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**Steel castings — General technical
delivery requirements**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Steel Castings and Forgings Association of Japan (JSCFA)/ Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently, **JIS G 0307 : 1998** is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Steel castings — General technical delivery requirements

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **ISO 4990** published in 2003 with some modifications of the technical contents.

The portions given sidelines or 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 the supply of steel, nickel and cobalt alloy castings (hereafter referred to as “castings”), including the requirements for the selection and preparation of test pieces and samples.

When a material or product standard differs from this delivery specification, the material or product standard shall apply. This Standard also specifies a group of supplementary requirements which may be applied to castings. These requirements are provided for use when additional testing or inspection is desired and apply only when individually specified by the purchaser.

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

ISO 4990 : 2003 *Steel castings — 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.

JIS B 0403	<i>Castings — System of dimensional tolerances and machining allowances</i>
JIS B 0659-1	<i>Geometrical Product Specifications (GPS) — Surface texture : Profile method; Measurement standards — Part 1 : Material measures</i>
JIS G 0203	<i>Glossary of terms used in iron and steel (Products and quality)</i>
JIS G 0320	<i>Standard test method for heat analysis of steel products</i>

JIS G 0415	<i>Steel and steel products — Inspection documents</i>
JIS G 0417	<i>Steel and iron — Sampling and preparation of samples for the determination of chemical composition</i>
JIS G 0553	<i>Steel — Macroscopic examination by etching</i>
JIS G 0567	<i>Method of elevated temperature tensile test for steels and heat-resisting alloys</i>
JIS G 0575	<i>Method of copper sulfate-sulfuric acid test for stainless steels</i>
JIS G 0581	<i>Methods of radiographic examination for steel castings</i>
JIS G 0585	<i>Radiographic inspection for steel castings</i>
JIS G 0588	<i>Visual examination and classification of surface quality for steel castings</i>
JIS G 1201	<i>Iron and steel — General rules for analytical methods</i>
JIS H 1270	<i>General rules for chemical analysis of nickel and nickel alloys</i>
JIS Z 2241	<i>Metallic materials — Tensile testing — Method of test at room temperature</i>
JIS Z 2242	<i>Method for Charpy pendulum impact test of metallic materials</i>
JIS Z 2320-1	<i>Non-destructive testing — Magnetic particle testing — Part 1 : General principles</i>
JIS Z 2343-1	<i>Non-destructive testing — Penetrant testing — Part 1 : General principles — Method for liquid penetrant testing and classification of the penetrant indication</i>
JIS Z 2344	<i>General rule of ultrasonic testing of metals by pulse echo technique</i>
JIS Z 3422-1	<i>Specification and approval of welding procedures for metallic materials — Welding procedure tests — Part 1 : Arc and gas welding of steels and arc welding of nickel and nickel alloys</i>
JIS Z 8401	<i>Guide to the rounding of numbers</i>
ISO 18265	<i>Metallic materials — Conversion of hardness values</i>

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS G 0203, JIS Z 3422-1, and the following apply.

3.1 inspection document

document necessary for the approval that the technical delivery requirements for the castings have been met (see JIS G 0415)

3.2 cast, heat

all the molten metal poured from a single furnace or all the molten metal from two or

more furnaces poured into a single ladle which is considered as a unit for one lot

NOTE : Some examples are :

- All the molten metal from one or more furnaces poured into a single ladle.
- All the molten metal in one melt in a single furnace.

The words “single ladle” and “single furnace” are the criteria for determining the cast (heat) definition.

4 Information to be supplied by the purchaser

4.1 Enquiry and order requirements

The enquiry and order shall include the following particulars. If the purchaser cannot specify these particulars, they shall be agreed between the purchaser and the manufacturer.

- a) A description of the casting(s) by pattern number and/or drawing shall be by the following :
 - 1) When a pattern is supplied, a description on the pattern equipment shall be included.
 - 2) When no drawing is supplied, the casting is purchased on the basis of as per pattern. In that case, the manufacturer shall not be responsible for the dimensions of the part.
 - 3) Dimensional tolerances and machining allowances may be selected from JIS B 0403.
 - 4) All modifications to be made to the drawing, for the technical requirements of the manufacturer, shall form the subject of an agreement between the purchaser and the manufacturer.
- b) The product standard, delivery condition, and grade of castings.
- c) The non-destructive testing procedures to be used, the extent of the non-destructive tests and the acceptance criteria.
- d) The type of inspection document to be provided at the time of supply.

4.2 Additional information

Where appropriate, the enquiry and order shall include the additional information, such as given in the following.

