INTERNATIONAL STANDARD

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Third edition
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Wrought aluminium and aluminium alloys — Cold-drawn rods/bars, tubes and wires —

Part 1: Technical conditions for inspection and delivery

Aluminium et alliages d'aluminium corroyés — Barres, tubes et fils étirés à froid —

Partie 1: Conditions techniques de contrôle et de livraison

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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 Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 6, *Wrought aluminium and aluminium alloys*.

This third edition cancels and replaces the second edition (ISO 6363-1:2012), which has been technically revised. The main changes are as follows:

— JIS H1305 has been added as an option for the chemical composition analysis method;

— errors have been corrected and expressions modified throughout.

A list of all parts in the ISO 6363 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.

Wrought aluminium and aluminium alloys — Cold-drawn rods/bars, tubes and wires —

Part 1: Technical conditions for inspection and delivery

1 Scope

This document specifies the technical conditions for the inspection and delivery of wrought aluminium and aluminium alloys rods/bars, tubes and wires for general engineering applications.

It is applicable to products which are extruded and then cold drawn.

It does not apply to:

— products which are rolled and then cold drawn, including seam-welded tubes;

— forging stock, wire for drawing stock;

— drawn wires for aeronautical application, electrical or welding purposes.

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 2107, *Aluminium and aluminium alloys — Wrought products — Temper designations*

ISO 6362-7, *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles — Part 7: Chemical composition*

ISO 6363-2, *Wrought aluminium and aluminium alloys — Cold-drawn rods/bars, tubes and wires — Part 2: Mechanical properties*

ISO 6363-3, *Wrought aluminium and aluminium alloys — Cold-drawn rods/bars, tubes and wires — Part 3: Tolerances on form and dimensions for drawn rods/bars and wires*

ISO 6363-4, *Wrought aluminium and aluminium alloys — Cold-drawn rods/bars, tubes and wires — Part 4: Tolerances on form and dimensions for drawn rectangular bars and wires*

ISO 6363-5, *Wrought aluminium and aluminium alloys — Cold-drawn rods/bars, tubes and wires — Part 5: Tolerances on form and dimensions for drawn square and hexagonal bars and wires*

ISO 6363-6, *Wrought aluminium and aluminium alloys — Cold-drawn rods/bars, tubes and wires — Part 6: Tolerances on form and dimensions for drawn round tubes*

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

ISO 9591, *Corrosion of aluminium alloys — Determination of resistance to stress corrosion cracking*

EN 2004-1, *Aerospace series — Test methods for aluminium and aluminium alloy products — Part 1: Determination of electrical conductivity of wrought aluminium alloys*

EN 14242, *Aluminium and aluminium alloys — Chemical analysis — Inductively coupled plasma optical emission spectral analysis*

ASTM B557M, *Standard Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products*

ASTM E34, *Standard Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys*

ASTM E607, *Standard Test Method for Atomic Emission Spectrometric Analysis Aluminum Alloys by the Point to Plane Technique Nitrogen Atmosphere*

ASTM E716, *Standard Practices for Sampling and Sample Preparation of Aluminum and Aluminum Alloys for Determination of Chemical Composition by Spectrochemical Analysis*

ASTM E1251, *Standard Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry*

ASTM G47, *Standard Test Method for Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminium Alloy Products*

JIS H1305, *Method for optical emission spectrochemical analysis of aluminium and aluminium alloys*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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/

3.1
rod/bar
solid wrought product of uniform cross-section along its whole length, supplied in straight lengths

Note 1 to entry: A rod is normally less than 6 mm in diameter or of minor dimension.

Note 2 to entry: In North America, the minimum diameter or perpendicular distance between parallel faces of a rod is more than 10 mm (0,375 in); below this limit the product is called *wire* (3.3).

Note 3 to entry: The cross-sections are in the shape of circles, squares, rectangles or regular hexagons. Products with a square, rectangular or hexagonal cross-section may have corners rounded along their whole length.

Note 4 to entry: For rectangular bars, the thickness exceeds one tenth of the width. The term "rectangular bar" includes "flattened circles" and "modified rectangles", of which two opposite sides are convex arcs, the other two sides being straight, of equal length and parallel.

3.2
tube
hollow wrought product of uniform cross-section with only one enclosed void along its whole length, and with a uniform wall thickness, supplied in straight lengths or in coiled form, provided the inner and outer cross-sections are concentric and have the same form and orientation

3.3
wire
wrought product of uniform cross-section along its whole length, supplied in coiled form

Note 1 to entry: In North America, the maximum diameter or perpendicular distance between parallel faces of a wire is less than 10 mm (0,375 in). Above this limit, the product is called "rod" or "bar".

