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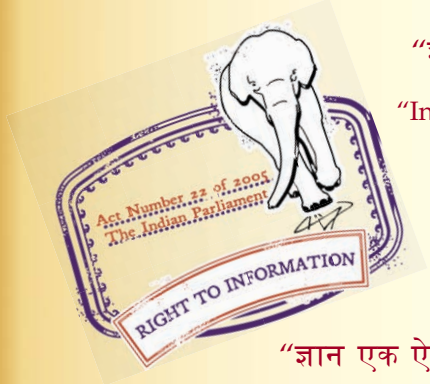
IS 1030 (1998): Carbon steel castings for general engineering purposes [MTD 14: Foundry]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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सामान्य इंजीनियरी उद्देश्यों के लिए कार्बन इस्पात ढलाइयाँ – विशिष्टि

(पाँचवां पुनरीक्षण)

Indian Standard

CARBON STEEL CASTINGS FOR GENERAL ENGINEERING PURPOSES — SPECIFICATION

(Fifth Revision)

ICS 77.140.80

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

November 1998

Price Group 3

FOREWORD

This Indian Standard (Fifth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Steel Castings Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1956 and was revised in 1962, 1974, 1982 and 1989. While reviewing the standard in light of the experience gained during these years the committee has decided that the standard may be further revised. In this revision various clauses have been aligned with the recent standards on steel castings. Amendments No. 1 and 2 have also been incorporated in this revision.

In the preparation of this standard, assistance has been derived from ISO 3755 : 1991 'Cast carbon steels for general engineering purposes'.

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 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CARBON STEEL CASTINGS FOR GENERAL ENGINEERING PURPOSES — SPECIFICATION

(Fifth Revision)

1 SCOPE

This standard covers the requirements for carbon steel castings for general engineering purposes.

2 REFERENCES

The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Cast (Melt)

The product of any of the following:

a) One furnace heat,
b) One crucible heat, or
c) A number of furnace or crucible heats of similar composition mixed in a ladle or tapped in separate ladles and poured simultaneously for making a casting.

3.2 Batch

A group of castings of one grade of material, cast from the same melt and heat-treated together under identical conditions.

4 GRADES

4.1 This standard covers a total of eight grades of carbon steel castings for general engineering purposes.

4.2 Included in 8 grades are 4 grades with chemical composition restricted to ensure ease of welding at the purchaser's end and these grades carry the suffix 'W'.

5 SUPPLY OF MATERIAL

General requirements relating to supply of steel castings shall be as laid down in IS 8800.

6 MANUFACTURE

Steel for the castings shall be made by electric arc or electric induction or such other processes as may be agreed to between the purchaser and the manufacturer.

7 PARTICULARS TO BE SPECIFIED WHILE ORDERING

For the benefit of the purchaser, particulars to be specified while ordering for steel castings to this specification are given in Annex B.

8 CHEMICAL COMPOSITION

8.1 The ladle analysis of steel when carried out either by the method specified in IS 228 and its relevant parts or any other established instrumental/chemical methods shall be as given in Table 1. In case of dispute the procedure given in IS 228 shall be the referee method. However, where the method is not given in IS 228, the referee method shall be as agreed to between the purchaser and the manufacturer.

8.2 The manufacturer shall carry out analysis from a sample of each melt and, if so specified by the purchaser at the time of enquiry and order, shall supply a test certificate of chemical analysis of the sample of steel for each melt.

8.3 Product Analysis

If specified at the time of enquiry and order, product analysis may be carried out from a test piece or from a casting representing each melt. Drillings for analysis shall be taken from not less than 6 mm beneath the cast surface, and in such a manner as not to impair the usefulness of any casting selected. The permissible variation in product analysis from the limits specified in Table 1 shall be as given in IS 6601.

8.4 Residual Elements

8.4.1 Elements not specified in Table 1 shall not ordinarily be added to the steel and all reasonable precautions shall be taken to prevent contamination from scrap, etc, to keep them as low as practicable.

