Operation manual of frameless motor

Content

1. Summary

Thank you very much for using the frameless motor products of Changzhou Fulling Motor Co., Ltd. Our frameless motor has the characteristics of high efficiency, stable operation, long life and simple and convenient installation. If you need customized services, please contact us to accurately understand your needs and design a new customized motor to meet the unique needs of your application system.

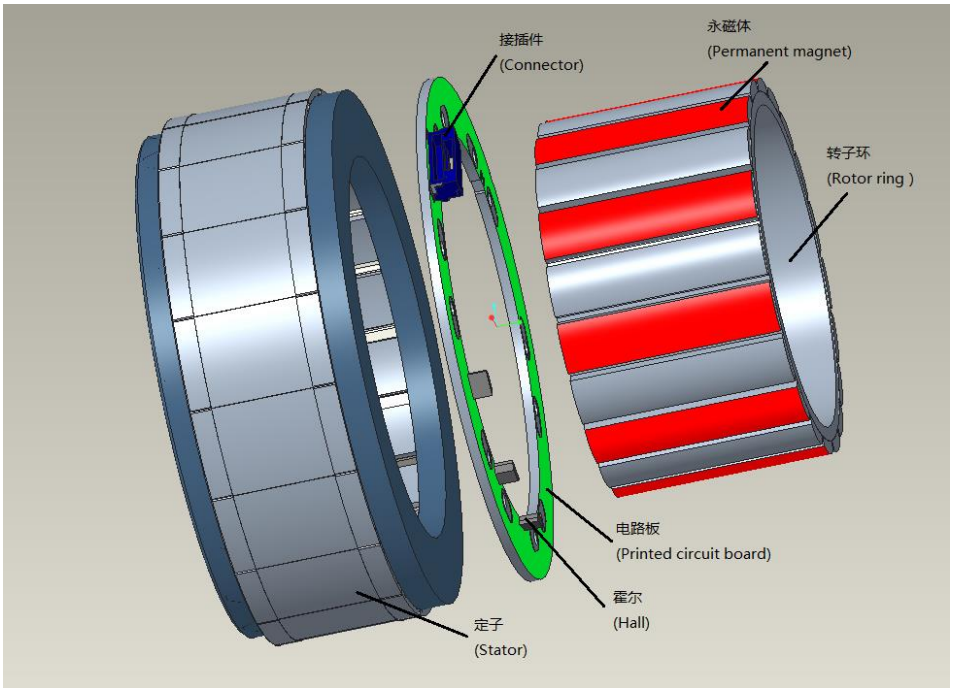
This manual contains instructions for installing and adjusting various components in the kit.

The motor dimensions are as follows:

FL50BL, FL63BL, FL70BL, FL85BL, FL115BL

2. Motor Structure

Frameless motors generally consist of two parts: a stator assembly and a rotor assembly. The stator assembly includes a stator core, a copper winding embedded in the stator core, and a PCB circuit board. The PCB circuit board is used as a winding wire and a hall sensor. The hall sensor can sense the rotor position and provide position signals for the control system. The hall sensor signal port can be led out by plug-in terminals. In order to improve the reliability and service life of the stator assembly, the stator assembly is vacuum potted with potting glue. The rotor assembly is usually composed of a magnetic ring and permanent magnets. The permanent magnet is fixed on the permeable ring in a corresponding manner according to specific working conditions. The choice of permanent magnet material will depend on the application requirements and can include samarium cobalt or neodymium iron boron.



3. Unpacking and Storage

The stator and rotor of the frameless motor are protectively packed in foam and ziplock bags, while the stator and rotor are separately packed to prevent the motor from collision and rust during transportation and storage.

3.1 Unpacking

After unpacking, first check whether the stator and rotor are damaged. If any damage occurs, please contact Changzhou Fulling Motor Co., Ltd. for timely treatment.

