INTERNATIONAL STANDARD

ISO 3898

Third edition
1997-08-15

Bases for design of structures — Notations — General symbols

Bases du calcul des constructions — Notations — Symboles généraux

Reference number
ISO 3898:1997(E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 3898 was prepared by Technical Committee ISO/TC 98, *Bases for design of structures*, Subcommittee SC 1, *Terminology and symbols*.

This third edition cancels and replaces the second edition (ISO 3898:1987), which has been technically revised.

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Printed in Switzerland

Bases for design of structures — Notations — General symbols

1 Scope

This International Standard defines standard notations for structural design.

It covers general terms which are necessary to this field of application and, in general, excludes terms relevant to a particular material or to a particular technical field.

It indicates only the symbols to be used without prejudice to the exact definition of each term, which is within the scope of other International Standards.

Table 1 gives general indications about the usage of different types of letter. Tables 2, 3 and 4 give letters to be used as a main symbol and their meanings. Table 5 gives a list of special and mathematical symbols. Tables 6 gives letters or groups of letters when used as subscripts and their meanings.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 31-0:1992, *Quantities and units — Part 0: General principles.*

3 Construction of symbols

The construction of a symbol to represent a given quantity or term shall be carried out as follows.

3.1 The main letter of the symbol shall be selected from table 2, 3, 4 or 5, based in most cases on considerations of the main usage, as given in table 1.

3.2 Descriptive subscripts may be selected from table 6. When other subscripts are used, a clear definition of their meaning shall be given.

3.3 Numerical figures may be used as subscripts.

3.4 When several subscripts are used with a main symbol, they shall be separated for example by commas or semicolons in order to avoid any ambiguity.

3.5 In the construction of a symbol representing an effect under a given action, the first subscripts shall indicate the location of the effect, and the following subscripts shall identify the action.

3.6 When there is no likelihood of confusion, some or all descriptive subscripts may be omitted.

3.7 In the absence of a specific rule, the sign of a computed stress is positive (+) for tension, negative (–) for compression.

3.8 For the rules for inclined (italic) or upright letters and figures, ISO 31-0 shall be applied.

NOTE — The use of a subscript such as c, t (ten) makes it possible to avoid the use of ' (prime).

4 Precautions

Owing to the possibility of confusion, the following precautions shall be taken.

a) Where there is a possibility of confusing 1 (numeral) with *l* (letter), in some typewritten work, *L* or *l* shall be used in place of *l* (letter).

b) Latin capital and lower-case letter O shall not be used as a main letter owing to the possibility of confusion with zero. The lower-case o may, however, be used as a subscript, with the same meaning as 0 (zero).

c) Greek lower-case letters iota (ι), omicron (ο) and upsilon (υ) shall not be used owing to the possibility of confusing them with various Latin letters. For the same reason, it is recommended that, as far as possible, the use of kappa (κ) and chi (χ) be avoided. When Greek lower-case letters eta (η), omega (ω) and mu (μ) are used, care must be taken in writing the letters to avoid confusion with Latin lower-case letters n, w and u.

d) In the case where a symbol is to be used twice with different meanings, supplement it in one place with additional letters to avoid confusion. For example: S (Sn) to designate an internal moment in which snow action intervenes. See also table 6, note 2).

Table 1 — Letter guide for the construction of symbols

Type of letter	Main usages
Latin capital	-action, internal force, internal moment -area, first and second moments of area -elastic modulus -temperature
Latin lower-case	-action, internal force, internal moment (per unit of length or of area) -distance (displacement, eccentricity, length, etc) -strength -velocity, acceleration, frequency -descriptive letter (subscript) -mass -time
Greek capital	mathematics; physical quantity excluding geometrical or mechanical quantity
Greek lower-case	-coefficients, factors, ratios -strain -angle -density (mass density, weight density) -stress
NOTE — Concepts not included in table 1 shall comply with the nearest appropriate category listed.	

