

Operation method and parameters of dynamic balancing machine

The purpose of the customer's purchase of the balancing machine is to realize the dynamic balancing process of the rotor.

Manufacturing qualified balancing machine is responsible to customers.

Reliability and high efficiency are the technical requirements for the balance machine manufacturer.

The balance machine should be reliable - that is, there is no moisture in the measurement result, the repeatability of the instrument, the purity of the mechanical signal, the interference degree of the mechanical signal, and the signal-to-noise ratio of the sensor.

The linear working range of balancing machine, modern hard support balancing machine has a very good linear range - that is, after calibration at one speed, other speeds and rotors of other sizes can be directly calculated and measured without recalibration. Normal unbalance measurement range of balancing machine:

Micro balancing machine From 100g to 0.1mg.

Small balance machine from 10kg to 0.01g.

Large balancing machine from 100kg to 1g.

The super large balance machine can be from 1000kg to 100g.

If the product does not have these functions at all, a different rotor will have to be recalibrated, which will bring trouble to users.

1. The highest accuracy of the rotor passing through the mandrel is determined by the accuracy of the mandrel. G6.3 is less than 0.02mm diameter jump.
2. The best operating mandrel is 1:2000 taper mandrel. (the drive motor is controlled by frequency converter)
3. The interface error of mandrel and universal joint can be fixed and balanced at the joint to remove the influence of empty shaft.
4. The precision of limit can be overcome by low interference mode,
5. The influence of couple must be considered for balancing machine with single side

balance. Otherwise, it can not meet the requirements of vibration accuracy.

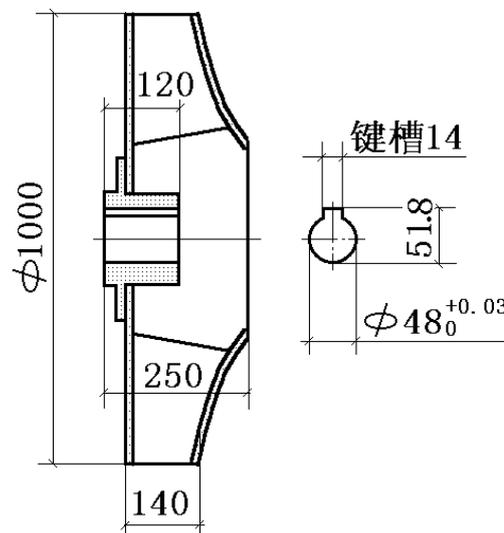
4.1 General fan rotor balancing operation process

This section will take the fan rotor shown in Figure 9 as an example to introduce the operation process of general fan impeller balance calibration. The balance calibration of other types of rotors can also refer to this process.

4.1.1 preparation

4.1.1.1 the impeller process shaft and connecting sleeve should be made first. See the following for process shaft and connection set drawing

Fig. 10 and FIG. 11 (Note: the dimensions shown in the figure are corresponding to those shown in Fig. 9).



