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NATIONAL METERING AND CALIBRATION REGULATION OF THE PEOPLE'S REPUBLIC OF CHINA

JJG 162-2009

Cold water meter

冷水水表

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Verification regulation of cold water meter

This regulation, referring to the international recommendation OIML R49-1:2006 (E) "Water meters for measuring drinkable cold and hot water - Part 1: Measurement and technical requirements", OIML R49-2:2006 (E) "Water meters for measuring drinkable cold water and hot water - Part 2: Test methods", combined with the current situation of the Chinese industry, added and deleted some content.

1 Scope

This regulation is applicable to the type evaluation, first verification, subsequent verification and in-use inspection of cold water meters.

The cold water meter referred to in this regulation is a water meter that measures clean cold water flowing through a closed pipe and has a temperature of T30 or T50, including mechanical water meters, mechanical water meters equipped with electronic devices, water meters based on electromagnetic or electronic principles.

2 Normative references

The following documents are cited in this regulation:

GB/T 778.1-2007 Measurement of water flow in fully charged closed conduits - Meters for cold potable water and hot water - Part 1: Specifications

GB/T 778.2-2007 Measurement of water flow in fully charged closed conduits - Meters for cold potable water and hot water - Part 2: Installation requirements

GB/T 778.3-2007 Measurement of water flow in fully charged closed conduits - Meters for cold potable water and hot water - Part 3: Test methods and equipment

OIML R49-1:2006 (E) Water meters intended for the metering of cold potable water and hot water. Part 1: Metrological and technical requirements

OIML R49-1:2006 (E) Water meters intended for the metering of cold potable water and hot water. Part 2: Test methods

OIML D11:2004 (E) General requirements for electronic measuring

of a number of metering chambers of known volume that are successively filled and discharged with water and a mechanism driven by flow.

3.1.12 Velocity meter

A mechanical water meter which is installed in a closed pipeline and composed of moving element driven by the speed of water flow.

3.1.13 Woltmann meter

A velocity meter consisting of a wing rotor rotating around the flow axis.

3.1.14 Single-jet meter and multiple-jet meter

A velocity meter consisting of a turbine rotor rotating around an axis perpendicular to the water flow. If a single stream impinges on a certain part of the edge of the rotor, it is called a single-jet meter; if multiple streams impinge on a certain part of the edge of the rotor at the same time, it is called a multiple-jet meter.

3.1.15 In-line meter

The water meter which is directly installed in the closed pipeline by using the connecting thread or flange at the end of the water meter.

3.1.16 Combination meter

A water meter composed of a large water meter, a small water meter, a conversion device; the water flow automatically flows through the small water meter or the large water meter, or flows through both meters at the same time according to the flowrate. The reading of the water meter is given by two independent calculators, or given by a calculator after adding the values on the two water meters.

3.1.17 Concentric meter

A water meter that can be connected to the pipeline with a collecting pipe. At the contact surface, the inlet, outlet and collecting pipe, the water meter is coaxial. The collecting pipe is a special connecting pipe for concentric meters.

3.1.18 Water meters equipped with electronic devices

A water meter equipped with electronic devices to achieve predetermined functions. Water meters with electronic devices include mechanical water meters equipped with electronic devices and water meters based on electromagnetic or electronic principles. The electronic device includes a flow signal conversion and processing unit, meanwhile it may be added with storage memory devices, presetting devices, price display devices, etc.

high zone.

The following are not considered to be significant faults:

- a) Fault caused by simultaneous and independent causes in the water meter itself or its checking facility;
- b) Temporary fault, manifested as an instant indication change that cannot be interpreted, stored or transmitted as a measurement result.

3.2.11 Durability

The ability of the water meter to maintain its performance characteristics after a period of use.

3.2.12 Metering conditions

When measuring water volume, the conditions of the water at the measuring point (such as water temperature and water pressure).

3.2.13 First element of an indicating device

The graduated ruler element with verification scale interval as equipped in an indicating device which is composed of several elements.

3.2.14 Verification scale interval

The smallest division of the first element of an indicating device.

3.2.15 Resolution (of an indicating device)

The smallest difference between the indicating values that can be effectively distinguished in the indicating device.

Note: For digital devices, the resolution is the amount of change when the minimum effective number of the indicating device changes by one step.

3.3 Operating conditions

3.3.1 Flowrate Q

The quotient of the actual volume through the water meter and the time used.

