INTERNATIONAL STANDARD

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Austenitic cast irons — Classification

Fontes austénitiques — Classification

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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 2892 was prepared by Technical Committee ISO/TC 25, *Cast irons and pig irons*, Subcommittee SC 6, *High alloy cast irons*.

This second edition cancels and replaces the first edition (ISO 2892:1973), which has been technically revised.

This International Standard is one of a number that have been prepared by ISO/TC 25/SC 6 under the auspices of ISO/TC 25 for the family of cast irons. The Secretariats of ISO/TC 25 and ISO/TC 25/SC 6 are held by BSI; however, the funding and resources for the Secretariats are provided by the Cast Metals Federation in the United Kingdom.

Introduction

This International Standard deals with the classification of a range of cast irons, principally used for their heat resistance, corrosion resistance and low temperature properties, as well as for their special physical properties and wear properties.

The austenitic cast irons are a range of highly alloyed cast irons containing nickel, and, according to the grade: manganese, copper, chromium, niobium, and an elevated silicon content.

Carbon is present either as flake (lamellar) or spheroidal graphite and, in some grades, carbides.

Typical applications for the various grades are given in Annex A.

Austenitic cast irons — Classification

1 Scope

This International Standard specifies the grades of austenitic cast irons in terms of

— graphite form and matrix structure: either flake (lamellar) or spheroidal graphite in an austenitic matrix,

— chemical composition as given for each of the grades, and

— mechanical properties obtained from separately cast samples.

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 148-3:—[1)], *Metallic materials — Charpy pendulum impact test — Part 3: Preparation and characterization of Charpy V-notch test pieces for indirect verification of pendulum impact machines*

ISO/TR 15931, *Designation system for cast irons and pig irons*

ISO 6892, *Metallic materials — Tensile testing — Method of testing at ambient temperature*

3 Terms and definitions

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

3.1
austenitic cast iron
cast material with an austenitic matrix which is iron and carbon based and alloyed with nickel and manganese, copper and/or chromium in order to stabilize the austenitic structure at room temperature

NOTE The graphite can be present in flake (lamellar) or spheroidal form.

3.2
graphite spheroidizing treatment
process which brings the liquid iron into contact with a substance to produce graphite in the predominantly spheroidal (nodular) form during solidification

NOTE This process is only used for the spheroidal graphite grades.

1) To be published. (Revision of ISO 148-3:1998)

4 Designations

The material shall be designated by symbol, in accordance with the designations given in Tables 1 to 4.

NOTE 1 The symbols given in this International Standard comply with the guidance given in ISO TR 15931.

NOTE 2 According to the designation system given in ISO/TR 15931, the designations of the material grades have been changed. For comparison, see Annex D.

5 Order information

The following information shall be supplied by the purchaser:

a) the complete designation of the material;

b) any special requirements that have been agreed upon between the manufacturer and the purchaser by the time of acceptance of the order.

6 Manufacture

The method of producing austenitic cast iron and any heat treatment, unless otherwise specified by the purchaser, shall be left to the discretion of the manufacturer. The manufacturer shall ensure that the requirements of this International Standard are met for the material grade specified in the order.

7 Requirements

7.1 Chemical composition

7.1.1 The chemical composition of the grades of austenitic cast iron shall be in accordance with Table 1 for engineering grades and Table 2 for special purpose grades.

NOTE Unless otherwise specified, other elements may be present, at the discretion of the manufacturer, provided that they do not alter the structure or adversely affect the properties.

7.1.2 If the presence of any element specified in Tables 1 and 2 is required outside the limits indicated, or, if any other elements are required, their content shall be agreed between the manufacturer and the purchaser, and specified in the order.

Table 1 — Chemical composition of austenitic cast irons — Engineering grades

Graphite form	Material designation	Chemical composition in % (mass fraction)						
		C	Si	Mn	Ni	Cr	P	Cu
Flake (lamellar)	ISO 2892/JLA/XNi15Cu6Cr2	⩽ 3,0	1,0 to 2,8	0,5 to 1,5	13,5 to 17,5	1,0 to 3,5	⩽ 0,25	5,5 to 7,5
Spheroidal	ISO 2892/JSA/XNi20Cr2	⩽ 3,0	1,5 to 3,0	0,5 to 1,5	18,0 to 22,0	1,0 to 3,5	⩽ 0,08	⩽ 0,5
	ISO 2892/JSA/XNi23Mn4	⩽ 2,6	1,5 to 2,5	4,0 to 4,5	22,0 to 24,0	⩽ 0,2	⩽ 0,08	⩽ 0,5
	ISO 2892/JSA/XNi20Cr2Nb[a]	⩽ 3,0	1,5 to 2,4	0,5 to 1,5	18,0 to 22,0	1,0 to 3,5	⩽ 0,08	⩽ 0,5
	ISO 2892/JSA/XNi22	⩽ 3,0	1,5 to 3,0	1,5 to 2,5	21,0 to 24,0	⩽ 0,5	⩽ 0,08	⩽ 0,5
	ISO 2892/JSA/XNi35	⩽ 2,4	1,5 to 3,0	0,5 to 1,5	34,0 to 36,0	⩽ 0,2	⩽ 0,08	⩽ 0,5
	ISO 2892/JSA/XNi35Si5Cr2	⩽ 2,0	4,0 to 6,0	0,5 to 1,5	34,0 to 36,0	1,5 to 2,5	⩽ 0,08	⩽ 0,5
NOTE In some cases, the elevated temperature strength can be improved by the addition of Mo (see Table A.1).								
[a] Good weldability of this material with: % Nb ⩽ [0,353 - 0,032 (% Si + 64 x % Mg)]. The normal range of Nb is 0,12 % to 0,20 %.								