3.1.1 Rotor Unpacking

The rotor of the frameless motor adopts strong magnetic magnetic steel. When taking out the rotor out of the box, be sure to stay away from magnetic and magnetic objects, mainly including the following precautions:

1. When taking out multiple rotors at the same time, ensure the safety distance between the rotors to prevent the rotors from attracting together and causing damage to the rotor magnets.
2. When equipped with auxiliary medical equipment such as cardiac pacemakers, keep a certain safe distance from the rotor to prevent the rotor magnet from interfering with the operation of the auxiliary medical equipment.
3. The removed rotor should be far away from magnetically conductive materials to prevent the magnets from being damaged by being attracted together.

4. When taking the rotor, handle it gently to prevent the rotor from bumping.

3.1.2 Stator Unpacking

The stator includes iron core and sensor elements. When taking out the stator out of the box, pay attention to the following matters:

1. Take the stator with anti-static equipment to prevent static electricity from damaging the sensor element.
2. Wear gloves when handling the stator to prevent sweat on your hands from rusting the iron core.
3. After taking out the stator, keep a safe distance from the rotor to prevent the rotor magnets from being damaged by being attracted together.
4. If the stator is not assembled immediately after unpacking, do not open the ziplock bag that packs the stator to prevent the stator core from rusting.

3.2 Storage

The storage environment of frameless motors is -20℃~85℃, and the maximum humidity of the environment is 85%. In a clean and well-ventilated warehouse, the air must not contain corrosive gas. Under this condition, the storage period of the motor is one year.

4. Motor Assembly Recommendations

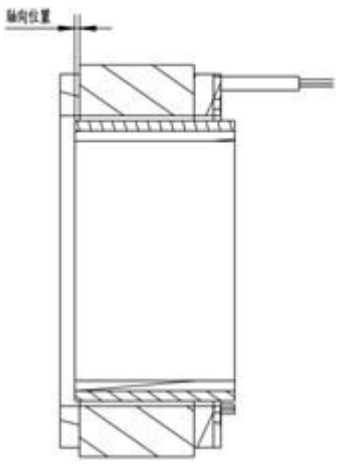
Changzhou Fulling Motor Co., Ltd. provides customers with suggestions for the external assembly of the frameless motor. At the beginning of the motor customization, the assembly method will be confirmed with the customer so that the customer can safely and reliably integrate the frameless motor into its own equipment to ensure the stable operation of the frameless motor.

4.1 Stator and Rotor Positioning

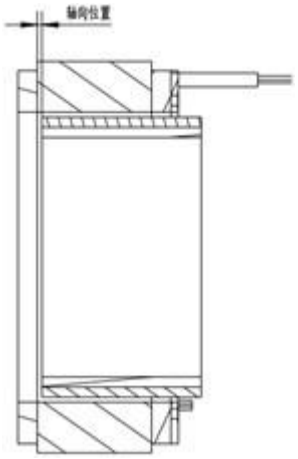
The axial and radial positioning of the stator and rotor of a frameless motor is very important, and the best positioning helps the motor run smoothly.

4.1.1 Axial Positioning

In general, the length of the rotor of a frameless motor design is larger than that of the stator, especially when there are Hall elements. During axial positioning, the stator must be completely coupled to the rotor, that is, the rotor must completely wrap the stator, so as to ensure that the motor does not have axial tension and the motor does not lose output torque. The axial assembly of the stator and rotor is shown in the figure below.



