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SPIRIT LEVEL VIALS

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Associated Chamber of Manufactures of Australia
Department of Defence
Department of Productivity
Federal Chamber of Automotive Industries
Institution of Production Engineers
Metal Trades Industry Association of Australia
National Measurement Laboratory
Queensland Institute of Technology
Railways of Australia Committee
Society of Manufacturing Engineers
The Institution of Engineers, Australia
University of New South Wales
Weapons Research Establishment

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PREFACE

This standard was prepared by the Association's Committee on Metrology as part of its program of providing a rational range of specifications for measuring equipment in metric units.

Currently there is no international agreement on the subject of spirit levels within ISO/TC 3, Dimensional Metrology, nor does any appear likely in the foreseeable future. With this in mind, the committee took into account practices specified in BS 3509, Spirit Levels for Use in Precision Engineering.

The only Australian standard to refer to spirit level vials is AS 2054, Spirit Levels for Use in Precision Engineering, and that document also has been taken into account in the preparation of this standard.

The standard includes provisions for spirit levels used in surveying instruments, general levelling instruments, and also in various inspection techniques. These spirit levels have previously been designed to suit the instruments in which they were fitted and used, and consequently although the sensitivity required of any particular vial has been directly related to the accuracy and function of the instrument its size has been governed by the space available for fitting its individual casing.

The purpose of the standard is to provide the designer and the user with the choice of vials of an optimum size for all given accuracies. In this connection it should be pointed out that there is little to be gained in accuracy by increasing the sensitivity of a vial beyond the values given for a particular size.

Attention is drawn to the fact that spirit level vials may be tested for compliance with this standard by laboratories registered with the National Association of Testing Authorities (NATA) for the class and field of testing.

In accordance with the practice adopted in AS 1100, Drawing Practice, the decimal comma has been used in this standard.

This standard may require reference to the following Australian standards:

AS 1652 Dental Laboratory Plaster

AS 2054 Spirit Levels for Use in Precision Engineering.

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STANDARDS ASSOCIATION OF AUSTRALIA

**Australian Standard Specification
for
SPIRIT LEVEL VIALS**

1 SCOPE. This standard specifies the sizes and performance requirements for both precise and coarse vials for spirit levels. The vials are for use in instruments for precision surveying, inspection, and general levelling. Ranges for the parameters of spirit level vials are related to the sensitivity of the vial, and preferred sets of parameters for given sensitivities are indicated.

NOTES:

1. Appendix A gives recommended methods of testing vials.
2. Appendix B gives recommendations for standard mounts for vials.

2 CLASSIFICATION Straight cylindrical spirit level vials shall be classified according to their dimensions, and designated as Types I to VI, as shown in Table 1.

3 DEFINITIONS For the purpose of this standard, the following definitions apply. For further definitions refer to AS Z23*.

3.1 Spirit level vial—a glass vessel suitably processed, partially filled with a liquid of low freezing point and viscosity, and completely sealed.

3.2 Straight cylindrical vial—a vial made from nominally straight glass tube which has been fully barrel-ground or partially ground internally to a required radius of curvature longitudinally.

3.3 Bent cylindrical vial—a vial made by bending a glass tube to a required radius of curvature longitudinally.

3.4 Circular vial—a vial possessing a spherical functional surface whereby inclinations in all directions can be detected (in contradistinction to vials defined in Clauses 3.2 and 3.3 which are only required to be sensitive to tilts along their longitudinal axis).

3.5 Bubble—the small space created inside the sealed glass tube by partial filling, occasionally referred to as the air space or air bell.

NOTE: It is customary to refer to spirit level vials themselves as 'bubbles'; to avoid confusion of terms this mode of reference is not used in this standard.

3.6 Sensitivity—that angle of tilt which causes the bubble in the vial to move through one scale division.

* AS Z23, Glossary of Terms Relating to the Performance of Measuring Instruments.

- 3.7 Range**—the total angle of tilt throughout which a vial can be used.
- 3.8 Roll**—the rotation of a straight cylindrical vial about an axis parallel to the axis of the internally ground surface.
- 3.9 Roll error**—the longitudinal movement of the bubble (due to imperfections in the ground surface of the vial) when a straight cylindrical vial is rolled through a specified amount about the roll axis.
- 3.10 Repeatability**—the measure of the ability of the bubble to return to its original position when the vial has been disturbed and subsequently restored to its original attitude.
- 3.11 Settling time**—the time taken for a bubble to return to within one-tenth of a scale division of its steady position when the vial has been tilted through a specified angle.
- 3.12 Scale spacing**—the distance between the centres of two adjacent scale marks, measured along the scale base.

4 MATERIALS.

4.1 Glass. The glass shall be well annealed and, over the viewing portion, transparent, free from striae, flaws, and other defects. The composition of the glass shall be such that it does not react with the filling liquid or any colouring agent.

4.2 Filling Liquid. The liquid shall be clear, free from impurities and solid particles, and chemically inert to the glass and to the colouring material, if present. It shall not cloud or decompose on prolonged exposure to sunlight and shall remain fluid at a temperature of -40°C .

NOTE: The filling liquid should not normally be coloured. Fluorescent materials such as cosin (for orange) and fluorescein (for green) may be used if specified by the purchaser.

5 SCALE MARKS.

5.1 Straight Cylindrical Vials.

5.1.1 Scale marking. Scale marks on straight cylindrical vials shall be centrally located to an accuracy of 1 mm, between the ends of the vial (see Notes 1 and 2), and their form shall be selected from those given in Fig. 1. The scale marks shall be straight with sharp edges, normal to the longitudinal axis of the vial and of a uniform thickness of 0,25 mm within 0,05 mm. An imaginary line drawn through the mid-points of the scale marks shall be parallel to the same longitudinal axis of the vial.

The two major scale marks of any scale shall be clearly distinguished by their increased length or by their being terminated by dots. They shall be of equal length and indicate the position of the bubble at the centre of its run. The major scale marks shall be separated by a distance equal to the length of the bubble plus 0,5 mm to 3,0 mm at 20°C .

When the scale is of the continuous type, every fifth line shall be extended for ease of reading. All intermediate scale marks shall be the same length. When viewed