



—— 拓品质 传天下 ——

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南通荣恒环保设备有限公司
Nantong Rongheng Environmental Equipment Co., Ltd



- 高效HIGH-EFFICIENCY • 节能ENERGY-SAVING
- 低噪音LOW-NOISE • 无振动NO-VIBRATION



罗茨鼓风机/罗茨真空泵
ROOTS BLOWER
ROOTS VACUUM PUMP

使用说明书

OPERATING INSTRUCTION MANUAL

南通荣恒环保设备有限公司
Nantong Rongheng Environmental Equipment Co., Ltd

感谢您使用

“荣恒”牌罗茨鼓风机/罗茨真空泵

Thank you for choosing

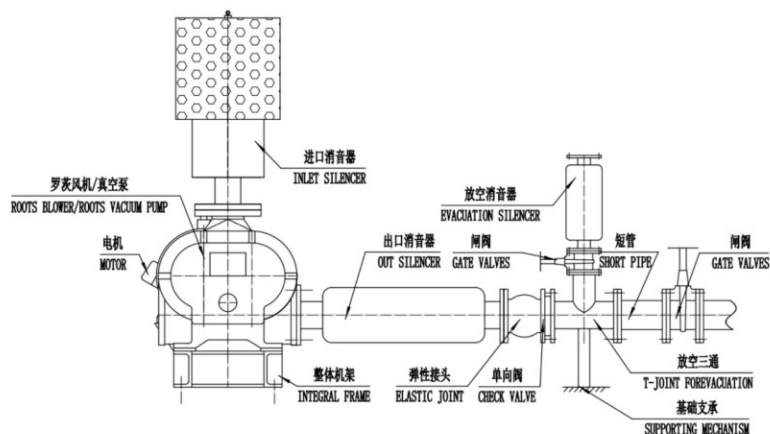
“RONGHENG” Roots Blower/Roots
Vacuum Pump

3 配管参考图

3 Pipeline connection diagram

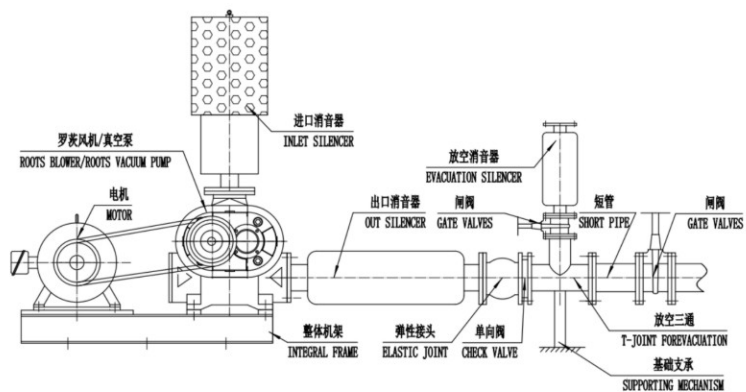
3.1 直联传动

3.1 Direct connection transmission



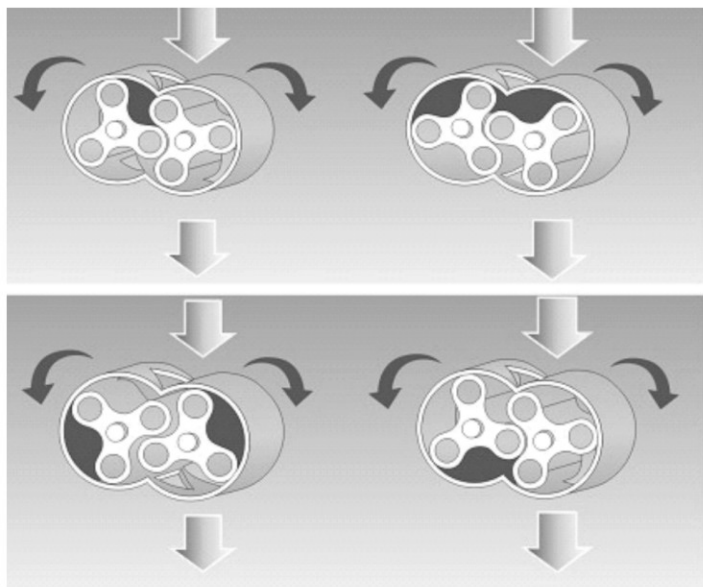
3.2 皮带传动

3.2 Belt transmission



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前言
Introduction

图(1) Figure (1)

1.1 工作原理:

1.1 Working principle:

三叶型罗茨鼓风机/罗茨真空泵（以下简称风机）通过一对相互啮合的叶轮在腔体内旋转，完成吸气排气动作，属于容积回转式风机，具有强制输出的恒转矩特性。其压力随系统压力改变而自动改变，具有极强的适应能力和优越的气力学特征。

Clover Roots blower/The roots vacuum pump (hereinafter referred to as draught fan), completing suction and exhaust action through a pair of inter-meshing impellers rotating in the cavity, belongs to volume rotary draught fan, with characteristic of forced output constant torque. Its pressure changes automatically with the change of system pressure, which has strong adaptability and superior pneumatic characteristics.

但是传统二叶型罗茨鼓风机在实际工作中存在噪声大、能耗高等一系列问题，于是三叶型罗茨鼓风机应运而生。三叶型罗茨风机因在工作过程中，多了一次吸排气和压缩过程，其压力脉动小，工作平稳，噪声明显下降。

However, there are a series of problems in the practical work of the traditional two-blade Roots fan, such as high noise and high energy consumption so that So Clover Roots blower emerges as the times require. In the practical work, an exhaust and compression process is added in Clover Roots blower with small pressure fluctuation, stable work as well as obviously decreased noise.

