

BS EN ISO 15630-3:2010



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Steel for the reinforcement and prestressing of concrete — Test methods

Part 3: Prestressing steel

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This British Standard is the UK implementation of EN ISO 15630-3:2010. It supersedes BS EN ISO 15630-3:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/104, Concrete Reinforcing and Pre-Stressing Steels.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

The text of ISO 15630-3:2010 has been prepared by Technical Committee ISO/TC 17 “Steel” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 15630-3:2010 by Technical Committee ECISS/TC 104 “Concrete reinforcing and prestressing steels” 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of an identical text or by endorsement, at the latest by April 2011, and conflicting national standards shall be withdrawn at the latest by April 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 15630-3:2002.

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Endorsement notice

The text of ISO 15630-3:2010 has been approved by CEN as a EN ISO 15630-3:2010 without any modification.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15630-3 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 16, *Steels for the reinforcement and prestressing of concrete*.

This second edition cancels and replaces the first edition (ISO 15630-3:2002), which has been technically revised.

ISO 15630 consists of the following parts, under the general title *Steel for the reinforcement and prestressing of concrete — Test methods*:

- *Part 1: Reinforcing bars, wire rod and wire*
- *Part 2: Welded fabric*
- *Part 3: Prestressing steel*

Introduction

The aim of ISO 15630 is to provide all relevant test methods for reinforcing and prestressing steels in one standard. In that context, the existing International Standards for testing these products have been revised and updated. Some further test methods have been added.

Reference is made to International Standards on the testing of metals, in general, as they are applicable. Complementary provisions have been given if needed.

Steel for the reinforcement and prestressing of concrete — Test methods —

Part 3: Prestressing steel

1 Scope

This part of ISO 15630 specifies test methods applicable to prestressing steels (bar, wire or strand) for concrete.

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.

ISO 4957, *Tool steels*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

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 7801:1984, *Metallic materials — Wire — Reverse bend test*

ISO 9513, *Metallic materials — Calibration of extensometers used in uniaxial testing*

3 Symbols

The symbols used in this part of ISO 15630 are given in Table 1.

Table 1 — Symbols

Symbol	Unit	Description	Reference
a_m	mm	Rib height at the mid-point	13.3, 14.2
$a_{\max}$	mm	Maximum height of rib or depth of indentation	13.3
$a_{s,i}$	mm	Average height of a portion i of a rib subdivided into p parts of length Δl	14.2
$a_{1/4}$	mm	Rib height at the quarter-point	13.3, 14.2
$a_{3/4}$	mm	Rib height at the three-quarters point	13.3, 14.2
A	%	Percentage elongation after fracture	5.1, 5.3
A_{gt}	%	Percentage total elongation at maximum force	Clause 5
b	mm	Width of transversal rib at the mid-point	13.3.1.6
c	mm	Rib or indentation spacing	13.3
C	mm	Groove width at nominal diameter of the mandrel, d_a , used for the deflected tensile test	11.3.4
d	mm	Nominal diameter of the bar, wire or strand	5.3.1, 7.2, 9.2, 9.4.6, 10.3.4
d_a	mm	Nominal diameter of the mandrel used for the deflected tensile test	11.3.4
d_b	mm	Diameter with 2 gauge cylinders in the groove of the mandrel used for the deflected tensile test	11.3.4
d_e	mm	Diameter of the gauge cylinder used for the deflected tensile test	11.3.4
d_g	mm	Diameter of guide hole	7.2
d_i	mm	Inner diameter of the groove of the mandrel used for the deflected tensile test	11.3.4
D	%	Average coefficient of reduction of the maximum force in the deflected tensile test	11.2, 11.4
D_c	mm	Inner diameter of the cell in the stress corrosion test	10.3.4
D_i	%	Individual percentage of reduction of the maximum force in the deflected tensile test	11.4
D_m	mm	Diameter of the mandrel of the bending device in the bend test	6.2.1
e	mm	Average gap between two adjacent ribs or indentation rows	13.3.1.4, 13.3.2.5
E	MPa	Modulus of elasticity	5.2, 5.3
f	Hz	Frequency of force cycles in the axial force fatigue test	9.1, 9.4.2
f_R	—	Relative rib area	Clause 14
$F_{a,i}$	N	Individual breaking force in the deflected tensile test	11.4
F_m	N	Maximum force in the tensile test	5.3
$\bar{F}_m$	N	Mean value of the maximum force	8.2, 10.2, 11.2, 11.4
$F_{p0,1}$	N	0,1 % proof force, non-proportional extension	5.2, 5.3
$F_{p0,2}$	N	0,2 % proof force, non-proportional extension	5.2, 5.3
F_r	N	Force range in the axial force fatigue test	9.1, 9.3, 9.4.2

Table 1 (continued)