Note 2 to entry: Cross-sections are in the shape of circles, ovals, squares, rectangles, equilateral triangles or regular polygons. Products with square and regular polygons and products with a square, rectangular, triangular or polygonal cross-section may have corners rounded along their whole length.

3.4
cold-drawn
hot-worked wrought product brought to final dimensions by cold working

3.5
seamless tube
tube (3.2) in which there is no split or deliberate longitudinal bonding of two or more edges by pressure, fusion or mechanical interlocking

3.6
inspection lot
consignment, or a part thereof, submitted for inspection, comprising products with an identical set of criteria, and processed in the same manner

Note 1 to entry: Examples of criteria are grade, alloy, form, temper, size, shape, thickness and cross-section.

3.7
sample
representative part, portion or piece of an *inspection lot* (3.6) selected for inspection or testing

Note 1 to entry: A sample can be selected from molten metal, a product or products taken for evaluation of some specific characteristics or properties.

3.8
test specimen
one or more pieces taken from each product in the *sample* (3.7), for the purpose of producing *test pieces* (3.9)

3.9
test piece
piece taken from each *test specimen* (3.8) and suitably prepared for the *test* (3.10)

3.10
test
operation to which the *test piece* (3.9) is subjected in order to measure or classify a property or properties

3.11
certificate of conformity
document by which the producer certifies that, according to inspections and results of representative tests, the products for delivery conform to the relevant International Standards and with the additional requirements in the order

3.12
test report
document by which the producer certifies that the products for delivery comply with the requirements specified in the order

Note 1 to entry: The document details the results of the current production controls carried out on identical products made using the same methods as the products for delivery but not necessarily on the products for delivery themselves.

3.13
specific test report
test report (3.12) that details the chemical composition and the results of prescribed mechanical tests and of any other test specified in the order

Note 1 to entry: It is established on the basis of tests carried out on specimens taken from among the products for delivery themselves. The delivery of such a certificate generally implies inspection tests on individual lots.

4 Orders or tenders

The order document shall contain the following:

a) the form and type of product:
   1) the form of the product (cold drawn rod/bar, tube, wire); if tube, whether seamless or porthole/bridge;
   2) a reference to ISO 6362-7 for chemical composition limits;
   3) a reference to ISO 2107 for temper designation;
   4) the purchaser application, in particular whether subsequent anodising is intended; this shall be clearly stated in the order document;
b) a reference to ISO 6363-2 for mechanical property limits;
c) a reference to this document, i.e. ISO 6363-1;
d) the dimensions and shape of the product:
   1) round tube:
      i) length;
      ii) only two of the following dimensions:
         1) outside diameter;
         2) inside diameter;
         3) wall thickness;
   2) round bar:
      i) diameter;
      ii) length;
   3) square and hexagonal bar:
      i) width across flats;
      ii) length;
   4) rectangular bar:
      i) width;
      ii) thickness;

iii) length;

5) wires:

i) diameter;

ii) thickness and width for rectangular wires;

iii) reference to a drawing if necessary;

6) all other cases:

i) drawing of cross-section;

ii) length;

e) the tolerances on dimensions and form, with reference to the appropriate International Standard;

f) the quantity:

1) the mass;

2) the number of pieces;

3) the total length;

4) the tolerance on quantity;

g) any requirements for inspection documents;

h) any special requirements agreed between the supplier and the purchaser:

1) marking of products;

2) reference to drawings, part numbers, etc;

3) additional or special testing, e.g. stress corrosion testing;

4) surface finish requirements;

5) surface protection;

6) packaging;

7) inspection prior to delivery;

8) use of A_{50mm} value instead of A value for elongation.

NOTE A is the percentage elongation on a gauge length of 5,65 $\sqrt{S_o}$. A_{50mm} is the percentage elongation on a gauge length of 50 mm.

For products intended to be anodised by purchaser, the order document shall also contain the information about the intended particular surface treatment with reference to the appropriate International Standard.

5 Requirements

5.1 Production and manufacturing processes

Unless otherwise specified in the order, the production and manufacturing processes shall be left to the discretion of the producer. Unless it is explicitly stated otherwise in the order, no obligation shall be placed on the producer to use the same processes for subsequent and similar orders.

5.2 Quality control

The supplier shall be responsible for the performances of all inspection and tests required by the relevant International Standard or specification, prior to shipment of the product. If the purchaser wishes to inspect the product at the supplier's works, the supplier shall be notified at the time of placing the order.

5.3 Chemical composition

The chemical composition shall conform to the requirements specified in ISO 6362-7.