Table 2 — Latin capital letters

Letter	Meaning
A	area
A	accidental action
B	*(unallocated)*
C	fixed or nominal value
C	constraint
D	flexural rigidity (plate, shell)
D	damage index (fatigue)
E	longitudinal modulus of elasticity
E (or Eq)	earthquake action
E	effect of an action
F	action in general
F	force in general
G	shear modulus
G	permanent action [1)]
H	horizontal component of a force
I	second moment of a plane area
J	*(unallocated)*
K	flexural rigidity (of a frame)
L	can be used for the length (see table 3) or the height of a member or of the total structure
M	moment in general
M	bending moment
N	normal force
O	*(to be avoided as far as possible)*
P	prestressing action
P (or p)	probability
Q	variable action
R	resultant force
R	reaction force
R	resistance
S	first moment of a plane area (static moment)
S	internal force, internal moment
S (or Sn)	snow action
T	torsional moment
T	temperature
T	period of time
U	*(unallocated)*
V	shear force
V	volume
V	vertical component of a force
V (or v)	coefficient of variation
W	section modulus [2)]
W	wind action
X	value of a property (of a material)
X, Y, Z	force in general (parallel to *x-, y- or z*-axis)

1) With a subscript if necessary (example G_0, self-weight).

2) To be used with appropriate subscript (e or el, pl) where relevant; W_{pl} is sometimes substituted by *Z*.

Table 3 — Latin lower-case letters

Letter	Meaning
a	distance
a	acceleration
a	geometrical parameter
b	width
c	*(unallocated)*
d	deflection
d	depth (for example foundation)
d	diameter
e	eccentricity
f	strength (of a material)
f	frequency
g	distributed permanent load [1)]
g	acceleration due to gravity
h	height
h	thickness
i	radius of gyration
j	number of days
k	coefficient
l	span; length of a member [2)]
m	bending moment per unit of length or width
m	mass
m	mean value of a sample
n	normal force per unit of length or of width
n	number of . . .
o	*(unallocated)*
p	pressure
p	probability
q	distributed variable load [1)]
r	radius
s	standard deviation of a sample
s	spacing
s	distributed snow load
t	time in general
t	thickness of thin members
t	torsional moment per unit of length or of width
u	perimeter
u, v, w	components of the displacement of a point
v	velocity; speed
v	shear force per unit of length or of width
w	distributed wind load
x, y, z	coordinates
z	lever arm

1) With a subscript if necessary (example: g_0 distributed self-weight).

2) Can be replaced by *L* or by *I* for some lengths, or to avoid confusion with 1 (numeral).

Table 4 — Greek lower-case letters

Letter	Symbol	Meaning
alpha	α	angle; ratio
beta	β	angle; ratio; factor
beta	β	reliability index
gamma	γ	partial factor (reliability)
gamma	γ	ratio (relative rigidity)
gamma	γ	shear strain [1)]
gamma	γ	weight per unit volume (gravity force density)
delta	δ	coefficient of variation
epsilon	ε	strain [2)]
xi, eta, zeta	ξ, η, ζ	relative coordinates
eta	η	conversion factor
theta	θ	rotation, angle
iota	ι	*(unallocated)*
kappa	κ	*(to be avoided as far as possible)*
lambda	λ	ratio (slenderness); factor
mu	μ	coefficient; coefficient of friction
mu	μ	average of a population
mu	μ	corrective factor
nu	ν	Poisson's ratio
omicron	o	*(to be avoided as far as possible)*
pi	π	*(mathematical use only)*
rho	ρ	mass per unit volume (mass density)
sigma	σ	normal stress
sigma	σ	standard deviation of a population
tau	τ	shear stress [3)]
upsilon	υ	*(unallocated)*
phi	φ (ϕ)	angle of friction (for example for soils)
phi	φ (ϕ)	angle; creep coefficient
chi	χ	*(to be avoided as far as possible)*
psi	ψ	relative humidity
psi	ψ	reduction factor
omega	ω	angular velocity
omega	ω	moisture content

1) For shear strain, it is also possible to use ε with asymmetric subscripts.
Example: ε_{23} or ε_{yz}.

2) Examples: $\varepsilon_{e, max}$, $\varepsilon_{0,02}$, ε_{max}, ε_{u}.

3) For shear stress, it is also possible to use σ with asymmetric subscripts.
Example : σ_{23} or σ_{yz}.

Table 5 — Mathematical and special symbols

Symbol	Meaning
Σ	Sum
Δ	Difference; Increment
ϕ	Diameter (for example reinforcing bar, rivets, etc.)
' (prime)	Compression (especially for geometrical or locational purposes) [1)]
e	Base of Napierian logarithms: 2,71828 . . .
π	Ratio of the circumference of a circle to its diameter: 3,14159...
n	Number of . . .
ll or //	Parallel
$\perp$	Perpendicular, normal

1) The use of subscript such as ac, t (ten) makes it possible to avoid this use of ' (prime).