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**Spheroidal graphite cast irons —  
Classification**

*Fontes à graphite sphéroïdal — Classification*

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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.

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 1083 was prepared by Technical Committee ISO/TC 25, *Cast iron and pig iron*, Subcommittee SC 2, *Spheroidal graphite, ferritic-perlitic and ausferritic cast irons*.

This third edition cancels and replaces the second edition (ISO 1083:1987), which has been technically revised.

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## Introduction

The properties of spheroidal graphite cast irons depend on their structure.

The mechanical properties of the material can be evaluated on machined test pieces prepared from:

- separately cast samples;
- samples cast on to either the casting or the running system, hereafter referred to as cast-on sample;
- samples cut from a casting (only when an agreement is made between the manufacturer and the purchaser).

The material grade is defined by mechanical properties measured on machined test pieces prepared from separately cast samples, cast-on samples or samples cut from the casting, by agreement between the manufacturer and the purchaser.

If hardness is a requirement of the purchaser as being important for the application, then Annex E provides means for its determination.

It is well known that tensile properties and hardness of spheroidal graphite cast iron are interrelated. When considered by the purchaser as being important for the application, both tensile and hardness properties may be specified.

Some material grades may be suitable for pressure applications.

Further technical data on spheroidal graphite cast irons is given in Annexes C and G.

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# Spheroidal graphite cast irons — Classification

## 1 Scope

This International Standard defines the grades and the corresponding requirements for spheroidal graphite cast irons.

This International Standard specifies a classification based on mechanical properties measured on machined test pieces prepared either from:

- separately cast samples;
- cast-on samples;
- samples cut from a casting.

This International standard also specifies a classification as a function of hardness.

This International Standard does not apply to spheroidal graphite cast iron used for pipes, fittings and accessories which are specified in accordance with ISO 2531 and ISO 7186. It does not apply to highly alloyed (austenitic) spheroidal cast irons which are specified in accordance with ISO 2892. This International Standard does not apply to ausferritic cast irons which are specified in accordance with ISO 17804.

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## 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, *Steel — Charpy impact test (V-notch)*

ISO 945:1975, *Cast iron — Designation of microstructure of graphite*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

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

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

## 3 Terms and definitions

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

### 3.1

#### **spheroidal graphite cast iron**

cast material, iron and carbon-based, the carbon being present mainly in the form of spheroidal graphite particles

NOTE Spheroidal graphite cast iron is also known as ductile iron, and less commonly as nodular iron.

3.2

**graphite spheroidizing treatment**

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

3.3

**relevant wall thickness**

section of the casting, agreed between the manufacturer and the purchaser, to which the determined mechanical properties shall apply

**4 Designation**

The material shall be designated in accordance with ISO/TR 15931. The relevant designations are given in Tables 1 to 4.

**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 to be agreed upon between the manufacturer and the purchaser by the time of acceptance of the order.

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**6 Manufacture**

The method of producing spheroidal graphite cast iron, and its chemical composition, shall be left to the discretion of the manufacturer who shall ensure that the requirements of this international Standard are met for the material grade specified in the order.

NOTE For spheroidal cast irons to be used in special applications, the chemical composition and heat treatment may be the subject of an agreement between the manufacturer and the purchaser.

All agreements between the manufacturer and the purchaser shall be made by the time of the acceptance of the order.

**7 Requirements**

**7.1 Test pieces machined from separately cast samples**

**7.1.1 General**

The mechanical properties of spheroidal graphite cast iron shall be as specified in Table 1 and, if applicable, in accordance with the requirements given in 7.1.2 and Table 2.

The requirements for grade ISO1083/JS/500-10/S shall be as specified in Annex A.



