Instruction Manual for the Product

Applicable series: FL series

Version: V1.0

Date: 2024.11

Preface

Thanks for choosing MYACTUATOR.

Our FL series motors have the characteristics of high integration, strong adaptability, flattening, large hollow and good heat dissipation. If you need a customized service, please contact us to learn more about your needs and design a new custom motor to meet your application needs.

The manual contains the procedure instructions for the installation and adjustment of various components in the set, and provides customers with assembly suggestions for this series of motors. At the beginning of motor customization, our company will confirm the assembly method with the customer to ensure that the motor can be safely and reliably integrated into its own equipment to ensure the stable operation of the motor.

If you need to know more about our company's other products, please contact us.

CN WEB

EN WEB

The name of the company: Suzhou Micro Actuator Technology Co., Ltd

Hotline: 400-998-9592

Address: Building 2, No. 599, Yuanchuang Road, Huaqiao Town,
Kunshan City, Jiangsu Province

Imprint Notice

 The product manual is only used as a reference for users and does not constitute the basis for meeting the user's overall usage requirements. Please be sure to evaluate it in combination with the user's overall system. The content of the manual strives to be detailed and accurate, but oversights are inevitable. If you find any errors, please provide your valuable feedback.

The company reserves the right to modify and improve this manual at any time without prior notice. For the latest version of the manual, please visit the official website (www.myactuator.com) to download it by yourself, or contact the company to obtain it.

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Catalog

1. Safety precautions

This product is a high-precision product. Only professionals with corresponding qualifications can perform tasks such as installation, debugging, and maintenance. Corresponding personnel must understand and comply with IEC60364/IEC60664 and national accident prevention regulations. Please read the manual carefully before installing, operating, or repairing this product. Wrong operation may damage the module or even cause casualties. Be sure to follow the safety precautions in this manual.

This manual has the following safety symbols:


Warn! May endanger personal safety


Note! It is possible to damage the product or even the entire device


Be careful! Beware of surface temperatures

In this manual, we record hazardous situations as much as possible, and please see Table 1-1 for details. Relevant personnel are requested to understand and follow the following precautions. In addition, there are too many uncertain factors that cannot be considered and recorded. In actual application processes It is necessary to prevent and handle it according to the actual situation.

Table 1-1 Safety precautions

Unboxing	
	**Please check whether the outer packaging of the device is intact** Before unpacking, please check whether the outer packaging of the device is intact and whether it is damaged, damp, deformed, etc.
	**Please do not unbox violently** Please unpack in accordance with the hierarchical order, and violent knocking is strictly prohibited.

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	**Please check whether the module and its accessories are complete** Please refer to the list to check whether the module name is correct, whether the accessories are complete, whether there is any damage on the surface of the equipment and its accessories, etc. If there is any problem, please do not install it and contact our company in time.

Installation and maintenance phase	
	**Please assemble the module in place** When assembling the module, assemble it in place according to the screw torque standards to ensure that there will be no danger of accidental falling.
	**Do not plug or unplug the power cord while the power is on** Make sure the power indicator light goes out before wiring and maintaining the device.
	**Do not disassemble the module and its associated equipment while the power is on** It is strictly prohibited to disassemble any device or accessory of the equipment while the power is on, otherwise there is a risk of electric shock.
	**Please keep the module shell grounded and use shielding layer properly** If the module shell is not grounded, it may cause charge accumulation in the shell, affecting the normal operation of the motor, and even causing harm to the human body. The wiring cable must meet the corresponding wire diameter and shielding requirements, and the shielding layer of the shielded cable must be reliably grounded.
	**It is strictly prohibited to connect the power supply to the output of the device** It is strictly prohibited to connect the power supply to the output

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	terminal of the device to avoid damage to the device or even fire.
	**Please do a risk assessment** Please conduct a risk assessment before use and take appropriate measures to ensure personal safety and equipment safety.
	**Please observe the technical data and specifications** Please refer to the parameters of each model in the manual to set reasonable parameters to prevent damage to the module.
	**Please set appropriate protection limits** Set appropriate position limits, speed limits, current limits, etc. Exceeding the limits may damage the motor or even threaten personal safety.
	**Do not disassemble or replace parts by yourself** Product failure due to abnormal use will void the warranty rights of the product.
	**Do not hit or squeeze the module and its components with gravity** The module is a precision device. Do not use a hammer to hit the module hard. Please place it carefully to prevent the module from falling off the table and causing cracks and other damage.
	**The use environment complies with regulations** The working environment temperature of the module is -10~55℃. When the temperature is low, it is recommended to use low-temperature grease to improve the operating resistance of the module. Please keep the environment free of dust, corrosive gases, flammable gases, etc.
	**Be careful of high temperature burns** During the operation of the module, the surface may be very hot, please pay attention to protection. When the surface temperature exceeds 40℃, please avoid long-term contact, which may cause low-temperature burns. When the surface temperature exceeds 85℃, please avoid touching it, which may cause minor burns.

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Storage	
	**Storage environment meets standards** Please refer to the manual to strictly require transportation and storage temperature and humidity, and avoid direct sunlight, strong magnetic fields, strong electric fields, strong vibrations and other places.
	**Storage time should not be too long** Avoid storing time for too long. If the storage time is too long, please take more stringent protective measures and necessary inspection and maintenance.
	**Do not mix and transport equipment that may cause damage** Please pack the module strictly before transporting it. It is strictly prohibited to transport it mixed with equipment that may affect it.
	**Regular inspection and maintenance** Please perform daily and regular inspection and maintenance on the module, and keep maintenance records.

