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MAGNETIC SUSPENSION OF AN ARTIFICIAL HEART PUMP USING EM/PM BEARINGS

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ABSTRACT

An artificial heart pump is under development for use as a ventricular assist device. This paper describes a fourth generation prototype pump of diameter 68 mm (2.62 in) and axial length 33.5 mm (1.32 in). The pump is a small centrifugal pump with a shaftless impeller fully supported in magnetic bearings. It is desired that the magnetic support system have high load capacity, be very compact, and have very low power consumption. A hybrid electromagnet/permanent magnet bearing design has been developed and tested. The bearings consist of two identical rings, one placed on the inlet side of the centrifugal impeller and one placed on the discharge side of the impeller. Each ring has eight poles, four radial and four axial, to control the pump impeller in five axes (x, y, z, α, β) – three displacements and two angular displacements relative to the x, y axes. The bearings have a radial load capacity of 9.65 N (2.16 lbf) and an axial load capacity of 19.3 N (4.33 lbf). The dynamic model of the impeller in the magnetic bearings is developed. The estimated coil ohmic power loss in normal operation is less than 5 watts.