- a) Any supplementary requirements in accordance with clause 6
- b) Size of a test lot (see 6.2.2.1)
- c) Procedures for marking in accordance with clause 7, machining, rust prevention, packaging, loading, dispatching and destination
- d) The submission of sample castings for approval before production quantities are produced (see A.1.2)

- e) Methods of statistical control to be used
- f) Any supplementary requirements in accordance with Annex B
- g) The place of inspection for the purchaser, if the inspection cannot be performed at the manufacturer's works (for inspection method, see Annex A)

5 Conditions of manufacture

5.1 Method of melting, casting, heat treatment, etc.

Unless otherwise agreed at the time of enquiry and order or specified in the product standard, the selection of the method of melting, casting, heat treatment, etc. is left to the discretion of the manufacturer.

5.2 Cleaning and dressing

All the castings shall be cleaned and dressed well enough to determine compliance with the requirements of 6.2.3. Additional dressing may be agreed upon at the time of enquiry and order.

5.3 Repair by welding

Repair by welding shall be, when specified at the time of enquiry and order, performed according to a welding procedure agreed between the purchaser and the manufacturer. When it is not specified at the time of enquiry and order the casting(s) may be subject to repair by welding without the previous approval of the purchaser, in which case, the procedures for repair by welding may be in accordance with JIS Z 3422-1.

For a supplement specifying major finishing welds, see B.8.

6 Inspection and testing

6.1 Non-specific inspection and testing

Non-specific inspection and testing shall be as follows.

- a) This inspection and testing shall be arranged by the manufacturer, and drawn up to ensure that the specified requirements are complied with.
- b) At the request of the purchaser at the time of enquiry and order, the manufacturer shall supply a specified inspection document from JIS G 0415 on the basis of these non-specific inspection or tests.

6.2 Specific inspection and testing

6.2.0A Specific inspection and testing

The specific inspection and testing shall be performed in accordance with 6.2.2, 6.2.3 and Annex A.

6.2.1 Inspection documents

Inspection documents shall be as follows.

- a) Inspection documents shall be agreed upon at the time of enquiry and order, and

shall be in accordance with **JIS G 0415**.

- b) If ordered by the purchaser at the time of enquiry and order, the manufacturer shall submit one of the documents for specific inspection and testing from **JIS G 0415**.
- c) The inspection document shall contain the results of the chemical analysis and mechanical tests, including the results of any other tests required by the specification and by the purchaser. It shall include a statement that castings were manufactured in accordance with the requirements of the specification.
- d) The inspection document shall be given a sign or seal by an authorized agent responsible for confirming its validity.
- e) In the case of Electronic Data Interchange (EDI), the manufacturer's certification, printed form or used in electronic form, shall be regarded as having the same validity as a counterpart printed in the certifier's facility provided it conforms to any existing agreement between the purchaser and the manufacturer.
- f) The inspection document shall provide the required traceability to the castings. Traceability in this provision refers to mutual traceability, recognised at the time of delivery, between the inspection document and the castings, through identification by the inspection items given in the inspection document or by identification symbols remaining on casting products.

If no specification is made at the time of the order, the manufacturer is not required to submit the inspection document or any similar document. Also, if agreed at the time of enquiry and order, all of the requirements of a) to f) need not be satisfied.

6.2.2 Sampling, preparation of test pieces, and mechanical and chemical test methods and requirements

6.2.2.0A General

The purchaser and the manufacturer shall agree on matters specified in 6.2.2.1 to 6.2.2.5.

6.2.2.1 Formation of test lots

The method of forming test lots shall be stated in the order. The size of the test lot may be defined in terms of mass or number of castings, e.g., it may be done as follows.

- a) **Classification by material and heat treatment** : the products that come from casts of the same grade and from heat treatments having the same cycles; the size in this case shall be determined between the purchaser and the manufacturer according to the number of castings or their total mass.
- b) **Classification by heat treatment** : the products that come from the same cast and have undergone the same heat treatment in the same furnace
- c) **Classification by piece** : for certain products where made necessary by technical requirements
- d) **Classification by supplementary agreement** (see **B.2.3**)

- e) Classification by others : the products classified according to other statistical technique; test block is prepared per lot of the castings, with which the mechanical tests are carried out

6.2.2.2 Test blocks

Test blocks shall be as follows.

- a) The test blocks shall be produced from the same cast of steel as used for the castings, and may be cast separately or attached to the castings or cast integrally on the castings.

When molten metal from more than one furnace have been poured into one ladle, this shall be regarded as one cast. Further, when one casting product is cast by molten metal from more than one furnace, the resulting castings shall be regarded as one cast, and the test block shall be attached to the castings or cast integrally on castings. Where this is impracticable, the position and method of attaching the test blocks shall be as agreed between the purchaser and the manufacturer, and in the case of no specification made by the purchaser, it shall be at the discretion of the manufacturer.

- b) Test blocks shall have a shape as described in 1) or 2) below, and shall be taken at the position as described in 3) below.

