British Standard

BRITISH STANDARD

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15630-2:2002
Incorporating
Corrigendum No. 1

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

Part 2: Welded fabric

The European Standard EN ISO 15630-2:2002 has the status of a British Standard

ICS 77.140.99; 91.080.40

National foreword

This British Standard is the official English language version of EN ISO 15630-2:2002. It is identical with ISO 15630-2:2002.

The UK participation in its preparation was entrusted by Technical Committee ISE/9, Steel for concrete reinforcement, to Subcommittee ISE/9/1, Bars, wire and fabric for concrete reinforcement, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN ISO title page, the EN ISO foreword page, the ISO title page, pages ii to v, a blank page, pages 1 to 11, the Annex ZA page, an inside back cover and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

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13973 Corrigendum No. 1	18 June 2002	Replacing the EN ISO foreword page and incorporating the Annex ZA

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EUROPEAN STANDARD

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EN ISO 15630-2

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ICS 77.140.99; 91.080.40

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English version

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

Aciers pour l'armature et la précontrainte du béton - Méthodes d'essai - Partie 2: Treillis soudés (ISO 15630-2:2002)

Stähle für die Bewehrung und das Vorspannen von Beton - Prüfverfahren - Teil 2: Geschweißte Matten (ISO 15630-2:2002)

This European Standard was approved by CEN on 11 April 2002.

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Foreword

This document (ISO 15630-2:2002) has been prepared by Technical Committee ISO/TC 17 "Steel" in collaboration with Technical Committee ECISS/TC 19 "Concrete reinforcing and prestressing 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 October 2002, and conflicting national standards shall be withdrawn at the latest by October 2002.

This document supersedes ENV 10080:1995.

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

Endorsement notice

The text of the International Standard ISO 15630-2:2002 has been approved by CEN as a European Standard without any modifications.

NOTE Normative references to International Standards are listed in annex ZA (normative).

INTERNATIONAL STANDARD

ISO 15630-2

First edition
2002-04-15

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

Part 2: Welded fabric

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

Partie 2: Treillis soudés

Reference number
ISO 15630-2:2002(E)

Contents

Page

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 3.

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 part of ISO 15630 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15630-2 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 16, *Steels for the reinforcement and prestressing of concrete*.

This part of ISO 15630, together with parts 1 and 3, cancels and replaces ISO 10065:1990, ISO 10287:1992 and ISO 10606:1995.

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 testing of metals in general as they are applicable. Complementary provisions have been given if needed.

Test methods which do not form the subject of an existing International Standard on metal testing are fully described in ISO 15630.

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

Part 2:
Welded fabric

1 Scope

This part of ISO 15630 specifies test methods applicable to welded fabric.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15630. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15630 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4965:1979, *Axial load fatigue testing machines — Dynamic force calibration — Strain gauge technique*

ISO 6892:1998, *Metallic materials — Tensile testing at ambient temperature*

ISO 7438:1985, *Metallic materials — Bend test*

ISO 7500-1:1999, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ISO 9513:1999, *Metallic materials — Calibration of extensometers used in uniaxial testing*

ISO/TR 9769:1991, *Steel and iron — Review of available methods of analysis*

3 Symbols

See Table 1.

Table 1 — Symbols

Symbol	Unit	Description	Reference
A	%	Percentage elongation after fracture	5.1, 5.3
A_g	%	Percentage non-proportional elongation at maximum force (F_m)	5.3
A_{gt}	%	Percentage total elongation at maximum force (F_m)	5
A_n	mm^2	Nominal cross-sectional area of the bar or wire	8.4.2
d	mm	Nominal diameter of the bar or wire	5.3, 7.2, 8.4.8
D	mm	Diameter of the mandrel of the bending device in the bend test on welded intersection	6.2.1 (Figure 2), 6.3
f	Hz	Frequency of load cycles in the fatigue test	8.1, 8.4.3
F_m	N	Maximum force in the tensile test	5.3
F_r	N	Force range in the axial load fatigue test	8.1, 8.3, 8.4.2, 8.4.3
F_s	N	Weld shear force	Clause 7
F_{up}	N	Upper force in the axial load fatigue test	8.1, 8.3, 8.4.2, 8.4.3
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}	N/mm^2	Upper yield strength	5.2, 5.3
R_m	N/mm^2	Tensile strength	5.3
$R_{p0,2}$	N/mm^2	0,2 % proof strength, non-proportional extension	5.2, 5.3
γ	°	Angle of bend in the bend test on welded intersection	6.3
$2\sigma_a$	N/mm^2	Stress range in the axial load fatigue test	8.4.2
σ_{max}	N/mm^2	Maximum stress in the axial load fatigue test	8.4.2
NOTE	$1\ N/mm^2 = 1$ MPa.		