Others	
	**Do not remove the anti-tear warranty label** Do not remove the anti-tear warranty label, otherwise you will lose your warranty rights.
	**Please dispose of it as industrial waste** Please dispose of the module and its accessories as industrial waste.

2. Quality Assurance

2.1. After-sales policy

This product strictly implements the following after-sales services in accordance with the “Law of the People's Republic of China on the Protection of Consumers' Rights and Interests” and the “Law of the People's Republic of China on Product Quality”.

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①All users who purchase this product can enjoy the return and exchange service if there is a product quality problem within 7 days. When returning or exchanging, you should provide a valid proof of purchase and return invoice, and ensure that the returned product has intact functions, no damage to appearance, and complete accessories;

②Users who purchase this product will enjoy free warranty service within one year from the day after receipt. In the event of man-made damage, manual disassembly, etc., no warranty service will be provided; if after testing, it is confirmed that the motor needs to be replaced, the merchant will need to negotiate with customers whether to purchase additional repair parts;

③If there is a quality problem with the product within 7 to 15 days from the day after receipt, you can enjoy the exchange service after confirmation. When exchanging goods, you should provide a valid proof of purchase and return invoice, and ensure that the returned product has intact functions, no damage to appearance, and complete accessories;

④The following situations are found not to be covered by the warranty:

●Failure to install and connect other control equipment according to the requirements of the user manual may cause the motor to burn out;
●When used, the specifications or standards shown in the user manual are exceeded (such as wrong motor parameter settings);
●The storage method and working environment exceed the specified range in the user manual (such as pollution, salt damage, condensation, etc.);
●Product damage caused by abnormal working conditions (such as falling, impact, liquid intrusion, violent impact, etc.);
●Product damage caused by force majeure (natural disasters, fires, floods, etc.);
●Users dismantle the product by themselves, causing damage to the motor;
●Exceeds the warranty period provided by the post-sale policy;
●Unable to provide valid proof of purchase;
●Failures other than those mentioned above are not caused by Suzhou Micro Actuator Technology Co., Ltd.'s responsibility.

In the event of a joint module failure, you must contact Suzhou Micro Actuator

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Technology Co., Ltd as soon as possible to obtain a solution. Users are not allowed to disassemble and assemble the joint module for any reason, otherwise the warranty service will be terminated.

2.2. Disclaimer

Please read this statement carefully before use. Once used, it is deemed to be recognition and acceptance of the entire content of this statement. Please install and use this product in strict compliance with the manual, product instructions, and relevant laws, regulations, policies, and guidelines. In the process of using the product, users promise to be responsible for their own actions and all consequences arising therefrom. Myactuator will not be held legally responsible for any losses caused by improper use, installation, or modification by users. The final right to interpret the disclaimer belongs to Myactuator.

3. Basic parameters of the module

This series of modules is composed of two parts: stator assembly and rotor assembly. The stator assembly is vacuum-potted with potting compound, which contains the stator core, windings and PCB circuit board. The winding is a wire wound in the core groove and is responsible for generating the magnetic field; PCB circuit boards are used to wire crosses the windings and hold Hall sensors; Hall sensors sense the position of the rotor and provide a position signal to the system. The rotor assembly consists of a magnetic ring and a magnet. The magnet is fixed on the magnetic ring, and the fixing method is determined by the specific working conditions.

This series of modules is currently available in FL-38-12, FL-50-08, FL-50-15, FL-70-10, FL-70-16, FL-85-13 and FL-85-23 models, making robot development more convenient and flexible.

3.1. Module nameplate and model

The nameplate of this series model is as follows.

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RMD	-	FL	-	50	-	08	-	180
Brand		Inward rotation frameless series		Stator diameter		Stator height		Rated power

Table 3-1 shows the models of this series.

Table 3-1 Product model description

Model	Abbreviation
RMD-FL-50-08-180	FL-50-08
RMD-FL-50-15-200	FL-50-15
RMD-FL-70-10-200	FL-70-10
RMD-FL-70-16-400	FL-70-16
RMD-FL-85-13-400	FL-85-13
RMD-FL-85-23-750	FL-85-23

