SLOVENSKI STANDARD
SIST EN 10080:2005

01-september-2005

Nadomešča:
SIST ENV 10080:1997

Jeklo za armiranje betona – Varivo armaturno jeklo - Splošno

Steel for the reinforcement of concrete - Weldable reinforcing steel - General

Stahl für die Bewehrung von Beton - Schweißgeeigneter Betonstahl - Allgemeines

Aciers pour l'armature du béton - Aciers soudables pour béton armé - Généralités

Ta slovenski standard je istoveten z: EN 10080:2005

ICS:

77.140.15	Jekla za armiranje betona	Steels for reinforcement of concrete

SIST EN 10080:2005 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10080

May 2005

ICS 77.140.15; 77.140.60; 77.140.65

Supersedes ENV 10080:1995

English version

Steel for the reinforcement of concrete - Weldable reinforcing steel - General

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This European Standard was approved by CEN on 21 April 2005.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Ref. No. EN 10080:2005: E

Contents

Foreword

This document (EN 10080:2005) has been prepared by Technical Committee ECISS/TC 19 “Concrete reinforcing and pre-stressing steels - Properties, dimensions, tolerances and specific tests”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2005, and conflicting national standards shall be withdrawn at the latest by May 2007.

This document has been prepared under Mandate M/115 given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of the EU Construction Products Directive (89/106/EEC).

For relationship with the EU Construction Products Directive, see informative Annex ZA, which is an integral part of this document.

This document does not apply to non-weldable reinforcing steel.

This document does not define technical classes. Technical classes should be defined in accordance with this document by specified values for R_e, A_{gt}, R_m/R_e, $R_{e,act.}/R_{e,nom.}$ (if applicable), fatigue strength (if required), bendability, weldability, bond strength, strength of welded or clamped joints (for welded fabric or lattice girders) and tolerances on dimensions.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

1.1 This European Standard specifies general requirements and definitions for the performance characteristics of weldable reinforcing steel used for the reinforcement of concrete structures, delivered as finished products in the form of:

— bars, coils (rod, wire) and de-coiled products;

— sheets of factory-made machine-welded fabric;

— lattice girders.

1.2 Steels according to this European Standard have a ribbed, indented or smooth surface.

1.3 This European Standard does not apply to:

— non-weldable reinforcing steel;

— galvanized reinforcing steel;

— epoxy-coated reinforcing steel;

— corrosion resistant reinforcing steel;

— prestressing steels (see prEN 10138-1 to -4);

— indented strip;

— further processing, e.g. cutting or cutting and bending.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10020:2000, *Definition and classification of grades of steel*

EN 10079:1992, *Definition of steel products*

EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997)*

EN ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension / compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

EN ISO 15630-1, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 1: Reinforcing bars, wire rod and wires (ISO 15630-1:2002)*

EN ISO 15630-2, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 2: Welded fabric (ISO15630-2:2002)*

NOTE See also C.2 and D.2.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 10020:2000 and EN 10079:1992 and the following apply.

3.1
reinforcing steel
steel product with a circular or practically circular cross-section which is suitable for the reinforcement of concrete

3.2
ribbed reinforcing steel
reinforcing steel with at least two rows of transverse ribs, which are uniformly distributed over the entire length

3.3
longitudinal rib
uniform continuous protrusion parallel to the axis of the bar, rod or wire

3.4
transverse rib
any rib on the surface of the bar, rod or wire other than a longitudinal rib

3.5
rib height, *h*
distance from the highest point of the rib (transverse or longitudinal) to the surface of the core, to be measured normal to the axis of the bar, rod or wire

3.6
rib or indentation spacing, *c*
distance between the centres of two consecutive transverse ribs or two consecutive indentations measured parallel to the axis of the bar, rod or wire

3.7
angle of transverse rib or indentation inclination, ß
angle between the axis of the transverse rib or indentation and the longitudinal axis of the bar, rod or wire

