TECHNICAL REPORT

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Mechanical testing of metals — Symbols used with their definitions —

Part 2:
Recommendations for the development of symbols and definitions

Essais mécaniques des métaux — Symboles utilisés et leurs définitions — Partie 2: Recommandations pour le développement des symboles et des définitions

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 12735-2, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*.

ISO/TR 12735 consists of the following parts, under the general title *Mechanical testing of metals — Symbols used with their definitions*:

— *Part 1: Symbols and definitions in published standards*

— *Part 2: Recommendations for the development of symbols and definitions*

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Introduction

This part of ISO/TR 12735 has been prepared to provide the appropriate means of avoiding contradiction and misunderstanding and to standardize various kinds of symbols and their definitions generally used in ISO/TC 164 documents. Wherever possible the same symbol has been used to denote the same type of parameter in different tests but differing types of test piece, product form and test have to be taken into account. This has not been universally possible and symbols should always be considered in the context of the specific method of test being used.

Symbols are attached to concepts and phenomena in order to communicate data succinctly. They must be simple to use and readily comprehensible in both speech and writing across geographical frontiers and language barriers.

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Mechanical testing of metals — Symbols used with their definitions —

Part 2:
Recommendations for the development of symbols and definitions

1 Scope

This part of ISO/TR 12735 contains recommendations on the choice of definitions and symbols to be used in ISO International Standards for methods of mechanical testing of metallic materials which are the specific responsibility of Technical Committee ISO/TC 164.

It establishes the procedure for co-ordinating the adoption of suitable symbols between WG 1 and the technical subcommittees of ISO/TC 164. Furthermore, it establishes a procedure for the review of both parts of the document itself at regular intervals by ISO/TC 164 WG 1.

2 The use of definitions

(See ISO/IEC Directives, Part 3, annex B.1.4.)

2.1 A definition is a statement of the precise meaning of a word or term.

2.2 The use of a definition in a standard prepared by a TC 164 subcommittee is recommended under the following conditions.

2.2.1 Where one of many widely used meanings of a word or a term is to be applied.

2.2.2 When the word or term is not widely recognized, because it is specific only to the test or type of test to which the standard refers.

2.2.3 If the subcommittee believes that ambiguity may arise if a definition of the word or term is not included in the standard.

2.3 Definitions are gathered in a clause which follows immediately after "Normative references".

2.4 It is recommended that the definitions be listed in alphabetical order. The purpose is to ease the task of locating the definition for readers of the standard, who will generally be referring back from subsequent clauses to refresh their minds on the precise meaning of a word or a term.

NOTE — In many standards however, symbols and definitions are presented in their order of importance or order of use within the body of the standard.

2.5 It is recommended that each definition be given a sub-clause number to assist communication between readers.

3 The use of symbols

3.1 A symbol is a combination of marks or characters representing a concept, an object, a measurement or a process.

3.2 The purpose in using a symbol is to reduce the time and space required to transmit the concept or the data attached to the concept from person to person, visually or verbally, while simultaneously reducing the effort required on the part of the receiver to comprehend the information.

3.3 It is recommended that symbols be employed whenever this purpose can be achieved.

3.4 Symbols are built up from components in a formal structure as described in clause 5.

3.5 Mathematical symbols already widely used to represent algebraic or analytic functions such as integration or summation shall not be used within ISO/TC 164 to represent other concepts.

3.6 Symbols are to be first presented in tabular form, the appropriate clause and table to follow immediately after the Definitions (see 2.3).

3.7 It is recommended that the symbol table comprise one or two header rows for numbering and titling the table, followed by three vertical columns for:

a) the symbols themselves;

b) the units in which the data relevant to the symbol are presented;

c) the designation or concept which the symbol is to represent in the rest of the document.

NOTE — The word *Designation* is preferred to the word *Definition* as the heading for the 3rd column of the symbols table.

Part 1 of ISO/TR 12735 contains many examples.

3.8 It is recommended that the tables be presented in alphabetical order of the symbols used (see 2.4).

3.9 It is recommended that, when printed, symbols representing variables be set in italic script to distinguish them from surrounding text.

4 Explanatory figures

4.1 Comprehension and communication of the concept behind a symbol or definition, or the application of that concept, will often be enhanced by the inclusion of a figure.

4.2 It is recommended that figures be used wherever beneficial.

4.3 Figures shall always be drafted in accordance with current ISO rules. (See ISO/IEC Directives, Part 3, 4.3.)

4.4 If a figure is used to illustrate one or more concepts and includes the symbols used to designate those concepts, then the figure should be referenced in the designation column of the symbol table [see 3.7 a)] as part of the designation for each of those symbols.

5 The components of a symbol

5.1 When preparing a standard, it is often necessary to distinguish between:

a) several different states of a single parameter, or

b) several different but closely related items from a single class of parameter.

5.2 In order to achieve clarity, symbols are built up from an essential root and three other possible elements, a suffix, a prefix and a signifier.

5.2.1 The general rule is to minimize the number of elements employed and the number of characters within each element.

5.2.2 Where a single parameter achieves or is measured in several different states [see 5.1 a)], a suffix of a single numerical character to identify each state will often be sufficient.

For example: X_i where i = 1, 2, ..., 10

5.2.3 However, where there exist numerous different states or interpretations of a class of parameters, brevity may reduce the ability to communicate with clarity (see 5.4.1).