3.3.2 Permanent flowrate Q_3

Maximum flowrate under rated operating conditions. At this flowrate, the water meter works normally, and the indication error is within the maximum permissible error.

meter can withstand for a long time without reducing its measurement performance.

3.3.10 Working temperature T_w

The average water temperature of the upstream and downstream pipe sections of the water meter.

3.3.11 Working pressure p_w

The average value of the water pressure in the upstream and downstream pipe sections of the water meter.

3.3.12 Pressure loss Δp

At a given flowrate, the pressure drop due to the presence of a water meter in the pipeline.

3.3.13 Nominal size

The nominal value of the diameter of the water meter. It is usually expressed by the number plus the unit of the nominal value of the diameter at the beginning of the capital letter "DN", for example: DN15 mm.

Note: The nominal size is also called the nominal diameter.

3.4 Test conditions

3.4.1 Influence quantity

A physical quantity that is not measured but affects the measurement result.

3.4.2 Influence factor

The influence quantity within the rated working conditions of the water meter specified in this regulation.

3.4.3 Disturbance

The influence quantity whose value is within the limit specified in this regulation but is outside the range of the rated working conditions of the water meter.

Note: If the rated working condition does not specify a certain influence quantity, the influence quantity is a disturbance.

3.4.4 Rated operating condition

Given the use conditions of the value range of the influence factor, the error of

calculator to calculate the volume of water flowing for a period of time. The measurement sensor of water meter generally adopts mechanical principle, but also can adopt electronic or electromagnetic principle to measure.

The water meter shall include at least three parts: a measurement sensor, a calculator (which may include an adjustment or correction device), an indicating device. Each part can be grouped together or installed at different locations.

In order to increase the measurement range, the water meter can be combined with multiple meters into an integral type, such as a combination meter.

Water meters can be equipped with auxiliary equipment used to complete specific functions.

Mechanical water meters equipped with electronic devices (such as electronic remote water meters, IC card water meters, etc.) usually use coding circuits or inductive signaling devices to convert the primary indication or variation of mechanical water meters into electrical signals or other signals.

The specific working principle and structural composition of water meters (such as electromagnetic water meters, ultrasonic water meters, etc.) that are measured by electronic or electromagnetic principles can refer to the flowmeter verification regulations with the same working principle.

4.2 Classification

4.2.1 According to the working principle and composition structure of water meters, water meters can generally be divided into mechanical water meters and water meters with electronic devices.

4.2.2 Mechanical water meters are divided into velocity meters and volumetric water meters.

4.2.3 Water meters with electronic devices include electronic water meters and mechanical water meters equipped with electronic devices.

Note: In this regulation, water meters whose measurement sensors are based on electric or electronic principles are collectively referred to as electronic water meters, such as electromagnetic water meters and ultrasonic water meters.

5 Measurement performance requirements

5.1 Q₁, Q₂, Q₃, Q₄ value

5.1.1 The flow characteristics of the water meter are determined by Q₁, Q₂, Q₃, Q₄.

5.2.6 The manufacturer shall indicate whether the water meter can measure reverse flow. If possible, the actual volume during the reverse flow period shall be subtracted from the displayed volume or recorded separately. Both forward flow and reverse flow shall meet the requirements of the maximum permissible error.

Water meters that cannot measure reverse flow shall be able to prevent reverse flow; or otherwise it is able to withstand unexpected reverse flow without causing any degradation or change in forward flow metering performance.

5.2.7 When the temperature and pressure change within the rated working conditions of the water meter, the water meter shall meet the requirements of the maximum permissible error.

5.2.8 When the flow is zero, there shall be no change in the integrated reading of the water meter.

5.2.9 According to the accuracy level of the water meter, the maximum permissible error of the water meter in use is twice the maximum permissible error in 5.2.1 or 5.2.2.

6 General technical requirements

6.1 Material and structure

6.1.1 The materials used to make the water meter shall have sufficient strength and durability to meet the use requirements of the water meter.

6.1.2 The material of the water meter shall not be adversely affected by the water temperature change within the working temperature range (see 6.4).

6.1.3 All parts of the water meter that contact water shall be made of materials that are generally considered non-toxic, non-polluting, non-biologically active, comply with relevant technical standards.

6.1.4 The manufacturing material of the integral water meter shall be resistant to internal and external corrosion, or be treated with appropriate surface protection.

