INTERNATIONAL STANDARD

ISO 6362-1

Second edition
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Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles —

Part 1: Technical conditions for inspection and delivery

Aluminium et alliages d'aluminium corroyés — Barres, tubes et profilés filés —

Partie 1: Conditions techniques de contrôle et de livraison

Reference number
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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.

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

ISO 6362-1 was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 6, *Wrought aluminium and aluminium alloys*.

This second edition cancels and replaces the first edition (ISO 6362-1:1986), which has been technically revised.

ISO 6362 consists of the following parts, under the general title *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles*:

— *Part 1: Technical conditions for inspection and delivery*

— *Part 2: Mechanical properties*

— *Part 3: Extruded rectangular bars — Tolerances on shape and dimensions*

— *Part 4: Profiles — Tolerances on shape and dimensions*

— *Part 5: Round, square and hexagonal bars — Tolerances on shape and dimensions*

— *Part 6: Round, square, rectangular and hexagonal tubes — Tolerances on shape and dimensions*

— *Part 7: Chemical composition*

Wrought aluminium and aluminium alloys — Extruded rods/ bars, tubes and profiles —

Part 1: Technical conditions for inspection and delivery

1 Scope

This part of ISO 6362 specifies the technical conditions for inspection and delivery of wrought aluminium and aluminium alloy rods/bars, tubes and profiles for general engineering applications.

It applies to extruded products, but does not apply to the following:

— forging stock;

— extruded precision profiles in alloys A6060 and A6063;

— products delivered in coils;

— coiled tubes cut to lengths.

2 Normative references

The following referenced documents are indispensable for the application 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 6362-2, *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles — Part 2: Mechanical properties*

ISO 6362-3, *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles — Part 3: Extruded rectangular bars — Tolerances on shape and dimensions*

ISO 6362-4, *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles — Part 4: Profiles — Tolerances on shape and dimensions*

ISO 6362-5, *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles — Part 5: Round, square and hexagonal bars — Tolerances on shape and dimensions*

ISO 6362-6, *Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles — Part 6: Round, square, rectangular and hexagonal tubes — Tolerances on shape and dimensions*

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

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

ISO 7438, *Metallic materials — Bend test*

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 Atomic Emission Spectromety*

3 Terms and definitions

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

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

NOTE 1 Rod is normally less than 6 mm in diameter or minor dimension.

NOTE 2 In North America, the minimum diameter of a rod is 9,525 mm (0,375 in). Below this limit the product is called wire.

NOTE 3 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 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

NOTE The cross-sections are in the shape of circles, squares, rectangles or regular hexagons. Hollow products with square, rectangular or regular hexagonal cross-sections may have corners rounded along their whole length.

3.3
profile
wrought product of uniform cross-section along its whole length, with a cross-section other than rod/bar, tube, sheet or strip, supplied in straight lengths or in coiled form and where the product is long in relation to its cross-sectional dimensions

NOTE According to the form of its cross-section, it is called:

a) hollow profile: the cross-section includes either one enclosed void, provided that the cross-section is other than tube, or more than one enclosed void;

b) solid profile: the cross-section does not include any enclosed void.

3.4
inspection lot
consignment, or a part thereof, submitted for inspection, comprising products of the same grade or alloy, form, temper, size, shape, thickness or cross-section and processed in the same manner

3.5
heat-treatment batch or lot
quantity of products with an identical set of criteria, e.g. grade or alloy, form, thickness or cross-section and produced in the same way, heat-treated in one furnace load, or such products so solution-treated and subsequently precipitation-treated in one furnace load

NOTE 1 More than one solution-treatment lot may be included in a furnace load.

NOTE 2 For the heat-treatment in a continuous furnace, the products heat-treated during a period of time less than 8 h may be considered as belonging to the same heat-treatment lot.

3.6
sample
either a quantity of molten metal, product or products which are used for the production of specimens

3.7
test specimen
one or more pieces taken from each product in the sample, for the purpose of producing test pieces

3.8
test piece
piece taken from each test specimen and suitably prepared for the test

3.9
test
operation to which the test piece is subjected in order to measure or classify properties

4 Orders or tenders

The order or tender shall define the product required and shall contain the following:

a) the type and form of product:

   — the designation of the aluminium or aluminium alloy;

   — the form of the product (rod/bar, tube, profile, etc.);

b) the metallurgical temper of the material for delivery (degree of hardness or heat-treatment condition) and, if different, the metallurgical temper for use;

c) the number of this International Standard or specification number, or, where none exists, the properties agreed between the supplier and the purchaser;

d) the dimensions and shape of the product (thickness, width, length, diameter); and/or reference to a drawing defining the product;

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

f) quantity;

g) any requirements for certificates of conformity, test and/or analysis;

h) any special requirements agreed between the supplier and the purchaser (for example drawings).

