JJG

NATIONAL METROLOGICAL VERIFICATION REGULATION

OF THE PEOPLE'S REPUBLIC OF CHINA

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Goriolis Mass Flow Meters

科里奥利质量流量计

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Table of Contents

Verification Regulation of Goriolis Mass Flow Meters

1 Scope

This Regulation applies to the type evaluation, initial verification, subsequent verification and in-use inspection of Coriolis mass flow meters (hereinafter referred to as flow meters).

2 References

The provisions contained in the following standards and specifications constitute the provisions of this Regulation through reference.

JJF 1094-2002, Evaluation of the Characteristics of Measuring Instruments

JJF 1004-2004, Metrological Terms and Their Definitions for Flow Rate

GB 17820-1999, Natural Gas

GB 50251-2003, Code for design of gas transmission pipeline engineering

GB/T 13609-1999, Natural gas - Sampling guidelines

GB/T 13610-2003, Analysis of natural gas by gas chromatography

GB/T 17747.2-1999, Natural gas - Calculation of compression factor - Part 2: Calculation using molar-composition analysis

GB 3836.1-2000, Electrical apparatus for explosive gas atmospheres - Part 1: General requirements

GB 3836.2-2000, Electrical apparatus for explosive gas atmospheres - Part 2: Flameproof enclosure d

GB 3836.3-2000, Electrical apparatus for explosive gas atmospheres - Part 3: Increased safety e

During the use of this Regulation, attention shall be paid to the currently valid version of the above-referenced documents.

3 Terms and definitions

This Regulation uses the following terms and definitions, as well as the terms and definitions specified in JJF 1094-2002 and JJF 1004-2004.

6.2 Marking and nameplate

6.2.1 The flow meter shall have clear flow direction markings.

6.2.2 The flow meter shall have a nameplate. The nameplate shall generally indicate the name, model, factory number, measuring medium, flow range, nominal diameter, accuracy level, maximum working pressure, power supply voltage, flow sensor material, manufacturer and manufacturing date, manufacturing meter license mark and number, explosion-proof level (for flammable and explosive occasions), and protection grade.

6.3 Appearance

6.3.1 Newly manufactured flow meters shall have good appearance, uniform surface color, and shall be free of burrs, scratches, cracks, rust, mildew, peeling, etc. The sealing surface shall be flat and free of damage.

6.3.2 The welding parts of the flow meter shall be smooth and clean, without any cold welding or desoldering.

6.3.3 The connectors of the flow meter must be firm and reliable and must not become loose or fall off due to vibration.

6.3.4 The numbers, words and symbols displayed on the flow meter shall be clear and neat.

6.3.5 The buttons of the flow meter shall have a moderate feel and no sticking.

6.4 Protection function

The flow meter shall have protection functions (such as passwords, etc.) for the relevant parameters that can change the metering performance of the flow meter. The meter factor or pluses per unit shall be the same as the value in the previous verification certificate.

6.5 Sealing property

Under the verification installation conditions, when the flow meter maintains the maximum verification pressure for 5 minutes, there shall be no seepage or leakage at all connections.

7 Control of measuring instruments

Measuring instrument control includes type evaluation, initial verification, subsequent verification and in-use inspection. Appendix A is the outline of type evaluation.

7.1 Verification conditions

7.1.1 Requirements for flow standard devices

7.1.1.1 The flow standard device (hereinafter referred to as the device) and its supporting instruments shall have a valid verification certificate or calibration certificate.

7.1.1.2 Mass method devices shall be selected first; volumetric method devices and standard meter method devices can also be used, but the device shall be able to provide a mass flow rate that meets the uncertainty requirements.

7.1.1.3 When the vapor pressure of the liquid for verification is higher than the ambient atmospheric pressure, the device shall be closed.

7.1.1.4 The static pressure of the liquid at any point in the piping system and flow meter of the device shall be higher than its saturated vapor pressure. For easily vaporized liquid for verification, there shall be a certain back pressure downstream of the flow meter. The recommended minimum back pressure is the sum of 1.25 times the saturated vapor pressure of the liquid for verification at the highest verification temperature and 2 times the pressure loss of the flow meter.

7.1.1.5 The expanded uncertainty of the mass flow rate of the device shall not be greater than 1/3 of the absolute value of the maximum allowable error of the flow meter.

7.1.2 Fluid for verification

7.1.2.1 The fluid for verification shall be single-phase and clean, without visible particles, fibers, etc. The fluid shall fill the pipe and flow meter. The fluid for verification shall be close to the physical parameters such as density and viscosity of the fluid for flow meter measurement.

