

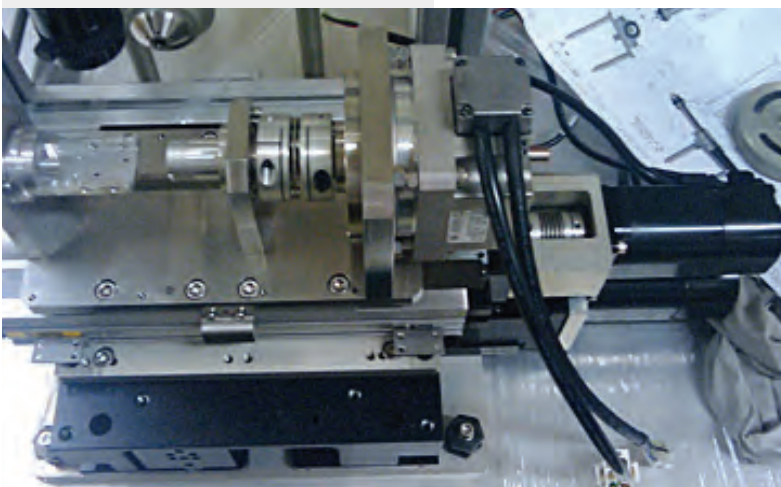
How To Specify Couplings For Servo Applications

Choosing the right coupling style for a servo application may seem like a confusing task, but it doesn't have to be. Understanding application requirements with regard to factors such as torque, stiffness, rpm values and shaft misalignment details will easily narrow the suitable choices. Typical servo applications encompass any automation system with shaft-driven linear motion, including machine tools, packaging equipment, test and measurement systems, semiconductor manufacturing and other high-speed motion scenarios. The primary job of the coupling is to smoothly transmit torque between connected shafts while compensating for radial, axial and/or angular misalignment. In high-speed servo applications, certain coupling styles work better than others to handle the demands of today's dynamic automated systems.



Servo Insert Coupling

A good place to start when researching coupling choices is to have a broad understanding of overall servo coupling requirements. Considering these points early in the design process will help determine the correct style for the specific motion application. Look for couplings that are backlash-free to maintain repeatable positioning accuracy. Couplings should also be mass balanced to handle high rotational speeds. It is also important to keep in mind that most servo couplings are designed for low to moderate torques, typically to 100 Nm. In addition, servo couplings should be tolerant of shaft misalignments and maintenance free. Two styles that meet all of these criteria for servo applications include rigid metal bellows couplings and flexible servo insert couplings. Many servo applications could use either style to satisfy basic torque, shaft size and lifecycle requirements. However, each style has specific strengths and weaknesses that are important to be aware of.



DKN 45 Metal Bellows Coupling Laser Engraving Machine

METAL BELLOWS COUPLINGS FEATURE LOW INERTIA, HIGH STIFFNESS



Metal Bellows Coupling

Metal bellows couplings are typically comprised of stainless steel bellows with aluminum hubs. Miniature models often feature integrated clamping hubs or set screws for ease of use and a space-saving design. The bellows concept is ideal for torque transmission in motion control applications due to uniformly thin walls that let it bend freely while compensating for radial, axial or angular shaft misalignment. The uniform walls also achieve minimal bearing loads along all rotating points in contrast to other coupling styles that can experience uneven loading. In addition, metal bellows couplings offer low inertia and high stiffness, making them well suited for servo applications that require both high accuracy and repeatability.

For example, in a recent machining application, a coupling was needed to compensate for some misalignment between the motor and ball screw, with the motor rotating in both directions. In this case, a zero-backlash DKN 20 metal bellows coupling from Ringfeder offers the best misalignment capability and highest torsional stiffness possible. High torsional stiffness is closely associated with machine accuracy, a critical requirement in this particular machine tool setup. In a similar application, a DKN 45 metal bellows coupling was used to connect the motor and ball screw in a laser engraving machine. This coupling was chosen based on its ability to provide a torsionally stiff connection for exact positioning. Regardless of what size is used, the DKN style features a compact design and low inertia, and is well suited for backlash-free connections in tight spaces.

SERVO INSERT COUPLINGS OFFER ADJUSTABLE VIBRATION DAMPING

Servo insert couplings are typically made of aluminum hubs and elastomer “spider” inserts. Similar to the metal bellows design, servo insert couplings also feature clamping via set screws or an integrated clamping hub for a streamlined