6.1.5 The indicating device of the water meter shall be protected by a transparent window, equipped with a suitable meter cover as auxiliary protection.

6.1.6 If condensation may form inside the transparent window of the water meter indicating device, the water meter shall be equipped with a device to eliminate condensation.

6.5 Marking and nameplate

The following information shall be clearly and permanently marked on the water meter enclosure, the dial or nameplate of the indicating device, the non-separable water meter cover, in a centralized or scattered manner.

Note: For the case of a combination meter, the following marks indicate the parameter information of the entire combination meter.

- a) Unit of measurement: cubic meter or m^3 ;
- b) Accuracy level: If it is not level 2, it shall be marked;
- c) Q_3 value, Q_3/Q_1 ratio, Q_2/Q_1 ratio (when it is not 1.6, it shall be noted);
- d) The mark and number of the license for manufacturing measuring instruments;

Note: Imported measuring instruments shall be marked with the type approval mark and serial number.

- e) Manufacturer's name or trademark;
- f) Manufacturing year, month and serial number (as close as possible to the indicating device);
- g) Flow direction (marked on both sides of the water meter enclosure, or if the flow direction indicator arrow can be easily seen under any circumstances, it can also be marked on one side only);
- h) Maximum admissible pressure: If it exceeds 1 MPa (for water meters with a diameter of $\text{DN} \geq 500$ mm, if it exceeds 0.6 MPa), it shall be marked;
- i) Installation method: If it can only be installed horizontally or vertically, it shall be marked (H stands for horizontal installation, V stands for vertical installation);

- j) Temperature level: If it is not T30, it shall be marked;

- k) Maximum pressure loss: If it is not 0.063 MPa, it shall be noted;

Note: The pressure loss level can be marked according to GB/T 778.1-2007.

For water meters with electronic devices, it shall have additional marks:

- l) External power supply: Voltage and frequency;
- m) Replaceable battery: The latest battery replacement time;

These two colors shall be used for pointers, indicator marks, numbers, dials, or for perforated frames.

For electronic water meters, as long as it is ensured that there is no doubt when distinguishing between the primary indication and other displays (such as decimals for verification and testing), other forms of cubic meters and their multiples and scores can be used. For the requirements of electronic display devices, see A.6.4.6.

6.6.2 Type of indicating device

The indicating device of the water meter shall adopt any of the following types.

6.6.2.1 Type 1 analog device

The volume of water is given by the continuous movement of the following components:

- a) One or more pointers that move relative to the graduation scale;
- b) One or more circular rulers or drums, each passing an indicator mark.

The indication value of each scale division in cubic meters shall be in the form of 10^n , where n is a positive integer, a negative integer or zero, thereby establishing a continuous decimal system.

Each scale shall be scaled by cubic meters; or attached with a multiplier (X 0.001; X0.01; X 0.1; X1; X10; X100; X1000, etc.).

The rotation movement of the pointer and the circular ruler shall be clockwise. The linear movement of the pointer or ruler shall be from left to right. The movement of the digital drum indicator shall be upward.

6.6.2.2 Type 2 digital device

The indicated volume is given by a row of adjacent numbers displayed in one or more openings. The carry of the previous digit shall be completed when the value of the adjacent lower digit changes from 9 to 0. The movement of the digital drum indicator shall be upward.

The lowest ten numbers can move continuously, the opening is large enough to read the numbers clearly.

The visible height of the number shall be at least 4 mm.

6.6.2.3 Type 3 combination of analog and digital devices

The volume of water is given in the form of a combination of type 1 and type 2

shall not exceed 0.5 mm.

6.6.3.4 Resolution

The division value of the verification scale shall be small enough to ensure the resolution of the water meter: for a level 1 water meter, it shall not exceed 0.25% of the actual volume value for 1.5 h at the minimum flowrate Q_1 ; for a level 2 water meter, it shall not exceed 0.5% of the volume value.

Note: When the first component is displayed continuously, the error of each reading is allowed to not exceed half of the interval of minimum scale grid. When the first element is displayed intermittently, the error of each reading is allowed to be one digit.

When the additional device is used for verification, the maximum error of its reading is not more than 0.25% (for the level 1 meter) or 0.5% (for the level 2 meter) of the test volume; meanwhile it does not affect the normal operation of the indicating device.

6.6.3.5 Combination meter

If the combination meter has two indicating devices, both shall meet the requirements of 6.6.3.2 and 6.6.3.3.