5.3 The root

This is the basic element of every symbol to be used. It consists of one or more characters that identify the single parameter or the single class of parameter (see 5.1).

5.3.1 The characters shall be letters from recognized alphabets. Numbers shall not be used.

5.3.2 A compound root is one consisting of several upper case characters, combined and treated as a single symbol. Each of the various hardness scales is so identified as is the Erichsen Cupping Index. The leading character in all symbols for hardness scales is H.

For example: HBW, HV, HRC, HRK.

5.3.3 When printed, the characters are at full size in the chosen font and they are placed on the baseline of the main text.

5.4 A suffix

This is the preferred choice of identifier to distinguish between two different but closely related parameters having the same root. The suffix immediately follows that root both in speech and on the printed page.

For example, in the symbol L_{R}, L is the root and $_{\mathrm{R}}$ is the suffix.

5.4.1 Where there are many different possible interpretations of the application of a root, the requirement for clarity of communication may be better met by using a suffix that is a word or part of a word to identify particular categories.

For example, in a complex stress field with many states of stress, it may be better to identify concepts such as total and notch stresses as σ_{total} and σ_{notch} rather than as σ_{t} and σ_{n} respectively.

5.4.2 There may be a need to introduce a second order of differentiation between parameters based on a non-numerical set of factors. The preferred method of achieving this is by using a suffix that consists of more than one character, either selected from different character sets or typefaces, or separated by punctuation marks. Characters may be either letters or numbers.

For example, $A_{1,3}$ and K_{Ic} show second order differentiation in this sense.

5.4.3 When printed, the suffix shall always be in subscript, placed below the baseline of the main text and set in a smaller typeface, typically 60 % of the size of the root. There is no character space between the root and the suffix.

5.5 A prefix

When otherwise identical parameters are to be distinguished by two different numerical factors, then one of the factors may be expressed as a numerical prefix that precedes the root.

5.5.1 When printed, the prefix shall be set in subscript, placed below the baseline and in a smaller typeface than the root.

5.5.2 One letter from the Greek alphabet, Δ, is permitted as a prefix by common usage when it is necessary to create a symbol for the *difference* in two values of a parameter which is itself symbolized by the root. In this single case, the prefix is printed full size on the baseline of the surrounding text.

For example, ΔK, where the root is K.

5.6 A signifier

The signifier is an alternative method of distinguishing between different sets of values of a parameter and is used to avoid building a multi-character suffix. It is particularly useful where one set of values is nominal or predicted at various states of a parameter, the other is the set of actual values at those states.

5.6.1 It shall not consist of letters or numbers, but only of one of a limited number of marks, such as the prime, the circumflex or the asterisk. These follow immediately after the root or, in the case of the circumflex, immediately above it in the same character space.

5.6.2 When printed the signifier occupies a position at the top of the available line height, in the same zone as characters printed in superscript. This is the zone in which are printed the mathematical powers of a function such as X^2. Great care should be taken to ensure that no confusion can arise. If a signifier is used, it shall be attached firmly to the root and precede any powers.

For examples, F' (F prime), $\hat{a}$ (a circumflex), F'^2 (F prime squared).

6 The choice of characters

NOTE — Many upper case letters in the Greek alphabet are shared by the Roman alphabet thus reducing the total range of choice.

6.1 Prefixes and signifiers are restricted to a small range of characters and marks (see 5.5 and 5.6).

6.2 Suffixes shall not be created from the marks assigned to signifiers but are otherwise unrestricted as to choice of character from the available range.

6.3 Restrictions are applied to the choice of character available for the symbol root. The following rules shall be applied.

6.3.1 Ratios between parameters of the same dimension shall be given lower case Greek letters.

For example, angles (arc length/radius); strain (deformation/original length).

6.3.2 Ratios between parameters of different dimensions shall be given lower case Greek letters where a conflict with other recommendations contained herein may occur.

For example, stress (force/area), for which σ (sigma) may be used in preference to S, a reserved symbol (see 6.4).

6.3.3 Linear dimensions and combinations of linear dimensions shall be represented by letters from the Roman alphabet.

6.3.4 Where a pair of similar dimensions is to be represented, the one larger than the other, it is permissible to use for the root of the symbol the upper case letter for the greater dimension and the lower case letter for the smaller.

For example, D and d for the outer and inner diameters of a tube.

6.4 In addition to the restrictions in 5.3, some characters are reserved for use in designating particular classes of parameter. These are identified in table 1.

Table 1 — Symbol roots — reserved characters

Designation	Symbol
Crack tip opening displacement	δ
Strain	ε
Temperature	θ
Constant of circular measure, π = 3,1416	π
Stress	σ
Poisson's ratio	ν
Crack length	a
Percent elongation	A
Constant in formula	C
Diameter	D
Elastic (Young's) modulus	E
Force	F
Acceleration due to gravity	g
Vertical distance	h
Hardness (compound root, see 5.3.2)	H..
Stress intensity factor	K
Fracture resistance (J integral)	J
Length	l
Strain hardening exponent	n
Number of events	N
Plastic strain ratio	r
Cross-sectional area	S
Time	t
Velocity	V
Reading on an indicator	X
Percent reduction in area	Z