

# INTERNATIONAL STANDARD

# ISO 404

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## Steel and steel products — General technical delivery requirements

*Aciers et produits sidérurgiques — Conditions générales techniques  
de livraison*



Reference number  
ISO 404:2013(E)

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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. [www.iso.org/directives](http://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. [www.iso.org/patents](http://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.

The committee responsible for this document is ISO/TC 17, *Steel*, Subcommittee SC 20, *General technical delivery conditions, sampling and mechanical testing methods*.

This third edition cancels and replaces the second edition (ISO 404:1992), which has been technically revised.

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# Steel and steel products — General technical delivery requirements

## 1 Scope

This International Standard specifies the general technical delivery requirements for all steel products covered by ISO 6929, with the exception of steel castings and powder metallurgical products.

ISO 10474 describes the inspection documents to be used.

Where the delivery requirements agreed upon for the order or specified in the appropriate product or material standard differ from the general technical delivery requirements defined in this International Standard, then it is the requirements agreed for ordering or specified in the appropriate product or material standard that apply.

## 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 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 4948-1, *Steels — Classification — Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition*

ISO 4948-2, *Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics*

ISO 6929, *Steel products — Vocabulary*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

ISO 80000-1:2009, *Quantities and units — Part 1: General*

## 3 Definitions

For the purposes of this document, the definitions in ISO 4948-1, ISO 4948-2 and ISO 6929, and the following apply.

### 3.1 inspection

activities such as measuring, examining, testing, gauging one or more characteristics of a product or service and comparing these with specified requirements to verify conformity

### 3.2 testing

any operation or action to determine one or more properties or characteristics of a material or product

**3.3**

**non-specific inspection**

inspection carried out by the manufacturer in accordance with his own procedures, to verify that products made by the same manufacturing process meet the requirements of the order

Note 1 to entry: The products inspected and tested can be different from the products actually supplied.

**3.4**

**specific inspection**

inspection carried out, before delivery, in accordance with the product specification, on the products being supplied or on test units of which the products are part, to verify that these products meet the requirements of the order

**3.5**

**inspection representative**

one or more individuals who is/are either the manufacturer's authorized inspection representative(s), independent from the manufacturing department; the purchaser's authorized representative; or the inspector(s) designated by a third party

**3.6**

**test unit**

number of pieces or the tonnage of products to accept or reject together, on the basis of the verification tests carried out on sample products in accordance with the requirements of the product standard or order

Note 1 to entry: See [Figure 1](#).

Note 2 to entry: This term is sometimes referred to in other International Standards as "inspection lot" or "batch".

**3.7**

**sample product**

item (a sheet, for example) selected from a test unit for inspection and/or testing

Note 1 to entry: See [Figure 1](#).

**3.8**

**sample**

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

Note 1 to entry: See [Figure 1](#).

Note 2 to entry: In certain cases, the sample may be the sample product itself.

**3.9**

**rough specimen**

part of the sample having undergone mechanical treatment, followed by heat treatment where appropriate, for the purpose of producing test pieces

Note 1 to entry: See [Figure 1](#).

**3.10**

**test piece**

part of the sample, with specified dimensions, machined or unmachined, brought to a required condition for submission to a given test

Note 1 to entry: See [Figure 1](#).

Note 2 to entry: In certain cases, the test piece may be the sample itself or the rough specimen.

**3.11**

**cast (heat) analysis**

chemical analysis representative of the cast (heat) determined by the steelmaker

**3.12****product analysis**

chemical analysis carried out on the product

**3.13****sequential testing**

group or series of tests from which the average and individual results are used to demonstrate that the requirements of the order and/or product standard have been satisfied

**3.14****manufacturer**

organization that manufactures the respective products according to the requirements of the order and to properties specified in the referenced product specification

**3.15****intermediary**

organization that is supplied with products by the manufacturers and that then, in turn, supplies them without further processing or after processing without changing the properties specified in the purchase order and referenced product specification