Servo Couplings at a Glance

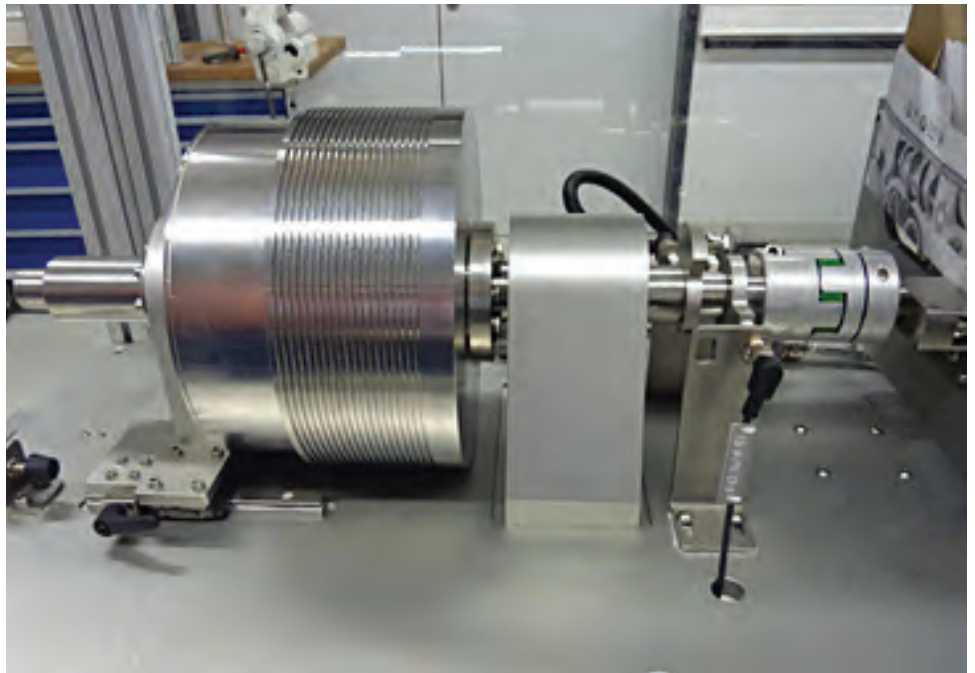
Product Examples	Metal Bellows EKN, DKN, AKN Series	Servo Insert GWE Series
Adjustable Rigidity	★ ★	★ ★ ★ ★
Torque Transmission	★ ★ ★ ★	★ ★ ★ ★
Backlash Free	★ ★ ★ ★	★ ★ ★
Misalignment Tolerance	★ ★ ★	★ ★ ★ ★
Damping	★ ★	★ ★ ★ ★
Low Inertia	★ ★ ★ ★	★ ★ ★

design. One outstanding feature of this coupling style is its adjustable flexibility, achieved by simply changing the elastomer insert. Color coded for ease of use, harder inserts approach the high stiffness of metal bellows while softer inserts maximize both damping performance and misalignment tolerance. Inserts may be selected to optimize vibration damping and this coupling design is noted for its excellent tolerance of radial, axial and angular shaft misalignment. Superior torque transmission and accurate angular positioning accuracy are additional hallmarks of servo insert couplings.

In a recent grinding machine application, key requirements for the coupling included backlash-free performance, misalignment compensation and high torsional stiffness. This particular machine is used to work on small parts for the automotive and weapons industries. The GWE 5112 servo insert coupling was chosen based on its high working tolerance, excellent torque transmission and vibration damping ability. This backlash-free, self-aligning coupling guarantees perfect concentric running and is suitable for very high torques, up to 525 Nm. In another demanding application—a test stand used in a climate chamber—a stainless steel GWE 5104 servo insert coupling was specified not only for its backlash-free, vibration damping performance, but also its ability to withstand the hot and humid conditions of the chamber.

COUPLINGS SERVE AS VITAL LINK IN LARGER SYSTEM

Because servo couplings act as vital links in the overall automation system, their design and specification should be considered as early as possible. They must work together with other power transmission components such as gearboxes and



*GWE 5104 Servo Insert Coupling
Test Stand in Climate Chamber*

linear actuators as well as other types of couplings or shaft locking devices. For this reason, it is important to select a coupling design that works well with these related system components, as well as complementary parts such as shrink discs and locking assemblies.

When deciding between metal bellows and servo insert coupling styles for your next servo application, keep these final tips in mind along with your key application requirements:

- Metal bellows couplings and servo insert designs both excel in terms of torque transmission. However, the metal bellows style scores higher than the servo insert design in terms of backlash free, low inertia performance.
- Servo insert couplings score higher than metal bellows designs when it comes to vibration damping and adjustable rigidity.
- Servo insert couplings offer slightly better misalignment tolerance than their metal bellows counterparts.

Although both coupling styles are ideal for highly dynamic and demanding servo applications, understanding the subtle differences between these two options will result in less wear and tear on the overall system and fewer maintenance issues. In addition, correct shaft alignment will improve the lifespan of not only the couplings, but also all related components such as motors, driven shafts, actuators and bearings. When in doubt, be sure to consult a respected supplier of power transmission components or a trusted coupling manufacturer for expert guidance.

For detailed technical specifications, visit www.ringfeder.com.