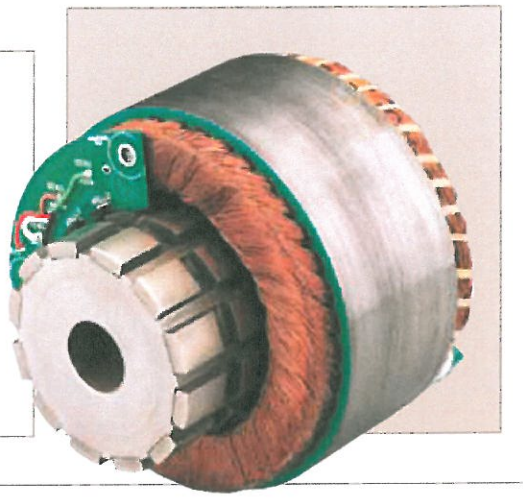
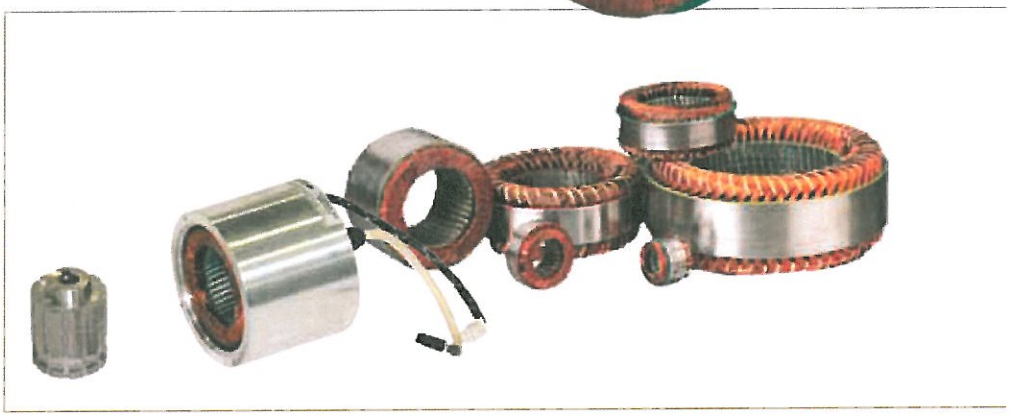
K Series Kit Motors

Frameless Kit Motors are the Reliable and Compact Approach to Build Your Own High-Performance Motor



Direct drive motion construction gives equipment designers the advantages of lower costs, increased reliability and improved performance

Frameless kit motors are the ideal solution for machine designs that require high performance in small spaces. Kit Motors allow for direct integration with a mechanical transmission device, eliminating parts that add size and compliance. Use of frameless kit motors results in a smaller, more reliable motor package. Direct drive motion construction gives equipment designers the advantages of lower costs, increased reliability and improved performance.



Features & Benefits:

- **High torque from 0.5 in-lb (0.06 Nm) to 85.6 in-lb (9.7 Nm)**
- **High speeds up to 50,000 RPM**
- **Superior performance – high stiffness and better response**
- **High reliability – no mechanical transmission devices (couplings, flanges)**
- **Compact design – minimizes product size**
- **Low cogging - unique magnetic circuit design decreases cogging**

Applications:

- **Automotive**
- **Machine tool**
- **Material handling**
- **Packaging**
- **Robotics**
- **Semiconductor**

When to Use:

- **A significant cost savings**
- **Reduced mechanical complexity**
- **Greater design flexibility**
- **High performance in a compact package**
- **Improved dynamic response and settling**
- **Minimum motor size per application space**
- **Low cogging for smooth operation**
- **Low inertia for high acceleration**

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MOUNTING FRAMELESS MOTOR INTO ASSEMBLY

This section outlines a number of methods that can be used to mount the stator and rotor assemblies in the product.

Which method to be used will largely depend on the product design, performance requirements (torque, velocity, temperature, etc.) and the manufacturing capabilities of the user.

Dimensioned drawings for all the kits are shown in the catalog pages.

STATOR

The stator will be typically be mounted into a cylindrically shaped hole in the product (see Figure 9). It is recommended that a banking step be incorporated at the bottom of the hole to assure accurate and repeatable location of the stator.

Alternately, a non-ferrous "plug" could be used to provide a banking surface, which can be removed once the stator is fixed in place.

Figure 9 shows two methods for holding the stator in position; either with adhesive for a permanent assembly or with set screws for a removable assembly.

