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Magnetically Coupled Drive

Introduction

Most industrial motors have fixed number of poles, allowing them to operate at a constant speed at designed voltage and frequency. However, many industrial processes require different operating speeds. Examples of applications include fans, centrifugal blowers, centrifugal pumps, axial-flow pumps, turbine pumps, agitators, and axial compressors. In these applications, if the motor speed is reduced 20%, motor horsepower is reduced by a cubic relationship (.8 X .8 X .8), or 51%. Due to cubic relationship between speed reduction and energy consumption, Adjustable Speed Drive (ASD) can significantly increase energy savings. This article will discuss magnetically coupled ASD.

Overview of Magnetically Coupled ASD

Magnetically coupled adjustable speed drives place a magnetic disc on the load shaft and conductor assembly on the motor shaft. By varying magnetic strength across an air gap between the motor shaft and the driven side of the coupling, variable torque is transmitted to the load, thereby reducing speed and energy consumption. There are two types of magnetic coupling used between the motor and load: fixed or electromagnets. Both types of coupling uses induced eddy current to transfer torque from motor shaft to load. Figure 1 below shows the schematic of permanent magnet coupling.

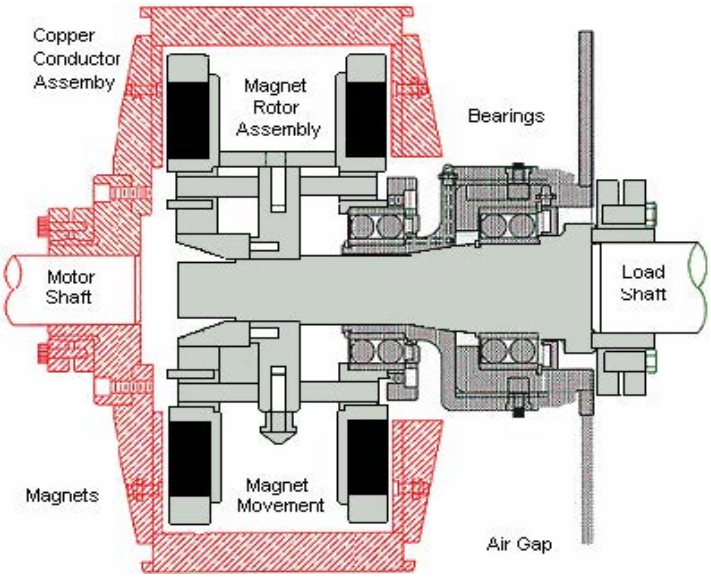

Figure 1: Magnetically coupled Drive Schematic (Schematic of Magna Drive™)

Advantages and Disadvantages

Reduced vibration, noise and misalignment: Presence of air gap between motor and load shafts reduces transmission of vibration. In addition, this also reduces noise, tolerates misalignment, provides overload protection, extends motor and equipment life and reduces overall maintenance costs.

Soft start/stop – the presence of coupling between motor and load, allows motor to slip, reducing starting current.

Power quality – Magnetically coupled ASDs introduce insignificant amounts of harmonic distortion to the power grid. In addition, they continue to function during other electrical disturbances such as voltage sag and swells.

Disadvantages of magnetically coupled ASDs include space constraint, weight constraint and efficiency. Magnetically coupled ASDs require space for coupling magnets with added weight, disallowing applications where space and weight can't be accommodated. Magnetically coupled ASDs may not be suitable for vertical shaft motors or belt-driven loads.

Magnetically coupled ASDs are only applicable in applications where maximum speed control is less than 30%. Furthermore, they only capture 60% of the energy savings obtainable by Variable Frequency Drives (VFDs). This saving further decreases as the speed decreases.

Conclusion

Magnetically coupled ASDs are applicable to niche applications where speed control range is limited (less than 30%). They are generally suitable for many rugged environments as they don't require controlled environment (typically required for VFD's), tolerate poor power quality and are immune to harmonic noise.

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