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

Part 1: Reinforcing bars, rods and wire

Aciers pour l'armature et la précontrainte du béton — Méthodes d'essai —

Partie 1: Barres, fils machine et fils pour béton armé

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 17, *Steel*, Subcommittee SC 16, *Steels for the reinforcement and prestressing of concrete.*

This third edition cancels and replaces the second edition (ISO 15630-1:2010), which has been technically revised. Changes have been introduced in the Introduction, Clause 2, Clause 3, Clause 4, Clause 5 (only the title), 5.3, 6.3, 8.3, 8.4.5, 10.3.1.1, 10.3.1.2, 10.3.3 and 11.3.2 and Figure 6. A new Clause 13 has been added for "specialized" tests. The Bibliography has been updated and the dated references have been replaced by undated references.

A list of all parts in the ISO 15360 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The aim of ISO 15630 (all parts) is to provide all relevant test methods for reinforcing and prestressing steels in one standard series.

This document covers standard test methods (see Clauses 5 to 12), as well as specialized test methods (gathered in Clause 13) that are not commonly used in routine testing and that should only be considered where relevant (or specified) in the applicable product standard.

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

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

Part 1: Reinforcing bars, rods and wire

1 Scope

This document specifies chemical and mechanical test methods and measurement methods of geometrical characteristics applicable to reinforcing bars, rods and wire for concrete.

This document does not cover the sampling conditions that are dealt with in the product standards.

A list of options for agreement between the parties involved is provided in Annex A.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 4965-1, *Metallic materials — Dynamic force calibration for uniaxial fatigue testing — Part 1: Testing systems*

ISO 4965-2, *Metallic materials — Dynamic force calibration for uniaxial fatigue testing — Part 2: Dynamic calibration device (DCD) instrumentation*

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

ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*

ISO 6892-3, *Metallic materials — Tensile testing — Part 3: Method of test at low temperature*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

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

ISO 16020, *Steel for the reinforcement and prestressing of concrete — Vocabulary*

3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in ISO 16020 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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For the purposes of this document, the following symbols apply.

Symbol	Unit	Description	Reference
a'	mm	Height of longitudinal rib	10.3.2, 11.3
a_m	mm	Rib height at the mid-point or indentation depth in the centre	10.3.1.2, Figure 6, 11.3.2, 11.4.1, 11.4.2
a_{max}[a]	mm	Maximum height of transverse rib or maximum indentation depth	10.3.1.1
$a_{s,i}$	mm	Average height of a portion i of a rib subdivided into p parts of length Δl, or average depth of a portion i of an indentation subdivided into p parts of length Δx	Figure 6, 11.3.1, 11.4.1
$a_{1/4}$	mm	Rib height at the quarter-point or indentation depth at the quarter of their length	10.3.1.2, 11.3.2, 11.4.2
$a_{3/4}$	mm	Rib height at the three-quarters point or indentation depth at the three-quarters of their length	10.3.1.2, 11.3.2, 11.4.2
A	%	Percentage elongation after fracture	5.1, 5.3
A_g	%	Percentage plastic extension at maximum force (F_m)	5.3
A_{gt}	%	Percentage total extension at maximum force (F_m)	Clause 5
A_r	%	Percentage uniform elongation after fracture	5.3
b	mm	Width of transverse rib at the mid-point or width of indentation	10.3.8
c	mm	Transverse rib or indentation spacing	Figure 6, 10.3.3, 11.3
d	mm	Nominal diameter of the bar, rod or wire	5.3, Figure 3, 8.2, 8.4.7, 11.3, 11.4, Table 1, 13.3.4.8
D	mm	Diameter of the mandrel of the bending device in the bend or reb-end test	Figure 2, 6.3, 7.3.2
e	mm	Average gap between two adjacent rib or indentation rows	10.3.5, Figure 6, 11.3.2, Figure 7
f	Hz	Frequency of force cycles in the axial force fatigue test	8.1, 8.4.3, Table 1
f_P	—	Relative indentation area	Clause 11
f_R	—	Relative rib area	Clause 11
F_m	N	Maximum force in the tensile test	5.3
F_P	mm^2	Area of the longitudinal section of one indentation	11.4.1
F_r	N	Force range in the axial force fatigue test	8.1, 8.3, 8.4.2, 8.4.3
F_R	mm^2	Area of the longitudinal section of one rib	Figure 6, 11.3.1
F_{up}	N	Upper force in the axial force fatigue test	8.1, 8.3, 8.4.2, 8.4.3
l	mm	Length of the transverse rib at the rib-core interface	Figure 6
n, m, q, p	—	Quantities used in formulae defining f_R, f_P, F_R and F_P	11.3, 11.4
P	mm	Pitch for cold-twisted bars	10.3.4, 11.3
r_1	mm	Distance between the grips and the gauge length for the manual measurement of A_{gt}	5.3
r_2	mm	Distance between the fracture and the gauge length for the manual measurement of A_{gt}	5.3
R_{eH}	MPa	Upper yield strength	5.3
R_m	MPa	Tensile strength	5.3
$R_{p0,2}$	MPa	0,2 % proof strength, plastic extension	5.2, 5.3
S_n	mm^2	Nominal cross-sectional area of the bar, rod or wire	8.4.2
x	mm	Length of an indentation	Figure 7