In designing the housing, be sure to provide a means for the stator lead wires (three) and the commutation Hall sensor PCB wires (five) to extend outside of the housing without interfering with the rotor / shaft assembly.

For volume production, a jig should be fabricated that will assure that the stator is located in the same position for each assembly. The yellow dot on the stator provides an index point for accomplishing this. This will eliminate the need to perform mechanical commutation alignment at final assembly.

Rotor

Except for the smaller motors (K032 and K044), the ID of the rotor will usually be larger than the shaft diameter.

An adapter sleeve will be required to allow mounting of the rotor to the shaft (see Figure 9).

The rotor / sleeve assembly must be positioned on the shaft such that the magnets are located in line with the stator assembly laminations. If the version in which the commutation PCB assembly is bonded to the end turns is being used, the commutation magnets must be located in proper proximity to the Hall sensors on the PCB. Figure 9 shows two methods for holding the rotor / sleeve on the shaft, either with adhesive or by using a spring pin and retaining ring.

When using the adhesive method, a shoulder should be provided on the shaft to properly locate the rotor/sleeve assembly.
When using the spring pin/retaining ring method, a slot must be provided in the sleeve that will engage the spring pin in the shaft, thus properly locating the rotor / sleeve assembly. During assembly, be sure that the pin and slot are fully engaged.

Note: The following adhesives are recommended for rotor and stator assembly (see Figure 9)

Loctite #325
Activator $7074
Loctite #609

Assembly

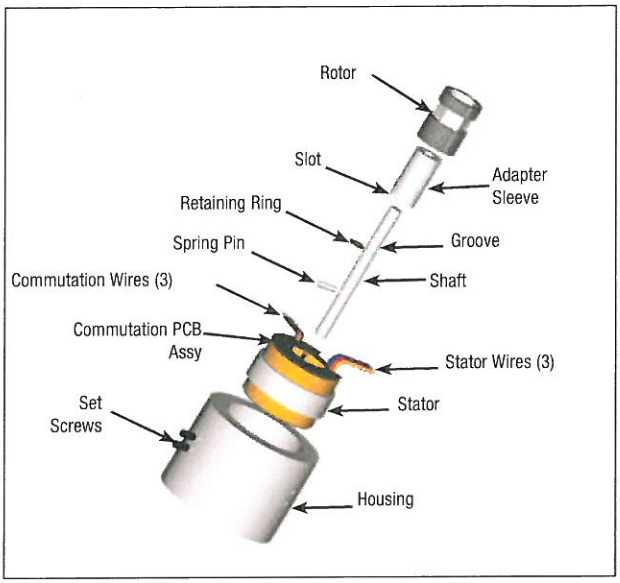
Stator Assembly:
Assemble stator in housing or sleeve (aluminum recommended) with the following locational clearances:

- Diameter to 127mm (5in) 0.025mm (0.001in) to 0.127mm (0.005in) diametrical clearance.
- Diameter over 127mm (5in) 0.05mm (0.002in) to 0.254mm (0.010in) diametrical clearance.

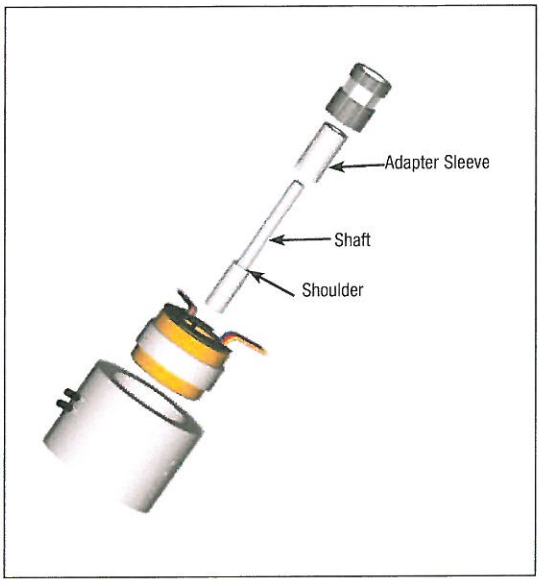
Do not force stator in position. This may damage or deform stator.

Permanent Assembly:
Secure stator with adhesive, Loctite #325 with activator #7074 or equivalent

Removable Assembly:
Secure with cup point screws or setscrews thru housing into stator steel laminations only. Use a minimum of three (3) screws equally spaced about stator O.D. Tighten evenly. Do not over torque screws. This may damage or deform stator.



