Indian Standard

SPECIFICATION FOR
SPHEROIDAL OR NODULAR GRAPHITE IRON
CASTINGS FOR PAPER MILL DRYER ROLLS

(First Revision)

First Reprint FEBRUARY 1993

UDC 669.131.7-14

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4 February 1987
Indian Standard

SPECIFICATION FOR SPHEROIDAL OR NODULAR GRAPHITE IRON CASTINGS FOR PAPER MILL DRYER ROLLS

(First Revision)

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(Continued from page 13)
Indian Standard
SPECIFICATION FOR SPHEROIDAL OR NODULAR GRAPHITE IRON CASTINGS FOR PAPER MILL DRYER ROLLS
(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 12 June 1986, after the draft finalized by the Pig Iron and Cast Iron Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1970. While reviewing this standard in the light of experience gained during these years, the Committee has decided to revise this standard aligning it with other existing standards on the subject.

0.3 This standard keeps in view the manufacturing and trade practices being followed in the country in this field. Assistance has also been derived from ASTM A-476-1970 Ductile iron castings for paper mill dryer rolls, issued by the American Society of Testing and Materials.

0.4 This standard contains clauses which require the purchaser agreement and/or to specify these requirements, if necessary, while placing the order.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements for iron castings with spheroidal or nodular graphite to be used for pressure containing parts for paper mill dryer rolls for working temperatures up to 230°C.

*Rules for rounding off numerical values (revised).
2. SUPPLY OF MATERIAL

2.1 General requirements relating to the supply of the material shall be as laid down in IS: 1307-1967.

3. MANUFACTURE

3.1 The method of manufacture shall be left to the discretion of the manufacturer provided that the castings conform to this standard.

4. CHEMICAL COMPOSITION

4.1 The castings when tested in accordance with IS: 228-1972, shall have the following chemical composition:

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total carbon, Min</td>
<td>3.0</td>
</tr>
<tr>
<td>Silicon, Max</td>
<td>3.0</td>
</tr>
<tr>
<td>Phosphorus, Max</td>
<td>0.08</td>
</tr>
<tr>
<td>Carbon equivalent</td>
<td>3.8 to 4.5</td>
</tr>
</tbody>
</table>

[Total C + 0.3 (Si + P)]

5. WORKMANSHIP AND FINISH

5.1 The castings shall be accurately moulded in accordance with the pattern or working drawings supplied by the purchaser with the addition of such letters, figures or marks as may be specified.

5.2 The drawings shall specify the tolerance on all important dimensions. On other dimensions, the tolerance specified in IS: 8350-1971 shall apply.

6. FREEDOM FROM DEFECTS

6.1 The castings shall be free from surface defects such as adhering sand and shall be reasonably smooth. The runners, risers, fins and other extraneous metals shall be removed from the castings. They shall be well dressed and festled.

6.2 The castings shall not be repaired by welding or brazing but may be plugged in case they leak on hydrostatic test, provided that the diameter of the plug does not exceed 50 mm. The details of the plugging of the casting may be agreed to between the purchaser and the manufacturer. Also any inherent defect revealed during subsequent machining, notwithstanding any previous certificate of satisfactory testing might make the castings liable to rejection.

*General requirements for the supply of metallurgical material (first revision).
†Methods for chemical analysis of steels (second revision).
‡Deviations for untoleranced dimensions of spheroidal or nodular graphite iron castings.
AMENDMENT NO. 1 JANUARY 1988

TO

IS:5787-1986 SPECIFICATION FOR SPHEROIDAL OR
NODULAR GRAPHITE IRON CASTINGS FOR PAPER
MILL DRYER ROLLS

(First Revision)

(Page 4, clause 4.1) - Substitute the following for the existing clause:

'4.1 The chemical composition of the castings when determined in accordance with the methods specified in IS:228-1959* and/or any of its relevant part or by any other established instrumental/chemical method, shall be as given below:

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total carbon, Min</td>
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<td>0.08</td>
</tr>
<tr>
<td>Carbon equivalent</td>
<td>3.8 to 4.5</td>
</tr>
<tr>
<td>[Total C + 0.3 (Si + P)]</td>
<td></td>
</tr>
</tbody>
</table>

In case of dispute the procedure specified in IS:228-1959* or in its relevant part shall be the referee method.'