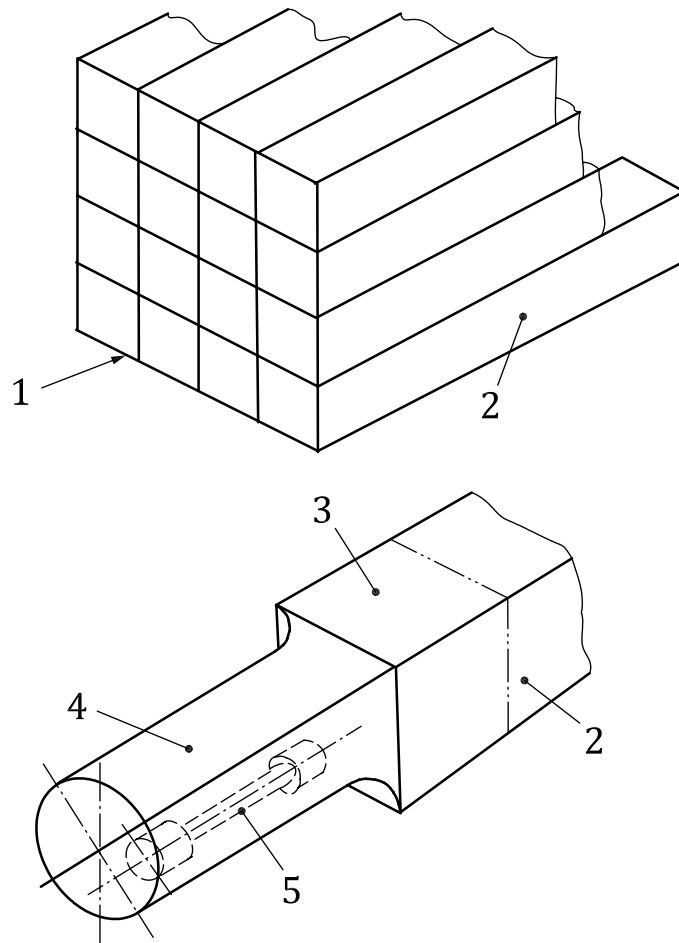
Note 1 to entry: Examples of intermediaries can be steel service centres and stockists.

## 4 Information to be supplied by the purchaser

**4.1** The purchaser shall select the steel type, the shape of the product and the dimensions, taking the intended processing and use into account. The purchaser may consider the manufacturer's advice in making the choice.

The order shall provide all the information necessary for describing the product and its characteristics, and also details concerning delivery such as

- a) mass, length, area, number of pieces to be delivered;
- b) the product form (it can be a number referring to a drawing, for example);
- c) the nominal dimensions;
- d) the tolerances on the characteristics in items a) and c);
- e) the designation of the steel;
- f) delivery condition (type of heat treatment, surface treatment etc.);
- g) specific requirements for surface and/or internal quality (see [7.4](#));
- h) the type of inspection document required and, where not specified in the product standard, the inspection and testing requirements (see [Clause 8](#));
- i) where applicable, the application of the quality management systems given in ISO 9001;
- j) requirements for marking, packaging and loading;
- k) any optional (supplementary) requirements provided for by the product standard.



**Key**

- 1 test unit
- 2 sample product
- 3 sample
- 4 rough specimen
- 5 test piece

**Figure 1 — Examples of terms defined in [Clause 3](#)**

**4.2** The information in [4.1](#) shall be specified either

- a) by reference to one or more International Standards, or
- b) in the absence of an International Standard, by stipulation of the characteristics and conditions required.

If, in an order, reference is made to a given International Standard without specifying its edition date, this reference shall be interpreted as being the edition current at the date of order acknowledgement.

**5 Manufacturing process**

The manufacturing process shall be left to the discretion of the manufacturer, unless otherwise agreed at the time of ordering or otherwise specified in the product standard.

**NOTE** The manufacturing process covers all operations up to the delivery of the product.



## 6 Supply by an intermediary

The intermediary shall submit to the purchaser, the manufacturer's inspection documents in accordance with ISO 10474.

This documentation from the manufacturer shall be accompanied by suitable means of identification of the product, in order to ensure the traceability between the product and the documentation (see [Clause 10](#)).

If the intermediary has changed the dimensions of the product, the intermediary shall supply an additional document for these particular new conditions. This also applies to all special requirements given in the order and not defined in the manufacturer's documentation.