If the purchaser requires closer limits for elements than those specified in ISO 6362-7, those limits shall be agreed between the supplier and the purchaser and stated in the order.

5.4 Mechanical properties

The mechanical properties shall either be in accordance with ISO 6363-2 or those agreed upon between the supplier and the purchaser and stated in the order.

5.5 Freedom from surface defects

The products shall be free from defects detrimental to their use. While an operation designed to mask a fault is not permitted, the elimination of a superficial fault is allowed, provided the dimensional tolerances remain.

5.6 Tolerances on dimensions and form

The tolerances on form and dimensions shall be:

— in accordance with ISO 6363-3 for drawn round bars and wires;

— in accordance with ISO 6363-4 for drawn rectangular bars and wires;

— in accordance with ISO 6363-5 for drawn square and hexagonal bars;

— in accordance with ISO 6363-6 for drawn round tubes;

— or otherwise as agreed between the supplier and the purchaser and stated in the order.

Unless otherwise agreed, the purchaser may only reject those products having dimensions not complying with the specified tolerances.

5.7 Stress corrosion cracking resistance

The products of alloy 7075, in tempers T73, T73510 and T73511, for thicknesses equal to or greater than 20 mm, shall exhibit no evidence of stress corrosion cracking whenever tested in accordance with ISO 9591 or ASTM G47 in the transverse direction at a stress level of 75 % of the specified Rp0,2.

If this testing is required, it shall be specified in the order document.

5.8 Additional requirements

Any additional requirements shall be agreed between the supplier and the purchaser and stated in the order.

6 Test procedure

6.1 Sampling

6.1.1 Samples for chemical analysis

The specimens for chemical analysis shall be taken at the time of casting. Their shape and conditions of production (mould design, cooling rate, mass, etc.) shall be so designed that their composition is homogeneous, and shall be suitable for the method of analysis in accordance with ASTM E34, ASTM E607, ASTM E716, ASTM E1251 or EN 14242.

6.1.2 Specimens for mechanical testing

6.1.2.1 Location and size

Specimens shall be taken from samples in such a way that it is possible to orientate the test pieces in relation to the product, as specified in 6.1.2.2.

The specimens shall be large enough to allow manufacture of sufficient test pieces for the required tests, and for any retests which are required.

6.1.2.2 Orientation

Specimens shall be generally taken in the longitudinal direction, unless otherwise agreed upon between the supplier and the purchaser and stated in the order.

6.1.2.3 Identification

Each specimen shall be marked in such a manner that, after removal, it is still possible to identify the product from which it was taken, its location and orientation.

If, during the course of subsequent operations, removal of the markings cannot be avoided, new markings shall be made before the originals are removed.

6.1.2.4 Preparation

Specimens shall be taken from the sample after completion of all the mechanical and heat treatments that the product has to undergo before delivery, and which can influence the mechanical properties of the metal. In cases where this is not possible, the sample or specimens may be taken at an earlier stage, but they shall be subjected to the same treatment as that to which it is intended to submit the product concerned.

Cutting shall be carried out in such a manner that it does not change the characteristics of the part prepared. Thus, the dimensions of the specimens shall provide an adequate machining allowance to permit removal of the zone affected by cutting.

Specimens shall not be machined or treated in any way which would alter their mechanical properties. Any straightening required shall be carried out with great care, preferably by hand.

6.1.2.5 Number of specimens

Unless otherwise specified, the minimum numbers of specimens shall be as follows:

— for products having a nominal mass up to and including 1 kg per linear metre (1 kg/m), one specimen shall be taken for each lot of 1 000 kg or part thereof;

— for products having a nominal mass greater than 1 kg/m up to and including 5 kg/m, one specimen shall be taken for each lot of 2 000 kg or part of thereof;

— for products having a nominal mass greater than 5 kg/m, one specimen shall be taken for each lot of 3 000 kg or part of thereof.

Not less than one representative specimen shall be taken from any given inspection or heat-treatment lot.

6.1.3 Test pieces for tensile test

6.1.3.1 Identification

Each test piece shall be marked in such a manner that it is possible to identify the inspection lot from which it was taken and, if required, its location and orientation in the product.

If a test piece is marked by stamping, this shall not be in a place or manner which can interfere with subsequent testing.

Where it is not convenient to mark a test piece, an identification tag may be attached. Alternative methods, such as specially designed boxes, may be used for the purpose of test-piece identification.

6.1.3.2 Machining

Any machining necessary shall be carried out in such a manner that it does not change the characteristics of the metal in the test piece.

