

WP0163

Dodge® Raptor couplings: the two setscrew advantage

Dodge Customer/Order Engineering

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For over 60 years, ABB has brought to market innovative elastomeric coupling technologies through its Dodge branded products. The Dodge Raptor exhibits the newest and most innovative elastomeric coupling technology available in the market today. The Raptor offers easier installation, reduced maintenance, and improved reliability for a wide range of new and existing applications. These numerous advantages were uncovered through a rigorous product development process. Painstaking attention to detail identified numerous opportunities to improve against competitive designs, including an opportunity to increase reliability and performance associated with clearance and transitional fit shaft hubs.

The Raptor coupling provides multiple shaft attachment methods; including finished bore (clearance, transitional, and interference fits), Taper-Lock bushed, and QD Bushed shaft hubs. Clearance fit finished bore hubs are one of the most common and simplest options available in the industry. Clearance fit hubs are machined with a bore dimension slightly larger than the shaft and are commonly referred to as a “slip fit.” This nickname comes from the fact that the hub can be easily slid onto the shaft without heating the hub or cooling the shaft. Clearance, or slip-fit, bored hubs are generally accompanied by one or two setscrews. These setscrews are used to lock the hub to the shaft and are accompanied by shaft keys which are used to transmit the majority of the torque between the shafts to the coupling hubs.

Competitive designs only provide a single setscrew located over the keyway to fasten the hub to the shaft. Using a single setscrew gives less than adequate holding power, resulting in increased fretting corrosion, excessive shaft wear, increased shaft damage, difficult hub removal, and even shaft or hub failure in the most severe cases.

Baldor recognizes the issues associated with using only one setscrew and has designed Raptor clearance fit hubs with an optimized and superior setscrew quantity and orientation. All shaft hubs come standard with two cup point setscrews, one located over the keyway and one located 65° away from the first. Both setscrews are located in the same plane. Many customers might question the importance of a second setscrew. Additionally, customers often wonder if there is really a difference between a setscrew positioned at 180°, 90°, or 65°, but the difference is substantial.

The cup point setscrews provided on all Raptor clearance fit hubs are key to providing superior holding power. Cup point setscrews are designed to physically deform the shaft as it is torqued into the coupling hub. The material of the shaft actually forms around the edges of the cup and creates positive engagement between the setscrew and shaft. This creates a semi-permanent, assembly which is more capable of resisting torque spikes, vibration, and axial loads.

The second setscrew that is provided with all Raptor clearance fit hubs is equally important in providing superior holding power. A single setscrew over the keyway only provides two points of contact. One point located at the key, and the second located 180° from the key between the shaft and hub. Providing a second setscrew increases the overall holding power of the assembly by increasing the contact area between the shaft and the hub as illustrated in **Figure 1**. The first point of contact is at the key. The second point of contact is at the second setscrew, and the third point of contact is between the hub and the shaft opposite the location of the setscrews.

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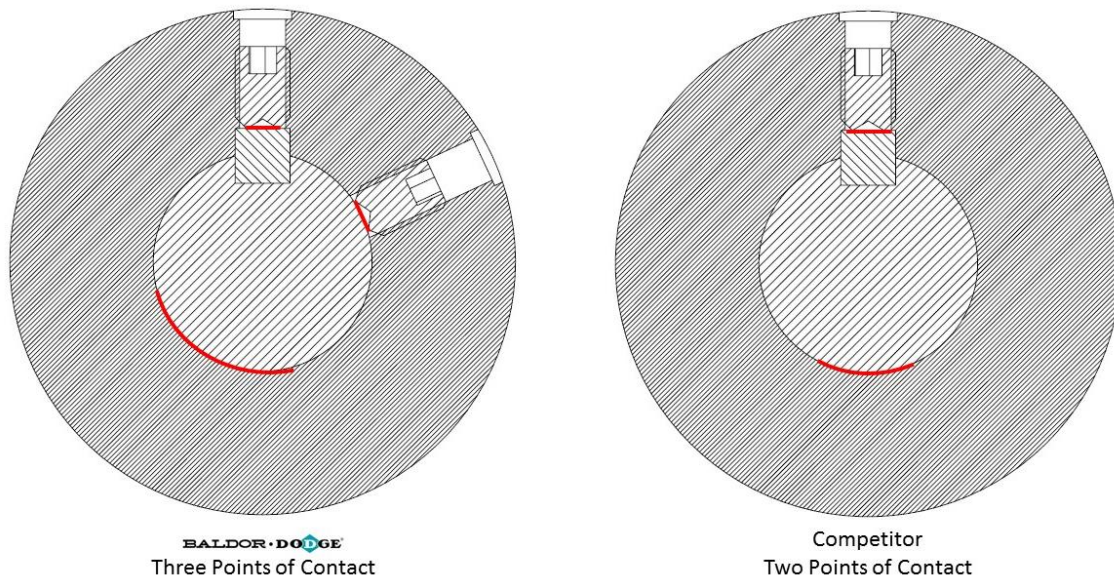


Figure 1. Points of contact using one or two setscrews

The addition of a second setscrew only benefits the holding power of the assembly if the second setscrew is positioned in such a way that it maximizes the contact between the shaft and hub. The Dodge Raptor utilizes a second setscrew located 65° away from the first setscrew. Research has shown that positioning the second setscrew 65° away from the first provides the optimal combination of both Radial holding power ensures contact is maintained between the shaft and the inner diameter of the coupling hub bore. Torsional holding power minimizes the twisting motion between the shaft and coupling hub caused by torque fluctuations and spikes. **Figure 2** shows the torsional holding power and the radial holding power of two setscrews in the same plane at varying angles of separation.



Figure 2. Holding power as a function of setscrew angle

As shown in **Figure 2**, the radial holding power and the torsional holding power of two setscrews decreases as the angle increases from 0° to 180°. Positioning the second setscrew at 90° apart causes uneven torsional and radial holding power. Increasing the angle to 180° can actually reduce the total effectiveness of the two setscrews and reduce the total holding power, while maximizing stresses in the hub. It can also be seen that the lines representing radial holding power and torsional holding power only intersect at two locations; 0° and 65°. Positioning two set screws at 0° from each other is physically impossible as the setscrews would have to be within the same cross-sectional plane. For this reason, the next best choice is 65°. This allows the setscrews to provide equal amounts of radial and torsional holding power, maximizing the Raptor hub's stability on the shaft while also minimizing the tangential and bending stresses induced in the hub.

As expected, a single setscrew can provide 100% of the rated holding power based off the setscrew size, type, and installation torque, as noted in **Figure 2**. Providing a second set screw of the same size, type, and torque located at 65° will provide an additional 75% increase to the overall holding power. With the addition of 75% more holding power, the second setscrew ensures a stable connection between the hub and shaft, while reducing fretting corrosion and shaft damage, ultimately providing superior performance.

The advantage is clear. The two setscrews at a 65° angle provided on all Dodge Raptor clearance fit hubs provides superior performance when compared to competitive designs. This two setscrew system ensures that customers will experience the same quality and performance they expect from a Dodge elastomeric coupling product.

For additional information or questions related to the Dodge Raptor's 65° setscrew angle, Dodge Bearings and PT Component Customer Order (C.O.) Engineering should be contacted.

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