3.2. Module appearance size

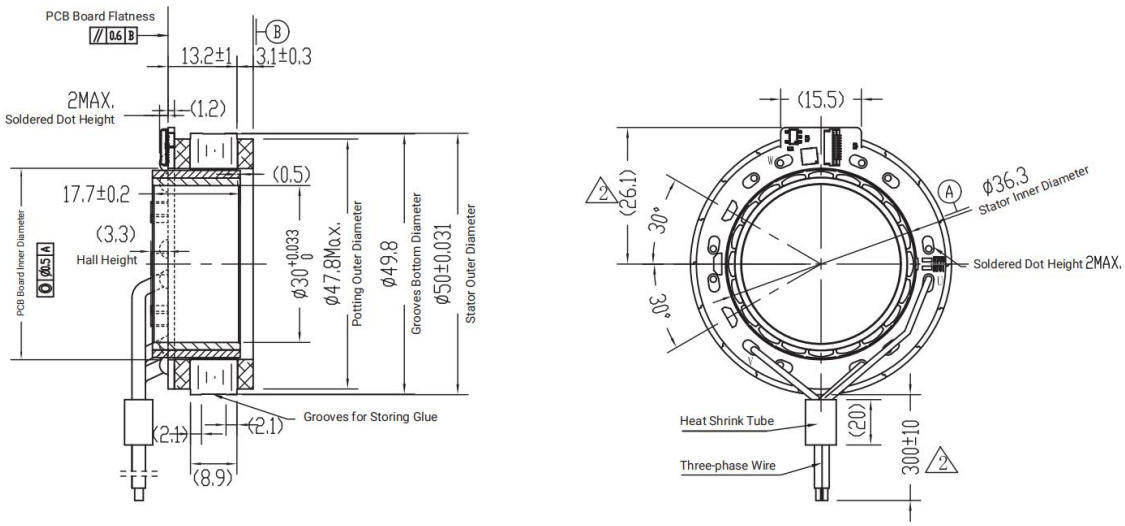

Figure 3-1 RMD-FL-50-08-180 appearance dimension drawing

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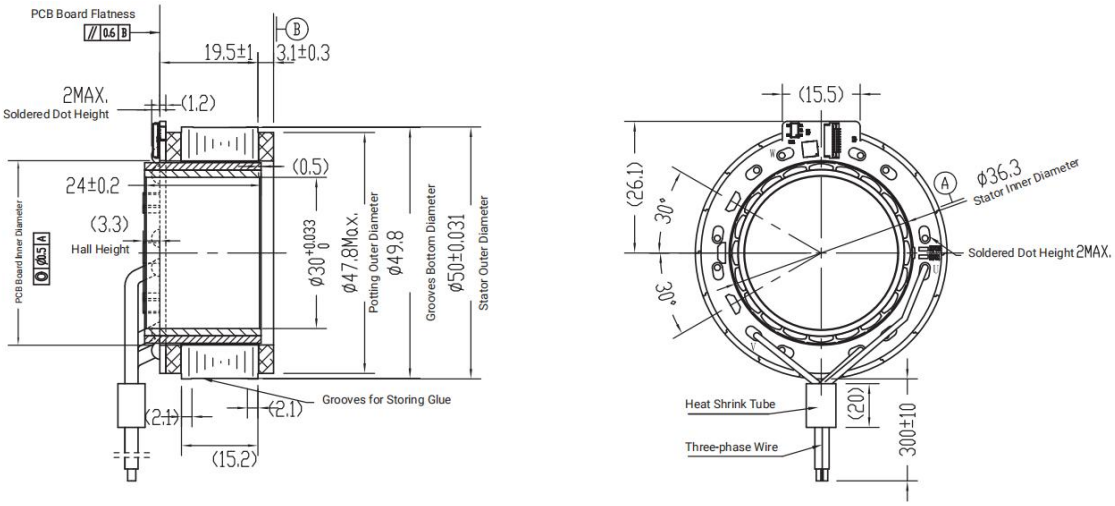

