Steel and Steel Products – General Technical Delivery Requirements

Content **Page**

Steel and Steel Products _ General
Technical Delivery Requirement

Introduction

This Standard has been prepared based on the third edition of **ISO 404** published in 2013 with some modification of the technical contents.

The portions given dotted underlines are the matters in which the contents of the corresponding international standard have been modified. A list of modifications with the explanations is given in annex JA.

1. Scope

This standard specifies the general technical delivery requirements for steel and steel products as defined in **JIS G 0203** with the exception of steel forgings/ castings and powder metallurgical products.

Where the delivery requirements agreed at the time of ordering or those specified in the product standard differ from the requirements specified in this standard, then it is the requirements agreed for ordering or specified in the product standard that apply.

NOTE: The international standard corresponding to this standard and the symbol of degree of correspondence are as follows.

ISO 404 : 2013 Steel and Steel Products _ General Technical Delivery Requirements **(MOD**)

In Addition, Symbols Which Denote the Degree of Correspondence in the Contents Between the Relevant International Standard and JIS are IDT(Identical), MOD (Modified), and **NEQ** (Not Equivalent) According to **ISO/IEC Guide 21-1.**

2. Normative references

The Following Standards Contain Provisions which, through reference in this Text, Constitute Provisions of this Standard. The Most Recent Editions of the Standards (Including Amendments) Listed below shall be Applied.

MMS JIS G 0203 Glossary of Terms used in Iron and Steel (Products and Quality)

MMS JIS G 0320 Standard Test Method for Heat Analysis of Steel Products

MMS JIS G 0321 Product Analysis and Its Tolerance for Wrought Steel

MMS JIS G 0415 Steel and Steel Products _ Inspection Documents

MMS JIS G 0416 Steel and Steel Products _ Location and Preparation of Samples and Test Pieces for Mechanical Testing.

MMS JIS G 0417 Steel and Iron _Sampling and Preparation of Samples for the Determination of Chemical Composition.

MMS JIS G 9001 Quality Management Systems _ Requirements

NOTE : Corresponding International Standard: ISO 9001 Quality Management Systems _ Requirements (IDT)

JIS Z 8401 Guide to the rounding of numbers

3 Terms and definitions

For the Purpose of this Standard, the Following Terms and Definitions and those Given in **JIS G 0203** Apply.

3.1 Inspection

Activities Such as Measuring, Examining, Testing and 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 Specific Inspection

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

3.4 Inspection representative

On or more individuals among the following:

a) The manufacturer's authorized inspection representative (s) independent from the manufacturing department;

b) The purchaser's authorized inspection representative;

c) The inspector (s) designated by a third party.

3.5 Test unit

Lot or batch of products to accept or reject together, on the basis of the verification tests carried out on the sample products in accordance with the requirement of the product standard or the order (see figure 1)

3.6 Sample product

Item (a sheet, for example) selected from a test unit for inspection and/ or testing (see figure 1)

3.7 Sample

Sufficient quantity of material taken from the sample product for the purpose of producing one or more test pieces (see figure 1)

3.8 Rough Specimen

Part of the sample having undergone mechanical treatment, followed by the heat treatment where appropriate, for the purpose of producing test pieces (see figure 1)

3.9 Test Piece

Part of the sample, with specified dimensions, brought to required condition for submission to a given test (see figure 1)

NOTE : In certain cases, the test piece may be the sample itself or the rough specimen itself.

3.10 Cast (heat) analysis

Chemical analysis representative of the cast (heat) determined by the manufacturer and carried out by the manufacturer according to **JIS** or other documented procedures.

Generally, it means the analysis of chemical composition carried out on the analytical samples [1]) taken during a series of processes in which the molten steel is poured into the mould from a ladle, then solidified.

Note [1]) where it is not feasible to obtain the analytical sample from the molten steel, such as in vacuum arc remelting method (VAR), electro-slag remelting method (ESR) or other method, the analysis shall be carried out on analytical samples taken from steel ingot, steel slab, or steel material, and the results are applied to the cast analysis.

3.11 Product analysis

A chemical analysis carried out on the product.

