Frameless Motors

An Assembly Guide

Frameless Motor Mounting and Installation

Emoteq produces brushless DC motors in housed and frameless versions. This procedure provides guidelines for the mounting and installation of frameless motors.

Handling and Storage

Handling and storage of motor components is very important. It is recommended that stators and rotors be stored in their original packaging until installation is required. Special care must be taken while handling stator assemblies. Damage to the coil insulation and lead wires can result in electrical shorts and possible electrical shocks. Precautions must also be taken while handling the rotor assembly, as strong magnet forces are present. Magnets can be chipped, cracked or broken if the rotor is dropped or large magnetic objects and other rotors are suddenly attracted to the rotor.

Description

Refer to Fig. 1 and Fig. 2.
Frameless motors are supplied as two separate components, stator assembly and rotor assembly. The stator assembly consists of a laminated stator core with powder coat insulation, magnet wire, slot wedge and 3 stator leads. Depending on the design and/or customer preference the stator assembly may also contain 3 hall effect sensors with 5 leads and a thermistor or thermal switch. A circuit board containing the hall sensors and leads may be attached to the coil endturns. The rotor assembly consists of a magnetic rotor hub and magnets. The design may also require a nonmagnetic sleeve around the magnets in stainless steel, brass or fiberglass.

Motor Design Layout

Refer to outline drawing, Table 1 and Fig. 3.
When laying out the motor design, refer to the mounting dimension on the outline drawing to ensure the rotor and stator are axially aligned. Rotor magnets are approximately .125" longer than the stator core length. The extra length is required to trigger the hall sensors. Maximum radial misalignment or concentricity between the rotor and stator is .004" TIR. (Total Indicator Reading). Angular misalignment will vary with the stator stack length.

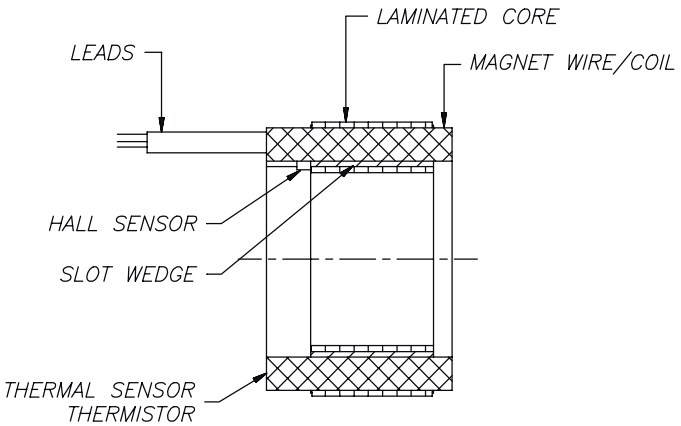

Fig 1

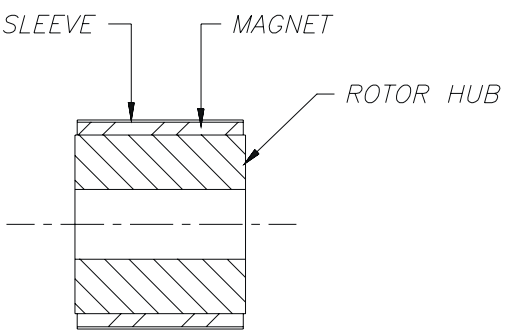

Fig 2

TABLE 1.

ANGULAR ALIGNMENT STACK LENGTH	ANGLE
MIN. TO .650(16.5)	.3 DEG.
.651(16.53) TO 1.050(26.7)	.2 DEG.
1.051(26.7) TO 1.850(46.9)	.12 DEG.
OVER 1.851(47.0)	.07 DEG.

