in normal condition.

警惕：水泵在真空状态下，千万不能起动。由于停车后，系统产生回流，会在泵内引起真空，由于泵体内流速的急剧变化，造成压力急剧变化，此时若马上开机，会在泵内产生水锤，对泵机组造成破坏。在泵重新启动之前，要有足够的时间让空气进入泵内，以消除真空。Warning: Must not start the pump in a vacuum state. After parking, the system generates reflux, causing a vacuum in the pump, due to the drastic changes make the drastic change in pressure, if immediately start at this time, will produce water hammer within the pump, causing damage to the pump unit. Before restarting the pump, need sufficient time to allowing air into the pump, to eliminate the vacuum.

4. 停机 Shut-down

4.1 正常停机 Orderly shut-down

排出阀门与泵电机联锁，当阀门关闭 30°时，泵电机断开电源，阀门关闭时间 45 秒左右。泵组润滑冷却水需在泵组完全停止运行后方可停止供给。

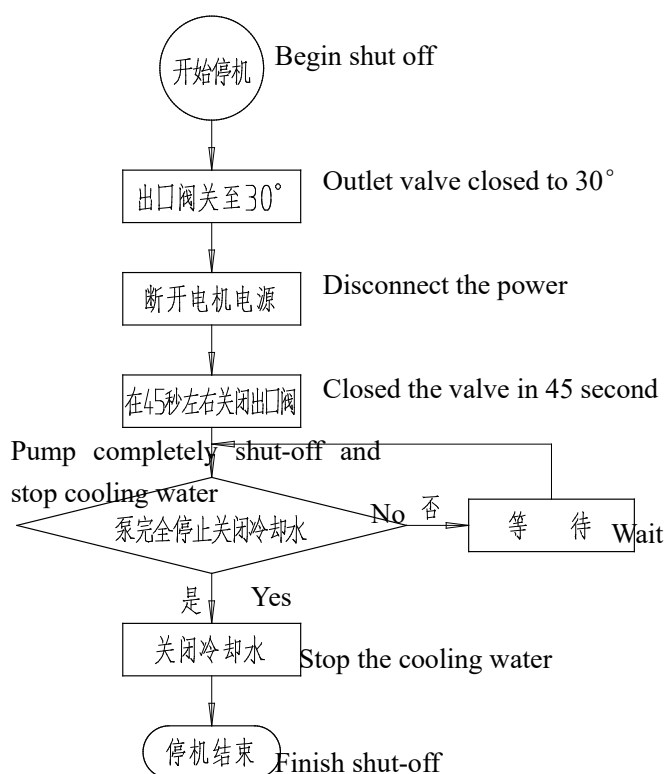
The discharge valve and the pump motor, when the valve close 30°,the motor cut the power, the closes time is about 45 seconds. The pump unit lubrication cooling water stopping supply after the pump units completely stop running.

4.2 事故停机 Note of accidental Shutdown

判断泵出现异常现象时，按 4.1 方法停机，泵的外部系统恢复到正常停机状态。

If find abnormal phenomenon, shut down the pump by method 4.1, the pump external system restore to the normal stop state.

当吸入池水位低于下限值或者冷却润滑水系统堵塞发出报警信号时，运行人员应迅速作出处理。



When inhalation pool water level is below the lower limit or the lubricating cooling water system clogged and sending the alarm signal, operating personnel should be deal with it quickly.

泵停机后延时 2 分钟再关闭冷却润滑水系统阀门。

Pump shutdown delay 2 minutes and then turn off the cooling lubricating water system valves.

4.3 全停电非常停机 Full blackout unusual shut down

当泵系统全停电时，应检查泵的供电、电气系统是否都恢复到正常停机状态。

When the pump system power outage, should check whether the power of the pump, the electrical system have restored to normal shutdown state.

5. 停机以后的工作 Work after shut-off

5.1 水泵准备作立即启动时

Pump should be in instant-on state.

5.1.1 进水池注水至最低水位以上。

Fill the pool above the lowest water level.

5.1.2 每周进行一次泵启动，大约 30 分钟后按照要求停机。

Weekly start the pump, and then shut off in accordance with the requirements after about 30 minutes.

5.1.3 建议对泵进行切换操作，从工作泵到备用泵 30-40 天轮换一次，确保备用泵经常处于正常状态。

Recommended to switch the pump operation, from the working pump to the standby pump take turns every 30-40 days to ensure that the standby pump in a normal state frequently.

5.2 水泵停机不准备运行时 Pump shutdown and not ready to operate

5.2.1 拆去联轴器和推力轴承区域的防护罩。

Remove the shield of the coupling and the thrust bearing area.

5.2.2 松开填料压盖，取出填料。

Loosen the packing gland, remove the packing.

5.2.3 清洁轴防护表面，涂上二硫化钼防护剂。

Clean the axis protective surface coated with molybdenum disulfide protective agent.

5.2.4 利用合适的工具紧固泵转子，分开泵与电机联轴器，放下泵转子，直至叶轮落到叶轮室上。

Suitable tool for tightening the pump rotor, separate the pump and motor couplings, put down the pump impeller rotor till the impeller fall into the impeller house.

5.2.5 用塑料布盖住泵组上所有的凸出部件。

Cover the all protruding parts on pump unit with plastic sheeting.

5.2.6 当预计停机时间超过一年以上，请与本公司售后服务联系。

When shutdown time is expected to more than one year, contact us for after-sales service.

第七章 运行检查、拆卸、检修和维护

OPERATION, DISMANTLEMENT , MAINTENANCE AND REPAIR

1. 运行检查 Operation inspection

1.1 泵运行日记和管理档案 Pump operation log and file management

1.1.1 运行日记 Pump operation log

运行日记应如实记录泵的运行情况，并以此作为制定运行计划的基础。
有一个完整的运行日记，发生事故时就能方便地找出事故发生的原因。

Operation log shall faithfully record the pump operation, and use this as the foundation of establishing operation plan. having a complete operation log, when accident can easily find out the cause.

运行日记应包括下列内容：检测时间、开（停）机时间、吸入水位、排出压力泵读数、电流、电压、频率、转速、振动、噪声、环境温度、轴承温度、填料函温度和泄漏等。

Operation log should at least consist of: measurement time, time for start-up and shut-off, suction water-level, pump reading discharge pressure, current , voltage ,frequency, speed, ambient temperature, bearing temperature ,stuffing box temperature , leakage and etc. .