*Method of chemical analysis of pig iron, cast iron and plain carbon and low alloy steels (revised).

(SMDC 9)

Printed at Simco Printing Press, Delhi, India
7. TEST SAMPLES

7.1 The test samples shall be cast separately in sand moulds. They shall be poured from the same ladle of metal as that used to produce the castings they represent and immediately after the castings are poured. Some additional recommendations regarding casting the test samples are given in Appendix A.

7.1.1 The test pieces used for the test specified in 10.1 shall be machined from one of the following type of test samples:

a) U-type test samples — The test piece shall be machined from the keel (that is, the cross-hatched section of Fig. 1),

b) T-type test samples — The test piece shall be machined from the keel (that is, the cross-hatched section of Fig. 2), and

c) Knock-off type test samples — See Fig. 3.

---

Fig. 1 'U' TYPE TEST SAMPLES
7.1.2 In principle, test sample Type IIa or IIIb, of 25 mm effective thickness shall be used; however, if its mass differs widely from the casting it represents, another test sample type may be used, by agreement between the manufacturer and the purchaser.

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

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

7.1.5 When castings are supplied in the heat-treated condition, all test samples shall be heat-treated similar to simultaneously with and adjacent to the casting or castings they represent.
According to length of test piece, an as-cast test sample.

All dimensions in millimetres.

FIG. 5 'Knock-Off' Type Test Samples
8. SAMPLING

8.1 Sampling for Chemical Analysis — Two spoon samples shall be taken during the pouring of each cast or ladle when about one-third and two-third of the metal has been discharged. The spoon samples so obtained shall be cast separately in dry sand in the form of 30 mm diameter bars about 75 mm long. Alternatively, the mould may be filled directly from the metal stream. The test bars shall be suitable marked so that the castings they represent could be identified.

8.1.1 After cleaning the surface, two flats shall be ground near the bottom of each test bar and the test bar drilled with a 25 mm drill from one clear surface to the other. The speed of the drill should not be more than 9 to 10 rev/min. Drillings after being thoroughly mixed shall constitute the sample for chemical analysis.

8.1.2 For the determination of total carbon the molten metal shall be poured into a special split mould (see Fig. 4). This gives pins of iron 3 mm in diameter which have solidified white and which can be broken off and used directly for total carbon determination. Carbon determination from drillings taken from grey samples shall not be done.

9. SAMPLING FOR MECHANICAL TESTS

9.1 If one ladle of metal treated to produce spheroidal or nodular graphite iron is used to make one or more castings, one tensile test shall be made on a test sample poured from that ladle.

9.2 If successively treated ladles filled from one furnace are used to produce castings, one tensile test shall be made from each 0-5 tonne of castings or part thereof. If more than one treated ladles are involved in the production of this quantity of castings, the manufacturer shall take steps to ascertain that the treatment of other ladles is done by such method as may be agreed to between the purchaser and the manufacturer. He may examine the procedure adopted and satisfy himself that this is adequate.

9.2.1 In the case of large tonnage of castings being produced continuously the minimum number of test bars to be provided shall be one tensile test representing every two hours production from a melting furnace.

9.3 For castings weighing more than one tonne, one tensile test shall be conducted on a test sample for each casting, the test sample being cast as an integral part of the casting.

9.4 If more than one furnace is used to fill the ladles, than one tensile test shall be made on a test sample poured from a treated ladle of each of the furnaces.

