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Magnetostrictive liquid level meter

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Foreword

This Standard is based on the current technical conditions and the development directions of domestic and foreign magnetostrictive level meter, and it has taken full consideration of the needs of the domestic market. The level meter has the characteristics of high precision – It not only belongs to a common sensor, but also be used as measuring instrument. Therefore, during preparation of this Standard, the effort has been made to consider above two application aspects, comply and consistent with JJG 971-2002 "*level meter test procedures*."

Magnetostrictive liquid level meter

1 Scope

This Standard specifies the magnetostrictive level meter - product classification, basic parameters, technical requirements, test methods, inspection rules, signs, instructions, packaging, storage and transport.

This Standard applies to the magnetostrictive (known as levelmeter for short hereafter).

2 Normative references

The following normative documents contain provisions which, through reference in the text, constitute provisions of this Standard. For dated reference, subsequent amendments or revisions (excluding contents of corrigenda) do not apply. However, parties who enter into agreement based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. For undated references, the latest edition of the normative document referred to applies.

GB 3836.1 Electrical apparatus for explosive gas atmospheres Part 1: General requirements (GB 3836.1—2000, eqv IEC 60079-0: 1998)

GB 3836.2 Electrical apparatus for explosive gas atmospheres Part 2: Flameproof enclosure “D” (GB 3836.2—2000, eqv IEC 60079-1: 1990)

GB 3836.4 Electrical apparatus for explosive gas atmospheres Part4: Intrinsic safety “I” (GB 4208 Degrees of protection provided by enclosure) (IP Code KGB 4208—1993, eqv IEC 60529: 1989)

GB 9969.1 General principles for preparation of instructions for use of industrial products

GB/T 15464 Instrumentation packaging technology

GB/T 15479-1995 Industrial automation instrumentation insulation resistance, dielectric strength technical requirements and test methods

GB/T 17626.2—1998 Electromagnetic Compatibility Testing and measurement techniques - electrostatic discharge immunity test (idt IEC 61000-4-2: 1995)

GB/T 17626.3—1998 Electromagnetic Compatibility Testing and measurement techniques RFEMS test (idt IEC 61000-4-3:1995)

GB/T 17626.4—1998 Electromagnetic Compatibility Testing and measurement techniques - electrical fast transient burst immunity test (idt IEC 61000-4-4:1995)

GB/T 17626.5—1999 Electromagnetic Compatibility Testing and measurement techniques surge (impact) immunity test (idt IEC 61000-4-5: 1995)

GB/T 17626.6—1998 Electromagnetic Compatibility Testing and measurement techniques conducted disturbances induced RF field immunity test (idt IEC 61000-4-6:1996)

GB/T 17626.8—1998 Electromagnetic compatibility test and measurement techniques - Power frequency magnetic field immunity test (idt IEC 61000-4-8: 1993)

GB/T 18268—2000 Electrical equipment EMC requirements for measurement, control and laboratory use (idt IEC 61326-1:1997, Amd. 1: 1998)

GB/T 18271.1-2000 Process measurement and control devices - general methods and procedures for evaluating performance Part 1 : General Principles (idt IEC 61298-1: 1995)

GB/T 18271.3-2000 Process measurement and control devices - general methods and procedures for evaluating performance Part 3: Tests for the effects of influence quantities (idt IEC 61298-3 : 1998)

GB/T 18271.4-2000 Process measurement and control devices - general methods and procedures for evaluating performance Part 4: Evaluation report content (idt IEC 61298-4: 1995)

JB/T 9329-1999 Instrumentation transport, transportation storage and basic environmental conditions and test methods

3 Terms and Definitions

The following terms and definitions apply to this Standard.

3.1 Magnetostriction

The phenomenon - Changing the magnetization direction of the ferromagnetic material will cause a change in the lattice spacing of the medium, so that the ferromagnetic length and volume change.

3.2 Magnetostrictive Liquid Level Meter

A device for measuring the liquid interface or liquid-liquid interface positioning, of which the internal sensing elements are designed and manufactured based on

magnetostrictive principles.

4 Product Classification

4.1 Classified by the level structure of the measurement rod

- a) Rigid rod - Overall structure of the measuring rod is rigid, and it has a certain amount of support to ensure its linear state.
- b) Flexible rod - Measuring rod can be bent during transport and installation process. Hammer, magnet steel and lifting hook shall be adopted to ensure it at straight state when used and in operation.

4.2 Classified by the type of level meter measurement parameters

- a) Liquid level measurement - only MEASURE a location parameter of liquid level;
- b) Interface measurement - simultaneously MEASURE multiple locations of liquid level and interface parameters.

4.3 Classified by the form of the output signal level meter

- a) Analog output type - include: current output type and voltage output type;
- b) Digital communications type;
- c) Composite output type - it contains more than two functions, such as: HART protocol.

4.4 Classified by the safety performance of level meter

- Ordinary type;
- Explosion-proof type (mainly: flame-proof, intrinsic safety, and others).

5 Basic Parameters

5.1 Measurement Range

Rigid rod: ≤ 6 m; Flexible rod: 3.5 m $\sim$ 20 m.

The upper-blind area of level measurement: ≤ 100 mm, the lower-blind area: ≤ 60 mm.

The lower-blind area of interface measurement: ≤ 15 mm.

