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Water ring vacuum pumps and compressors - Testing method

水环真空泵和水环压缩机 试验方法

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1 Scope

GB/T 13929-2024 is the Chinese national standard on water ring vacuum pumps and

compressors - testing method, in the field of fluid systems and general-purpose components. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 25 April 2024 by the State Administration for Market Regulation; Standardization Administration of China, and has been in force since 1 August 2024. Classification: ICS 23.080, CCS J71. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This document describes the test methods, measurements, calculation of isothermal compression efficiency, as well as conversion methods for test results of water ring vacuum pumps and water ring compressors (hereinafter collectively referred to as pumps without distinction). It also specifies performance curves, measurement uncertainties, performance tolerances, test report content. This document applies to pumps without any piping accessories, also to pump assemblies connected with all or part of the upstream and/or downstream piping accessories. This document applies to pump testing using water as the working fluid and ambient air as the test medium. This document shall be used as a reference, when testing with other liquids besides water as the working fluid.

2 Normative references

The following documents, through normative references herein, constitute essential provisions of this document. For dated references, only the edition cited applies; for undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 1032-2023 Test methods for three-phase asynchronous motors

GB/T 3216-2016 Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1, 2 and 3

GB/T 13930 Water ring vacuum pumps and compressors - Method for measurement of volume flow of gas

GB/T 29529 Methods of measuring and evaluating noise of pumps

GB/T 29531 Methods of measuring and evaluating vibration of pumps

JB/T 7255 Water ring vacuum pumps and compressors

3 Terms and definitions

The terms and definitions defined in JB/T 7255, as well as the following terms and The relationship between gas volume and discharge pressure, shaft power, isothermal

compression efficiency, etc., of the < water ring compressor> at a certain speed.

4 Test methods

4.1 Test types Pump tests are divided into type tests and exit-factory tests. Both type tests and exit- factory tests shall begin with an operational test. Note

1.Type testing refers to performance testing, vibration testing, noise testing. Note

2.Exit-factory testing involves testing the pump's relevant performance indicators at specified points within a specified range.

4.2 Test medium and working fluid

4.2.1 The test medium is ambient air, with a temperature range preferably from 0 °C ~ 35 °C.

4.2.2 During testing, the pump inlet water temperature shall not exceed 35 °C, which is preferably 15 °C. The water shall be clean; the water supply volume and pressure shall comply with the relevant technical documents.

4.3 Uncertainty of test instruments All instruments shall have verification certificates or reports and shall be verified or calibrated according to the specified cycle. The measurement uncertainty of all types of instruments shall meet the requirements of Table 1 for the uncertainty of each measurement parameter. - For single-stage water ring vacuum pumps, the suction pressure point is 400 hPa; - For two-stage water ring vacuum pumps, the suction pressure point is 80 hPa; - For water ring compressors, the maximum permissible operating pressure point.

4.7 Performance test

4.7.1 The performance test of the water ring vacuum pump shall measure the gas volume, shaft power, efficiency, ultimate pressure at different suction pressures under the test speed. The performance test of a water ring compressor shall measure the gas volume, shaft power, efficiency at different discharge pressures (including the maximum permissible operating pressure) at the test speed. During the pump performance test, the bearing temperature, ambient air temperature, ambient air relative humidity, atmospheric pressure, discharge temperature, temperature, pressure, flow rate of the supplied water shall be measured simultaneously (see Figure 1).

4.7.2 When performing performance tests on a single-stage water ring vacuum pump, the number of measurement points shall not be less than 12 (including the measurement points specified in 4.8.2). Additional measurement points shall be added in areas where the gas volume curve changes significantly; the number of additional measurement points shall reflect the changes in the gas volume curve. When performing performance tests on a

two-stage water ring vacuum pump, the measurement points shall start from the suction pressure of 200 hPa to the ultimate vacuum; the number of measurement points shall meet the buyer's requirements. When the buyer has no requirements, the number of measurement points may be appropriately selected, but shall at least include the measurement points specified in 4.8.2. When conducting performance tests on a water ring compressor, the number of test points may be appropriately selected according to the buyer's requirements, but shall include the test points specified in 4.8.2.

4.7.3 When conducting performance tests on a water ring vacuum pump equipped with an atmospheric ejector, the number of test points may be appropriately increased. In addition to measuring the performance of the water ring vacuum pump when operating alone, the gas volume, shaft power, ultimate vacuum when equipped with an atmospheric ejector shall also be measured.

4.8 Exit-factory tests

4.8.1 The performance test points for exit-factory tests shall conform to the buyer's specifications. If the buyer has not specified, the performance test points shall be conducted according to the following provisions. - Single-stage water ring vacuum pump. Ambient air pressure (or close to ambient air pressure), suction pressure of 400 hPa, ultimate vacuum; - Two-stage water ring vacuum pump. Suction pressure of 200 hPa, 80 hPa, ultimate vacuum; - Water ring compressor. Ambient air pressure (or close to ambient air pressure), the midpoint between ambient air pressure and the maximum permissible operating pressure, and the maximum permissible operating pressure.

4.8.2 The vibration and noise operating points for exit-factory testing shall be as specified by the buyer. If not specified by the buyer, the following shall apply. - For single-stage water ring vacuum pumps, the point of suction pressure 400 hPa; - For two-stage water ring vacuum pumps, the point of suction pressure 80 hPa; - For water ring compressors, the point of maximum permissible operating pressure.

5 Measurement and calculation of isothermal compression

5.1 Measurement of gas flow rate The measurement of gas flow rate shall be performed in accordance with GB/T 13930.

5.2 Measurement of suction pressure (vacuum)

5.2.1 The suction pressure shall be measured at the pump inlet, using a liquid column manometer (U-tube manometer or single-tube vacuum gauge) or a spring vacuum gauge. The inner diameter of the connecting pipeline for the measuring instrument shall not be less than 6 mm. The pipeline shall not be bent; the sealing of the connecting pipe shall be ensured to prevent blockage due to condensation.