Figure 3-2 RMD-FL-50-15-200 appearance dimension drawing

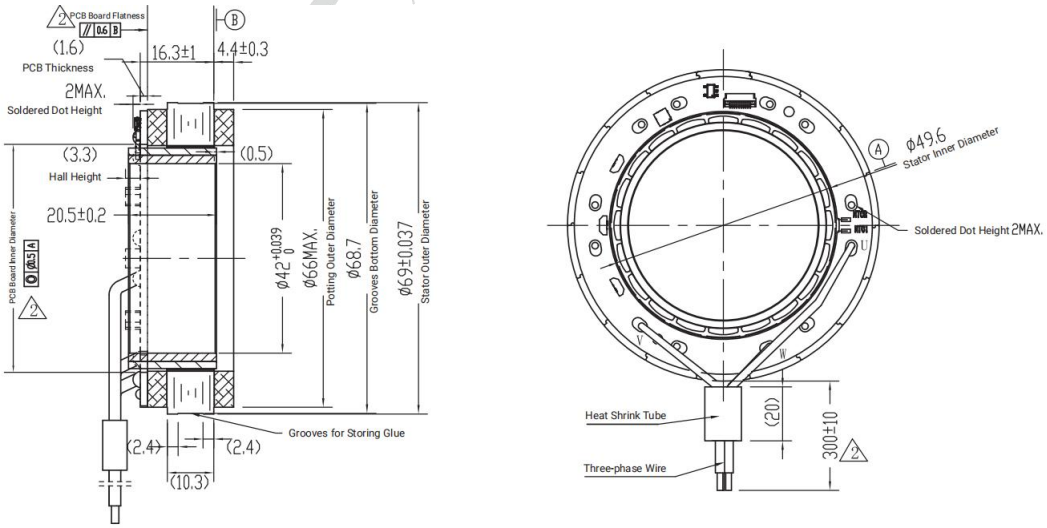

Figure 3-3 RMD-FL-70-10-200 appearance dimension drawing

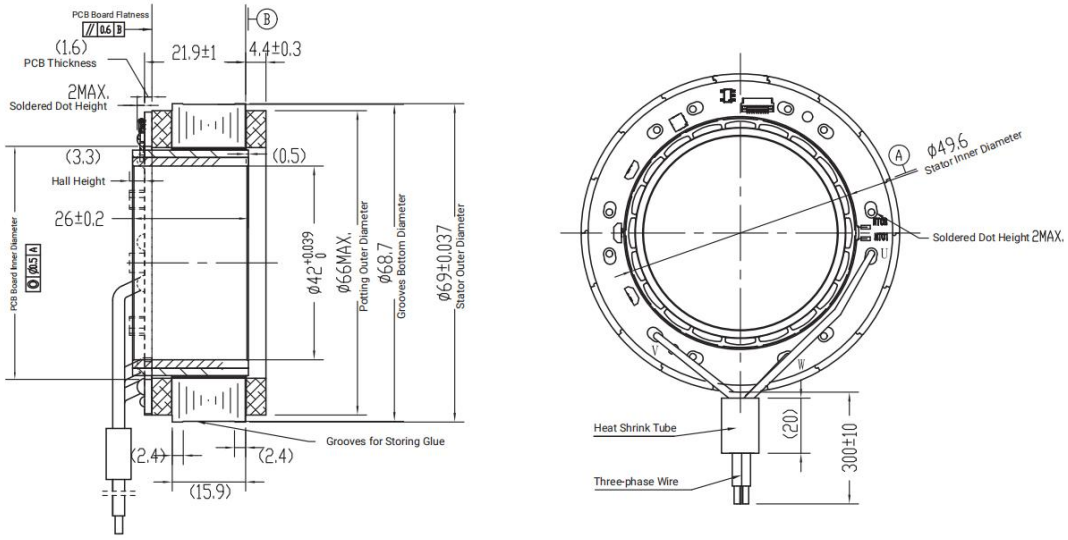

Figure 3-4 RMD-FL-70-16-400 appearance dimension drawing

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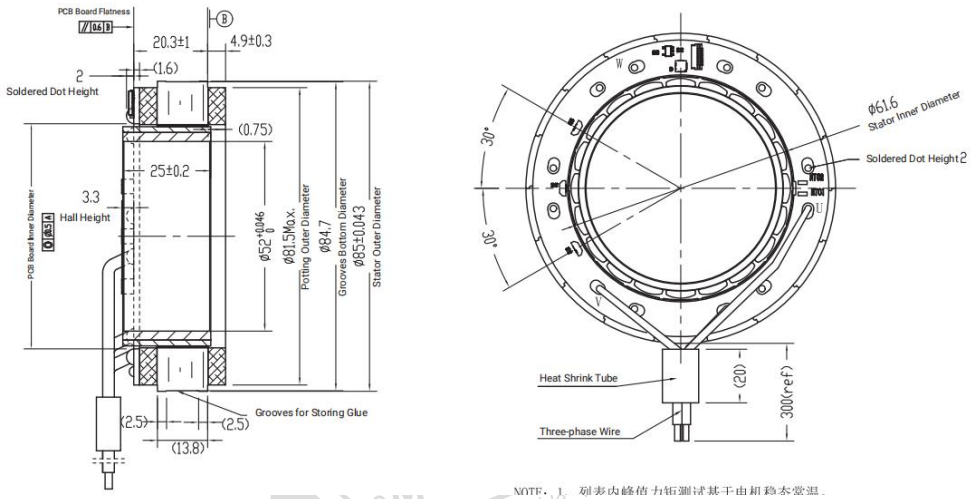

Figure 3-5 RMD-FL-85-13-400 appearance dimension drawing

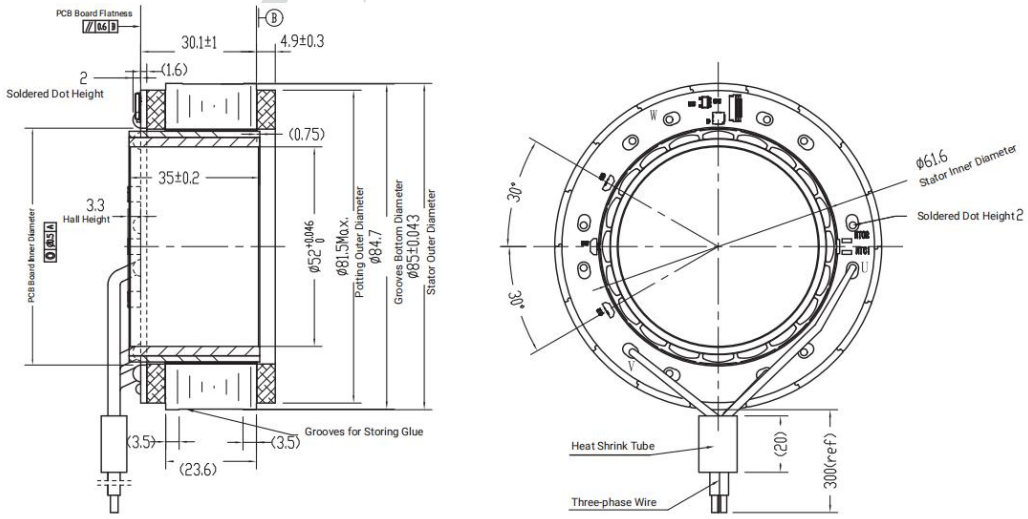

Figure 3-6 RMD-FL-85-23-750 appearance dimension drawing

3.3. Module parameters

Table 3-2 Module parameter list 1

Parameter	FL-50-08	FL-50-15	FL-70-10
Input Voltage(V)	48	48	48
Rated Speed (RPM)	5200 (REF)	3800 (REF)	3500 (REF)
Rated Torque (N.m)	0.3	0.51	0.55
Rated Power (W)	163	203	201
Rated Current (A)	3.6 (REF)	4.3 (REF)	4.4 (REF)
Peak Torque (N.m)	0.96	1.5	1.65

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Dielectrical strength	500V 1s 1mA	500V 1s 1mA	500V 1s 1mA
Insulation resistance	100MOhm 20C	100MOhm 20C	100MOhm 20C
Mounting type	IM B5 V1 V3	IM B5 V1 V3	IM B5 V1 V3
Cooling type	IC410	IC410	IC410
Polar	10	10	10
Protection grade	IP00	IP00	IP00
Insulation class	B 130C	B 130C	B 130C
Stator weight(g)	78	-	172
Rotor weight(g)	37	-	71
Inertia (g.cm^2)	100	-	358

