

MPTA-C1c-2008

**ELASTOMERIC COUPLING ENGINEERING  
STANDARD GLOSSARY OF TERMS**



MPTA STANDARD

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## **ABSTRACT**

This standard is a listing of commonly used terms as compiled by the members of the elastomeric coupling industry. It contains the definitions of these terms as they apply to elastomeric couplings.

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## **FORWARD**

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The transmission of mechanical power between two shafts is commonly achieved through the use of a coupling. In many cases the use of an elastomeric coupling satisfies and has desirable characteristics to achieve this power transmission. There are many commonly used terms used to communicate the mechanical characteristics of these couplings and the way in which they transmit power.

Suggestions for the improvement of, or comments on this publication are welcome. They should be mailed to Mechanical Power Transmission Association, 6724 Lone Oak Blvd., Naples, FL 34109 on your company letterhead.

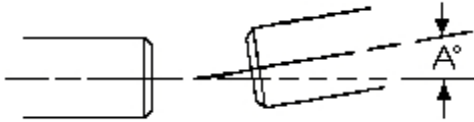
## **SCOPE**

This standard applies to flexible shaft couplings which employ the use of non-metallic elastomeric elements incorporated into the coupling. Power is transmitted from one rotating shaft to another through the elastomeric element(s).

## GLOSSARY

### **ANGULAR ALIGNMENT**

A measure of the angle between two shafts.



The angle of error,  $A^\circ$ , between two shafts is the amount of angular misalignment.

### **ANGULAR MISALIGNMENT**

The condition which exists when the center lines of connected shafts are neither parallel nor co-axial. The amount of misalignment is the angle measured between the intersecting axes of the connected shafts.

### **ANGULAR STIFFNESS**

A measure of a coupling's resistance to angular displacement. Measured in inch pounds per degree.

### **AXIAL MISALIGNMENT OR END FLOAT**

The axial movement from the normal gap setting for a standard coupling. Frequently associated with thermal growth stated as a +/- value from the normal setting as specified by the coupling manufacturer.

### **AXIAL STIFFNESS**

A measure of a coupling's resistance to axial displacement. Measured in pounds per inch.

### **BORES**

Cylindrical or conical holes in hubs of couplings with axes coincident with the rotational axis of the coupling.

## **CRITICAL SPEED** (of a rotating mechanical system)

Is that speed at which torsional vibration excitation from rotating components is equal to a natural frequency of the system. The torsional vibration frequency will be equal to the speed multiplied by the order number. (See definition)

As an example, a 4-cycle, 4-cylinder in-line engine with an order number of two operating at 1,000 RPM would generate a frequency of excitation of 33 Hz ( $2 \times 1,000/60$  sec/min). If the natural frequency of the system is also 33 Hz, then the critical speed, for that system, would be 1,000 RPM.

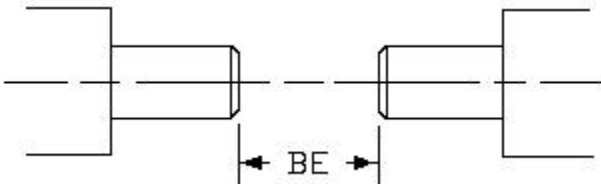
## **DAMPING**

Is the dissipation of energy (usually as heat) in a manner which decreases peak strain in a mechanical member.

## **DAMPING RATIO** (FACTOR OF CRITICAL DAMPING)

Is the ratio of the actual damping co-efficient (C) to the critical damping co-efficient ( $C_c$ ). The critical damping coefficient is a measure of the minimum damping that will allow a displaced system to return to its initial position without oscillation. For a single mass system it is defined  $C_c = 2 m \omega_n$  where  $m$  = Mass, Kg;  $\omega_n$  = Natural Circular Frequency, radians/sec;  $C_c$  = Kg/sec.

## **DISTANCE BETWEEN SHAFTS**



The distance between the face of one shaft to the next.

This is commonly called the “BE” dimension, for between ends.

## **ELASTOMERIC COUPLING**

An assembly of components designed to connect axially oriented shafts in order to provide power transmission and accommodate shaft misalignment through elastomeric materials.

## **ELASTOMERS**

Resilient materials having elastic properties (rubber, synthetic rubber or plastics).

## **ELASTOMERIC ELEMENT**

The component of the elastomeric coupling which transmits the power between the driving and the driven equipment. This may be in many forms or shapes and may include metallic or composite materials.

## **FLYWHEEL EFFECT $WR^2$**

A measure of the potential of the coupling to resist change in speed.  $WR^2$  is the product of the weight of the coupling times the square of the radius of gyration. The radius of gyration is the radius at which the mass of the part (coupling) can be considered concentrated.  $W$  = PART WEIGHT, lb;  $R$  = RADIUS OF GYRATION in feet or inches.  $WR^2$  is expressed in lb.ft<sup>2</sup> or lb.in<sup>2</sup>. For a cylinder (such as a coupling hub)  $WR^2 = W(R_o^2 - R_i^2)$  where  $R_o$  = the outside radius and  $R_i$  = the inside radius.

