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**Bases for design of structures —  
Notations — General symbols**

*Bases du calcul des constructions — Notations — Symboles généraux*

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## Foreword

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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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# 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. Table 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 / (letter), in some typewritten work, L or I shall be used in place of / (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 ( $\iota$ ), omicron ( $\omicron$ ) and upsilon ( $\upsilon$ ) 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 ( $\kappa$ ) and chi ( $\chi$ ) be avoided. When Greek lower-case letters eta ( $\eta$ ), omega ( $\omega$ ) and mu ( $\mu$ ) 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 ( $S_n$ ) 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	<ul style="list-style-type: none"> <li>-action, internal force, internal moment</li> <li>-area, first and second moments of area</li> <li>-elastic modulus</li> <li>-temperature</li> </ul>
Latin lower-case	<ul style="list-style-type: none"> <li>-action, internal force, internal moment (per unit of length or of area)</li> <li>-distance (displacement, eccentricity, length, etc)</li> <li>-strength</li> <li>-velocity, acceleration, frequency</li> <li>-descriptive letter (subscript)</li> <li>-mass</li> <li>-time</li> </ul>
Greek capital	mathematics; physical quantity excluding geometrical or mechanical quantity
Greek lower-case	<ul style="list-style-type: none"> <li>-coefficients, factors, ratios</li> <li>-strain</li> <li>-angle</li> <li>-density (mass density, weight density)</li> <li>-stress</li> </ul>
NOTE — Concepts not included in table 1 shall comply with the nearest appropriate category listed.	

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Table 2 — Latin capital letters

Letter	Meaning
A	area
A	accidental action
B	<i>(unallocated)</i>
C	fixed or nominal value
C	constraint
D	flexural rigidity (plate, shell)
D	damage index (fatigue)
E	longitudinal modulus of elasticity
E (or $E_q$ )	earthquake action
E	effect of an action
F	action in general
F	force in general
G	shear modulus
G	permanent action <sup>1)</sup>
H	horizontal component of a force
I	second moment of a plane area
J	<i>(unallocated)</i>
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	<i>(to be avoided as far as possible)</i>
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 $S_n$ )	snow action
T	torsional moment
T	temperature
T	period of time
U	<i>(unallocated)</i>
V	shear force
V	volume
V	vertical component of a force
V (or $v$ )	coefficient of variation
W	section modulus <sup>2)</sup>
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
<i>a</i>	distance
<i>a</i>	acceleration
<i>a</i>	geometrical parameter
<i>b</i>	width
<i>c</i>	( <i>unallocated</i> )
<i>d</i>	deflection
<i>d</i>	depth (for example foundation)
<i>d</i>	diameter
<i>e</i>	eccentricity
<i>f</i>	strength (of a material)
<i>f</i>	frequency
<i>g</i>	distributed permanent load <sup>1)</sup>
<i>g</i>	acceleration due to gravity
<i>h</i>	height
<i>h</i>	thickness
<i>i</i>	radius of gyration
<i>j</i>	number of days
<i>k</i>	coefficient
<i>l</i>	span; length of a member <sup>2)</sup>
<i>m</i>	bending moment per unit of length or width
<i>m</i>	mass
<i>m</i>	mean value of a sample
<i>n</i>	normal force per unit of length or of width
<i>n</i>	number of . . .
<i>o</i>	( <i>unallocated</i> )
<i>p</i>	pressure
<i>p</i>	probability
<i>q</i>	distributed variable load <sup>1)</sup>
<i>r</i>	radius
<i>s</i>	standard deviation of a sample
<i>s</i>	spacing
<i>s</i>	distributed snow load
<i>t</i>	time in general
<i>t</i>	thickness of thin members
<i>t</i>	torsional moment per unit of length or of width
<i>u</i>	perimeter
<i>u, v, w</i>	components of the displacement of a point
<i>v</i>	velocity; speed
<i>v</i>	shear force per unit of length or of width
<i>w</i>	distributed wind load
<i>x, y, z</i>	coordinates
<i>z</i>	lever arm

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

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

Table 4 — Greek lower-case letters

Letter	Symbol	Meaning
alpha	$\alpha$	angle; ratio
beta	$\beta$	angle; ratio; factor
beta	$\beta$	reliability index
gamma	$\gamma$	partial factor (reliability)
gamma	$\gamma$	ratio (relative rigidity)
gamma	$\gamma$	shear strain <sup>1)</sup>
gamma	$\gamma$	weight per unit volume (gravity force density)
delta	$\delta$	coefficient of variation
epsilon	$\epsilon$	strain <sup>2)</sup>
xi, eta, zeta	$\xi, \eta, \zeta$	relative coordinates
eta	$\eta$	conversion factor
theta	$\theta$	rotation, angle
iota	$\iota$	<i>(unallocated)</i>
kappa	$\kappa$	<i>(to be avoided as far as possible)</i>
lambda	$\lambda$	ratio (slenderness); factor
mu	$\mu$	coefficient; coefficient of friction
mu	$\mu$	average of a population
mu	$\mu$	corrective factor
nu	$\nu$	Poisson's ratio
omicron	$\omicron$	<i>(to be avoided as far as possible)</i>
pi	$\pi$	<i>(mathematical use only)</i>
rho	$\rho$	mass per unit volume (mass density)
sigma	$\sigma$	normal stress
sigma	$\sigma$	standard deviation of a population
tau	$\tau$	shear stress <sup>3)</sup>
upsilon	$\upsilon$	<i>(unallocated)</i>
phi	$\varphi$ ( $\phi$ )	angle of friction (for example for soils)
phi	$\varphi$ ( $\phi$ )	angle; creep coefficient
chi	$\chi$	<i>(to be avoided as far as possible)</i>
psi	$\psi$	relative humidity
psi	$\psi$	reduction factor
omega	$\omega$	angular velocity
omega	$\omega$	moisture content

