

Australian Standard™

Preferred numbers and their use

This Australian Standard was prepared by Committee ME-071, Quantities, Units and Conversions. It was approved on behalf of the Council of Standards Australia on 28 July 2003 and published on 31 December 2003.

The following are represented on Committee ME-071:
CSIRO Telecommunications and Industrial Physics
Department of Industry Science and Resources
National Association of Testing Authorities Australia
University of Melbourne

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Australia web site at www.standards.com.au and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Global Standard*, has a full listing of revisions and amendments published each month.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at mail@standards.com.au, or write to the Chief Executive, Standards Australia International Ltd, GPO Box 5420, Sydney, NSW 2001.

Australian Standard™

Preferred numbers and their use

Originated as MP 19—1970.
Previous edition AS 2752—1985.
Second edition 2003.

COPYRIGHT

© Standards Australia International

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia International Ltd
GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 3283 6

PREFACE

This Standard was prepared by Standards Australia Committee ME-071, Quantities, Units and Conversions, to supersede AS 2752—1985.

The objective of this Standard is to rationalize and to reduce the number of sizes that have taken place since the introduction of SI units.

This Standard will be of use to those who wish to adopt the international system of preferred numbers when determining, for example, a series of sizes or ratings.

This Standard is based on the following documents:

- | | |
|---------|--|
| ISO 3 | Preferred numbers—Series of preferred numbers |
| ISO 17 | Guide to the use of preferred numbers and of series of preferred numbers |
| ISO 497 | Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers |

CONTENTS

	<i>Page</i>
FOREWORD.....	4
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	6
1.2 DEFINITIONS.....	6
SECTION 2 PREFERRED NUMBERS AND SERIES OF PREFERRED NUMBERS	
2.1 DESIGNATION OF SERIES.....	7
2.2 BASIC SERIES	7
2.3 EXCEPTIONAL R 80 SERIES.....	7
2.4 DERIVED SERIES.....	7
SECTION 3 GUIDE TO THE USE OF PREFERRED NUMBERS AND OF SERIES OF PREFERRED NUMBERS	
3.1 GEOMETRICAL PROGRESSIONS AND PREFERRED NUMBERS	11
3.2 DIRECTIVES FOR THE USE OF PREFERRED NUMBERS	12
3.3 RECOMMENDATION FOR CALCULATION WITH PREFERRED NUMBERS...	14
3.4 ADVANTAGES OF ADHERING STRICTLY TO PREFERRED NUMBERS.....	15
SECTION 4 GUIDE TO THE CHOICE OF SERIES OF PREFERRED NUMBERS AND OF SERIES CONTAINING MORE-ROUNDED VALUES OF PREFERRED NUMBERS	
4.1 SCOPE OF SECTION	17
4.2 MORE-ROUNDED VALUES.....	17
4.3 EXCEPTIONAL USE OF MORE-ROUNDED VALUES	17
4.4 RULES CONCERNING CHOICE OF SERIES.....	18
4.5 DANGERS OF USING MORE-ROUNDED VALUES	18
APPENDIX A PRECISION OF THE VALUES AND REGULARITY OF THE RATIO.....	21

FOREWORD

Preferred numbers were first utilized in France at the end of the nineteenth century. From 1877 to 1879, Captain Charles Renard, an officer in the engineer corps, made a rational study of the elements necessary in the construction of lighter-than-air aircraft. He computed the specifications for cotton rope according to a grading system, so that the rope could be produced in advance without prejudice to the installations where such rope was subsequently to be utilized. Recognizing the advantage to be derived from the geometrical progression, he adopted, as a basis, a rope having a mass of a grams per metre, and as a grading system, a rule that would yield a tenth multiple of the value a after every fifth step of the series, i.e.—

$$a \times q^5 = 10a \text{ or } q = \sqrt[5]{10}$$

whence the following numerical series:

$$a \sqrt[5]{10} \ a(\sqrt[5]{10})^2 \ a(\sqrt[5]{10})^3 \ a(\sqrt[5]{10})^4 \ 10a$$

the values of which, to five significant figures, are—

$$a \ 1.5849a \ 2.5119a \ 3.9811a \ 6.3096a \ 10a$$

Renard's theory was to substitute more-rounded but more practical values for the above values, and he adopted as a a power of 10, positive, nil or negative. He thus obtained the following series:

$$10 \ 16 \ 25 \ 40 \ 63 \ 100$$

which may be continued in both directions.