6.7 Verification marks and protective devices

6.7.1 The water meter shall have the primary verification mark attached, so that it can be seen without disassembling the water meter.

6.7.2 The water meter shall be equipped with a protective device that can be sealed, to ensure that before and after the water meter is installed correctly, the water meter and/or adjustment device or correction device cannot be disassembled or modified without damaging the protective device. For combination meters, this requirement applies to the large and small water meters.

6.7.3 Electronic seal

6.7.3.1 When the mechanical sealing device cannot prevent the parameters that have an influence on the determination of the measurement results from being accessed, the protective measures shall meet the following requirements:

- a) Parameter access is only allowed by authorized persons, such as using passwords (keywords) or special equipment (such as keys). The password shall be changeable.
- b) At least the last access intervention shall be recorded. The record shall

Water meters with electronic devices shall have a good surface treatment, free of burrs, scratches, cracks, rust, mildew and peeling of the coating.

The displayed numbers shall be eye-catching and tidy; the text symbols and signs indicating the function shall be complete, clear and correct.

The protective glass on the reading device shall have good transparency; there shall be no defects such as distortion that hinder the reading.

6.9.2 Function

Water meters with electronic devices shall have corresponding functions according to product characteristics and meet the relevant requirements of product standards or instructions for use.

Such functions usually include display function, query function, prompt function, control function, protection function, etc. The water meter with water price calculation and display shall also have the function of price setting, segmented (or time-sharing) water price calculation and display. The number of digits of unit price and the division of water segment shall meet the needs of water consumption management.

If there is a key switch, contact or non-contact controller (such as IC card, magnetic bar, etc.), the operation shall be flexible and reliable.

6.9.3 Signal conversion

For mechanical water meters equipped with electronic devices (including electronic remote water meters and IC card water meters, etc.), the signal conversion shall be accurate and reliable.

6.9.4 Power supply

When the power supply is interrupted or the battery is replaced, the primary indication of the water meter before the failure shall not be lost.

6.10 Ancillary device

The function of the ancillary device of the water meter shall meet the requirements of the product standard or instruction manual.

The permanent installation of ancillary devices shall not affect the measurement performance of the water meter and the reading of the primary indication.

7 Control of measuring instrument

The control of measuring instruments includes type evaluation, first verification,

installing straight pipe sections are not clear, generally it can be specified that the upstream straight pipe section is no less than 10 DN and the downstream straight pipe section is no less than 5 DN, or an equivalent straightener can be installed. DN is the nominal size of the tested water meter.

The water meter shall be installed coaxially with the upstream and downstream straight pipe sections; the seals must not protrude into the pipe.

The entire verification piping system shall have neither leakage or seepage during verification, nor air being sucked into the pipe.

7.1.5 Verification medium

The verification medium is clean water. There shall be no air bubbles in the water.

The medium shall not contain substances that may damage the water meter or affect its operation. If it uses circulating water, it shall try to prevent the residual water in the water meter from harming human health.

The conductivity of the water medium may affect water meters that use the principle of electromagnetic induction. The conductivity of the water medium shall be within the value range as specified by the manufacturer.

7.1.6 Water pressure

During verification, the pressure at the inlet of the water meter shall not be greater than the maximum allowable working pressure of the water meter to be inspected, the outlet pressure of the water meter shall not be less than 0.03 MPa.

The pressure upstream of the water meter shall remain stable. Measures shall be taken to stabilize the pressure, so that the pressure change upstream of the water meter does not exceed 10%. In a verification process, the interference of water hammer, pulsation, vibration and other factors shall be eliminated as much as possible.

7.1.7 Water temperature

The working water temperature shall generally be within the range of $20\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$.

During the verification test, the water temperature change shall not exceed $5\text{ }^{\circ}\text{C}$.

7.1.8 Flowrate

During a verification test, the flowrate shall be constant at the selected value. The relative change in flowrate during each test period (excluding start and stop)

license mark and number, nominal pressure (if it exceeds 1 MPa), installation method (the letter H means that it can only work in a horizontal position, the letter V means that it can only work in a vertical position, no indication means that it can work in any position), the nominal size of water meter.

Function inspection is generally only performed on water meters with electronic devices. The inspection shall select content related to legal measurement management, such as display and signal conversion functions related to the primary indication. These functions shall comply with the relevant provisions of the corresponding product standard technical requirements.