1) Shape of test blocks shall be such that the cross-sectional dimensions at the position for obtaining test piece is 28 mm × 28 mm (see **B.6.1**).

2) Shape of test blocks shall be as shown in a), b), c) or d) in figure 1.

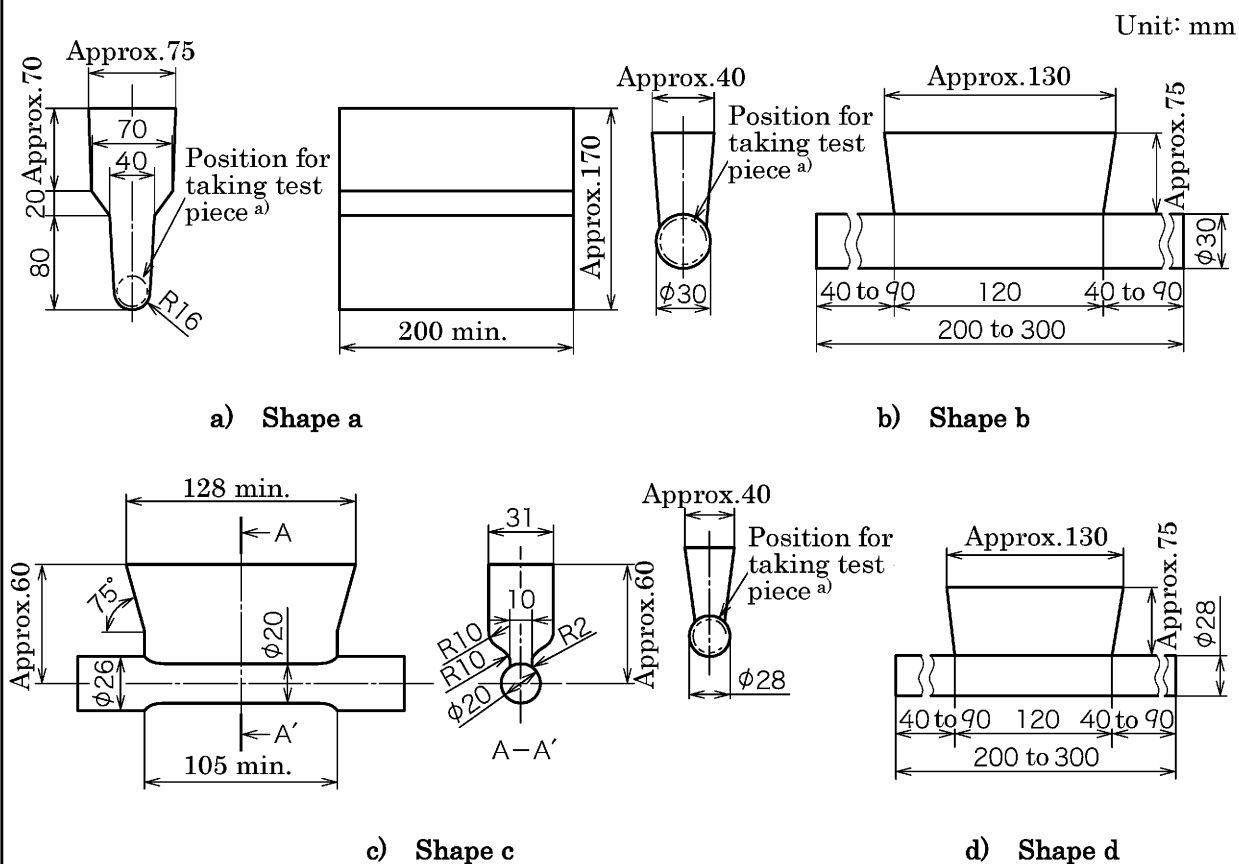
3) Test pieces used for mechanical tests shall be taken from test blocks with their axis at least 7 mm from the surface.

- c) Test blocks shall be given heat treatment, including stress relief treatment, in the production furnaces of the same procedure as the castings they represent. Giving the heat treatment of the same procedure in this case means either loading together with the castings for heat treatment or maintaining at the same temperature and for the same duration within the same control range and also using the same cooling method as the castings.

- d) In order to confirm mechanical properties representing the castings, the test block other than a) to c) above may be agreed between the purchaser and the manufacturer. In this case, the following items shall be agreed.

- 1) The grade and sampling method of a test block
- 2) The grade and method of attachment of an attached test block
- 3) The sampling position and sampling method from a product
- 4) Separately cast test block
- 5) The dimensions and shape of the test block
- 6) The sampling time of the test block

- 7) The position and cutting method of a test piece from the test block
 - 8) Mechanical properties
- e) The test results represent the material from which the castings have been poured. They do not necessarily represent the properties of the castings. These may be affected by solidification conditions and the rate of cooling during heat treatment, which are in turn influenced by casting thickness, size and shape.