5.2 The Output Signal

- a) Analog output type:
 - 1) current output type: 4mA(d.c) $\sim$ 20 mA(d.c), load resistance range: 0 Ω $\sim$ 750 Ω .
 - 2) voltage output type: 0V(d.c) $\sim$ 5 V(d.c), 1 V(d.c) $\sim$ 5 V(d.c) or 0 V(d.c) $\sim$

7.4.8 Electromagnetic Compatibility Test

- According to the provisions of Chapter 5 of GB/T 18268-2000 in Chapter 5, DEVELOP electromagnetic compatibility testing program
- According to the provisions of GB/T 17626.2—1998, electrostatic discharge immunity test shall be conducted;
- According to the provisions of GB/T 17626.3—1998, RFEMS test shall be conducted;
- According to the provisions of GB/T 17626.4—1998, electrical fast transient burst immunity test shall be conducted;
- According to the provisions of GB/T 17626.5—1999, surge (shock) immunity test shall be conducted;
- According to the provisions of GB/T 17626.6—1998, conducted disturbances induced by RF field immunity test shall be conducted;
- According to the provisions of GB/T 17626.8—1998, power frequency magnetic field immunity test shall be conducted;
- According to the provisions of 6.5 in GB/T 18268—2000, the test results shall be assessed. According to the provisions of Chapter 8 of GB/T 18268—2000, test reports shall be written.

7.5 Other Tests

7.5.1 Insulation Resistance Test

Test shall be conducted according to the provisions of 5.3 in GB/T 15479—1995.

7.5.2 Working pressure test

Measure rod of level meter shall be installed on the pressure test equipment. Test pressure is 1.5 times the rated working pressure. CHECK the performance of level meter, LAST for 20 min.

7.5.3 Visual Inspection

Eye-sight observation and powered inspection.

7.5.4 Explosion-proof Performance Test

- Flame-proof level meter shall be tested according to the provisions of GB 3836.1 and GB 3836.2;
- Intrinsic safety level meter shall be tested according to the provisions of GB 3836.1 and GB 3836.4.

7.5.5 Protection Performance Test

Test shall be conducted according to the provisions of GB 4208.

7.5.6 Anti-transportation Environment Performance Test

In the case of level meter is packaged - transportation, transport storage and basic environmental conditions shall be tested according to the following sequence:

- a) Hypothermia test is conducted according to the provisions of 4.2 in JB/T9329—1999. For those level meters which temperature of working environment is less than -40° C and it has been tested by the provisions of 7.4.5, this item test is not required.
- b) Collision test is conducted according to the provisions of 4.4 in JB/T9329—1999.
- c) Drop test is conducted according to the provisions of 4.5 in JB/T9329—1999.
- d) CHECK the level meter performance.

8 Test Rules

8.1 Test Items

According to the provisions of Table 2.

Table 2 Test Items and Test Sequence

No.	Item Name	Chapter No. of Requirements	Chapter No. of Test Method	Out-Factory Inspection	Type Test
1	Indication error	6.1.1	7.3	√	√
2	Non-linearity	6.1.2	7.3	√	√
3	Hysteresis	6.1.3	7.3	√	√
4	Repeatability	6.1.4	7.3	√	√
5	Stability	6.2.1	7.4.1	—	√

Table 2(continued)

No.	Item Name	Chapter No. of Requirements	Chapter No. of Test Method	Out-Factory Inspection	Type Test
6	Load resistor	6.2.2	7.4.2	√	√
7	Power Changes	6.2.3	7.4.3	√	√
8	Power protection	6.2.4	7.4.4	√	√
9	Temperature performance	6.2.5	7.4.5	—	√
10	Constant damp heat	6.2.6	7.4.6	—	√
11	Mechanical vibration	6.2.7	7.4.7	—	√
12	Electromagnetic compatibility	6.2.8	7.4.8	—	√
13	Insulation resistor	6.3.1	7.5.1	√	√
14	Working pressure	6.3.2	7.5.2	√	√
15	Appearance	6.3.3	7.5.3	√	√
16	Explosion-proof performance	6.3.4	7.5.4	—	√
17	Protective performance	6.3.5	7.5.5	—	√
18	Anti-transportation environment Performance	6.3.6	7.5.6	—	√
Note: “√” stands for compulsory test items; “—” stands for not-required test items.					

8.2 Factory Inspection

Each product must pass the out-factory inspection before delivery.

8.3 Type Test

When any of the following conditions occurs, type inspection shall be carried out:

- The new product trial is stereotyped;
- Periodic quality supervision of normal production, the interval shall not exceed 2 years;
- When there is significant change of design, technology or material;
- When product discontinued more than a year restores production;
- When out-factory test result is significantly different from the last type test;
- When State Administration of Quality Supervision body raises corresponding requirements.

10.1 Package

Level meter shall be packaged according to the requirements of GB/T 15464.

10.2 Storage

Level meter shall be stored at ambient temperature: $-25^{\circ}\text{C}\sim+40^{\circ}\text{C}$, relative humidity: 10%~75%, indoor storage with ventilated and without corrosive gases.

10.3 Transport

Under the condition of level meter is well-packaged, it can be transported by conventional transportation and shall be protected from the severe impact, rain and heavy sunlight during transportation.

References and Original Chinese Documents

[1] GB/T 21117-2007 Magnetostrictive level gauge.

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