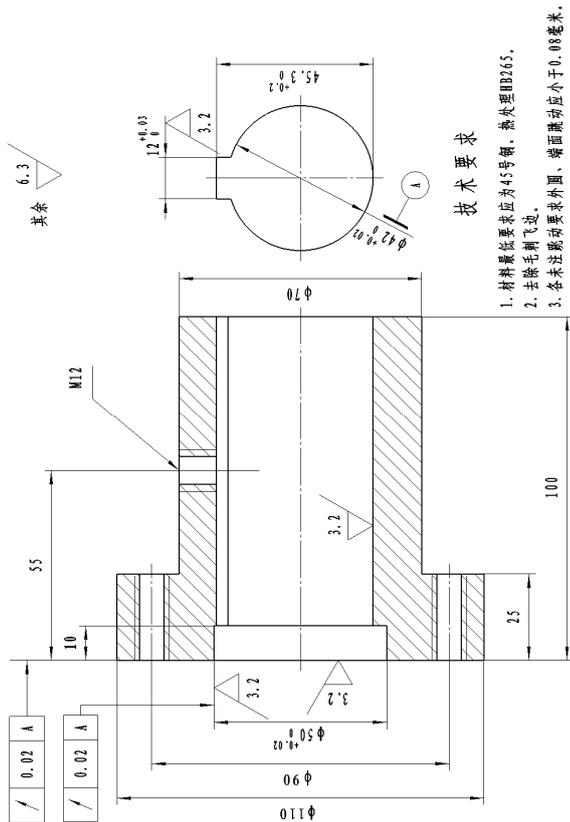
图九：示例转子简图

4.1.1.2 check whether the anchor bolt is loose, and if it is loose, it must be tightened. Check other parts of the machine for abnormalities.

4.1.1.3 set the main power switch on the electrical control box to "0" (off position).

4.1.1.4 check whether the connection is normal. Note that the main power supply must not be energized during the preparation work.

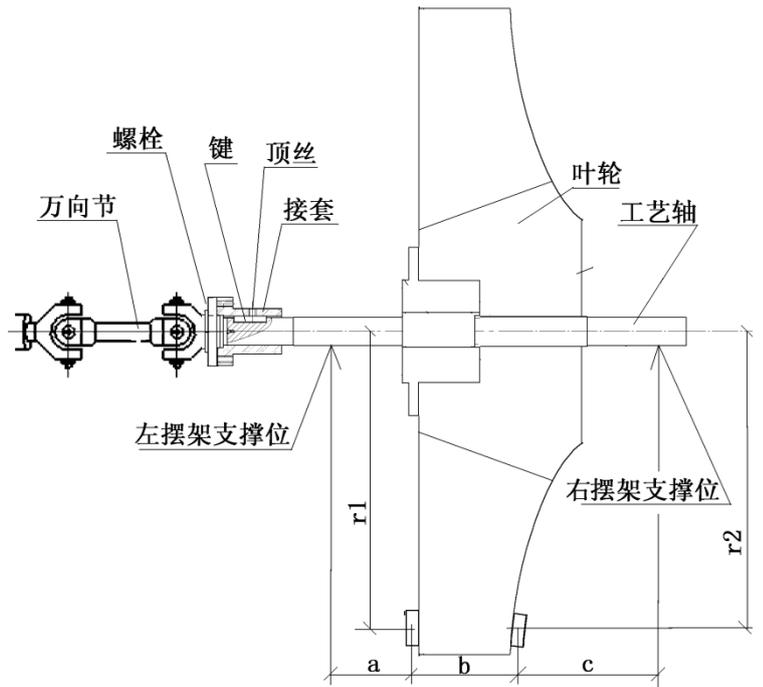
4.1.1.5 adjust the roller carrier scale to "43" position and fasten the roller carrier. Adjust the position of the two swing frames to fit the installation of the rotor and process shaft. Install and connect impeller, process shaft and universal joint as shown in FIG. 13. Each joint must be firmly connected.



