

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1083

SPHEROIDAL GRAPHITE OR NODULAR GRAPHITE

CAST IRON

1st EDITION

May 1969

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BRIEF HISTORY

The ISO Recommendation R 1083, *Spheroidal graphite or nodular graphite cast iron*, was drawn up by Technical Committee ISO/TC 25, *Cast iron*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of a Draft ISO Recommendation.

In March 1968, this Draft ISO Recommendation (No. 1510) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	India	Romania
Belgium	Iran	South Africa, Rep. of
Canada	Israel	Switzerland
Chile	Italy	Thailand
Colombia	Japan	Turkey
Czechoslovakia	Netherlands	U.A.R.
France	Poland	United Kingdom
Germany	Portugal	U.S.S.R.

Four Member Bodies opposed the approval of the Draft :

Finland
Norway
Sweden
U.S.A.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in May 1969, to accept it as an ISO RECOMMENDATION.

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SPHEROIDAL GRAPHITE OR NODULAR GRAPHITE CAST IRON

1. SCOPE

- 1.1 This ISO Recommendation relates to spheroidal graphite or nodular graphite cast iron. The classification herein has been prepared on the basis of the mechanical properties.
- 1.2 Spheroidal graphite cast iron is a casting material, iron and carbon based, the latter element being present principally as graphite particles in spheroidal form.*

2. PRODUCTION-CASTING

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

However, for cast iron to be used in special applications, the chemical composition may be agreed between purchaser and manufacturer.

3. MECHANICAL PROPERTIES

This ISO Recommendation relates to five types of spheroidal graphite cast iron, the mechanical properties of which are shown in Tables 1 and 2.

* Corresponding to Form VI of ISO Recommendation R 945, *Designation of the microstructure of graphite in cast iron.*

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

Type	Tensile strength (R_m) min.			0.2 % proof stress [R_c (0.2)] min.			Elongation** (A) min.	For information only	
	kgf/mm ²	lbf/in ²	tonf/in ²	kgf/mm ²	lbf/in ²	tonf/in ²	%	Typical Brinell hardness value ranges	Predominant structural constituent
70-2	70	100 000	44	45	65 000	29	2	230 – 300 HB	Pearlite
60-2	60	86 000	38	40	57 000	25	2	210 – 280 HB	Pearlite
50-7	50	71 000	31	35	50 000	22	7	170 – 240 HB	{ Ferrite Pearlite
42-12	42	60 000	26	28	40 000	17	12	150 – 200 HB	Ferrite
38-17	38	55 000	24	24	35 000	15	17	140 – 180 HB	Ferrite

* Values specified in lbf/in² and tonf/in² are merely the nearest equivalents of the metric units.

** Measured on a gauge length $L_0 = 5d$

TABLE 2 – Impact values for type 38-17 only

Test piece	Minimum impact value kgf.m/cm ²	
	mean value (on 3 tests)	individual value
V-notch (Charpy) in accordance with ISO/R 148*	1.7	1.5
U-notch (Mesnager) in accordance with Figure 5 (page 12)	1.9	1.6

* Beam impact test (V-notch) for steel.

4. MECHANICAL TESTS

4.1 Tensile test

This test should be carried out on a 14 mm diameter proportional test piece, as shown in Figure 4 on page 11.

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

$$L_0 = 5.65 \sqrt{S_0}$$

where

S_0 is the original cross-sectional area of the test piece, and

L_0 is the original gauge length.

4.2 Impact test

This test is specified only for type 38-17 cast iron.

It should be carried out either on a V-notch (Charpy) test piece in accordance with ISO Recommendation R 148* or on a U-notch (Mesnager) test piece in accordance with ISO Recommendation R 83** except that the dimensions of the U-notch in the test piece should be in accordance with Figure 5 on page 12. The results should be expressed in kilogramme-force metres per square centimetre.

5. TEST SAMPLES

5.1 The test pieces used for the tests specified in section 4 should be machined from "U"-type test samples as specified in Figure 1 on page 9. Alternatively, the mechanical properties may be measured using test pieces as shown in Figure 4, machined from either the "Y"-type test sample (see Fig. 2) or the "knock-off" type (see Fig. 3), for which the casting procedure is optional.

