Dodge® mounted bearings: cup point versus ball point setscrews

Background

Not all bearing setscrew mounting systems are engineered to a world class level. This paper discusses the differences in setscrew mounting systems and explains the advantages of the Dodge system.

Design Differences

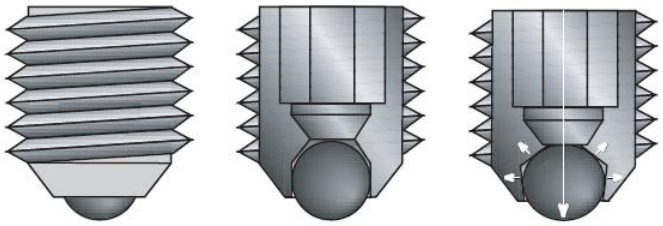

Figure 1. Ball Point Setscrew

Figure 1 illustrates the design of the ball point setscrew. There is a steel ball in a cavity at the tip of the setscrew. When the setscrew is tightened, the ball presses into the shaft, deforming the shaft, and then due to reactionary forces presses against the walls of the cavity. This can cause the threads to expand.

Figure 2. Cup Point Setscrew

Figure 2 shows a cup point set screw, which is the style used by Dodge mounted ball bearings.

Cup Point Set Screw

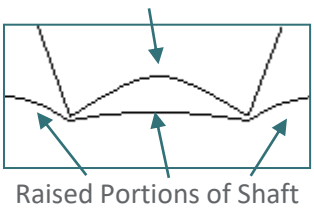

Figure 3. Cup Point on Shaft

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In **Figure 3**, when a cup point setscrew is tightened, such as during installation, the circular edge of the cup cuts into the shaft, forming a raised section of the shaft under the cup and around the perimeter of the edge.

Reviewing the competitor setscrew

For holding power, with respect to the ability of the setscrew to hold onto the shaft, the Dodge cup point design is superior to the ball point setscrew. The raised portions of the shaft shown in **Figure 3** on a cup point during installation very effectively prevents the setscrew from moving on the shaft. In contrast, the ball in the ball point would likely have a greater tendency to rise up over the edge of the indentation it made in the shaft because of the gentler deformation of the shaft that it makes.

The energy from installation torque applied to the setscrew goes into three components: the radial component (the radial load in the set screw), thread friction component (the friction between the screw threads and the inner ring threads), and the point friction component (the friction between the point of the screw and the shaft). With the ball point design, there is little point friction, but as the threads expand, the thread friction increases, leaving little energy to go into radial holding power. With the cup point design, there is higher point friction, and less thread friction. This leaves more energy available to increase the radial holding power.

When choosing a bearing, the entire setscrew mounting system must be considered, not just the setscrew type. Dodge designs its setscrews to be 65° apart because it has been determined that radial and axial holding power are both maximized at 65°, **Figure 4**. The axial holding power decreases linearly as setscrew separation increases. The radial holding power decreases exponentially as setscrew separation increases.

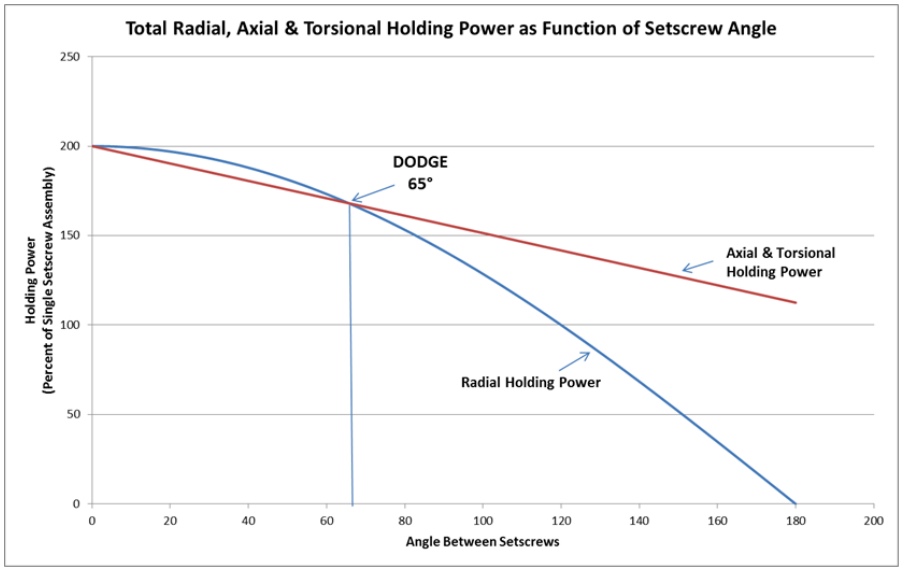

Figure 4: Setscrew Angle

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Both radial and axial holding power are lower at setscrew separations greater than 65° such as 120° separation.

Conclusion

In summary, the Dodge® setscrew system has greater holding power due to the raised shaft surface created by the cup point design, the greater installation torque energy available to go into radial holding power, and the 65° set screw separation.

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