During the in-use inspection, the inspection is mainly whether the protection device of the water meter is effective and whether the indicating device is clear and readable.

During the appearance and function inspection, attention shall be paid to whether the inspected water meter is consistent with the type approved. Whether the inspection result is compliance shall be judged according to the type approval certificate (if necessary, check the corresponding type evaluation report, the registration form of measuring instruments).

7.3.2 Tightness inspection

Install the water meter on a pressure test bench or a water meter checking facility with a pressure resistance device. First, lead water to remove the air in the equipment under test and the water meter; then slowly increase the pressure to make the water meter bear the specified test static pressure. During the test, the pressurization speed of the water pressure shall be slow and steady.

During the first verification and subsequent verification, the test pressure shall be the maximum admissible pressure of the water meter; the duration shall not be less than 1 min; the water meter shall have no leakage.

7.3.3 Verification of indication error

7.3.3.1 Verification flowrate

In general, during the first verification and subsequent verification, each water meter shall be verified at the three flowrate points: permanent flowrate Q_3 , transition flowrate Q_2 , minimum flowrate Q_1 . The actual flowrate value shall be controlled separately as follows:

- a) Between $0.9Q_3 \sim Q_3$;
- b) Between $Q_2 \sim 1.1Q_2$;
- c) Between $Q_1 \sim 1.1Q_1$.

For digital indicating devices with discontinuous changes in the calibration scale, the total reading error is an interval number.

Certain types of electronic water meters may have pulse output or status settings for testing. If so, the connection configuration and data processing of the readings shall be performed according to their operating instructions.

a) Reading when the water meter is stationary

A valve installed downstream of the water meter controls the flow during the test; it is closed to stop the water flow. When the flow is zero, there shall be no change in the integrated reading of the water meter. The reading when the water meter is stationary is to read the indication value of the water meter after its indicating device is stationary.

Note: During the test from zero flow to reaching the specified constant flow, the indication error of the water meter changes with the change of flow. When the flow stops, the combination of the inertia of the moving parts of the water meter and the rotating movement of the water meter may cause significant errors in certain types of water meters and certain test flowrates. For this kind of situation, it cannot determine a simple rule of thumb cannot be determined at present or specify some conditions to reduce the error to negligible. Therefore, if in doubt, it is best to:

- ① Increase test water consumption and extend test duration;
- ② Compare the test results with the results obtained by one or more other methods, especially the commutation reading method at a stable flow.

b) Reading during commutation under steady flow

The verification is carried out after the flow state is stable. At the beginning of the verification, the commutator introduces the water flow into a calibrated container; at the end it leads out the water flow. The reading is performed while the water meter is running.

The reading of the water meter shall be synchronized with the action of the flow commutator.

Note: When the manual reading at the time of running of the water meter cannot reach the accuracy of the reading in the stationary state, it shall use additional devices (such as photoelectric sensors, etc.) to read the water meter. Otherwise, the accuracy of manual readings shall be reassessed and the water consumption for verification shall be increased.

c) The reading of combination meter during verification

Appendix A

Type evaluation outline of cold water meter

A.1 Scope

This outline is applicable to the type evaluation of cold water meters.

A.2 References

GB/T 778.1-2007 Measurement of water flow in fully charged closed conduits - Meters for cold potable water and hot water - Part 1: Specifications (idt ISO 4064-1:2005)

GB/T 778.3-2007 Measurement of water flow in fully charged closed conduits - Meters for cold potable water and hot water - Part 3: Test methods and equipment (idt ISO 4064-3:2005)

OIML R49-1:2006 (E) Water meters intended for the metering of cold potable water and hot water. Part 1: Metrological and technical requirements

OIML R49-2:2006 (E) Water meters intended for the metering of cold potable water and hot water. Part 2: Test methods

OIML R49-3:2006 (E) Water meters intended for the metering of cold potable water and hot water. Part 3: Test report format

OIML D11:2004 (E) General requirements for electronic measuring instruments

GB/T 2421-1999 Environmental testing for electrical and electronic products - Part 1: General

GB/T 2422-1995 Environmental testing for electric and electronic products - Terms and definitions

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 2423.4-2008 Environmental testing for electric and electronic products - Part 2: Test method - Test Db: Damp heat, cyclic (12h + 12h cycle)

GB/T 2423.43-2008 Environmental testing for electric and electronic products - Part 2: Test methods - Mounting of specimens for vibration impact

If the water meter with electronic device is equipped with an electronic device without checking facility, in addition to the prototype as specified in Table A.1, 5 identical integral water meters or their detachable parts need to be submitted for type approval. If equipped with the electronic device with checking facility, it only needs to submit 1.