6.1.3.3 Number, type and location of test pieces

One test piece shall be taken from each specimen. The recommended shapes and dimensions of test pieces are specified in ISO 6892-1 or ASTM B557M.

Details of the location of the test pieces are given in Annex A.

For drawn wire, the test piece shall consist of a full cross-section of the sample.

6.2 Test methods

6.2.1 Chemical composition limits

Methods of analysis shall be at the discretion of the supplier in accordance with ASTM E34, ASTM E607, ASTM E716, ASTM E1251 or EN 14242 or JIS H1305.

In case of dispute concerning the chemical composition, referee analysis shall be carried out by the methods of analysis and the results obtained by these methods shall be accepted.

For heavy plate analysis, variations of composition may occur across the thickness.

6.2.2 Tensile testing

The tensile test shall be carried out in accordance with ISO 6892-1 or ASTM B557M.

6.2.3 Measurement of dimensions

All dimensions shall be measured with suitably calibrated instruments which are appropriate to the range of dimensions under consideration. The measurements shall be made at ambient temperature or, in the case of dispute, at a temperature between 15 °C and 35 °C.

6.2.4 Surface finish

Unless otherwise specified, examination of surface appearance shall be carried out without the assistance of magnifying apparatus on products before delivery.

For products intended to be anodised, it is recommended that an anodizability test be carried out by the producer on the products before delivery. The frequency and the conditions of the test may be agreed between the supplier and the purchaser.

6.2.5 Resistance to stress corrosion cracking

For the products of alloy 7075, in tempers T73, T73510 and T73511, for thickness equal to or greater than 20 mm, the stress corrosion behaviour shall be tested in accordance with ISO 9591 or ASTM G47.

Testing in accordance with ISO 9591 or ASTM G47 shall be carried out on at least one specimen every six months, unless otherwise agreed and stated in the order.

An electrical conductivity test shall be carried out on at least one specimen per heat treatment lot in accordance with Annex B.

6.2.6 Additional tests

If other tests are required, they shall be agreed between the supplier and the purchaser. These tests shall be carried out in accordance with the relevant International Standards or a method agreed between the supplier and the purchaser.

6.3 Retests

6.3.1 Mechanical properties

If any one of the test pieces first selected fails to meet the requirements for the mechanical tests, the following procedure shall be applied:

a) If an error is clearly identified, either in the test piece preparation or the test procedure, the corresponding result shall be disregarded and the testing carried out again as initially required.

b) If this is not the case, then two further specimens shall be taken from the same inspection lot, one being from the same unit of product (rod/bar, tube) from which the original specimen was taken, unless that unit of product has been withdrawn by the supplier. If both test pieces from these additional specimens meet the requirements, the inspection lot which they represent shall be deemed to conform to the requirements of this document.

Should one test piece fail to meet the required limits:

— the inspection lot shall be deemed not to conform to the requirements of this document;

— or where applicable, the lot may be submitted to additional mechanical or thermal treatment(s) and then retested as a new lot.

6.3.2 Other properties

The retest procedure of other properties shall be agreed upon between the supplier and the purchaser.

7 Inspection documents

Where requested by the purchaser and agreed upon by the supplier, the supplier shall provide the appropriate inspection documents. The following documents shall be established on the basis of inspections and tests performed by qualified personnel involved in the manufacturing process and/or belonging to the quality control department:

— certificate of conformity;

— test report;

— specific test report.

8 Marking

Marking of products shall be undertaken where specified in this document or where agreed upon between supplier and the purchaser and stated in the order.

This marking shall not adversely affect the final use of the product.

The details of information required in the marking shall be agreed between the supplier and the purchaser.

9 Packing

Unless otherwise specified in the International Standards relating to special products or specified in the order, the method of packing shall be determined by the supplier, who shall take all suitable precautions to ensure that, under the usual conditions or transportation, the products are delivered in a condition suitable for use.

10 Arbitration

In case of any dispute concerning the conformity of the products to the requirements of this document or the specifications cited on the order, testing and examination shall be carried out before rejecting the products by an arbitrator chosen by mutual agreement between the supplier and the purchaser.

The arbitrator's decision shall be final.