Any organization which during processing changes the metallurgical state of the product is considered as a product manufacturer.

## 7 Requirements

### 7.1 General

The product shall comply with the requirements of the order.

The manufacturer shall carry out appropriate process control, inspection and testing to verify that the delivery complies with the requirements of the order, irrespective of the type of inspection document required (see [Clause 8](#)).

### 7.2 Chemical composition

Requirements concerning the chemical composition shall be considered to refer to the cast (heat) analysis unless they refer expressly to the product analysis.

### 7.3 Mechanical properties

#### 7.3.1 Effect of dimensions

Where, in the product standard, the mechanical properties are specified by dimensional categories such as thickness, diameter etc., the dimension that shall be considered is the nominal dimension of the product at the prescribed location for taking samples for mechanical tests.

#### 7.3.2 Applicable material condition

In the absence of any specification in the order or the product standard, the mechanical properties relate to the as-delivered condition of the products.

#### 7.3.3 Assessment of impact energy value

Where an impact-energy value is specified, without any further information, it shall be taken to represent the average value of those individual tests that shall be assessed as described in 8.3.4.2.

### 7.4 Surface and internal quality

#### 7.4.1 General

All products shall have a finish appropriate to the manufacturing route. Minor surface and internal imperfections that can occur under normal manufacturing conditions shall not be grounds for rejection.

## ISO 404:2013(E)

Detailed requirements referring to these characteristics shall, where appropriate, be agreed upon at the time of enquiry and order, by reference to the appropriate International Standard (or another relevant standard if no International Standard exists).

NOTE The following International Standards on surface qualities exist: ISO 7788[4], ISO 9443[5] (and any others that are relevant).

### 7.4.2 Detection of defects

The use of special techniques (radiography, ultrasonics, magnetic detection, etc.) to detect defects, as well as the number of products being tested per test unit and the procedures for interpreting the results, when required, shall be as specified in the product standard or as agreed at the time of ordering.

### 7.4.3 Removal of discontinuities

Surface discontinuities may be removed by mechanical or thermal means, provided that the dimensions and properties of the product remain within the limit specified in either the order, product standard, dimensional standard or surface quality standard.

Unless otherwise stated in the product standard thermal means to remove discontinuities are accepted.

### 7.4.4 Repairs by welding

Where there is no provision in the product standard or order, the purchaser may permit local repairs by welding.

NOTE Regulations can prohibit repair by welding.

## 8 Inspection and testing

### 8.1 Types of inspection documents and inspection and testing

When ordering, the purchaser shall state which type of inspection document [see 4.1 h)], if any, is required (see ISO 10474), thereby indicating the required type of inspection and testing: non-specific or specific. If non-specific inspection and testing is required, see 8.2. If specific inspection and testing is required, see 8.3.

### 8.2 Non-specific inspection and testing

The purchaser may require that, on the basis of non-specific inspection and testing, a declaration of compliance with the order "2.1" or a test report "2.2" (see ISO 10474) shall be furnished by the manufacturer. When the purchaser requires a test report, he shall indicate for which product characteristics the test results shall be given in this document, if the product standard does not cover such detail.

### 8.3 Specific inspection and testing

#### 8.3.1 General

##### 8.3.1.1 Information to be supplied

When the purchaser specifies that compliance with the requirements of the order shall be verified by specific inspection and testing, the enquiry and order shall cover

- the type of document required, for example an inspection certificate of type 3.1, or 3.2 (see ISO 10474) if not specified in the product standard;
- the testing frequency (see 8.3.2);

- the requirements for sampling and for the preparation of the samples and test pieces (see 8.3.3);
- the identification of test units, if any;
- the test methods (see 8.3.4);
- the address of the inspection body in the case of inspection certificates and inspection reports validated also by external inspectors.

### 8.3.1.2 Place of specific inspection and testing

If the necessary facilities are not available at the manufacturer's works, the inspection and testing shall be carried out at another place agreed between the two parties, or at an establishment certified by a recognized organization, preferably in the country of manufacture. In the latter case, the products shall not be delivered prior to the receipt of the test results by the manufacturer.

