MPTA-C8c-2011 R2021

COMMON CAUSES OF SLEEVE COUPLING FAILURES

MPTA INFORMATIONAL BULLETIN

Mechanical Power Transmission Association
1250 Tamiami Trail N., Suite 211, Naples, FL 34102
www.mpta.org

Contributors

ABB Motors and Mech. Inc.	**Greenville, SC**	www.baldor.com
Altra Industrial Motion – TB Woods Inc.	**Chambersburg, PA**	www.tbwoods.com
Custom Machine & Tool Co., Inc.	**Hanover, MA**	www.cmtco.com
Frontline Industries, Inc.	**Irvington, NJ**	www.frontlineindustries.com
Lovejoy, LLC.	**Downers Grove, IL**	www.lovejoy-inc.com
Martin Sprocket & Gear, Inc.	**Arlington, TX**	www.martinsprocket.com
Maurey Manufacturing Corp.	**Holly Springs, MS**	www.maurey.com
OptiBelt	**Carol Stream, IL**	www.optibelt.com
Regal Beloit America, Inc.	**Maysville, KY**	www.regalbeloit.com
Rexnord Industries, LLC	**New Berlin, WI**	www.rexnord.com
Torque Transmission	**Fairport Harbor, OH**	www.torquetrans.com

Disclaimer Statement

This Informational Bulletin is presented for the purpose of providing reference information only. You should not rely solely on the information contained herein. Mechanical Power Transmission Association (MPTA) recommends that you consult with appropriate engineers and / or other professionals for specific needs. Again, this publication is for reference information only and in no event will MPTA be liable for direct, indirect, incidental, or consequential damages arising from the use of this information.

Abstract

This Informational Bulletin is intended to provide users with a general overview of the most common failures of elastomeric shear sleeve style couplings and their causes.

Copyright Position Statement

Foreword

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

Suggestions for the improvement to or comments about this publication are welcome. They should be emailed to Mechanical Power Transmission Association at www.mpta.org

Scope

This Informational Bulletin is intended to provide users with a general overview of the most common failure modes with elastomeric sleeve style couplings and common causes for these failures.

This Informational Bulletin contains information for use to the industry but is not a standard. This Bulletin is made available to the public via the MPTA website.

Table of Contents

SECTION & TITLE **PAGE**

FIGURES **PAGE**

1. Introduction

Elastomeric Sleeve Couplings, sometimes referred to as shear sleeve type couplings, consist of two flange style hubs and an elastomeric sleeve operating in shear. The sleeve interlocks with the flanged hubs through meshing teeth on the inside diameter and outside diameter. Torque is transmitted from the driving hub through the sleeve to the driven hub. (Figure 1). As torque is transmitted through the sleeve, the elastomeric element dampens any shock loading, vibration (both lateral and torsional), and/or forces being applied to the element. The elastomeric sleeve style coupling is not a 'fail safe' coupling and upon failure of the sleeve, the coupling will cease to transmit torque. Elastomeric sleeve couplings can accommodate misalignment through flexing of the sleeve due to the inherent material properties and geometry. The sleeve coupling can accommodate greater amounts of parallel and angular misalignment than many other styles of couplings without imposing high reaction loads on equipment bearings. 'Shear' type elastomeric sleeve couplings tend to offer lower levels of torsional stiffness which, in many cases, offers some degree of protection against damage that may be caused by torsional vibrations.

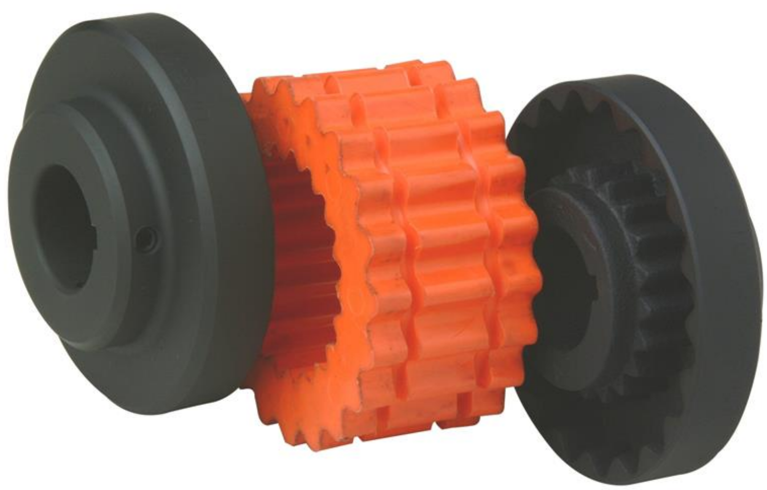

Figure 1

2. Misalignment

Misalignment types and capacities as follows:

Angular:	1° for EPDM or Neoprene sleeves, 1/4° for Hytrel sleeves
Radial/Parallel:	.010" to .062" depending on size.
Axial:	.030" to .25" depending on size

The above limits are intended as a guideline only. Refer to the appropriate manufacturers' Installation Instructions / Product Manuals for specific misalignment limits. Refer to manufacturer for suggested methods to check alignment.

3. Failure Modes

Elastomeric sleeve couplings can be separated into flange hub failures and sleeve element failures.

3.1 Flanged Hub Failures

3.1.1 Keyway Burst

A keyway burst failure can be caused by four possible situations. The first is due to the hub being subjected to an over torque condition. The weakest point in the hub is usually over the top of the keyway where there is the smallest cross section of material between the top of the keyway and the outside diameter of the hub. This is where an overload fracture is most likely to originate (Figure 2).