1.1.2 档案管理 File management

管理档案是将泵及电机的出厂时间、制造厂家、泵主要性能参数记录存档，见下表：

The management of the file is documenting the delivery time of the pump and motor factory, manufacturers, pump main performance parameters in the following table:

泵管理档案 Pump file management

泵 Pump	电机 Motor
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型号 Type		型号 Type	
名称 Name		名称 Name	
吸 入 口 径 suction size		输出功率 Output power	
吐 出 口 径 Discharge size		额定电压 Rated voltage	
流量 Flow		额定电流 Rated current	
扬程 Head		转速 Speed	
转速 Speed		极数 Poles	
轴功率 shaft power		频率 Frequency	
效 率 Efficiency		绝 缘 等 级 Insulation grade	
出厂年月 Delivery date		冷却方式 Cooling Model	
出厂编号 Ex-works No.		启动方式 Starting mode	
制造厂名 Manufacturer		出厂年月 Delivery date	
		出厂编号 Ex-works No.	
		制造厂名 Manufacturer	

1.2 运行检查 Running check

在泵组调试和运行期间，须按照下表运行检查计划的项目作定期检查并记录。

In the pump unit commissioning and operation period, should operation

inspection plan project for regular inspection and record in accordance with the table below.

运行检查计划 Running check plan

检查部位 Check parts	检查内容 Check content	要求 Requirement
出口管压力表 Outlet pressure gage	每天检查泵出口压力 Check the pump Outlet pressure every day	附件 1 泵性能曲线 Accessory 1 characteristic performance curve
轴封 Shaft sleeve	每天检查泄露情况是否正常 Check whether the leakage is normal	见运行注意事项中 3.2.4 Follow the operation notices 3.2.4
检测元件：泵径向和推力轴承（如果有） Detecting element: pump radial and thrust bearing(if any)	连续监测控制室中温度 Continuous monitoring the control room temperature	
检查油位：泵轴承（如果有） Check the oil level: pump bearing(if any)	每周一次，注意观看油位变化 Notice the oil level change weekly	高于最低油位，无漏油现象。 Higher than min oil level, no leakage
泵与电机联轴器 Pump and motor coupling	每月一次，检查其运行是否平稳。 Check the operation is steady or not weekly	联接正常，运行平稳。 Normally connect, steady operation
电机与电机支座法兰 Motor and motor support flange	每周一次 Weekly	运行平稳，振动值小于 0.076mm。 Steady operation, the vibration value less than 0.076mm.
检测元件：电机绕组	连续监测控制室中温度	详见电机厂技术文件要求

Detecting element: machine winding	Continuous monitoring the control room temperature	Follow the motor factory technical documents
检测元件: 电机推力轴承 Detecting element: motor thrust bearing	连续监测控制室中温度 Continuous monitoring the control room temperature	详见电机厂技术文件要求 Follow the motor factory technical documents
检测元件: 电机径向轴承 Detecting element: motor radial bearing	连续监测控制室中温度 Continuous monitoring the control room temperature	详见电机厂技术文件要求 Follow the motor factory technical documents
指示器, 电机输入功率 Indicator, motor input power	连续监测控制室中温度 Continuous monitoring the control room temperature	详见电机厂技术文件要求 Follow the motor factory technical documents

2. 拆卸 Dismantlement

泵组拆卸为安装的逆过程。通常泵筒体部件不须拆卸，但每次拆卸都需要检查泵支撑板水平度是否满足 0.05mm/m。

The dismantling procedure is the opposite process to the installing procedure. The pump casing does not need disassembling but should inspect whether the horizontality of the supporting plate is within 0.05mm/m.

泵组拆卸的注意事项 Note of dismantles pump:

- a 在必要的配合处作好相配的标记，以便下次安装；

Mark every necessary junction place for the sake of the next installation.

- b 准备一些小箱子，盛装拆卸下来的小型零件，以防散失，每处拆下来的紧固件也用箱子分别装好，并在箱子上标记为何处，何种零件，切忌混杂；

Prepare several small cases to store the disassembled small accessories prevent them from being lost. Fasteners taken down from each parts also should

be loaded in chests, which are them marked with the kinds and location of the parts, avoid being intermingled.

- c 准备好稀释过的防锈油，以便涂于零件的某些配合表面；

Prepare diluted rust-preventative oil, in order to apply to some of the parts with surface;

- d 准备好防锈漆，以便涂于零件需要防锈的部位；

Prepare antirust paint to apply on certain parts of the accessories;

- e 下列零件往往不能重复使用：“O”形密封圈、填料、锈坏的紧固件。

The following accessories should not be used repeatedly: O-ring, Packing and rusty fasteners.

3. 检修 Maintenance

3.1 检修先决条件 Prerequisite for maintenance

3.1.1 泵组已按照第六章要求停机并准备检修。

Pump unit already according to chapter 6 request stop and prepare for maintenance.

3.1.2 进水池水已经排空。

Water pool water has been empty.

3.1.3 已拆除泵与电机联轴器部位防护罩。

Already demolished pump and motor coupling parts shield.

3.2 请参考表 3 检修计划完成各项检修项目

Please refer to the table 3 maintenance plan to finish the maintenance project

表 3：检修计划 Maintenance plan

需要进行检修的部位 Need maintenance part	检查事项 Maintenance item	检修工作 Maintenance work	检修间隔时间 Maintenance spacing interval
进水池 Inlet pool	检查有无泥沙沉淀 Check have sediment or not	必须时清洗进水池 Clean the pool when necessary	由操作人员负责 Take charge by operating personnel
基础 Foundation	基础下沉、开裂 Foundation sink、craze	注意任何发现的基础变化，对于裂缝如果需要请土建方修补 Attention to any foundation change, let the civil engineering repair the crack	由操作人员负责 Take charge by operating personnel
泵与电机的装配附件 Assemble accessory of pump and motor	螺栓和螺母的松紧程度 The tightness of bolt and nuts	如果需要，应根据要求重新拧紧 Retightening when necessary	每月一次 Monthly
油漆 Paint	是否损坏、生锈 Whether damaged、rusted	除锈，根据需要对外露点重新涂漆 Do rust removal, new paint the expose point when necessary	每隔六个月 At intervals of six months
冷却水润滑管道 Cooling water lubricating pipe	紧密度，损坏 Tightness,damage	如果需要，应重新拧紧螺纹接头或更换管道 Retightening the nipple or change the piping if any	每月一次 Monthly
泵转子 Pump rotor	见本章中“检修工作”一节说明 Follow the section 1 for “maintenance work”	见本章中“检修工作”一节说明 Follow the section 1 for “maintenance work”	由操作人员负责 Take charge by operating personnel
泵与电机联轴器 Pump and motor coupling	对中（将测量值与以前联轴器检查的测量值相比较） Centering(Compare the test value and former coupling test value)	如果发现有变化，查出原因并修复 Find out the reason and repair when there is sth changes	由操作人员负责 Take charge by operating personnel