3.8
transverse rib flank inclination, α
angle of the rib flank measured perpendicular to the longitudinal axis of the rib

3.9
relative rib area, f_R
area of the projection of all ribs on a plane perpendicular to the longitudinal axis of the bar, rod or wire, divided by the rib spacing and the nominal circumference

3.10
indented reinforcing steel
reinforcing steel with defined indentations uniformly distributed over the entire length

3.11
indentation depth, *t*
distance between the surface of the wire and the deepest point of the indentation

3.12
indentation width, *b*
width of the indention to be measured parallel to the axis of the bar, rod or wire

3.13
plain reinforcing steel
reinforcing steel with a smooth surface

3.14
coil
single length of reinforcing steel (usually rod or wire) wound in concentric rings

3.15
de-coiled product
reinforcing steel manufactured in coils and subsequently straightened for further processing

3.16
nominal cross-sectional area, A_n

cross-sectional area equivalent to the area of a circular plain bar of the same nominal diameter, d (i.e. $\frac{\pi d^2}{4}$)

3.17
welded fabric
arrangement of longitudinal and transverse bars, rods or wires of the same or different nominal diameter and length that are arranged substantially at right angles to each other and factory electrical resistance welded together by automatic machines at all points of intersection

3.18
lattice girder
two or three-dimensional metallic structure comprising an upper chord, one or more lower chords and continuous or discontinuous diagonals which are welded or mechanically assembled to the chords

3.19
characteristic value
value of a material or product property having a prescribed probability of not being attained in a hypothetical unlimited test series

NOTE This value generally corresponds to a specific fractile of the assumed statistical distribution of the particular property of the material or product.

3.20
minimum value
value below which no test result shall fall

3.21
maximum value
value which no test result shall exceed

3.22
batch
quantity of bars, rods, wires or decoiled products of one nominal diameter and one cast either in coils or bars or any quantity of welded fabric or lattice girders of one type produced by one manufacturer and presented for examination at any one time

3.23
factory production control
permanent internal control of production performed by the manufacturer

3.24
semi-finished product
product which requires further processing in order to achieve the standard and special properties specified in this document for reinforcing steels

3.25
standard property
property which is contained in this document as part of the factory production control requirements for every test unit

3.26
special property
property contained in this document which is not determined as part of the factory production control requirements for every test unit

3.27
standard welded fabric
welded fabric manufactured according to specified delivery conditions and available from stock

3.28
purpose made welded fabric
welded fabric manufactured according to user's specific requirements

3.29
longitudinal wire
reinforcing steel in the manufacturing direction of the welded fabric

3.30
transverse wire
reinforcing steel perpendicular to the manufacturing direction of the welded fabric

3.31
twin wires
two wires of the same technical class and nominal diameter placed adjacent to each other as a pair in welded fabrics

3.32
pitch of welded fabric
centre-to-centre distance of wires in a sheet of welded fabric

NOTE For twin wire fabric the pitch is measured between the tangents of the adjacent wires.

3.33
overhang of welded fabric, u_1, u_2, u_3, u_4
length of longitudinal or transverse wires projecting beyond the centre of the outer crossing wire in a sheet of welded fabric

NOTE For twin wire welded fabric the overhang is measured from the tangent line of the adjacent wires.

3.34
length of a welded fabric sheet, *L*
dimension of the longest side of a sheet of welded fabric, irrespective of the manufacturing direction

3.35
width of a welded fabric sheet, *B*
dimension of the shortest side of the sheet of welded fabric, irrespective of the manufacturing direction

3.36
standard lattice girder
lattice girder manufactured according to specified delivery conditions and available from stock

3.37
purpose made lattice girder
lattice girder manufactured according to user's specific requirements

3.38
lower chord
set of longitudinal reinforcing steels placed in the lower part of a lattice girder

NOTE The constituent longitudinal reinforcing steels of the lower chord can be interlinked or not.