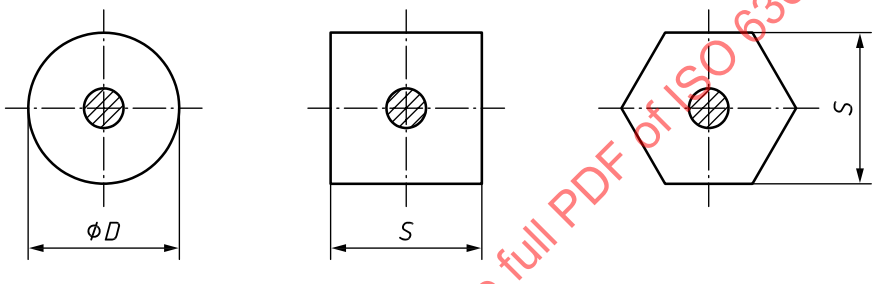
Annex A
(normative)

Location of test pieces

A.1 Round, square and hexagonal bar

A.1.1 Diameter or width across flats up to and including 40 mm

Use a round standard test piece of up to and including 10 mm in diameter taken from the centre of the bar, shown as a cross-hatched area in Figure A.1.



Key

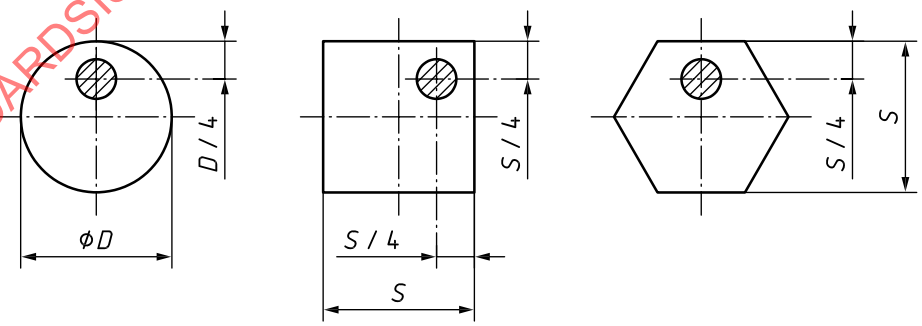
D diameter

S width across flats

Figure A.1 — Location of test piece on round, square and hexagonal bar — Diameter or width across flats up to and including 40 mm

A.1.2 Diameter or width across flats over 40 mm

Use a round standard 10 mm diameter test piece located and shown as a cross-hatched area in Figure A.2.



Key

D diameter

S width across flats

Figure A.2 — Location of test piece on round, square and hexagonal bar — Diameter or width across flats over 40 mm

A.2 Rectangular bar

A.2.1 Thickness *T* up to and including 12,5 mm

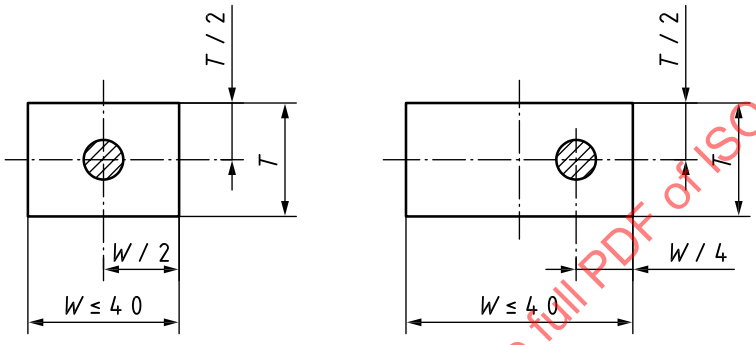
Use a rectangular test piece. The test piece shall be prepared such that the two fabricated surfaces are preserved without modification.

A.2.2 Thickness *T* over 12,5 mm and up to and including 40 mm

Use a round standard test piece of up to and including 10 mm in diameter located and shown as a cross-hatched area in Figure A.3.

It is up to the discretion of the producer to choose either of the two locations shown in Figure A.3.

Dimensions in millimetres



Key

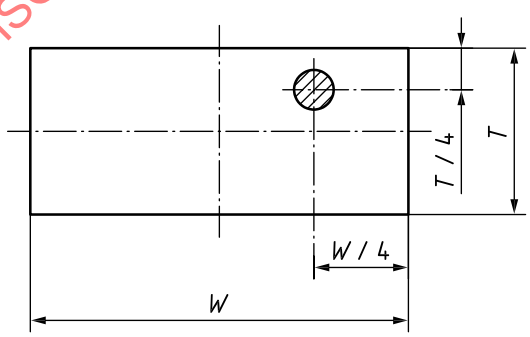
T thickness

W width

Figure A.3 — Location of test piece on rectangular bar — Thickness *T* over 12,5 mm and up to and including 40 mm

A.2.3 Thickness *T* exceeding 40 mm

Use a round standard 10 mm test piece located and shown as a cross-hatched area in Figure A.4.



Key

T thickness

W width

Figure A.4 — Location of test piece on rectangular bar — Thickness *T* exceeding 40 mm