3.12 Sequential testing

A series of tests from which the average and/ or individual test results are obtained to demonstrate that the requirements of the purchaser and/or the product standard have been satisfied.

3.13 Manufacturer

Organization that manufactures products according to the requirements of the order and the related product specifications.

3.14 Intermediary

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

NOTE : Examples of intermediaries can be steel service centres and stockists.

3.15 Processor

Organization that is supplied with products by the manufacturer, and that then, performs the required processing on those products.

NOTE : See clause 6 for handling of inspection documents to be supplied by the manufacturer and additional documents by the processor.

4 Information to be supplied by the Purchaser

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

The purchaser shall provide all the information necessary for describing the product and its characteristics, and also details concerning delivery exemplified as:

a) Mass, length, area and quantity of products to be delivered;

b) Product shape (it can be a number referring to a drawing, for example);

c) Nominal dimensions;

d) Tolerances on the characteristics in items of a) and c);

e) Symbol of type of steel;

f) Delivery condition (type of heat treatment, surface treatment, etc.);

g) Specific requirements for surface quality and/or internal quality;

h) Where not specified in the product standard, the type of inspection document and the inspection and testing requirements;

i) When the quality management system given in **JIS Q 9001** is applied, the standard number thereof;

j) Requirements for marking, packing and loading;

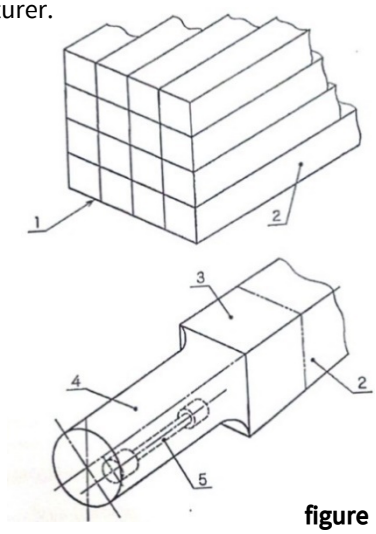
k) Any optional (supplementary) requirements provided for by the product standard.

4.2 The information in 4.1 shall be specified in accordance with the following.

a) It shall be specified by reference to one or more of Japanese Industrial Standards;

b) In the absence of Japanese Industrial Standard, it shall be specified by stipulation of the characteristics and conditions required;

c) If, in an order, reference is made to a given Japanese Industrial Standard without specifying the edition date (year of publication), this reference interpreted as being the edition current at the date of the order acknowledgement shall be applied; in the special case where reference is made to a Japanese Industrial Standard by specifying the edition (year of publication), the edition to be applied shall be upon the agreement between the purchaser and the manufacturer.



1. Test unit
2. Sample product
3. Sample
4. Rough specimen
5. Test piece

figure 1 examples of terms defined in clause 3

5 Manufacturing process

The manufacturing process shall be left to the discretion of the manufacturer, unless otherwise agreed between the purchaser and the manufacturer or otherwise specified in the product standard.

NOTE : The manufacturing process covers all operations up to the delivery of the products.

6. Supply by intermediary or processor

Where there is a request from the purchaser, the intermediary or processor shall submit the manufacturer's inspection documents in accordance **WITH JIS G 0415.**

This documentation from the manufacturer shall include suitable means of identification of the product in order to ensure the relationship between the product and the documentation (see clause 14).

If the intermediary has changed the dimension [2)] of the product, the intermediary shall supply an additional document for these particular new conditions to the purchaser.

The processor shall inspect by itself the properties that are changed from the requirements of the order and the referenced product specification and report in the additional documents the type of processing it performed and the results of the inspection. This is not applicable to minor processing such as recoiling, or local heating or plastic deformation during cutting.

NOTE [2)] The dimensions herein mean, for example, the width and length of steel sheets and steel strips or the length of steel bars and do not include the sheet thickness and diameter.

7 General 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 ascertain that the products to be supplied comply with the quality and dimension requirements of the order, irrespective of the type of inspection document required. Where the testing is associated with any health and safety hazards, it is the responsibility of the user of this standard to establish adequate safety and health measures.