**Table 1 — Mechanical properties measured on test pieces machined from separately cast samples**

Material designation	Tensile strength	0,2 % proof stress	Elongation
	$R_m$ N/mm <sup>2</sup> min.	$R_{p0,2}$ N/mm <sup>2</sup> min.	$A$ % min.
ISO1083/JS/350-22-LT/S <sup>a</sup>	350	220	22
ISO1083/JS/350-22-RT/S <sup>b</sup>	350	220	22
ISO1083/JS/350-22/S	350	220	22
ISO1083/JS/400-18-LT/S <sup>a</sup>	400	240	18
ISO1083/JS/400-18-RT/S <sup>b</sup>	400	250	18
ISO1083/JS/400-18/S	400	250	18
ISO1083/JS/400-15/S	400	250	15
ISO1083/JS/450-10/S	450	310	10
ISO1083/JS/500-7/S	500	320	7
ISO1083/JS/550-5/S	550	350	5
ISO1083/JS/600-3/S	600	370	3
ISO1083/JS/700-2/S	700	420	2
ISO1083/JS/800-2/S	800	480	2
ISO1083/JS/900-2/S	900	600	2

NOTE 1 The values for these materials apply to castings cast in sand moulds of comparable thermal behaviour. Subject to amendments to be agreed upon in the order, they can apply to castings obtained by alternative methods.

NOTE 2 Whatever the method used for obtaining the castings, the grades are based on the mechanical properties measured on test pieces machined from samples separately cast in a sand mould or a mould of comparable thermal behaviour.

NOTE 3 The mechanical properties of the materials refer to separately cast samples produced in accordance with Figures 1, 2 or 3.

NOTE 4 Elongation values are determined from  $L_0 = 5 d$ . For other gauge lengths, see 9.1 and Annex B.

NOTE 5 1 N/mm<sup>2</sup> = 1 MPa.

<sup>a</sup> LT for low temperature (– 20 °C or – 40 °C).

<sup>b</sup> RT for room temperature (23 °C).

7.1.2 Impact test

The particular impact resistance values given in Table 2 for room and low temperature applications, if applicable, shall only be determined if specified by the purchaser by the time of acceptance of the order.

**Table 2 — Minimum impact resistance values measured on V-notched test pieces machined from separately cast samples**

Material designation	Minimum impact resistance values					
	J					
	room temperature (23 ± 5) °C		low temperature (– 20 ± 2) °C		low temperature (– 40 ± 2) °C	
	Mean value from 3 tests	Individual value	Mean value from 3 tests	Individual value	Mean value from 3 tests	Individual value
ISO1083/JS/350-22-LT/S <sup>a</sup>	—	—	—	—	12	9
ISO1083/JS/350-22-RT/S <sup>b</sup>	17	14	—	—	—	—
ISO1083/JS/400-18-LT/S <sup>a</sup>	—	—	12	9	—	—
ISO1083/JS/400-18-RT/S <sup>b</sup>	14	11	—	—	—	—

NOTE 1 The impact resistance values for these materials apply to castings cast in sand moulds of comparable thermal behaviour. Subject to amendments to be agreed upon in the order, they can apply to castings obtained by alternative methods.

