Choosing couplings for mixers

Selecting the best couplings for mixer applications can be a challenge. As Robert Watkins, vice-president of sales and applications at Ruland Manufacturing*, explains, designers need to take into account factors including the operating environment, and how often the propeller or paddle will need to be changed.

Three-piece rigid couplings remove the risk of cross-cut failures that can affect traditional clamp-style rigid couplings.

Mixers are one of the most common industrial applications. They usually consist of a motor coupled to a paddle or impeller. While the connection is simple, their applications can vary widely with mixers being used in the chemical, food, paint, adhesive and other industries. This can complicate the choice of the coupling.

A basic consideration is that the motor is bearing-supported, while the paddle or impeller is not. This limits the type of coupling to a rigid design because most standard servo couplings are not meant to be used without bearing support. There are three styles of rigid coupling – set-screw, clamp-screw and flanged – each with its own benefits and drawbacks.

Set-screw rigid couplings are the most basic and common style. They are suitable for mixers in all industries due to their sleeve construction which allows them to support the paddle or impeller without needing a bearing. Set-screw rigid couplings are machined from a solid piece of material and have two, four or eight set-screws. They derive all of their holding power from the screw being tightened onto the shaft. The amount of torque the coupling transmits depends largely on the material of the shaft, which must be softer than the material of the screw. The nature of the set-screw is its biggest weakness. When installed, it mars the shaft, making removal difficult. In applications where frequent paddle or impeller change-outs are needed, a set-screw type may not be the best option.

Clamp-style rigid couplings are an improvement over set-screw versions. They use compressive forces to wrap evenly around the shaft, leading to a more secure connection. Standard variations include one- and two-piece types. They have the advantages of not marring the shaft and of infinite adjustability. Two-piece styles have the benefits of one-piece, while also allowing for in-place servicing, eliminating the need to remove adjacent components for installation or removal. The result is quicker changeovers and less damage to impeller or paddle shafts. The main drawback to clamp-type rigid couplings is the cross-cut which is a point of weakness and can cause the coupling to fail over time. While these failures are rare, designers who want to use a clamp coupling and eliminate such failures can opt for a three-piece designs or no-cross cut.

Flange-type rigid couplings function in a similar way to set-screw couplings. They consist of two independent hubs connected to each other by a series of bolts that join the coupling halves. Each hub has one or two set-screws to hold the shaft in place. This design is most suitable for applications where space is limited and the benefits of standard rigid coupling are desired. The main drawback is assembly time, which is increased significantly because all of the bolts must be removed completely to disassemble the coupling. This is the least common form of mixer coupling. They are generally more desirable in applications with space restrictions or shaft sizes of more than 50mm.

Rigid couplings are available in various materials including steel, 303 and 316 stainless-steel, and aluminium. Steel is the most common and is available with zinc-plated or black oxide finishes. It is suitable for most industrial applications. Stainless-steel types are used in food and high-corrosion chemical mixing applications. The grade of stainless is determined largely by the corrosiveness of the environment and regulatory requirements. When using 316 stainless-steel, it is important that the hardware is of a similar material to ensure consistent corrosion resistance. Aluminium is not widely used, but could be desirable if low inertia is required.

To specify the best coupling, designers of mixers must understand the operating environment, the frequency with which the impeller or paddle will be changed, and the system requirements. ■

* Ruland couplings are available in the UK from Acorn Industrial Services

A clamp-type steel coupling connecting a mixer motor to a impeller