8.4.2 Analysis and reporting of the analysis in test certificate for the residual elements shall be done only when so specified by the purchaser in enquiry and order. However, the manufacturer shall ensure that the residual elements are within the limits, when such limits are specified by the purchaser in enquiry and order.

9 WORKMANSHIP AND FINISH

9.1 The castings shall be accurately moulded in

accordance with the pattern or the working drawings supplied by the purchaser or as mutually agreed to with the addition of such letters, figures and marks as may be specified.

9.2 The purchaser shall specify the tolerances on all important dimensions. On other dimensions, tolerances specified in IS 4897 shall apply.

10 FREEDOM FROM DEFECTS

10.1 All castings shall be free from defects that will adversely affect machining or utility of castings.

10.2 When necessary to remove risers or gates by flame or arc or a combination thereof, or by any other process involving intense heat, care shall be taken to make the cut at a sufficient distance from the body of the casting so as to prevent any defect being introduced into the casting due to local heating. Any such operation is to be done before final heat treatment.

10.3 In the event of any casting proving defective from foundry causes in the course of preparation, machining or erection, such a casting may be rejected notwithstanding any previous certification of satisfactory testing and/or inspection.

11 FETTLING AND DRESSING

All castings shall be properly fettled and dressed, and all surfaces shall be thoroughly cleaned.

12 HEAT TREATMENT

12.1 The castings shall be heat treated in a properly constructed furnace, having adequate means of temperature control, which shall permit the whole of the castings to be uniformly heated to the necessary temperature. All castings shall be suitably heat treated so as to attain the specified mechanical properties.

12.2 Unless otherwise specified in enquiry and order or agreed to between the purchaser and the manufacturer, all castings shall either be fully annealed or normalized or normalized and tempered.

12.3 Test pieces shall be heat treated along with the castings they represent.

13 MECHANICAL TESTS

13.1 The mechanical properties specified are those which are to be obtained from test bars cast either separately from or attached to the castings to which they refer and heat treated as given in 12. The test values so exhibited, therefore, represent the quality of steel from which the castings have been poured; they do not necessarily represent the properties of the castings themselves.

13.2 The tensile test shall be carried out in accordance with IS 1608. The relevant mechanical properties shall be as given in Table 2.

13.3 If specified in enquiry and order, impact test shall be carried out in accordance with IS 1757 and the values obtained shall conform to the requirements given in Table 2.

13.4 Bend Test

If so specified at the time of enquiry and order the bend test shall be carried out in accordance with IS 1599. Test pieces shall be capable of being bent cold without fracture to an angle given in Table 2 round a mandrel having a diameter of 50 mm.

Table 1 Chemical Composition

(*Clauses* 8.1, 8.3 *and* 8.4.1)

Sl No.	Grade	Constituent, Percent, *Max*									
		C[1]	Si	Mn	P	S	Cr[2]	Ni[2]	Mo[2]	Cu[2]	V[2]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	200-400N	—	—	—	0.045	0.040	—	—	—	—	—
ii)	200-400W	0.25	0.60	1.00	0.040	0.035	0.35	0.40	0.15	0.40	0.05
iii)	230-450N	—	—	—	0.045	0.040	—	—	—	—	—
iv)	230-450W	0.25	0.50	1.20	0.040	0.035	0.35	0.40	0.15	0.40	0.05
v)	280-520N	—	—	—	0.045	0.040	—	—	—	—	—
vi)	280-520W	0.25	0.60	1.20	0.040	0.035	0.35	0.40	0.15	0.40	0.05
vii)	340-570N	—	—	—	0.045	0.040	—	—	—	—	—
viii)	340-570W	0.25	0.60	1.50	0.040	0.035	0.35	0.40	0.15	0.40	0.05

NOTE—The choice of chemical composition except for P and S in the grades other than the grades requiring case of welding and having the suffix W is left to the discretion of the manufacturer.