### 8.3.1.3 Submission for specific inspection and testing

Where appropriate, the inspection representative shall be informed, by the manufacturer or his authorized representative, of the date of availability of part or all of the consignment for specific inspection and testing. Reference shall be made to the order. The manufacturer and the inspection representative shall agree upon the time and date of the inspection and testing, in order to avoid interference with the normal operation of the works and time for the delivery of the relevant documentation.

### 8.3.1.4 Rights and duties of the inspection representative

In order to carry out the agreed inspection and testing, the inspection representative shall have free access, at the agreed time, to the places where the products to be tested/inspected are stored. The inspection representative shall have the right to be present during the selection of the samples, preparation (machining and treatment) of test pieces and during the tests. The inspection representative shall observe all the relevant instructions in force in the manufacturer's works and especially the safety rules. The works shall have the right to have him accompanied by one of their representatives. The testing/inspection procedures shall be carried out so that disturbance of the normal run of production is minimized.

### 8.3.1.5 Traceability during testing

During the test operations, the manufacturer shall be able to provide traceability between the sample products, samples and test pieces and the test units to which they belong.

## 8.3.2 Testing frequency

### 8.3.2.1 Formation of test units

For each type of test, the test unit shall be specified in the product standard or the order. Such specifications are normally based on the indication of whether the test unit shall be composed only of products of

- the same cast (heat), and/or
- the same casting sequence, and/or
- the same rolling unit, and/or
- the same heat treatment condition or heat treatment batch; and/or
- the same product form; and/or
- the same thickness or diameter range; and
- whether the maximum size of the test unit is restricted by mass or number of pieces.

In certain cases, the test unit may consist of an individual product.

### 8.3.2.2 Number of sample products, samples and test pieces

From each test unit, a certain number of sample products shall be selected for sampling. This number is specified in the product standard or the order. For each type of test, the following shall be as specified in the product standard or order:

- the number of sample products taken for each test unit;
- the number of samples taken for each sample product;
- the number of test pieces taken per sample.

### 8.3.3 Sampling conditions and test pieces

ISO 377 gives details of sample preparation for mechanical tests. Sampling for chemical analysis of steel is specified in ISO 14284. The general conditions of ISO 377 and ISO 14284 and the specifications of the product standard or order for the location, direction and preparation of test pieces shall apply.

### 8.3.4 Test methods and assessment of results

#### 8.3.4.1 Test method and equipment

Tests shall be carried out, and the results presented, in accordance with the corresponding International Standard. Where no such International Standard exists, other test methods shall be used that shall be agreed upon at the time of ordering [see 4.1 h)].

All inspection, measuring and test equipment used by the supplier to verify characteristics for which specific requirements are included in the order or product standard, shall be calibrated and adjusted against certified equipment having a known valid relationship to nationally recognized standards, where such standards exist, and be so maintained. Where such standards do not exist, the basis for calibration shall be documented. The supplier or his authorized representative shall maintain calibration records for inspection, measuring and test equipment. The accuracy of the measuring or testing equipment shall be sufficient in relation to the specified values and tolerances.

The chemical composition may be determined by chemical or spectrochemical methods of analysis (see ISO/TR 9769). In cases of arbitration, the method used shall be agreed upon.

Some of the major International Standards used for testing and analysis are listed in the Bibliography as references [8] to [18].

#### 8.3.4.2 Assessment of results of sequential tests

The assessment of some results is carried out in a sequential manner (see 3.13). The following example refers to impact tests.

- a) The averaged value of a set of three test pieces shall meet the specified requirement. One individual value may be below the specified value, provided that it is not less than 70 % of that value.
- b) If the conditions described in item a) are not satisfied and not more than two of the three individual values are lower than the specified minimum value, and not more than one of the three individual values is lower than 70 % of the specified value, then the manufacturer may take an additional set of three test pieces from the same samples. To consider the test unit as conforming, after testing the second set, the following conditions shall be satisfied simultaneously.
  - 1) The average value of the six tests shall be equal to or greater than the specified minimum value.
  - 2) Not more than two of the six individual values may be lower than the specified minimum value.

- 3) Not more than one of the six individual values may be lower than 70 % of the specified value.
- c) If these conditions are not satisfied, the sample product is rejected and retests are carried out on the remainder of the test unit (see [8.3.4.3.3](#)).

