

Australian Standard™

Laboratory glassware—Density hydrometers



This Australian Standard was prepared by Committee CH-001, Laboratory Glassware and Related Apparatus. It was approved on behalf of the Council of Standards Australia on 31 March 2003 and published on 8 May 2003.

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Laboratory glassware—Density hydrometers

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PREFACE

This Standard was prepared by the Standards Australia Committee CH-001, Laboratory Glassware and Related Apparatus to supersede AS 2026—1994, *Density hydrometers*.

The objective of this Standard is to provide a document giving requirements for density hydrometers. This edition is essentially the same as 1994 edition but has been reformatted for clarity.

The main provisions of this Standard follow closely those of ISO 649:1981, *Laboratory glassware—Density hydrometers for general purposes*, Part 1: *Specification*, and Part 2: *Test methods and use*, with minor differences in some technical details and in the units which are used.

Five series of hydrometers are specified, and dimensions were chosen that would lead to convenience in use and economy in manufacture.

To assist users who may, for special purposes, require a hydrometer which is not included in any of the five series specified, appendices are provided giving notes on the design and adjustment of hydrometers, a method for the determination of density, the measurement of liquid in bulk and for suitable vessels for use with hydrometers.

The Standard does not make provision for the high surface tension category for hydrometers.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Laboratory glassware—Density hydrometers

1 SCOPE

This specification sets out the requirements for five main series and three sub-series of glass hydrometers of constant mass which are graduated to indicate the density (mass per unit volume) of a liquid. The specification does not include hydrometers for use with liquefied petroleum gas or lead-acid batteries.

NOTES:

- 1 Appendix A provides information on the use of hydrometers.
- 2 Appendix B provides information on the design of hydrometers.
- 3 Appendix C provides information on vessels which may be used when making hydrometer measurements.
- 4 Appendix D provides information on the application of hydrometer values to liquids in bulk.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard.

AS

2163 Laboratory glassware—Measuring cylinders

2849 Density of water—Numerical value

ISO

649 Laboratory glassware—Density hydrometers for general purposes

649-1 Part 1: Specification

649-2 Part 2: Test methods and use

3675 Crude petroleum and liquid petroleum products—Laboratory determination of density—Hydrometer method

3 DESIGNATION

The five series of hydrometers are designated by the symbols L20, L50, M50, M100, and S50, where L, M, and S indicate long, medium, and short, respectively, and 20, 50, and 100 indicate the range of the scale on each hydrometer in the particular series.

The L50, M50 and S50 series contain the special sub-series designated by the suffix SP. These hydrometers are used mainly in petroleum technology.

4 RANGES**4.1 Main series**

Each main series of hydrometer shall cover the range of 600 kg/m³ to 2000 kg/m³ or 0.600 g/mL to 2.00 g/mL according to the scale marking.

4.2 Sub-series

Each sub-series of hydrometer shall cover the range of 600 kg/m³ to 1100 kg/m³ or 0.600 g/mL to 1.100 g/mL according to the scale marking.

5 BASIS OF SCALE

The basis of scale shall be density (mass per unit volume) in kilograms per cubic metre (kg/m^3). The use of g/cm^3 , for which the symbol g/mL may be used, is acceptable.

NOTES:

- 1 The term millilitre (mL) is commonly used as a special name for cubic centimetre (cm^3), in accordance with a decision of the 12th General Conference of Weights and Measures. The term millilitre, is acceptable, in general, for reference to capacities of volumetric glassware and is used in the present text.
- 2 If water is used for calibration, AS 2849 provides density values.

6 REFERENCE TEMPERATURE

6.1 General

The reference temperature for density hydrometers excluding the special sub-series L50SP, M50SP and S50SP shall be 20°C . When used in a liquid at this temperature, the hydrometers shall indicate the density of the liquid at 20°C .

6.2 Sub-series L50SP, M50SP and S50SP

The reference temperature for density hydrometers of the special sub-series L50SP, M50SP and S50SP shall be either 20°C or 15°C . When used in a liquid at the appropriate temperature, the hydrometer shall indicate the density of the liquid at that temperature.

7 MATERIAL AND WORKMANSHIP

The bulb and stem shall be made of clear glass which is free from stress and visible defects.

NOTE: The use of thin wall glass tubing is necessary to achieve adequate buoyancy.

Solid loading material shall be fixed securely into the bottom of the bulb.

The scale and inscriptions shall be clearly and permanently marked in black on smooth white paper and shall be securely fixed in the stem.

The hydrometer shall be able to withstand a temperature of 80°C for a period of 1 h without exhibiting deterioration of any part.

8 FORM

The stem and bulb shall be circular in cross-section and symmetrical about the main axis. There shall be no abrupt changes in section that could hinder cleaning and drying or permit air bubbles to be trapped. The preferred form of hydrometer is shown in Figure 1.