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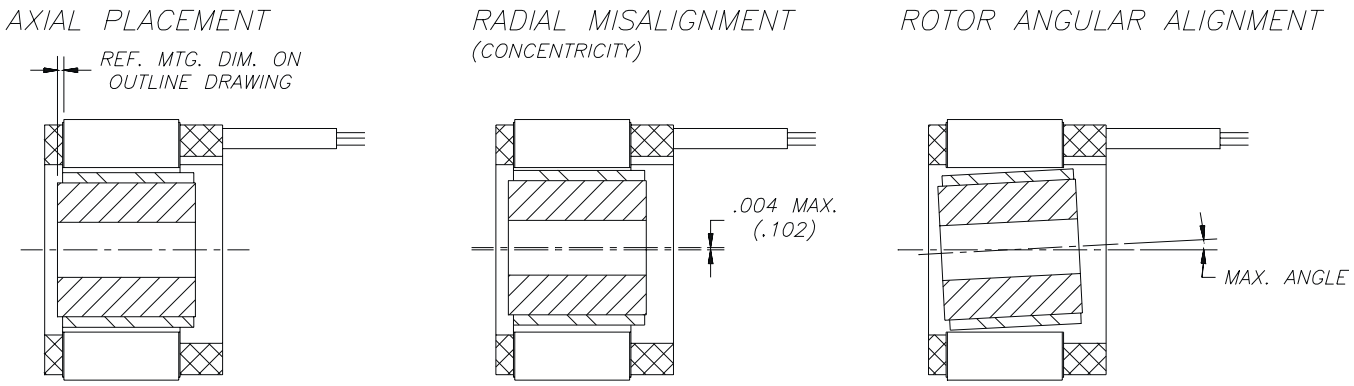

Fig 3

Refer to Fig. 3. Table 1. The size and application of the motor will dictate the type of bearings required. Consult bearing catalog or manufacture for the proper size and type.

Stator Mounting

Refer to outline drawing and Fig. 4.
The stator assembly is designed to mount between two endbells. Endbells can be produced by either machining a solid piece of stock or through a die-casting process. In either case the endbells must be designed to provide a rigid and stable support for the stator and rotor assembly. Stators are supplied with a mounting surface machined on each end of the stator core. The mounting surface on the endbell must be designed to the following criteria. The outside diameter of the endbell shoulder is equal to the maximum stator OD + .001" +.001"/-.000". The inside diameter of the shoulder is equal to the max. stator core mounting diameter + .005" +.005"/-.000". The depth of the shoulder is suggested at .100" min. up to ½ the stator core length. A clearance gap of .050" minimum must be provided between the end coils and the endbell wall. A greater