1.2 产品特点:

1.2 Product features:

我公司在原有成功机型的基础上，采用国际先进的设计技术，自主开发了新型CONCH叶轮型线，实现了三叶型罗茨风机实际容积效率超过二叶型罗茨鼓风机的目标，同时保持了风机在工作过程中的平稳啮合(叶轮啮合不平稳度理论上小于0.01mm)，实现了风机噪声、流量、容积效率的完美平衡。

On the basis of the original successful model, adopting the international advanced design technology, we company developed a new type of CONCH impeller profile independently and realize the target that actual volume efficiency of Clover Roots blower exceeds that of two-blade Roots fan. At the same time, the smooth meshing of draught fan in the working process is maintained (the meshing instability of the impeller is theoretically smaller than 0.01mm) and the perfect balance of noise, flow rate and volume efficiency of draught fan is realized.

产品采用全新的设计理念，零部件类型缩减了30%，零部件外观精简干练，实际强度大幅提升，实现了更为优化的零部件通用性、可维护性。

For adopting the new design concept, the type of component is reduced by 30%. Its appearance of the parts is concise and capable and the actual strength is greatly improved, realizing more optimized universal property and maintainability of parts and components.

本系列风机分为S、F两种构型：S型（双油箱构型）注重高性能、多功能于一体，F型（单油箱构型）注重结构简练、维护便捷。

This series of draught fan is divided into two configurations: the S type (double tank configuration) pays attention to high performance and integrates multi-functions. Type F (single tank configuration) pays attention to structural simplicity and convenient maintenance.

产品结构见章节2.1，维护保养详见章节3.1。

The product structure is shown in Section 2.1. For details of maintenance, see Section 3.1.

1.3 应用:

1.3 Application

本产品作为通用机械广泛应用于气力输送、污水处理、烟尘脱硫、物料输送、易燃易爆气体输送、重油喷燃、高炉冶炼、水产养殖、农药化工、甲醛合成、造纸等领域。

As a general machinery, this product is widely used in pneumatic transportation, sewage disposal, soot desulphurization, material transportation, transportation of flammable and explosive gas, heavy oil burning spray, blast furnace smelting, aquaculture, pesticide chemical industry, formaldehyde synthesis, papermaking and other fields.

本产品以输送清洁空气、清洁煤气、二氧化硫及其他惰性气体为主。当输送煤气、沼气、二氧化硫等易燃易爆易腐气体时，须在订货前与本公司及时联系，便于我公司对风机做优化选型；当输送二氧化碳、氢气、氦气等摩尔数与空气差距较大的气体，或工作地区地处高原时，须进行流量、能耗换算，以便合理选型。

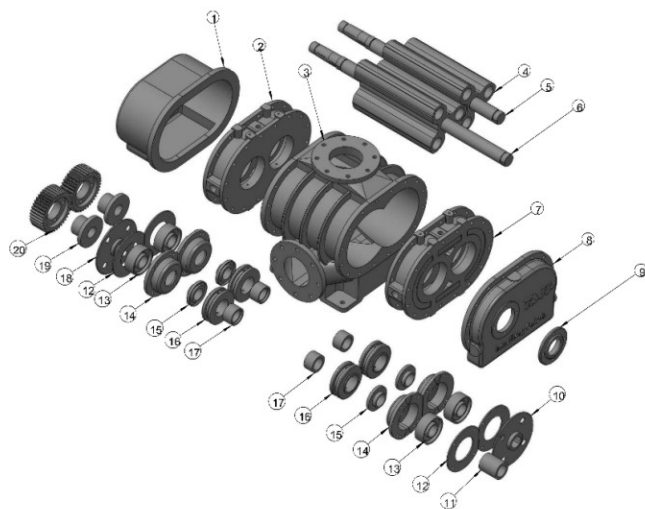
This product is mainly to transport clean air, clean gas, sulfur dioxide and other noble gases. When transporting flammable, explosive and perishable gases such as coal gas, biogas, and sulfur dioxide.etc., please contact us before ordering so that it is convenient for our company to optimize the selection of draught fan; When transporting gases such as carbon dioxide, hydrogen and Helium, which are different from the air in moles, or when the work area is on the plateau, matrixing of flow and energy consumption is needed for selecting a reasonable type.

2 产品结构

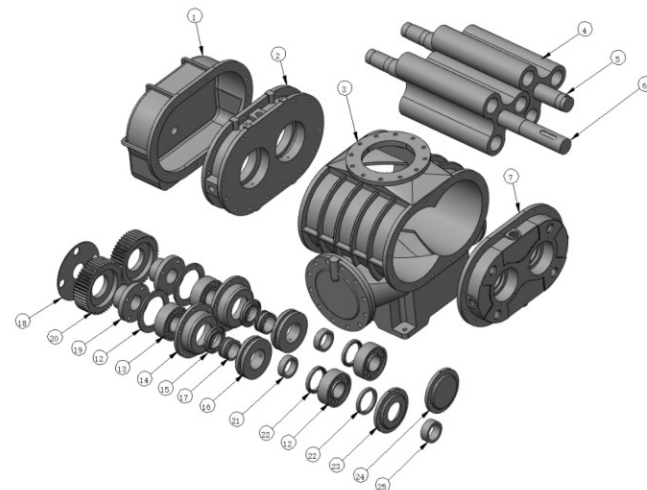
2 Product structure

2.1结构图（如下图），本系列产品气流走向为上进下出。

2.1 Structure diagram(see figure below), the airflow trend of this series of products is over-entering and down-out.



S型结构 S-type structure



F型机构 F-type mechanism

图（2）Figure (2)

