MPTA-C4-2014

ELASTOMERIC COUPLING PRIMER

INFORMATIONAL BULLETIN

Mechanical Power Transmission Association
5672 Strand Ct., Suite 2, Naples, FL 34110
www.mpta.org

Contributors

Altra Industrial Motion – TB Wood's	**Chambersburg, PA**	www.tbwoods.com
Baldor Dodge Maska	**Greenville, SC**	www.baldor.com
Emerson Power Transmission	**Maysville, KY**	www.emerson-ept.com
Frontline Industries, Inc.	**Irvington, NJ**	www.frontlineindustries.com
Lovejoy, Inc.	**Downers Grove, IL**	www.lovejoy-inc.com
Magnaloy Coupling Company	**Denver, CO**	www.gates.com
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Maurey Manufacturing Corp.	**Holly Springs, MS**	www.maurey.com
Rexnord Industries, LLC	**New Berlin, WI**	www.rexnord.com

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Abstract

This publication is an introduction into the primary features of elastomeric couplings and provides a brief overview of those features so the reader may understand the differences between elastomeric coupling alternatives.

Foreword

This Foreword is provided for informational purposes only and is not to be construed to be part of any technical specification.

This standard is formatted in consistency with other MPTA documents.

Suggestions for the improvement of or comments on this publication are welcome. They should be mailed to Mechanical Power Transmission Association, 5672 Strand Ct., Suite 2, Naples, FL 34110 on your company letterhead.

Scope

This informational bulletin is intended to educate the reader on elastomeric coupling features and provide basic explanations of those features that influence proper coupling selection.

1. Features of Elastomeric Couplings

1.1. Common Elastomeric Materials

1.1.1. Thermoset 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. Examples include natural rubber, nitrile, butyl, polyester resin, and neoprene.

1.1.2. Thermoplastic Elastomers

Thermoplastic elastomers are not cross-linked. They soften when heated and harden when cooled. They work well in low wind-up applications. Unlike thermoset elastomers, thermoplastic elastomers can be remolded. Examples include nylon, acetal, vinyl, polyethylene, fluoroplastics, and PBT.

1.2. Chemical Resistance

Chemical resistance is dependent upon the elastomeric material. With the wide range of elastomeric materials utilized with couplings, it is best to contact the coupling supplier for recommendations in harsh environments.

1.3. Temperature Resistance

Elastomers have a wide operating temperature range. Contact the coupling supplier for recommendations in harsh environments.

1.4. Torsional Stiffness

Torsional stiffness is a measure of a coupling's resistance to angular displacement about its axis of rotation and is usually represented in units of in-lbs/degree or in-lbs/radian. Coupling stiffness has an affect 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.

1.5. Fail Safe

Fail safe couplings continue to maintain physical connection and transmit torque short-term after the element has failed. 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 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.

1.6. Ease of Replacement

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 to the ease of component removal, replacement and realignment influenced by replacing the damaged coupling components provides greater insight into replacement costs.

1.7. Overload Protection

Some elastomeric coupling designs allow for the elastomer to act as a fuse. The element completely fractures causing a physical separation between shafts and 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.

1.8. No Lubrication

Elastomeric couplings generally do not require lubrication, and as such can result in low operating costs.

1.9. Misalignment Capability

Misalignment capability 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, absolve application demands and/or account for thermal growth. All elastomeric couplings are flexible and allow for some misalignment in one or more axes.

1.10. Design Type

1.10.1. Compressive

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.

1.10.2. Shear

Shear designs stress the elastomeric component of the coupling in shear or tension. The advantages over compressive couplings include greater misalignment capability, vibration dampening and torsional softness.

1.10.3. Combination – Shear/Compressive

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.

1.11. Static Conductivity

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.

1.12. Backlash

Backlash in couplings is considered free angular movement about its axis of rotation from one shaft side of the coupling to the other. This feature is critical in applications where precision positioning is required as with encoders.

2. Shaft Attachment

2.1. Bushed (See MPTA-B6i and MPTA-TL1 for more information)

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. Bore size limitations should be considered upon selection process.

2.2. Finished Bore (See MPTA-B1 for more information)

Couplings that have straight bores with keyways and setscrews as appropriate for shaft diameter 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. Bore size limitations should be considered upon selection process.

2.3. Taper Shaft

Taper shaft couplings have a tapered bore that mates 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.

3. Supplemental Considerations for Elastomer Selection

3.1. Hardness

Typically measured on a Shore A durometer scale, hardness combined with coupling design type and geometry may have an affect on angular misalignment capability, axial misalignment capability, torsional stiffness and the ability to dampen shock loads. If needed, various elastomeric materials are often available to increase wear resistance.

3.2. Hysteresis

Hysteresis in elastomeric couplings is the internal buildup of heat within the elastomer due to absorption of energy through mechanical power transference. This is often the means to which an elastomeric coupling fails as hysteresis-influenced temperatures rise within the element and exceed the operating temperature limit of the material.

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