Spring Pin / Retaining Ring Method



Shoulder / Adhesive Method

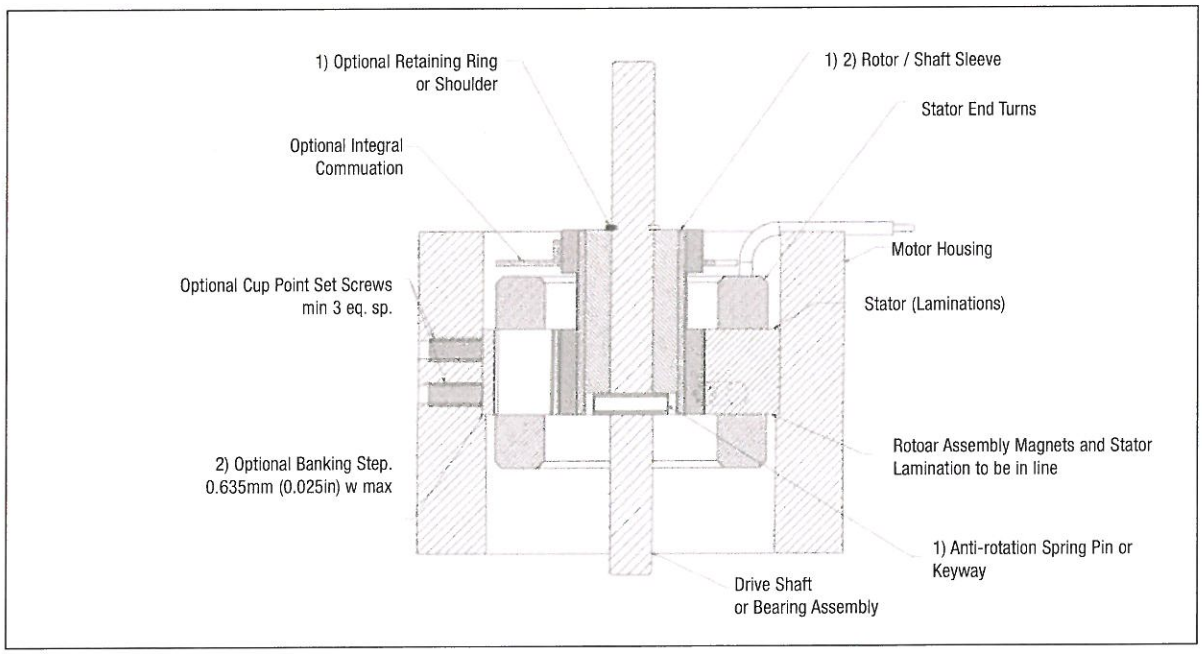


Figure 9

Rotor Assembly:
Assemble rotor to shaft with a locational clearance fit of 0.013mm (0.0005in) to 0.038mm (0.0015in) diametrical clearance.

Shoulder / Adhesive Method:
Fabricate shaft with shoulder. Secure rotor assembly and sleeve with adhesive. Loctite#609 or equivalent.

Spring Pin / Retaining Ring Method:
Fabricate a sleeve (steel or aluminum) with anti rotation spring pin groove. Fabricate shaft to accept retaining ring and spring pin. Permanently bond to rotor assembly.

Final Assembly:
Rotor magnets to be in line with stator laminations and concentric to stator lamination I.D. within 0.127mm (0.005in) MAX.

Caution:
Rotor assembly magnets are powerful and fragile!
Do not place near magnetically sensitive material
Do not place near other ferromagnetic materials such as iron, steel and nickel alloys. Strong uncontrolled attraction may damage magnets on contact.