NOTE 1 MPa = 1 N/mm^2.

[a] In some product standards, the symbol h is also used for this parameter.

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Symbol	Unit	Description	Reference
α	°	Transverse rib flank inclination	10.3.7
β	°	Angle between the axis of a transverse rib or indentation and the bar, rod or wire axis	10.3.1, 10.3.6, Figure 6, 11.3, 11.4
γ	°	Angle of bend in the bend or rebend test	6.3, Figure 4, 7.3.2
Δl	mm	Incremental part of the length of the transverse rib at the rib-core interface	11.3.1, Figure 6
Δx	mm	Incremental part of the length of an indentation	11.4.1
δ	°	Angle of rebend in the rebend test	Figure 4, 7.3.4
λ	—	Empirical factor in empirical formulae of f_R and f_P	11.3.2, 11.4.2
φ	—	Empirical factor in formula of f_R for ribs of constant height	11.3.2
$2\sigma_a$	MPa	Stress range in the axial force fatigue test	8.4.2
σ_{max}	MPa	Maximum stress in the axial force fatigue test	8.4.2
$\sum e_i$	mm	Part of the circumference without indentation or rib	10.3.5, 11.3.2, 11.4.2

NOTE 1 MPa = 1 N/mm^2.

[a] In some product standards, the symbol h is also used for this parameter.

4 General provisions concerning test pieces

Unless otherwise agreed or specified in the product standard, the test piece shall be taken from the bar, rod or wire in the as-delivered condition.

In the case of a test piece taken from a coil (rod or wire), the test piece shall be straightened prior to any testing by a bend operation with a minimum amount of plastic deformation.

NOTE 1 The straightness of the test piece is critical for the tensile test at room temperature, the tensile test at low temperature, the axial force fatigue test and the cyclic inelastic load test.

The means of straightening the test piece (manual, machine) shall be indicated in the test report.

For routine tests conducted by the manufacturers of reinforcing steels, the test information, including the test piece condition and method of straightening, should be described within internal documentation.

For the determination of the mechanical properties in the tensile test at room temperature, the tensile test at low temperature, the axial force fatigue test and the cyclic inelastic load test, the test piece may be artificially aged (after straightening if applicable), depending on the requirements of the product standard.

If ageing is specified but the product standard does not specify the ageing treatment, the following conditions should be applied: heating the test piece to 100 °C, maintaining at this temperature ±10 °C for a period between 60 min and 75 min and then cooling in still air to ambient temperature.

NOTE 2 Depending on the conditions (number of test pieces, diameter of test pieces, type of heating device), different heating times can be required for the test piece to reach the temperature of 100 °C. Unless otherwise proven, a minimum heating time of 40 min can be assumed for the test pieces to reach the oven/bath operating temperature.

If an ageing treatment is applied to the test piece, the conditions of the ageing treatment shall be stated in the test report.

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