
INTERNATIONAL STANDARD



1083

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Spheroidal graphite or nodular graphite cast iron

Fonte à graphite sphéroïdal ou à graphite nodulaire

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1083 was drawn up by Technical Committee ISO/TC 25, *Cast iron*, and was circulated to the Member Bodies in July 1975.

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It has been approved by the Member Bodies of the following countries :

Australia
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Romania

South Africa, Rep. of

Spain

Switzerland

Turkey

U.S.S.R.

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Norway
Sweden
United Kingdom

This International Standard cancels and replaces ISO Recommendation R 1083-1969, of which it constitutes a technical revision.

Spheroidal graphite or nodular graphite cast iron

1 SCOPE AND FIELD OF APPLICATION

This International Standard relates to spheroidal graphite or nodular graphite cast iron the classification of which has been prepared on the basis of the mechanical properties.

This International Standard applies only to spheroidal graphite iron cast into sand moulds or moulds of comparable thermal diffusivity.

Spheroidal graphite cast iron is a casting material, iron and carbon based, the latter element being present principally as graphite particles in spheroidal form¹⁾.

2 REFERENCES

ISO/R 79, *Brinell hardness test for steel and cast iron.*

ISO 82, *Steel – Tensile testing.*

ISO 83, *Steel – Charpy impact test (U-notch).*²⁾

ISO 148, *Steel – Charpy impact test (V-notch).*³⁾

ISO 945, *Cast iron – Designation of microstructure of graphite.*

3 PRODUCTION

The method of producing spheroidal graphite cast iron, its composition and, if applicable, the heat treatment, are left to the discretion of the manufacturer, who shall ensure that the property requirements given in this International Standard are complied with for the grade required in the order.

However, for cast iron 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.

4 MECHANICAL PROPERTIES

This International Standard relates to six grades of spheroidal graphite cast iron, the mechanical properties of which shall be as given in tables 1 and 2.

TABLE 1 – Tensile strength, proof stress, elongation properties and additional information

Grade	Tensile strength R_m min. N/mm ² *	0,2 % proof stress $R_{p0,2}$ min. N/mm ² *	Elongation** A min. %	For information only	
				Typical hardness value ranges HB	Predominant structural constituent
800-2	800	480	2	248-352	Pearlite or tempered structure
700-2	700	420	2	229-302	Pearlite
600-3	600	370	3	192-269	Pearlite + ferrite
500-7	500	320	7	170-241	Ferrite + pearlite
400-12	400	250	12	≤ 201	Ferrite
370-17	370	230	17	≤ 179	Ferrite

* 1 N/mm² = 1 MPa

** Elongation is measured on a gauge length $L_0 = 5d$ where d is the original diameter of the test piece.

TABLE 2 – Impact values for grade 370-17 only

Tensile strength R_m min. N/mm ² *	Elongation A min. %	Minimum impact values at ambient temperature (23 ± 5 °C) J			
		V-notch (Charpy) in accordance with ISO 148		U-notch (Mesnager) in accordance with figure 5	
		Mean value (on 3 tests)	Individual value	Mean value (on 3 tests)	Individual value
370	17	13	11	15	13

* 1 N/mm² = 1 MPa

1) Corresponding to Form VI of ISO 945.

2) At present at the stage of draft. (Revision of ISO/R 83.)

3) At present at the stage of draft. (Revision of ISO/R 148.)

5 MECHANICAL TESTS

5.1 Tensile test

This test shall be carried out on a 14 mm diameter proportional test piece, as shown in figure 4, in accordance with the requirements of ISO 82.

If, for technical reasons, it is necessary to use a test piece with a different diameter, it should comply with the ratio.

$$L_o = 5,65 \sqrt{S_o}$$

where

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

L_o is the original gauge length.

The 0,2 % proof stress values in table 1 are mandatory. However, the values will be determined only if specified by the purchaser on the order. Nevertheless, the material supplied will be required to comply with the values given in table 1.

5.2 Impact test

This test is specified only for Grade 370-17 cast iron.

Up to the end of 1977 the impact test shall be carried out either on a V-notch (Charpy) test piece in accordance with the requirements of ISO 148, or on a U-notch (Mesnager) test piece in accordance with the requirements of ISO 83, except that the dimensions of the U-notch in the test piece shall be in accordance with figure 5. The results shall be expressed in joules. From 1 January 1978 the test shall be carried out only on a V-notch (Charpy) test piece in accordance with the requirements of ISO 148.

Impact tests may be carried out at low temperatures, if specified by the purchaser on the order. The minimum acceptance values and the temperature of test shall then be the subject of an agreement between the manufacturer and the purchaser.

