LIN ENGINEERING
Step Motor Specialists

Frameless BLDC Mounting and Installation Guidelines

Customer Responsibilities

The user is responsible for designing the mounting interface or system, including the rotor shaft, stator enclosure, and bearing system. This guide is provided by Lin Engineering to ensure proper performance and reliability of the motor when installed in the system and should be used for reference purposes only. Fit calculations and tolerance analysis should be based upon the needs of the intended application and is the responsibility of the user.

Required Air Gap Clearance

		Models		
		FL060CH25-XX	FL070CN007-XX	
Nominal Air Gap	MM	0.476	0.430	
	INCH	0.019	0.017	

The above table outlines the nominal air gap clearance between the rotor and stator for all available frameless models throughout ideal motor operation. The user should closely adhere to the concentricity requirements found on Figure I of this document. These concentricity and axial alignment requirements should be used as a reference in the design and choice of the bearing and rotor shaft assembly.

Choice of bearing systems should exhibit the lowest possible friction and highest possible lubricant quality to ensure overall system friction is minimized. Further, the bearing system should exhibit sufficient rigidity to ensure a uniform clearance of the air gap between the rotor and stator under all operating conditions. Axial alignment control is vital when implementing the frameless motor into any system, and is commonly achieved through machined shoulders or grooves at the customer's discretion.

Mounting Materials

Mounting material selection and housing design details are defined by the user and are, to an extent, application specific. The following guidelines are provided as a reference.

Stator Mounting Materials

A metallic housing structure is strongly suggested to ensure the stator is rigidly mounted to the system. Metallic housing also provides conductive heatsinking capabilities which ensure the motor's rated operating temperature range is respected. Suggested metals are aluminum alloys, which provide high thermal conductivity and great strength to weight ratio, and stainless steel alloys, which are sufficient in less thermally critical applications. Magnetic flux conducting ferrous metals such as carbon steel or cast iron are least desirable, as they run the risk of redirecting valuable magnetic flux unless the housings are meticulously designed and optimized. Any thermally isolating materials are strongly discouraged, since they adversely affect the heatsinking capacity of the system, which effectively de-rates the motor to a significant degree.

Rotor Mounting Materials

The rotor may be mounted to a wider range of metals, although carbon steel and stainless steel are the most commonly used materials. The user's choice of material for the rotor shaft may influence the method of attachment and tolerance clearances.

Stator Mounting Methods

Since the motor's performance is contingent on a uniform air gap, any deviation from concentricity will lead to lower motor performance. Thus, proper stator mounting is critical to ensure concentricity, perpendicularity, and axial alignment between the stator and the motor housing, and ultimately the stator and rotor. Lin Engineering suggests the following methods for installation of the motor stator depending upon characteristics of application.

Bonding – Applications with peak torque values within that of the structural epoxy's shearing range are well suited for mounting using bonding adhesives.

- Stator enclosure is often a cylindrical housing to successfully utilize adhesive bonding
- This method can potentially lead to perpendicularity problems between stator and housing, but is easily combated using shoulder feature stops and chamfers for easy insertion and location
- Closely follow chosen structural adhesive guidelines for cleaning and application to ensure optimal bonding, adhesion, and strength

Axial Clamping & Press Fits – Applications with low to moderate torque requirements, or instances where stator must be repeatedly removed from system are well suited for axial clamping or press fit mounting methods. Critical stator OD dimensions are provided to aid in housing design and can be found on the company website for each individual model.

- Not recommended for high shock/vibration applications, as stator could move relative to mount and create a non-uniform air gap

- If high thermal conditions are required, it is vital that enclosure and stator are the same material to ensure equal expansion and stress/strain relief

- Similarly to the bonding method, shoulder stops and locating features can help ensure perpendicularity between stator and housing and promote proper operation

Bolting – Acceptable for any and all applications, recommended for high torque applications

Rotor Mounting to Shaft

Any of the above mounting methods are sufficient options for mounting the rotor to the user's shaft or rotary output, although bolting is seldom used. Once again, it is vital to ensure axial alignment when mounting the shaft to the rotor hub, as this has a large impact on the smooth predictable operation of the motor. It is also important to consider thermal environment and its implication on material selection.