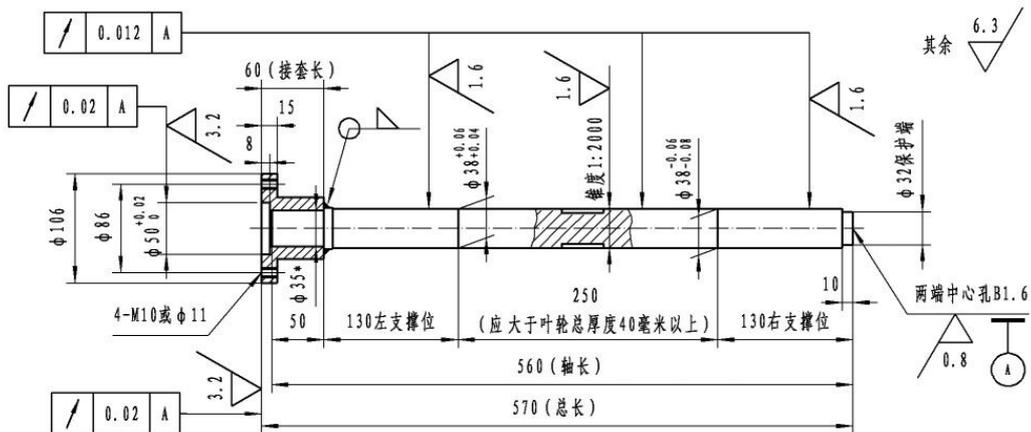
技术要求

1. 材料最低要求应为45号钢，热处理HB265。
2. 去除毛刺飞边。
3. 各表面过盈量要求外圆、端面过盈量小于0.08毫米。

图十：接套图样（例）



图十三：叶轮、工艺轴、万向节连接及a、b、c、r1、r2尺寸示意图



技术要求

1. 材料最低要求应为45号钢，热处理HB265。
2. 去除毛刺飞边。
3. 各轴位跳动要求为初始加工要求，使用过程中跳动超过0.05毫米时必须报废。
4. φ35*用于接套联接，较小规格工艺轴推荐：先将工艺轴和接套加工φ35*联结尺寸后焊接，然后参考本图加工。
5. 键槽对称加工，位置按工艺轴和叶轮试装确定。
6. 两个支撑位直径可加工成与转子装配轴位相同的直径和锥度，并一起加工成。但支撑位直径不得接近于滚轮外径的整数倍或整数。例如：当滚轮直径为101时，此直径不得加工成：90-110或45-55。
7. 本图例用于：内孔φ38、总厚度小于200毫米的转子。用户应根据转子实际情况调整长度尺寸，不必完全照搬此图！

φ38锥度工艺轴图样（例）

4.1.1.7 as shown in FIG. 13 and referring to sections (11) and (12) of section 3.3.1, the measured dimensions a, B, C, R1 and R2 are input into the electric measuring box respectively.

4.1.1.8 pay attention to inspection: the swing frame, safety bracket and roller carrier must be pressed tightly, the support position of roller and process shaft should be cleaned, and a little lubricating oil should be applied on the surface of four rollers.

4.1.1.9 turn the impeller by hand to check whether there is any abnormal phenomenon, and confirm that all mechanical connections are reliable.

4.1.1.9 set the main power switch to "0" (off position). Check whether the wires are connected

Normal. Set the high and low speed switch to the "low speed" position, and then power the whole machine, and the power indicator is on.

4.1.1.10 turn on the power supply of the electric measuring box, and the power indicator light on the front panel of the electric measuring box is on.

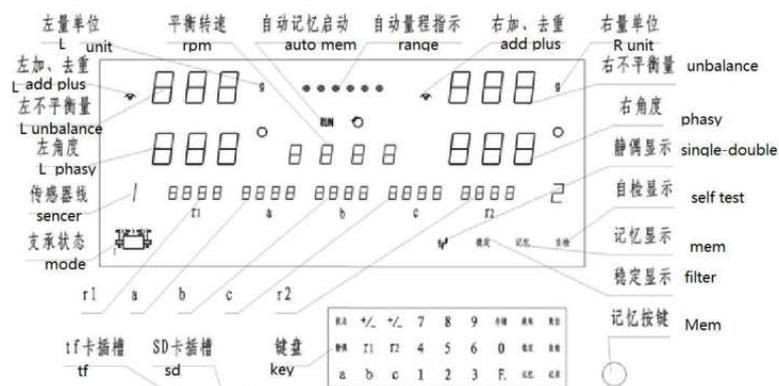
4.1.2 unbalance detection process

4.1.2.1 confirm that all mechanical connections are reliable and the dimensions a, B, C, R1 and R2 are input correctly,

4.1.2.2 inspection: when the balancing machine is working, there must be no one in the direction of rotor rotation diameter.

Note: a when the balancer is in normal use, the steering must be correct

B. when the balance machine is used for the first time after installation and when the external power supply system of the balancing machine changes, it is necessary to verify whether the working direction of the balancing machine is correct. The method is: press the "start" button,



Then immediately press the "stop" button to see whether the rotation direction of the rotor is consistent with the direction indicator of the front part of the vehicle.