部件表Component List

序号	名 称	数量	序号	名 称	数量
1	主油箱	1	14	轴承座	2+2
2	主墙板	1	15	抛油轴套	2+2
3	机壳	1	16	密封外圈	2+2
4	叶轮/转子	2	17	密封内圈	2+2
5	从动轴	1	18	主甩油盘	1
6	主动轴	1	19	齿轮毂	2
7	副墙板	1	20	齿轮	2
8	副油箱	1	21	副墙板内油封轴套	2
9	油封盖	1	22	骨架油封	3
10	副甩油盘	1	23	轴承通盖	1
11	油封轴套	1	24	轴承闷盖	1
12	轴承压圈	2+2	25	副墙板油封轴套	1
13	轴承	2+2			

No.	Name	QUANTITY	No.	Name	QUANTITY
1	Main tank	1	14	Bearing block	2+2
2	Primary wallboard	1	15	Oil slinger axle housing	2+2
3	Casing	1	16	Sealed outer ring	2+2
4	Impeller / rotor	2	17	Sealing inner ring	2+2
5	Driven shaft	1	18	Primary oil flinger	1
6	Capstan shaft	1	19	Gear hub	2
7	Secondary wallboard	1	20	Gear	2
8	Secondary tank	1	21	Grease seal axle housing inside the auxiliary wall board	2
9	Oil seal cover	1	22	Skeleton oil seal	3
10	Secondary oil thrower	1	23	Bearing cover	1
11	Oil seal shaft sleeve axle housing	1	24	Bearing core lid	1
12	Bearing clamping ring	2+2	25	Grease seal axle housing of secondary wallboard	1
13	Bearing	2+2			

表(1) Table (1)

2.2 概述

2.2 Overview

2.2.1.序号3机壳,采用HT250、304L、316L等材质,经回火、时效处理。

2.2.1.Sequence No.3 casing is made of HT250, 304L, 316L and other materials after tempering and aging treatment.

2.2.2.序号2、7主副墙板,采用HT250、304L、316L等材质,经回火、时效处理。主副墙板与机壳组成机体,采用圆锥销定位,共同形成气室。

2.2.2.Sequence No.2, 7 primary and secondary wallboard are made of HT250, 304L, 316L and other materials after tempering and aging treatment. The body is constituted by primary and secondary wallboard and casing and the taper pin location is used to form the gas chamber together.

2.2.3.序号4叶轮采用HT250、304L、316L等材质,序号5、6主/从动轴采用40Cr材质,利用液压系统压紧为一体。

2.2.3.Sequence No.4 impeller are made of HT250, 304L, 316L and other materials. Sequence No.5, 6 principal axis is made of 40Cr, adopting hydraulic system compression as one.

2.2.4.序号20同步齿轮,采用20CrMnTi材质,精滚、高频淬火后再经磨齿制成。

2.2.4.Sequence No.20 synchromesh gear is made of 20CrMnTi; through precision hobbing, high frequency hardening and gear grinding.

2.2.5.序号13轴承,根据定位端、自由端的不同,分别采用双列向心球轴承、单列圆柱滚子轴承,可实现对叶轮组件的精确定位,同时又兼顾热膨胀自由延伸。

2.2.5.Sequence No.13 bearing, depending on various location end and free end, adopts double row concentric ball bearing and single row cylindrical roller bearing, respectively. The accurate location of impeller assembly can be realized, and the free extension of thermal expansion can be taken into account at the same time.

2.2.6.序号16、17密封组件,默认采用活塞环密封,可根据客户需求,定制不同密封形式及材质。

2.2.6.Sequence No.16, 17 seal assembly gives tacit consent to seal with piston ring. Different sealing forms and materials can be customized according to customer needs.

2.3 润滑

2.3 Lubricating

2.3.1.加油方式为,打开序号1主油箱、序号8副油箱上下的加油塞及放油塞,放空失效的润滑油,之后先锁紧下端的放油塞,从油箱上端的加油孔,加入220#齿轮油至油位镜中心线上方1~3mm处,锁紧加油塞即可。

2.3.1The way to refuel is to open the primary tank of Sequence No. 1, fuel plug and discharge plug of secondary tank of Sequence No.8 to empty invalid lubricating oil, and then lock the drain plug at the lower end, refuse 220 # gear oil to 1~3mm above the center line of the oil level mirror from the filling hole at the top of the tank.

2.3.2.加脂方式为,打开序号23轴承通盖、24轴承闷盖(部分型号在序号7副端墙板)上方的加油塞及23轴承通盖、24轴承闷盖下方的放油塞,用黄油枪加注指定润滑脂(德国福斯RENOLITLX-TAC2万能脂),直至下部放油口溢出新油即可,锁紧加油塞及放油塞。

2.3.2.The way of fatliquoring is to open fuel plug at the top of Sequence No.23 bearing cover and 24 bearing core lid (part of the model is in the Sequence No.7 sub-end wallboard) and the drain plug under 23 bearing cover, 24bearing core lid, to refuse a specified grease with a butter gun(RENOLITLX-TAC2 universal fat, Foss, Germany), until the lower oil drain port overflows the new oil, and to lock the refueling plug and drain plug.