The design inspection and performance test of the water meter with electronic device shall be carried out during the type approval, so more information and prototypes may need to be submitted.

When the electronic device becomes an inseparable part of the water meter, the integral water meter shall be used for testing.

If the electronic device of the water meter is installed separately from the measurement sensor, it can be tested separately.

The ancillary device can be tested separately.

A.3.2.3 Series products

The water meter series products can be judged whether they meet the series products according to the requirements of Appendix D; meanwhile the prototype specifications that need to be tested are determined.

A.4 Legal management requirements

A.4.1 Unit of measurement

- a) Volume: Cubic meter, symbol m^3 .
- b) Flowrate: Cubic meter per hour or liter per hour, symbol m^3/h , L/h.

A.4.2 Metrological characteristics

A.4.2.1 Flowrate characteristics

The flowrate characteristics of the water meter are determined by Q_1 , Q_2 , Q_3 , Q_4 . Water meters with a nominal size less than or equal to 50 mm and a permanent flowrate Q_3 not exceeding $16 \text{ m}^3/\text{h}$ shall be marked by the ratio of Q_3 (in m^3/h) and Q_3/Q_1 . The water meters with a nominal size greater than 50 mm or the permanent flowrate Q_3 exceeding $16 \text{ m}^3/\text{h}$ shall be marked by the ratio of Q_3 (in m^3/h), Q_3/Q_1 , Q_2/Q_1 ; its value shall meet the requirements of 5.1.3, 5.1.4, 5.1.5 of this regulation.

A.4.2.2 Accuracy level

The accuracy level of the water meter shall be level 1 or level 2, of which level 1 is only applicable to water meters with a permanent flowrate $Q_3 \geq 100 \text{ m}^3/\text{h}$.

For combination meters, add:

h) Between $0.85 Q_{X1} \sim 0.95 Q_{X2}$;

i) Between $1.05 Q_{X2} \sim 1.15 Q_{X2}$.

A.5.2.2 The indication error under each of the above flow points shall not exceed the maximum permissible error as specified in 5.2.1 or 5.2.2 of this regulation. If the indication error of one or several water meter prototypes exceeds the maximum permissible error at only one flow point, the test shall be repeated at this flowrate. If two of the three test results at the flow point are within the maximum allowable range, meanwhile the arithmetic average of the three test results does not exceed the maximum permissible error, it is considered qualified.

A.5.2.3 If the signs of all errors of the water meter are the same, at least one of the errors shall not exceed one half of the maximum permissible error.

A.5.2.4 The water meter shall be tested for error of indication in its marked flow direction. If the water meter can measure reverse flow or anti-reverse flow, its performance shall meet the requirements of 5.2.6 of this regulation.

A.5.2.5 The water meter shall be tested for error of indication under its marked installation mode. If the water meter does not have these signs, it shall be tested at least in three installation modes: horizontal, vertical, diagonal.

Note: The water meter of volumetric structure can be tested in only one way, usually in the horizontal installation direction.

A.5.2.6 The test result shall be used to make the error characteristic curve of each water meter in the form of flow-error, to evaluate the overall performance of the water meter within its flow range.

A.5.3 Durability

A.5.3.1 The water meter shall be subjected to a endurance test that simulates the use conditions according to the permanent flowrate Q_3 and the overload flowrate Q_4 , as shown in Table A.2. The water temperature during the test shall be within the range of reference conditions as much as possible.

A.6.1 The water meter shall meet all the requirements of Chapter 6 of this regulation.

A.6.2 Pressure loss

Between the rated flow range Q_1 and Q_3 , the pressure loss through the water meter (including its component filters, control valves, etc.) shall not be greater than 0.063 MPa.

The manufacturer can specify and indicate on the nameplate or dial the maximum admissible pressure loss or the corresponding pressure loss level not greater than 0.063 MPa. In this case, the pressure loss of the water meter shall not exceed the stated value.

Note: For combination meters, the maximum pressure loss may exceed the pressure loss under the permanent flowrate Q_3 .

A.6.3 Compressive strength

The water meter shall be able to withstand the following pressure tests without leakage or damage:

- a) Withstand a test pressure of 1.6 times the maximum admissible pressure for a duration of 15 minutes;
- b) Withstand a test pressure of 2.0 times the maximum admissible pressure for a duration of 1 min.