7.2 Inspection by representative

Upon the request, the inspection representative shall be informed by the manufacturer of the date of availability of part or all of the products to be supplied 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 the interference with the normal operation of the works.

A submission note referring to the order shall be delivered to the inspection representative by the manufacturer not later than the beginning of the inspection and testing procedure.

In order to carry out the agreed inspection and testing, the manufacturer shall make sure that the inspection representative has free access, at the agreed time, to the places where the products to be tested and inspected are manufactured and stored. The inspection representative may select the sample products from the test unit from which the samples are to be taken in conformity with the specifications. The inspection representative shall have the right to be present on the sampling, the preparation (machining and treatment) of test pieces and the test. However, 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 the inspection representative accompanied by one of their representatives. The inspection and testing procedures shall be carried out so that disturbance of the normal run of production is minimized.

7.3 Specific inspection and testing

7.3.1 Information to be supplied at the time of enquiry and order

The enquiry and the order shall cover all the following items, if not specified in the product standard:

a) The type of document required, for example an inspection certificate 3.1 or inspection certificate 3.2 specified in table 1 OF **JIS G 0415;**

NOTE 1: In JIS G 0415: 1999, replaced by the current edition, the designation for inspection certificate 3.1 was inspection certificate **"3.1.b"**

NOTE 2: In the clause of "report" in product standards that states that the type of inspection document is to comply with **3.1.b** (inspection certificate **3.1.b**) in table 1 of **JIS G 0415**, the inspection certificate 3.1.b should be understood to be equivalent to the inspection certificate **3.1** specified in **JIS G 0415.**

b) The testing frequency (see 9.2);

c) The requirements for sampling and for the preparation of the samples and test pieces (see 7.6);

d) The identification of test units, where appropriate;

e) The test methods (see 7.5)

f) The address and name of the inspection body, in the case of inspection certificates or inspection reports validated by external inspectors.

7.3.2 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 purchaser and the manufacturer, or at an establishment accredited by a recognized organization. In the latter case, products shall not be delivered prior to the receipt of the test results by the manufacturer.

7.4 Traceability during testing

During the test operations, the manufacturer shall be able to provide traceability between the samples and test pieces, and the test unit from which they are taken. When a retest is carried out in accordance with 9.8.2.2, the manufacturer shall ensure the traceability between the sample product and the test unit so that removing the sample product from the test unit or retesting using the sample product is possible.

7.5 Test method and equipment

Tests shall be carried out in accordance with the corresponding Japanese Industrial Standard. Where no such Japanese Industrial Standard exists, other test methods shall be used agreed upon at the time of ordering (see 4.1 h)

The equipment used by the manufacturer for final inspection and testing to test the characteristics for which specific requirements are included in the order or the product standard shall be calibrated and adjusted against certified equipment having a known valid relationship to national standards or equivalent thereto, and so as to be maintained, where such standards exist. Where such standards do not exist, the basis for calibration shall be documented. The manufacturer shall maintain the calibration records for the equipment. the precision of the measuring or testing device shall be sufficient in relation to the specified values and tolerances thereof.

The chemical composition may be determined by chemical, physical or spectrochemical methods of analysis. in cases of arbitration, the method to be used shall be agreed upon.

a list of the major **Japanese industrial standards** used for testing and analysis are shown in bibliography.

7.6 Sampling conditions and test pieces

Sample preparation for mechanical tests and chemical analysis shall be in accordance with **JIS G 0416** and **JIS G 0417**, respectively.

For the location, direction and preparation of test pieces, JIS G 0416 and JIS G 0417, and the provisions of the product standard or the requirements of the order shall apply. In the case of neither the provisions of the product standard nor the requirements of the order, the test pieces shall be taken in parallel to the rolling direction (in the axial direction) for steel bars, wire material, wire, section steel, flat steel, etc., and in parallel to the rolling direction (in the axial direction) or perpendicular to the rolling direction for steel sheets, strips, and pipes. for the hardness test piece, a part of other test piece such as the tensile test piece may be used, unless otherwise specified.

