Dodge® mounted bearings: proper bearing fits and how they can improve uptime

Bearing fits are an important factor to consider for proper bearing operation. If the fit between the bearing and the outer housing or the bearing and the rotating shaft are not correct then bearing life will be sacrificed. These fits are dependent upon the type and level of loading the bearing is subjected to.

Most mounted bearing manufacturers offer a general fit between their outer housing and the bearing inserts. These fits are practical for the majority of applications experienced but occasionally inherent machine loading characteristics warrant a different type of fit. Shaft or housing wear, bearing creep and/or thrust load evidence can all reflect improper bearing fits for the application.

When discussing fits it is important to note that most fits are defined through ISO (International Standards Organization) standards. Definitions of these tolerances are often available through bearing manufacturer publications, standards pamphlets, textbooks and various websites. Additionally, these fits can be utilized for the design of mating components other than bearings.

The ISO fits are defined by an alphanumeric designation starting with a letter character and then followed by a numeral. Tolerances on outside diameters are defined with a lower case letter-character while tolerances on bore inside diameters are defined with a upper case letter-character. Examples of ISO fits on an OD might look similar to g6, m14, or d3 whereas ISO fits on an ID might look similar to H7, G6, or JS12.

There are three main types of fits; interference, clearance and a mechanized fit. Interference fits are just that; pure interference between two surfaces. Basically the diameter of the bore of one part is smaller than the outer diameter of the mating part. The result is high pressure in the localized area that will keep the static interaction between the surfaces snug against each other. This requires tight tolerances on both surfaces and a great deal of preparation before assembly.

Interference between the two surfaces is achieved by either a press or shrink fit. Press fits are usually accomplished when the overall interference is not that great and a large mechanical press can be utilized to force the two components together. A shrink fit is usually accomplished by leveraging the thermal growth characteristics of the part. One or both parts are either heated to a larger diameter, cooled to a smaller diameter or a combination of the two. After the temperature of the components have been altered then they are assembled and allowed to reach ambient temperatures. As the component temperatures neutralize the surfaces gradually work together, thus resulting is an interference fit. The assembly process is usually quite tedious as errors in locating during assembly will result in a time-consuming correction process. Although interference fits are time consuming to assemble and the machining is more costly the overall result of the tight fit is consistent and productive service.

864-284-5700 | engineering@dodgeindustrial.com | 1061 Holland Road, Simpsonville, SC 29681 USA | **dodgeindustrial.com**

Clearance fits for bearings are much more common since they are easily assembled, mounted and disassembled. A clearance fit is when the bore is basically larger than the OD of the mating part. For a bearing, at least one of the raceways must be anchored. Therefore, clearance-fit inner rings are commonly held to the shaft by setscrews, clamp collars, eccentric cams, locknuts, snap rings or spring washers. They must utilize some sort of reinforcement otherwise they would move freely on the shaft.

The final type of fit is a mechanized fit which mimics an interference fit without the special shaft tolerances. Mechanized fits provide all the benefits of interference fits and also allow for easy disassembly. These fits commonly utilize a slotted tapered adapter sleeve that collapses down on the shaft during installation and provides a fully concentric, high pressure installation.

Bearings that utilize these types of mechanized fits to the shaft traditionally include adapter-mounted spherical roller bearings. However, mounted bearing manufacturers have now expanded these fits into smaller mounted ball bearings due to the advantages they offer in customer applications beyond the benefits of standard setscrew mounted ball bearings.

When selecting the correct bearing fit it is best to understand the type of loading. Fit selection is usually dependent upon raceway point loading or raceway circumferential loading. For example, consider the loading characteristics on an outer ring within a stationary housing when a rotating shaft (and inner ring) is affected by a belt drive. The load from the belt pull will result in a single point load on the bearing outer race in the direction of the pull. However, the inner ring would have a circumferential load since for every single shaft rotation the entire inner ring raceway would have been exposed to the load zone.

Looking at a different example where an eccentric or imbalance load is applied to a rotating shaft with a stationary housing (outer ring). The outer ring would now have a circumferential load whereas the inner ring would now have a point load from the eccentricities.

The two scenarios above warrant different housing-bearing fits as well as different shaft-bearing fits otherwise bearing failure is likely. Bearings with point-loads on the outer ring typically require tight fits between the shaft and inner ring yet can tolerate loose fits between the outer ring and outer bearing housing. The scenario with the imbalance load would work best with a tighter fit between the outer bearing housing and the outer ring yet could tolerate a loose fit between the shaft and bearing inner ring. Load level and bearing speeds will provide further guidance as to how tight or loose each fit should be.

864-284-5700 | engineering@dodgeindustrial.com | 1061 Holland Road, Simpsonville, SC 29681 USA | **dodgeindustrial.com**