



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 7548 : 2009

**Alcohol hydrometers — Metrological and
technical requirements and tests**

ICS 17.060

Reference number : JIS B 7548 : 2009 (E)

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B 7548 : 2009

Date of Establishment: 2009-10-20

Date of Public Notice in Official Gazette: 2009-10-20

Investigated by: Japanese Industrial Standards Committee

Standards Board

Technical Committee on Testing and Measurement

Technology

JIS B 7548 : 2009, First English edition published in 2010-10

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

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Alcohol hydrometers — Metrological and technical requirements and tests

Introduction

This Japanese Industrial Standard has been prepared to specify technical standards and test methods pertaining to the structure and performance of alcohol hydrometers required as a specified measuring instrument by the Measurement Law. Compliance with this Standard does not mean that the hydrometer has passed the verification specified in the Measurement Law. In addition, the marking specified in Article 19 of the Industrial Standardization Law can not be affixed to declare the conformance to this Standard.

1 Scope

This Standard specifies alcohol hydrometers used in transaction or certification in Japan (hereafter referred to as “hydrometers”) marked with scales indicating the alcohol concentration in mixed solution of alcohol and water at the temperature 15 °C by vol% of a defined concentration range within 0 vol% to 100 vol%, and that of 0.1 vol%, 0.2 vol% and 0.5 vol% in scale interval.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards with the year indication, only the editions of the indicated year shall be applied and any revisions (including amendments) made thereafter shall not be applied. For those without the indication of the year, the most recent edition (including amendments) shall be applied.

JIS Z 8103 *Glossary of terms used in measurement*

OIML R 22 : 1975 *International alcoholometric tables*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in JIS Z 8103 and following apply.

3.1 reference temperature

the temperature to be the reference when hydrometers are given the scale of concentration

3.2 bases of scale

concentration of a component in a substance in volume percent [(vol%) or (%)]¹⁾

Note ¹⁾ In accordance with the Measurement Unit Rule, Article 2.

3.3 meniscus top reading

method of taking a reading of a hydrometer at the top of the meniscus

3.4 horizontal surface reading

method of taking a reading of a hydrometer at the level of the horizontal liquid surface

3.5 instrumental error

the value obtained by subtracting the true value from the measured value

3.6 comparative method

method to obtain instrumental error of a hydrometer by comparing its reading with that of a reference hydrometer floated in a given test liquid at the inspection on instrumental error of the hydrometer

3.7 verification

inspection on specified measuring instruments set forth in the Measurement Law

NOTE : Those who perform verification are stipulated by the Measurement Law to be the prefectural governor, a designated verification body, National Institute of Advanced Industrial Science and Technology and Japan Electric Meters Inspection Corporation according to the classification of the specified measuring instrument.

3.8 verification tolerance

tolerance on the instrumental error applied in the verification

3.9 tolerance in service

tolerance on the instrumental error applied in the inspection in service

3.10 scale interval

difference of state quantities of physical phenomena represented by each adjacent scale marker

3.11 type approval indication

a mark given on a measuring instrument which indicates that it belongs to a type of the measuring instruments approved by the Measurement Law

4 Verification tolerance

Verification tolerances for hydrometers shall be as specified in table 1.

Table 1 Verification tolerance for hydrometers

Unit : vol %		
Scale interval	Concentration indicated by scale line	Verification tolerance
0.1	70 or under	±0.3
	Over 70	±0.2
0.2	70 or under	±0.3
	Over 70	±0.2
0.5	0 or over up to and incl. 100	±0.5

5 Materials

The materials used in a hydrometer shall be as follows.

- The glass shall be transparent.
- The glass shall have a coefficient of cubical thermal expansion of 0.000 02 to 0.000 03, except for the case where the value of coefficient of cubical thermal expansion is indicated on the hydrometer.
- The glass shall be free from such bubbles, seams and stress as making reading of the values indicated by the hydrometer difficult, or be free from bubbles that can be crushed by a press of fingernail.

6 Performance

6.1 Strip bearing scale

Strip bearing scale shall be as follows.