9.5 All test samples and castings shall be marked strictly for identification.
10. MECHANICAL TEST

10.1 Tensile Test — The tensile test shall be carried out in accordance with IS : 1688-1972*, unless otherwise agreed to between the purchaser and the manufacturer. The test piece shall have a gauge diameter of

*Method for tensile testing of steel products (first revision).
14 mm and a gauge length of 70 mm (see Fig. 5). To determine compliance with proof stress requirements, the material tested shall be considered to have passed the test if it does not undergo an elongation exceeding the specified percentage on being subjected to the specified minimum stress for a period of 15 seconds.

**Note**: The method of gripping the ends of the test pieces, together with the length $l_0$, may be agreed between the manufacturer and the purchaser.

- $l_0$ is the original gauge length, here $l_0 = 5d$;
- $d$ is the original diameter of the test piece;
- $l_e$ is the parallel length; $l_e > l_0$ by agreement between the manufacturer and the purchaser (in principle $l_e = l_0 + 3d$), and $l_t$ is the total length of the test piece, which depends on $l_0$ and $l_t$.

All dimensions in millimeters.

**Fig. 5** Tensile Test Piece

10.1.1 The mechanical properties shall be as specified in Table 1.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Requirements for Test Sample of Tensile Test Bars (For Fig. 1 and 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength, MPa, Min</td>
<td>550 550 550</td>
</tr>
<tr>
<td>Proof stress (0.2 percent) MPa, Min</td>
<td>410 410 410</td>
</tr>
<tr>
<td>Elongation, percent, Min</td>
<td>3 2 1</td>
</tr>
</tbody>
</table>

10.1.2 In the case of tests carried out on test bars cut from the finished castings, the mechanical properties shall be as agreed to between the purchaser and the manufacturer.
10.2 Hardness Test — The Brinell hardness of the material, when tested in accordance with IS : 2500-1983*, shall not be less than 201 HB.

10.2.1 The hardness test shall be carried out on either the casting or on a test coupon representing the material of the casting.

11. VALIDITY OF TESTS

11.1 A test may be disregarded if poor results are obtained which 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; and
d) Casting defects in the test piece, evident after fracture.

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

12. RE-TEST

12.1 Should any of the tests fail to meet the specified property requirements, two re-tests per failed test shall be carried out.

12.1.1 The batch is regarded as conforming to the specified requirements when the results of the two re-tests conform to the values specified in the standard. However, the batch may be rejected if one of the re-tests fails.

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

12.3 Should the samples of castings supplied in the heat-treated condition fail to pass the test, the manufacturer shall have the right to reheat-treat the castings together with the representative test bars and resubmit them for inspection and testing.

13. ADDITIONAL TESTS

13.1 If the purchaser desires any special tests or requirements, such as microstructure, not specified in this standard, he shall state these when placing the enquiry and order for the material.

*Method for Brinell hardness test for metallic materials (second revision).
14. MARKING

14.1 Unless the purchaser desires otherwise, each casting, wherever practicable, shall be legibly marked with a number or identification mark by which it can be traced to the melt from which it was made.

14.1.1 Wherever practicable, the castings may also bear the ISI Certification Mark.

Note — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is deemed and accepted by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A

( Clause 7.1 )

RECOMMENDATIONS FOR CASTING OF TEST SAMPLES

A-1. The test sample may be cast in sand to any convenient size and shape, provided the sample is sound and free from any casting defects.

A-1.1 Suitable samples for providing a proportional sound tensile test piece are represented in Fig. 1, 2 and 3. These keel or U-blocks have been found satisfactory in service.

A-1.2 A convenient form of test sample cut from one of the castings, as agreed to between the purchaser and the manufacturer, may be used for the purpose of testing strength of the casting.

A-1.3 In case of sand moulds for test samples of type III and type IV (as Fig. 1 and 2), a rigid CO₂ sand mould is recommended.
Spheroidal Graphite Iron Castings Subcommittee, SMDC 9 : 2

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