1) For shear strain, it is also possible to use  $\epsilon$  with asymmetric subscripts.  
Example:  $\epsilon_{23}$  or  $\epsilon_{yz}$ .

2) Examples:  $\epsilon_e$ , max,  $\epsilon_{0,02}$ ,  $\epsilon_{max}$ ,  $\epsilon_u$ .

3) For shear stress, it is also possible to use  $\sigma$  with asymmetric subscripts.  
Example :  $\sigma_{23}$  or  $\sigma_{yz}$ .

Table 5 — Mathematical and special symbols

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

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

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Table 6 :— Subscripts: Latin letters 1)

Letter 2)	Meaning		
	General	Materials	Actions, internal forces and moments, resistances 6)
a (ac)			accidental action
a (sa)		structural steel	
abs	absolute		
act, pas	active, passive		
add	additional		
adm	admissible (permissible)		
al		aluminium	
b		masonry unit (e.g. brick)	
c (con)		concrete	
c			compression in general
cal	calculated 3)		
cr (crit)	critical		
d (des)	design		
dir, ind			direct, indirect
dyn			dynamic
e (el)	elastic	elastic limit 4)	
eff	effective		
eq			earthquake action
eqv	equivalent		
est	estimated		
exe	execution		
exp	experimental 5)		
ext	external		
f			action in general; force in general
f (fl)		beam flange	
f (fr)			friction
fat	fatigue		
g			permanent action
g (ga)		guaranteed	
h (hg) 8)	high; higher		
h (hor)	horizontal		
inf	inferior		
i (ini)	initial (in time)		
i (int)	integer		
int	internal		
<i>i</i>	number of .....		
<i>j</i>	number of days		
k	characteristic		
l (lon)	longitudinal 7)		
l (lw) 8)	low; lower 7)		
lat	lateral		
lgt, sht	long term, short term		
lim	limit		

"(continued)"

Table 6 (continued)

Letter <sup>2)</sup>	Meaning		
	General	Materials	Actions, internal forces and moments, resistances <sup>6)</sup>
m			bending in general
m (mv)	average value		
m (mat)		material	
ma	masonry		
max, min	maximum, minimum		
mor		mortar	
n			normal force
n (net)	net		
n (nom)	nominal		
nor	normal		
o	zero		
o	at the origin		
obs	observed		
p			prestressing action
p (or sp)		prestressing steel	
par	parallel		
per	perpendicular		
pl		plastic	
pro	provisional		
q			variable action
r			resistance
red	reduced		
ref	reference		
rel	relative		
rep	representative		
req	required		
res	residual		
s			internal force, internal moment
s		reinforcing steel	
s (sn)			snow action
s (sol)			soil action
ser	serviceability		
shr		shrinkage	
sit			site (load)
st (stat)			static
stab, dest			stabilizing, destabilizing
sup	superior		
"(continued)"			

Table 6 (concluded)

Letter <sup>2)</sup>	Meaning		
	General	Materials	Actions, internal forces and moments, resistances <sup>6)</sup>
t (tem)	temperature		temperature
t (ten)			tension in general
th (theo)	theoretical		
t (tor)			torsion in general
t (tra)	transversal		
tim		timber	
tot	total		
u (ult)		ultimate (material only)	
v	vertical		
v			shear force
var	variable		variable
w (wat)			water action
w (wi)			wind action
w		web	
x, y, z	coordinate		
y (yi)		yield	
0, 1, 2, etc.	particular value		
$\infty$	asymptotic value		

1) As far as possible, abbreviations which are not contained in this table should be derived from words preferably for English language having Latin roots. If there is no risk of confusion, these subscripts may be reduced to one or two letters.

2) In parentheses: abbreviations to be used when a single letter could lead to misinterpretation. If there is any other risk of confusion, the complete word may be used (written in English or French).

3) As opposed to "observed".

4) If necessary, a suitable subscript may be added or substituted in order to define the elastic limit more precisely: for example 0,2.

5) As opposed to "theoretical".

6) When it is necessary for clarification, Latin capital letters may be used for actions, internal forces, internal moments, and resistances. Examples are  $\gamma_F$ ,  $\gamma_{Sd}$ ,  $\gamma_{Rd}$ ,  $\sigma_{TF}$ .

7) Can also be replaced by L ou I to avoid confusion with 1 (numeral).

8) If "sup" and "inf" cannot be used.