4 General provisions concerning test pieces

The test pieces shall be taken from the welded fabric in the as-delivered condition.

For the determination of the mechanical properties in the tensile test and the fatigue test, the test piece may be artificially aged depending on the requirements of the relevant product standard.

NOTE When the product standard does not specify any ageing treatment, the following conditions may be applied: heating the test piece to 100 °C, maintaining at this temperature ± 10 °C for a period of 1 hour $^{+15}_{0}$ min and then free cooling in still air to the ambient temperature.

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

The test piece shall include at least one welded intersection. The number of welded intersections in the test piece shall be noted in the test report.

Cross wires or bars and the wire or bar not to be tested in a twin wire or bar sample shall be cut off before the test without damaging the wire or bar to be tested or the weld under test.

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 percentage elongations in accordance with 5.3.

When percentage elongation after fracture (A) is determined, the test piece shall be marked according to clause 8 of ISO 6892:1998.

When percentage total elongation at maximum force (A_{gt}) is determined by the manual method, equidistant marks shall be made on the free length of the test piece (see annex H of ISO 6892:1998). The distance between the marks shall be 20 mm, 10 mm or 5 mm, depending on the bar or wire diameter.

5.2 Test equipment

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

When an extensometer is used it shall be of class 1 (see ISO 9513) for the determination of R_{eH} or $R_{p0,2}$; for the determination of A_{gt}, a class 2 extensometer (see ISO 9513) may be used.

5.3 Test procedure

The tensile test shall be carried out in accordance with ISO 6892. For the determination of $R_{p0,2}$, if the straight portion of the force-extension diagram is limited or not clearly defined, one of the following methods shall be applied:

— the procedure recommended in 13.1 of ISO 6892:1998;

— the straight portion of the force-extension diagram shall be considered as the line joining the points corresponding to 0,1 F_m and 0,3 F_m.

In case of dispute, the second procedure shall be applied.

NOTE The test should be considered invalid when the slope of this line differs by more than 10 % from the theoretical value of the modulus of elasticity.

For the calculation of tensile properties (R_{eH} or $R_{p0,2}$, R_m), the nominal cross-sectional area shall be used, unless otherwise specified in the relevant product standard.

Where fracture occurs in the grips or at a distance from the grips of less than 20 mm or d (whichever is the greater), the test may be considered as invalid.

For the determination of percentage elongation after fracture (A), the original gauge length shall be 5 times the nominal diameter (d), unless otherwise specified in the relevant product standard.

For the determination of the percentage total elongation at maximum force (A_{gt}), ISO 6892 shall be applied with the following modifications or complements:

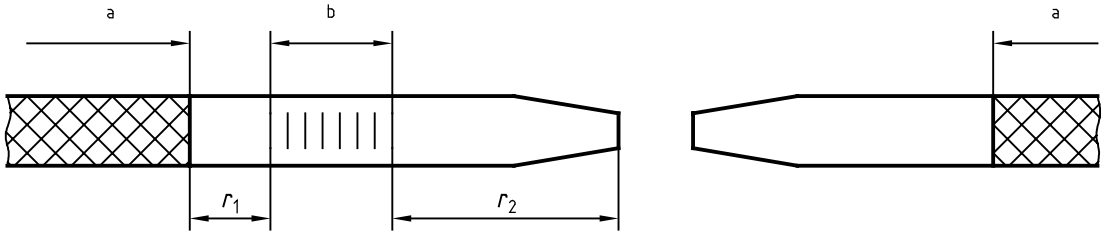
— if A_{gt} is measured by using an extensometer, A_{gt} shall be recorded before the force has dropped more than 0,5 % from its maximum value;

— if A_{gt} is determined by the manual method after fracture, A_{gt} shall be calculated from the following formula:

$$A_{gt} = A_g + R_m / 2\,000$$

where A_g is the percentage non-proportional elongation at maximum force. The measurement of A_g shall be made on a gauge length of 100 mm at a distance, r_2, of at least 50 mm or $2d$ (whichever is greater) away from the fracture. This measurement may be considered as invalid if the distance, r_1, between the grips and the gauge length is less than 20 mm or d (whichever is greater) (see Figure 1);

— in case of dispute, the manual method shall apply.



a Grip length

b Gauge length 100 mm

Figure 1 — Measurement of A_{gt} by the manual method

6 Bend test on welded intersection

6.1 Test piece

The general provisions given in clause 4 apply.

