

WP0215

Dodge® mounted bearings: comparison of mounting methods

Dodge Customer/Order Engineering

11-12-2015



All rotating shafts need to be supported by at least two bearings. It sounds simple, but with so many bearings on the market, choosing the right bearing can be confusing. Not only do you have to select the type of bearing for the application, you also have to consider the sealing system, lubrication needs, and type of housing. You have a wide range of options and your choices will impact not only the operation of the bearing, but also how long it will last. However, no matter what type or size of bearing you choose, the mounting method has, arguably, the most significant influence on proper bearing operation, including load and speed utilization.

Mounting Methods

Several types of bearing mounting methods exist. The most common include setscrew mount, eccentric mount, squeeze or clamp mount, direct or interference mount, multiple-piece adapter mount, and the latest in the industry, unitized adapter mount.

Setscrew mounted bearings are possibly the most common. Typically mounted with 2 setscrews, this attachment method is quick, straightforward, and can be positioned with ease. However, tighter shaft tolerances are normally required, and the eccentric nature leads to limitations at high speed.

Eccentric locking methods attach with opposing cams between an installation collar and an inner ring. Although these bearings are easy to mount, they are only capable of unidirectional rotation. Opposing rotation against the cam will often lead to loosening and shaft disengagement.

Squeeze/clamp mount methods are also quite easy to mount. This attachment method utilizes clamping collars to squeeze down on one or both sides of an inner ring or adapter sleeve. Although this method improves concentricity, the load capacity of the bearing assembly is a function of the adapter sleeve material life.

Direct mounted bearings are mounted with an interference fit between the shaft and the bearing bore. This mounting method consumes much more installation time, plus, tighter shafting tolerances are required. Bearings will need to be heated in an oil bath or oven and pressed on the shaft. This style of bearing is positioned axially by means of a shaft collar or sleeve.

The multiple-piece adapter mounted anti-friction bearing, commonly referred to in the industry as the SAF product, mounts concentrically to the shaft utilizing full bearing speed and load capability. SAF require feeler gauges to measure the radial bearing clearance prior to mounting. This also confirms proper clearance reduction in the bearing to allow for sufficient mounting. However, this task can be time consuming. Although the advantages of the adapter mount have been worth the sacrifice in mounting time, the task is still quite cumbersome and can be confusing for less experienced assemblers. Fortunately, manufacturers have been working to eliminate the confusion and provide an adapter mounted product that is easily attached to the shaft without the arduous assembly tasks typically associated with these types of mounted bearings. These patented products are referred to as unitized adapter mounted bearings.

EXTERNAL/PUBLIC DOCUMENT

ABB Motors and Mechanical Inc.

6040 Ponders Court

Greenville, SC 29615

Phone: +1 864 284 5700

Email: DodgeEngineering@abb.com

Unitized adapter mount bearings offer many advantages over traditional SAF product offerings. The benefits include lubricated and sealed units, easy mounting and removal features, and improved misalignment capability. Additionally, the designs have been extended to include ball bearings as well. Now mounted ball bearings can reach direct mount bearing speed limits in a lubricated and sealed unit. Adapter mounted ball bearings with removal features have not been available in the past.

Advantages of Adapter Mounted Bearings

Adapter mounted bearings are mounted to the shaft by means of a tapered adapter sleeve. Much like a tapered bushing, tapered adapter sleeves mount concentrically to the shaft. The adapter has a slot running the length of the part and as the bearing is moved axially up the thicker portion of the adapter sleeve, the adapter collapses down on the shaft. All clearance is removed between the shaft and the sleeve, as well as between the sleeve and the bearing inner ring. The shaft centerline aligns with the bearing centerline resulting in excellent concentricity.

The benefit of true concentricity is not available with any other slip fit mounting method. Other methods, including setscrew and eccentric attachments, push the shaft centerline away from the bearing centerline resulting in a linear offset. As bearing speed increases, the consequence of the offset leads to imbalance, vibration, heat and reduced bearing life. However, concentricity allows for higher speeds and longer life.

At low speeds the offset from eccentricity in setscrew mounted bearings results in load transmission through the setscrews and localized pressure distanced from the bearing raceway. This leads to increased bending on the inner ring causing fretting corrosion, shaft slip, and eventually premature bearing failure. These low speed, high load applications pose no problems with adapter mounted bearings because the raceway is fully supported by the adapter with no clearance between the inner ring and shaft. Additionally, maximum surface contact area between the shaft and bearing promotes improved radial holding power without causing fretting corrosion or premature bearing failure. Adapter mounted products collapse on the shaft around the entire shaft circumference allowing wide, commercial shaft tolerances. All other slip fit and direct mount bearings require tighter shaft tolerances to achieve comparable speeds and loads.

Removing a bearing that has not been mounted with a tapered adapter is often difficult. Fretting corrosion and contamination between the mounting surfaces bonds the surfaces together making removal nearly impossible. However, unitized adapter mounted bearings cause no fretting corrosion, and have removal features designed into the bearing. Adapter nuts rotated counterclockwise essentially push the bearing directly down the mounting sleeve allowing for prompt removal, cutting maintenance costs and improving uptime.

Regardless of the application requirements, it may be beneficial to investigate the benefits of a unitized adapter or multiple-piece adapter mounted product in your facility. These benefits may save money on shaft expenditures and the costs associated with downtime. **Table 1** summarizes the benefits and drawbacks of each mounting method mentioned in this paper.

EXTERNAL/PUBLIC DOCUMENT

ABB Motors and Mechanical Inc.
6040 Ponders Court
Greenville, SC 29615
Phone: +1 864 284 5700
Email: DodgeEngineering@abb.com

Table 1: Summary of Mounting Methods

| Mounting Method | Ease of Installation | Speed Capability | Load Capability | Ease of Dismount | Concentricity | Shaft Tolerances | Exposed Bearing – Protection |
|------------------------------|----------------------|------------------|-----------------|------------------|---------------|------------------------|------------------------------|
| Unitized Adapter Mount | Excellent | Excellent | Excellent | Excellent | Excellent | Excellent (Commercial) | Excellent |
| Multiple-Piece Adapter Mount | Fair | Excellent | Excellent | Good | Excellent | Excellent (Commercial) | Poor |
| Setscrew Mount | Excellent | Fair | Good | Fair | Poor | Fair (Tight) | Excellent |
| Eccentric Mount | Excellent | Fair | Good | Fair | Poor | Fair (Tight) | Excellent |
| Clamp Mount | Excellent | Good | Fair | Fair | Good | Fair (Tight) | Excellent |
| Direct Mount | Poor | Excellent | Excellent | Poor | Excellent | Fair (Tight) | Poor |