2.4 冷却

2.4 Cooling

2.4.1.在风压小于68.6kPa时,无需水冷却装置

2.4.1.When the wind pressure is less than 68.6kPa, there is no need for water cooling device.

2.4.2.在风压大于等于68.6kPa时,须采用水冷却装置,或采用我公司的专利产品:循环水冷却系统,该系统能有效降低运行成本及产品发热等现象。

2.4.2.When the wind pressure is greater than or equal to 68.6kPa, a water cooling device

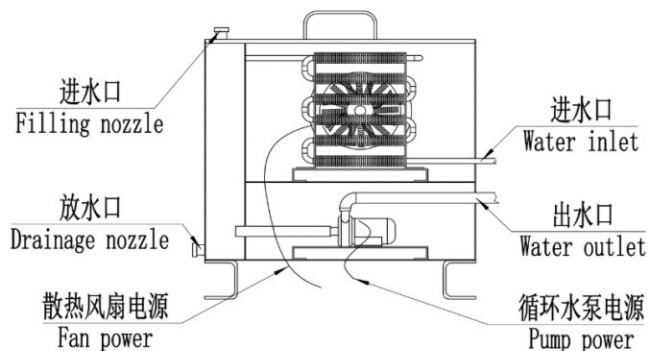
shall be used, or our patented products shall be adopted: Circulating water cooling system can effectively reduce the operating cost and product heating.

2.4.3. 水冷型风机在室温低于0℃以下时：如采用自来水冷却，停车之后必须放空机体内部自来水；如采用循环冷却系统冷却，须加注对应牌号冷却液。否则，由此导致产品机体开裂，或产品故障，我公司不承担责任。

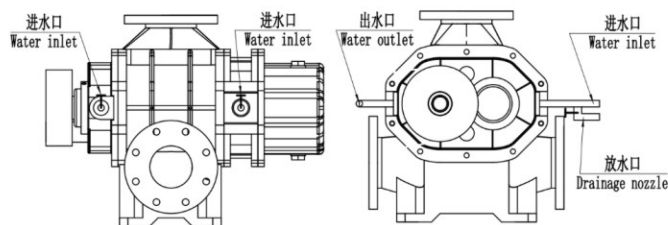
2.4.3. When the water-cooled draught fan is in room temperature below 0 °C: if tap water is used to cool down, the internal running water of the body must be emptied after parking; If the circulating cooling system is used for cooling, the corresponding coolant should be refused. Otherwise, our company will not be responsible for the cracking of the product body, or the failure of the product that caused by above factors.

2.4.4 水冷型风机接管图

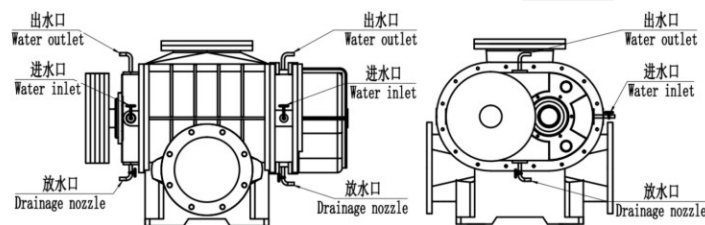
2.4.4 The takeover chart of water-cooled roots blower



(1) 循环冷却系统 Circulating cooling system



(2) 适用于RH10032、RH12533、RH30072、RH35073
Apply to RH10032、RH12533、RH30072、RH35073



(3) 适用于RH10041~RH30064
Apply to RH10041~RH30064

2.5 安装

2.5 Installation

本产品安装可参阅一般机械设备安装规范，同时需另外注意以下各点：

This installation of product can be referred to the installation specification of general mechanical equipment. At the same time, it needs to pay attention to the following points:

2.5.1. 风机地脚螺栓孔采用二次灌浆法。

2.5.1. The foundation bolt hole of draught fan adopts back-grouting.

2.5.2. 机组安装的基础表面应当平整。根据维护保养需求，基础四面当留有50cm的空余位置。

2.5.2. The foundation surface of unit installation should be smooth. According to maintenance requirements, the foundation should be left with 50cm spare position on four sides.

2.5.3. 安装时，首先检查机体内部，确认无杂物，清除管道内的铁屑焊渣；然后风机与管道连通，同时保证各法兰结合面无泄漏。

2.5.3. When installing, first check the interior of the body to make sure there is no sundries, to remove iron crumbs from the pipe, and then connect with draught fan. At the same time, the flange joint surface need to guarantee to be free of leakage.

2.5.4. 当输送空气介质含尘量超过100mg/m³时，建议订购空气滤清器(进风口消音器用)。

2.5.4. When the dust content of the conveying air medium exceeds 100mg/m³, it is recommended to order air filters (imported silencers).

2.5.5. 消音器应当优先安装在风机的进风口，以实现最大程度的消音效果。

2.5.5. The muffler should be installed at the inlet and outlet of draught fan as a matter of priority in order to achieve maximum silencing effect.

2.5.6. 在靠近风机进风口的直管路上应装置压力仪表，当风机处于超负荷时，仪表应能反映出超压状态。

2.5.6. Pressure meters should be installed on the straight pipe road near air outlets and inlets of the draught fan. When the draught fan is overloaded, the instrument should be able to reflect the overvoltage state.

2.5.7. 为保障风机安全运行，机体本身不得承载除进风口消音器以外的任何：管道、阀门、框架等外加载荷；进风口消音器亦不得承载外加载荷。

2.5.7. In order to ensure the safe operation of draught fan, the body itself shall not bear any external loads : pipes, valves, frames, etc. other than the silencer at air intake ; The inlet and outlet silencers shall not bear the external load.