For welded fabric with single wires or bars in both directions, the thicker wire or bar shall be submitted to bending.

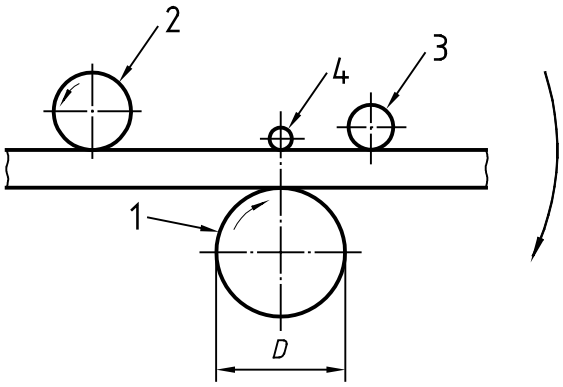
For welded fabric with twin wires or bars, one of the twin wires or bars shall be submitted to bending.

6.2 Test equipment

6.2.1 A bending device, the principle of which is shown in Figure 2, shall be used.

NOTE Figure 2 shows a configuration where the mandrel and support rotate and the carrier is locked. It is also possible that the carrier rotates and the support or mandrel is locked.

6.2.2 The bend test may also be carried out by using a device with supports and a mandrel (see 4.1 of ISO 7438:1985).



Key

1 Mandrel
2 Support
3 Carrier
4 Crossing wire

Figure 2 — Principle of a bending device

6.3 Test procedure

The bend test shall be carried out at a temperature between 10 °C and 35 °C. The test piece shall be bent over a mandrel so that the weld will be in the centre of the bent portion of the test piece and in the zone under tension.

NOTE The bending rate should be about 60 °/s.

The angle of bend (γ) and the diameter of the mandrel (D) shall be in accordance with the relevant product standard.

6.4 Interpretation of test results

The interpretation of the bend test shall be carried out according to the requirements of the relevant product standard.

When these requirements are not specified, the absence of cracks visible to a person with normal or corrected vision is considered as evidence that the test piece has withstood the bend test.

7 Determination of the weld shear force (F_s)

7.1 Test piece

The general provisions given in clause 4 shall apply.

For welded fabric with single wires or bars in both directions, the thicker wire or bar shall be used as the pulling wire or bar.

For welded fabric with twin wires or bars, one of the twin wires or bars shall be the pulling wire or bar.

Test pieces previously subjected to tensile testing may be used for the weld shear test, provided that the necking at the fracture is clear of the weld zone.

7.2 Test equipment

The tensile testing machine shall be verified in accordance with ISO 7500-1 and shall be of class 1 or better.

The holder for the support of the test piece shall be of one of the following three types:

— type a: the cross wire or bar is simply supported by a smooth steel plate, with a slot for the pulling wire or bar. Neither the deflection of the pulling wire or bar nor the rotation of the cross wire or bar is prevented [see Figure 3 a)];

— type b: in addition to the provisions applicable to type a holders, the deflection of the tail of the pulling wire or bar is prevented, but not the rotation of the cross wire or bar. The tail of the pulling wire or bar is supported at a distance of 50 mm from the support surface. The tail support shall allow small movements in the direction of the wire or bar. The side movement of the cross wire or bar due to the reaction from the tail support is prevented by a stopper, adjustable according to the size of the test piece. No initial compression of the joint is allowed [see Figure 3 b)];

— type c: in addition to the provisions applicable to type b holders, the rotation of the cross wire or bar is prevented. The cross wire or bar is firmly tightened between jaws with suitable surface structure. The jaws will also prevent any side movement of the cross wire or bar [see Figure 3 c)].

For all types of holder, the distance between the support and the pulling wire shall be as small as possible but there shall be no friction between the support and the pulling wire.

In case of dispute, a holder of type c shall be used.

The type of holder that is used, shall be stated in the test report.

NOTE 1 The support provisions with holders of type c reproduce best the support conditions of fabric in concrete.

NOTE 2 It is recommended that the distance between the support and the pulling wire be no greater than 0,5 mm for $d \leqslant 9$ mm and 1 mm for $d > 9$ mm.

NOTE 3 The choice of the support provisions will affect the test results.