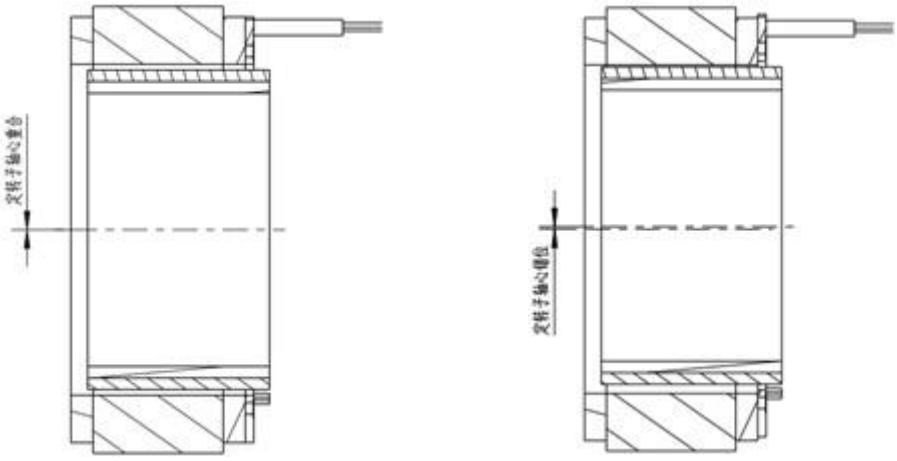
Correct axial positioning



Wrong axial positioning

4.1.2 Radial Positioning

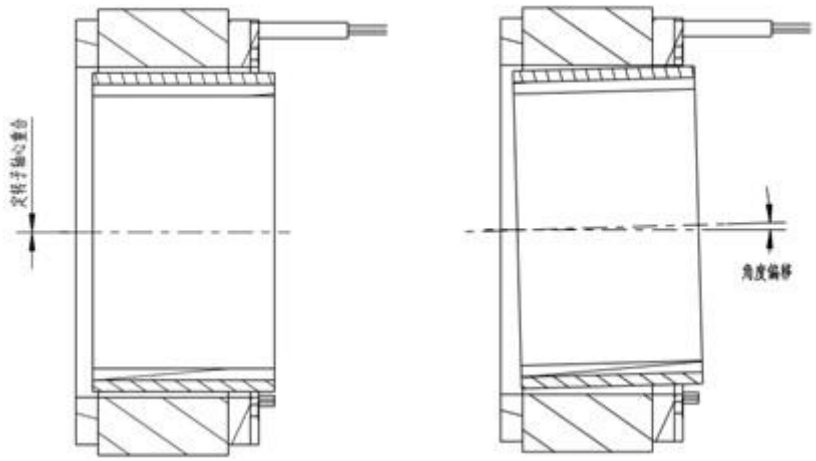
The stator and the rotor need to be concentric. When the rotor rotates in the stator, the rotor cannot be eccentric in the radial direction, nor can the rotor contact the stator. The air gap must be considered when designing the tolerances of the stator and rotor installation parts. The cumulative tolerance cannot exceed the maximum Half of the unilateral air gap. The size of the air gap depends on the motor model. For details, see the frameless motor series catalog. The radial position of the stator and rotor assembly is shown in the figure below:



Correct radial positioning　　Wrong radial positioning

4.1.3 Angle Positioning

The angular positioning of the stator and rotor should ensure that the axis of the stator and rotor coincide to prevent the angular deviation of the axis of the stator and rotor as shown in the figure below, resulting in uneven air gap, causing unstable operation, and in severe cases, causing the stator and rotor to sweep the hall.



Correct angle positioning　　Wrong angle positioning

The above is just a few of the more common stator and rotor installation problems, but it is not limited to this. Other problems that cause the stator and rotor axial misalignment and uneven air gap should be avoided as much as possible.

4.2 Stator Assembly

The stator assembly must ensure that the stator is firmly fixed on the equipment during the operation of the motor, without tangential sliding.