A.6.4 Other technical requirements for water meters with electronic devices

A.6.4.1 General requirements

The water meter with electronic device shall be able to work normally under the specified environmental conditions. The tests listed in Table A.4 can be used as a supplement to the prescribed tests. When evaluating the influence of one influence quantity, other influence quantities shall be relatively stable within the range of reference conditions.

The design and manufacture of water meters with electronic devices shall be such that there is no significant fault under the disturbance conditions specified in this outline; the error under the rated working conditions shall not exceed the maximum permissible error specified in 5.2.1 or 5.2.2.

A.6.4.2 Design inspection

Water meters with electronic devices shall be subject to design inspection. The purpose of this document inspection is to verify whether the design of the electronic device and its checking facility (if any) meets the requirements of this

- b) At least one of the five water meters has undergone all tests;
- c) There is no failure in each test.

A.6.4.5.4 The water meter with electronic device shall provide visual inspection of the overall display, which can be in the following order:

- a) Display all units (such as "8" test);
- b) Blank all cells (such as "blank" test).

A.6.4.6 Electronic indicating device

The electronic indicating device shall provide a reliable, clear, defined reading of the measured water volume.

The electronic indicating device shall be able to display the volume as required at any time, but is not required to display permanently, even during the measurement test. Each volume display time shall be at least 10 s.

If the electronic pointing device can display additional information, the displayed information shall be unambiguous.

Note: This condition can be met if the additional instructions can indicate the exact nature of the information currently displayed, or if each display is controlled by an independent button.

The electronic indicating device shall have a feature to be able to check whether the display is normal by means such as continuous display of various characters. Each step of the whole process shall last at least 1 s.

For readings expressed in cubic meters, the decimal part does not have to be displayed on the same indicating device. In this case, the reading shall be clear and unambiguous (the indicator shall indicate another display of flow).

The value can be read in the following ways:

- a) Two separate display devices are used on the electronic indicating device;
- b) Take the reading values in two consecutive steps on the same display device;
- c) Use a detachable indicating device so that the decimal part can be read. In this case, the fixture shall indicate that the water meter is counting with proper resolution. The manufacturer shall provide information on the approximate resolution of this fixed indicating device on the water meter.

A.6.4.7 Power

The water meter shall indicate the date of battery replacement.

When replacing the battery, the power failure shall not affect the performance or parameters of the water meter.

Note: It is expected that comprehensive factors such as maximum allowable volume, display volume, remote reading and extreme temperature will be considered when determining the battery and performing type approval.

The operation of replacing the battery shall not necessarily damage the legal metrology seal. If the replacement of the battery must damage the legal metrology seal, the national legal measurement agency or other authorized agency shall replace the lead seal.

The battery box can be used to protect the battery to avoid unauthorized modification.

A.6.4.8 Ancillary device

The ancillary device of the water meter with electronic device shall meet the service life requirements specified in the product standard.

A.6.4.9 Enclosure protection

The water meter with electronic device or its parts shall be able to withstand the test requirements of the enclosure protection level as specified in the product standard.

A.6.5 If the water meter prototype has technical features not mentioned in this regulation, a test program shall be prepared and test methods specified to prove that the other technical functions of the water meter meet the technical requirements specified in the product standard.

A.7 Type evaluation items

A.7.1 Basic test items

Water meters with a nominal size less than or equal to 50 mm and a permanent flowrate Q_3 not exceeding 16 m³/h.

A.7.1.1 See Table A.5 for the basic test items of water meters with a nominal size less than or equal to 50 mm and with a permanent flowrate Q_3 not exceeding 16 m³/h.

A.7.3 Test item requirements for various types of equipment under test (EUT)

In order to facilitate the test, the water meter prototype shall be listed in the following one category of A ~ E according to A.7.3.1 ~ A.7.3.4:

Category A: No need to carry out the performance test of the items listed in Table A.7;

Category B: The equipment under test is an integral water meter or a combination meter; there shall be water flowing through the volume testing element or flow detection element during the test; the water meter shall work as designed;

Category C: The equipment under test is a measurement sensor (including flow or volume testing elements); water shall flow through the volume detection element or flow detection element during the test; the water meter shall work as designed;

Category D: The equipment under test is an electronic calculator (including an indicating device) or an ancillary device. There shall be water flowing through the volume detection element or flow detection element during the test; the water meter shall work as designed;

Category E: The equipment under test is an electronic calculator with indicating devices or ancillary devices. The analog measurement signal can be used during the test; no water flows through the volume detection element or the flow detection element.