5.2 Test samples (often called keel blocks) should be poured at the same time as the castings represented (see clause 5.3 below).

Test pieces should be taken from the keel of the "U"-type test sample (the hatched section of Fig. 1).

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

5.3 Test samples should 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 should be poured separately.

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

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

5.4 Should the castings represented have to be heat treated, the test samples should also be submitted to the same heat treatment.

* Beam impact test (V-notch) for steel.

** Charpy impact test (U-notch) for steel.

6. 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 2000 kg of fettled castings. A single casting constitutes a batch if its mass equals or exceeds 2000 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 two hours.

7. NUMBER OF TESTS PER BATCH

7.1 Tensile test

One tensile test should be carried out for each batch.

As an exception to the requirements of section 6 (first paragraph), several batches may be grouped for acceptance, after agreement between purchaser and manufacturer. In this case, the tensile test will be performed on one of the batches only, provided that appropriate tests (micrographic examination, fracture examination, bend test, etc.) show that the successive spheroidization treatments have actually been carried out successfully under the same conditions.

7.2 Impact test

This test is specified only for type 38-17 cast iron.

Each batch should be submitted to three tests for determination of the impact value, performed under the temperature conditions stipulated in clause 5.2 of ISO Recommendation R 83, *Charpy impact test (U-notch) for steel*.

8. 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 :

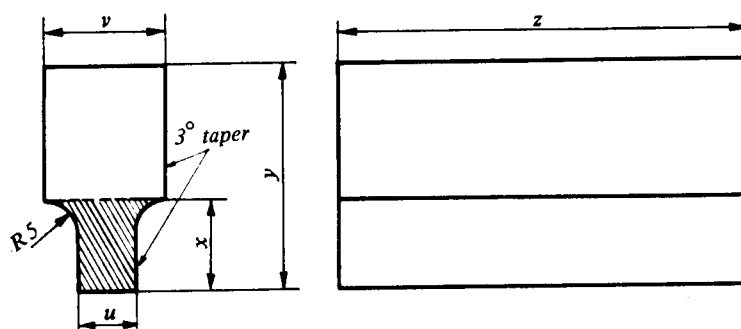
- (a) faulty mounting of the test piece or defective operation of the test machine;
- (b) defective casting or machining of the test piece;
- (c) fracture of the tensile test piece beyond the gauge marks;
- (d) casting defects in the test piece, evident after fracture.

In the above cases, a new test piece may be taken from the same test sample and the results obtained substituted for those of the defective test piece.

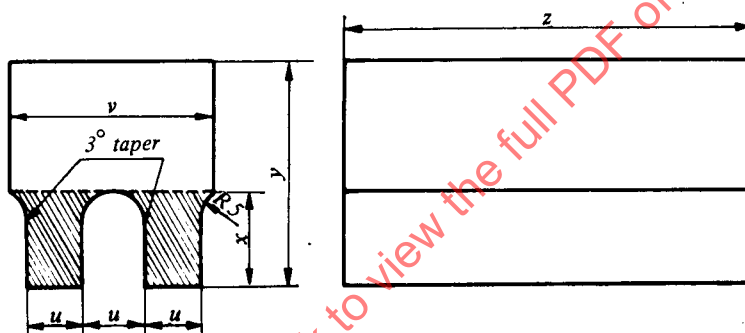
9. RETESTS

- 9.1 Should any of the test pieces fail to meet the specified property requirements, two retests per failed test piece may be carried out.
- 9.2 The batch is regarded as conforming to the specified requirements when the results of the two retests conform to the values shown in sections 3 and 4. However, the batch may be rejected if one of the new test pieces fails.
- 9.3 In the case of castings supplied in the heat-treated condition, the manufacturer should have the right to re-heat treat the castings, together with the representative test samples, and to re-submit them for acceptance.
- 9.4 In the case of castings supplied in the as-cast condition, the manufacturer, by agreement with the purchaser, should have the right to heat treat the castings, together with the representative test samples, and to re-submit them for acceptance.

Types I, IIa, III and IV



Type IIb



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

FIG. 1 – “U”-type test samples