7.1.2.2 When the fluid for verification is natural gas, the quality of natural gas shall at least meet the requirements of Class II gas in GB 17820, and the relative density of natural gas shall be 0.55 ~ 0.80. During the verification process, the gas composition shall be relatively stable. Natural gas sampling shall be carried out in accordance with GB/T 13609; natural gas composition analysis shall be carried out in accordance with GB/T 13610; natural gas compression factor calculation shall be carried out in accordance with GB/T 17747.2.

7.1.2.3 When volumetric method devices are adapted, the effect of fluid temperature changes on mass flow rate shall be negligible during each verification at each flow point.

7.1.3 Verification environmental conditions

7.1.3.1 The ambient temperature is generally 5 ℃ ~ 45 ℃; the relative humidity is generally 35% ~ 95%; the atmospheric pressure is generally 86 kPa ~ 106 kPa.

7.1.3.2 The AC power supply voltage shall be (220±22) V; the power supply frequency shall be (50±2.5) Hz, or a suitable AC or DC power supply (such as 24V DC power supply) according to the requirements of the flow meter.

Repeatability	+	+	-
Note: "+" indicates verification or inspection is required, and "-" indicates verification or inspection is not required.			

7.2.2 Check of accompanying documents, marking and nameplate, appearance, protection function and sealing property.

7.2.2.1 Check the accompanying documents of the flow meter, which shall meet the requirements of 6.1.

7.2.2.2 Check the marking and nameplate of the flow meter, which shall comply with the requirements of 6.2.

7.2.2.3 Check the appearance of the flow meter, which shall comply with the requirements of 6.3.

7.2.2.4 Check the protection function of the flow meter, which shall comply with the requirements of 6.4.

7.2.2.5 Check the sealing property of the flow meter, which shall comply with the requirements of 6.5.

7.2.3 Error and repeatability verification

7.2.3.1 Connect the device, supporting instruments and flow meter circuits; power on and preheat for 30 minutes; use appropriate tools (buttons, handheld operator, communication software, etc.) to check the flow meter parameter settings (meter factor or pulse per unit, maximum flow, frequency or current corresponding to the maximum flow). If the flow meter has multiple output signals, the pulse output shall be used for verification first.

7.2.3.2 Operate the flow meter at a rate above 50% of the maximum achievable verification flow rate for a period of time, which is generally not less than 10 minutes; then, perform zero adjustment in accordance with the requirements of the instruction manual.

7.2.3.3 Control of verification flow points and verification frequency

(1) The verification flow points are q_{max}, $0.5q_{max}$, $0.2q_{max}$, q_{min}, and q_{max}, respectively.

(2) During the verification process, the deviation between the actual verification flow rate and the set flow rate at each flow point shall not exceed ±5% of the set flow rate.

(3) The verification frequency at each flow point shall be at least 3. For flow meters for type evaluation, the verification frequency at each flow point shall be at least 6.

7.2.3.4 Verification procedures

Appendix A

Outline of type evaluation

A.1 Scope

This outline applies to the type evaluation of Coriolis mass flow meters (hereinafter referred to as flow meters).

A.2 References

The provisions contained in the following standards and regulations constitute the provisions of this regulation through reference.

JJF 1015-2002, General Norm for Pattern Evaluation and Pattern Approval of Measuring Instruments

GB 4208-1993, Degrees of protection provided by enclosure (IP code)

GB/T 2423.1-2001, Environmental testing for electric and electronic and electronic products - Part 2: Test methods - Tests A: Cold

GB/T 2423.2-2001, Environmental testing for electric and electronic products - Part 2: Test methods - Tests B: Dry heat

GB/T 2423.3-2006, Environmental testing for electric and electronic products - Part 2: Testing method test Cab: Damp heat Steady state

GB/T 2423.10-2008, Environmental testing for electric and electronic products - Part 2: Tests methods - Test Fc: Vibration (sinusoidal)

GB/T 17626.2-2006, Electromagnetic compatibility (EMC) - Testing and measurement techniques - Electrostatic discharge immunity test

GB/T 17626.4-1998, Electromagnetic compatibility - Testing and measurement techniques - Electrical fast transient/burst immunity test

GB/T 17626.5-1999, Electromagnetic compatibility - Testing and measurement techniques - Surge immunity test

GB/T 17626.11-1999, Electromagnetic compatibility - Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests

When using this outline, attention shall be paid to the currently valid versions of the above-referenced documents.

A.3 Technical documents and test samples provided for review

A.3.1 Technical documents

The applicant shall submit technical documents in accordance with the requirements of 5.1 of JJF 1015.

A.3.2 Test samples

A.3.2.1 For each type of flow meter, 1/3 of the representative specifications including the smallest diameter shall be selected.