Table 3-3 Module parameter list 2

Parameter	FL-70-16	FL-85-13	FL-85-23
Input Voltage(V)	48	48	48
Rated Speed (RPM)	3000 (REF)	3000 (REF)	3500 (REF)
Rated Torque (N.m)	1.3	1.3	2
Rated Power (W)	408	408	733
Rated Current (A)	9.2 (REF)	8.6 (REF)	14.5 (REF)
Peak Torque (N.m)	2.6	3.9	6
Dielectrical strength	500V 1s 1mA	500V 1s 1mA	500V 1s 1mA
Insulation resistance	100MOhm 20C	100MOhm 20C	100MOhm 20C
Mounting type	IM B5 V1 V3	IM B5 V1 V3	IM B5 V1 V3
Cooling type	IC410	IC410	IC410
Polar	10	10	10
Protection grade	IP00	IP00	IP00
Insulation class	B 130C	B 130C	B 130C
Stator weight(g)	150	324	-
Rotor weight(g)	90	135	-
Inertia (g.cm^2)	454	1086	-

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4. Product features and applications

4.1. Product Features

This series of motors has a compact structure and high degree of integration, and the characteristics are as follows.

1. Modular stator and rotor design, optimized crack ratio, improve the torque density of the motor;

2. The rotor inner hole space is large, and the stator is for customers to install embedded (installation structure, heat dissipation system, etc.), which is conducive to personalized design and more flexibility for customer customized systems;

3. Optimize the groove and pole coordination, reduce the cogging torque of the motor, and ensure the smooth operation of the motor.

4.2. Product Applications

This series of motors is suitable for a variety of robotics and automation applications, including robotics, medicine, machine tools, packaging, printing, processing and general automation. In the field of humanoid robots, this series of motors is expected to give full play to its advantages of compact structure and high performance, and is used for high-precision motion control and attitude adjustment of robots.

5. Unboxing

This series of motors are packed in foam and ziplock bags for protective packaging, and the stator and rotor are packed separately to prevent the motor from being damaged by collision during transportation. After unpacking, first check whether the stator and rotor are damaged, if any damage occurs, please immediately our company, so that it can be dealt with in time.

5.1. Unpacking of the stator

The stator assembly of this series of motors includes an iron core and sensor elements, and the following matters should be paid attention to when unpacking.

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1. If it is not assembled immediately, do not open the ziplock bag of the package to prevent the stator core from rusting;

2. Wear anti-static equipment when taking the stator to prevent static electricity from damaging the sensor elements;

3. Wear gloves when taking the stator to prevent the iron core from rusting caused by sweat stains on your hands;

4. Keep a safe distance from the rotor after taking it out to prevent the rotor magnet from being damaged due to suction.

5.2. Unpacking of the rotor

The rotor of this series of motors is made of strong magnetic magnets, and the following matters should be paid attention to when unpacking.

1. Keep a safe distance between the rotors when taking multiple rotors to prevent the magnet from being damaged due to rotor engagement;

2. Keep the rotor away from magnetic and permeable objects to prevent damage to the magnet caused by suction;

3. Keep a safe distance between the rotor and auxiliary medical equipment (such as pacemaker) to prevent magnets from interfering with the normal operation of medical equipment;

4. Handle the rotor gently to prevent the rotor from bumping.

6. Assembly positioning

Pay attention to the positioning problem when assembling the stator and rotor of the motor, and accurate positioning will help the smooth operation of the motor.

6.1. Axial positioning

The rotor length of this series of motors is larger than the stator length, and when the axial positioning is carried out, it is necessary to ensure that the stator is fully coupled to the rotor, so that the motor does not have axial tension and the motor does not lose output torque, as shown in Figure 6-1.

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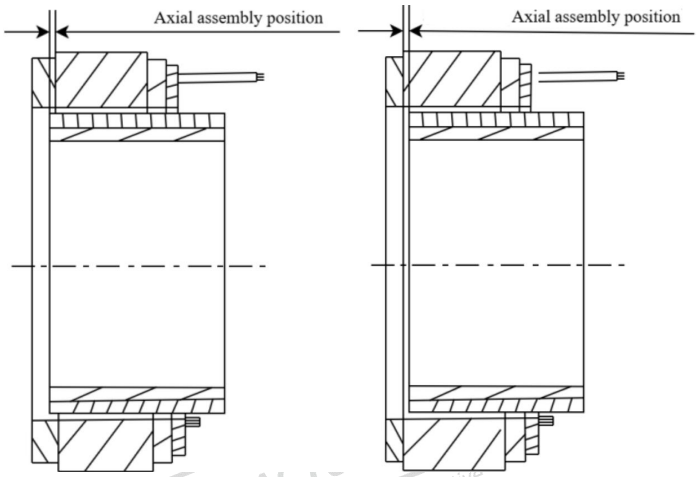
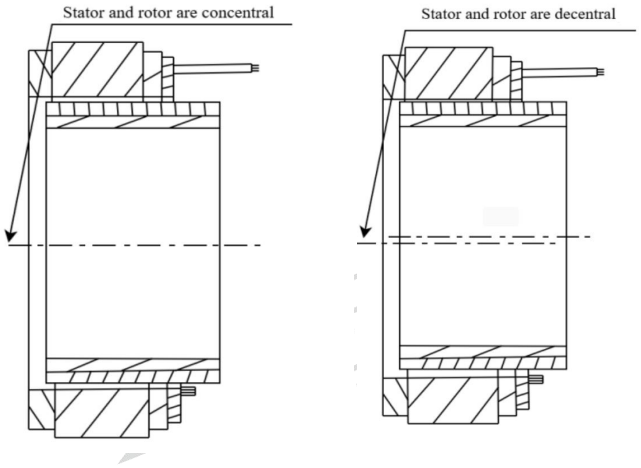


(a) Correct axial positioning （b）Incorrect axial positioning

Figure 6-1 Schematic diagram of axial positioning

6.2. Radial positioning

In the process of motor enablement, the rotor can not appear along the radial eccentricity in the stator, let alone contact the stator, the size of the air gap must be considered when designing the tolerance of the stator and rotor mounting accessories, the cumulative tolerance can not exceed half of the unilateral air gap at most, and the radial position of the stator and rotor assembly is shown in Figure 6-2.