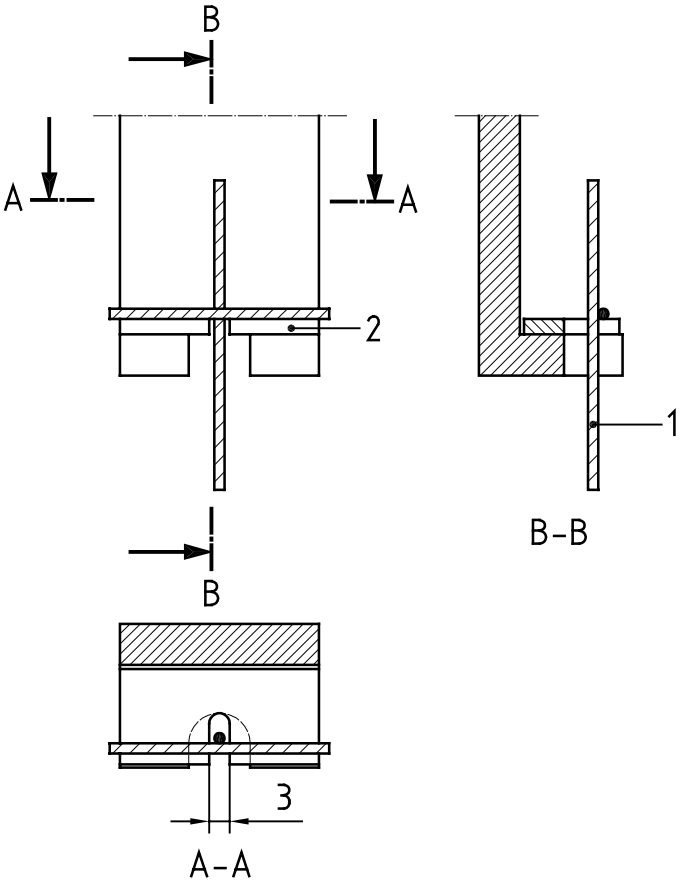
NOTE 4 Figures 3 a), b) and c) are presented as examples of holders of type a, b and c respectively. Other holder shapes may be used. The classification of the holder should be made on the basis of the relevant requirements given in the second paragraph of 7.2.

7.3 Test procedure

The test piece shall be placed on the holder.

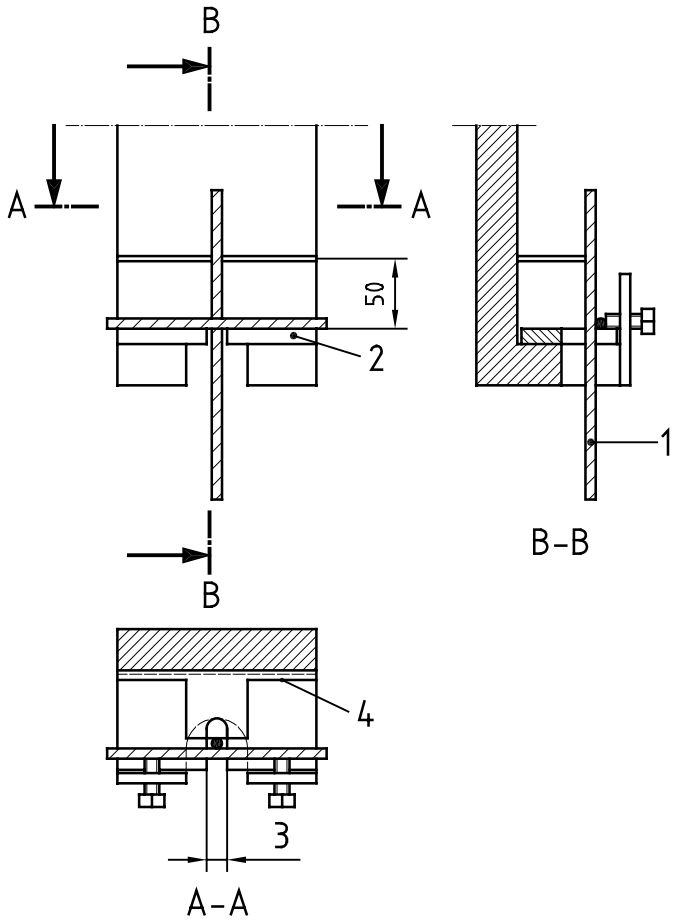
The tensile force shall be applied to the pulling wire or bar with a stress rate between 6 N/mm^{2}s and 60 N/mm^{2}s.

The maximum force, in newtons, during the test and the location of the fracture shall be recorded.