各运转部位间隙 Gap between all parts	测量各转动配合部位间隙值 Check the gap between all parts	按本章 3.4 节表 5 运行间隙要求判断并修复 Judge and repair by chapter 3.4 table 5 running clearance	由操作人员负责 Take charge by operating personnel
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3.3 检修工作 Maintenance work

3.3.1 零件检查 Parts inspection

用钢丝刷清理所有泵的零件，检查零件是否有磨损、腐蚀、锈蚀，检查叶轮、导叶体是否完好无损。

Clear all accessories with wire brush, checking whether the accessories have any abrasion, corrosion, rusty and partial erosion. Inspect whether the impeller and diffuser casing are damaged or not.

3.3.2 主轴校验 Verify the main shaft

a. 将轴置于“V”形垫铁上，检查轴某些截面的径向跳动，轴支承应用两块“V”形垫铁，位置靠近轴两端的精加工面，而且轴径大致相等的轴承或联轴器部位。

Place the shaft on the “V”-shaped iron mat and check the radial pulsation of certain parts. Two pieces of the V-shaped iron mat are used for supporting the shaft, positioned near each end of the shaft finish machining surface, where the diameter is approximately equal e.g. the shaft bearing or the coupling.

b. 在轴的每一轴承和联轴器部位每 300mm 的跨距上进行测量。记下测量数据和测量部位至某一端面的距离。

Measure each shaft bearing and coupling at gap of 300mm. Record the data and the distance from the measuring position to the ends of the shaft.

c. 轴的最大径向跳动: δ (mm) = 0.083L (L 最大为 1/2 轴长), 轴长单位为 m, 超出此范围的轴要矫直。(注: 测量处为精加工面)

The maximum radial pulsation: δ (mm) = 0.083L (L max = 1/2 length of the shaft), The unit of length of the shaft is m. If the figure exceeds this range the shaft must be corrected. (Measuring place for finishing surface)

3.3.3 泵转子校验 Verify pump rotor

用手转动泵转子, 并在所有叶片的三处部位 (每一叶片的进水边、中心和出水边) 上测量叶片与叶轮室的间隙。超过规定值则应该按照相关的组装规则来调节泵转子。

Hand turning the pump rotor and measuring impeller and impeller house gap on all three parts of the leaves (each blade inlet edge, the center and the outlet edge). Exceed the specified value should be adjusted in accordance with the relevant rules of the assembly to the pump rotor.

3.3.4 检查轴套和导轴承之间的间隙

Check the gap between the shaft sleeve and the guide bearing.

如果轴套磨损需要更换的方法是: 松开轴套上的三个螺钉, 从轴上移出轴套, 用新的更换旧的, 并装上新的紧定螺钉。注意: 若轴套上的定位螺孔与原来的方位不对, 则要求根据新轴套在轴上重新钻孔, 再在轴套上攻丝, 装上定位螺钉。

If the sleeve has been abraded then replace it. The procedure is: Loosen three screws on the sleeve, take out the sleeve from the shaft and replace it with a new one, then insert new locking screws. Attention: If the position of the screw holes on the sleeve does not coincided with the original one, it is necessary to

drill the hole again to fit the new sleeve. Then tap on the sleeve and insert locking screws.

3.3.5 更换磨损的导轴承。

Replace the guide bearing in case of abrasion .

3.3.6 作叶轮静平衡试验检查叶轮磨损情况。

Conduct the impeller static balance testing for abrasion of the impeller.

3.3.7 更换所有密封垫板及“O”形圈和填料。

Replacing all the sealing gasket, " O " ring and stuffing

3.4 运行间隙 Running clearance

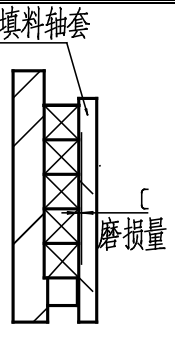
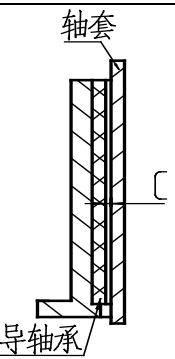
泵经过长时间运行后，其转动配合面地磨损比其它部位会更严重。由于间隙增大，会产生性能降低、振动和噪声增加，甚至会引起严重事故。转动配合部位设计间隙与磨损间隙极限运行间隙极限值参考表 4。

After a long-running, the pump mating surfaces wear would be more serious than the other parts. As the gap increases, will produce the performance reducing, also the vibration and noise increasing, and even cause a serious accident. Rotation mating part design clearance and wear clearance limit running clearance limits refer to Table 4.

表 4 转动配合部位设计间隙与磨损间隙极限运行间隙

Rotation mating part design clearance and wear clearance limit running clearance

零件名称 Parts name	更换标准 Replacement standard	of 简图及说明 Diagram & Introductions
--------------------	---------------------------------	--

填料轴套 Stuffing sleeve	填料轴套外表面磨损沟纹凹处 External surface of stuffing sleeve wear groove concave $C=0.3\text{mm}$		在填料接触部位磨损量或沟纹单侧超过 0.3mm 时应进行研磨或更换填料轴套。 When the wearing capacity or the groove unilateral exceed 0.3mm should grinding or change the stuffing sleeve.
轴承轴套 Bearing sleeve 导轴承 Guide bearing	$t=25 \sim 30^{\circ}\text{C}$ 时设计单侧间隙 C 值为 0.474~0.635mm (当 $d=185\text{mm}$ 时) Design unilateral gap C is 0.474 ~ 0.635mm when $t=25 \sim 30^{\circ}\text{C}$ (when $d=185\text{mm}$)		当单侧间隙 C 值大于 2~2.5 倍设计间隙值时, 应更换。 When unilateral gap big than 2~2.5 times of design unilateral gap, should be changed

4. 维护 Repair

4.1 日常维护检查项目 Routine repair check item

日常维护应注意的要点按本章 1.2 节。

The main point of routine repair follow section 1.2 of this chapter.