When two or more types of test pieces are admitted to be used by the provisions of each product standard, unless otherwise specified, the test piece to be used shall be selected by the manufacturer. The location of test pieces, except when the test is to be carried out on the whole cross- section of steel products, shall be in accordance with JIS G 0416, unless otherwise specified.

The method of taking samples and test pieces for submission to mechanical tests shall be in accordance with either class a or class b as described in the following, depending on the types of steel. which of the two methods is to be adopted shall be in accordance with each product standard.

a) Class a method shall be applied in the case of performing the mechanical test using test pieces prepared from a sample taken from the product according to JIS G 0416.

1) The test pieces shall be prepared from the sample taken from the product itself or its extra length according to JIS G 0416. The samples shall not undergo any treatments, e.g., heat treatment, likely to affect their quality. Where it is unavoidably necessary, the samples or test pieces may be straightened at ordinary temperature.

2) The sample shall be taken from the product itself or its extra length. Where the sample is required to be heated treated, it shall be given the prescribed heat treatment without changing its thickness, diameter or other dimensions. from the heat-treated sample, test pieces shall be prepared in accordance with the method described in JIS G 0416.

b) Class b method shall be applied in the case of performing the mechanical test using test pieces prepared from a reference sample which has been given the prescribed heat treatment, and shall be as follows.

1) The reference sample shall be 25 mm in diameter, prepared from steel products or semi-finished steel products by stretching or cutting in the axial direction. for steel products of 25 mm or under in dimensions or semi-finished steel products that are as continuously cast, the following shall apply.

- In the case of steel products of 25 mm or under in diameter, width across flats or thickness, the product, as it is, may be used as a reference sample.
- In the case of semi-finished products that are as continuously cast, reference sample shall be prepared by stretching in the axial direction. in this case, the forming ratio shall be 4 or greater.

2) The test pieces shall be cut out from the reference sample subjected to the pre - scribed heat treatment.

8. Chemical composition

The chemical composition shall be as follows.

a) For the requirements concerning the chemical composition, the cast analysis shall be carried out unless otherwise clearly specified as the product analysis. The analysis method shall be in accordance with **JIS G 0320.**

b) The sample for cast analysis shall be taken from the location representative of the cast. Sampling and preparation of samples shall be in accordance with **JIS G 0417**.

c) When requested by the purchaser, the product analysis shall be carried out. In this case, the sampling method shall be in accordance with **JIS G 0417**. Tolerances on variation from the specified values for analyzed elements and chemical composition shall be as specified in each standard. where not specified in each standard, the tolerances shall be designated by the indication of the table number in **JIS G 0321** upon the agreement between the purchaser and the manufacturer.

d) The analysis values shall be expressed in the mass fraction, and when percentage is used, they may simply be indicated with the symbol %. In this case, unit indication for tables may simply be %. The analysis values shall be rounded to the specified significant figures according to rule A of **JIS Z** 8401. When the carbon equivalent, weld crack sensitivity composition and crack sensitivity equation for galvanizing are to be indicated, all the elements specified in the calculation equation shall be analyzed and calculated based on the respective equations for the carbon equivalent, weld crack sensitivity composition and crack sensitivity equation for galvanizing given in each product standard, and rounded to the specified significant figures according to rule a of **JIS Z 8401.**

9 Mechanical properties

9.1 Mechanical tests (tensile test, impact test, hardness test, bend test, etc.;)

The test methods and the types of test pieces shall be as specified in each product standard.

9.2 Testing frequency

9.2.1 Formation of test unit

For each type of test, the test unit shall be specified in accordance with the order or the product standard.

The test unit shall generally be in accordance with a) and b).

a) The combination of the following factors:

1) The same cast;

2) The same casting sequence;

3) The same rolling unit;

4) The same heat treatment condition or simultaneous heat treatment;

5) The same product form;

6) The same range of thickness or diameter, side length or width across flats.

b) The mass or the number of the test unit

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

9.2.2 Number of sample products, samples and test pieces

For each test, the number of sample products taken from each test unit, the number of samples taken from each sample product and the number of test pieces taken from each sample shall be as specified in the product standard or the order.