From this series, designated by the symbol R 5, the R 10, R 20, R 40 series were formed, each adopted ratio being the square root of the preceding one:

$$\sqrt[10]{10} \ \sqrt[20]{10} \ \sqrt[40]{10}$$

The first standardization drafts were drawn up on these bases in Germany by the Normenausschuss der Deutschen Industrie on 13 April 1920, and in France by the Commission Permanente de Standardisation in document X of 19 December 1921. These two documents offering few differences, the commission of standardization in the Netherlands proposed their unification. An agreement was reached in 1931, and in June 1932 the International Federation of the National Standardizing Associations (ISA) organized an international meeting in Milan, where the ISA Technical Committee 32, Preferred Numbers, was set up and its secretariat assigned to France.

Following a meeting of ISA Technical Committee 32 in September 1934, an international recommendation was laid down in ISA Bulletin 11 (December 1935).

After the Second World War, the work was resumed by ISO. Technical Committee ISO/TC 19, Preferred Numbers, was set up and France held the Secretariat. This committee at its first meeting, in Paris in July 1949, recommended the adoption by ISO of the series of preferred numbers defined by the table of ISA Bulletin 11, i.e., R 5, R 10, R 20, R 40. As a result of this and subsequent meetings, the series R 80 was added and slight alterations were made. The draft thus amended became ISO Recommendation ISO/R 3-1953.

ISO/TC 19 then recognized the need for some guidance on the use of preferred numbers, and ISO/R 17 was published in November 1955. This made brief reference to more-rounded values of preferred numbers.

In certain special applications, it may be found that the standard preferred numbers are unacceptable, e.g., because the precision that they imply cannot be achieved, or because the use of more than one or two significant figures is undesirable for other reasons, or because some section of industry or the general public is not yet ready to accept them. In such circumstances, it is better to use more-rounded numbers than non-preferred numbers, and this may, in some cases, lead to the adoption of preferred numbers in the future.

The members of ISO/TC 19 considered it desirable however to emphasize that such more-rounded values must be used with considerable care, and this consideration led in due course to the publication of ISO/R 497 in August 1966.

In 1973, ISO 3, ISO 17 and ISO 497 were published as International Standards.

STANDARDS AUSTRALIA

Australian Standard
Preferred numbers and their use

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard defines preferred numbers and a series of preferred numbers.

The Standard includes a guide to—

- (a) the use of preferred numbers and a series of proposed numbers (see Section 3); and
- (b) the choice of series of preferred numbers and of series containing more-rounded values of preferred numbers.

The precision of values and the regularity of the ratio used is discussed in Appendix A.

1.2 DEFINITIONS

For the purpose of this Standard, the following definitions apply:

1.2.1 Series of preferred numbers

The conventionally rounded-off term values of geometrical series, including the integral powers of 10 and having as ratios the following factors:

$$\sqrt[5]{10} \sqrt[10]{10} \left(\sqrt[20]{10}\right) \left(\sqrt[40]{10}\right) \left(\sqrt[80]{10}\right)$$

in accordance with Tables 2.1 and 2.2, set out for the 1 to 10 range.

NOTE: Because the series of preferred numbers is unlimited in both directions, the values of the terms in other decimal ranges are obtained by multiplying the values in the Tables by positive or negative integral powers of 10.

1.2.2 Theoretical values

The extended term value of $\left(\sqrt[5]{10}\right)^N$, $\left(\sqrt[10]{10}\right)^N$, etc., where the exponent N is the serial number of the preferred number.

1.2.3 Calculated values

Values approximating to the theoretical values, expressed to five significant figures (the relative error in comparison with the theoretical values is less than 1 in 20 000). (See Table 2.1, column 7.)

1.2.4 Preferred numbers

Values rounded off in accordance with columns R 5, R 10, R 20, R 40 and R 80. (See Table 2.1, columns 1 to 4, and Table 2.2.)

1.2.5 Serial numbers

An arithmetic series of consecutive numbers between 0 and 40 by which a preferred number is identified. (See Table 2.1.)