2.5.8. 安装时，必须找正风机和电机的正确位置，允许底座与基础平面采用调整垫铁来进行水平调整，允许误差不大于0.2/1000mm。

2.5.8. When installing, you must correct the correct position of the draught fan and the motor. The base and the foundation plane are allowed to be adjusted horizontally by means of adjusting parallels and the allowable error is not more than 0.2/1000 mm.

2.5.9. 安装时，严禁破坏风机的装配间隙，安装后盘动风机转子应转动灵活，无撞击和摩擦现象。

2.5.9. During installation, it is strictly forbidden to destroy the assembly gap of draught fan. After installation, the draught fan rotor should rotate flexibly without impact and friction.

2.5.10. 风机出风管道必须安装单向阀（两台以上风机并联使用时，如无单向阀可能造成重大毁机事故）。

2.5.10. The air outlet pipe of the draught fan must be fitted with non-return valve (when more than two draught fan are used in parallel, if there is no non-return valve, it may cause major damage to the machine.)

2.5.11. 单向阀须安装在水平管道上，垂直于管道方向。

2.5.11. The non-return valve shall be installed on the horizontal pipe perpendicular to the direction of the pipe.

2.6 使用

2.6 Operation instructions

2.6.1 使用要求

2.6.1 Operating requirement

a. 进口气体温度一般不超过40℃，如若超过此温度，须与我司联系。

a. Generally, the imported gas temperature does not exceed 40 °C. Contact us if the temperature exceeds this temperature.

b. 气体中固体微粒含量不大于100mg/m³，微粒最大尺寸根据不同机型，不超过表(2)所示。

b. The content of solid particles in the gas is not more than 100mg / m³. The maximum size of the particles, based on the different models, not exceeds the table (2).

风机型号 Model of roots blower	最大微粒直径 Maximum particle diameter	风机型号 Model of roots blower	最大微粒直径 Maximum particle diameter
1#	0.04mm	5#	0.10mm
2#	0.05mm	6#	0.12mm
3#	0.06mm	7#	0.15mm
4#	0.08mm		

表(2) Table (2)

c. 煤气的含煤焦油指标应符合TJ28-78城市煤气设计规范的规定。

c. The coal tar containing index of coal gas should conform to TJ28-78 code for design of urban gas.

d. 轴承温度最高不超过95℃。

d. The bearing temperature shall not exceed 95℃.

e. 风机上的压力表所示压力不得超过铭牌所规定的升压范围，否则必须停车检查系统中的进排气口是否堵塞，进排气口阀门是否完全开启等，并采取相应措施。

e. The pressure shown by the pressure gauge on the draught fan shall not exceed the pressure range specified by the nameplate. Otherwise, it must be stopped to check whether the intake and exhaust ports of the system are clogged, whether the inlet and exhaust valves are fully opened, and so on. And corresponding measures should be taken.

2.6.2 风机启动前的准备工作

2.6.2 Preparation before the start of draught fan

a. 检查各紧固件及定位销等安装质量。

a. Check the installation quality of fasteners and positioning pins.

b. 检查进、排气管道和阀门等安装质量。

b. Check the installation quality of intake and exhaust pipes and valves.

c. 检查风机的装配间隙是否符合要求。

c. Check whether the assembly clearance of the draught fan meets the requirements.

d. 检查风机和电机的同轴度，风机主动轴与电机轴的同轴度误差不得超过0.1mm，否则会导致风机振动、漏油等现象，影响风机使用寿命；检查风机带轮和电机带轮的平行度，误差不得超过0.2mm。

d. Check the coaxiality of the roots blower and the motor. The coaxiality error of the roots blower capstan shaft and the motor shaft shall not exceed 0.1mm, or it will lead to vibration of roots blower and oil leakage and affects the life length of roots blower. Check the parallelism of roots blower pulley and motor pulley, the error should not exceed 0.2mm.

e. 检查机组底座四周是否全部垫实，地脚螺栓是否紧固。

e. Check if all the pads around the base of the unit are solid and the anchor bolts are fastened.

- f. 风机在投入运行前须检查主、副油箱油位，是否在油位镜中心向上1-3mm。
f. Before it comes into operation, oil level of primary and secondary fuel should be checked. It should be 1-3 mm upward in the center of the oil level mirror.
- g. 由于主、副油箱存在压力，故主、副油箱的加、放油塞均应拧紧，否则会引起漏油。
g. Because of the pressure in the primary and secondary fuel tanks, the oil filler plug and drain plug of primary and secondary fuel tanks should be tightened. Otherwise, it will cause an oil leak.
- h. 如有冷却机构，须打开冷却系统，循环水冷系统须注入防冻冷却液。
h. If there is a cooling mechanism, the cooling system shall be turned on. The circulating water cooling system shall be injected with antifreeze coolant.
- i. 全部打开风机进排气口阀门，盘动转子，注意倾听各部分有无不正常的杂声。
i. Open all inlet and exhaust valve of the draught fan, rotate the rotor, and pay attention to the abnormal noise of all parts.
- j. 检查电动机转向，必须符合转向标牌所示方向，否则风机不能正常排风，还可能出现风叶碰撞现象，曝气时，水将反向流入风机；气力输送时，会将被输送物吸入风机，造成事故。
j. Check the steering of the motor and it must conform to the direction indicated by the steering sign. Otherwise, draughtfan cannot be discharged normally. There may also be wind blade collision. When aerated, water will flow backwards into draught fan; When pneumatic conveying, the conveying material will be inhaled into the draught fan, to cause an accident.

