INTERNATIONAL STANDARD

ISO 377-1

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Selection and preparation of samples and test pieces of wrought steels —

Part 1:
Samples and test pieces for mechanical test

Prélèvement et préparation des échantillons et éprouvettes en aciers corroyés —

Partie 1: Échantillons et éprouvettes pour essais mécaniques

Reference number
ISO 377-1 : 1989 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 377-1 was prepared by Technical Committee ISO/TC 17, *Steel.*

Together with International Standard ISO 377-2, it cancels and replaces the first edition of ISO 377 (ISO 377 : 1985), of which it constitutes a technical revision.

ISO 377 consists of the following parts, under the general title *Selection and preparation of samples and test pieces of wrought steels*:

- *Part 1: Samples and test pieces for mechanical test*
- *Part 2: Samples for the determination of the chemical composition*

Annexes A and B form an integral part of this part of ISO 377. Annexes C and D are for information only.

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Selection and preparation of samples and test pieces of wrought steels —

Part 1: Samples and test pieces for mechanical test

1 Scope

1.1 This part of ISO 377 specifies all the operations by which samples and test pieces intended for mechanical test are obtained from a given product.

It does not apply to non-destructive tests.

These samples and test pieces are for use in tests which, unless agreed to the contrary when ordering, are carried out in conformity with the methods indicated in the product standard or, in the absence of this, in the test standard.

1.2 This part of ISO 377 applies to crude products,[1) 2)] semi-finished products[2)] and finished wrought steel products, dealt with in ISO 404.

In cases where the product standards or the test standards specify different conditions, these different conditions are applicable.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 377. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 377 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 404 : 1981, *Steel and steel products — General technical delivery requirements.*

ISO 630-1 : —[3)], *Structural steels — Part 1: Plates, wide flats, bars, sections and profiles.*

ISO 683-1 : 1987, *Heat-treatable steels, alloy steels and free-cutting steels — Part 1: Direct-hardening unalloyed and low-alloyed wrought steel in form of different black products.*

ISO 9328-1 : —[3)], *Steel plates and strips for pressure purposes — Technical delivery conditions — Part 1: General requirements.*

ISO 3785 : 1976, *Steel — Designation of test piece axes.*

ISO 9329-1 : 1989, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steels with specified room temperature properties.*

ISO 9330-1 : —[3)], *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steels with specified room temperature properties.*

3 Definitions

NOTE — The equivalent English, French and Russian terms are given in annex C. They are illustrated in figure C.1.

For the purposes of this part of ISO 377, the following definitions apply.

3.1 sample product: Item (a sheet, for example) selected from a supplied batch for the purpose of obtaining test pieces.

3.2 sample: A sufficient quantity of material taken from the sample product for the purpose of producing one or more test pieces.

In certain cases, the sample may be the sample product itself.

1) In the context of this standard, the concept of "crude products" includes not only ingots, but also continuously cast products intended for subsequent transformation such as blooms, billets, slabs and all products with other sections.

2) In the case of crude products and semi-finished products, the test pieces are generally obtained from rough specimens (see 3.3).

3) To be published.

3.3 rough specimen: Part of the sample having undergone mechanical treatment, followed by heat treatment where appropriate, for the purpose of producing test pieces.

3.4 test piece: Part of the sample or rough specimen, with specified dimensions, machined or unmachined, brought to a required condition for submission to a given test. In certain cases, the test piece may be the sample itself or the rough specimen.

3.5 reference condition: The sample, rough specimen or test piece may undergo a heat treatment and/or mechanical treatment to bring it to a condition distinct from the as-delivered condition. This condition is known as the reference condition.

In such cases the sample, rough specimen or test piece is called the reference sample, reference rough specimen or reference test piece.

4 General requirements

4.1 Samples, rough specimens and test pieces selected in accordance with the requirements of the product standard or, in the absence of such requirements in accordance with annex A, shall be representative of the product.

4.2 Identification of samples, rough specimens and test pieces

Samples, rough specimens and test pieces shall be marked so that the original product and their location and orientation in the product is known. For this purpose, if, during the preparation of the sample, rough specimen and/or test piece, the removal of the marks cannot be avoided, transfer of these marks shall be carried out before the existing marks are removed. In the case of specific inspection, at the request of the purchaser's representative, transfer of the marks is carried out in his presence.

