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Dodge® couplings: selecting the right coupling

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Shaft couplings are made in a variety of shapes, materials and sizes while offering many different benefits to a user's application. The two primary purposes of shaft couplings are to connect two shafts and to transfer torque. Beyond these purposes couplings are differentiated by the functional benefits they provide to the application. Proper selection should include comparison of features required and the value those features offer for the intended application.

Flexible and Rigid Couplings

All couplings are easily split into two main categories: flexible and rigid. Flexible couplings are the most common type because they tolerate angular and parallel misalignment as well as provide a means of shaft end-float. Since flexible couplings are more forgiving, alignment is not as critical thus making installation a less demanding chore. Rigid couplings are exactly the opposite. Although rigid couplings are inexpensive, they provide minimal latitude for installation error. Although they require no maintenance once installed. Rigid couplings act solely as an extension of one shaft to the other.

Flexible coupling designs include those requiring maintenance and those that are maintenance-free. Maintenance-required couplings are generally metallic in nature and must be lubricated on a routine basis. These designs include chain couplings, grid or spring couplings, and gear couplings. All designs have metallic contacting surfaces. Proper lubrication is required to prevent metal on metal contact, wear, and heat generation.

Maintenance-free flexible couplings are designed to eliminate metal on metal contact either through material advantages or mechanical design. Elastomeric elements eliminate the need for maintenance since the design optimizes the element's resilience to wear. Additionally, elastomeric elements absorb shock and vibration, thus dampening the effect these characteristics have on mating machinery. Common flexible elements that require no maintenance include sliding elastomeric element couplings, clamped elastomeric couplings, disc couplings, magnetic couplings, and elastomeric jaw couplings.

Design Differences

Flexible couplings are offered with a wide range of benefits. These benefits are either featured in combination or exclusively and might include: misalignment capability, thermal capacity, vibration dampening, zero-backlash, ease of maintenance, ease of replacement, installation/repair cost, torque-to-bore capacity, and speed capability.

Misalignment capability is a common comparison between coupling types. Ability to account for improper alignment is critical to most applications. Additionally, while detailed alignment practices are generally followed, it is not uncommon for extreme shock loads to alter the initial installation alignment. Therefore, it is common for users to select additional coupling misalignment capacity as a precaution. Several widely available elastomeric element couplings can handle up to 4° angular misalignment combined with 1/8" offset or parallel misalignment with no reduction in overall torque capacity.

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Often flexible couplings are installed in an application as a means to minimize overall downtime. For example, demanding applications that are prone to high vibration levels and heavy shock loads may use a flexible elastomeric element coupling. The coupling would be designed and selected as the weakest link in the system, thus protecting more expensive equipment that require extended installation periods. The low-cost elastomeric element would fail first and would be easily replaced in a fraction of time compared to motors, shafts, or other application machinery.

Couplings are generally offered as either bushing mount or finished bore mount. Bushing mounted couplings offer greater flexibility with inventory and have a simplified installation process. Finished bores are provided as clearance fits with setscrews for small shaft sizes and interference fits for larger shaft sizes. Most finished bore couplings accommodate larger shaft sizes than bushing mounted couplings.

Selection

Coupling manufacturers provide two simple means for selecting coupling size; however, only one of the two is required for selection. Both methods can be utilized knowing three pieces of information; (1) Motor HP, (2) Coupling Speed, and (3) Application Type. The application type will be used as reference to obtain the proper service factor for the coupling. Service factor reference charts are available in the product manufacturer's catalog and will generally range from 1.0 to 3.0. Add-on service factors are often required for high-torque motors and internal combustion engines.

The first and most common method for size selection is to calculate the torque demanded of the coupling. This is accomplished through the following equation. It is important to note the relationships of HP and speed to torque. For example, as coupling rpm decreases torque increases. Thus, larger stronger shafts and couplings are required at slower speeds for a given horsepower.

$$Torque(in \cdot lbs) = \frac{63,025 \cdot Hp \cdot Service \ Factor}{Coupling \ RPM} \quad (1)$$

The second method for coupling size selection is the horsepower per one hundred (HP/100) method. This is calculated as follows.

$$\frac{HP}{100} = \frac{Hp \cdot 100 \cdot Service \ Factor}{Coupling \ RPM} \quad (2)$$

Product manufacturers generally provide both values of torque and HP/100 for product selection. Once one of these two values is determined the next step is to find the coupling that meets or exceeds this value while still having adequate bore capacity for the intended shaft sizes. Manufacturers also publish maximum speed limits per coupling size. This step should not be overlooked since exceeding the intended speed limits of a coupling is dangerous and will likely result in imbalance and, even worse, disintegration.

Finally, the manufacturer's coupling should be reviewed for end user space considerations. Outside diameter, overall length, and distance between shaft ends should be compared with the amount of space within the coupling mounting area. If the distance between shaft ends is sizeable, then a spacer coupling or a combination of floating shaft couplings may be necessary. Spacer couplings are ideal for applications where machinery cannot be moved easily. They simply drop and install within two rigidly mounted shafts. Finding the perfect coupling for an application doesn't have to be a laborious or confusing task. Following these simple procedures and installing couplings properly will result in a reliable coupling attachment and years of service.

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