3.39
upper chord
longitudinal reinforcement placed in the upper part of a lattice girder, of which the base steel is either a reinforcing steel or a steel strip

3.40
diagonals
reinforcing steels linking the upper and lower chord of a lattice girder

NOTE They form harmonic curves in the case of continuous diagonals or are independent elements in the case of discontinuous diagonals.

3.41
lattice girder length, L
overall length of a lattice girder

3.42
design height of a lattice girder, H_1
distance between the lowest point of the lower chord and the highest point of the upper chord

3.43
overall height of a lattice girder, H_2
distance between the lowest point and the highest point of a lattice girder

3.44
lattice girder overhang, u_1,u_2
length of the diagonals beyond either the upper chord (u_1) or the lower chord (u_2)

3.45
design width of a lattice girder, B_1
distance between the outlying points of the lower chords

3.46
overall width of a lattice girder, B_2
distance between the outlying points of a lattice girder

3.47
pitch of diagonals, P_s
distance between equivalent consecutive junction points of the diagonals with the chords

3.48
angle of inclination of diagonals, ϑ
angle between the axis of a diagonal and the longitudinal axis of a lattice girder in the plane of the diagonal in the middle of the height of a lattice girder

3.49
technical class
type of reinforcing steel defined by its performance characteristics, identified by a unique product number

3.50
reinforcing steel grade
steel grade defined by its characteristic yield strength and ductility requirements

4 Symbols

Symbols used in this European Standard are listed in Table 1.

NOTE For comparison of symbols used in this European Standard with those used in EN 1992-1-1 and EN 1992-1-2 (see Annex E).

Table 1 — List of symbols

Symbol	Description	Unit
A_n	Nominal cross-sectional area	mm^2
A_{gt}	Percentage total elongation at maximum force	%
b	Width of indentation	mm
c	Transverse rib or indentation spacing	mm
C_{eq}	Carbon equivalent value (CEV)	% by mass
C_v	Specified characteristic value	[a]
d	Nominal diameter of the reinforcing steel	mm
e	Gap between rib or indentation rows	mm
f_R	Relative rib area	-
f_P	Relative indentation area	-
h	Rib height	mm
k	Coefficient as a function of the number of test results	-
$\bar{x}$	Average value of test results	[a]
R_e	Yield strength	MPa [b]
R_{eH}	Upper yield strength	MPa [b]
R_m	Tensile strength	MPa [b]
R_m/R_e	Ratio tensile strength/yield strength	-
$R_{p0,2}$	0,2 % proof strength, non proportional extension	MPa [b]
s	Estimate of the standard deviation	[a]
α	Transverse rib flank inclination	°
ß	Angle of transverse rib or indentation inclination	°
$2\sigma_a$	Stress range in the axial load fatigue test	MPa [b]
$\sigma_{max.}$	Specified maximum stress in the fatigue test	MPa [b]
B	Length of transverse wire in welded fabric	mm
d_C	Diameter of transverse wires in welded fabric	mm
d_L	Diameter of longitudinal wires in welded fabric	mm
L	Length of longitudinal wire in welded fabric, or length of lattice girder	mm
N_C	Number of transverse wires in welded fabric	-
N_L	Number of longitudinal wires in welded fabric	-
P_C	Pitch of transverse wires in welded fabric	mm
P_L	Pitch of longitudinal wires in welded fabric	mm
F_s	Shear force of welded connections in welded fabric	kN
$R_{e,act.}$	Actual value of yield strength	MPa [b]
$R_{e,nom.}$	Specified value of yield strength	MPa [b]
$R_{e,act.}/R_{e,nom.}$	Ratio actual value of yield strength / specified value of yield strength	-
a_1, a_2, a_3, a_4	Increment (specified in the product specification)	[a]
u_1, u_2	Overhang of the longitudinal wires in welded fabric or length of the diagonals beyond the upper or lower chord of a lattice girder	mm
u_3, u_4	Overhang of the transverse wires in welded fabric	mm
A_{Ch}	Cross-sectional area of chord	mm^2
A_{Di}	Cross-sectional area of diagonal	mm^2
B_1	Design width of lattice girder	mm
B_2	Overall width of lattice girder	mm
F_d	Shear force of a clamped joint in lattice girder	kN
F_w	Shear force of a single weld in lattice girder	kN
H_1	Design height of lattice girder	mm
H_2	Overall height of lattice girder	mm
P_s	Pitch of diagonals of lattice girder	mm
$R_{e,Ch}$	Yield strength of the chord in lattice girder	MPa [b]
$R_{e,Di}$	Yield strength of the diagonal in lattice girder	MPa [b]
t	Depth of indentation	mm
t_s	Thickness of metal strip in lattice girder	mm
ϑ	Inclination of the diagonals in lattice girder	°