Lin engineering provides the critical rotor ID dimension on individual model drawings available for download on the website. These dimensions as well as their associated concentricity and axial alignment requirements should be taken into account closely in the design of the rotor shaft assembly and bearing system.

Proper Rotor Stator Installation

Ensure the stator is securely mounted before attempting to install the rotor. If the rotor is off-center with respect to the stator, radial forces are induced on the rotor shaft which effect the performance of the motor. Similarly, improper axial alignment creates an axial force which will translate to the mount housing and ultimately the system in which the motor is integrated. Further, improper axial alignment can work to de-rate the peak torque characteristics of the motor. Again, the axial alignment and concentricity tolerance are provided for reference in Figure I below.

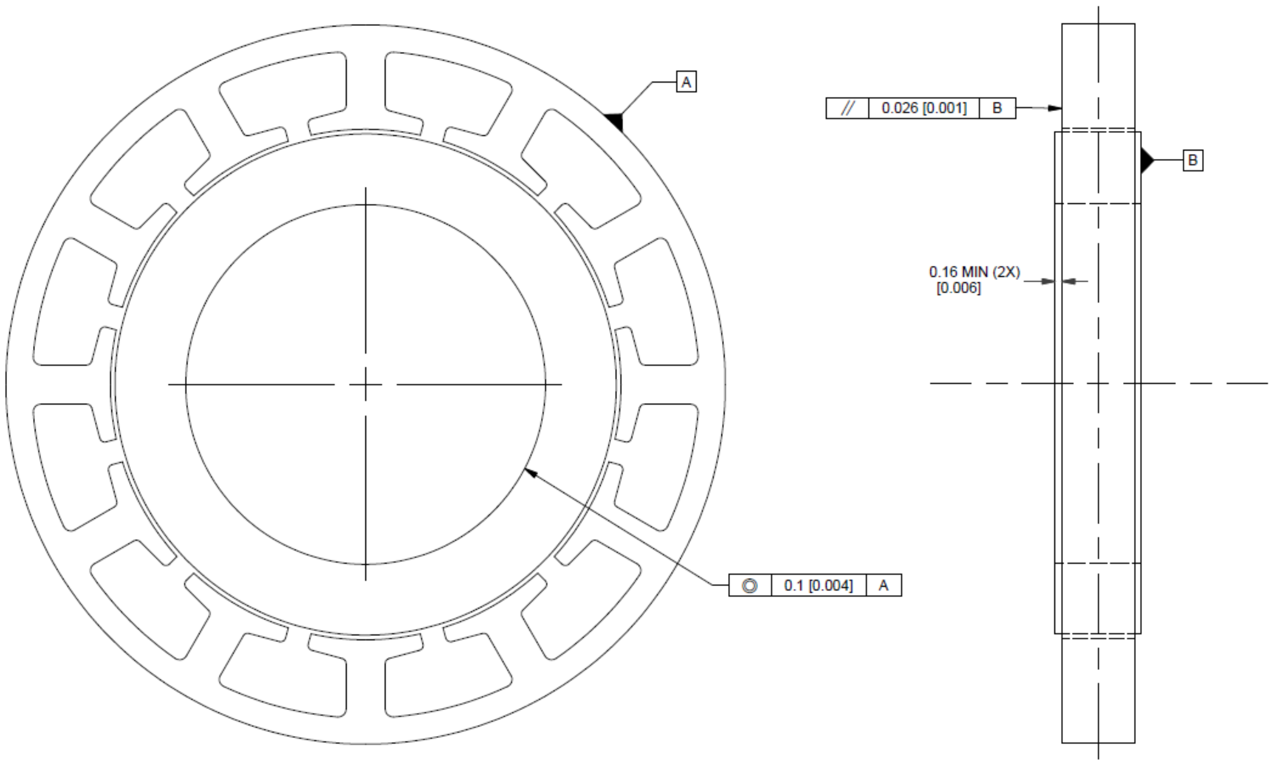

Figure I: Stator Rotor Position Tolerances