Note a) The test piece shall be taken from the position near the lower portion of the test block indicated by a chain double-dashed line in the figure.

Figure 1 Shapes and dimensions of test block

6.2.2.3 Mechanical tests

6.2.2.3.1 Tensile test

Tensile test pieces shall be prepared and one tensile test shall be carried out at room temperature per test lot (see 6.2.2.1). The shape and the dimensions of test piece, sampling method and the test method shall comply with table 1. The test results shall comply with the product standard for the grade of material ordered.

6.2.2.3.2 Impact test

Three Charpy test pieces with V-notches shall be prepared per test lot and the im-

test shall be carried out. The shape, dimensions of test piece, sampling method and the test method shall comply with table 1. The test temperature shall be as shown in the material specification. The test results shall comply with the product standard for the grade of material ordered.

Table 1 Types of mechanical tests and test methods

Type of test	Shape and dimensions of test piece and sampling method ^{a)}	Test method
Tensile test	One No.14A test piece (diameter of parallel portion 14 mm) specified in JIS Z 2241, taken in accordance with 6.2.2.2.	In accordance with JIS Z 2241.
Impact test	Three V-notch test pieces ^{b)} with square section with 10 mm sides as specified in clause 6 of JIS Z 2242, taken in accordance with 6.2.2.2.	In accordance with JIS Z 2242.
Notes ^{a)} Sampling method for centrifugally cast steel tubes shall be as agreed between the purchaser and the manufacturer. ^{b)} For centrifugally cast steel tubes, the test piece width may be changed to 7.5 mm or 5.0 mm, depending on the dimensional restriction of the product.		

6.2.2.4 Re-tests

6.2.2.4.1 Invalid tests

The test results not in compliance with the specifications are not valid when due to the following a) to d).

In all cases, a new test piece shall be taken from the same test block or from another test block belonging to the same test lot and the results obtained can be substituted for those corresponding to the defective piece.

- a) Defective assembly of the test piece or abnormal functioning of the test machine
- b) Defective manufacture of the test pieces or existence of flaws considered irrelevant to the quality of the material
- c) A break in the tensile test piece that is observed outside the area from the centre of reference marks to 1/4 the gauge distance, the value of which does not conform to the specification
- d) Anomalies shown in the test piece

6.2.2.4.2 Re-tests of non-conforming products

When the results of the test do not comply with the requirements of the material specifications, the manufacturer may, unless otherwise agreed upon at the time of enquiry and order, perform the re-tests specified in 6.2.2.4.2.1 and 6.2.2.4.2.2.

6.2.2.4.2.1 Re-tests

The re-test shall be in accordance with either of the following.

a) **JIS steel grade** The re-test of **JIS** steel grades shall be as follows.

- 1) **Tensile test** When the specified value has not been satisfied in the tensile test, a re-test shall be carried out using test pieces two times the predetermined number taken (two spare test pieces).

When all of the test pieces satisfy the specified value, the product shall be considered as acceptable.

When any of the test pieces fails the test, the re-test under re-heat treatment shall be carried out in accordance with **6.2.2.4.2.2**.

- 2) **Impact test** The re-test of impact test shall be in accordance with either of the followings.

- 2.1) **Where the average value of three test pieces is specified** When the average value of three test pieces does not conform to the specified value but is not less than 85 % of the specified value, a retest shall be performed with further three test pieces.

When the average value of all six test pieces conforms to the specified value, the products shall be considered as acceptable.

- 2.2) **Where the average value of three test pieces and individual values are specified** When each of the test results of three test pieces conforms to the specified individual value, but the average value is below the specified value and not less than 85 % of it, or when the average value of the three test pieces conforms to the specified value but one of the results of the three test pieces is below the specified individual value, the re-test shall be performed with further three test pieces.

When each of the test results of three test pieces is equal to or greater than the individual specified value, and the average value of all six test pieces conforms to the specified value, the products shall be considered as acceptable.

- 2.3) **Where the specification of either 2.1) or 2.2) is not satisfied** The re-test under re-heat treatment may be carried out in accordance with **6.2.2.4.2.2**.

b) **ISO steel grade** The re-tests of **ISO** steel grades shall be as follows.

- 1) **Tensile test** When the specified value has not been satisfied in the tensile test, a re-test shall be carried out using test pieces two times the predetermined number taken (two spare test pieces).

If any of the obtained test results fails to satisfy the specification requirements, the manufacturer may follow the procedure for the re-test after re-heat treatment (**6.2.2.4.2.2**).

- 2) **Impact test** In the case of impact tests, if the average value obtained from the three tests does not reach the minimum specified value, or if one of the individual values does not reach the specified minimum (i.e. 70 % of the minimum specified value), the manufacturer may test three additional test pieces.