[1] For each reduction of 0.01 percent carbon below 0.25 percent, an increase of 0.04 percent manganese above the maximum specified will be permitted up to a maximum of 1.40 percent for grade 280-520 W.

[2] The total content of these elements shall not exceed 1.00 percent in case of grades with suffix W.

Table 2 Mechanical Properties

(*Clauses* 13.2, 13.3 *and* 13.4)

Sl No.	Grade	Tensile Strength MPa	Yield[1] Stress MPa	Elongation Percent	Reduction of Area Percent	Impact Strength J	Angle of Bend Degrees
		Min	*Min*	*Min*	*Min*	*Min*	*Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	200-400N	400	200	25	40	30	90
ii)	200-400W	400	200	25	40	45	90
iii)	230-450N	450	230	22	31	25	90
iv)	230-450W	450	230	22	31	45	90
v)	280-520N	520	280	18	25	22	60
vi)	280-520W	520	280	18	25	22	60
vii)	340-570N	570	340	15	21	20	60
viii)	340-570W	570	340	15	21	20	60

NOTES

1 Impact test and bend test are optional (*see* **13.3** and **13.4**).

2 The W grades restrict the chemical composition and may be ordered when ensuring ease of welding in a requirement.

[1] If measurable the upper yield stress, otherwise 0.2 percent proof stress.

13.4.1 Bend test pieces shall be of suitable length, convenient for the machines in which they will be bent, and shall have either a diameter of 25 mm or a rectangular section of 25 mm × 20 mm. The edges of the rectangular test piece shall be rounded to a radius of not more than 1.5 mm and in case of rectangular test piece the test shall be made by bending the test piece over the thinner section.

14 NON-DESTRUCTIVE TESTS

14.1 Non-destructive testing shall be applied if so specified in enquiry and order. Under this heading are grouped the tests, which aim at revealing defects which cannot be revealed by a simple visual examination, such as, penetrant, magnetic particle, ultrasonic, X-radiographic, or gamma-radiographic inspection; also included under this heading are tests on the surface condition by visual or visual-tactile examination. The purchaser shall specify in enquiry and order:

a) The type of non-destructive testing which he intends to carry out or to have carried out;

b) The area or areas of the casting to which these tests apply, and the types of discontinuity, where relevant;

c) Whether all, or what proportion, of the castings are to be tested;

d) The severity level defining the acceptability or non-acceptability of defects which may be revealed; and

e) Whether the manufacturer is or is not contractually responsible for carrying out the tests.

14.2 Unless otherwise agreed upon, when non-destructive testing is to be done, the castings shall be examined as follows:

a) Ultrasonic examination (*see* IS 7666),

b) Magnetic particle examination (*see* IS 3703),

c) Liquid penetrant examination (*see* IS 3658), and

d) Radiographic examination (*see* IS 2595).

14.3 Unless otherwise agreed upon the following shall be the acceptance standards:

a) IS 9565 for ultrasonic inspection,

b) IS 10724 for magnetic particle inspection,

c) IS 11732 for liquid penetrant inspection, and

d) IS 12938 for radiographic inspection.

15 REPAIR OF CASTINGS

15.1 Unless otherwise specified by the purchaser in enquiry and order, castings may be rectified by welding. All repairs by welding shall be carried out in accordance with the procedure laid down in IS 5530. If castings have been subjected to non-destructive testing by agreement between the purchaser and the manufacturer, the castings shall be re-examined in the area of repair following any rectifying operation performed on the castings.

15.2 To form the basis of an agreement between the purchaser and the supplier in this respect where relevant, the following classification shall apply concerning the extent of repair:

a) Weld repair involving a depth not exceeding 20 percent of wall thickness or 25 mm, whichever is lower, shall be termed as a minor repair.

b) Any weld repair exceeding the above shall be termed as a major repair. Further any single repair having an area exceeding 250 mm square for every millimetre of wall thickness shall also

be deemed to be a major repair, regardless of the considerations mentioned in (a) above.