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, specification or customer requests, prior to shipment of the product. If the purchaser wishes to inspect the product at the supplier's works, he shall notify the supplier at the time of placing the order.

5.3 Chemical composition

The chemical composition shall comply with the requirements specified in ISO 6362-7.

If the purchaser requires content limits for elements not specified in ISO 6362-7, these limits shall be stated in the order document.

5.4 Mechanical properties

The mechanical properties shall be in conformity with those specified in ISO 6362-2 or those agreed upon between the supplier and purchaser and stated in the order.

5.5 Surface finish

The products shall be free from defects detrimental to its required use and performance. Whilst an operation designed to mask a fault is not permitted, the elimination of a superficial fault is permissible, provided that the dimensional tolerances remain.

5.6 Dimensional tolerances

The dimensions and form tolerances shall be:

— in accordance with ISO 6362-3 for extruded rectangular bars;

— in accordance with ISO 6362-4 for extruded profiles;

— in accordance with ISO 6362-5 for extruded round, square and hexagonal bars;

— in accordance with ISO 6362-6 for extruded tubes;

— or otherwise as agreed between the supplier and 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, T73511, for thicknesses equal to or greater than 20 mm, shall exhibit no evidence of stress corrosion cracking when tested in accordance with ISO 9591 in the transverse direction at a stress level of the specified $R_{p0,2}$.

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

6 Test procedure

6.1 Production of specimens

6.1.1 Specimens for chemical analysis

The specimens for chemical analysis shall be cast from molten metal samples 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 be suitable for the method of analysis according to 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 may be required.

6.1.2.2 Orientation of specimens

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

6.1.2.3 Identification of specimens

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 and 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 of specimens

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 may 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.

NOTE If the purchaser intends to convert the material to a final temper which is different from the 'as supplied' temper, then additional testing may be requested by the purchaser in order to satisfy himself that the material is capable of meeting the specified properties of the final temper. It is only necessary for the supplier to confirm that selected samples, heat-treated using supplier laboratory conditions, meet the properties specified for the final temper required by the purchaser.

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 by which their mechanical properties may be altered. 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 number 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 thereof;

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

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 may 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 of test pieces

One test piece shall be taken from each specimen.

The recommended shapes and dimensions for test pieces are specified in ISO 6892-1 or ASTM B557M.

6.1.3.4 Type and location of test pieces

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

6.1.4 Test pieces for bend test

The procedures shall be agreed between the supplier and the purchaser.

6.2 Test methods

6.2.1 Chemical composition

Methods of analysis shall be at the discretion of the supplier according to ASTM E34, ASTM E607, ASTM E716, ASTM E1251 or EN 14242. In case of dispute concerning the chemical composition, referee analysis shall be carried out by the methods and the results obtained by these methods shall be accepted.

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

6.2.2 Tensile test

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 anodized, 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 producer and customer.

6.2.5 Bend test

The bend test shall be applied only when agreed between the supplier and purchaser. The bend test shall be carried out either in accordance with ISO 7438 or agreed upon by the supplier and purchaser.

6.2.6 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 according to ISO 9591.

Testing according to ISO 9591 shall be at least one specimen per 6 months unless otherwise agreed and stated in the order document.

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

6.2.7 Additional tests

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

— if an error is clearly identified, either in the test piece preparation or the test procedure, then the corresponding result shall be disregarded and the testing recommended as initially required;

— 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, profile) 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 comply with the requirements of this International Standard.

Should one test piece fail to meet the required limits:

— the inspection lot shall be deemed not to comply with the requirements of this International Standard;

— 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 purchaser.

7 Inspection documents

7.1 General

When 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.

7.2 Certificate of conformity

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

7.3 Test report

The test report is a document by which the producer certifies that the products for delivery comply with the requirements specified in the order.

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.

7.3.1 Specific test report

The specific test report is a document by which the producer certifies that the products for delivery comply with the requirements specified in the order.

This document details the chemical composition and the results of prescribed mechanical tests and of any other test specified in the order.

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.

8 Marking

Marking of products is only undertaken when agreed upon between the supplier and purchaser and stated in the order. This marking shall not adversely affect the final use of the product.