## **HORSEPOWER**

Is the unit of power that has been adopted for engineering work in the English system. One HP is equal to 33,000 foot pounds (of work) per minute or 550 feet pounds per second.

## **HUBS**

The rigid components of the elastomeric coupling which are attached to the shafts of the driving and driven equipment.

## **KEY**

Metallic load transmitting members placed in a groove between the shaft and hub.

## **KEYWAY**

The axial groove in the hub and shaft that holds the key in the proper location.

## **MAXIMUM SPEED**

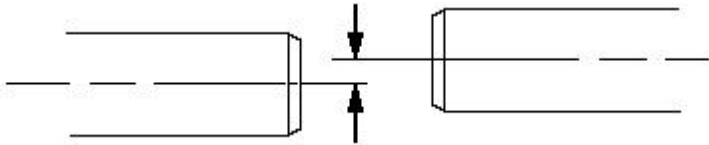
The manufacturer's definition of the rotating speed limit of the coupling usually defined in revolutions per minute.

## ORDER NUMBER

The number of exciting pulses per revolution of a shaft. As an example, a 4-cycle engine delivers one power pulse for every 2 revolutions of the crank shaft for each cylinder. Normally for a 4-cycle and 4 cylinder engine there will be 2 pulses for every revolution, and this is an order number of 2.

## PARALLEL MISALIGNMENT

The lateral displacement between non-intersecting axis of the connected shafts.



## PEAK LOAD CAPACITY

The maximum load a coupling can transmit for momentary periods.

## POLAR MASS MOMENT OF INERTIA

The polar mass moment of inertia (J) is the measure of resistance to a change in rotational velocity about an intended rotational axis. It may be derived by dividing the flywheel effect  $WR^2$  by the acceleration due to gravity.

$$J = \frac{WR^2}{g} \text{ lb-ft-sec}^2 \text{ where } R = \text{Radius of Gyration, ft } g = \frac{W}{32.2} \text{ lb } g = 32.2 \text{ ft/sec}^2$$

## RADIAL STIFFNESS

Measure of a coupling's resistance to parallel offset. Measured in pounds per inch.

## RESTORING FORCE

A force caused by the coupling's resistance to displacement.

## SERVICE FACTOR

A factor recommended by the coupling manufacturer to assure proper sizing of a coupling for a specific application.

## **SPLINE BORE**

A series of parallel keyways formed internal with the bore and mating with the corresponding grooves cut in a shaft. Splined hubs and shafts are used when relatively heavy torques are to be he most common splines conform to standards published by other organizations, such as SAE and ANSI, and are in the form of involutes or straight, parallel sides.

## **STATIC TORSIONAL STIFFNESS**

A measure of a coupling's resistance to angular displacement about its axis of rotation at its static torque rating. Measured in pound inches per radian (lb-in/rad) or in pound inches per degree (lb-in/deg).

## **TORQUE OR MOMENT OF A FORCE**

Is the measure of the tendency of the force to rotate the body upon which it acts about an axis. The magnitude of the moment due to a force acting in plane perpendicular to some axis is obtained by multiplying the force by the perpendicular distance from the axis to the line of action to the force. Torque is commonly expressed in pounds feet or pound inches, or Newton Meters, etc. (Machinery Handbook, 17th Edition)

$$T = F \times r \text{ Where } F = \text{Force, lb. } r = \text{distance, ft. or in.}$$

## **TORQUE RATING**

The manufacturers' definition of the torsional load that may be applied to the coupling with an anticipated satisfactory operating life.

## TORSIONAL NATURAL FREQUENCY

The frequency at which a system will oscillate in torsion when vibrating freely. For a single mass system the equation is:  $K$  is the torsional stiffness in lb-in per radian.  $I$  is the mass moment of inertia,  $WR^2/g$  lb-in sec<sup>2</sup>

$$f_n = \sqrt{\frac{K}{I}} \text{ radians per second}$$

$$f_n = \frac{60}{2\pi} \sqrt{\frac{K}{I}} \text{ cycles per minute}$$

For a two mass system is:

$$I = \frac{I_1 I_2}{I_1 + I_2}$$

Substituting this for  $I$ , the equation for  $f_n$  is:

$$f_n = \sqrt{K \left( \frac{I_1 + I_2}{I_1 I_2} \right)} \text{ radians per second}$$

$$f_n = \frac{60}{2\pi} \sqrt{K \left( \frac{I_1 + I_2}{I_1 I_2} \right)} \text{ cycles per minute}$$

## TORSIONAL VIBRATION

The periodic variation in torque of a rotating system. Causes of torsional vibration are typically gas pressures in internal combustion engines creating peak torques, inertial unbalance or irregular torque requirements of rotating equipment. It is important to note that torsional vibration calculations are typically analyzed for the continuous steady state, rather than the transient start-up or run-down condition.

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