9.3 Applicable dimensions

Where, in the product standard, the mechanical properties requirements are given according to the dimension categories such as thickness, diameter, etc., applicable dimension shall be the nominal dimension of the product at the specified sampling position for mechanical test.

9.4 Applicable product condition

When not specified in the order or the product standard, the mechanical properties tested shall be those of the as-delivered condition of the products.

9.5 Assessment of absorbed energy value of impact test

Unless otherwise specified, the absorbed energy value of the impact test shall be the average value of results of individual tests, and shall be assessed in accordance with 9.6.

9.6 Assessment of results of sequential testing

the assessment of the results of a set of sequential testing shall be carried according to the method of sequential testing. for the impact test, the following shall be applied the assessment of other testing, for example tensile testing in the thickness direction, shall be carried out in a similar manner.

a) The average value of a set of three test pieces shall satisfy 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 a) are not satisfied and not more than two of the three individual values are lower than the specified 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 value;

2) Not more than two of the six individual values may be lower than the specified value;

3) Not more than one of the six individual values may be lower than 70% of the specified value.

c) If the conditions of 1) or b) are not satisfied, the sample product shall be rejected and retests shall be carried out on the remainder of the test unit (see 9.8.2.3)

9.7 Handling of leftovers

Where the purchaser demands that the samples be taken from steel products having the ordered dimension, the purchaser shall accept the leftovers of the steel products from which samples have been taken and which fall short of the ordered dimensions as those having the ordered dimensions.

9.8 Retests

9.8.1 Invalidation of test

Test results that are due to improper sampling and/ or preparation of test pieces and or to tests carried out improperly, such as described in the following, shall be considered invalid:

a) Where, before testing, defective machining is found on the test piece or where the test piece has flaws considered irrelevant to the quality;

b) Where an erroneous test operation is found;

c) Where, in tensile test, the test piece breaks off at a point outside ¼ of the gauge length from the centre between the two gauge marks with the result that the elongation does not meet the specified value.

9.8.2 Method of retests

9.8.2.1 General

Where one or more tests give non-conforming test results, the manufacturer may either withdraw the test unit concerned, or carry out retests in accordance with the procedures specified in 9.8.2.2. and 9.8.2.3.

NOTE: If the test results significantly deviate from the specified value for the objective steel type, there is a suspicion that foreign products have been incorporated. Therefore, the retest shall be carried out properly with caution according to the procedures specified in 9.9.

9.8.2.2 Test determined by individual value

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 quenching test), the following procedures shall be carried out.

a) Where the test unit is a single piece of product (see figure 2)

Two new tests of the same type as the one giving a non-conforming test result shall be carried out. Both new retests shall give conforming results. If not, the products shall be rejected.

b) Where the test unit is more than one piece of the product (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, in accordance with the following.

1) If the sample product is withdrawn from the test unit, the inspection representative shall designate two other sample products 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) When the sample product is retained in the test unit, the procedure shall be as indicated in 1), but one of the new test pieces shall be taken from the sample product retained in the test unit. If agreed between the purchaser and the manufacturer, both of the two test pieces for retest may be taken from the sample product rejected in the first test. Both new tests shall give conforming results.

Further, when the marking of each bundle or package is admitted by the marking specification of the product standard, the product group (bundle, package, etc.) which satisfies the following conditions may be considered as the same sample product.

- Weld steel pipe: product group manufactured by the same coil at the same forming under the same conditions.
- Rod steel, section steel, seamless steel pipe: product group manufactured from the same steel slab product.

9.8.2.3 Sequential testing

Where the non-conforming result arises from the impact test specified in 9.6, the following sequential test shall be carried out (see figure 4).

As stated in 9.6, the sample product which has given non-conforming results shall be rejected. The procedure shall be as indicated **in 9.8.2.2.b**) 1), carrying out the test on new set of three test pieces (six in total) on each of two different sample products from the remainder of the test unit, and both sets shall give conforming results. in this case**, 9.6 b**) no longer applies.