(*to be continued*)

Table 1 — List of symbols (***concluded***)

Symbol	Description	Unit
b	Width of the beam (beam test)	mm
d_m	Bend diameter (beam test)	mm
F_a	Total force applied (beam test)	kN
F_a	Tension force (pull-out test)	kN
f_c	Average of concrete strength (pull-out test)	MPa [b]
f_{cm}	Target value of the concrete strength class (pull-out test)	MPa [b]
F_i	Force in hinge and bar or wire (beam test)	kN
v_p	Loading rate (pull-out test)	N/s
Δ_o	Slip (pull-out test)	mm
σ_s	Stress in the bar or wire (beam test)	MPa [b]
τ_b	Bond stress (beam test)	MPa [b]
τ_{bu}	Bond stress at maximum force (beam test)	MPa [b]
τ_{dm}	Bond stress (pull-out test)	MPa [b]
$\tau_{0,01}$, $\tau_{0,1}$, τ_1	Bond stress at 0,01 mm, 0,1 mm and 1 mm slip (beam test)	MPa [b]
[a] The unit depends on the property. [b] 1 MPa = 1 N/mm^2.		

5 Designation

5.1 Bar, coil and de-coiled product

The products covered by this European Standard shall be designated with the following information:

a) description of the product form (i.e. bar, coil, de-coiled product);

b) number of this European Standard;

c) nominal dimensions of the product;

d) technical class.

5.2 Welded fabric

Welded fabric shall be designated with the following information:

a) designation of the product form (welded fabric);

