

Hydrostatic Pivoted Pad Bearing for Oil-Free Turbomachinery

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ABSTRACT

To replace traditional rolling element bearings and eliminate liquid lubricants used in small gas turbine engines, a unique bearing configuration has been developed – the Hydrostatic Pivoted Pad Bearing, or HyPad[®]. This patent-pending concept consists of several pivoting pads, through which a number of holes are placed to create a hydrostatic gas film. During operation, the gas film, supplied from a small amount of compressor bleed air, more than adequately supports normal loads, with contact between the rotor and bearing only during start/stop and high load conditions, such as maneuvers. To permit limited contact and provide wear resistance, the pads are constructed from a proprietary self-lubricating material. The combination of the hydrostatic assist with self lubricated pivoting pads offers desirable rotor dynamic properties, including high stiffness, reasonable damping, and very low cross coupling, resulting in excellent stability characteristics. The feasibility of the HyPad was demonstrated both analytically and by actual testing in a gas bearing rig, with superb performance obtained from the prototype hardware to a surface speed over 2.5 million DN, the practical limit for most rolling element bearings. Results from the analysis and testing are presented in this paper, to demonstrate the operating characteristics and potential of this unique bearing concept.

Keywords: Oil-Free Bearing Hydrostatic Gas Film Pivoted Pad Rotor Dynamics Testing