(a) Correct radial positioning （b）Incorrect radial positioning

Figure 6-2 Schematic diagram of axial positioning

6.3. Angular positioning

If the angle of the stator and rotor is positioned to ensure that the two axes coincide,

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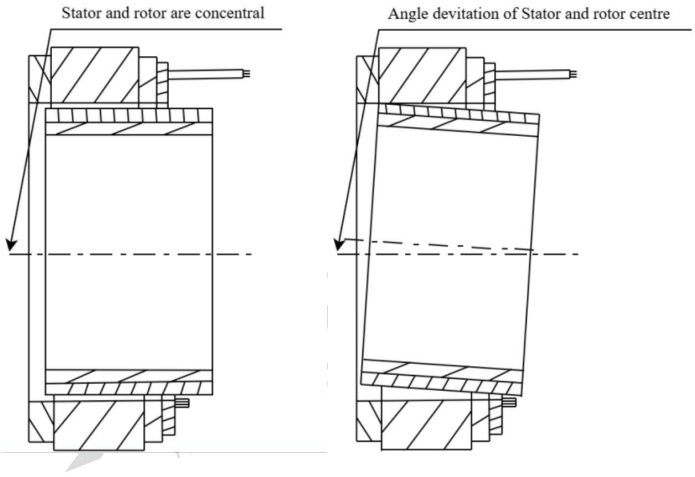
if the axis angle shifts, as shown in Figure 6-3, the air gap will be uneven, which will cause unstable operation.



(a) Correct angular positioning （b）Incorrect angular positioning

Figure 6-3 Schematic diagram of angular positioning

The above are the more common problems in the process of stator and rotor positioning, and should be avoided as much as possible during installation.

7. Stator assembly

The primary goal of stator assembly is to hold it firmly on the machine without tangential slippage. There are three main ways of assembly:

1. Fix with end cap;
2. Fix by hot sleeve or tight fit;
3. Fix by gluing.

7.1. End cap fixation

The stator is fixed by using the front and rear end caps, the stator core is pressed between the front and rear end caps, and the stator is not displaced when the motor is running by using the friction between the end faces, and it is fixed by bolts, as shown in Figure 7-1. In addition, the front and rear end caps are used as the supporting structure for mounting bearings and other components, and when there is a lead wire that needs to be worn out of the structure, corresponding holes need to be cut in the end cover.

In order to ensure concentricity, it is better to complete the inner diameter of the

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end cap by machining, and the critical size of the inner diameter of the end cap is the outer diameter of the stator core, and the limit tolerance between the two can be H8/js8.