4.2 每月一次的检查项目 Monthly check item

a. 检查泵与电机联轴器状态是否正常。

Check the pump and motor coupling condition is normal or not.

b. 对长期不使用的泵组, 启动一次跑合运转。

Start a running-in to pump which has not been used for a long operation.

4.3 每六个月的检查项目 Semi-annual check item

- a. 检查填料和轴套，必要时进行更换。

Check the stuffing and shaft sleeve, change when necessity

- b. 检测泵组的振动和噪声。

Check the vibration and noise.

- c. 检查调整泵和电机联接状态，如果存在较大偏移，则需检查是否因为出水管道变形，外力或负荷作用到泵上。

Check and adjust the pump and motor coupling state, if there is a large offset, then need to check whether it is because the pipeline deformation, external force or load is applied to the pump.

4.4 每一年的检查项目 Annual check item

- a. 检查转动部分的磨损情况。

Check the rotating element wearing condition.

- b. 检查叶轮与叶轮室的间隙值。

Check the gap of impeller and impeller house.

- c. 检查叶轮、导叶体及其它过流部件的汽蚀、冲蚀状况。

Check the cavitation and erosion condition of impeller, diffuser casing and other flow passage components.

4.5 大修：大修周期取决于工作情况，参见下表大修间隔时间（推荐）：

Overhaul: The overhaul period is subject to working performance, follow the table of spacing interval (recommendation)

检修 Overhaul	间歇运行状态 Intermittent operation state	连续运行状态 Continuous operation state
首次 First time	在 8000 工作小时或 500 个轮换周期以后，或者最多 2 年	在 16000 工作小时或者最多 3 年

	In 8000 work hours or after 500 alternate periods, or up to 2 years	After 16,000 hours up to 3 years
第二次以及以后 Second and future	在 16000 工作小时或 1000 个轮换周期以后，或者最多 4 年 After 16,000 hours or 1000 alternate periods, or up to 4 years	在 40000 工作小时或者最多 6 年 After 40000 hours up to 6 years

上述间隔时间只适用于正常的工作条件和无故障运行。现场还须考虑到泥沙堆积程度、泵切换频率和负载状况等调节大修间隔时间。发生运行故障或者出现异常的工作状态，则必须按照本章要求立即对泵进行检修，以防止泵组在电气或机械方面承受过度应力。

The above interval only applies to normal working conditions and trouble-free operation. The site must also take into account the degree of sediment accumulation, pump switching frequency and load conditions to adjust the overhaul interval. Occurrence of operational failure or abnormal working condition, must be in accordance with the requirements of this chapter immediately pump maintenance, to prevent the pump unit in electrical or mechanical withstand excessive stress.

大修注意事项 Note for overhaul:

a. 进行解体检查，检查零部件特别是易损件的精度，确定是否需要修复或更换；

Disintegration of inspection, check the accuracy of the parts, especially the wearing parts, determine whether need to repair or replace;

b. 对锈蚀或防护涂层脱落的零件表面进行防锈及重新涂装处理，对已影响泵正常运行的零件应予以更换；

Rust and re-painting treatment for rust or protective coating off the surface of the part, has affected the normal operation of the pump parts should be replaced;

c. 更换密封件（如填料、O 形密封圈、橡胶石棉垫等）；

Replacement of the sealing element (such as stuffing, O-ring, rubber asbestos padt, etc.);

d. 清理检查冷却润滑水的供应系统，如阀门、流量开关的灵敏度，管道是否结垢、阀门或接头是否良好等；

Clean and check the cooling lubricating water supply system, such as valves, flow switch sensitivity, whether the pipe scaling, valves or fittings is good;

e. 检查各种仪表的完好性，特别是容易失去精度的仪表应进行计量；

Examine integrity of various instrumentation, especially measured the instrument which easily lose precision;

f. 对供电系统，自控系统（装置）进行检查；

Check the power supply system, automatic control system (device);

g. 对电机、阴极保护系统进行全面检查；

Conduct a comprehensive inspection of the motor, the cathodic protection system;

h. 清除拦污栅、吸入槽（池）等引水系统中的杂物、淤泥等。

Clear trash rack, suction slot (pool), and other debris and silt in the water diversion system.

第八章 故障排除 TROUBLE REMOVAL

故障原因类别	泵起不动	出力不足	打不出水	超负荷	异常振动和噪声	填料泄漏过量和温升高	处理方法
电动机系统毛病	●	●	●		●		检查电机系统
转动部件中有异物	●	●		●	●		清理转子部件
轴承损坏	●			●	●		更换轴承
起动条件不满足	●		●				满足应满足的条件
吸入侧有异物		●			●		清理滤网、叶轮和吸入喇叭口
叶片与叶轮室间隙过大		●					调整间隙
叶片损坏		●	●		●		更换叶片
转速低		●					测量电压、周波，检查电机
有空气吸入		●			●		提高吸入水位或在水面放一浮体
汽蚀		●			●		提高水位，调整工况
转向反了			●				校正转向
泵内有异物	●	●	●	●	●		除去异物
入口有反向预旋		●	●		●		设消旋装置
转动部件不平稳					●		检修
一相断线，单向运行				●			检查修理供电线路和电机接线
装配精度不高				●	●	●	提高装配精度
吸入水面过低		●			●		提高水位
轴弯曲				●	●		校直
联轴器螺栓松动损坏					●		拧紧或更换螺栓
基础不紧固					●		增加基础的刚性
排出管路的影响					●		检查和排除影响
填料压盖过紧或不均匀						●	放松压盖，正确压紧填料
填料磨损或装配不当						●	重装填料
轴磨损或偏位				●		●	换轴或校正