2.6.3 风机空负荷试运转

2.6.3 Vacant load test run of draught fan

- a. 新安装或大修后的风机都应经过空负荷试运转。
a. Newly installed or overhauled draught fan should go through vacant load test run.
- b. 风机空负荷试运转：在进排气口阀门全部打开，直通大气的条件下投入运转。
b. Vacant load test run of draught fan: Bring it into operation under the condition that the inlet and outlet valves are all opened straightly through the atmosphere.
- c. 试运转时应注意观察润滑油的飞溅情况是否正常，如过多或过少则应调节油量。
c. During test run, attention should be paid to whether the spatter of lubricating oil is normal or not. If there is too much or too little, the amount of oil should be adjusted.
- d. 没有不正常的气味或冒烟现象，没有碰撞或摩擦声。
d. There is no abnormal smell or smoke, no collision or friction.
- e. 空负荷运行30分钟左右，如情况正常即投入带负荷运转。
e. Test run for about 30 minutes, if the situation is normal, put into load operation.

2.6.4 风机正常带负荷运转

2.6.4 Normal load operation of draught fan

- a. 按要求逐步缓慢地调节，带上负荷，直到额定负荷。不允许一次即调至额定负荷。
a. Adjust gradually and slowly as required, with load until rated load. It is not allowed to be adjusted to rated load at one time.

- b. 所谓额定负荷系指铭牌所示的进排气口之间的静压差。在排气口压力正常的情况下，必须注意进气口的压力变化，以免超负荷。
b. The so-called rated load refers to the static pressure difference between the intake and exhaust ports shown in the nameplate. In the case of normal exhaust pressure, attention must be paid to the pressure change of the intake port to avoid overload.
- c. 由于风机的特性，不允许将排气口的气体长时间地直接接回风机的进气口，否则会导致进气温度超标，将影响风机的安全。
c. Because of the characteristics of roots blower, gas from the exhaust port is not allowed to be connected directly to the roots blower inlet for a long time, which may cause the intake temperature to exceed the standard, which will affect the security of roots blower.
- d. 风机正常工作中，严禁完全关闭排气口阀门，严禁超负荷运行。
d. In the normal work of draught fan, it is strictly forbidden to completely close the exhaust valve. And overload operation is strictly forbidden.

- e. 风机在额定工况下运行时各滚动轴承的表面温度一般不超过95℃。
e. Generally, when roots blower is running under rated conditions, the surface temperature of each rolling bearing does not exceed 95℃.

- f. 注意润滑油的飞溅情况及油量位置，若油位低于油位镜中心线，必须及时加油至要求位置。
f. Pay attention to the splashing of lubricating oil and the position of oil quantity. If the oil level is lower than the center line of the oil level mirror, it must be refueled to the required position in time.

- g. 皮带传动风机需注意皮带张紧度，新风机出厂时已调整好，开机24小时再张紧一次，以后定期张紧以保证风机正常运行。
g. Pay attention to belt tension of belt drive draught fan which has been adjusted when it leaves the factory. Tighten again after starting 24 hours, and then tighten regularly to ensure the normal operation of draught fan.

- h. 更换三角带时，应将全套皮带同时更换，且带型、规格、批次要统一，皮带安装时，要注意两带轮平行，切勿使用工具强行挂入，应用张紧装置张紧。
h. When replacing the triangle belt, the whole belt should be replaced at the same time and the belt type, specification and batch shall be unified. When installing the belt, please pay attention to the parallelism of the two pulleys. Do not use tools to force them in, instead, tensioning it with tightener.

2.6.5 停车

2.6.5 Stop

- 风机不宜在满负荷情况下突然停车，需逐步卸负荷后再停车，以免损坏风机，关于紧急停车原则，用户可自行拟订细则明确之。

The draught fan is not suitable for a sudden stop at full load. It is necessary to stop after gradually unloading the load so as not to damage the draught fan. With regard to the principle of emergency stop, users can draw up their own detailed rules.

2.7 维护和检修

2.7 Maintenance, examination and repair

风机的安全运行及使用寿命，取决于日常维护和保养，除了需注意一般性的维修规程外，还须着重注意以下各点：

The safe operation and service life of draught fan depends on daily maintenance examination and repair. In addition to the general maintenance procedures, attention should also be paid to the followings:

2.7.1.检查各部位的紧固情况及定位销是否松动，如有松动应紧固之。

2.7.1.Check the fastening of each part and whether the positioning pin is loose. If there is loosening, it should be fastened.

2.7.2.风机机内有无渗水渗油现象。

2.7.2.There is no water and oil seepage phenomenon in draught fan.

2.7.3.定期清除风机机体内部结垢，保证风机叶轮转动灵活。

2.7.3.Regularly removing draught fan block internal scaling to ensure flexible rotation of draught fan impeller.

2.7.4.注意润滑油冷却情况是否正常，注意润滑油的质量，经常倾听风机运行有无声，注意机组是否在不符合规定工况下工作。

2.7.4.Pay attention to whether the cooling condition of the lubricating oil is normal, pay attention to the quality of lubricating oil and whether there is noise when draught fan running. Pay attention to whether the unit works under conditions that do not meet the requirements.