The impact values given in table 2 are mandatory. However, if so specified by the purchaser on the order, the impact test need not be carried out. Nevertheless, the material supplied will be required to comply with the values given in table 2.

5.3 Brinell hardness test

The Brinell hardness test, when specified by the purchaser, shall be carried out in accordance with the requirements of ISO/R 79. The test shall be carried out on test samples or at a point or points on the casting as agreed between the manufacturer and the purchaser.

6 TEST SAMPLES

6.1 The test pieces used for the tests specified in clause 5 shall be machined from the keel of the U-type test samples, as indicated by the hatched portion of figure 1.

Alternatively, the mechanical properties may be determined by using test pieces as given in figure 4, machined either from the keel of Y-type test samples as indicated by the hatched portion of figure 2 or from the "knock-off" type (see figure 3), for which the casting procedure is optional.

6.2 Test samples (often called keel blocks) shall be poured at the same time as the castings represented (see 6.3).

In principle, test sample type IIa or IIb, of 25 mm effective thickness, shall be used; however, if its mass differs widely from the casting which it represents, another test sample type may be used, by agreement between manufacturer and purchaser.

6.3 Test samples shall be poured from the same ladle of metal as that used to produce the castings, in accordance with the sampling procedure which is agreed. They shall be poured separately and, if possible, cast towards the end of pouring of the castings.

In exceptional cases, and by agreement between the parties, the test samples may be attached to the castings; in such cases, their location, size and type shall be agreed between manufacturer and purchaser.

The test samples shall be cast in sand moulds and stripped at a temperature not exceeding 500 °C.

6.4 The test samples shall, in all cases, be heat treated together with the castings which they represent.

7 FORMATION OF BATCHES

A batch consists of the castings poured from the same ladle of metal and which have been submitted, if necessary, to the same heat treatment.

The maximum mass of a batch is 2 000 kg of fettled castings. A single casting constitutes a batch if its mass equals or exceeds 2 000 kg.

However, for the continuous production of large tonnages, the maximum mass of the batch may be increased. In this case, it should be restricted to the tonnage produced by a melting furnace in 2 h.

8 NUMBER OF TESTS PER BATCH

8.1 Tensile test

One tensile test shall be carried out for each batch.

As an exception to the requirements of clause 7 (first paragraph), several batches may be grouped for acceptance, after agreement between manufacturer and purchaser. In this case, the tensile test shall be performed on one of the batches only, provided that appropriate tests (micrographic examination, fracture examination, bend test, etc.) show that successive spheroidization treatments have actually been carried out successfully under the same conditions.

8.2 Impact test

This test is specified only for Grade 370-17 cast iron.

For each batch the impact value shall be determined by means of three tests performed under the temperature conditions given in 5.2 of ISO 83.

9 VALIDITY OF TESTS

A test may be disregarded if poor results are obtained and are not due to the quality of the cast iron itself, but to any of the following reasons :

- a) faulty mounting of the test piece or defective operation of the test machine;
- b) defective casting or machining of the test piece;
- c) fracture of the tensile test piece beyond the gauge marks;
- d) casting defects in the test piece, evident after fracture.

In the above cases, a new test piece shall be taken from the

same test sample and the results obtained substituted for those of the defective test piece.

10 RETESTS

10.1 Should any of the tests fail to meet the specified property requirements, other than for the reasons given in clause 9, two retests per failed test shall be carried out.

10.2 The batch shall be regarded as conforming to the specified requirements when the results of the two retests conform to the value shown in clauses 4 and 5. However, the batch shall be rejected if one of the retests fails.

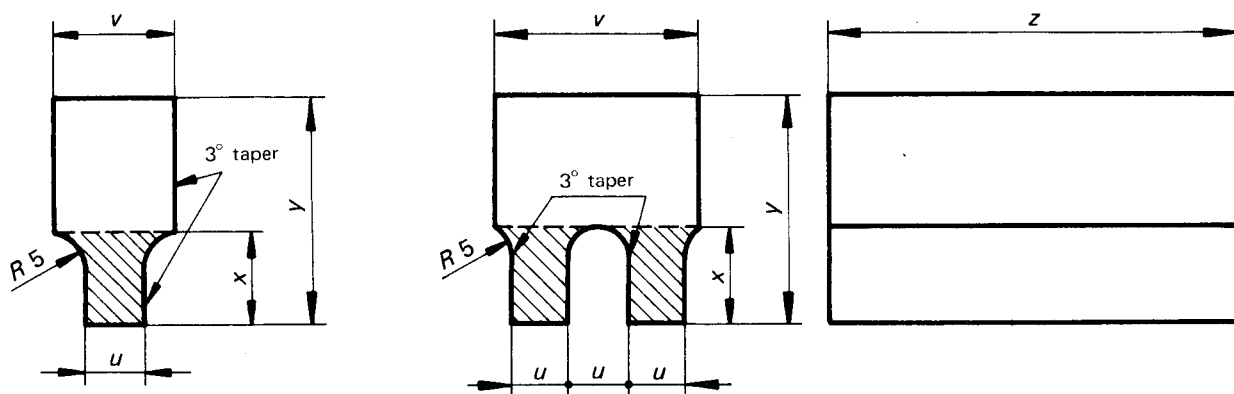
10.3 In the case of castings supplied in the as-cast condition, the manufacturer, by agreement with the purchaser, has the right to heat treat the castings, together with the representative test samples, and re-submit them for acceptance.