故障类别 Breakdown 原因 项目 Causes	泵起不动 Unable to start up	出力不足 No enough force	打不出水 No enough force	超负荷 Over load	异常振动和噪声 Abnormal vibration and noise	填料泄漏过量 和温升过高 Leakage in packing and temperature increasing	处理方法 Remedies
电动机系统 毛病 Motor system problems	•	•	•		•		检查电机系统 Overhaul the system
转动部件中 有异物 The materials in rotating nits	•	•		•	•		清理转子部件 Clean the rotor
轴承损坏 Bearing damage	•			•	•		更换轴承 Replace the old bearing
启动条件不 满足 Start-up conditions can't be satisfied	•		•				满足应满足的 条件 Satisfy the start-up conditions
吸入侧有异物 Something on the side of inlet		•			•		清理滤网、 叶轮和吸入喇 叭口 Clean filter net, suction bell, impeller
叶片与叶轮 室间隙过大 Distance between vane and impeller too big		•					调整间隙 Adjust the distance.
叶片损坏 Dama ge of impeller vane.		•	•		•		更换叶片 Replace the impeller vane
转速低 Rotation speed too low.		•					测量电压、周 波，检查电机 Measure the voltage, frequence, check the motor
有空气吸入 With air in.		•			•		提高吸入水位 或在水面放一 浮体 Increase the suction level or put a floating on the water
汽蚀 NPSH not suitable.		•			•		提高水位，调 整工况 Make the

							suction level higher. Adjust the operating point
转向反了 Incorrect rotation			•				校正转向 Correct the direction
泵内有异物 Sth. In pump	•	•	•	•	•		除去异物 Remove it.
入口有反向预旋 Unexpected rotation in inlet		•	•		•		设消旋装置 Set the remove turning device
转动部件不平衡 Unbalanced rotating units.					•		检修 Overhaul and adjust.
一相断线, 单向运行 One phase of motor broken				•			检查修理供电线路和电机接线 Overhaul the circuit and its panel
装配精度不高 Assembly accuracy not high enough.				•	•	•	提高装配精度 Higher it
吸入水面过低 Suction level too low		•			•		提高水位 Higher it
轴弯曲 Shaft twisted.				•	•		校直 Line up the shaft.
联轴器螺栓松动损坏 Coupling bolt/nut loosened.					•		拧紧或更换螺栓 Tighten or replace them.
基础不坚固 Basic rigidity not enough.					•		增加基础的刚性 Raise the rigidity.
排出管路的影响 Influence from discharge pipe					•		检查和排除影响 Eliminate the influence.
填料压盖过紧或不均匀 Gland too tightly or not even						•	放松压盖, 正确压紧填料 Loosen and properly tighten the gland.

填料磨损或装配不当 Packing abrasion or improper assembly.						•	重装填料 Replace or remove the packing.
轴磨损或偏位 Shaft abraded.				•		•	换轴或校正 Replace or revise the shaft.

第九章资料 附件清单 ATTACHMENT LIST

序号 NO	名 称 Description	数量 QTY	备注 Remark
斜流泵资料清单 Mixed flow pump item list			
附图 1 Figure a	性能曲线图 Performance chart	1 张 1 PC	
附图 2 Figure b	外形安装图 Installation diagram	1 张 1 PC	
附图 3 Figure c	总装图 General assembly drawing	1 张 1 PC	
附图 4 Figure d	冷却润滑水系统图 Cooling and lubricating water system diagram	1 套 1 set	
外购件资料清单 Outsourcing item list			
1	配套电机油、水管路布置图 Motor oil pipeline arrangement drawing	1 张 1 PC	
2	配套电机使用说明书 Motor installation and operation instruction	1 套 1 set	
3	外购仪器仪表、阀门说明书 Outsourcing instrument、valve operation instruction	1 份 1 PC	
安装检查记录 Installation inspection record			
附表 1	流道尺寸检查数据表	1 张	填写后返厂

	Flow pass dimensional inspection data sheet	1 PC	Return factory after filling in .
附表 2	泵安装垫板水平度检测数据表 Pump mounting plate levelness test data table	1 张 1 PC	
附表 3	泵支撑板水平度检测数据表 Pump supporting plate levelness test data table	1 张 1 PC	
附表 4	电机支座上法兰面水平度检测数据表 Motor support levelness test data table	2 张 2 PC	
附表 5	联轴器对中数据表 Coupling centering data sheet	3 张 3 PC	
附表 6	电机安装检测数据表 Motor installation and test data	3 张 3PC	

编制 Draw up	校对 Revision	审核 Examine and verify	批准 Approve

附表 1:

流道尺寸检查数据表

Flow pass dimensional inspection data sheet

泵型号 Pump type: _____
 泵编号 Pump No: _____ 日期 Date: ____年 Y__月 M__日 D

流道长度 Length of flow pass (mm)	流道宽度 (mm) Width of flow pass	泵中心至 后墙距离 The distance from pump center to backwall (mm)	泵中心至 前滤网距 离 The distance from pump center to former strainer	吸入水池水 流冲角 Inhalation pool flow attack angle	消涡斜面尺寸 Size of vortex slope (mm)

			(mm)					
A	W	B	Y	a°	L1	L2	H1	H2
安装责任人签字 Person in charge								
安装公司 Installing Company	监理单位 Supervision unit	水泵现场指导 Pump site instruction	电机现场指 导 Motor site instruction	业主代表 Employer's Representati ve				

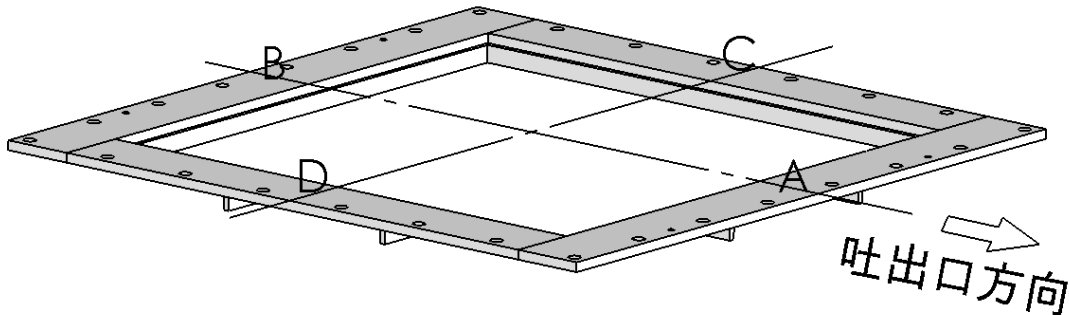
附表 2:

