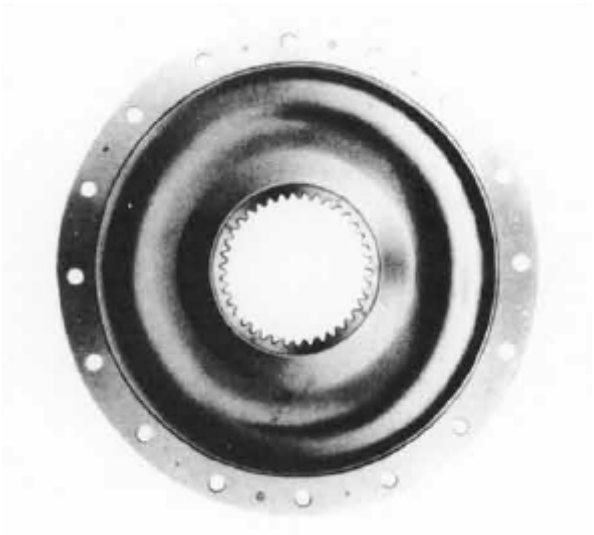
High Performance Flexible Coupling Introduced for Turbomachinery



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Ameridrives® Couplings
An Altra Industrial Motion Company

High Performance Flexible Coupling Introduced for Turbomachinery

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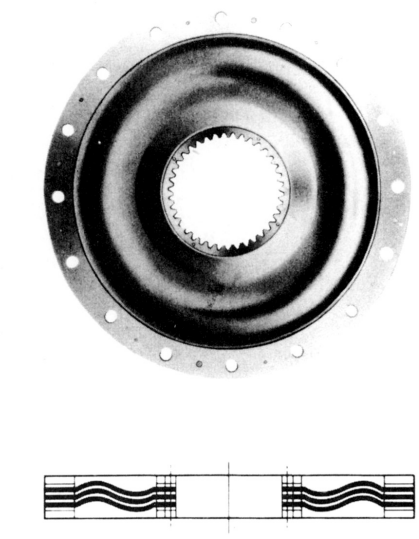
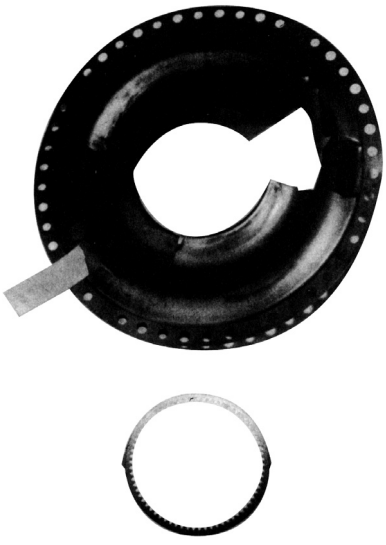


Zurn's Ameriflex coupling uses a number of thin diaphragms to transmit torque.



Outermost diaphragm of a coupling that failed due to overly-high misalignment. The rest of the coupling continued to operate for more than 10 million cycles

An improved version of a popular diaphragm-type flexible coupling design has been introduced for commercial turbomachinery applications by the Mechanical Drives Division of Zurn Industries. The new "integral filler" version of the company's Ameriflex coupling is the latest variation of multiple convoluted diaphragm coupling design that has enjoyed great acceptance in high performance dry coupling applications since its introduction in 1971.

The Ameriflex diaphragm coupling transmits torque and accommodates misalignment through a flexible membrane from the outside diameter to the inside diameter. The membrane in the Ameriflex coupling uses a number of flexible discs to provide high flexibilty and reduced operating stresses.

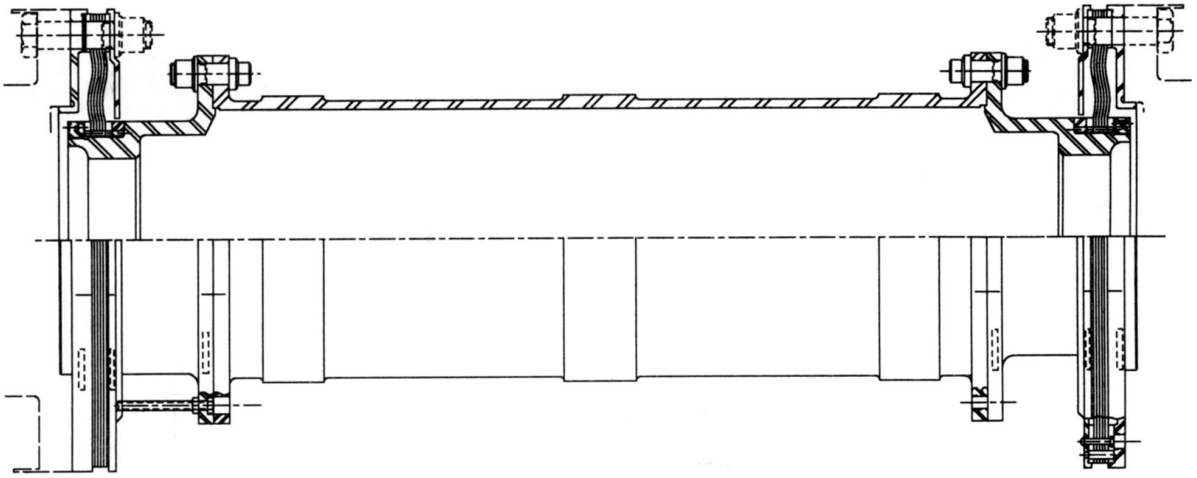
Stresses, moments and forces on a diaphragm increase with the cube of the thickness, therefore lower forces can be achieved without sacrificing peak torque capability or relying on mechanical back-up systems. Mechanical back-up devices, used to transmit power in the event of transient peak torques, can increase the level of damaging forces on a system since they transmit the highest forces at the worst possible time.