10.4 In the case of a batch of castings supplied in the heat-treated condition, the manufacturer has the right to re-heat treat the batch, together with representative test samples, and re-submit the castings for acceptance.

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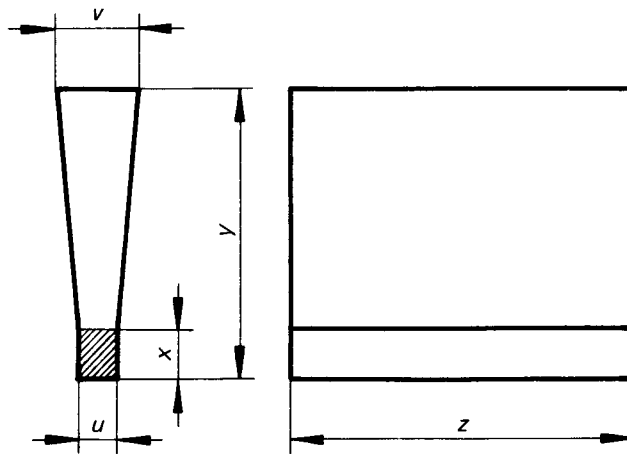
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Types I, IIa, III and IV



Dimensions	Dimensions in millimetres for type				
	I	IIa	IIb	III	IV
u	12	25	25	50	75
v	40	55	90	90	125
x	30	40	40	60	65
y	80	100	100	150	165
z	A function of the test piece length				

FIGURE 1 – “U”-type test samples



Dimension	Dimensions in millimetres for type			
	I	II	III	IV
<i>u</i>	12	25	50	75
<i>v</i>	40	55	100	125
<i>x</i>	25	40	50	65
<i>y</i>	135	140	150	175
<i>z</i>	A function of the test piece length			

NOTE — The thickness of the sand mould surrounding the test sample during casting shall be

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

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FIGURE 2 — "Y"-type test samples