泵安装垫板水平度检测数据表

Pump mounting plate levelness test data table

泵型号 Pump type: _____

泵编号 Pump No: _____ 日期 Date: ____年 Y__月 M__日 D

					
位置 location 序号 No		A(mm/m)	B(mm/m)	C(mm/m)	D(mm/m)
1					
2					
最终值 Final value	灌 浆 Before grouting				
	灌 浆 After grouting				
安装责任人签字 Person in charge					
安装公司 Installing	监理单位 Supervision	水泵现场指导 Pump site	电机现场指导 Motor site	业主代表 Employer's	

印尼巴厘岛 3X142MW 燃煤电厂工程
plant
循环水泵安装使用手册
Manual

India Bali 3X142MW coal-fired power
Operation and Maintenance Instruction

Company	unit	instruction	instruction	Representative

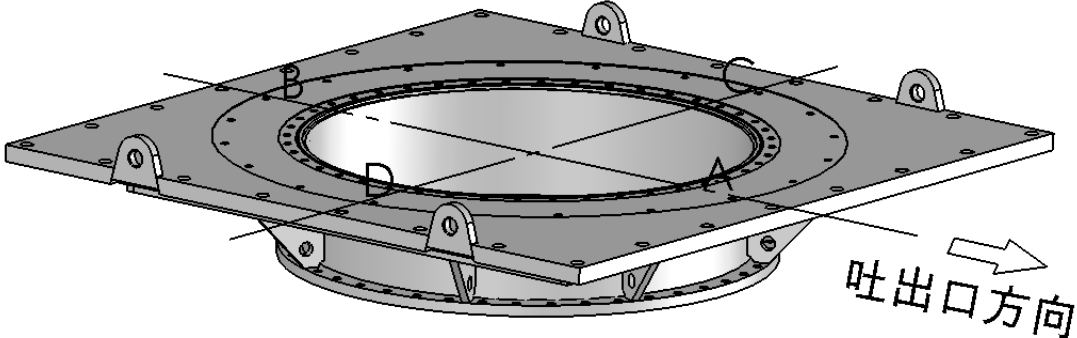
附表 3:

泵支撑板水平度检测数据表

Pump supporting plate levelness test data table

泵型号 Pump type: _____

泵编号 Pump No: _____ 日期 Date: ____年 Y__月 M__日 D



位置 location 序号 No	A(mm/m)	B(mm/m)	C(mm/m)	D(mm/m)
1				
2				
最终值 Final value				
安装责任人签字 Person in charge				
安装公司 Installing Company	安装公司 Installing Company	安装公司 Installing Company	安装公司 Installing Company	安装公司 Installing Company

印尼巴厘岛 3X142MW 燃煤电厂工程
plant
循环水泵安装使用手册
Manual

India Bali 3X142MW coal-fired power
Operation and Maintenance Instruction

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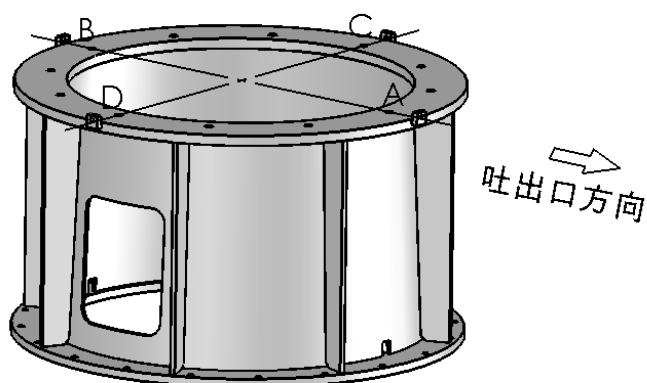
附表 4:

电机支座上法兰面水平度检测数据表

Motor support levelness test data table

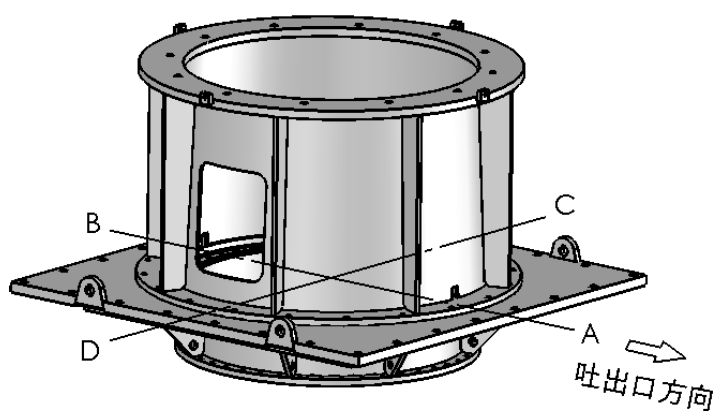
泵型号 Pump type: _____

泵编号 Pump No: _____ 日期 Date: ____年 Y__月 M__日 D



位置 location 序号 No	A(mm/m)	B(mm/m)	C(mm/m)	D(mm/m)
1				
2				
最终值 Final value				

垫铁所加位置分布(在下图中标出)
Location distribution of adding iron mat(marked in following drawing)



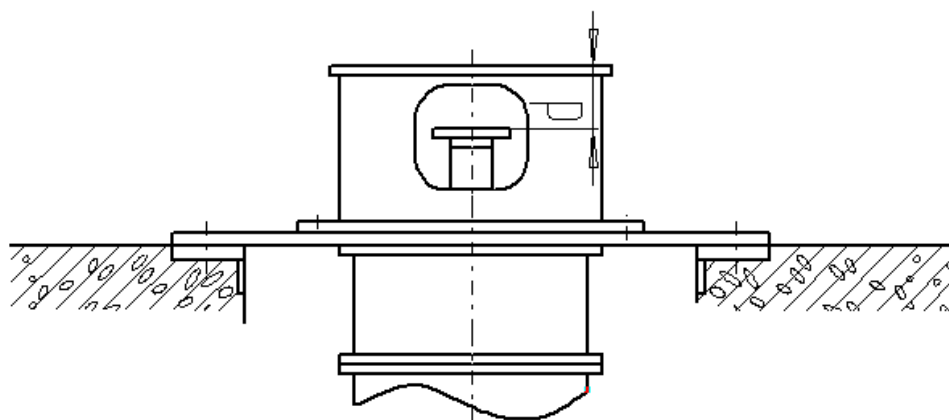
垫铁尺寸、数量、材质
Iron mat size、quantity、material