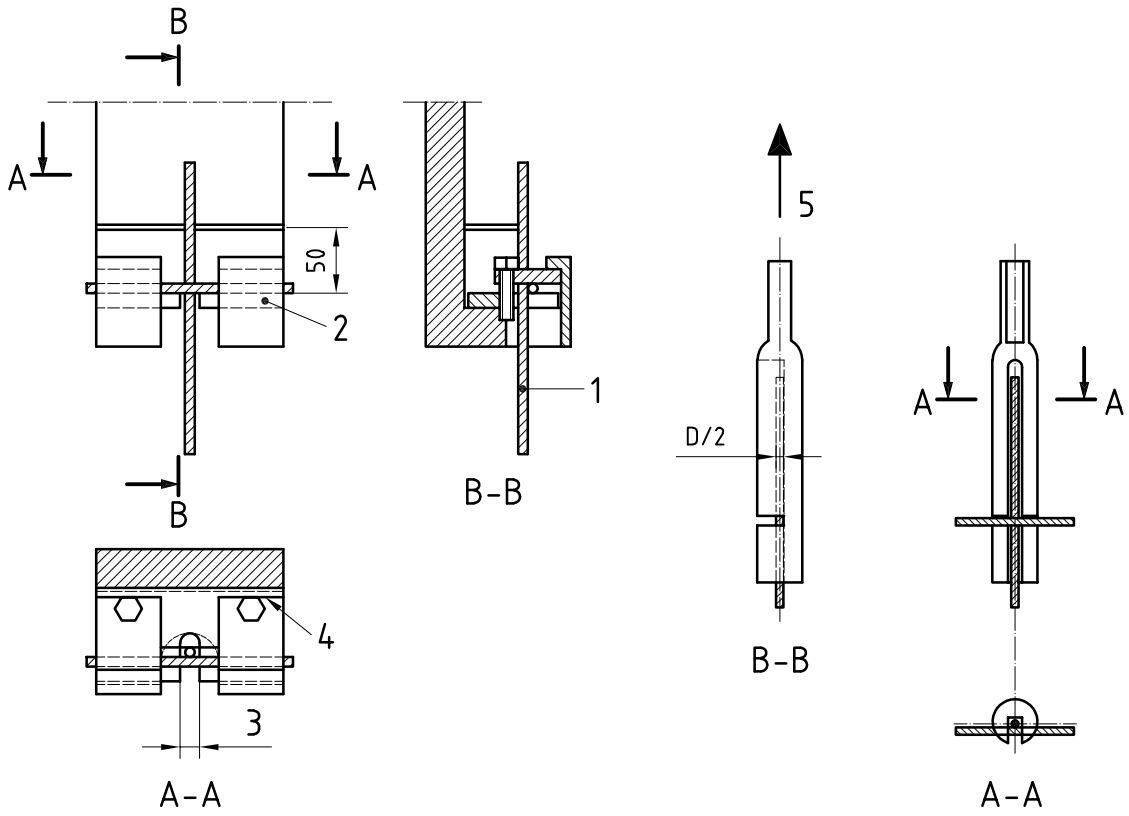
a) **Example of holder of type a**

Dimensions in millimetres



b) **Example of holder of type b**

Dimensions in millimetres



c) **Example of holder of type c**

Key

1 Pulling bar
2 Slot adjusting plate
3 Width of slot
4 Torsion spring
5 Pull

Figure 3 — Examples of holders of type a, b and c

8 Axial load fatigue test

8.1 Principle of test

The axial load fatigue test consists of submitting the test piece to an axial tensile force, which varies cyclically according to a sinusoidal wave-form of constant frequency f (see Figure 4) in the elastic range. The test is carried out until failure of the test piece, or until reaching the number of load cycles specified in the relevant product standard, without failure.