Table 2 — Chemical composition of austenitic cast irons — Special purpose grades

Graphite form	Material designation	Chemical composition in % (mass fraction)						
		C	Si	Mn	Ni	Cr	P	Cu
Flake (lamellar)	ISO 2892/JLA/XNi13Mn7	⩽ 3,0	1,5 to 3,0	6,0 to 7,0	12,0 to 14,0	⩽ 0,2	⩽ 0,25	⩽ 0,5
Spheroidal	ISO 2892/JSA/XNi13Mn7	⩽ 3,0	2,0 to 3,0	6,0 to 7,0	12,0 to 14,0	⩽ 0,2	⩽ 0,08	⩽ 0,5
	ISO 2892/JSA/XNi30Cr3	⩽ 2,6	1,5 to 3,0	0,5 to 1,5	28,0 to 32,0	2,5 to 3,5	⩽ 0,08	⩽ 0,5
	ISO 2892/JSA/XNi30Si5Cr5	⩽ 2,6	5,0 to 6,0	0,5 to 1,5	28,0 to 32,0	4,5 to 5,5	⩽ 0,08	⩽ 0,5
	ISO 2892/JSA/XNi35Cr3	⩽ 2,4	1,5 to 3,0	1,5 to 2,5	34,0 to 36,0	2,0 to 3,0	⩽ 0,08	⩽ 0,5
NOTE In some grades, the elevated temperature strength can be improved by the addition of Mo.								

7.2 Mechanical properties

7.2.1 The mechanical properties of the grades of austenitic cast iron shall be obtained from separately cast test samples and shall be in accordance with Table 3 for engineering grades and Table 4 for special purpose grades.

In exceptional cases, by agreement between the manufacturer and the purchaser, the mechanical properties may be obtained from cast-on samples.

NOTE Austenitic cast irons are suitable for pressure applications

Table 3 — Mechanical properties of austenitic cast irons — engineering grades

Graphite form	Material designation	Tensile strength R_m N/mm² min.	0,2 % proof stress $R_{p0,2}$ N/mm² min.	Elongation A % min.	Mean impact value on 3 tests Charpy V-notch J min.
Flake (lamellar)	ISO 2892/JLA/XNi15Cu6Cr2	170	—	—	—
Spheroidal	ISO 2892/JSA/XNi20Cr2	370	210	7	13 [a]
	ISO 2892/JSA/XNi23Mn4	440	210	25	24
	ISO 2892/JSA/XNi20Cr2Nb [b]	370	210	7	13 [a]
	ISO 2892/JSA/XNi22	370	170	20	20
	ISO 2892/JSA/XNi35	370	210	20	—
	ISO 2892/JSA/XNi35Si5Cr2	370	200	10	—

[a] Optional requirement, by agreement between the manufacturer and the purchaser.

[b] Good weld ability of this material with % Nb ⩽ [0,353 – 0,032 (% Si + 64 x % Mg)]. The normal range of Nb is 0,12% to 0,20%.

Table 4 — Mechanical properties of austenitic cast irons — special purpose grades

Graphite form	Material designation	Tensile strength R_m N/mm^2 min.	0,2% proof stress $R_{p0,2}$ N/mm^2 min.	Elongation A % min.	Mean impact value on 3 tests V-notch J min.
Flake (lamellar)	ISO 2892/JLA/XNi13Mn7	140	—	—	—
Spheroidal	ISO 2892/JSA/XNi13Mn7	390	210	15	16
	ISO 2892/JSA/XNi30Cr3	370	210	7	—
	ISO 2892/JSA/XNi30Si5Cr5	390	240	—	—
	ISO 2892/JSA/XNi35Cr3	370	210	7	—

7.2.2 Test pieces shall be taken from one of the samples given in Figure 1, 2, 3 or 6.

Where the purchaser requires the mechanical properties to be taken from the casting or from cast-on samples, then their location and properties shall be agreed between the manufacturer and purchaser and shall be specified on the order.