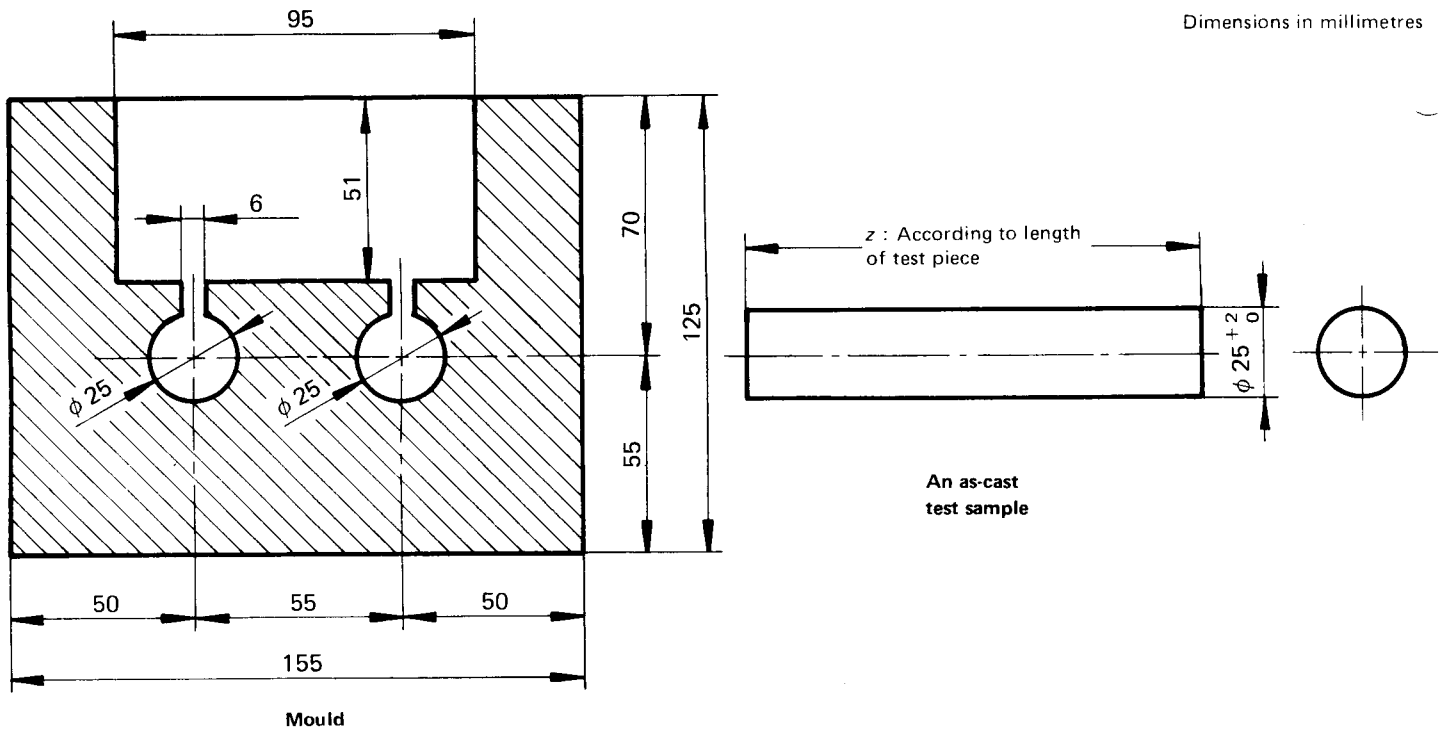
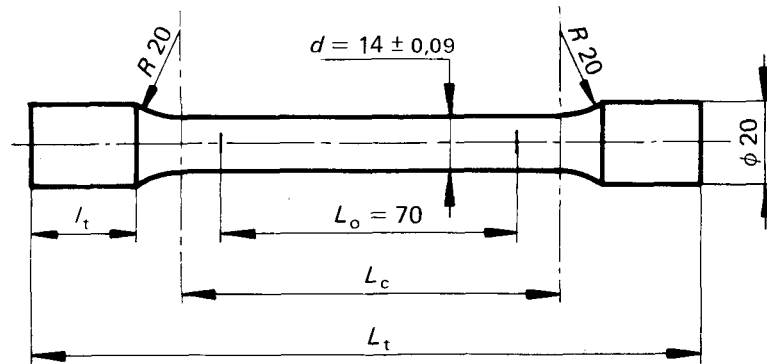


FIGURE 3 — "Knock-off" type test samples



NOTE – The method of gripping the ends of the test pieces, together with their length l_t , may be agreed between the manufacturer and the purchaser.

L_o is the original gauge length; here $L_o = 5d$;

d is the original diameter of the test piece;

L_c is the parallel length; $L_c > L_o$ by agreement between the manufacturer and the purchaser (in principle $L_c - L_o > d$);

L_t is the total length of the test piece, which depends on L_c and l_t .

FIGURE 4 – Tensile test piece

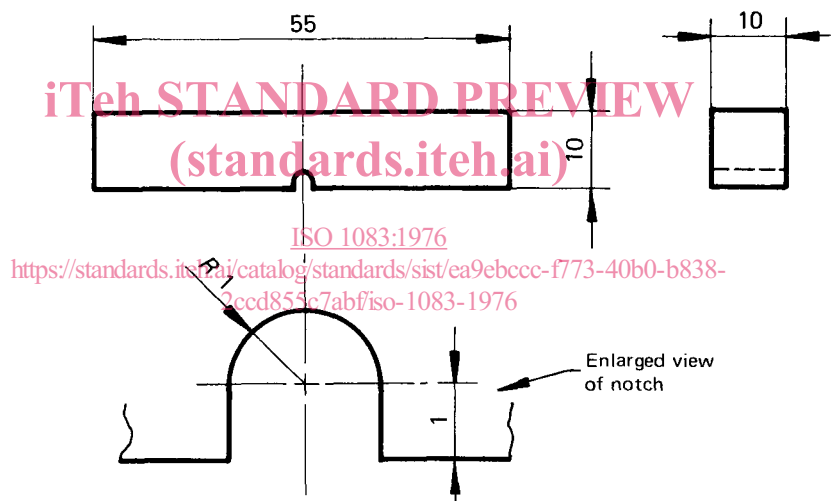


FIGURE 5 – Dimensions of Mesnager U-notch test piece for the impact test

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