Dodge® mounted bearings: 65° set screw locking collar

The DODGE practice is to continuously improve our products with field-proven technical features. The technology of utilizing the 65° spacing of the set screws in the bearing locking collars is integrated into Dodge® E-XTRA line of tapered roller bearings and S-2000 spherical roller bearing line. The superiority of the 65° set screw locking angle in maximizing the locking force for securing the bearing to the shaft has been field proven in 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 set screw 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 set screws appear very simple in design. 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 set screws. When the set screws are tightened against the shaft, the stiffness or spring action of the collar supports and maintains the load from the set screws 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 set screws and the collar's ability to support the set screw load. This clamping action results in a combined radial force from the set screws and two frictional forces. The two frictional forces are between the shaft and inner ring and be-tween 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. Dodge® utilizes cup point design set screws 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 set screws can withstand on the shaft. This total radial force equals to two times the set screw force times the cosine of ½ of the angle between the set screws. This axial holding power is the total set screw force times the effective friction coefficients at the set screw 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 set screws. In **Figure 2**, the total radial, axial and torsional holding power of a two set screw assembly is plot-ted as a function of the angle between the set screws. The holding power, which is plotted along the Y-axis, is rep-resented as the percent increase two set screws would have over a single set screw and collar assembly. In both curves of holding power versus set screw angle, the radial, torsional and axial holding power are greatly reduced with increased angle. Along the axis for set screw angle, positions have been marked to represent Dodge® and competitor's locking systems.

Where the two curves intersect at 65°, 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 set

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screw loaded without degrading the clamping load. The Dodge® approach to solving the problem of securing a set screw mounted bearing to the shaft is to maximize radial, axial and torsional holding power, while minimizing collar stress. The 65° set screw location is clearly superior to 90° or 120° angle. In addition, the Dodge® Type E-XTRA bearing, which features two locking collars, doubles the holding power and gives stability the total locking system.

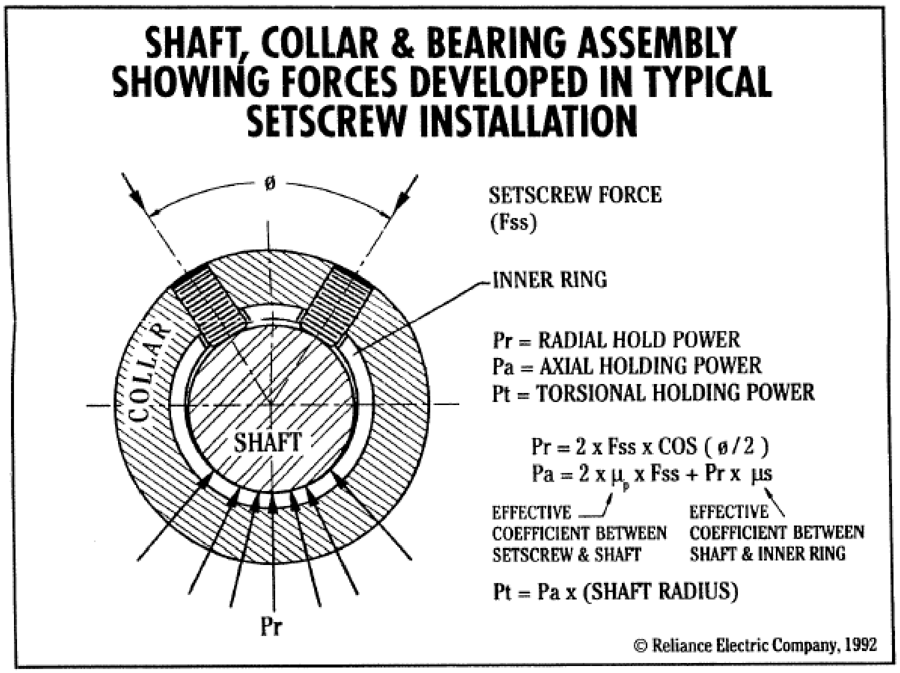

Figure 1. Shaft, Collar and bearing Assembly

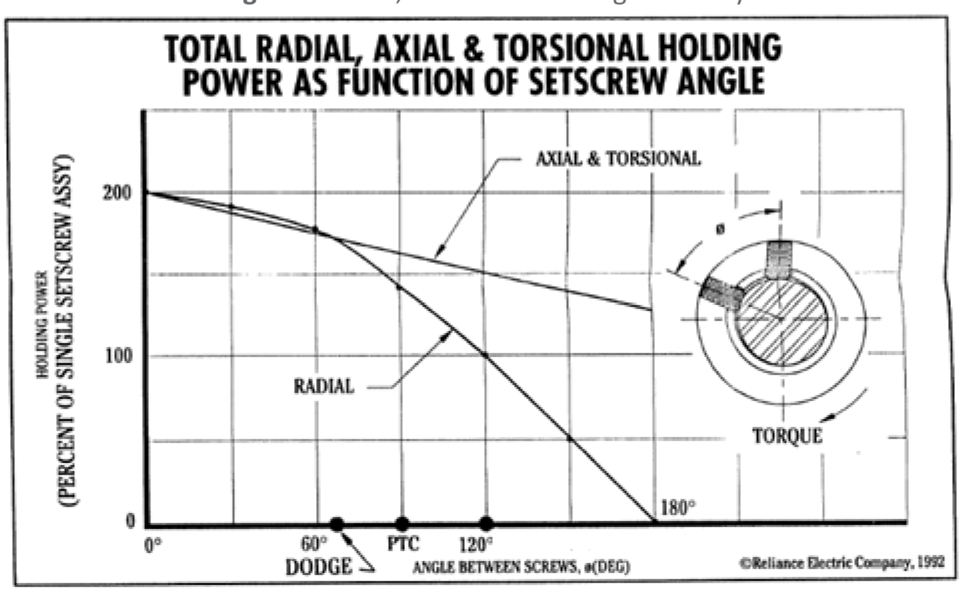

Figure 2. Total Radial, Axial and Torsional Holding