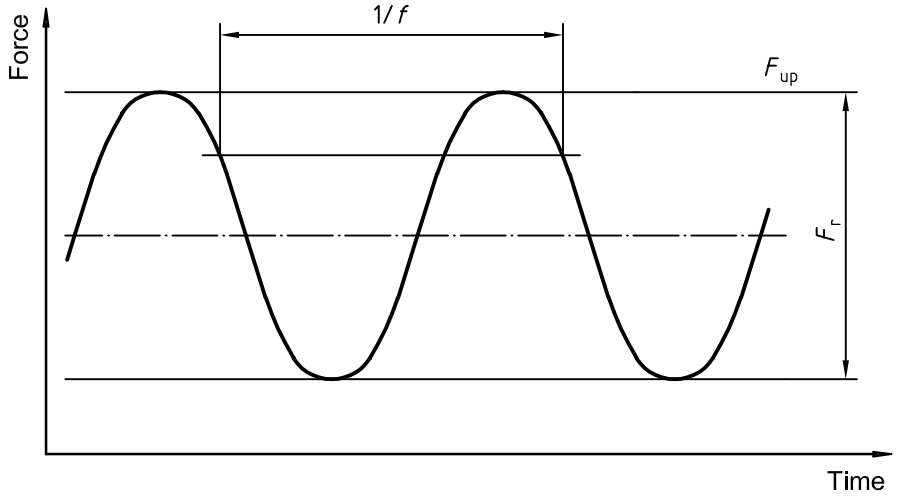


Figure 4 — Load cycle diagram

8.2 Test piece

The general provisions given in clause 4 shall apply.

The surface of the free length between the grips shall not be subjected to any surface treatment of any kind and shall not contain identification marks.

The free length shall be at least 140 mm or 14d, whichever is the greater.

8.3 Test equipment

The fatigue testing machine shall be calibrated in accordance with ISO 4965. The accuracy shall be at least ± 1 %. The testing machine shall be capable of maintaining the upper force (F_{up}) within ± 2 % of the specified value and the force range (F_r) within ± 4 % of the specified value.

8.4 Test procedure

8.4.1 Provisions concerning the test piece

The test piece shall be gripped in the test equipment in such a way that load is transmitted axially and free of any bending moment along the test piece.

8.4.2 Upper force (F_{up}) and force range (F_r)

The upper force (F_{up}) and the force range (F_r) shall be as given in the relevant product standard.

NOTE F_{up} and F_r can be deduced from the maximum stress (σ_{max}) and the stress range ($2\sigma_a$) given in the relevant product standard as follows:

$$F_{up} = \sigma_{max} \times A_n$$

$$F_r = 2\sigma_a \times A_n$$

where A_n is the nominal cross-sectional area of the bar or wire.

8.4.3 Stability of force and frequency

The test shall be carried out under conditions of stable upper force (F_{up}), force range (F_r) and frequency (f). There shall be no interruptions in the cyclic loading throughout the test. However, it is permissible to continue a test which is accidentally interrupted. Any interruption shall be reported.

8.4.4 Counting of load cycles

The number of load cycles shall be counted inclusively from the first full load range cycle.

8.4.5 Frequency

The frequency of load cycles shall be stable during the test and also during the test series. It shall be between 1 Hz and 200 Hz.

8.4.6 Temperature

The temperature of the test piece shall not exceed 40 °C throughout the test. The temperature of the testing laboratory shall be between 10 °C and 35 °C, unless otherwise specified. For tests carried out under controlled conditions the temperature of the testing laboratory shall be (23 ± 5) °C.

8.4.7 Termination of the test

The test shall be terminated upon failure of the test piece before reaching the specified number of cycles or on completion of the specified number of cycles without failure.

8.4.8 Validity of the test

If failure occurs in the grips or within a distance of $2d$ of the grips or initiates at an exceptional feature, the test may be considered as invalid.

9 Chemical analysis

In general, the chemical composition is determined by spectrometric methods.

In case of dispute about analytical methods, the chemical composition shall be determined by an appropriate referee method specified in one of the International Standards listed in ISO/TR 9769:1991.

10 Measurement of the geometrical characteristics of the fabric

10.1 Test piece

The test piece shall consist of a sheet of fabric in the as-delivered condition.

10.2 Test equipment

The wire spacing, the length and width of the sheet shall be measured with an instrument with a resolution of at least 1 mm.

10.3 Test procedure

The sheet of fabric shall be laid on a flat surface.

The length and width shall be determined as the gross dimensions of the sheet.

11 Test report

The test report shall include at least the following information:

a) reference to this part of ISO 15630, i.e. ISO 15630-2;

b) identification of the test piece (including the nominal diameter of the bars or wires);

c) length of the test piece;

d) the type of test and the relevant test results;

e) the relevant product standard, when applicable;

f) any complementary useful information concerning the test piece, test equipment and procedure.

Annex ZA
(normative)

Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE Where an International Publication has been modified by common modifications, indicated by (mod.), the relevant EN/HD applies.

Publication	Year	Title	EN	Year
ISO 7438	1985	Metallic materials - Bend test	EN ISO 7438	2000
ISO 7500-1	1999	Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines	EN ISO 7500-1	1999

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