9.9 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 the retests, and to submit these products as a new test unit in accordance with 9.2. where no reprocessing but only sorting has been applied, the new test/ inspection procedure shall be carried out only on the items which have been failed during the first test/ inspection. where agreed between the purchaser and the manufacturer, the manufacturer shall inform the inspection representative the sorting method or the reprocessing method used.

10. Other properties

Other properties (other than chemical composition and mechanical properties) shall be in accordance with the provisions of each product standard.

11 Surface and internal quality

11.1 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. Detailed requirements referring to these surface and internal imperfection shall, where appropriate, be agreed upon between the purchaser and the manufacturer at the time of enquiry and order by reference to the appropriate Japanese industrial standard (or other relevant standard if no Japanese Industrial Standard exists).

11.2 Detection of defects

The application of special techniques (radiography, ultrasonic, magnetic detection etc.) to detect defects shall be as specified in the product standard or as agreed between the purchaser and the manufacturer at the time of ordering, and the number of products tested and the procedure for interpreting the results, when required, shall be as specified in the product standard or as agreed between the purchaser and the manufacturer.

11.3 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.

11.4 Repairs by welding

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

12 Shape, dimensions and mass

When the shape, dimensions and mass of steel products are inspected, the determination shall be made using a measuring device with a proper precision in conjunction with their tolerances.

13 Report

13.1 Rounding method of results of mechanical tests and chemical analysis

For the purpose of deciding whether a test result meets a specified value, unless otherwise specified in the order or the product standard, the results of mechanical tests and chemical analysis shall be calculated to a place next to the lowest of significant figures in a specified value and rounded off to the same number of significant figures as the specified value according to rule **a of JIS Z 8401.**

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

13.2 Type of inspection document, and inspection and testing

The purchaser shall designate the type of inspection document **(JIS G 0415),** if other than that specified in the product standard is required at the time of ordering (see 4.1 b).

14 Marking

The manufacturer shall mark the products or the products to be supplied for identification in accordance with the product standard or upon the agreement at the time of ordering. In the absence of such demands, the selection of marking for identification shall be left to the discretion of the manufacturer.

When an inspection document is to be provided, the products and delivery lots shall be marked so as to be traceable to the document.

NOTE : Provision of space between letters of the marking of types, etc. is optional as long as the marking content is clearly recognizable, and therefore need not be specified.

15 Dispute

In case of dispute, the sampling conditions and test methods of test pieces used to evaluate the disputed characteristics shall be in accordance with 7.5 and 7.6, or in the relevant Japanese Industrial Standard.