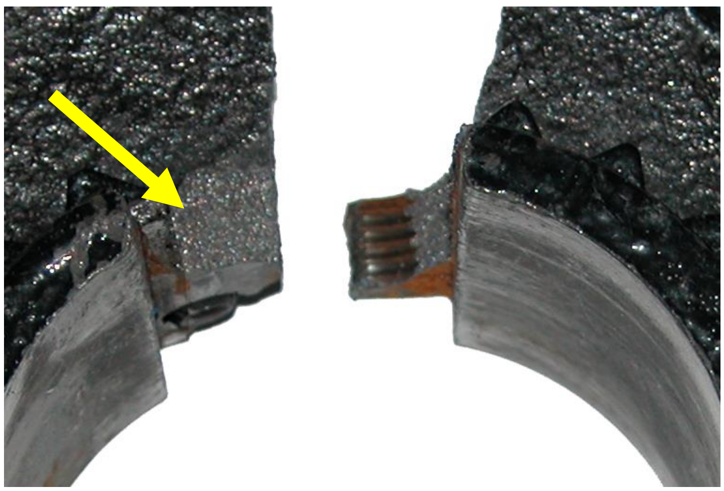

Figure 2

The second condition where this can occur is when a hub is forced onto a shaft in an interference fit condition or the key is too large. The pressure from this interference fit will cause the hub to burst at the weakest point which is typically at one of the top corners of the keyway.

The third condition occurs when there is excessive clearance between the hub and shaft, allowing relative motion between the hub and shaft.

The fourth condition is when the bore size exceeds the manufacturers recommend maximum bore limit, resulting in a very thin cross section from the keyway corner to hub outer diameter.

3.1.2 Flange Fracture

A fracture may occur across the face of a flange. This may be attributed to a material defect, or when the flange is subjected to improper installation practices with installation abuse. Use of improper, or abusive techniques during installation, such as aggressive hammering can cause cracks in the face of the flange. These cracks can fracture during the installation as can be seen in Figure 3 or in the presence of any sizable load when placed into operation.

Figure 3

3.2 Elastomeric Sleeve Failure

3.2.1 Diagonal Tear

When the elastomeric sleeve is subjected to a high cyclical torsional load, the sleeve will fail or tear in a classical diagonal pattern as shown in Figure 4 and Figure 5. This failure mode is indicative of torsional fatigue and is typically seen on applications subject to shock loads or frequent start / stop cycles.

Figure 4

Figure 5

3.2.2 Straight Tear

Straight tear failures (Figure 6) typically occur along a stress line between the teeth and the center section of the sleeve. These are sometimes caused by material defects created during the mold process of the sleeve.

This type of failure can also occur as the result of fatigue from misalignment, particularly when the hubs are installed too tightly together against the sleeve. Usually the fracture occurs completely across the sleeve prior to detection. The sleeve in Figure 6 was observed early prior to complete separation.

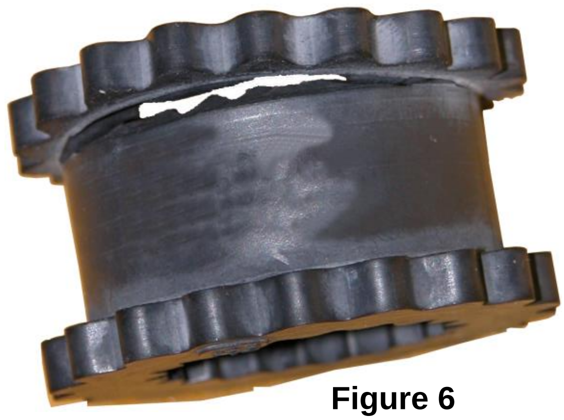

Figure 6

3.2.3 Tooth Wear

When the coupling is properly applied, and aligned, the sleeve will operate with some amount of torsional "wind-up". Under operating torque, this "wind-up" causes the sleeve teeth to grip the mating teeth on the flanges. Under these conditions, misalignment is accommodated through flexing of the elastomer sleeve. When the coupling is significantly oversized (service factor higher than 4.0), or the misalignment exceeds recommended limits, the sleeve does not grip the flanges. In this case, misalignment will result in relative motion between the sleeve teeth and flange teeth. This causes abrasive wear of the teeth as shown in Figure 7. If the wear is not detected relatively early, the sleeve will wear to the point that the teeth can no longer transmit torque, the sleeve will spin inside the flange and the teeth will wear off completely as in Figure 8.

Figure 7

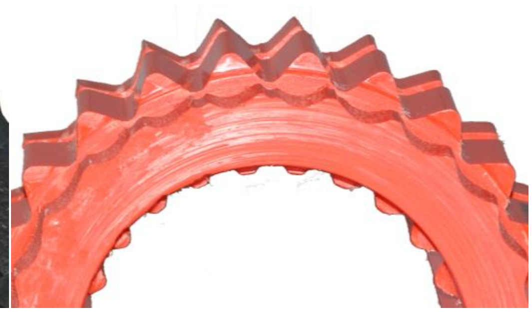

Figure 8

Figure 9 shows a new sleeve with normal teeth as should appear on any sleeve prior to that sleeve being installed in a coupling.

Figure 9

END OF DOCUMENT