Effect of some design parameters on the performance of water-ring type rotary compressors

By

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Thesis

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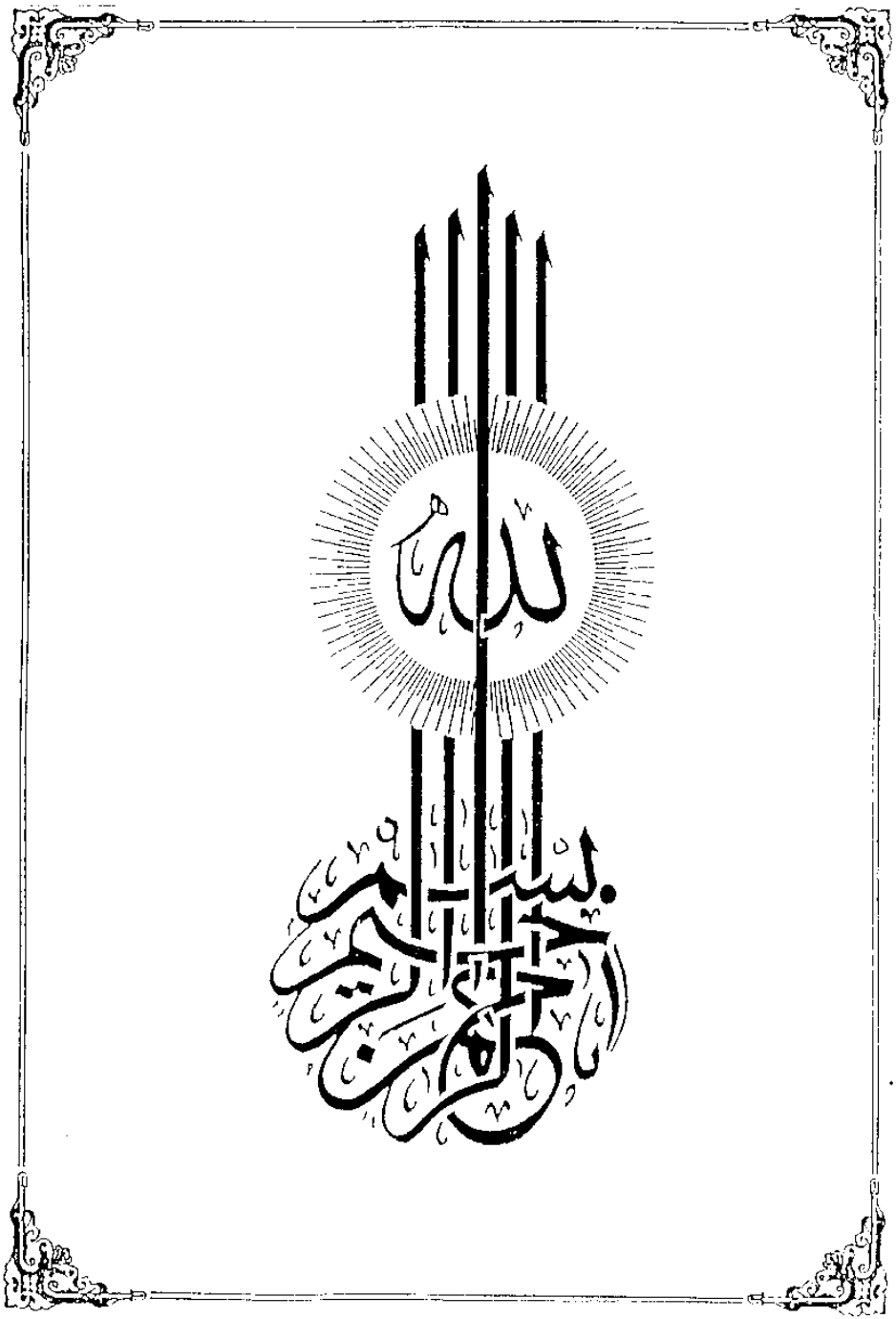

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(I) STATEMENT

This dissertation is submitted to Ain Shams University for the degree of master of science in Mechanical Engineering.

The work comprised in this thesis was carried out by the author in Mechanical Power Department, Faculty of Engineering, Ain Shams University from 12-1992 to 11-1997.

No part of this thesis has been submitted for a degree at any other University .

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ABSTRACT

(III) ABSTRACT

The present work is carried out to investigate the effect of some design parameters on the performance of water-ring type rotary compressors.

A test rig was designed to achieve the above requirements. The test rig is composed of a water-ring type rotary compressor, electric motor, air-water separator, calibrated measuring instruments to determine the compressor rotational speed, suction and delivery pressures, water flow supply, air mass flow rate and brake power input, as well as air temperatures.

The compressor was tested at four different operating rotational speeds of 960, 1350, 1600 and 1800 rpm and four different water flow supplies of 0.5, 1.0, 1.5 and 2.0 m^3/hr.

Five different impeller-vane shapes were tested. The vanes were designed to have the same chord length but different camber.

An analysis was made to the characteristics of each impeller at different speeds and different water flow supplies.

The followings are the major conclusions of this study :

1- The air capacity of the compressor decreases as the pressure ratio increases at any tested rotor rotational speed or water flow supply to the compressor.

2- The highest air capacity increases when increasing the rotor rotational speed. However, it becomes nearly independent of the water flow supply.

3- The maximum pressure ratio increases with the increase of the rotor rotational speed or water flow supply.

4- The fluid power and isothermal efficiency increase with the increase of the pressure ratio until they reach their

maximum values, then they decrease to zero values (at the maximum pressure ratios which can be reached). Also the maximum fluid power and isothermal efficiency increase with the increase of both rotor rotational speed and water flow supply.

5- The brake power increases with the increase of both pressure ratio and rotor rotational speed. In the meantime it is found to be slightly dependent upon water flow supply variation.

6- Generally, the vane curvature variation had a great effect on the performance of the water-ring type rotary compressor. Within the tested range, increasing the blade camber improved the compressor performance.