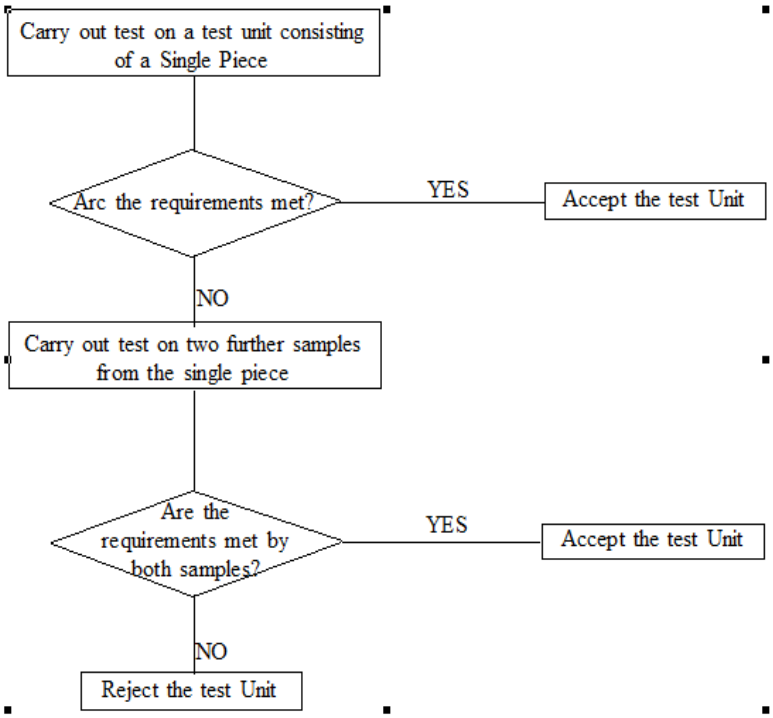
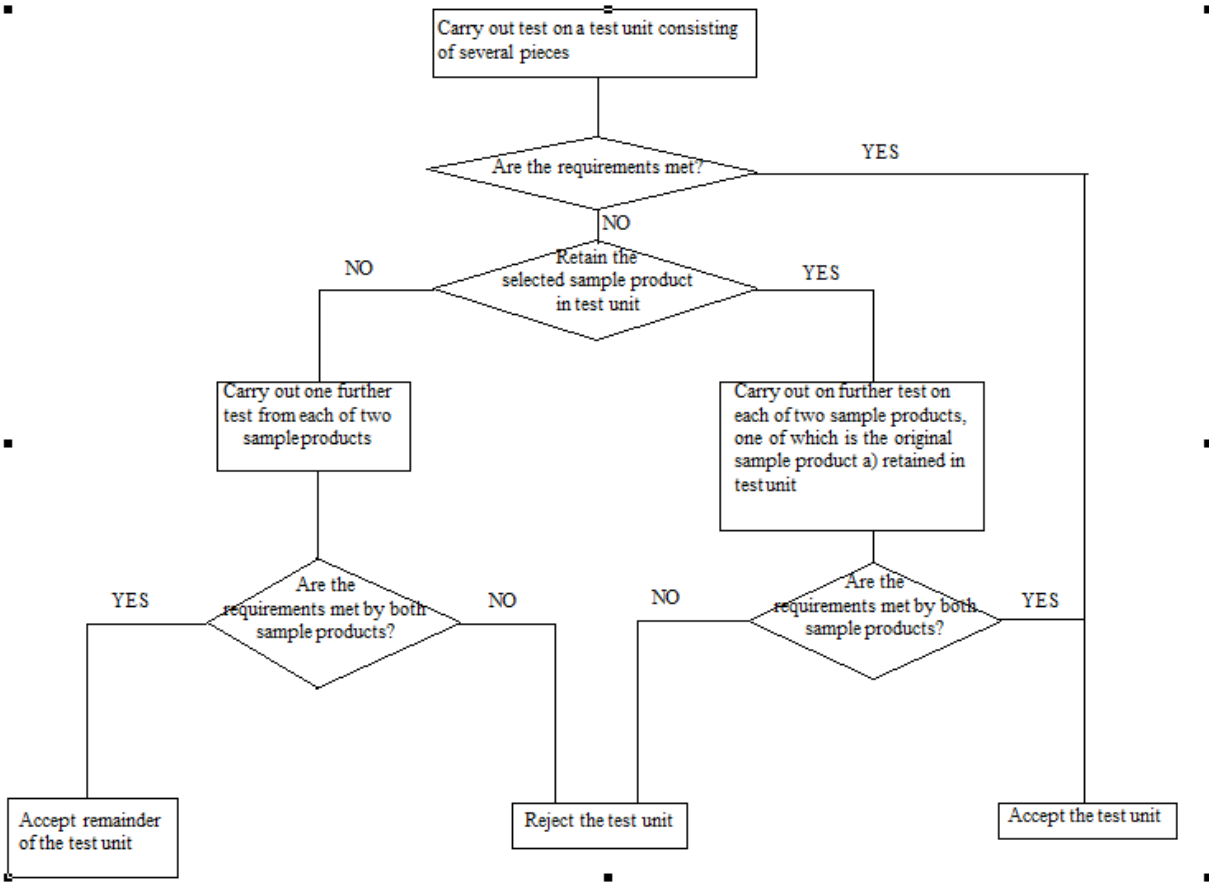


Figure 2 Flow chart for tests where the interpretation of results of non-sequential tests is based on individual values only (e.g., for tensile tests) for cases where the test unit consists of a single piece.