The hydrometer shall float so that the stem is within 1.5 degrees of vertical for all readings within the range of the scale.

9 PRINCIPAL DIMENSIONS

The dimensions of the hydrometers are as follows:

- (a) The dimensions of the hydrometer shall conform to those given in Table 1.
- (b) The cross-section of the stem shall remain unchanged for at least 5 mm below the lowest graduation line.
- (c) The stem shall extend at least 25 mm above the top graduation line.
- (d) No hydrometer shall have a stem of diameter less than 4 mm.
- (e) The stem diameters recommended for the range of hydrometers are listed in Table 2.

10 SCALE

The strip on which the scale is marked shall be securely fixed in the stem and shall remain in place at the temperature of use. Means shall be incorporated for detecting any displacement of the scale relative to the stem.

No hydrometer shall have more than one type of scale.

The scale shall be straight and without twist.

11 GRADUATION LINES

The graduation lines shall be distinct lines of uniform thickness not exceeding 0.2 mm.

The graduation lines shall be perpendicular to the longitudinal axis of the hydrometer and shall be extended beyond the nominal limits as indicated in Table 1.

The short, medium and long graduation lines shall extend respectively at least one-fifth, one-third or one-half of the way around the circumference of the stem.

The highest and lowest graduation lines and the numbering shall be as illustrated in Figure 2. The short, medium and long lines respectively shall be vertically aligned and numbered as illustrated in Figure 2. The highest and lowest graduation lines indicating the nominal limits of the scale shall be long lines and shall be numbered in full. At least every tenth line shall be numbered.

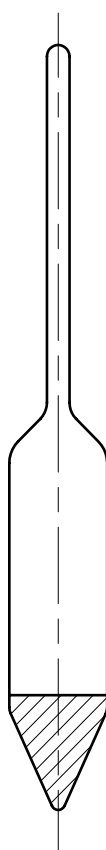


FIGURE 1 RECOMMENDED FORM OF HYDROMETER

12 ACCURACY

The maximum permitted errors at any point on the scale are given in Table 3. It is recommended that hydrometers in the special sub-series be supplied with certificates of correction.

13 CATEGORIES OF SURFACE TENSION FOR HYDROMETERS

The surface tension categories adopted for hydrometers for technical use are listed in Table 4. The adoption of these categories provides a precise basis for calibration and adjustment of hydrometers in the liquids indicated.

14 MARKING

Each hydrometer shall have the following information legibly marked on it within the stem or bulb:

- (a) The basis of the scale, e.g. kg/m^3 at 20°C .
- (b) The surface tension category or surface tension value for which the hydrometer is graduated, shown as one of the following:
 - (i) A particular surface tension expressed in millinewtons per metre.
 - (ii) A surface tension category.

NOTE: Surface tension categories are described in Table 4.

 - (iii) If the instrument is adjusted for use in a particular liquid, the name of that liquid.
- (c) The series of the hydrometer, e.g. L50.
- (d) The maker's or supplier's name or mark.
- (e) An identification number.

The marking shall not obscure the scale.

NOTE: Manufacturers making a statement of compliance with this Australian Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

TABLE 1
PARTICULARS OF DIMENSIONS AND GRADUATIONS OF HYDROMETERS

Series or sub-series	Maximum total length mm	Nominal range of each hydrometer		Number of scale divisions × value of the scale interval		Minimum scale length (nominal range) mm	Bulb diameter		Volume below lowest graduation line of nominal range		Extension of scale at each end beyond upper and lower nominal limits Graduation lines
		kg/m ³	g/mL	kg/m ³	g/mL		Min. mm	Max. mm	Min. mL	Max. mL	
L20	335	20	0.020	100 × 0.2	100 × 0.000 2	105	36	40	108*	132	5 to 10
L50	335	50	0.050	100 × 0.5	100 × 0.000 5	125	23	27	50*	65	2 to 5
M50	270	50	0.050	50 × 1	50 × 0.001	70	20	24	30	45	2 to 5
M100	250	100	0.100	50 × 2	50 × 0.002	85	18	20	18	26	2 to 5
S50	190	50	0.050	25 × 2	25 × 0.002	50	18	20	18*	26	2 or 3
L50SP †	335	50	0.050	100 × 0.5	100 × 0.000 5	125	23	27	50	65	2 to 5
M50SP †	270	50	0.050	50 × 1	50 × 0.001	70	20	24	30	45	2 to 5
S50SP †	190	50	0.050	50 × 1	50 × 0.001	50	18	20	18*	26	2 or 3

* For the diameter of the stem to exceed 4 mm (as required by Clause 9(d)), these volumes, for hydrometers covering the range 1700 to 2000 kg/m³ or 1.7 to 2.0 g/mL, will be nearer the maximum than the minimum value.

† See ISO 3675.