5 Selection and preparation of sample and rough specimen — Location and orientation of test pieces

5.1 Location and dimensions of the sample

The sample shall be selected so that the location and orientation of the test pieces to be taken from it in relation to the product correspond to the requirements of the product standard or, in the absence of this, to the specifications of annex A.

In cases of dispute, the samples shall be taken at a distance from the end of the product as given in annex B, unless otherwise stated in the product standard or agreed at the time of ordering.

The dimensions of the sample shall be sufficient to allow selection of the test pieces required for carrying out the specified tests. If necessary, a sufficient amount of material shall be provided for carrying out re-tests.

5.2 Location, dimensions and orientation of test pieces

The product standard or the order specifies the location and, where appropriate, the dimension of the test pieces and the orientation of the test piece relative to the principal direction of working. Designation of the test piece axes should be in agreement with ISO 3785.

In the absence of these specifications, the directions in annex A are applicable.

NOTE — In order to reduce losses in material and to take account of established practice, the product standard or the requirements of the order could, in cases where this is technically acceptable, provide for the possibility of using transverse instead of longitudinal test pieces in order to check the specified values for longitudinal test pieces.

In the case of the impact test piece, the longitudinal axis of the notch is normally perpendicular to the rolling skin.

5.3 Selection and preparation of samples

5.3.1 The material or product standard shall specify whether the test is intended to determine the properties

a) in the as-delivered condition (see 5.3.2), or

b) in the reference condition (see 5.3.3).

5.3.2 Test in the as-delivered condition

Unless specified to the contrary in the product standard or in the order, the sample shall be separated from the product only after completion of all the mechanical and/or heat treatments which the product has to undergo before delivery.

If the sample cannot remain attached to the product until manufacture has been completed (for example, sheets sheared before annealing, where the sample is taken from the shear scrap), the stage at which it is detached from the product shall be specified by the product standard or by special agreement. The treatments which the sample subsequently undergoes shall be, as far as possible, the same as those to which the product is submitted. In particular, heat treatments shall be carried out under the same conditions as those for the product itself, and, if possible, at the same time.

Separation of the sample shall be conducted in such a way as not to alter the characteristics of the part of the sample which is to provide the test pieces.

When it is necessary to flatten or straighten the sample in order to take correct test pieces from it, this shall be carried out cold, unless agreed to the contrary. Flattening or straightening is not regarded as a mechanical treatment in the sense of 5.3.3.2 if it does not cause work hardening likely to change the mechanical characteristics of the steel.

NOTE — In the case of cold-straightened test specimens, a heat treatment may be necessary in order to minimize the Bauschinger effect. The conditions of the heat treatment shall be defined by agreement.

If, in exceptional cases, flattening or straightening causes an appreciable change in the shape of the sample, the method of preparation shall be established by common agreement between the parties.

The sample shall not undergo any other processing or treatment.

5.3.3 Test in a reference condition

5.3.3.1 Sample

The sample shall be detached from the product at the stage of manufacture specified in the product standard or by special agreement.

This separation of the sample can be carried out by any process, provided that this process does not cause any change in the metal remaining after heat treatment. Where this process does cause a change, sufficient material shall be provided so that all the changed material can be removed during the preparation of the test piece. Flattening or straightening shall be carried out either hot or cold, before any heat treatment.

5.3.3.2 Rough specimen (if necessary)

a) Mechanical treatment: the product standard shall specify the conditions for any mechanical treatment (for example, forging, rolling) which the sample has to undergo and shall indicate, in particular, the initial and final dimensions of the sample.

b) Preparatory machining prior to heat treatment: when the sample is to be made smaller for the purposes of heat treatment, the product standard shall specify the dimensions to which the sample shall be reduced. When necessary, the product standard shall also indicate the reduction process.

c) Heat treatment: the heat treatment of the rough specimen shall take place in an environment where the uniformity of the temperature is adequately assured and the temperature is measured by means of a calibrated instrument.

The heat treatment shall be in conformity with the requirements of the product standard or the stipulation laid down in the order.