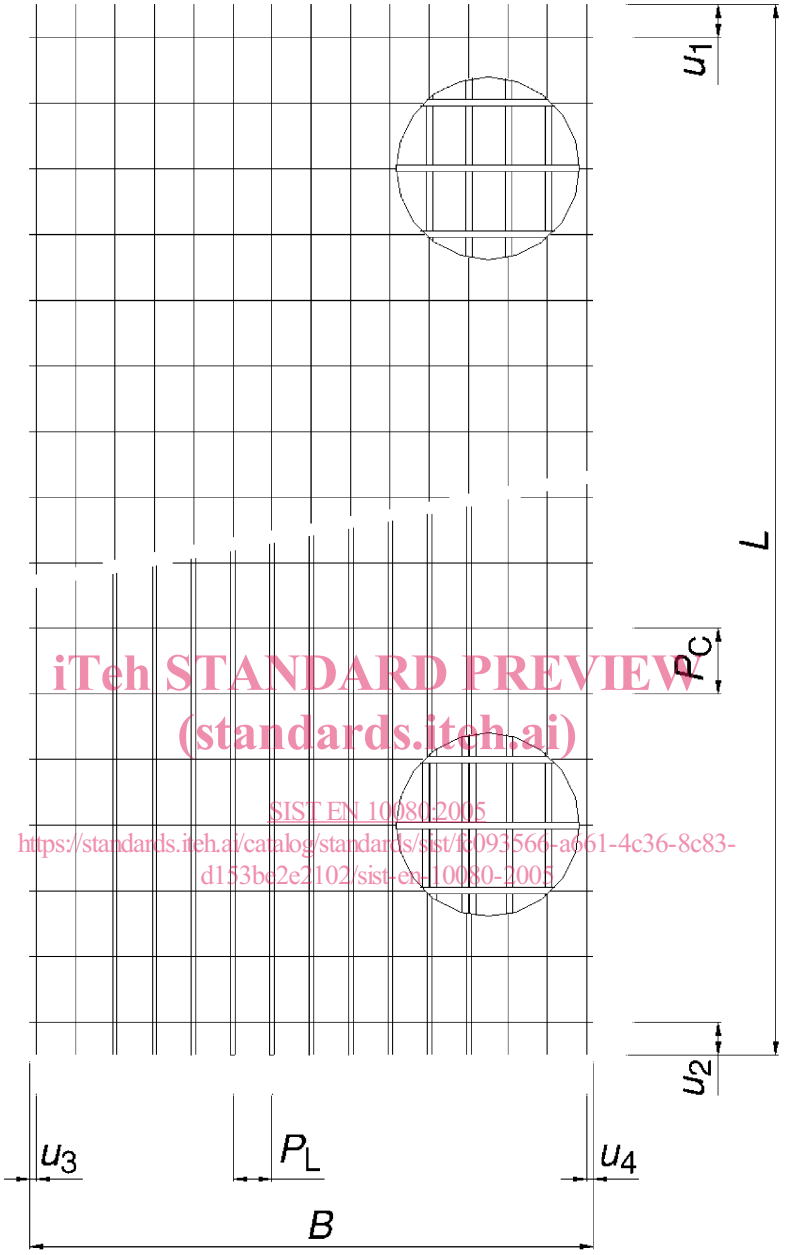
b) number of this European Standard;

c) nominal dimensions of the product (dimensions of the wires, dimensions of the sheet, pitch of wires, overhangs);

d) technical class(es) of the steel(s).

NOTE 1 Brief designations are widely used to describe standard welded fabric. The relevant mesh arrangement can be seen from the tabulated data issued by the manufacturer.

NOTE 2 Purpose made welded fabric can be described using the indications given in Figure 1, or by a fully dimensioned drawing, and should be identified by the user's reference.



Key

N_L	number of longitudinal wires
P_L	pitch of longitudinal wires
d_L	diameter of longitudinal wires
N_C	number of transverse wires
P_C	pitch of transverse wires
d_C	diameter of transverse wires
L	length of longitudinal wire
B	length of transverse wire
u_1	overhang of the longitudinal wires
u_2	overhang of the longitudinal wires
u_3	overhang of the transverse wires
u_4	overhang of the transverse wires

Figure 1 — Geometrical characteristics of purpose made welded fabric

5.3 Lattice girders

Lattice girders (see Figure 2) shall be designated with the following information:

a) designation of the product form, and/or product name (lattice girder);

b) number of this European Standard;

c) design height of the lattice girder;

d) nominal dimensions of the upper chord, diagonal and lower chord;

e) technical class(es) of the steel(s) for the upper chord, diagonal and lower chord.

NOTE Lattice girders can be described using the indications given in Figure 2, or by a fully dimensioned drawing and should be identified by the user's reference.

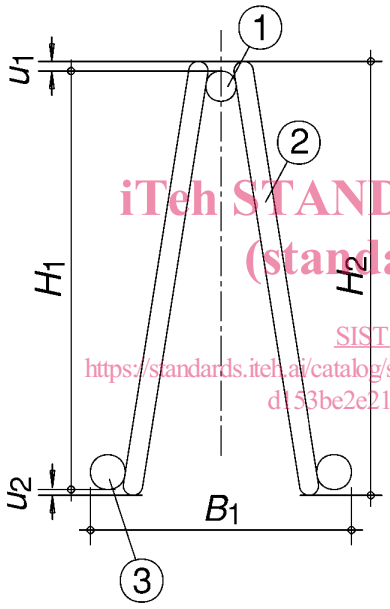


Figure 2a)

