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**THE ROLE OF HIGH PERFORMANCE FOIL BEARINGS IN ADVANCED, OIL-FREE, HIGH-SPEED  
MOTOR DRIVEN COMPRESSORS**

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**ABSTRACT**

The demand for high power density, reliable, low maintenance, oil-free turbomachinery imposes significant demands on the bearing system. The full benefits of high speed, motor driven machines, for example are realized at speeds exceeding the capabilities of rolling element bearings. The high speeds, and requirement for oil-free operation in fuel cell applications also make conventional liquid lubricated bearings an undesirable alternative. The modern, oil-free foil bearing provides an excellent alternative, with its low power loss, damping for smooth high-speed operation and shock tolerance, elevated temperature capability and long maintenance free life. In this paper, the application of modern foil bearings to two different high-speed, oil-free compressors is discussed. In each application, foil bearings support a multi-component rotor operating at speeds above 70,000 RPM. Stable and reliable operation over the full speed range is demonstrated in each case. These applications also required low bearing start-up torque for compatibility with the torque characteristics of the integral motor. This work discusses the rotor bearing system design, the development program approach, and the results of testing to date.