尺寸 Size				
数量 Quantity				
材质 Material				

泵吐出口与吐出管道联接时监控记录（变化值在±0.01mm/m） The monitoring record of pump outlet connect with discharge piping				
1				
2				

外部管道与伸缩节联接后张口 Gape of outer piping connect with expansion joint			
规定值 Specified value	<0.8mm	测量值 Measured value	

泵上轴端面至电机支架上法兰面的距离 d(mm)
The distance from pump upper shaft end face to motor support upper flange



规定值 Specified value		测量值 Measured value	
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安装责任人签字 Person in charge

安装公司 Installing Company	监理单位 Supervision unit	水泵现场指导 Pump site instruction	电机现场指导 Motor site instruction	业主代表 Employer's Representative

附表 5:

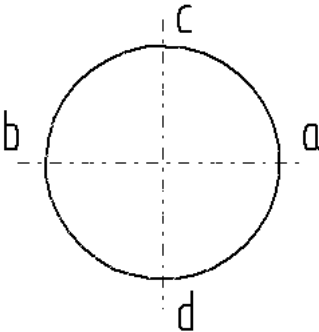
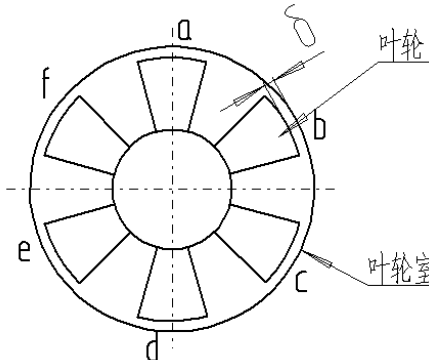
联轴器对中数据表

Coupling centering data sheet

泵型号 Pump type: _____

泵编号 Pump No: _____ 日期 Date: ____年 Y__月 M__日 D

1、确认泵轴置于中心位置后检测 4 个方向的间隙 (mm) Confirm pump shaft place in central position, then check the gap in 4 direction (mm)				
位置 Location	A	B	C	D
间隙 Gap				
2、叶轮室与喇叭口配合锥面接触面积 Impeller house and suction bell mating cone contact area				
规定 Provision	用 0.05mm 塞尺 8 个方向通不过 Use 0.05mm feeler gauge can not get through in 8 direction		实际 Actual	
3、两对轮对中偏差 (mm) Two coupling centering deviation				

						
位置 Location	a	b	c	D		
初步值 Provisional value						
最终值 Final value						
4、测量叶轮与叶轮室间间隙（仅限开式叶轮），要求各方间隙值要趋于均等，最大值与最小值之差不大于设计值的 20% (设计间隙_____mm)。 Measure the clearance between the impeller and the impeller house (only open impeller),demand each side gap value tend to be equal, the difference of maximum and the minimum value not more than 20% of the design value (design gap_____mm)						
						
位置 Location	a	b	c	d	e	f

提 升 高 度 hoisting height						
h1						
h2						
安装责任人签字 Person in charge						
安装公司 Installing Company	监理单位 Supervision unit	水泵现场指导 Pump site instruction	电机现场指导 Motor site instruction	业主代表 Employer's Representative		

附表 6:

电机安装检测数据表

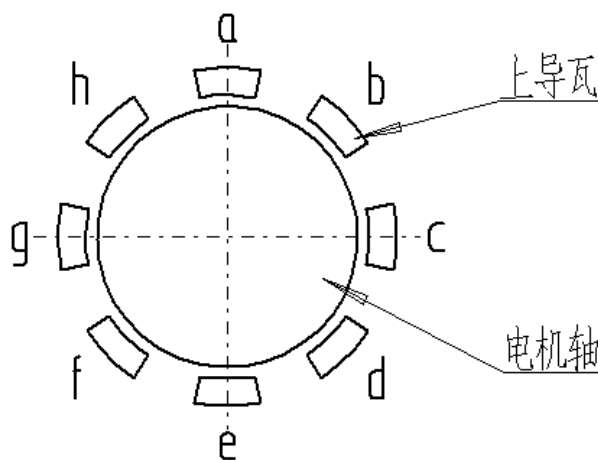
Motor installation and test data

泵型号 Pump type: _____

泵编号 Pump No: _____ 日期 Date: ____年 Y__月 M__日 D

1、测量电机上导瓦油隙 (mm)