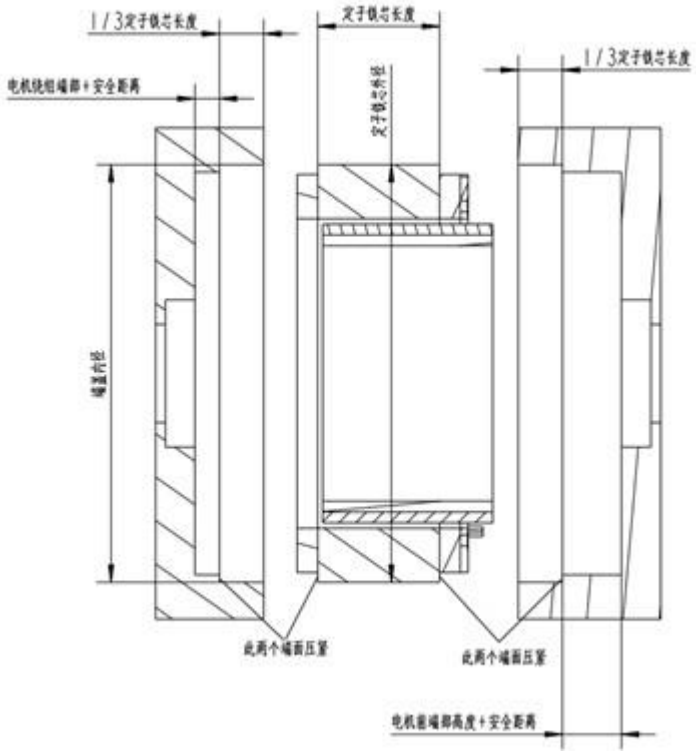
There are two main ways of stator assembly:

1. The stator is fixed by the end cover
2. The stator is fixed by shrinkage fit or press fit.
3. The stator is fixed by adhesives

4.2.1 Stator is Fixed by End Cover

The schematic diagram of stator fixed by front and rear end covers is shown as follows. One end face of front and rear end covers is tightly pressed together with the front and back of stator lamination. No displacement of the stator can be achieved due to the friction between end faces during motor operation. The fixation between two end covers and stator and the supporting structure for assembly of two end covers, bearings and other components can be achieved by using bolts. The position of the holes on the end covers should be determined according to that of the outgoing lines.

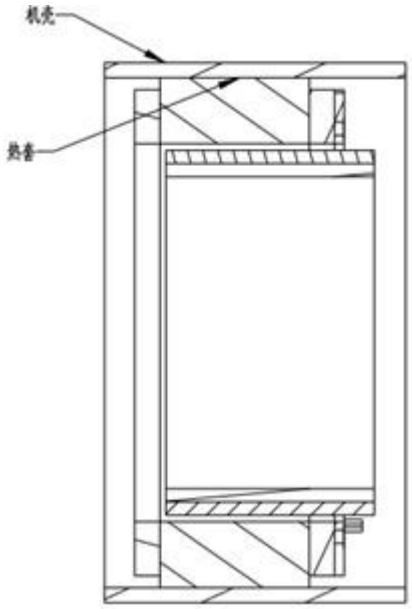
The inner hole honing process of stator lamination is finished by professional machine tool, which can lead to good concentricity if matched with the end cover whose inner diameter is processed in the same way. The critical dimension is that the outer diameter of stator lamination is equal to the inner diameter of end cover. Transition fit between them is recommended. The limit fit tolerance can be selected as H8 / js8.



4.2.2 Shrinkage Fit

It is difficult for us to give a specific introduction to the mode and matched dimensions of the shrinkage fit. However, our suggestions are as follows:

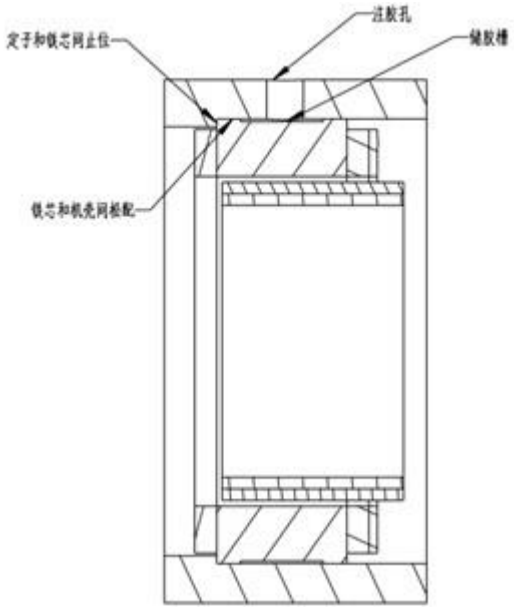
1. Different motor housing materials have different coefficients of thermal expansion (CTE). If the motor housing is made of aluminum, the limit fit tolerance dimension is recommended to be N8 / h7. At the same time, the temperature of storage or operation under the limiting case should be considered.
2. The motor housing should bear the torque transmitted by the stator, and the thickness of the motor housing should be determined according to the motor torque. The thicker the motor housing is, the greater the torque the motor housing transfer.
3. The surface roughness should be appropriate.



