Retrofitting Dry Diaphragm Couplings

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Ameridrives® Couplings
An Altra Industrial Motion Company

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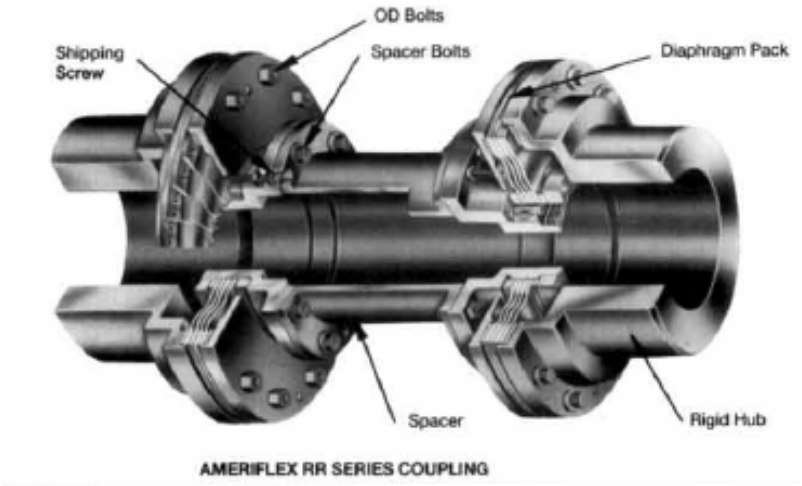


A cross-section of a Zurn Ameriflex multiple-convoluted diaphragm coupling

Dry diaphragm couplings are widely used in turbomachinery systems in petrochemical, process and power generation applications. Compared to traditional gear couplings, diaphragm couplings be-long lo a newer generation. So it is often the case that older machines, which were originally lilted with gear couplings, are retrofitted with a dry diaphragm coupling during maintenance or in case of failure.

Zurn Industries, one of the major manufacturers of both gear-type and flexible diaphragm couplings, reports thai a consistent share of their sales of diaphragm couplings is to the after-market. Plant operators make this choice because they are attracted by the advantages offered by such a conversion. However, to benefit from these advantages, many factors have to be taken into proper consideration.

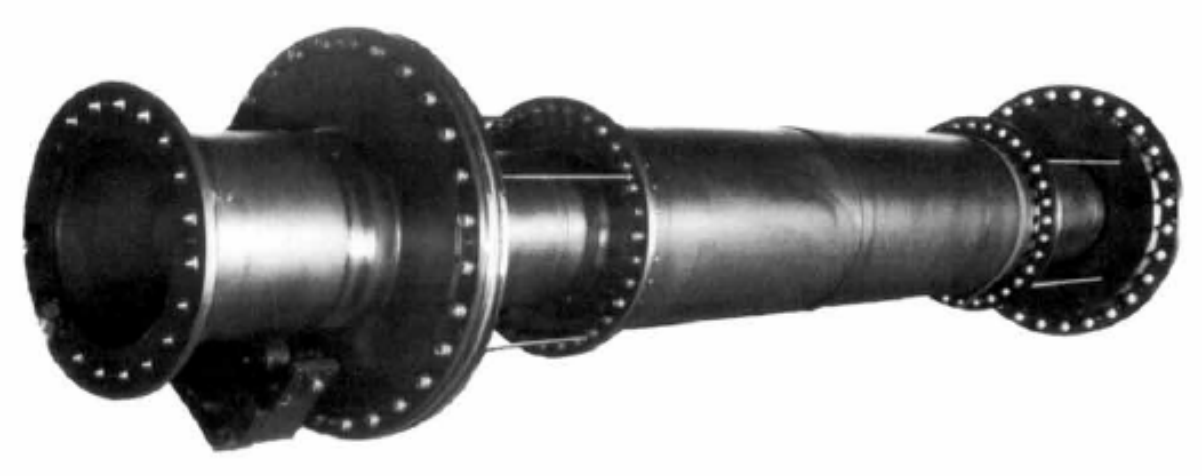
The coupling might be considered only a minor component in the equipment train, but Zurn reports that troubles caused by hasty selection of couplings during retrofits is, in fact, by far the most common inconvenience re-ported from the field.

Important factors to consider in selecting a coupling include the maximum rated power, maximum rated speed and maximum torque. Other important factors are the mass distribution of the coupling, the geometry of the coupling (which must fit into the available space), and finally the thermal growth of each machine.

The advent of diaphragm couplings has solved many chronic problems associated with gear couplings. Zurn states. However, with gear couplings, high vibration levels warn the operator that the coupling has been poorly in-stalled, is excessively worn, or lockcd-up. Diaphragm couplings, on the other hand, nm smoothly for the life of the machine.

The major differences between the two types of coupling are size, weight and mass distribution. For an equal torque capacity, a diaphragm coupling is generally larger and heavier than a gear coupling, and this can cause geometrical interference with other equipment.

When retrofitting a coupling, the overhung moment difference between the old and new couplings needs to be taken into account. Too large of a change in the overhung moment could place a lateral critical frequency



A Zurn Ameriflex # S23-10 LM 6000 diaphragm coupling, as has been supplied for use in a number of gas turbine packages

of the system near the operating speed range, thereby provoking instability. Therefore, the overhung moment should not increase by more than 20% for machines operating at speeds up to 3600 r/min., 15% for speeds in the 3600-6000 r/min range, and 10% for speeds exceeding 6000 r/min.

The overhung moment is based on only one-half of the total coupling weight, since this is shared equally by the shaft ends of the two machines. More important than the weight itself, however, is the combination of weight and location of the center of gravity, which determines the overhung moment. The coupling is the most influential component in the system's torsional critical speeds. Tuning is mainly done by modifying the ratio of the spacer inner diameter to the outer diameter. The use of special materials such as stainless steel, titanium or composites can also serve the purpose, though it is rarely necessary.

The axial natural frequencies in dry couplings show a completely different behavior. They are influenced by the metallic membrane used to accommodate misalignment. Membrane deformation gives rise to restoring forces, which induce the coupling to resonate along it's axis of rotation. Windage is another factor to consider. Dry couplings, having a larger diameter than gear couplings, produce more heat for the windage effect. And, unlike gear couplings, there is no lube oil available to help remove the heat.

Once the recommended precautions are observed, retrofitting a dry diaphragm coupling in the place of a gear coupling provides many benefits.

First, the lubricating system required by the gear couplings, including greasing or oil filtering operations, is eliminated. Absence of lubricant allows operation at extreme temperatures.

Diaphragm couplings also tolerate a greater parallel and angular misalignment, and do not have rubbing sur-faces subject to wear, so they exhibit a longer life span. The angular moment of a diaphragm coupling is from seven to ten times less than a comparable gear coupling. If the misalignment is maintained within rated limits, it will not affect the coupling life.

Bearings (radial and thrust) and shafts ends will also benefit from the use of diaphragm couplings, which feature lower moment and thrust loads. This results in much longer bearing life.

Maintenance of this type of coupling is reduced to less frequent intervals, and is limited to the replacement of the diaphragm pack subassembly, resulting in reduced maintenance costs.

The diaphragm coupling has no radial clearance, resulting in better, more repeatable balance levels. Gear couplings have a diametrical crown clearance that is a potential source of unbalance.

The flexible diaphragm coupling, if properly retrofitted, will increase machinery reliability and eliminate maintenance and related problems associated with the high performance gear couplings.

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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