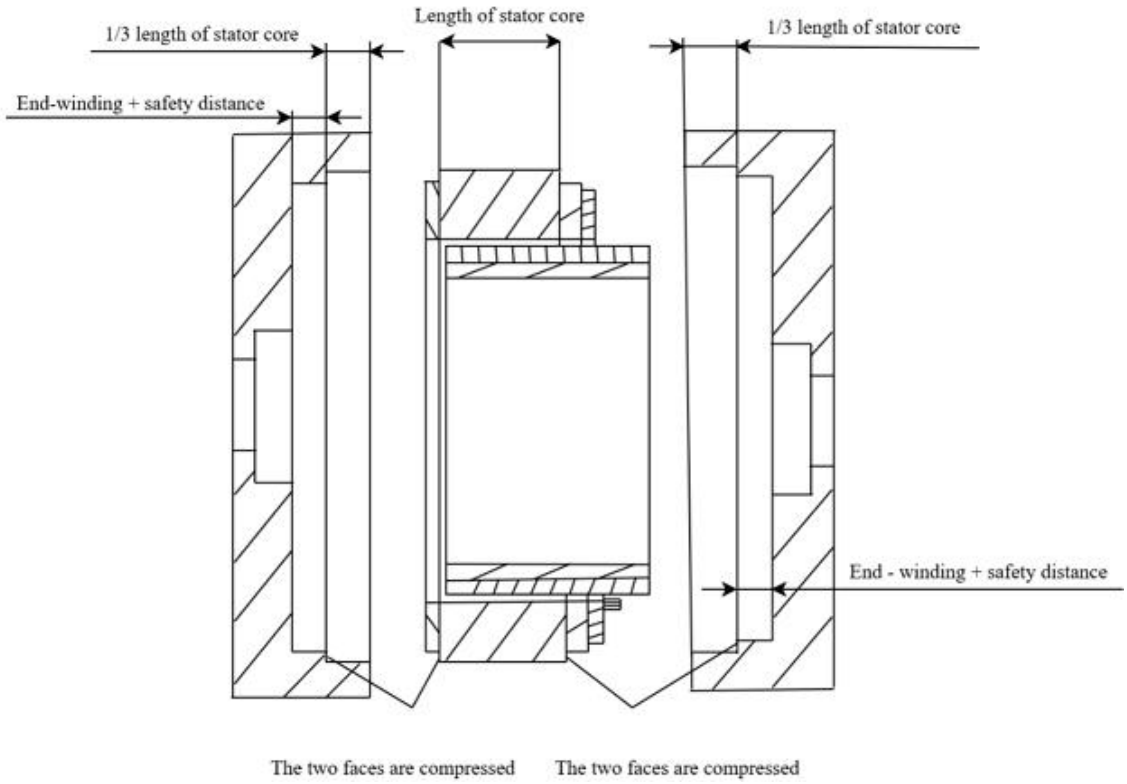

Figure 7-1 Schematic diagram of end cap fixing

7.2. Heated assembly

The casing material and thickness of the hot sleeve are different, and the size and installation method should be subject to the specific working conditions, as shown in Figure 7-2. When selecting materials, the thermal expansion coefficients of different materials should be considered, and the storage and operating temperature should also be considered for the setting of fit tolerance size (for example, when the chassis is made of aluminum, it is recommended to choose N8/h8 for the ultimate fit tolerance size). The thickness of the shell is selected according to the torque transmitted by the stator, and the thicker the shell, the greater the torque transmitted. In addition, the surface roughness of the casing should be appropriate.

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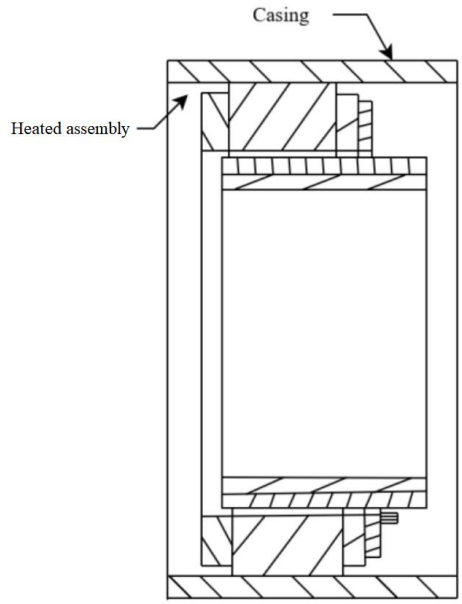

Figure 7-2 Schematic diagram of heated assembly

7.3. Gluing

In order to ensure the concentricity of the stator and rotor, it is recommended to set the ultimate fit tolerance of the contact position between the casing and the stator core to H8/js8. In this method, the end of the stator core is axially stopped by the boss of the casing, and at the same time, the glue bonding strength can withstand the tangential force that interacts with the motor during operation to ensure that the motor does not shift axially and radially during operation, as shown in Figure 7-3.

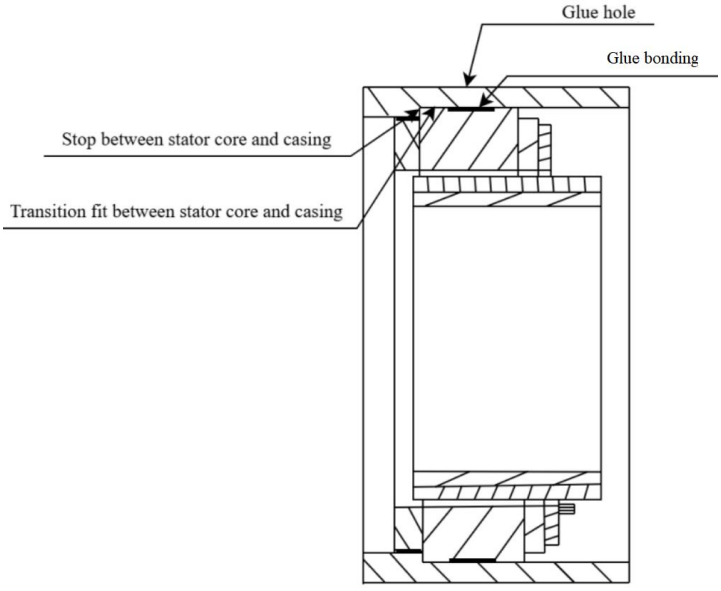

Figure 7-3 Schematic diagram of gluing

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8. Rotor assembly

The requirements of the rotor assembly are to ensure that the concentricity and air gap between the stator and rotor are uniform. The material selection of the rotating shaft is 40Cr, silicon steel sheet, etc., and the tolerance of the inner diameter of the rotor can also be selected to different grades, so the selection of the rotating shaft should be determined according to the price and specific working conditions. There are several main ways to fix the rotor to the shaft.

1. Screw fixing;
2. Gluing;
3. Interference fit.

8.1. Screw fixing

The rotor is fixed on the rotating shaft in the mode of transitional fit, it is recommended to determine the ultimate fit tolerance as H8/k7, the bottom uses the rear cover plate to press the other end of the rotor, resulting in a gap between the rotating shaft and the rear cover plate in the axial direction, and the rear cover plate and the rotating shaft are fixed together by fastening screws, so as to realize the fixing of the rotor on the rotating shaft, as shown in Figure 8-1. The number and size of screws can be determined according to the torque of the motor.