The assessment of some other tests, for example tensile testing in the thickness direction, is carried out in a similar manner.

### 8.3.4.3 Retests

#### 8.3.4.3.1 General

Where one or more tests give non-conforming results, subject to the following exception, the manufacturer may either withdraw the test unit concerned or perform retests in accordance with the procedures described in [8.3.4.3.2](#) and [8.3.4.3.3](#).

If the result of a test deviates significantly from the specified requirements for the steel type being supplied, so that there is a suspicion that products have become mixed, then the procedure described in [Clause 9](#) shall be used.

#### 8.3.4.3.2 Non-sequential tests

Where the non-conforming result comes from tests for which no average, but only individual values are specified (e.g. tensile test, bend test or end quench hardenability), the following procedures shall be carried out.

- a) The test unit is a single piece (see [Figure 2](#)). Two new tests of the same type as the one giving a non-conforming result shall be carried out. Both new tests shall give conforming results. If not, the product shall be rejected.
- b) The test unit is more than one piece, for example a rolling unit, cast or heat treatment condition (see [Figure 3](#)). The manufacturer may, at his discretion, retain in the test unit the sample product from which the non-conforming test results have been obtained.
  - 1) If the sample product is withdrawn from the test unit, the inspection representative shall designate two other sample products of his choice within the same test unit. One more test of the same type shall then be carried out on test pieces from each of the two sample products, under the same conditions as for the first tests. Both new tests shall give conforming results.
  - 2) If the sample product is retained in the test unit, the procedure is as indicated in 1), but one of the new test pieces shall be taken from the sample product retained in the test unit. Both new tests shall give conforming results.

#### 8.3.4.3.3 Sequential tests

Where the non-conforming result arises from the sequential method as defined in 8.3.4.2 for impact tests (see [Figure 4](#)), the following shall be carried out.

As stated in 8.3.4.2, the sample product that has given non-conforming results shall be rejected. The procedure shall be as indicated in [8.3.4.3.2](#) b) 1), carrying out one new set of three tests on each of two different sample products from the remainder of the test unit, both of which shall give conforming results. In this case, 8.3.4.2 b) no longer applies.

## 8.4 Invalidation of test results

Test results that are due to improper sampling and/or preparation of test pieces and/or to tests carried out improperly shall be considered invalid.

## 8.5 Rounding of results of mechanical and chemical tests

For the purpose of deciding whether a test result meets a specified value, the results of mechanical and chemical tests shall be expressed by or, if needed, be rounded to the same number of significant figures as in the specified value, using the rules in accordance with ISO 80000-1:2009, Annex B.

The choice of the rounding procedure shall be left to the discretion of the manufacturer, unless otherwise agreed at the time of ordering or otherwise specified in the product or testing standard.

NOTE When using digital display measuring devices, the number of digits shown can be in excess of the precision of the testing device and/or the test method.

## 9 Sorting and reprocessing

The manufacturer has the right to carry out sorting or reprocessing (e.g. heat treatment, machining, rolling, drawing, etc.) of non-conforming products, either before or after retests, and to submit these products as a new test unit in accordance with [8.3.2](#). Where no reprocessing, only sorting, has been applied, the new inspection procedure shall apply only to the requirements that were not complied with during the first inspection and testing. The manufacturer shall inform the inspection representative which method of sorting or reprocessing was used.

