

Baldor•Dodge Mounted Bearings: 65° Setscrew Locking Collar

C.O. Engineering - Bearings and PT Components
03/24/2008

The Baldor•Dodge practice is to continuously improve our products with field-proven technical features. The technology of utilizing the 65° spacing of the setscrews in the bearing locking collars is integrated into Baldor•Dodge E-XTRA line of tapered roller bearings and S-2000 spherical roller bearing line. The superiority of the 65° setscrew locking angle in maximizing the locking force for securing the bearing to the shaft, has been field proven in Baldor•Dodge SC/SCM ball bearings.

The bearing locking collar is just one of the many factors that contribute to a bearing's success in an application. The setscrew and locking collar used to secure a bearing to the shaft is the simplest and most cost efficient method. At first glance, the collar and setscrews appear very simple in design. But in reality, this is a securing system which has complex stresses and loads applied to it. The collar acts as a clamping spring system when torque is applied to the setscrews. When the setscrews are tightened against the shaft, the stiffness or spring action of the collar supports and maintains the load from the setscrews against the shaft, Figure 1.

The total clamping force that a locking system can supply to the shaft is a function of the angle between the setscrews and the collar's ability to support the setscrew load. This clamping action results in a combined radial force from the setscrews and two frictional forces. The two frictional forces are between the shaft and inner ring and between the shaft and set screw point, Figure 1. These forces provide most of the resistance to the relative radial, axial or rotational movement a shaft would encounter within a slip fit bearing. Baldor•Dodge utilizes cup point design setscrews to maximize the penetration of the shaft for additional axial and rotational resistance.

The resistance to radial shaft movement, in the relation to the bearing bore, is a function of the combined radial forces that two setscrews can withstand on the shaft. This total radial force equals to two times the setscrew force times the cosine of ½ of the angle between the setscrews. This axial holding power is the total setscrew force times the effective friction coefficients at the setscrew points and the shaft and inner ring contacts. The torsional resistance or torsional holding power is determined by multiplying the axial holding power time the shaft radius, Figure 1.

The effective locking or clamping of the bearing to the shaft depends largely on the total radial force produced from the two setscrews. In Figure 2, the total radial, axial and torsional holding power of a two setscrew assembly is plotted as a function of the angle between the setscrews. The holding power, which is plotted along the Y-axis, is represented as the percent increase two setscrews would have over a single setscrew and collar assembly. In both curves of holding power versus setscrew angle, the radial, torsional and axial holding power are greatly reduced with increased angle. Along the axis for setscrew angle, positions have been marked to represent Baldor•Dodge and competitor's locking systems.

Where the two curves intersect at 65 degrees, the combined bending and tangential stresses are also at a minimum value for the collar. The lower the stress, the better the collar will be able to support the setscrew loaded without degrading the clamping load. The Baldor•Dodge approach to solving the problem of securing a setscrew mounted bearing to the shaft is to maximize radial, axial and torsional holding power, while minimizing collar stress. The 65 degree setscrew location is clearly superior to 90 degree or 120 degree angle. In addition, the Baldor•Dodge Type E-XTRA bearing, which features two locking collars, doubles the holding power and gives stability the total locking system.

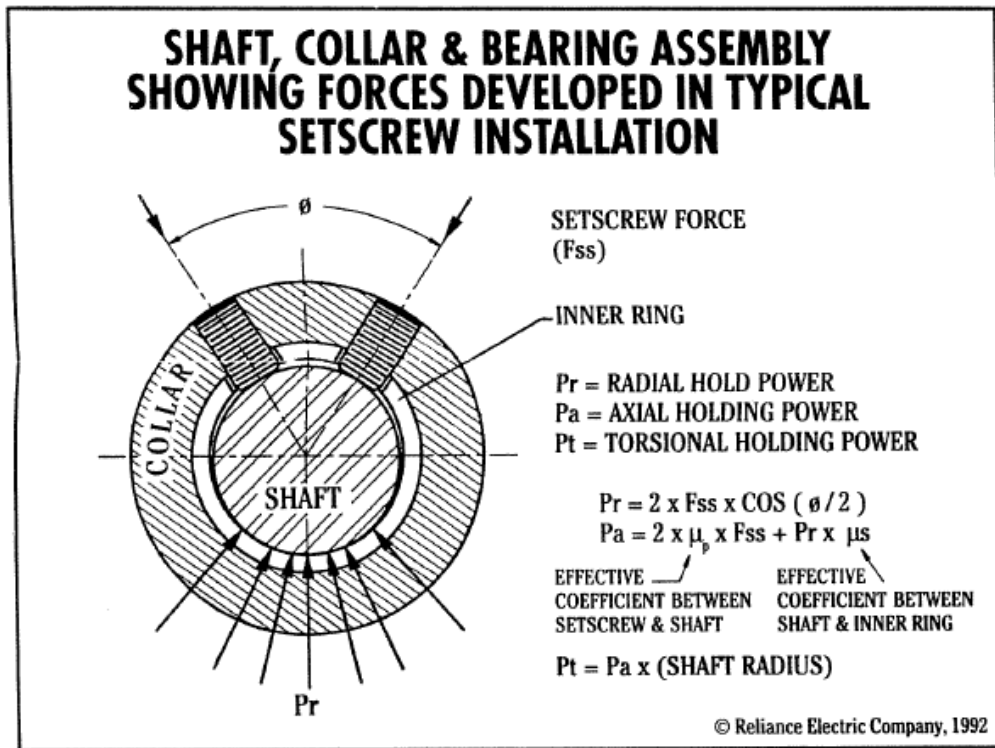


Figure 1: Shaft, Collar and bearing Assembly

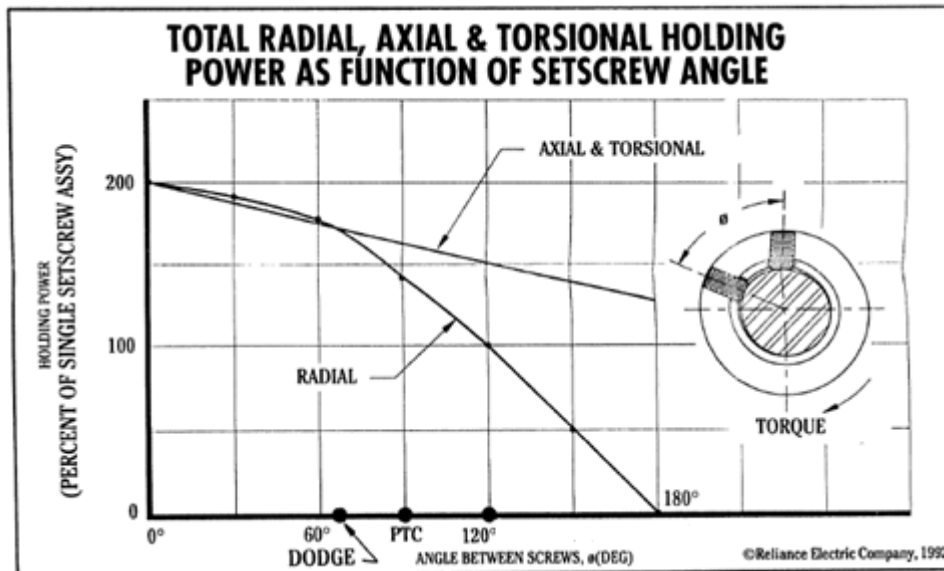


Figure 2: Total Radial, Axial and Torsional Holding