C. the steering process must be verified after the rotor installation process (section 4.1.1) is completed.

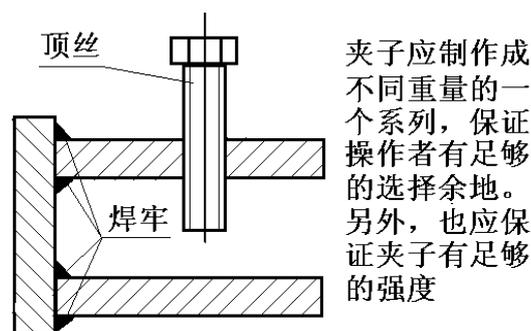
4.1.2.3 set the speed switch to "low speed" position. Make sure that no one is present in the direction of rotor rotation diameter. Press the "start" button to start the balancing machine.

4.1.2.4 after a few seconds, the rotor speed is stable. From the electric measuring box, it can be seen in turn that a tachometer is stable after a certain reading, and B four digital meters are stable (or relatively stable) indication.

4.1.2.5 pay attention to observe the indicated values of the two scales.

4.1.2.6 press the "memory" function button on the electrical test box, and the rotor will stop rotating.

4.1.2.7 according to the measurement value and angle indicated by the electric measuring box, add clamp to the corresponding position on the rotor (as shown in Figure 15 below). The size and position shall be accurate and the clamping shall be reliable. (this process is an unbalanced test to remove)



图十五：夹子试重

4.1.2.8 verify whether the size and position of the clamp test weight are correct according to the change of the indicated value of the electric measuring box.

4.1.2.9 adjustment can be made by moving the position (angle) of the clamp and changing the size (weight) of the clamp so that the remaining unbalance is small enough.

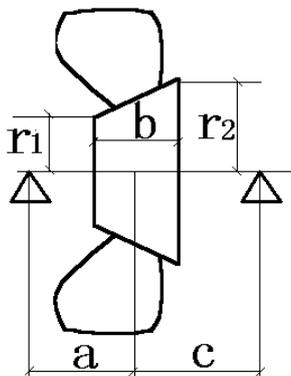
4.1.2.10 mark the position and counterweight size on the installation clamp position.

4.2.5 start the measurement process according to Section 4.1, memorize and stop the machine after the reading is stable.

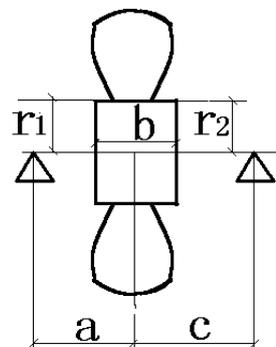
4.2.6 the size and angle of static unbalance are shown on the left digital table, and the size and angle of even unbalance are shown on the right digital table (refer to FIG. 16). The counterweight operation is carried out according to the size and angle indicated by the left digital table. Generally, the counterweight is welded at the appropriate position in the rotor housing cavity. Trial counterweight operation should also be carried out during counterweight process. When the static unbalance indicated by the left digital meter is balanced to within the required accuracy, the rotor balance calibration is considered to be completed.

4.2.7 in the process of balancing the rotor of axial flow fan and diagonal flow fan, counterweight operation is not required for the magnitude of even unbalance shown on the right digital table.

If the counterweight operation of couple unbalance is to be carried out, the size of a, B and C should be readjusted according to Section 4.1 (dynamic balance method) after the static unbalance calibration is completed, and the static couple key will adjust the static couple state (dynamic balance correction mode). The method of (dynamic balance method) shall be strictly followed until the accuracy requirements are met.



图十七：斜流风机转子装载示意图



图十八：轴流风机转子装载示意图

4.4.1 balancing operation of common motor rotors and crankshafts

This kind of rotor can be detected by the method and process described in Section 4.1. The corresponding universal joint sleeve needs to be processed before balance detection. The bearing position of the rotor can be directly used as the supporting position of the balancing process. Because there is no process axis error involved, the actual balance effect is better than that of the rotor with process shaft.