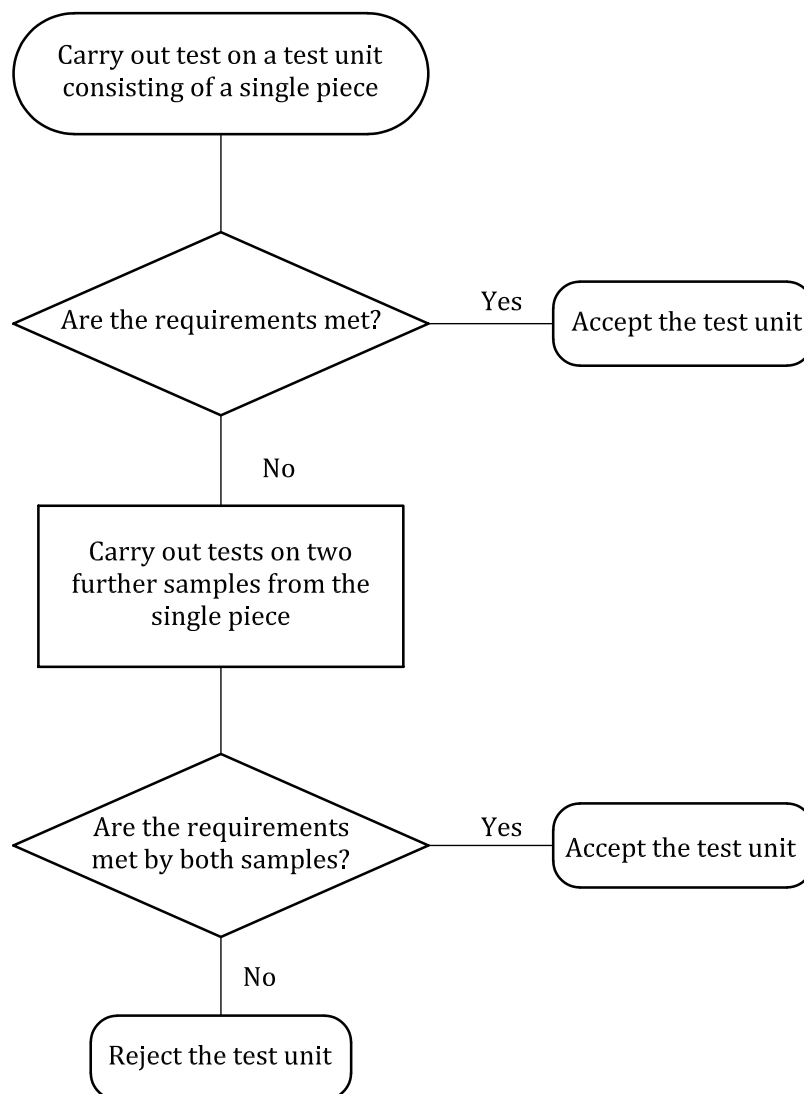
## 10 Marking

The manufacturer shall identify the delivery by marking the product or the consignment either in accordance with the product standard or with the agreement at the time of order. In the absence of such requirements, the manufacturer shall use the identification of his choice.