NOTE [a)] Upon agreement between the purchaser and the manufacturer, both two sample products may be the original sample products.

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.

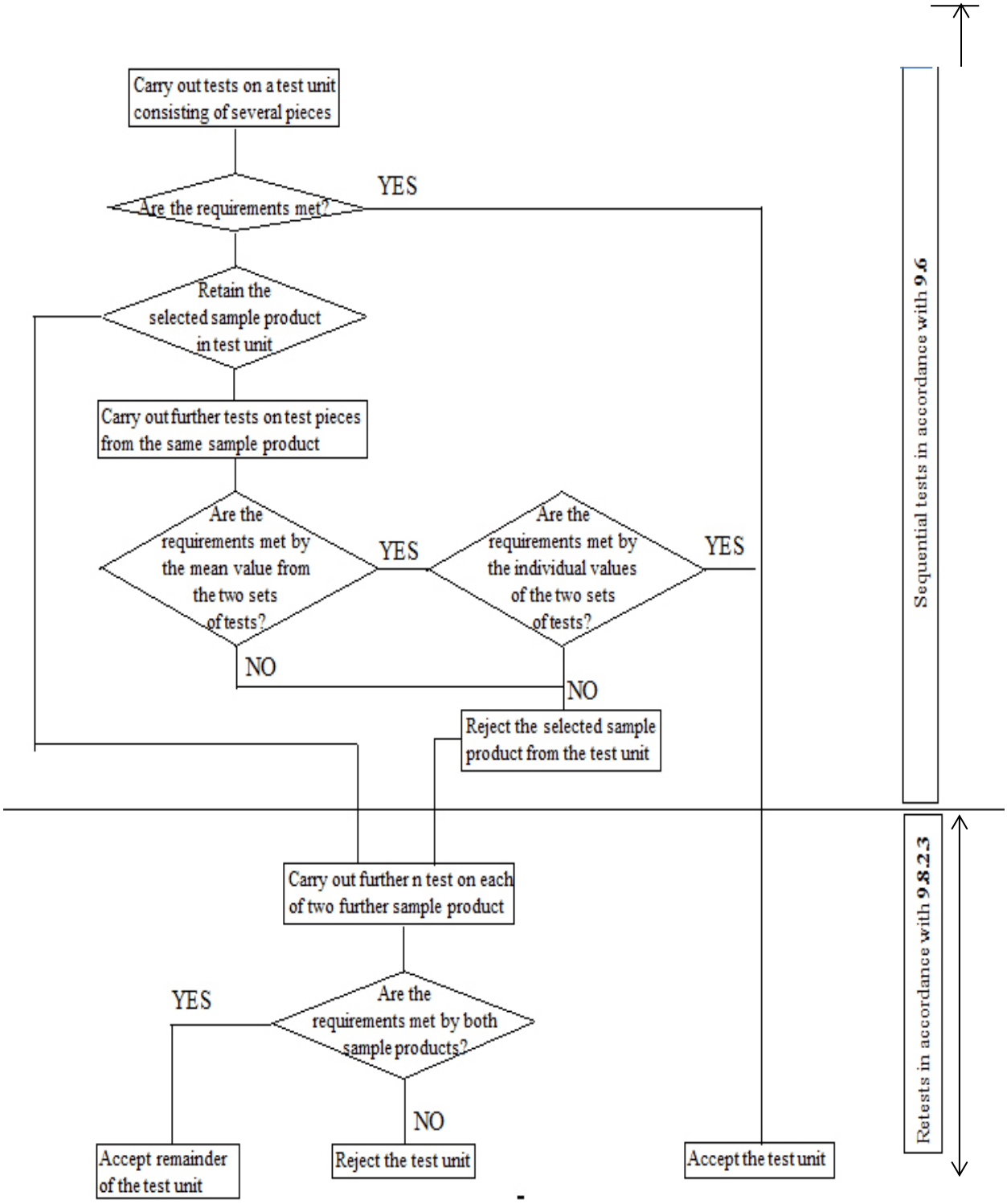


Figure 4 Flow chart for sequential tests in conjunction with retests (e.g., Charpy impact test)