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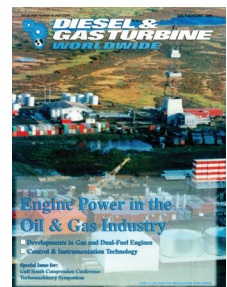
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# Operating Characteristics of High-Performance Diaphragm Couplings



As seen in  
**Diesel & Gas Turbine Worldwide**  
July-August, 1995

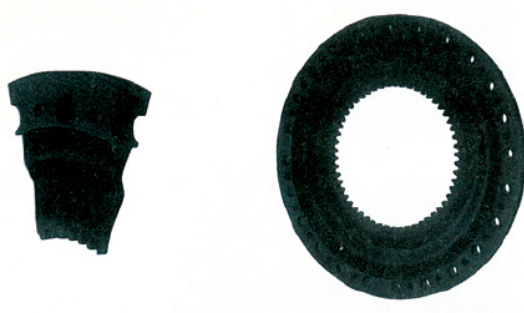


 **Ameridrives®**  
Couplings

An Altra Industrial Motion Company

# Operating Characteristics of High-Performance Diaphragm Couplings

*James H. Paluh, Manager of Engineering, High Performance Products, Zurn Industries Inc.*



The Zurn Ameriflex diaphragm pack, designed to provide infinite life, consists of thin, multiple convoluted and separated diaphragms with an inside-diameter spline.

Diaphragm couplings are one of the principle types of nonlubricated couplings used in high-performance turbomachinery, transmitting torque and accommodating misalignment between equipment shafts. These couplings rely on the flexure of metallic membranes to accept angular and axial misalignment.

In diaphragm couplings, torque is transmitted radially from the outside diameter of a drive flange through one or more metallic plates to an attachment at the inside diameter. The diaphragms may have either a constant or tapered thickness, and may be flat, convoluted, or spoked. The diaphragm outside diameter is usually clamped by bolts while the inside diameter may be electron beam welds, splines, or bolts. In the typical flange-to-flange connection of a diaphragm coupling, torque subjects the bolts predominately to shear stresses.

The Ameriflex diaphragm coupling from Zurn Industries incorporates significant life and safety factors. The metallic membrane of this coupling consists of thin, multiple, convoluted and separated diaphragms. Each of these properties provide a benefit to the overall coupling design. The diaphragm life is not dependent on the operating angle within its design rating.

The flex area is separated at the inside and outside diameters and then rigidly clamped. This separation prevents fretting corrosion from the rubbing of the flexing areas associated with multiple membrane couplings. Since there is no fretting, the designer can legitimately use classical infinite life engineering fatigue analysis for the diaphragm design utilizing the raw material properties. No reduction in the diaphragm material endurance limit or decreased reliability is caused by fretting corrosion or wear of the flex area. In fact, no credit is



Built-in guards to the Ameriflex coupling are designed to protect adjoining equipment in the event of a shear failure.

taken for the additional benefit of each diaphragm being individually shot peened.

Using the appropriate stresses confirmed by finite element analysis and strain gage testing, Zurn can accurately calculate safety factors using any of the fatigue failure theories such as Goodman, modified Goodman, or Constant Life. The Ameriflex coupling is a true infinite life design, with diaphragm packs operating in excess of twenty years. In operation, this translates into predictable equipment maintenance and inspection intervals, regardless of the angular and axial misalignment within the coupling's design rating, environmental conditions and the amount of service.

If an Ameriflex diaphragm coupling was subjected to excessive misalignment that was to initiate a fatigue failure, the crack will propagate gradually due to the separation of the diaphragm flex areas. Eventually, as each diaphragm fails, the remaining diaphragms will shear at their inner diameter due to excessive torque.

Most importantly, regardless of the cause of failure,

by fatigue or ultimate failure due to peak overload, the diaphragm inner diameter will shear from the spacer or spool, preventing the transfer of power from the driving to driven equipment. The instantaneous loss of load will result in standard turbomachinery overspeed trip. After shear failure, the Ameriflex coupling's anti-flail guards contain the center section for safety and can protect the adjoining equipment.

## About Altra Industrial Motion

Altra Industrial Motion (NASDAQ:AIMC) is a leading multi-national designer, producer and marketer of a wide range of electromechanical power transmission products. The company brings together strong brands covering over 40 product lines with production facilities in nine countries.

Altra's leading brands include Boston Gear, Warner Electric, TB Wood's, Formsprag Clutch, Wichita Clutch, Industrial Clutch, Ameridrives Couplings, Kilian Manufacturing, Marland Clutch, Nuttall Gear, Bauer Gear Motor, Stieber Clutch, Twiflex Limited, Bibby Turboflex, Matrix International, Inertia Dynamics, Huco Dynatork, Lamiflex Couplings, Ameridrives Power Transmission, Delroyd Worm Gear and Warner Linear. For information on any of these technology leaders, visit [www.AltraMotion.com](http://www.AltraMotion.com) or call 815-389-3771.



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