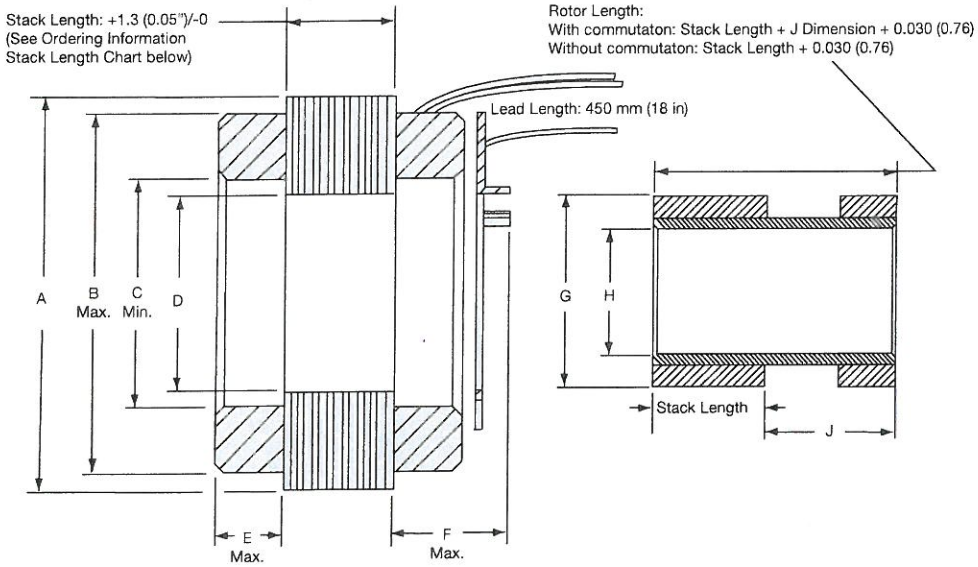
When assembling the rotor into the stator, high radial forces will be experienced, which can cause the magnets to "crash" into the stator and be damaged and / or cause bodily injury!

The following precautions should be taken:

- Wrap the rotor with a thin (0.005in thick) Mylar sleeve which will fill the air gap between the rotor and stator during assembly and can be easily removed when assembly is complete.
- Support the rotor and stator assemblies in a fixturing arrangement which will prevent radial motion while the two assemblies are being mated.

Example:
1. Hold the rotor / shaft / product assembly in a machine tool vise on the base of an arbor press.
2. Fasten the stator assembly to the vertical moving member of the arbor press, away from the stator.
3. Slowly lower the stator assembly around the rotor / shaft / product assembly.
4. Tighten all fasteners to complete assembly.
5. Remove Mylar shim and check for rotational clearance.

Dimensions

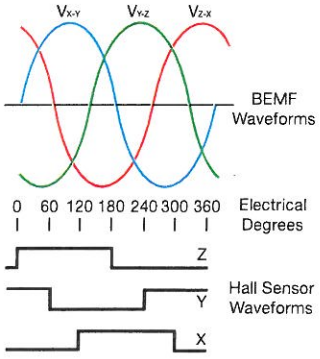


Frame Size	A O.D.	B End Turns O.D. Max	C End Turns I.D. Min	D I.D.	E End Turns Length Max	F Commutation Length	G Rotor O.D. Max	H Rotor I.D.	J Commutation Magnet Length
	Dimensions – in (mm)								
K032	1.251 (31.78) 1.249 (31.72)	1.17 (29.7)	0.65 (16.5)	0.593 (15.06) 0.583 (14.80)	0.25 (6.4)	0.57 (14.5)	0.559 (14.20)	0.301 (7.65) 0.299 (7.60)	0.52 (13.2)
K044	1.751 (44.48) 1.748 (44.40)	1.65 (42.0)	1.02 (25.9)	0.880 (22.35) 0.870 (22.10)	0.31 (7.9)	0.65 (16.5)	0.845 (21.46)	0.551 (14.00) 0.549 (13.95)	0.58 (14.7)
K064	2.501 (63.53) 2.498 (63.45)	2.39 (60.7)	1.50 (38.1)	1.385 (35.18) 1.375 (34.92)	0.38 (9.7)	0.69 (17.5)	1.350 (34.29)	0.927 (23.55) 0.925 (23.50)	0.62 (15.7)
K089	3.501 (88.93) 3.498 (88.85)	3.38 (85.9)	2.15 (54.6)	2.105 (53.47) 2.095 (53.21)	0.39 (9.9)	0.69 (17.5)	2.050 (52.07)	1.601 (40.67) 1.599 (40.61)	0.66 (16.7)
K178	7.003 (177.88) 6.997 (177.72)	6.80 (172.7)	4.39 (111.5)	4.356 (110.65) 4.346 (110.39)	0.60 (15.3)	*	4.319 (109.70)	3.771 (95.78) 3.769 (95.73)	*

Signal Timing

Motor Signal

Power Leads	Forward
SEN X	Red
SEN Y	Black
SEN Z	White



Commutation Assembly

Sensor Leads	Forward	Rearward
SEN Z	Brown	Brown
SEN Y	Green	White
SEN X	White	Green
+5 V	Violet	Violet
Ground	Gray	Gray