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मानक

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IS 2708 (1993): 1.5 Percent manganese steel castings for general engineering purposes [MTD 14: Foundry]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

सामान्य इंजीनियरी प्रयोजनों के लिये 1.5 प्रतिशत मैंगनीज़
इस्पात ढलाईयों की विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

**1.5 PERCENT MANGANESE STEEL CASTINGS
FOR GENERAL ENGINEERING PURPOSES —
SPECIFICATION**

(Third Revision)

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

FOREWORD

This Indian Standard (Third 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 1964 and was subsequently revised in 1973 and 1984. While reviewing the standard in the light of the experience gained during these years the committee has decided to revise this Indian Standard. In this revision various clauses have been aligned with the recent standards on steel castings.

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

1.5 PERCENT MANGANESE STEEL CASTINGS FOR GENERAL ENGINEERING PURPOSES — SPECIFICATION

(*Third Revision*)

1 SCOPE

This standard covers the requirements for 1.5 percent manganese steel castings for general engineering purposes.

2 REFERENCES

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

3 TERMINOLOGY

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

3.1.1 *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.

3.1.2 *Batch*

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

4 GRADES

This standard covers three grades of steel castings for general engineering purposes.

5 SUPPLY OF MATERIAL

General requirements relating to supply of steel castings shall be as laid down in IS 8800 : 1986.

6 MANUFACTURE

The 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 of steel 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, the product analysis may be carried out from a broken tensile 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 : 1987.

8.4 Residual Elements

8.4.1 Elements not specified in Table 1 shall not ordinarily be added to the steel except where agreed to, other than for the purpose of finishing the heat and all reasonable precautions shall be taken to prevent contamination from the scrap etc, to keep them as low as practicable.

8.4.2 The following limits shall apply for the elements not specified in Table 1:

<i>Constituent</i>	<i>Percent, Max</i>
Copper	0.30
Nickel	0.40
Chromium	0.30
Molybdenum plus tungsten	0.25
Total content of these unspecified elements	1.00

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

Table 1 Chemical Composition of 1.5 Percent Manganese Steel Castings
(Clauses 8.1, 8.3, 8.4.1 and 8.4.2)

Constituent	Requirement, Percent*	
	Grade 1	Grades 2 and 3
Carbon	0.18-0.25	0.25 to 0.33
Silicon	0.60	0.60
Manganese	1.20-1.60	1.20-1.60
Sulphur	0.050	0.050
Phosphorus	0.050	0.050

* Maximum, unless range is specified.

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 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 : 1986 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 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 being 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 the enquiry and order or agreed to between the purchaser and the manufacturer, all castings shall either be normalized, normalized and tempered or hardened and tempered.

12.3 The 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 : 1972. The relevant mechanical properties shall be as given in Table 2.

13.3 The impact test shall be carried out in accordance with IS 1757 : 1988 and the values obtained shall conform to the requirements given in Table 2.

13.4 The Brinell hardness test shall be carried out in accordance with IS 1500 : 1983 and Brinell hardness shall be as given in Table 2.

Table 2 Mechanical Properties of 1.5 Percent Manganese Steel Castings for General Engineering Purposes
(Clauses 13.3 and 13.4)

Property	Requirement		
	Grade 1	Grade 2	Grade 3
(1)	(2)	(3)	(4)
Tensile strength, MPa, <i>Min</i>	520	620	690
Yield stress (0.2 Percent proof stress) MPa, <i>Min</i>	320	370	495
Elongation, percent, <i>Min</i>	16	13	13
Charpy, V-notch impact value, J, <i>Min</i>	30	25	22
Brinell hardness, HB	152-207	179-229	201-255

14 NON-DESTRUCTIVE TESTS

14.1 Non-destructive testing shall be applied if so specified in the enquiry and the 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 the 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 as per IS 7666 : 1988,
- b) Magnetic particle examination as per IS 3703 : 1980,
- c) Liquid penetrant examination as per IS 3658 : 1981, and
- d) Radiographic examination as per IS 2595 : 1978.

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

- a) IS 9565 : 1986 for ultrasonic inspection,
- b) IS 10724 : 1990 for magnetic particle inspection,
- c) IS 11732 : 1986 for dye penetrant inspection, and
- d) IS 12938 : 1990 for radiographic inspection.

15 REPAIR OF CASTINGS

15.1 Unless otherwise specified by the purchaser in the 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 : 1986. 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, 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 mm² 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:

$$C.E. = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

16 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 : 1992.

17 MARKING

17.1 Each casting shall be legibly marked with the following:

- 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 of marking be used.

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

17.2.1 BIS Certification Marking

The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made

thereunder. The details of conditions 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

(Item 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
228 :	Methods for chemical analysis of steels (<i>second revision</i>)	6601 : 1987	Permissible deviations in chemical composition for products analysis of steel casting (<i>first revision</i>)
1500 : 1983	Methods for Brinell hardness test for metallic materials (<i>second revision</i>)	6907 : 1992	Methods of sampling steel castings (<i>second revision</i>)
1608 : 1972	Methods for tensile testing of steel products (<i>first revision</i>)	7666 : 1988	Recommended procedure for ultrasonic examination of ferritic castings of carbon and low alloy steel (<i>first revision</i>)
1757 : 1988	Methods of charpy impact test (V-notch) for metallic materials (<i>second revision</i>)	8800 : 1986	Technical delivery conditions for steel castings (<i>second revision</i>)
2595 : 1978	Code of practice for radiographic testing (<i>first revision</i>)	9565 : 1986	Acceptance standards for ultrasonic inspection of steel castings (<i>first revision</i>)
3658 : 1981	Code of practice for liquid penetrant flaw detection (<i>first revision</i>)	10724 : 1990	Acceptance standards for magnetic particle testing of steel castings (<i>first revision</i>)
3703 : 1980	Code of practice for magnetic particle flaw detection (<i>first revision</i>)	11732 : 1986	Acceptance standards for dye penetrant inspection of steel castings
4897 : 1986	Deviations on untoleranced dimensions and mass of steel castings (<i>second revision</i>)	12938 : 1990	Acceptance standards for radiographic inspections of steel castings
5530 : 1987	Recommendations for production, rectification and repair of steel castings by metal arc welding process (<i>first revision</i>)		

ANNEX B

(Item 7)

INFORMATION TO BE SUPPLIED BY THE PURCHASER**B-1 BASIS FOR ORDER**

While placing an order for the 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
- d) Test report, if required.

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	323 76 17, 323 38 41
Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola CALCUTTA 700054	{ 337 84 99, 337 85 61 337 86 26, 337 91 20
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022	{ 60 38 43 60 20 25
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	{ 235 02 16, 235 04 42 235 15 19, 235 23 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	{ 832 92 95, 832 78 58 832 78 91, 832 78 92
Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. PATNA. PUNE. THIRUVANANTHAPURAM.	