

# **OIL-FREE COMPRESSOR SYSTEMS FOR GAS PIPELINES: IS NOW THE TIME?**

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## **ABSTRACT**

The "World's First Oil-Free Compressor" was commissioned in the NOVA (now TransCanada Pipelines) gas transmission system in 1985. This move to oil-free technology was driven initially by a desire to reduce unscheduled downtime by removing the problematic oil seal and lubrication systems. Over the years more compressors were equipped with dry gas seals and magnetic bearings. By 1992, 34 compressors totaling about 60 percent of the installed power of the NOVA system were running on magnetic bearings. At that time problems with the reliability of the magnetic bearings were noticed and the oil-free compressor program was reviewed. The main reasons for these problems in the early days were connectors, amplifiers, auxiliary bearings, and some design and training issues (see "Magnetic Bearing Improvement Program: History and Details", Alves et al, NOVA GTL at MAG '95). These problems were corrected over the next three years and since then the systems have worked satisfactorily.

Since that time there have been significant advancements in performance and cost of magnetic bearings, driven in large part from applications outside the gas compressor industry. The key technical challenges faced in the early days have been addressed, including sensors, connectors, amplifiers, "black box" tuning, interchangeability, and more recently, auxiliary bearings. In addition the cost of manufacturing magnetic bearing systems has dropped significantly due to the incorporation of digital technology, increased use of "off the shelf" components, and modular design of the systems.

Although magnetic bearings have demonstrated good performance in gas pipeline compressors over the last five years, adoption of the technology has been slow. Large turbomachinery equipment manufacturers have been reluctant to pursue magnetic bearings due to high cost, high engineering effort and unfamiliarity with this technology. In addition, the gas transmission companies have not asked for magnetic bearing technology from the compressor manufacturers. One reason is the continuing use of oil lubrication systems for gas engines, gas turbines, steam turbines and gearboxes. The removal of all the lubrication systems through the use of electric high-speed motors on magnetic bearings offers an attractive solution for gas transmission companies. This concept, combined with the technology advancements of the magnetic bearing technology noted above, may finally provide the incentive for pipeline companies to favor an electrically driven oil-free compressor solution.

Electric motors with magnetic bearings have been developed during the last years but the real commercial breakthrough is still missing. The success of this technology will depend on the cost of such electric high-speed drives and magnetic bearings. ABB is currently developing a range of electric high-speed drives using magnetic bearings supplied by Revolve Magnetic Bearings Inc. These drives cover a large range of compressor applications and are highly modular and pre-engineered to be cost competitive compared with other drives. Although the outlook for oil-free compressor systems is improving, equipment manufacturers and magnetic bearings suppliers still need to work hard to make the vision of oil-free operation a reality.

