

JJG

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Ultrasonic Flowmeters (English Translation)

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1 Scope

This Regulation is applicable to the type evaluation, initial verification, subsequent verification and in-use inspection of ultrasonic flowmeters for closed pipes (hereinafter referred to as flowmeters), which takes time difference method as the principle.

This Regulation is not applicable to the verification of ultrasonic flow measuring instrument in open channels and closed conduits.

2 References

Through reference, the clauses included in the following standards and regulations become the clauses of this Regulation.

JJF 1001-1998 General Terms in Metrology and Their Definitions

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

GB 3836 Electrical Apparatus for Explosive Gas Atmospheres

GB/T 18604-2001 Measurement of Natural Gas Flow by Ultrasonic Flow Meter

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

ISO 17089.2004 (CD) Measurement of Fluid Flow in Closed Conduits - Ultrasonic

Meters for Gas; Meters for Fiscal and Allocation Measurement

3.1 Ultrasonic Flowmeter

Ultrasonic flowmeter refers to a flowmeter which utilizes the transmission characteristic of ultrasonic wave in fluid to measure flow.

3.6 Acoustic Path

Acoustic path refers to the actual path of ultrasonic signal's transmission among paired ultrasonic transducers.

3.7 Transmission Angle

Transmission angle refers to the included angle between acoustic path and pipeline's axes.

3.8 Single-path Meter

Single-path meter refers to a flowmeter that merely has one pair of transducers.

3.9 Dual-paths Meter

Dual-paths meter refers to a flowmeter that has two pairs of transducers.

3.15 Signal Processing Unit

Signal processing unit is constituted of electronic components and microprocessor system. It is a part of flowmeter.

3.16 Transition Flowrate (qt)

Transition flowrate refers to a flow value between the maximum flow and the minimum flow. It segments the range of flow into two zones with different allowable errors, namely, "high zone" and "low zone".

4.1 Operating Principle

Flowmeter takes the measurement of the relations between the time and the flow of acoustic wave's transmission in flowing medium as the principle. Generally speaking, it is believed that acoustic wave's actual transmission speed in fluid is constituted of acoustic

wave's transmission speed (cf) under the stationary state of the medium, and the component of fluid's axial average flow rate (vm) in the direction of acoustic transmission.

4.2.1 Composition

Flowmeter is mainly constituted of meter body, ultrasonic transducer and its installation parts, signal processing unit, and (or) flow computer. In terms of on-site wetted ultrasonic meters and clamp-on ultrasonic meters, pipelines where transducer is installed may be used as meter body. The transducer of wetted ultrasonic meters directly contacts the fluid being measured, while the transducer of clamp-on ultrasonic meters is tightly installed on the external wall of pipelines.

4.2.2 Form

4.2.2.1

In accordance with the installation mode of transducer, flowmeter may be divided into two forms, namely, wetted and clamp-on.

5.1 Grade of Accuracy

Table 1 provides recommended accuracy grade series. If a grade of accuracy that is not listed in this table is adopted, the maximum allowable error needs to comply with corresponding principles in Table 1 and needs to be clearly indicated in flowmeter product instruction and flowmeter nameplate.

5.2 Repeatability

Repeatability of flowmeter shall not exceed 1/5 of the absolute value of the maximum allowable error stipulated by the corresponding grade of accuracy.

5.3 Flowmeter Factor Adjustment

If meter factor is changed during verification, then, the verification certificate shall clearly indicate the previous meter factor, the meter factor after the current adjustment and the amount of meter factor adjustment.

6.1 Product Documents

6.1.1

Flowmeter shall be accompanied by an instruction for use.

6.1.2

In terms of clamp-on ultrasonic meters, the instruction for use shall describes flowmeter's installation methods and operating requirements in details.

6.2 Nameplate and Marking

6.2.1

Flowmeter shall have marking of flow direction.

6.2.3

Each pair of ultrasonic transducers shall have permanent uniqueness marking and installation marking in obvious positions.

6.2.4 When transducer's signal cable needs to make one-to-one correspondence with

ultrasonic transducer, there shall be permanent uniqueness marking and installation marking in obvious positions.

6.3 Appearance

6.3.1

Newly manufactured flowmeter shall have satisfying surface treatment; there shall be no phenomena like burrs, scratches, cracks, corrosion, mildew stains or stripping of coating. The sealed surface shall be flat; there shall be no damages.

6.5 Air-tightness

Verify the medium under the maximum experimental pressure, maintain for 5 min, there shall be no leakage in the various ports of the flowmeter body.

7 Control of Measuring Instrument

The control of measuring instrument includes type evaluation, initial verification, subsequent verification and in-use inspection. Appendix A stipulates the test conditions, items and methods of type evaluation. Appendix B stipulates the special requirements of on-site verification. Appendix C stipulates the test conditions, items and methods of in-use inspection.

7.1.1 Requirements of flow calibration device

7.1.1.5

When the pressure of fluid that flows through the flowmeter needs to be measured, directly take pressure from pressure ports on the flowmeter body. If there are no pressure ports on the flowmeter body, it shall, according to the requirements of the flowmeter, determine the measurement location of pressure.