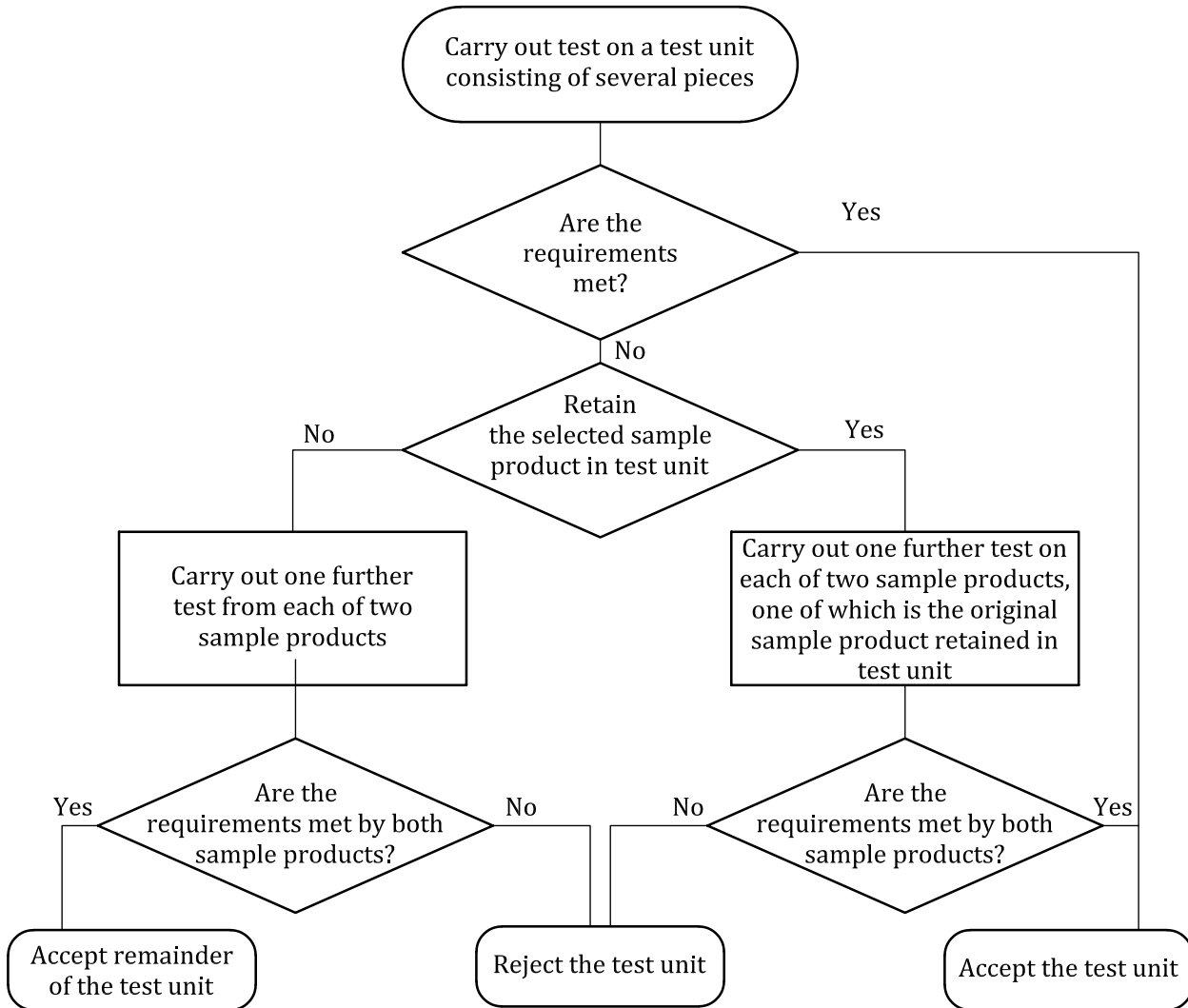
When it is required to provide an inspection document, the products and delivery units shall be marked so that traceability between these and the document is possible.

## 11 Disputes

In case of dispute, the sampling conditions and test methods used to evaluate the disputes characteristics shall be those described in the relevant International Standard, or in [8.3.3](#) and [8.3.4](#) of this International Standard.