9 Packing

Unless otherwise specified in 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 tests

In cases of dispute concerning conformity with the requirement of this International Standard or specification cited in the order, testing shall be carried out by an arbitrator chosen by mutual agreement between the supplier and purchaser.

The arbitrator’s decision shall be final.

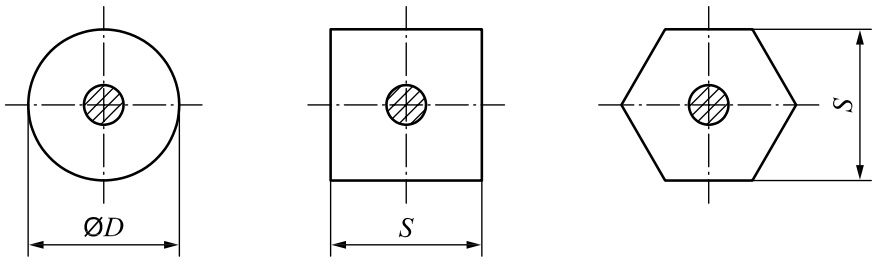
Annex A
(normative)

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 diameter taken from the centre of the bar, shown as a cross-hatched area in Figure A.1.



Key

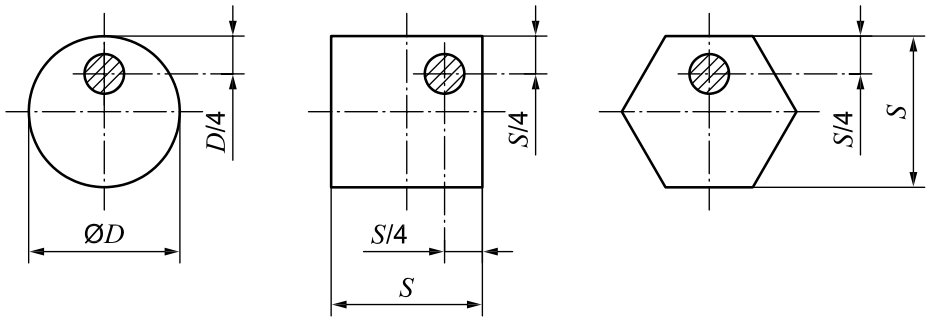
D diameter

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

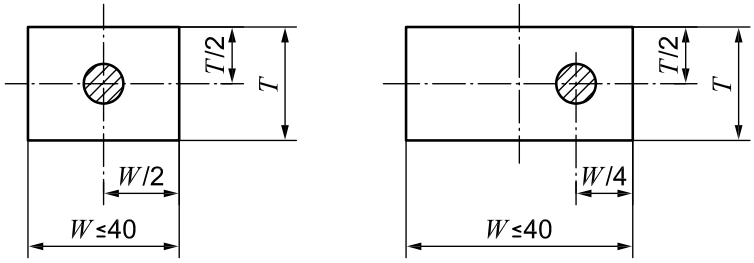
Use a rectangular test piece. The test piece shall be prepared such that the two fabricated surfaces are preserved without modification.

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 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 mm



Key

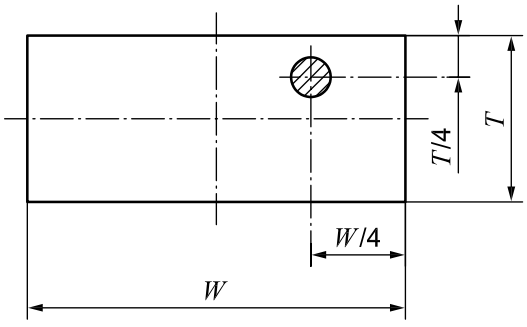
T thickness

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

A.3 Tube

Test pieces should be prepared from specimens as given in Table A.1

Table A.1 — Test pieces for tubes

Test piece	Round tube	Square tube	Rectangular tube
Full section test piece	Area ≤ 150 mm^2 and D ≤ 25 mm	Area ≤ 150 mm^2 and D ≤ 25 mm	
Rectangular machined test piece	Wall thickness ≤ 12,5 mm	Wall thickness ≤ 12,5 mm	Wall thickness ≤ 12,5 mm
Round machined test piece	Wall thickness > 12,5 mm	Wall thickness > 12,5 mm	Wall thickness > 12,5 mm