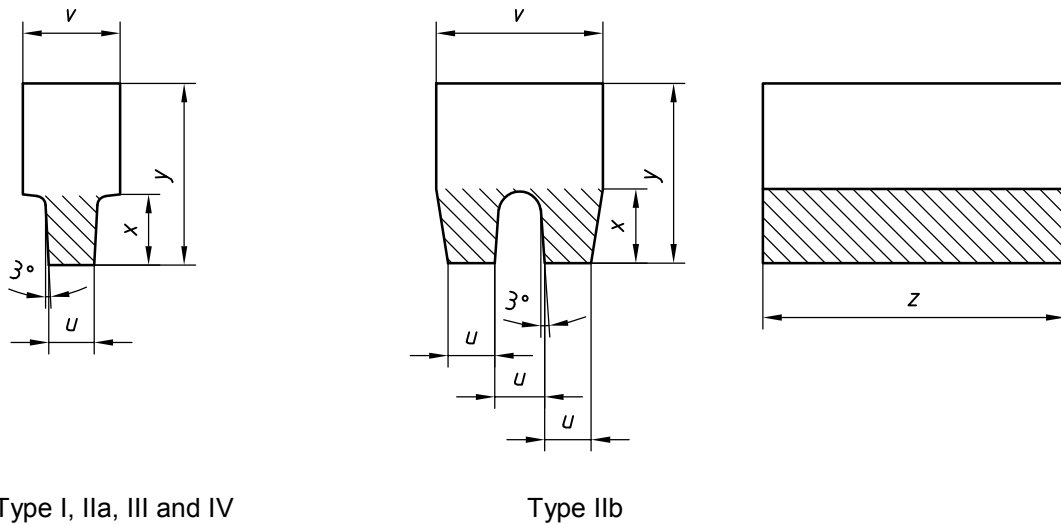
NOTE 2 Whatever the method used for obtaining the castings, the grades are based on the mechanical properties measured on test pieces machined from samples separately cast in a sand mould or a mould of comparable thermal behaviour.

NOTE 3 These material grades may be suitable for some pressure vessel applications. (For fracture toughness, see Annex C.)

<sup>a</sup> LT for low temperature.

<sup>b</sup> RT for room temperature.

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Dimensions in millimetres

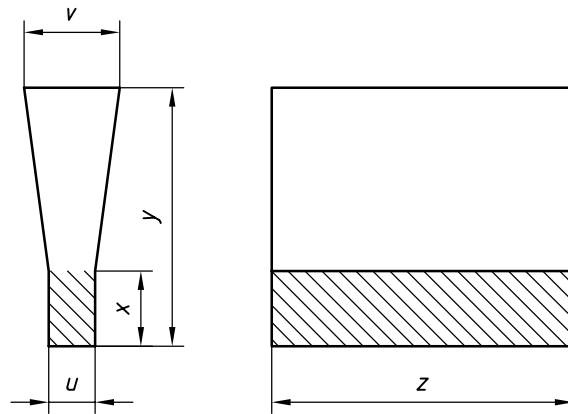
Dimension	Type				
	I	IIa	IIb	III	IV
$u$	12,5	25	25	50	75
$v$	40	55	90	90	125
$x$	30	40	40 to 50	60	65
$y^a$	80	100	100	150	165
$z^b$	A function of the test piece length				
<p><sup>a</sup> For information only.</p> <p><sup>b</sup> <math>z</math> shall be chosen to allow a test piece of dimensions shown in Figure 4 to be machined from the sample.</p>					

The thickness of the sand mould surrounding the samples shall be:

- 40 mm minimum for types I, IIa and IIb;
- 80 mm minimum for types III and IV.

NOTE For the manufacture of thin-walled castings or castings in metal moulds, the tensile properties may, by agreement between the manufacturer and the purchaser, be determined on test pieces taken from samples of thickness,  $u$ , less than 12,5 mm.

Figure 1 — Separately cast samples (option 1)



Dimensions in millimetres

Dimension	Type			
	I	II	III	IV
$u$	12,5	25	50	75
$v$	40	55	100	125
$x$	25	40	50	65
$y^a$	135	140	150	175
$z^b$	A function of the test piece length			
<sup>a</sup> For information only. (standards.iteh.ai) <sup>b</sup> $z$ shall be chosen to allow a test piece of dimensions shown in Figure 4 to be machined from the sample. ISO 1083:2004				

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The thickness of the sand mould surrounding the samples shall be:

- 40 mm minimum for types I and II;
- 80 mm minimum for types III and IV.

NOTE For the manufacture of thin-walled castings or castings in metal moulds, the tensile properties may, by agreement between the manufacturer and the purchaser, be determined on test pieces taken from samples of thickness,  $u$ , less than 12,5 mm.

Figure 2 — Separately cast samples (option 2)