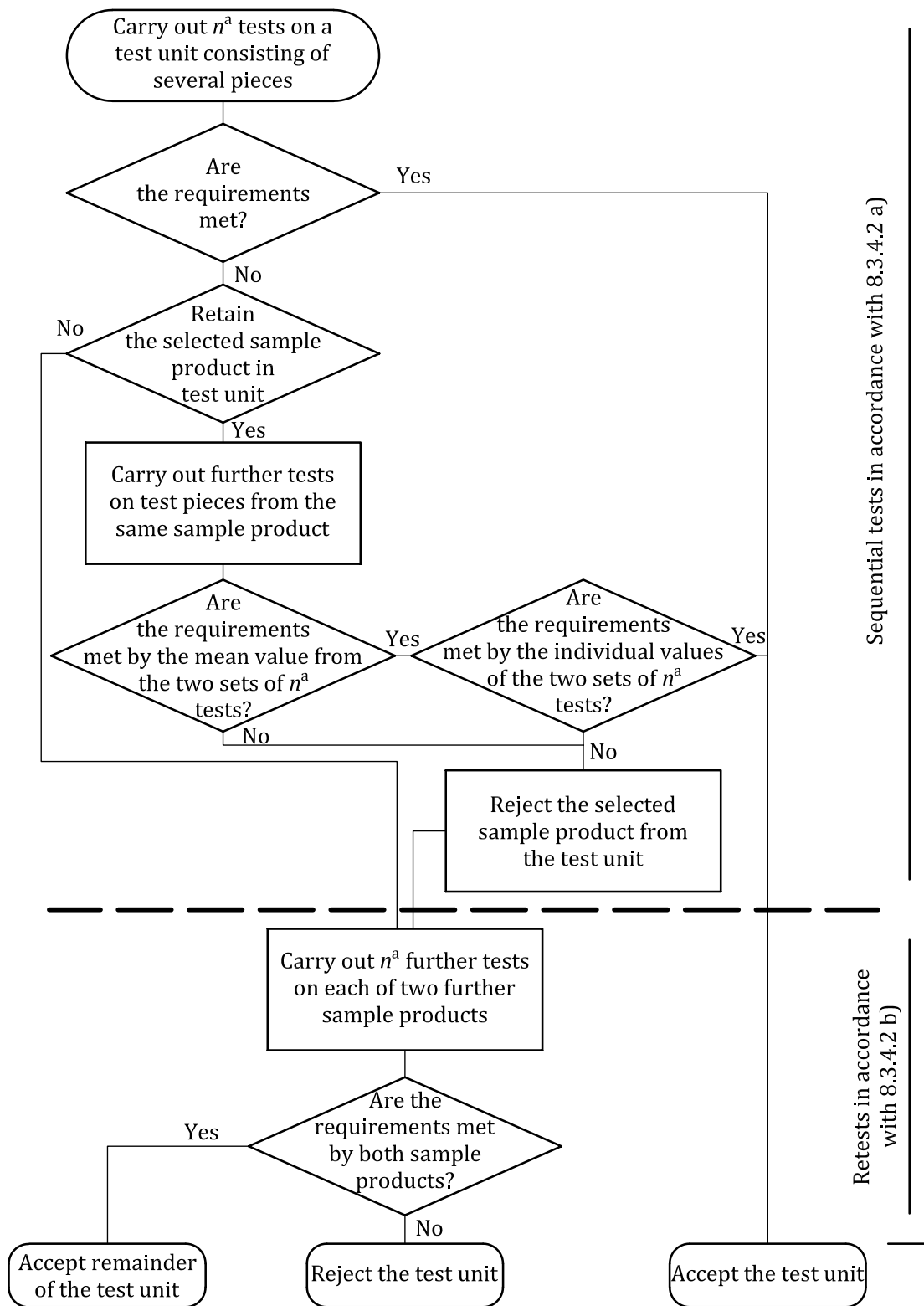
**Figure 2 — Flow chart for tests where the interpretation of results of non-sequential tests is based on individual values only (e.g. for tensile tests) for cases where the test unit consists of a single piece**



**Figure 3 — Flow chart for tests where the interpretation of results of non-sequential tests is based on individual values only (e.g. for tensile tests) for cases where the test unit consists of several pieces**

Vertical line of dots on the left margin.





**Key**

<sup>a</sup> For impact tests,  $n = 3$ .

**Figure 4 — Flow chart for sequential tests in conjunction with retests**

## Bibliography

NOTE General references.

- [1] ISO 3954, *Powders for powder metallurgical purposes — Sampling*
- [2] ISO 4489, *Sintered hardmetals — Sampling and testing*
- [3] ISO 4990, *Steel castings — General technical delivery requirements*
- [4] ISO 7788, *Steel — Surface finish of hot-rolled plates and wide flats — Delivery requirements*
- [5] ISO 9443, *Heat-treatable and alloy steels — Surface quality classes for hot-rolled round bars and wire rods — Technical delivery conditions*
- [6] ISO/TR 9769, *Steel and iron — Review of available methods of analysis*

NOTE Important standards for testing and analysis of iron and steel.

- [7] ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*
- [8] ISO 642, *Steel — Hardenability test by end quenching (Jominy test)*
- [9] ISO 3651-1, *Determination of resistance to intergranular corrosion of stainless steels — Part 1: Austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in nitric acid medium by measurement of loss in mass (Huey test)*
- [10] ISO 3651-2, *Determination of resistance to intergranular corrosion of stainless steels — Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels — Corrosion test in media containing sulfuric acid*
- [11] ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*
- [12] ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*
- [13] ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*
- [14] ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*
- [15] ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*
- [16] ISO 7438, *Metallic materials — Bend test*
- [17] ISO 9001, *Quality management systems — Requirements*
- [18] ISO/TR 9769, *Steel and iron — Review of available methods of analysis*