15.3 Carbon Equivalent

Unless otherwise specified in the enquiry and order, or otherwise agreed to, the Carbon Equivalent (C.E.) for the purpose of guidance in determination of the pre- and post-weld treatment applicable to carbon and low alloy steels shall be computed as follows:

$$\text{Carbon Equivalent (C.E.)} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

16 HYDRAULIC TEST

16.1 When so specified by the purchaser in enquiry and the order, a hydraulic test shall be carried out; the details of the test shall be as agreed to between the purchaser and the manufacturer.

16.2 The castings shall not be peened, plugged or impregnated, to stop leakages. However, unless otherwise specified at the time of enquiry and order, rectification and upgradation of a casting by welding may be carried out in accordance with the approved procedures as laid down in the relevant clause of the standard.

17 METHOD OF SAMPLING

The method of sampling steel castings for the purpose of chemical analysis and mechanical tests including re-test shall be in accordance with IS 6907.

18 MARKING

18.1 Each casting shall be legibly marked with the following as may be relevant. However, where linkage and traceability are required the relevant marking shall be indelible:

a) The number or identification mark by which it is possible to trace the melt and the heat-treatment batch from which it was made;

b) The manufacturer's initials or trade-mark; and

c) Other identification marks in accordance with any agreement between the purchaser and the manufacturer.

NOTE—It is recommended that minimum markings be used.

18.2 By agreement between the purchaser and the manufacturer, castings complying with the requirements of this standard may, after inspection, be legibly and indelibly marked with an acceptance mark.

18.3 BIS Certification Marking

The castings may also be marked with the Standard Mark.

18.3.1 The use of Standard Mark is governed by the provisions of *Bureau of Indian Standards Act,* 1986 and the Rules and Regulations made thereunder. The details of condition under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
228	Methods for chemical analysis of steels (*second revision*)
1500 : 1983	Methods for Brinell hardness test for metallic materials (*second revision*)
1599 : 1985	Method for bend test (*second revision*)
1608 : 1995	Mechanical testing of metals—Tensile testing (*second revision*)
1757 : 1988	Methods of Charpy impact test (V-notch) for metallic materials (*second revision*)
2595 : 1978	Code of practice for radiographic testing (*first revision*)
3658 : 1981	Code of practice for liquid penetrant flaw detection (*first revision*)
3703 : 1980	Code of practice for magnetic particle flaw detection (*second revision*)
4897 : 1994	Deviations for untoleranced dimensions and mass of steel castings (*third revision*)
5530 : 1987	Code of procedure for repair and rectification of steel castings by metal arc welding process (*first revision*)
6601 : 1987	Permissible deviations in chemical composition for products analysis of steel castings (*first revision*)
6907 : 1992	Methods of sampling steel castings (*second revision*)
7666 : 1988	Recommended procedure for ultrasonic

IS No.	*Title*	*IS No.*	*Title*
	examination of ferritic castings of carbon and low alloy steel (*first revision*)	10724 : 1990	Acceptance standards for magnetic particle inspection of steel castings (*first revision*)
8800 : 1997	Technical delivery conditions for steel castings (*third revision*)	11732 : 1995	Acceptance standards for dye penetrant inspection of steel castings
9565 : 1995	Acceptance standards for ultrasonic inspection of steel castings (*first revision*)	12938 : 1990	Acceptance standards for radiographic inspection of steel castings

ANNEX B

(*Clause* 7)

INFORMATION TO BE SUPPLIED BY THE PURCHASER

B-1 BASIS FOR ORDER

While placing an order for purchase of steel castings covered by this standard, the purchaser should specify the following:

a) Material specification;

b) Drawing or reference number of the pattern (if supplied by the purchaser), along with a copy of the drawing;

c) Optional/Additional tests required, if any;

d) Whether the castings are to be inspected and tested in the presence of the purchaser's representative;

e) Condition of delivery;

f) Any special requirement; and

g) Test report, if required.

Bureau of Indian Standards

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

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Amendments Issued Since Publication

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