A.3.2.2 For each specification of flow meter, 3 samples shall be provided for flow meters with a diameter not exceeding 100 mm; 2 samples shall be provided for flow meters with a diameter exceeding 100 mm.

A.3.3 If the technical data review results show any major defects or deficiencies, the data and samples shall be returned to the applicant for correction.

A.4 Legal management requirements

A.4.1 Units of measurement

The flow meter shall use legal measurement units. The measurement units of cumulative flow and instantaneous flow are kg and kg/h respectively; the pressure unit is MPa or kPa; the temperature unit is ℃; the density unit is kg/m^3.

A.4.2 Accuracy level

The accuracy level of the flow meter shall comply with the requirements of 5.1.

A.4.3 Measurement legal marking and measurement instrument marking

The flow meter nameplate or panel, meter head and other obvious places shall be marked with the measurement legal marking and measurement instrument marking. The marking, number and description shall be clear, legible, firm and reliable.

A.4.4 External structure design

The flow meter shall have protective measures for the external structure design of the relevant parameters that can change the metering performance of the flow meter, so that any artificial adjustment that can affect the metering performance of the flow meter will leave traces on the flow meter.

A.4.5 Installation marking

The flow meter shall have clear flow direction markings.

A.5 Measurement requirements

4) Vibration test

According to the requirements of GB/T 2423.10.

A.6.6 Electromagnetic compatibility

The flow meter shall have good anti-electromagnetic compatibility performance. During the electromagnetic compatibility test, the flow meter shall work normally, there shall be no program disorder or functional failure, and the memory data shall not be lost or changed.

A.6.6.1 Electrostatic discharge immunity

According to the requirements of Class 3 A of GB/T 17626.2. This clause is applicable to flow meters powered by AC and DC.

A.6.6.2 Electrical fast transient burst immunity

According to the requirements of GB/T 17626.4, level 3. This clause applies to AC powered flow meters.

A.6.6.3 Surge (impact) immunity

According to the requirements of GB/T 17626.5, level 2. This clause applies to AC powered flow meters.

A.6.6.4 Voltage dips, short interruptions and voltage variations

According to the requirements of GB/T 17626.11. This clause applies to AC powered flow meters.

A.6.7 After the transportation and storage resistance performance and electromagnetic compatibility performance tests, carry out the flow meter measurement performance test again, and its error and repeatability shall comply with the requirements of 5.1 and 5.2 of this Regulation.

A.7 Conditions and methods for type evaluation

A.7.1 Conditions for type evaluation

A.7.1.1 The flow standard device for type evaluation test shall comply with the requirements of 7.1.1 of this Regulation.

A.7.1.2 The test medium for type evaluation test shall comply with the requirements of 7.1.2 of this Regulation.

A.7.1.3 The environmental conditions for type evaluation test shall comply with the requirements of 7.1.3 of this Regulation.

A.7.2 Legal management requirements

A.7.2.1 If any errors or nonconformity with the requirements are found during the document check, the applicant shall be informed in a timely manner to correct them.

A.7.2.2 Visual inspection shall comply with the requirements of A.4.

A.7.3 Measurement requirements

A.7.3.1 Visual inspection shall comply with the requirements of A.5.1 and A.5.2.

A.7.3.2 Measurement performance test

A.7.3.2.1 Select the test flow points and determine the number of tests in accordance with 7.2.3.3 of this Regulation.

A.7.3.2.2 Carry out the test in accordance with 7.2.3.4 of this Regulation.

A.7.3.2.3 Calculate the flow meter error in accordance with 7.2.3.5 of this Regulation.

A.7.3.2.4 Calculate the flow meter repeatability in accordance with 7.2.3.6 of this Regulation.

A.7.3.2.5 The zero stability of the flow meter shall comply with the requirements of A.5.2.

A.7.3.2.6 The pressure loss of the flow meter measured at maximum flow shall comply with the requirements of A.5.3.

A.7.4 Type evaluation method

A.7.4.1 Check the technical documents and visually inspect the appearance, which shall comply with the requirements of A.6.1, A.6.2 and A.6.3.

A.7.4.2 Compression strength test

Install the flow meter on the pressure test bench; slowly increase the pressure to 1.5 times the maximum working pressure; maintain for 5 minutes; then slowly reduce the pressure. During the pressure maintenance stage, the pressure indication shall remain unchanged, and the flow meter connections shall be free of penetration, leakage, or damage.

A.7.4.3 Transportation and storage resistance performance test

The following tests shall be carried out under packaging conditions.

A.7.4.3.1 High temperature storage test

According to the requirements of GB/T 2423.2.

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