A.7.3.1 Volumetric meter and velocity meter

- a) Water meter without electronic device: Category A
- b) Measurement sensor and electronic calculator (including indicating device) are installed in the same enclosure: Category B
- c) The measurement sensor is separated from the electronic calculator, but there is no electronic device: Category A
- d) The measurement sensor is separated from the electronic calculator and equipped with electronic devices: Category C
- e) The electronic calculator includes the indicating device and is separated from the measurement sensor and cannot simulate the measuring signal: Category D
- f) The electronic calculator includes the indicating device and the measurement sensor are separated, can simulate the measuring signal:

correct the prototype until it meets the requirements.

A.8 Type evaluation conditions and methods

In this chapter, A.8.2 ~ A.8.11 are the test methods for the items listed in Table A.5 and Table A.6; A.8.12 ~ A.8.26 are the test methods for the items listed in Table A.7 (applicable to electronic water meters, mechanical water meters equipped with electronic devices, ancillary devices).

A.8.1 Test conditions

A.8.1.1 Test equipment

The equipment used in the water meter type evaluation test is generally: water meter test device, pressure test bench, differential pressure gauge, water meter endurance test device, water supply system, piping system.

The test equipment for the water meter with electronic device generally also needs: adjustable regulated power supply, pulse and analog signal generator, insulation resistance/strength tester, climate and mechanical environment test equipment, electromagnetic compatibility test equipment, enclosure protection test equipment, control valve test equipment, etc.

Functional inspection of water meters with electronic devices may require manufacturers to provide testing equipment, meters and software that match their water meter products.

The expanded uncertainty of the water meter test device (coverage factor $k = 2$) shall not be greater than one-fifth of the maximum permissible error of the water meter;

Maximum uncertainty of temperature measurement (coverage factor $k = 2$) shall not be greater than 1 °C;

The maximum uncertainty of pressure measurement (coverage factor $k = 2$) shall not be greater than 5% of the measured value;

The maximum uncertainty of differential pressure measurement (coverage factor $k = 2$) shall not be greater than 5% of the measured value.

A.8.1.1.1 Water meter test device

The indication error test of the water meter mainly adopts the collection method, that is, the volume of water flowing through the water meter is collected in one or more collection containers, the volumetric method or the weighing method is used to determine the water volume. For water meters with a nominal size greater than 500 mm, other methods can be used, such as the standard meter

pressure of 0.03 MPa at any flowrate.

In addition to the water meter, the test section also includes:

- a) One or several pressure taps for pressure measurement, one of which is located immediately upstream of the water meter (the first one);
- b) If necessary, a device for measuring the water temperature at the inlet of the water meter (the first one).

Any pipe fittings or devices installed in the measurement section shall not cause cavitation or fluid disturbances that may cause changes in the performance of the water meter or cause measurement errors.

The inner diameter or connecting end surface of the test section of the device shall correspond to the nominal diameter of the water meter under test. It shall avoid protruding the connecting seal into the test pipe.

For some types of velocity meters, their accuracy is susceptible to upstream disturbances caused by elbows, valves, or pumps. Therefore, the tested water meter shall be set at the position where the upstream and downstream can have the maximum length of straight pipe. Meanwhile as far as possible to avoid elbows, pumps, tapered pipes and changes in the diameter of the upstream pipe section system, etc., fluid straighteners shall be installed when necessary.

A.8.1.1.2 Pressure test bench

The pressure test bench is mainly composed of clamping device, booster mechanism, pressure display instrument, control valve, etc.

Note: The pressure test bench can be attached to the water meter test device.

The pressure test range of the piping system of the pressure test bench and the range of the equipped pressure gauge shall not be less than 2 times the maximum allowable working pressure of the tested water gauge.

A.8.1.1.3 Pressure loss test equipment

The pressure loss test equipment includes a measuring section of the piping system equipped with a water meter under test and a device that generates a prescribed constant flow through the water meter.

The inlet and outlet pipes of the measuring section shall be equipped with pressure holes of the same design and size.

Note: Refer to GB/T 778.3-2007 for the design of pressure hole.

The measuring section is composed of upstream and downstream pipe

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