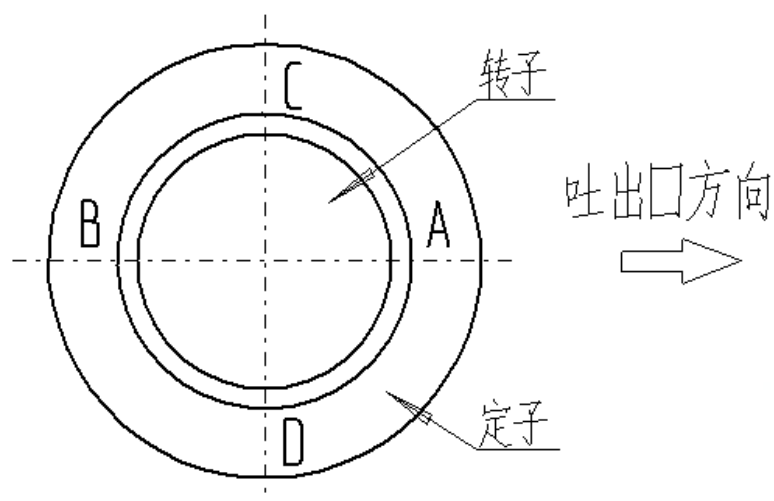
Check guide shoe oil clearance of motor



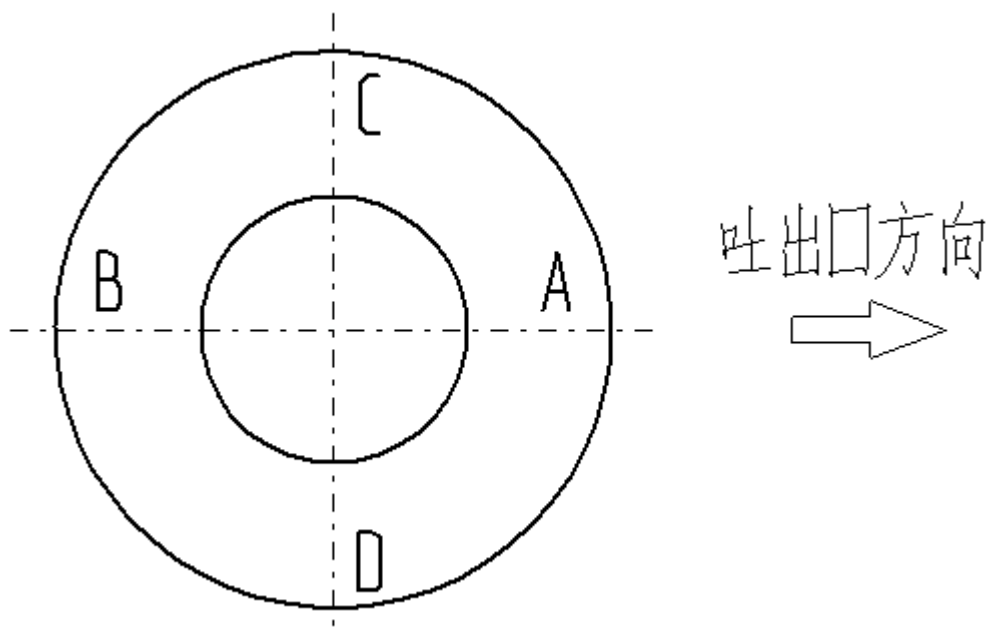
导瓦 Guide shoe	a	b	c	d	e	f	g	h
油隙 Oil clearance								

2、测量电机转子与定子间气隙 (mm)

Measure the air gap between rotor and stator



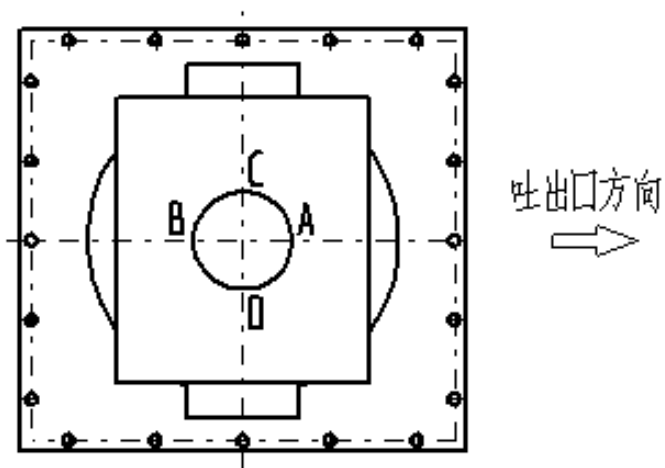
测量位置 Location	A	B	C	D
上气隙 Upper air gap				
下气隙 Lower air gap				
3、测量推力头同轴度 (mm) Measure the thrust collar axiality				



测量位置 Location	A	B	C	D
同轴度 Axiality				

4、测量电机水平度 (mm/m)

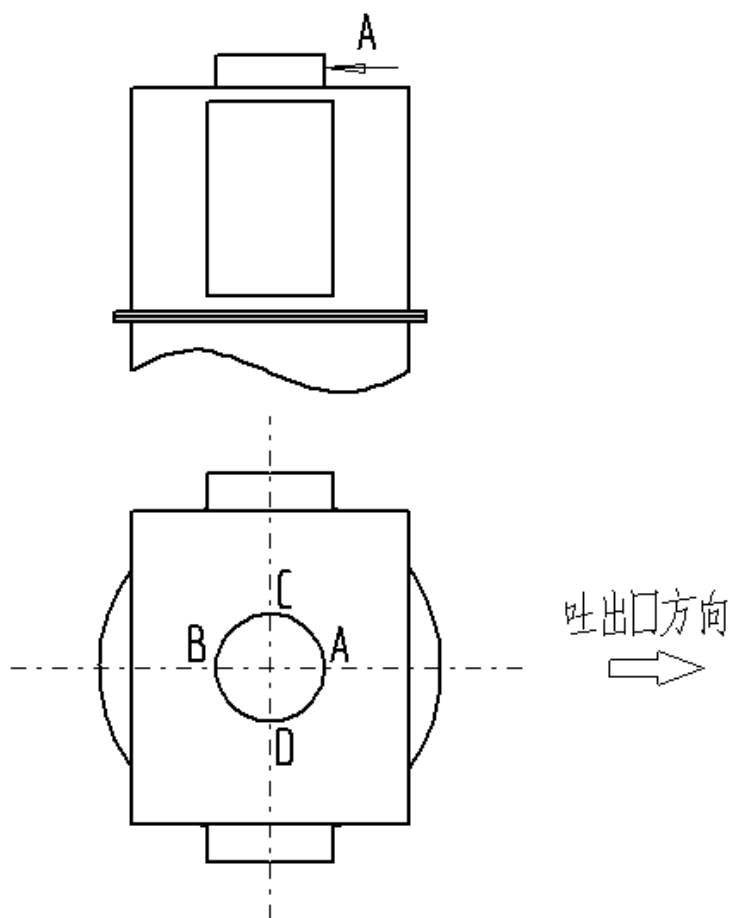
Measure the motor levelness



	A	B	C	D
1				
2				

5、每小时测量一次电动机空载运转振动值 (mm)

Measure the motor no-load running vibration once an hour



	A	B	C	D
1				
2				
3				
4				

安装责任人签字 Person in charge

安装公司 Installing Company	监理单位 Supervision unit	水泵现场指导 Pump site instruction	电机现场指导 Motor site instruction	业主代表 Employer's Representative
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印尼巴厘岛 3X142MW 燃煤电厂工程
plant
循环水泵安装使用手册
Manual

India Bali 3X142MW coal-fired power
Operation and Maintenance Instruction

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