INTERNATIONAL STANDARD ISO 3898

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Bases for design of structures — Notations — General symbols

Bases du calcul des constructions — Notations — Symboles généraux

First edition — 1976-09-30

UDC 624.04 : 003.62

Ref. No. ISO 3898-1976 (E)

Descriptors : buildings, construction, structural design, formulas (mathematics), symbols, definition.

Price based on 4 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3898 was drawn up by Technical Committee ISO/TC 98, *Bases for design of structures,* and was circulated to the Member Bodies in June 1975.

It has been approved by the Member Bodies of the following countries :

Australia	India	South Africa, Rep. of
Belgium	Israel	Spain
Bulgaria	New Zealand	Sweden
Denmark	Norway	Turkey
France	Poland	United Kingdom
Germany	Portugal	Yugoslavia
Hungary	Romania	

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Czechoslovakia
Switzerland

Printed in Switzerland

Bases for design of structures – Notations – General symbols

1 SCOPE AND FIELD OF APPLICATION

This International Standard defines standard notations for structural design.

It covers only general terms which are necessary to this field of application and excludes terms relevant to a particular material (for example steel, concrete, wood, etc.) or to a special technical field (for example foundations, etc.), which will be defined separately.

It indicates only the symbols to be used and does not prejudice the exact definition of each term, which will be within the scope of other International Standards.

This International Standard has been established for use in regulations, standards, technical literature and design. It does not cover future developments in safety theories or new techniques in computer design.

However, for the time being, letter J (table 2) has been reserved for line printers and telex.

2 TYPES OF SYMBOL

2.1 Tables of letters and symbols

2.1.1 Table 1 gives general indications about the usage of different types of letter.

2.1.2 Tables 2, 3 and 4 give the meanings of letters when used as a main symbol.

2.1.3 Table 5 gives a list of special and mathematical symbols.

2.1.4 Tables 6, 7 and 8 give the meanings of letters or groups of letters when used as subscripts.

2.2 Construction of symbols

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

1) The main letter of the symbol shall be selected from table 2, 3, 4 or 5, based on consideration of dimensions and usage, as given in table 1.

2) An apostrophe (′) can be used to represent compression (especially for geometrical or locational purposes).

3) Descriptive subscripts may be selected as desired. When subscripts other than those appearing in tables 6, 7 and 8 are used, a clear definition of their meaning shall be given.

4) In the construction of symbols, the first subscripts shall indicate the location, and the following subscripts shall identify the cause (nature, location, etc.)[1].

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

6) Numerical figures may be used as subscripts.

7) The sign of a computed stress is given by positive (+) for tension, and negative (–) for compression.

Owing to the possibility of confusion, the following precautions must be taken :

– Where there is a possibility of confusing 1 (numeral) with l (letter) in some typewritten work, L shall be used in place of l (letter) where ambiguity would otherwise arise.

– Roman upper and lower case letter O shall not be used as a leading 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).

– Greek lower case letters iota (ι), omicron (o) and upsilon (υ) shall not be used owing to the possibility of confusing them with various Roman 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 Roman lower case letters n, w and u.

1) Where it is necessary to avoid confusion, it is recommended that a comma be used between the two categories of subscript.

TABLE 1 — **Letter guide for the construction of symbols**

Type of letter	Dimensions	Usage
Roman upper case	Force, force times length, length to a power other than 1, temperature	1 Action and action-effects 2 Area, first and second moments of area 3 Elastic moduli (exception to the general rule) 4 Temperature
Roman lower case	Length, quotient of length and time to a power, force per unit length or area, mass, time	1 Actions and action-effects per unit of length or area 2 Linear dimensions (length, width, thickness, etc.) 3 Strengths 4 Velocity, acceleration, frequency 5 Descriptive letters (subscripts) 6 Mass 7 Time
Greek upper case	—	Reserved for mathematics
Greek lower case	Dimensionless	1 Coefficients and dimensionless ratios 2 Strains 3 Angles 4 Densities (mass density and weight density) (exception to the general rule) 5 Stresses (exception to the general rule)

NOTE — Concepts not included in the table above shall comply with the nearest appropriate category listed.

TABLE 2 — **Roman upper case letters**

Letter	Meaning
A	Area
B	(Void)
C	(Void)
D	Flexural rigidity of plates and shells
E	Longitudinal modulus of elasticity
E	Earthquake action
F	Action in general
F	Force in general
G	Shear modulus
G	Permanent load (dead load)
H	Horizontal component of a force
I	Second moment of a plane area
J	(Reserved for line printers and telex)
K	(Void)
L	Can be used for span, length of a member (see table 3)
M	Moment in general
M	Bending moment
N	Normal force
O	(To be avoided as far as possible)
P	Prestressing force
Q (or *V*)	Variable load (Live load)1) 2)
R	Resultant force
R	Reaction force
S	First moment of a plane area (Static moment)
S	Action-effect (Sollicitations)
S (or *Sn*)	Snow load (*Sn* where there is a risk of confusion)
T	Torsional moment
T	Temperature
U	(Void)
V (or *Q*)	Shear force2)
V	Volume
V	Vertical component of a force
W (or *Z*)	Section modulus2)
W	Wind load
X	Force in general parallel to *x*-axis
Y	Force in general parallel to *y*-axis
Z	Force in general parallel to *z*-axis
Z (or *W*)	Section modulus2)

1) With a subscript if it is necessary to define an imposed load more precisely.

2) Subject to a future definite choice, either letter may be used according to existing national customs.