One additional feature of the multiple convoluted diaphragm design is its inherent safety during failure caused by too much misalignment. Angular misalignment creates flexural stresses in the diaphragms, but the level of stress in each diaphragm will not be equal, due to the addition of the offset stress. This being the case, in the event of a fatigue failure the outermost diaphragm will fail first. The next diaphragm will have a lower combined alternating stress than the first, due to a lower offset stress. If machinery operation continues and diaphragms gradually fail, the decreasing-stress effect would continue until about one-half of the diaphragms have failed. Then the torque component of stress would cause the remaining diaphragms to fail in torsion.

As a failed diaphragm continues to operate, cracks can develop into broken pieces, which centrifuge out to be caught in the heavy machinery guard. Most turbomachinery today incorporates vibration monitoring equipment designed to detect any unbalance by such a failed diaphragm.

In at least one case in which an outer diaphragm failed when operated outside alignment limitations (i.e., over 2°), the coupling operated for ten million cycles after the outermost diaphragm failed, with no failure of the second diaphragm or the remainder of the pack.

In the Ameriflex coupling, the flexible membranes are separated, which helps prevent fatigues that might be caused by fretting. In previous



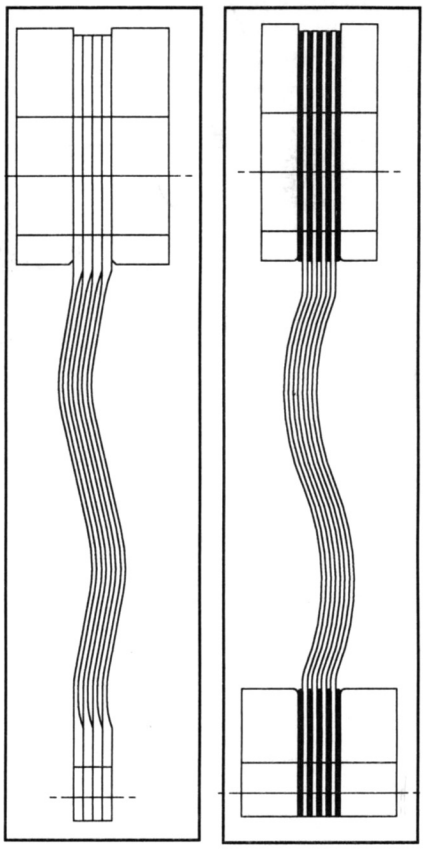
An Ameriflex coupling for use with a GE Frame 6 gas turbine.

versions of the design, the stainless steel diaphragms were of uniform thickness, separated by filler rings on the inside diameter and segmented rings on the outside diameter. After assembly on a fixture, the completed pack was riveted and clamped, or electron beam welded at the inside diameter and bolted together at the outside diameter.

Based on Zurn's experience with the Ameriflex coupling in such high performance applications as naval surface ships and submarines and tilt-wing rotor aircraft, the company has introduced the new integral filler Ameriflex coupling design into the commercial markets.

Finite element analysis of diaphragm stresses, combined with dynamic and static testing, has allowed for a precise data base to be applied to the Ameriflex design. The new integral filler design optimizes the shape, thickness and number of diaphragms. The separate filler rings and segments have been eliminated by machining a thicker diaphragm through the flex area only. This reduces the number of components and manufacturing processes, improving performance while containing costs.

The diaphragm thickness in the flex area can now be customized to meet the stiffness and torque requirements of a given application, and the outside diameter holes can be customized to bolt directly to the customers' integral flanged shaft. The redesigned coupling has a higher torque capacity, greater misalignment capability, and can be easily custom-designed to meet the requirements of turbomachinery in most petrochemical and power generation applications.



(Left) Diaphragm pack section of the new "integral filler" Ameriflex coupling. This design eliminates the use of filler rings and segments between the individual diaphragms, and allows the shape, thickness and number of diaphragms to be optimized.
(Right) Diaphragm pack section of the original Ameriflex coupling, which used filter rings and segments to separate the individual diaphragms.

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.

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