AS 2706—1984

Australian Standard®

Numerical values—Rounding and interpretation of limiting values

This Australian standard was prepared by Committee MS/10, Quantities, Units and Conversions. It was approved on behalf of the Council of the Standards Association of Australia on 28 February 1984 and published on 6 April 1984.

The following interests are represented on Committee MS/10:

- Bureau of Steel Manufacturers of Australia
- CSIRO, Division of Applied Physics
- Department of Defence
- Department of Science and Technology
- Electricity Commission of New South Wales
- Monash University
- National Association of Testing Authorities Australia
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This standard was issued in draft form for comment as DR 83068.

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First published 1984

Incorporating:
Amdt 1 — 1985

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140
ISBN 0 7262 3372 2

PREFACE

This standard was prepared by the Association's Committee on Quantities, Units and Conversions. The purpose of this standard is to promote the adoption of a consistent procedure in the presentation and interpretation of numerical values, particularly in regard to the number of figures to be used and the procedure for rounding. It is desirable that values should be expressed appropriately without using too few or too many figures, and that a standard practice should be adopted for rounding the last figure. The values may represent technical data, experimental results, or requirements in specifications and drawings, or may take the form of tables. Many branches of science and industry are concerned with the subject, and it is not possible to deal fully with all aspects in this standard; moreover, difficulties which are not amenable to rigorous treatment sometimes occur.

General principles and working rules relating to the different aspects of this subject are set out and illustrated with examples. These are, for the most part, matters of common sense. Fineness of expression is evidently associated with accuracy, achieved or required. Estimates of accuracy, i.e. uncertainties, where given, should follow a recognized convention, but a detailed discussion of the meaning of the term accuracy and the conventions for expressing it is not regarded as falling within the scope of this standard which does not deal with statistical aspects of numerical data.

The rounding procedure given in this standard is the same as that given in BS 1957 and in ASTM E 29.

It is hoped that this standard will serve as a guide, so far as the subject is concerned, for the preparation of other Australian standards, and that it will also be of general use in scientific work.

In the preparation of this standard, reference was made to the following standards:

AS 1000	The International System of Units (SI) and Its Application
AS 1514	Glossary of Terms Used in Metrology Part 1— General Terms and Definitions
AS 2415	Calibration System Requirements
BS 1957	Presentation of Numerical Values (Fineness of Expression; Rounding of Numbers)
ASTM E 29	Recommended Practice for Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values.

Acknowledgement is made of the assistance received from these sources.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard for NUMERICAL VALUES—ROUNDING AND INTERPRETATION OF LIMITING VALUES

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard deals with certain aspects of the rounding and interpretation of numerical values. It includes the following:

(a) Rules for the rounding of numbers (assuming a prior decision on the appropriate number of figures to be retained) (see Section 3).

(b) A discussion of the number of significant figures to be retained in presenting any particular value (see Section 4).

(c) Conventions concerning the interpretation of specification limits in relation to their mode of expression (see Section 5).

1.2 FORM OF NOTATION. For the purpose of this standard, all numerical values are expressed in accordance with the decimal system.

1.3 TYPES OF NUMERICAL VALUE. Numerical values may be regarded as being of three different kinds as follows:

(a) *Exact numerical values.* Exact numerical values are expressed to as many figures as are required to give the complete value, without approximation. Many definitive values are of this kind.

Example 1. 1 kilowatt hour (1 kW.h) = 3.6 MJ, exactly.

Example 2. Standard acceleration of free fall, g_n = 9.806 65 m/s^2, exactly.

Example 3. 1 litre (L) = 10^{-3} m^3, exactly.

(b) *Inexact decimal expressions of exactly defined numbers.* Exactly defined numbers can be expressed with any desired accuracy by taking sufficient figures. Many values having a purely mathematical basis fall into this category.

Example 4. The expressions 1/7, 1/3, $\sqrt{2}$, π, and e stand for exactly defined numbers. Decimal expressions for these are non-terminating, i.e. —

0.142 857 1 . . . . ;
0.333 333 3 . . . . ;
1.414 213 5 . . . . ;
3.141 592 7 . . . . ; and
2.718 281 8 . . . . , respectively.

(c) *Inexact values subject to inherent limitations of accuracy.* Inexact values that are subject to inherent limitations of accuracy may or may not include figures which are in doubt. Experimentally determined values fall into this category.

Example 5. The measured electrical resistance of a coil might be reported as 100.021 ± 0.002 Ω or as 100.02 Ω.

Here ±0.002 represents an estimate of the uncertainty of the determination. Such estimates should follow a recognized convention.

Example 6. The distance between two stations is stated to be 55.2 km. This value is to some extent inexact. To write this as 55 200 m could imply an accuracy finer than that of the original statement. Such a value should be written in the original form as 55.2 km or in some form such as 55.2 × 10^3 m.

Broadly, the provisions of this standard cover the use of all three kinds of values, but particular attention is given to the presentation of values of the kind described in (c) above.