TABLE 3 — **Roman lower case letters**

Letter	Meaning
a	Distance
a	Acceleration
b	Width
c	(Void)
d	Diameter
d	Depth (for example foundation)
e	Eccentricity
f	Strength[1) 2)]
g	Distributed permanent load (Dead load)
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[3)]
m	Can be used as bending moment per unit of length or width
m	Mass
m	Average value
n	Can be used as normal force per unit of length or width
n	Number of . . .
o	(Void)
p	(Void)
q (or *v*)	Distributed variable load (Live load)[4) 5)]
r	Radius
s	Standard deviation
s	Spacing
s	Distributed snow load
t	Time in general
t	Thickness of thin members
t	Can be used as torsional moment per unit of length or width
u	Perimeter
u, *v*, *w*	Components of the displacement of a point
v	Velocity; Speed
v (or *q*)	Can be used as shear force per unit of length or width[5)]
w	Distributed wind load
x, *y*, *z*	Co-ordinates
z	Lever arm

1) Some countries use f with subscript for stress, but σ is recommended.

2) Some countries use σ or β with subscript for strength, but f is recommended.

3) Can be replaced by L for some lengths or to avoid confusion with 1 (numeral).

4) With a subscript if it is necessary to define an imposed load more precisely.

5) See note 2 in table 2.

TABLE 4 — **Greek lower case letters**

Letter	Symbol	Meaning
alpha	α	Angle; Ratio
beta	β	Angle; Ratio[1)]
gamma	γ	Weight density
gamma	γ	Safety factor
gamma	γ	Shear strain[2)]
delta	δ	Coefficient of variation
epsilon	ϵ	Strain
xi	ξ	Relative co-ordinates x/l
eta	η	Relative co-ordinates y/l
zeta	ζ	Relative co-ordinates z/l
theta	θ	Rotation
iota	ι	(Void)
kappa	κ	(To be avoided as far as possible)
lambda	λ	Slenderness ratio
mu	μ	Coefficient of friction
nu	ν	Poisson's ratio
omicron	o	(To be avoided as far as possible)
pi	π	(Mathematical use only)
rho	ρ	Mass density
sigma	σ	Normal stress[1) 3) 4)]
tau	τ	Shear stress[4)]
upsilon	υ	(Void)
phi	φ (ϕ)	Limiting value of angle of friction (for example for soils)
chi	χ	(To be avoided as far as possible)
psi	ψ	(Void)
omega	ω	(Void)

1) Some countries use σ or β with subscript for strength, but f is recommended (see table 3).

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

3) Some countries use f with subscript for stress, but σ is recommended (see table 3).

4) 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.)
′ (apostrophe)	Compression (especially for geometrical or locational purposes)
e	Base of Naperian logarithms : 2,718 28 . . .
π	Ratio of the circumference of a circle to its diameter : 3,141 59 . . .
n	Number of . . .

TABLE 6 — **General subscripts — Roman lower case letters**[1)]

Letter	Meaning
a (or sa)	Structural steel
b (or c)	Concrete
c (or b)	Concrete
c	Compression in general
d	Design[2)]
e (or el)	Elastic limit[3)]
f	Beam flange
f	Friction
g	Guaranteed
h	Horizontal
i	Initial
j	Number of days
k	Characteristic
l	Longitudinal
m	Average value
m	Material
n	Net[4)]
o	Zero
p (or sp)	Prestressing steel
q	(Void)
r	(Void)
s	Reinforcing steel
t	Tension in general
t	Transversal
u	Ultimate
v	Vertical
w	Web
x	Co-ordinate
y	Co-ordinate
y	Yield
z	Co-ordinate
0, 1, 2, etc.	Particular values
∞	Asymptotic value

1) Other than subscripts for actions and action-effects (see table 7) and subscripts formed from abbreviations (see table 8).

2) To be used only when there is no risk of confusion

3) If necessary, a suitable subscript may be added or substituted in order to define the elastic limit more precisely (for example : *y*; 0, 1, etc.).

4) If there is a risk of confusion, "net" shall be used.

TABLE 7 — **Subscripts for actions and action-effects**[1)]

Letter		Meaning
a	(A)	Accidental action[2)]
eq	(E)	Earthquake action
f	(F)	Action in general
f	(F)	Force in general
g	(G)	Permanent load (Dead load)
m	(M)	Bending in general
n	(N)	Normal force
p	(P)	Pre-stressing force
q	(Q) or v (V)	Variable load (Live load)[3) 4)]
s	(S)	Action-effect
s	(S)	Snow load
t	(T)	Torsion in general
t	(T)	Temperature
v	(V) or q (Q)	Shear force[4)]
w	(W)	Wind load

1) When it is necessary for clarification, Roman upper case letters may be used as subscripts for actions and action-effects.

2) If there is a risk of confusion, "ac" may be used.

3) An imposed load must be defined more precisely.

4) See note 2 to table 2.

TABLE 8 — **Subscripts formed from abbreviations**[1)]

Letters	Meaning
abs	Absolute
adm	Admissible (Permissible)
cal	Calculated[2)]
crit (or cr)	Critical
ef	Effective
el (or e)	Elastic in general
est	Estimated
exc	Exceptional
ext	External
inf	Inferior
int	Internal
lat	Lateral
lim	Limit
max	Maximum
min	Minimum
nom	Nominal
obs	Observed
pl	Plastic
red	Reduced
rel	Relative
ser	Serviceability
sup	Superior
tot	Total
var	Variable

1) As far as possible, abbreviations which are not contained in this table should be derived from words having Latin roots.

2) As opposed to "observed".