4.4.2 balancing operation of flywheel, gear and other disc rotors

This kind of rotor can be detected by the method and process described in Section 4.2. Before the balance test, the corresponding universal joint sleeve and process shaft need to be processed. When the ratio of length to diameter is less than 1:10, only static unbalance can be calibrated.

5. Precautions, operation procedures and brief operation process of balancing machine

5.1 precautions during operation

5.1.1 when operating the balancing machine, one person must operate from starting to recording data and stopping the machine. The assistant workers other than the balance machine operator must obey the operator's command and must not touch any button of the balancing machine at will.

5.1.2 before hoisting the rotor, adjust the support frame of the balance machine, including the support position, diameter scale and the position of the support frame. After the rotor is placed on the support frame, the above mechanism is not allowed to be adjusted.

5.1.3 the larger rotor should be balanced at low speed and the smaller rotor should be balanced at high speed. The rotor with large initial unbalance should also be balanced at low speed.

5.1.4 the balancing machine is an instrument product. During and after the rotor unbalance detection, attention should be paid to the maintenance of the balancing machine at any time. Barbaric operation is not allowed.

5.1.5 for larger rotors, corresponding lifting equipment (> 20kg) must be provided to facilitate safe operation and avoid unnecessary accidents.

5.1.6 the balance machine must have a solid foundation as shown in the foundation map, otherwise its balance result data is unstable and untrue.

5.1.7 there must be a safety fence around each balancing machine. The distance between the guardrail and the balance machine is generally 500 mm to 1000 mm.

5.2 operation procedures

When the balancing machine is working, there must be no one in the direction of rotor rotation diameter!

5.2.1 when operating the balancing machine, one person must operate from starting to recording data and stopping the machine. When a large balancing machine is operated, the assistant workers other than the operator must follow the instructions of the operator

to install the rotor, and must not touch any button of the balancing machine.

5.2.2 the rotor must not be welded on the balancing machine!

5.2.3 before hoisting the rotor, adjust the support frame of the balance machine, including the support position, diameter scale and the position of the support frame.

5.2.4 before starting the balancing machine, measure the geometric dimension of the rotor and input it into the electric measuring box.

5.2.5 large rotors shall be balanced at low speed, and rotors with large initial unbalance shall also be balanced at low speed. Smaller rotors are balanced at high speed.

5.3 after the rotor is installed normally, the brief operation sequence of the balancing machine is as follows:

5.3.1 push the rotor manually to see if it is suitable for installation.

5.3.2 check that no one is present in the direction of rotor rotation diameter.

5.3.3 start the balancing machine.

5.3.4 measure and record data.

5.3.5 shut down.

5.3.6 remove the unbalance.

5.3.7 recheck the measured values.

5.3.8 remove the rotor and weld the unbalance mass.

Dynamic balance technology of motor

The balance process of the motor is similar to that of the fan.

There are universal joint balancing machine and belt driven balancing machine.

No matter which kind of balancing machine must be balanced, the rotor needs to be close to the mass distribution when in use. That is to say, when the motor is working, the keyway is full or 75% full (depending on the actual length of the motor key). Then the dynamic balance must maintain 55% of the actual key groove mass. The other 45% mass should belong to the output load body of the motor.

Motor balance selection speed: according to the specific balance machine operating stiffness parameter selection.

Generally more than 500kg, rotation 300-400rpm

Small rotor selection 600-800rpm

In the belt driven balancing machine, the position of the limit frame is adjusted as far as possible to minimize the impact on the balance accuracy.

The interface error between motor and universal joint can be turned 180 at the joint to remove the influence of universal joint.

After the rotor is balanced, the universal joint is rotated 180 degrees relative to the connection with the rotor, and 50% of the new unbalance value is removed from the universal joint and the rotor respectively.

Balance accuracy selection. The large rotor is about 10g, and the small rotor is about 1-2g.

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