Symbol	Unit	Description	Reference
F_{rt}	N	Residual force in the test piece at time t in the relaxation test	8.1
ΔF_{rt}	N	Force loss in the test piece at time t in the relaxation test	8.1
F_R	mm ²	Area of longitudinal section of one rib	14.2
F_{up}	N	Upper force in the axial force fatigue test	9.1, 9.3, 9.4.2
F_0	N	Initial force in the isothermal stress relaxation test and the stress corrosion test	8.1, 8.2, 8.3, 8.4, 10.1, 10.2, 10.4.2
G	mm	Depth of the groove of the mandrel used for the deflected tensile test	11.3.4
h	mm	Distance from the top tangential plane of cylindrical supports to the bottom face of the guide	7.2
h_b	mm	Bow height in the plane of the bow	13.3.4
l	mm	Length of indentation	13.3.2.4
L_t	mm	Length of the test piece in the stress corrosion test	10.2
L_0	mm	Gauge length (without force on the test piece) in the isothermal stress relaxation test Length of the test piece in contact with the solution in the stress corrosion test	8.1, 8.3, 8.4 10.2, 10.3.4, 10.4.1, 10.4.3, 10.4.5
ΔL_0	mm	Elongation of the gauge length, L_0 , under force, F_0 , in the isothermal stress relaxation test	8.1, 8.3, 8.4
L_1	mm	Length of the passive side in the deflected tensile test	11.3.2
L_2	mm	Length of the active side in the deflected tensile test	11.3.2
m, n	—	Coefficients or numbers	8.4.9, 13.3, 14.2
P	mm	Lay length of a strand	13.3.3
r	mm	Radius of cylindrical supports	7.2
R	mm	Radius at the base of the mandrel used for the deflected tensile test	11.3.4
Ra	µm	Surface roughness of the mandrel used for the deflected tensile test	11.3.4
S_n	mm ²	Nominal cross-sectional area of the test piece	5.3.2
t_a	h	Maximum agreed time for the stress corrosion test	10.4.5
$t_{f,i}$	h	Individual lifetime to fracture in the stress corrosion test	10.4.5
$\bar{t}_f$	h	Median lifetime to fracture in the stress corrosion test	10.4.6
t_0	s	Starting time in the isothermal stress relaxation test and in the stress corrosion test	8.4.2, 10.4
V_0	mm ³	Volume of test solution to fill the test cell in the stress corrosion test	10.4.3
Z	%	Percentage reduction of area	5.3.1
α	°	Angle of deviation in the deflected tensile test	11.3.2
β	°	Rib or indentation angle to the bar or wire axis	13.3
ε_x	—	Value of the strain for a force equal to x	5.3.2
ρ	%	Relaxation	8.4.9
$\sum e_i$	mm	Part of the circumference without indentation or rib	13.3.1.4, 13.3.2.5, 14.2
NOTE 1 MPa = 1 N/mm ² .			

4 General provisions concerning test pieces

Unless otherwise agreed or specified in the product standard, the pieces shall be taken from the finished product normally before packaging.

Special care should be taken when sampling is made from the packaged product (e.g. coil or bundle), in order to avoid plastic deformation which could change the properties of the samples used to provide the test pieces.

Specific complementary provisions concerning the test pieces may be indicated in the relevant clauses of this part of ISO 15630, if applicable.

5 Tensile test

5.1 Test piece

In addition to the general provisions given in Clause 4, the free length of the test piece shall be sufficient for the determination of the percentage total elongation at maximum force (A_{gt}) in accordance with 5.3.1.

If the percentage elongation after fracture (A) is determined manually, the test piece shall be marked in accordance with ISO 6892-1.

If the percentage total elongation at maximum force (A_{gt}) is determined by the manual method for bar or wire, equidistant marks shall be made on the free length of the test piece (see ISO 6892-1). The distance between the marks shall be 20 mm, 10 mm or 5 mm, depending on the test piece diameter.

5.2 Test equipment

The test equipment shall be verified and calibrated in accordance with ISO 7500-1 and shall be at least of class 1.

If an extensometer is used, it shall be of class 1 in accordance with ISO 9513 for the determination of E , $F_{p0,1}$ or $F_{p0,2}$; for the determination of A_{gt} , a class 2 extensometer (see ISO 9513) may be used.

Grips shall be such as to avoid breaks in or very near the grips.

5.3 Test procedure

5.3.1 General

The tensile test for the determination of the modulus of elasticity (E), 0,1 % and 0,2 % proof force ($F_{p0,1}$ and $F_{p0,2}$), percentage total elongation at maximum force (A_{gt}) and/or percentage elongation after fracture (A) and percentage reduction of area (Z) shall be carried out in accordance with ISO 6892-1.

An extensometer shall be used for the determination of the modulus of elasticity (E), 0,1 % and 0,2 % proof force ($F_{p0,1}$ and $F_{p0,2}$) and percentage total elongation at maximum force (A_{gt}). The extensometer gauge length shall be as given in the relevant product standard.

Accurate values of A_{gt} can only be obtained with an extensometer. If it is not possible to leave the extensometer on the test piece to fracture, the elongation may be measured as follows.

- Continue loading until the extensometer records an elongation just greater than the elongation corresponding to $F_{p0,2}$, at which the extensometer is removed and the distance between the testing machine cross-heads is noted. The loading is continued until fracture occurs. The final distance between the cross-heads is noted.