A rough specimen shall not undergo the specified heat treatment more than once, except in the case of a tempering treatment which may be repeated in the specified range of temperature. A new rough specimen shall be selected for any re-test.

6 Selection and preparation of test pieces

6.1 Cutting and machining

Cutting shall be carried out cold and with such precautions as to avoid superficial work hardening and overheating of the steel, likely to change the mechanical characteristics.

After machining, any marks left by the tool which might interfere with the results of the test shall be removed, either by grinding (with ample coolant supply) or by polishing, provided that the method of finishing chosen maintains the dimensions and shape of the test piece within the tolerances stipulated in the standard for the appropriate test.

The tolerances of the dimensions of the test pieces shall be those stipulated in the appropriate standards for the test methods.

6.2 Treatment

Any treatment of the test piece, the stage of preparation at which this treatment is carried out and the dimensions of the test piece at this moment shall be specified by the product standard.

In the case of heat treatment, the provisions shall be the same as for the rough specimen [see 5.3.3.2 c)].

Annex A
(normative)

Location of samples and test pieces in the product

This annex gives information on the usual location of samples and test pieces in the product, when not specified in the product standard or in the order.

It relates to the following four product categories:

— beams, U-sections, angles, T-sections, Z-sections and hollow sections;

— bars and wire (including wire rod);

— flat products;

— seamless and welded tubes.

The standards ISO 630-1, ISO 683-1, ISO 9328-1, ISO 9329-1, and ISO 9330-1 shall be used as guidance to the location of samples and test pieces.

Annex B
(normative)

Minimum distance of test piece from end of product in case of dispute

Product form	Minimum distance from end of product in case of dispute
Wire coils with rolled ends and a wire diameter[1], in millimetres, of	
⩾ 5 to < 7	5 m
⩾ 7 to < 13	4 m
⩾ 13 to < 18	3 m
⩾ 18 to < 23	2 m
⩾ 23 to < 28	1,5 m
⩾ 28 to < 30	1 m
Strips with rolled ends	1 turn, but maximum 2 turns from the outer end of the coil
Strips with quenched and tempered ends	0,5 × coil diameter, with a minimum of 160 mm
Strips with flame-cut or cold-worked ends	15 mm

1) In the case of wire with non-circular section, take the diameter of the circle which has a cross-sectional area equivalent to that of the non-circular section.

Annex C
(informative)

Equivalent English, French and Russian terms defined in clause 3

Reference (see figure C.1)	English	French	Russian	Sub-clause
A	Sample product	Produit échantillon	Образец-продукт	3.1
B	Sample	Échantillon	Образец	3.2
C	Rough specimen	Ébauche	Керный (неразработанный) Образец	3.3
D	Test piece	Éprouvette	Образец для испытания	3.4

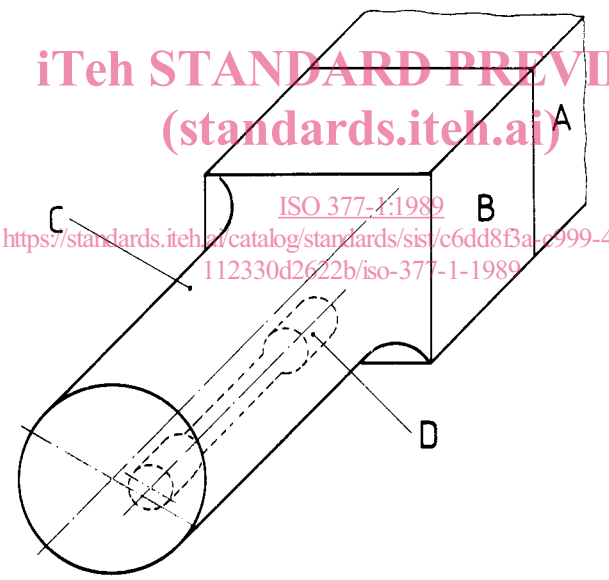

Figure C.1 — Terms defined in clause 3

Annex D
(informative)

Bibliography

ISO 83 : 1976, *Steel — Charpy impact test (U-notch).*

ISO 148 : 1983, *Steel — Charpy impact test (V-notch).*

ISO 6892 : 1984, *Metallic materials — Tensile testing.*