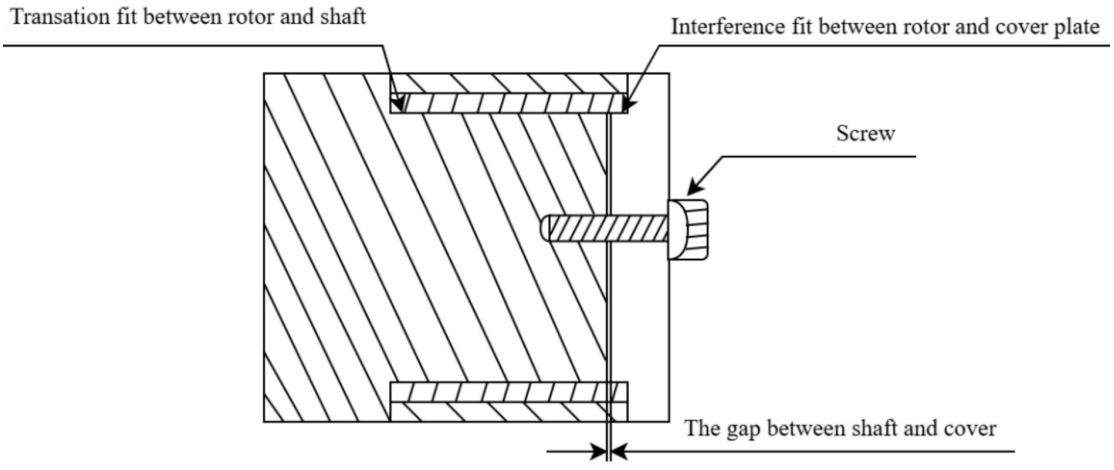

Figure 8-1 Schematic diagram of screw fixing

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8.2. Gluing

The first prerequisite for rotor adhesive is the addition of grooves on the surface of the shaft, the form of which can be determined according to the working conditions, such as the use of threaded grooves. The specific situation of using adhesive is determined according to the parameters such as glue model, shaft size and torque size, as shown in Figure 8-2.

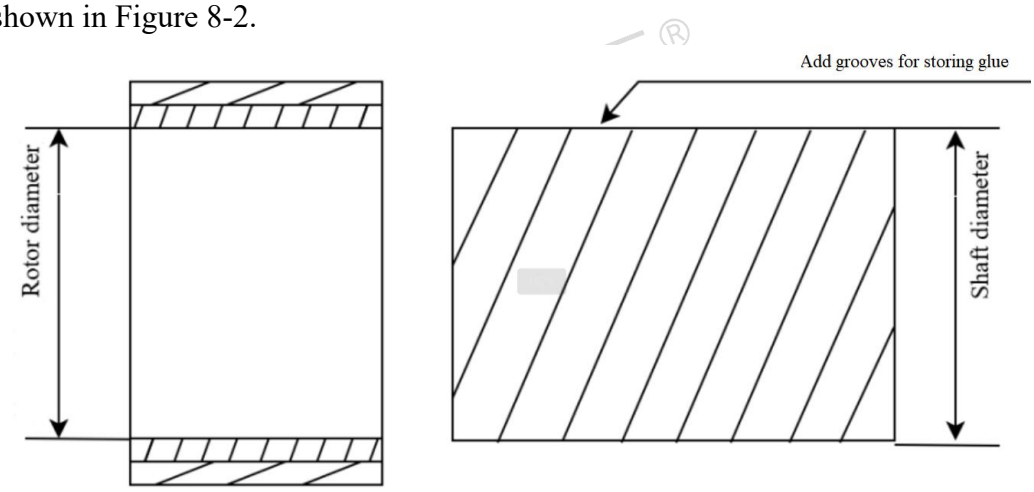

Figure 8-2 Schematic diagram of rotor gluing

8.3. Interference fit

A reasonable interference should be set between the inner diameter of the rotor and the outer diameter of the rotating shaft, and the assembly limit tolerance should be H8/p7, and the parameters such as motor speed and output torque should be considered, and the surface of the rotating shaft should be set with a reasonable roughness, as shown in Figure 8-3.

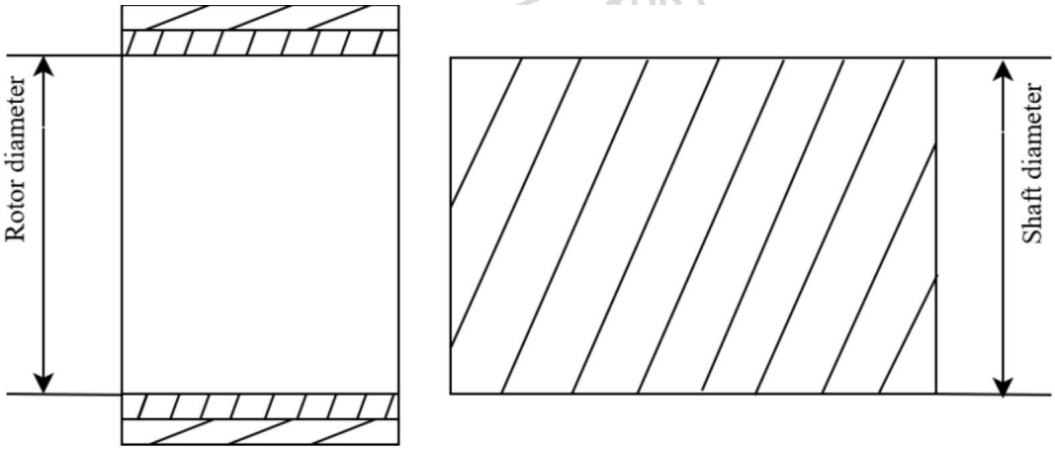

Figure 8-3 Schematic diagram of interference fit

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9. Storage

The storage environment of the frameless motor is -10°C~55°C, the maximum humidity of the environment is 85%, and the air shall not contain corrosive gases in the clean and well-ventilated warehouse, and the storage period of the motor under this condition is one year.

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