2.7.5.风机的超载有时不是立刻显示出来的，要经常注意进排气压力、轴承温度和电机电流的变化，借以判断风机是否正常。

2.7.5.The overload of draught fan is sometimes not immediately displayed. Attention should be paid to the changes of intake and exhaust pressure, bearing temperature and motor current so as to determine whether the draught fan is normal or not.

2.7.6.拆卸风机时应应对风机各配合尺寸进行测量，作好记录，并在零部件上作好标记，以保证装配且能保持原来的配合要求。

2.7.6.When removing draught fan, the matching dimensions of draught fan should be measured. Record it and mark on parts to ensure assembly and maintain the original requirements.

2.7.7.新风机或大修后的风机，按使用步骤投入运行，运行8小时后更换全部润滑油脂。

2.7.7. The new draught fan or overhauled draught fan, is put into operation according to the steps of use. It is recommended to replace all lubricating grease after running for 8 hours.

2.7.8.在正常情况下，风机工作1000小时以后更换润滑油脂，4000小时以后小修或检查一次，每年大修一次并更换骨架油封。机组日常维护按表（3）进行。

2.7.8.Under normal circumstances, change lubricating grease for draught fan after it working for 1000 hours, a minor repair or inspection after 4000 hours, overhaul and replace the skeleton seal ring once a year. Daily maintenance of the unit is carried out according to table (3).

项目	保养频率	每次开车	每天	每三个月	每年	备 注
取出管路中的异物	○					
拧紧接头	○			○		风机、管路等
检查阀门的运行情况	○					
检查电路	○			○		
检查油箱内的油量	○	○				加油至油位镜中心向上1-3mm
检查油的渗漏	○	○				
检查风机的旋转方向	○					转向标牌所示方向
检查压力	○	○				
检查电流和电压	○	○				
噪 声	○	○				
振 动	○	○				
温 度	○	○				压缩空气、风机、电机
齿轮和轴承运转的平稳性	○	○				
清洁吸入消音器的异物						

表(3)

Item	Maintenance Frequency	At every driving	Daily	Every three Months	Every year	Note
Remove foreign bodies from the pipeline	○					
Tighten the connector	○			○		Draught fan, pipeline.etc.
Check the operation of the valve	○					
check the power circuit	○			○		
Check the amount of oil in the tank	○	○				Refuse to 1-3mm above oil level mirror center
Check the leakage of oil	○	○				
Check the rotation direction of the draught fan	○					The direction indicated by the sign
Check pressure force	○	○				
Check current and voltage	○	○				
Noise	○	○				
Vibration	○	○				
Temperature	○	○				Compressed air, draught fan, electric motor
Stability of Gear and bearing Operation	○	○				
Clean foreign bodies in inhaled silencers						

Table (3)

2.8 故障和排除 2.8 Trouble shooting

风机发生的故障和原因，涉及使用条件和运行工况等复杂因素，很难以简单的文字来阐明其原因和排除法，需根据实际情况予以分析后排除，表4所提供的“故障和排除”，仅属一般常规性故障及排除法。

Since the faults and causes of draught fan involve complex factors such as service conditions and operating conditions, it is difficult to explain the reasons and troubleshooting methods in simple words. It needs to be analyzed and excluded in the light of the actual situation. The "failure and troubleshooting" provided in Table 4 is only a general routine fault and troubleshooting method.

故障现象	发生原因	排除方法
风量不足	1. 叶轮与机体因磨损而引起间隙增大	更换磨损零件
	2. 配合间隙有所变动	按要求调整
	3. 系统有泄漏	检查后排除
	4. 皮带张紧不够带轮打滑	张紧皮带
电动机超载	1. 系统压力变化	
	a. 进口过滤网堵塞, 或其他原因造成阻力增高, 形成负压(在出口压力不变的情况下, 进排气口压差增高)	检查后排除
	b. 出口系统压力增加	检查后排除
	2. 零部件不正常引起	
	a. 静动件发生摩擦	调整间隙
	b. 齿轮损坏	更换
	c. 轴承损坏	更换
温度过高	1. 机体	
	a. 出口压力上升	检查后排除
	b. 进口气体温度上升	检查后排除
	c. 静动体发生摩擦	调整间隙
	2. 轴承	
	a. 轴承损坏	更换
	b. 润滑油不足或过多	调整油量
	c. 润滑油温度过高或油质欠佳	更换干净质量好的润滑油
	3. 润滑油	
	a. 冷却水断路或水量不足	检查后排除或调节
	b. 齿轮啮合不正常或损坏	检查后调整或更换
	c. 轴承损坏	更换
	d. 油质欠佳	更换
	1. 齿轮与齿轮紧固零件松动	调整间隙后定位并紧固
	2. 齿轮齿面磨损	更换

