

WP0061

Dodge® elastomeric couplings: features to consider prior to selection

Dodge Customer/Order Engineering

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Elastomeric couplings are a popular means of transmitting torque. Elastomeric couplings require no lubrication and as a result little maintenance. Elastomeric couplings are also excellent at absorbing shock loading and damping vibration. There are a number of different designs and styles of elastomeric couplings available today. Some of these include the tire style, sleeve style, and jaw style. Each of these designs presents different strengths that can be leveraged in a number of different applications. Due to the wide variety of options, selecting an elastomeric coupling can be often be confusing. Understanding the main elastomeric coupling features will aid in making the correct and most appropriate selection possible.

First, there are two main types of elastomers utilized; thermoset elastomers and thermoplastic elastomers. Thermoset elastomers are polymers that are cross-linked during processing. This cross-linking leads to excellent creep resistance (progressive wind-up under constant torque). It also prevents plastic flow with the addition of heat. Thermoset materials are generally stronger than thermoplastics due to the cross-linking process. However, they are more brittle than thermoplastics. Examples include natural rubber, nitrile, butyl, polyester resin, urethanes, neoprene, and EPDM.

On the other hand, thermoplastic elastomers are not cross-linked. They soften when heated and harden when cooled. Instead of the double carbon bonds created during the cross-linking process, thermoplastics take advantage of their high molecular weight. Their chains associate through inner molecular forces which can spontaneously reform. This allows thermoplastics to be remolded and recycled. They work well in low wind-up applications. Examples include nylon, acetyl, vinyl, polyethylene, fluoroplastics and PBT.

Next, consideration should be given to both chemical resistance and temperature resistance. Chemical resistance is dependent upon the elastomeric material, the type of chemical encountered and the concentration of that chemical. As for temperature resistance, elastomers have a wide operating temperature range. Many common elastomers can range from -45°F to 180°F; however, others are available that can far exceed this range. Due to the wide varieties of compounds available, it is best to contact the coupling supplier for recommendations for harsh environments and high temperatures.

Torsional stiffness is another factor that should be reviewed prior to selection. Torsional stiffness is a measure of a coupling's resistance to angular displacement about its axis of rotation. It is usually represented in units of in-lbs/degree or in-lbs/radian. Coupling stiffness has an effect on the system's natural frequency, shock load reduction and system critical speeds. Depending upon the element material, torsional stiffness can increase or decrease through the life of the product. Couplings with higher torsional stiffness values are generally more power dense than those with low torsional stiffness values. In contrast, couplings with low torsional stiffness are better at damping shock loads and vibration than couplings with higher torsional stiffness values.

Some applications require couplings to continue to maintain a physical connection and transmit torque short-term after the element has failed. These types of couplings are often referred to as "fail safe" couplings. Once the element fails, the driving side of the coupling continues to engage the driven side for at least a short period of time. The need for this feature is common in critical applications where a loss of rotation and torque transmission could be

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ABB Motors and Mechanical Inc.

6040 Ponders Court

Greenville, SC 29615

Phone: +1 864 284 5700

Email: DodgeEngineering@abb.com

dangerous. Review of the coupling operation should be considered through this short-term period, as metal-on-metal contact (possibly resulting in sparking) is common in fail safe designs.

In contrast, some elastomeric coupling designs allow for the elastomer to act as a fuse. The element completely fractures, causing a physical separation between shafts and a loss of torque transmission. This feature protects more expensive equipment in the system such as gearboxes, motors, etc. when extreme conditions are applied to the system. Proper selection with appropriate service factor is important.

Ease of replacement is another consideration often evaluated. Upon failure of the elastomeric element, various coupling components may need repositioning. Some of these components, such as shaft hubs and flanges, may be difficult to reposition and may require rearranging the shaft assembly. Consideration of the ease of component removal, replacement and realignment influenced by replacing the damaged coupling components provides greater insight into replacement costs. Often times, spacer style couplings, with drop out center or element assemblies, can make replacement easier and most cost effective.

Misalignment capability is often one of the most important factors in coupling selection and is a function of geometry and elastomer properties. Alignment forgiveness is often listed as a maximum value, a combined value, or a value as a function of shaft rotation. Consideration for misalignment capability can ease overall installation and account for thermal growth. All elastomeric couplings are flexible and allow for some misalignment in one or more axes.

There are several different elastomeric design types available which are divided between compressive, shear and combination designs. Compressive designs stress the elastomeric component of the coupling in compression. Elastomers can generally tolerate more loading in compression than shear; therefore, these designs generally offer advantages of power density and have the ability to tolerate greater overload. Shear designs stress the elastomeric component of the coupling in shear or tension. The advantages over compressive couplings include greater misalignment capability, greater vibration dampening and higher torsional softness. Combination designs stress the elastomeric component of the coupling in both shear and tension. These designs are often considered a healthy balance of benefits between both shear and compressive designs.

Static conductivity is a consideration where either isolation or ground conduction redundancy is important. Polymers falling below various industry electrical codes for maximum electrical resistance are considered statically conductive and provide ground redundancy to prevent build-up of static charges on coupled equipment.

Shaft attachment is also an important consideration. The options include bushed, finished bore and taper bore. Several types of keyed bushings are available with tapered outside diameters that mate with inner diameters of the coupling hub. Keyless bushings are also available that mate with the coupling hub through a cylindrical ID. Both taper bushed and keyless bushed designs offer advantages with local inventory reduction, ease of replacement and ease of installation. Couplings that have straight bores with keyways and setscrews are considered finished bore couplings. These are often either clearance fits, where the hub inside diameter is slightly larger than the mating shaft diameter; or interference fits, where the hub inside diameter is slightly smaller than the mating shaft diameter. Setscrews are utilized with clearance fit couplings and are typically optional with interference fit couplings. Taper shaft couplings have a tapered bore that mate with the taper of the shaft. This mounting method is less common than either finished bore or bushed mounted couplings and have been traditionally utilized with mill motors.

For additional information on the benefits of elastomeric couplings, contact Dodge Bearings and PT Component Customer Order (C.O.) Engineering.

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ABB Motors and Mechanical Inc.
6040 Ponders Court
Greenville, SC 29615
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Email: DodgeEngineering@abb.com