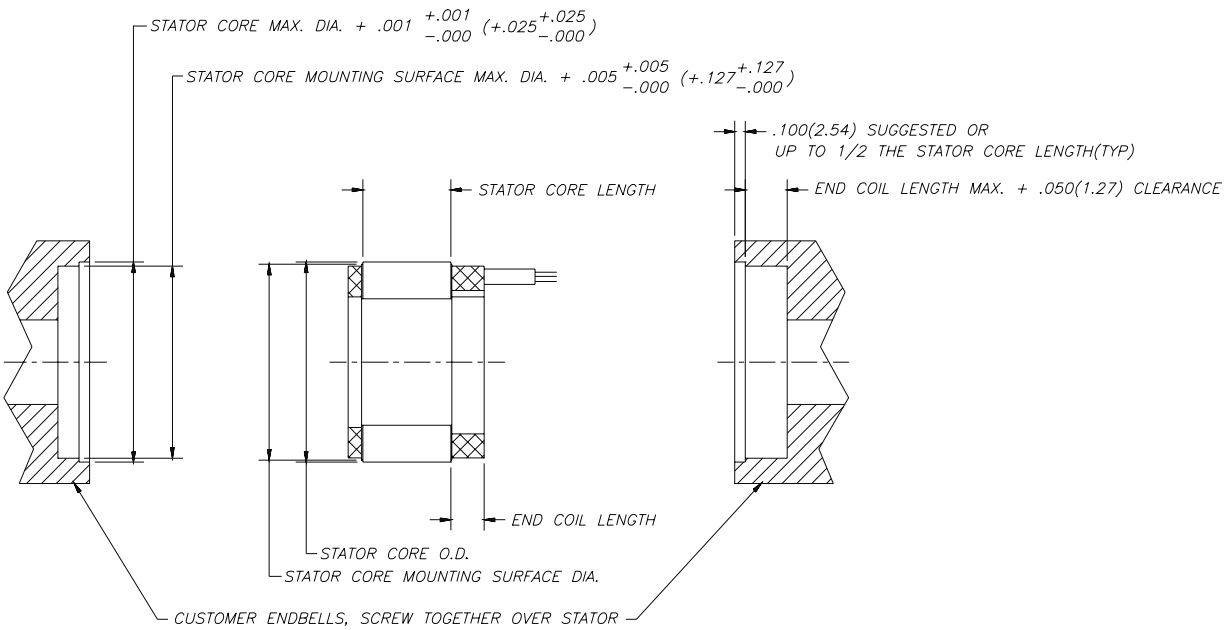

Fig 4

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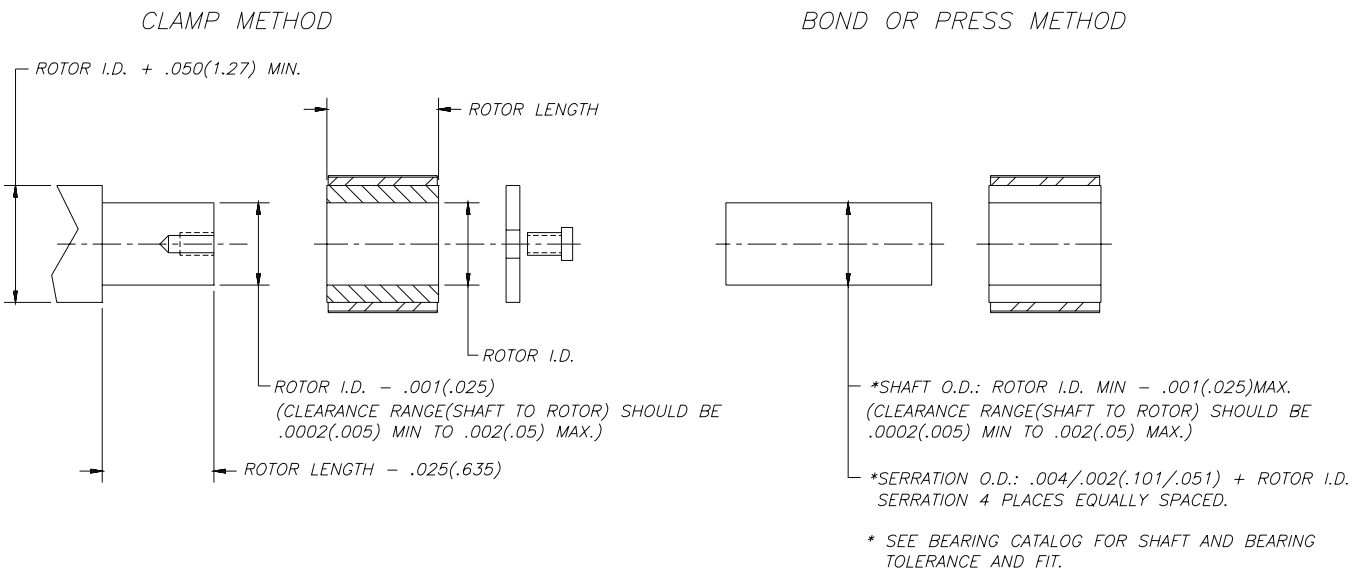

Fig 5

clearance gap will provide easier installation of the lead wires and may be necessary depending on lead wire exit. A grommet/strain relief should be used at the lead exit to protect lead insulation from chafing and protect leads from any tensile forces.

Rotor Mounting

Refer to outline drawing and Fig. 5.
Rotors can be mounted to shafts by various methods. Clamp, bond and press will be addressed in this procedure. The rotor ID is manufactured per the customer specification or to the standard catalog diameter. The shaft diameter for each method is equal to the rotor ID - .001". Clearance range between shaft and rotor should be .0002" min. to .002 max.

Clamp Method

This method involves holding the rotor to the shaft with force exerted thru a thrust disc and machine screw. A lock washer or bonding agent can be applied to prevent the screw from becoming loose. The number of screws will depend on the size of the rotor, torque requirements and customer application. Applications involving high torque or sudden start and stop modes may require a woodruff key or square key along with the clamp.

Bond Method

This method involves holding the rotor to the shaft with a high strength retaining compound. Adhesive manufacturers produce retaining compounds specifically for this design and should be consulted to help select the correct retaining compound for your application.

Press Method

This method involves holding the rotor to the shaft with an interference fit between a set of serrations on the shaft and the rotor ID. A set of 4 serrations equally spaced around the outside diameter of the shaft is required. The diameter over the serrations is equal to the rotor ID + .003 +/-.001". Serration length should be no less than ¾ the length of the rotor. A tapered serration is acceptable.

Assembly

Small motors (less than 4" OD) can usually be assembled by hand. Careful attention must be taken while inserting the rotor assembly thru the stator. Damage to the stator coil and magnets can occur if the magnet forces suddenly pull the rotor into the stator. The rotor assembly must be securely supported by hand during this process.
For large motors, assembly fixtures are recommended to support the stator and rotor during insertion of the rotor assembly.

Please contact Emoteq for further framless motor integration assistance.