A.4 Profiles

A.4.1 Thickness T up to and including 12,5 mm

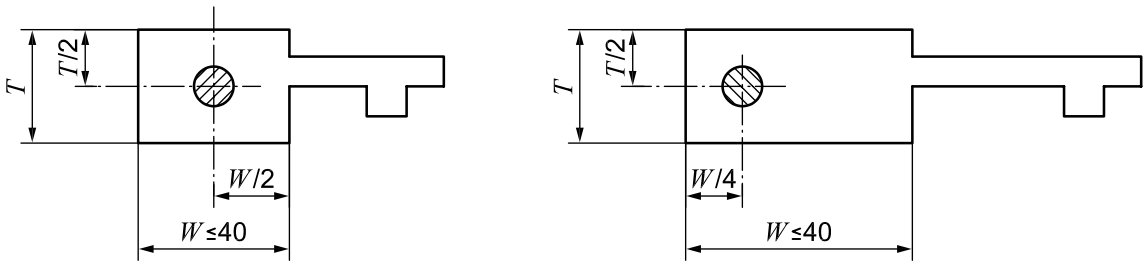
Use a rectangular test piece. The test piece shall be prepared such that the two fabricated surfaces are preserved without modification.

A.4.2 Thickness T over 12,5 mm and up to and including 40 mm

Use a round standard 10 mm diameter test piece located and shown as a cross-hatched area in Figure A.5.

It is up to the discretion of the producer to choose either of the two locations shown in Figure A.5.

Dimensions in millimetres



Key

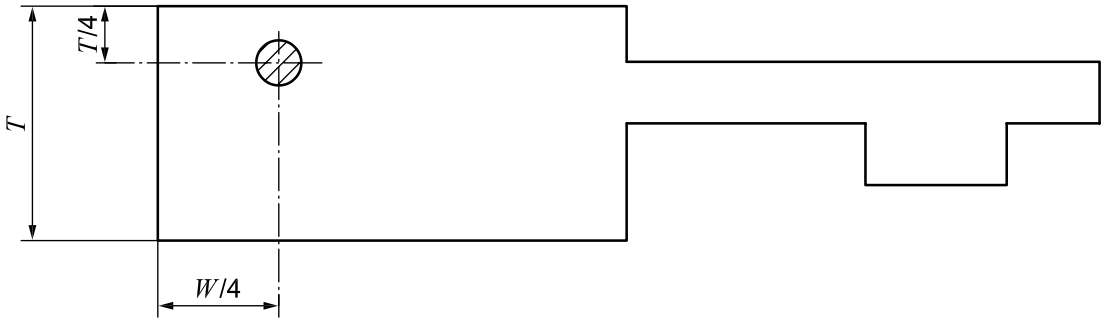
T thickness

W width

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

A.4.3 Thickness T exceeding 40 mm

Use a round standard 10 mm diameter test piece located and shown as a cross-hatched area in Figure A.6.



Key

T thickness

W width

Figure A.6 — Location of test piece on profile — Thickness T exceeding 40 mm

Annex B
(normative)

Resistance to stress-corrosion cracking for alloy 7075 in tempers T73, T73510, T73511: Electrical conductivity

The electrical conductivity of the specimen for tensile testing of each lot shall be determined in accordance with EN 2004-1.

Table B.1 specifies the minimum frequency; however, additional testing may be carried out upon agreement between the purchaser and supplier.

Table B.1 — Lot acceptance criteria on tempers T73, T73510 and T73511 for alloy 7075

Electrical conductivity γ MS/m	Level of mechanical properties	Lot acceptance status
$\gamma \geq 23{,}0$	Per standard requirements	Acceptable
$22{,}0 \leq \gamma < 23{,}0$	Per standard requirements and $R_{p0,2}$ does not exceed minimum by more than 85 MPa	Acceptable
	Per standard requirements, but $R_{p0,2}$ exceeds minimum by more than 85 MPa	Suspect[a]
$\gamma < 22{,}0$	Any level	Unacceptable[b]

[a] When the lot acceptance status is found to be "suspected", material shall be reprocessed or a test piece of the material shall be heat-treated for not less than 30 min at 465 °C ± 5 °C and quenched in cold water. Electrical conductivity shall then be measured within 15 min of quenching. If the difference between this measurement and the original measurement on the material is 3,5 MS/m or more, the production lot is acceptable. If the difference is less than 3,5 MS/m, the production lot is unacceptable and shall be reprocessed (additional precipitation heat treatment or re-solution treatment and precipitation heat treatment).

[b] When the lot acceptance status is "unacceptable", the material may be reprocessed (additional precipitation heat treatment or re-solution heat treatment and precipitation heat treatment).

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Price based on 13 pages