Scheme for shrinkage fit or press fit of motor and motor housing

4.2.3 Stator Bonding

Fixation by adhesives is convenient and easy to operate. It is recommended to adopt the transition fit scheme at the sites of connection between the motor housing and the stator lamination and the limit fit tolerance is recommended as H8 / js7, which can ensure the concentricity between the motor housing and the stator lamination. The axial rest position on the end region of the stator lamination can be achieved by the boss on the motor housing. The adhesive strength of the adhesives can withstand the tangential force of the motor to ensure that there's no axial and radial displacement during motor operation. The installation mode is shown in the figure below.



Motor fixed by glue injection

4.3 Rotor Assembly

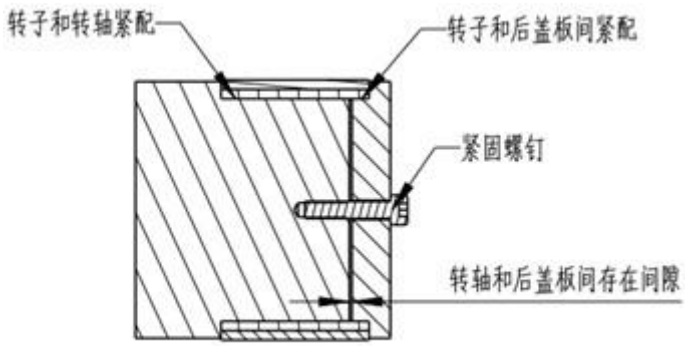
The shaft can be made of 40Cr, silicon steel sheet or other materials. There are several methods for fixing the rotor to the shaft:

1. Screw fixation
2. Adhesive
3. Interference fit

The concentricity and the even air gap between the stator and the rotor must be ensured by any of the above methods.

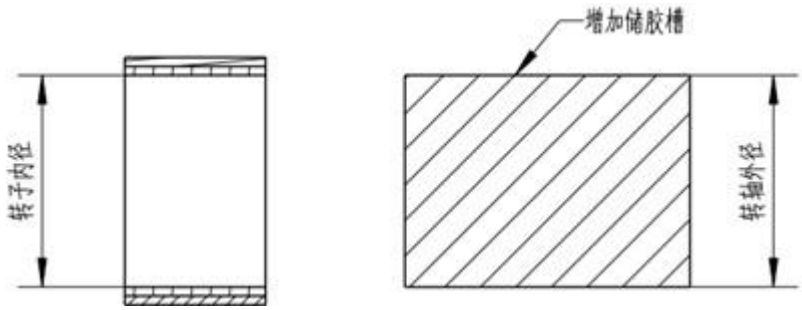
4.3.1 Screw Fixation

The rotor is fixed on the shaft by transition fit. The limit fit tolerance is recommended to be H7 / k6. Meanwhile, machining parts are used to ensure good concentricity. The rear cover plate is used to press the other end of the rotor at the bottom, and there is a gap between the shaft and the rear cover plate in the axial direction. The rear cover plate and the shaft are fixed together by the fastening screws. The rotor can be fixed on the shaft after these procedures. The number and size of screws can be determined according to the motor torque.



4.3.2 Adhesives

It is difficult to provide the specific fit tolerance for rotor gluing. Fit tolerance depends on the glue model, rotor shaft size, torque and other parameters. It is necessary to add adhesives storage tank on the surface of the shaft. The shape of the adhesives storage tank is determined at discretion, such as thread shape.



4.3.3 Interference Fit

Interference fit is an assembly method by setting reasonable interference between rotor inner diameter and shaft outer diameter. P7 / h6 is recommended for assembly limit tolerance. In additional, the speed, output torque and other parameters of the motor should be considered. Reasonable roughness should be set on the surface of the shaft.