故障现象	发生原因	排除方法
叶轮与叶轮之间发生摩擦	3. 齿轮键与叶轮键松动	更换
	4. 主从动轴弯曲超限	校直或更换轴
	5. 机体内混入杂质, 或由于介质形成结垢	清除杂质或结垢
	6. 轴承磨损	更换
	7. 超额定压力运行	检查超压原因后排除
叶轮与机壳径向发生摩擦	1. 间隙超差	调整间隙
	2. 滚动轴承磨损	更换
	3. 主从动轴弯曲超限	校直或更换轴
	4. 超额定压力运行	检查超压原因后排除
叶轮与墙板之间发生摩擦	1. 间隙超差	调整间隙
	2. 叶轮与墙板端面附粘杂质或介质结垢	清除杂质或结垢
	3. 滚动轴承磨损	更换
振动超限	1. 转子平衡精度低	调整
	2. 转子平衡被破坏(如焦油结垢)	检查后排除
	3. 轴承磨损	更换
	4. 齿轮损坏	更换
	5. 地脚螺栓或其他紧固件松动	检查后紧固
	6. 风机与电机同轴度超差	找正同轴度
齿轮损坏	1. 超负荷运行或承受不正常的冲击	更换
	2. 润滑油量过少或油质不佳	更换
	3. 齿轮磨损其侧隙超过叶轮之间间隙	更换
轴承损坏	1. 润滑油, 润滑脂质量不佳或供油不足	更换
	2. 由于密封失效, 致使与腐蚀性气体接触	更换轴承, 修复密封
	3. 长期超负荷运作	更换
	4. 超过额定的使用期限	更换
轴封漏油	1. 骨架密封圈磨损失效	更换骨架密封
	2. 风机主动轴与电机轴同轴度偏差太大, 密封失效	更换密封圈, 调整风机同轴度
油塞漏油	1. 油塞未拧紧	拧紧油塞
	2. 油塞垫片损坏	更换油塞垫片并拧紧
噪声异常	1. 轴承磨损	更换
	2. 皮带张紧不够带轮打滑	张紧皮带
	3. 超额定压力运行	检查超压原因后排出
	4. 齿轮磨损	更换
	5. 共鸣	改变周围环境

表(4)

Fault phenomenon	Cause	Troubleshooting method
Insufficient air volume	1.The increasing gap between impeller and block increases due to wear.	Replace worn part
	2.The changes of fit clearance	Adjust as required
	3.There's a leak in the system.	Troubleshooting after inspection
	4. Belt tension is not enough for pulley skidding	Tightening belt
Motor overload	1.The changes of system pressure	
	a.Formation of negative pressure for clogged imported filter, increasing of resistance by other reasons (Under the condition that the outlet pressure remains unchanged, the pressure difference between the inlet and exhaust port increases)	Troubleshooting after inspection
	b.Increased pressure of exit system	Troubleshooting after inspection
	2. Caused by abnormal components	
	a.Friction occurs in static parts	Control gap
	b.Gear distress	Replace
	c.Bearing failure	Replace
High Temperature	1. Body	
	a.Due to rising pressure in exit.	Troubleshooting after inspection
	b.Due to the rise in the temperature of the entrance gas	Troubleshooting after inspection
	c.Friction occurs in static and dynamic bodies	Control gap
	2. bearing	
	a.Bearing failure	Replace
	b.Lubricating oil; insufficient or excessive lubricating oil.	Adjusted oil quantity
	c.The oil temperature of lubricating oil is too high or the oil quality is poor.	Replace it by clean and good quality lubricating oil
	3. Lubricating oil	
	a.Cooling water breaks or insufficient water quantity	Troubleshooting after inspection or adjustment
	b.Abnormal or damaged gear meshing	Adjust or replace after inspection.
	c.Bearing failure	Replace
	d.Poor oil quality	Replace
Friction between impellers	1.Loose of gear and gear hub fastener	After control gap, positioning and fastening
	2.Worn gear tooth and surface	Replace
	3.Loosening of gear hub key and impeller key	Replace
	4.Over limit bend of master-follower shaft	Straighten or replace axis
	5.Mix impurities into the body, or scale due to medium	Remove impurities or scaling
	6.Bearing wear	Replace

Fault phenomenon	Cause	Troubleshooting method
	7.Overrated pressure operation	Troubleshooting after checking the cause of overrated pressure
Friction between impeller and casing radial	1. Gap over-difference	Control gap
	2. Rolling bearing wear	Replace
	3. Over limit bend of master-follower shaft	Straighten or replace axis
	4. Overrated pressure operation	Troubleshooting after checking the cause of overrated pressure
Friction between the impeller and the wallboard	1. Gap over-difference	Control gap
	2. The impeller and the end face of the wall panel are adhered with impurities or the medium is scaled.	Remove impurities or scaling
	3. Worn rolling bearing	Replace
Vibration overrun	1. Low rotor balance accuracy	Adjust
	2.Rotor balance is destroyed(e.g. tar fouling).	Troubleshooting after inspection
	3. Bearing wear	Replace
	4. Gear distress	Replace
	5. Loosening of anchor bolts or other fasteners	Fasten after inspection
	6. The coaxiality difference between draught fan and motor	Find positive coaxiality
Gear distress	1. Overrun or withstand abnormal impact	Replace
	2. The amount of lubricating oil is too small or the oil quality is not good.	Replace
	3.Gear wearing its side gap exceeds the clearance between impellers	Replace
Bearing failure	1.Poor quality of lubricating oil and grease or insufficient oil supply	Replace
	2.Contact with corrosive gas due to failure of seal	Replace bearing and repair seal
	3. Long-term overload operation	Replace
	4. Exceed rated service life	Replace
Oil leakage of shaft seal	1.Wear failure of skeleton sealing ring	Replace reinforced seal
	2.The large deviation of coaxiality of capstan shaft of draught fan and motor axis results in sealing failure	Replace sealing ring, adjust coaxiality of draught fan
Plug oil leakage	1. The oil plug is not tightened	Tighten the oil plug
	2. Oil plug gasket is damaged	Replace oil plug gasket and tighten it
Noise anomaly	1. Bearing failure	Replace
	2. Belt tension is not enough for pulley skidding	Tightening belt
	3. Overrated pressure operation	Troubleshooting after checking the cause of overrated pressure
	4. Gear distress	Replace
	5. Resonance	Changing the surrounding environment

Table (4)