The mechanical properties given in Tables 3 and 4 apply to the Type II (II a and II b) sample highlighted in Figures 1 and 2, and also to the sample given in Figure 3. Where other sizes of samples are requested, the mechanical properties shall be agreed upon between the manufacturer and the purchaser by the time of the acceptance of the order.

7.3 Heat treatment

The castings shall be supplied either as cast or heat-treated at the discretion of the manufacturer, or, if so required by the user, by agreement between the manufacturer and the purchaser.

NOTE Annex B (informative) gives details of typical heat treatments that can be applied.

8 Characteristics and applications

A summary of properties for each grade of material and the uses for which each is recommended is given in Table A.1.

For information purposes only, more detailed information on the typical mechanical and physical properties is given for each grade in Tables C.1 and C.2. Table C.3 gives mechanical property data for grade ISO 2892/JSA/XNi23Mn4 at low temperatures down to –196 °C.

Where particular physical or mechanical properties are required, this shall be stated on the order, and form the subject of an agreement between the manufacturer and the purchaser.

NOTE Typical applications for which each grade may be used are given in Table A.1.

9 Sampling

9.1 General

Samples shall be provided to represent the casting(s) produced.

Samples shall be made from the same material as that used to produce the casting(s) which they represent.

Several types of sample (separately cast samples, cast-on samples, samples cut from a casting) can be used, depending on the mass and wall thickness of the casting. When the mass of the casting exceeds 2 000 kg and its thickness exceeds 200 mm, cast-on samples or samples cut from a casting should preferably be used.

9.2 Separately cast samples

9.2.1 Frequency and number of tests

Samples representative of the material shall be produced at a frequency in accordance with the in-process quality assurance procedures adopted by the manufacturer.

In the absence of an in-process quality assurance procedure or any other agreement between the manufacturer and the purchaser, a minimum of one tensile test shall be carried out to confirm the material, at a frequency to be agreed upon between the manufacturer and the purchaser by the time of acceptance of the order.

When impact tests are agreed upon by the time of acceptance of the order, samples shall be produced at a frequency to be agreed upon between the manufacturer and the purchaser.

9.2.2 Samples

The samples shall be cast separately in sand moulds at the same time as the castings and under representative manufacturing conditions. The moulds used to cast the separately cast samples shall have comparable thermal behaviour to the moulding material used to cast the castings.

It is an option of the manufacturer to use an adequate running system which reproduces conditions similar to those of the castings.

The samples shall meet the requirements of Figure 1, 2, 3 or 6.

The samples shall be removed from the mould at a temperature similar to that at which the castings are removed.

If the graphite spheroidizing treatment is carried out in the mould (in-mould method), the samples shall be

— either cast alongside the castings, with a joint running system, or

— cast separately, using a similar treatment method in the sample mould as the method used to produce the castings.

Where applicable, the samples shall be given the same heat treatment as the castings which they represent.

The tensile test piece shown in Figure 4 and, if applicable, the impact test piece shown in Figure 5 shall be machined from a sample shown in Figure 1 or 2 (hatched part) or from the sample shown in Figure 3. Unless otherwise agreed, the choice of the option is left to the discretion of the manufacturer.

Samples for chemical analysis shall be cast in a manner which ensures that the accurate chemical composition can be determined.

10 Testing

10.1 Chemical analysis

The methods used to determine the chemical composition of the material shall be in accordance with recognized standards. Any requirement for traceability shall be agreed upon between the manufacturer and the purchaser by the time of acceptance of the order.

NOTE Spectrographic, X-ray or wet chemical laboratory techniques are acceptable methods of analysis.

10.2 Tensile test

The tensile test shall be carried out in accordance with ISO 6892.

The tensile test piece shall conform to the dimensions given in Figure 4 and shall be machined from the hatched section of one of the samples shown in Figure 1, 2, 3 or 6. Unless otherwise agreed, the selection of the sample type and option shall be left to the discretion of the manufacturer.

If, for technical reasons, it is necessary to use a tensile test piece having a different diameter to that specified in Figure 4, its original gauge length shall conform to the following formula:

$$L_0 = 5{,}65 \times \sqrt{S_0} = 5 \times d$$

where

L_0 is the original gauge length;

S_0 is the original cross-sectional area of the test piece;

d is the diameter of the test piece along the gauge length.

10.3 Impact test

Where applicable, the impact test shall be carried out on three Charpy V-notched impact test pieces in accordance with ISO 148-3.

NOTE 1 Annex C gives information on other properties.

NOTE 2 Annex D gives cross-references to other standards.

11 Retests

11.1 Need for retests

Retests shall be carried out if a test is not valid (see 11.2).

Retests are permitted to be carried out if a test result does not meet the mechanical property requirements for the specified grade (see 11.3).

11.2 Test validity

A test is not valid in the following cases:

a) a faulty mounting of the test piece or defective operation of the test machine;

b) a defective test piece because of incorrect pouring or incorrect machining;