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Metallic materials — Wire — Reverse torsion test

Matériaux métalliques — Fils — Essai de torsion alternée

FDIS stage

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Foreword

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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~~www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 2, *Ductility testing*.

This third edition cancels and replaces the second edition (ISO 9649:2016), which has been technically revised.

The main changes are as follows:

— ~~—~~a specification has been added at the end of ~~9.2.~~9.2;

— ~~—~~a specification has been added at the end of ~~clause 10~~Clause 10 [See g)].

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~~www.iso.org/members.html.

Metallic materials — Wire — Reverse torsion test

1 Scope

This document specifies a method for determining the ability of metallic wire, of diameter dimension from 0,3 to 10,0 mm inclusive, to undergo plastic deformation during reverse torsion. This test is used to detect surface defects, as well as to assess ductility.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

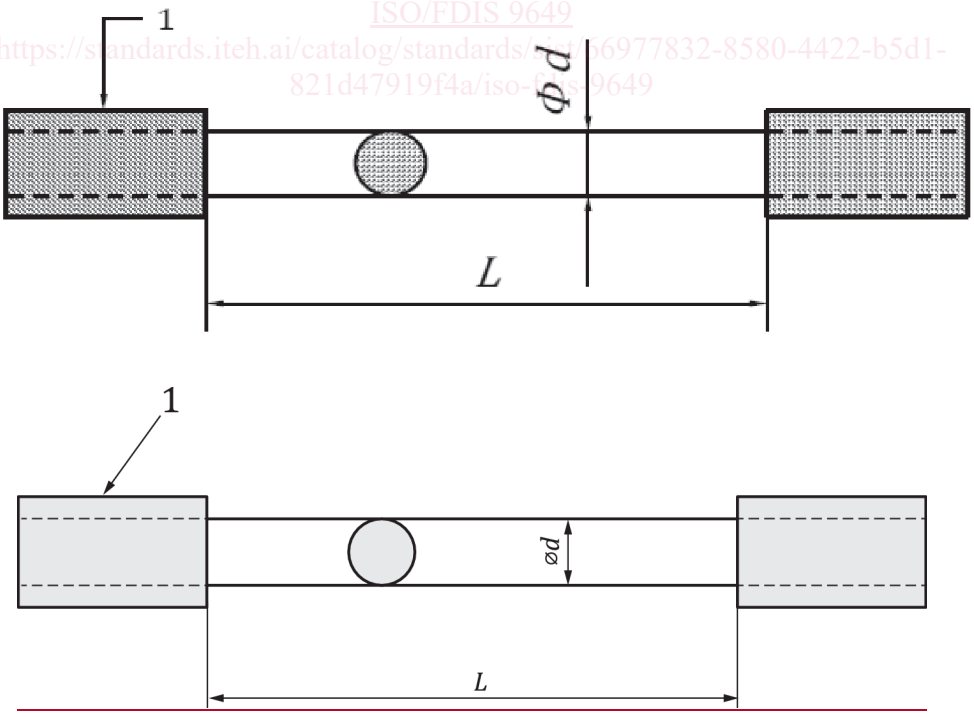
ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

4 Symbols and designations

The symbols and designations used in the reverse torsion test of wires are shown in Figure 1 and specified in Table 1.



Key

1 grip

Figure 1

Table 1 — Symbols and designations

Symbol	Designation	Unit
d	Diameter of a round wire	mm
L	Free length between grips	mm
N_1	Number of turns in one direction	—
N_2	Number of turns in the opposite direction	—

5 Principle

A test piece of wire is twisted a specified number of times through 360° around its own axis in one direction, and then a specified number of times through 360° in the opposite direction.

6 Testing equipment

6.1 The grips shall be of sufficient hardness to provide rigidity and/or resistance to abrasion. The grip shall be arranged in the testing machine in such a way that, during testing, they remain on the same axis and do not apply any bending force to the piece.

One of the grips shall be capable of being rotated around the axis of the test piece in two opposite directions while the other shall not be subject to any angular deflection, except for such deflection as may be necessary to measure the torque.

The distance between the grips shall be capable of adjustment for different test piece lengths.

6.2 The machine shall be constructed so that a change of length between the grips, caused by deformation of the test piece during the test, is not prevented.

The machine shall be constructed so that an appropriate tensile stress (see ~~7.1)~~7.1) may be applied to the test piece.

6.3 The testing speed shall be able to be adjusted, and the number of turns shall be recorded.

6.4 A protective shield shall be provided to protect the operator from flying fragment in cases when the wire breaks into more than two pieces.

7 Test piece

7.1 The length of wire to be used as the test piece shall be as straight as possible.

If straightening is necessary, it shall be done by using suitable methods.

During straightening, the surface of the wire shall not be damaged and the test piece shall not be subject to any twisting.

Wire with a localized sharp curvature or kink shall not be used in the test.

7.2 Unless otherwise specified in the relevant standards, the nominal free length between the grips (L) of the test piece shall be as given in ~~Table 2.~~Table 2.

When testing for surface defects, a fixed free length between grips may be used. This length shall be as specified in the relevant standards and shall be stated in the test report.

Table 2 — Dependence of free length between the grips on nominal diameter of the wire

Nominal diameter ***d*** **mm**	**Free length between grips** ***L*** **mm** (nominal)
$0{,}3 \leq d < 1$	$200d$
$1 \leq d < 5$	$100d$[1]
$5 \leq d \leq 10{,}0$	$50d$[2]

[1] $50d$ may be used by special agreement.

[2] $30d$ may be used by special agreement.

8 Test conditions

In general, the test is carried out at ambient temperature between 10 °C and 35 °C. Tests carried out under controlled conditions, where required, shall be made at a temperature of (23 ± 5) °C.

9 Procedure

9.1 Place the test piece in the testing machine in such a way that its longitudinal axis coincides with the axis of the grips and so that it remains straight during the test. Unless otherwise specified, this may be ensured by applying to the test piece a constant tensile stress not exceeding 2 % of the nominal tensile strength of the wire.

9.2 After placing the test piece in the testing machine, rotate one grip at a speed not exceeding 1 turn per second (or not exceeding 0,5 turns per second when the diameter d is 5 mm or greater) through the number of turns, N_1, in one direction and then the other number of turns, N_2, in the opposite direction. In general, N_1 and N_2 are specified in the relevant standards. One turn comprises 360°.

After the test, the free length of wire between the grips shall be examined by eyes unless otherwise specified in the relevant standards. The examination by eyes shall include the configuration of wire, surface defects and cracks and failure of wire.

9.3 If the number of turns, N_2, meets the requirement of the relevant standards, the test piece is considered as having passed the test. If the number of turns, N_2, reached does not meet the requirement of the relevant standards and the failure is within a distance of $2d$ from the grip, the test shall be considered invalid and shall be repeated.

NOTE There is an example for this test in ISO 8458-3.

10 Test report

The test report shall include the following information:

a) ~~a)~~ reference to this document;

b) ~~b)~~ all details necessary for the identification of the test piece (type of the material, heat number, etc.);

c) ~~c)~~ the diameter d of the test piece;

d) ~~d)~~ all details regarding the test piece preparation (method of straightening, etc.);

e) ~~e)~~ the test conditions (the free length between the grips, the tensile stress applied, test speed, etc~~);~~.);

f) ~~f)~~ number of turns (N_1, N_2);

4

g) ~~g)~~ result of the visual examination of the free length of the wire.

Bibliography

[1] ISO 8458-3:2002, *Steel wire for mechanical springs — Part 3: Oil-hardened and tempered wire*

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