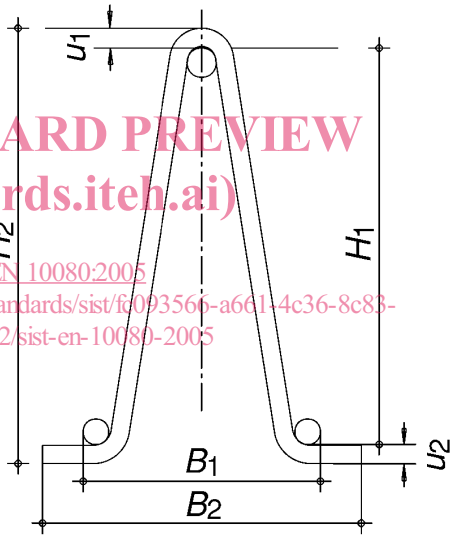


Figure 2b)

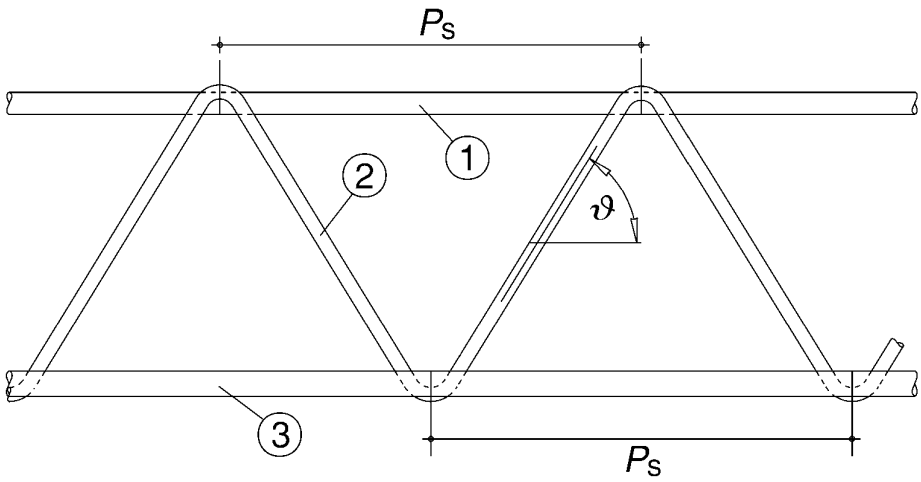


Figure 2c)

Key
1 upper chord
2 diagonal
3 lower chord

Figure 2 — Height (H_1, H_2), width (B_1, B_2), overhang (u_1, u_2) and pitch of diagonals (P_s) of a lattice girder

6 Steelmaking and manufacturing processes

6.1 The melting process and type of de-oxidation of the steel is at the discretion of the steel producer.

6.2 The manufacturing process for the production of coils and bars is at the discretion of the manufacturer. It shall be reported to the purchaser if requested.

6.3 De-coiling of coil material shall be done by a machine made for this purpose.

6.4 The manufacture of reinforcing steel by re-rolling finished products (e.g. sheets or rails) is not permitted.

6.5 All welded fabric shall be factory made and machine welded. The joints, at the intersection of the longitudinal wires and the transverse wires, shall be made by electrical resistance welding, to provide a specified shear resistance.

Welded fabric may be composed of a different technical class in each direction.

Twin wire welded fabric shall be composed of twin wires in only one direction.

6.6 All lattice girders shall be factory made, and may be made from bars and coils or strip (for upper chords only). The joints between chords and diagonals shall be made by electrical resistance welding, or by mechanical clamping, to provide a specified shear resistance.

7 Performance characteristics

7.1 Weldability and chemical composition

7.1.1 Weldability is determined by two characteristics:

— carbon equivalent;