- The hydrometer shall have a strip bearing scale inside of the stem.
- The hydrometer shall be free from possibility of misreading due to gaps between the inner surface of the stem and the strip bearing scale.
- The hydrometer shall be free from peeling of the strip bearing scale or from any possibility thereof.
- The strip bearing scale shall not become discoloured or distorted when the hydrometer is exposed to a temperature of 70 °C for 1 h.

6.2 Scale line

The scale line of the hydrometer shall be as follows.

- The main scale lines and scale lines indicating a specific concentration shall be marked with the value of concentration or the numeric indicating the value.
- The scale lines corresponding to each other shall be uniform in size and other properties.
- The scale line shall be inscribed so as to indicate the value of concentration at the centre line.

- d) The scale line shall extend over one fifth of the way round the circumference of the stem.
- e) The scale interval shall exceed 0.5 mm.
- f) The thickness of the scale lines shall be 0.1 mm to 0.5 mm, and not exceed one fifth of the scale interval.
- g) The scale lines of the hydrometer, when the hydrometer is floated in a liquid, shall not be slanted off the horizontal by more than 3°.
- h) The hydrometer shall not have scale lines other than those which indicate concentration.

6.3 Graduation

The hydrometers shall be marked with scales indicating the alcohol concentration in mixed solution of alcohol and water at the temperature 15 °C by vol% of a defined range of concentration within 0 vol% to 100 vol%, and that of 0.1 vol%, 0.2 vol% and 0.5 vol% in scale interval.

NOTE : The scale of the hydrometers is adjusted by the liquid surface reading or the meniscus top reading, with each reading taken at the middle of the thickness of a scale line.

6.4 Extension of scale

The extension of scale of the hydrometer shall be as follows.

- a) The scale shall be extended at each end beyond upper and lower measurable concentration limits by 5 or less scale lines.
- b) The extension at the upper end of the scale shall be separated from the top of the stem by at least 10 mm, and that at the lower end shall be at least 5 mm above the stem-bulb interface.

6.5 Weight chamber

The weight chamber of a hydrometer shall be as follows.

- a) When the weight chamber in which shot, mercury or other loading material is enclosed is set at the bottom of the hydrometer bulb, the hydrometer shall be free from loading material falling out of the weight chamber, or any possibility thereof.
- b) The anchorage which fixes the loading material shall not get soft when it has been kept at the temperature of 70 °C for 1 h.

6.6 Form

The form shall be as follows.

- a) The outer surface shall be symmetrical about the main axis.
- b) There shall be no abrupt changes in cross-section which may interfere with measurement.
- c) The hydrometer, when it is floated in a liquid and has stilled, shall not be slanted

off the horizontal by more than 3°.

6.7 Effect of surface tension

When the hydrometer is slightly displaced from its equilibrium position in the liquid, the stem shall pass through the liquid surface without causing any apparent alteration in the shape of meniscus.

7 Test methods

7.1 Cubical thermal expansion test

For checking conformance to the requirement in 5 b), determine the coefficient of linear expansion of the glass used as material of the hydrometer by means of a therm dilatometer, and then multiply it by 3 to calculate the coefficient of cubical thermal expansion.

7.2 Strip bearing scale adherence test

For checking conformance to the requirement in 6.1 c), give the hydrometer a mild vertical shake on the palm to see whether the strip bearing scale is firmly adhered to the stem or it is likely to peel off.

7.3 Heating test

The heating test shall be as follows.

- a) For checking conformance to the requirement in 6.1 d), leave the hydrometer to stand in the test chamber maintained at the temperature of 70° for 1 h, and after allowing to cool until its surface returns to the ordinary temperature, visually check if the strip bearing scale has become discoloured or distorted.
- b) For checking conformance to the requirement in 6.5 b), leave the hydrometer to stand in a test chamber maintained at the temperature of 70 °C for 1 h by laying it on its side, and after allowing to cool until its surface returns to the ordinary temperature, float it in a liquid to visually check if it slants when coming to rest.

8 Inscriptions

The following information shall be permanently and legibly marked within the hydrometer.

- a) The symbol of unit of concentration : “vol%” or “%”
- b) The reference temperature : “15 °C”
- c) The method to take reading : for example “meniscus top reading”
- d) The manufacturer’s name or its abbreviation
- e) Identification number of the instrument