IS 2985 (1990): Steel Castings for Ship's Structure [MTD 14: Foundry]

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IS 2985 : 1990
(Reaffirmed 2000)

भारतीय मानक

जहाज संरचना निर्माण के लिए इस्पात ढलाइयाँ – विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

STEEL CASTINGS FOR SHIP'S STRUCTURE — SPECIFICATION

(Third Revision)

UDC 669·14-14 : 629·12·011

BUREAU OF INDIAN STANDARDS
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Price Group 3

Steel Castings Sectional Committee, MTD 17

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards on 23 March 1990, 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 1982. While reviewing the standard in the light of the experience gained during these years, the committee has decided to bring it in line with the main requirements of the concerned classification. Societies and Statutory Authority. Further, 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

STEEL CASTINGS FOR SHIP'S STRUCTURE — SPECIFICATION

(Third Revision)

1 SCOPE

1.1 This standard covers the requirements for weldable steel castings for ship's structure, such as cast steel stern frames, rudder frames, rudder stocks, propeller shaft brackets and other steel castings intended for use in hull construction.

1.2 Notwithstanding what is stated in this specification, the requirements as laid down in the rules for manufacture, testing and certification of castings of Classification Society for which a ship is being built, are to be complied with, in all respects. For this purpose, it is necessary that the purchaser gives the required particulars to the foundry at the time of enquiry and order.

2 REFERENCES

2.1 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 GRADE

4.1 This standard covers one grade of steel castings for ship's structure.

5 SUPPLY OF MATERIAL

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

6 MANUFACTURE

6.1 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, and suitably killed.

7 PARTICULARS TO BE SPECIFIED WHILE ORDERING

7.1 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 agreed to between the purchaser and the manufacturer.

8.2 The manufacturer shall carry out analysis from 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 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 the scrap, etc, to keep them as low as practicable.

Table 1 Chemical Composition

(*Clause* 8.1)

Constituent	Requirement, Percent *Max*
Carbon	0·23
Silicon	0·60
Manganese	1·60 (but not less than 3 times the actual carbon content)
Sulphur	0·040
Phosphorus	0·040
Total residual elements including nickel, chromium, molybdenum and copper	0·80

NOTE — Alloy steel castings may be used, subject to agreement between the purchaser and the manufacturer.

8.4.2 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.

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. For other dimensions, tolerances specified in IS 4897 : 1986 shall apply.

10 FREEDOM FROM DEFECTS

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

10.2 When necessary to remove risers or gates by flame or arc or a combination thereof, or by sany other process involving intense heat, care hall 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 thermal heating. Any such operation is preferably done before 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

11.1 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 and the furnace 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 fully annealed, normalized or normalized and tempered.

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

13 TEST BARS

13.1 Test bars of suitable sizes shall be cast integrally with the castings, except as provided in **13.2**. Test bars shall not be cut from the castings until the heat treatment of such castings has been completed and duly stamped by the external inspecting authority.

13.2 However, in case of castings of mass less than 500 kg, the test blocks may be cast separately, unless otherwise specified at the time of enquiry and order.

14 MECHANICAL TESTS

14.1 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.

14.2 The tensile test shall be carried out in accordance with IS 1608. The properties shall be as given below.

Property	*Requirement*
Tensile strength, MPa, *Min*	400
Yield stress, MPa, *Min*	200
Elongation, percent, *Min*	25
Reduction in area, percent, *Min*	40

14.2.1 Where the mass of an individual casting is 10 tonnes or more, two tensile tests shall be conducted.

14.2.2 Where large castings are made from two or more melts which are not mixed in a ladle prior to pouring, two or more tensile tests are to be conducted on test samples which are integrally

cast at locations as widely separated as possible. The number of test samples tested shall equal the number of ladles used for pouring the casting.

14.2.3 In case of castings of complex design, additional tests may be stipulated at the time of enquiry and order.

14.3 If specified in the enquiry and order, the impact test shall be carried out in accordance with IS 1757.

15 NON-DESTRUCTIVE TESTS

15.1 Non-destructive testing shall be applied if 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.

15.2 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);

NOTE — Where magnetic particle examination is specified, it is to be carried out using the wet method. The dry method is not permissible.

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

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

15.3 Unless otherwise agreed upotn, the followingIndian Standards shall be he acceptance standards:

a) IS 9565 for ultrasonic inspection

b) IS 10724 for magnetic particle inspection

c) IS 11732 for dye penetrant inspection

d) IS 12938 for radiographic inspection (*under print*)

16 REPAIR OF CASTINGS

16.1 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.

16.2 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 limit shall be termed as a major repair. Further any single repair having an area exceeding 250 mm^2 for every millimetre of wall thickness shall also be deemed to be a major repair, regardless of the considerations mentioned in (a) above.

16.3 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:

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

17 SAMPLING

17.1 The method of sampling the 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:

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) Indication of the source of manufacture; and

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

NOTE — It is recommended that a minimum marking 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 marked with an acceptance mark.

18.2.1 The castings may also be marked with the Standard Mark, details for which may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
228	Methods for chemical analysis of steels (*second revision*)
1500 : 1983	Method for Brinell hardness test for metallic materials (*second revision*)
1608 : 1972	Method for tensile testing of steel products (*first revision*)
1757 : 1988	Method of beam impact test (V-notch) on steel (*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 (*first revision*)
4897 : 1986	Deviations for untoleranced dimensions and mass of steel castings (*second revision*)
5530 : 1986	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 product analysis of steel castings (*first revision*)
6907 : 1973	Methods of sampling of steel castings (*first revision*)
7666 : 1975	Recommended procedure for ultrasonic examination of ferritic castings of carbon and low alloy steel
8800 : 1986	Technical delivery conditions for steel castings (*second revision*)
9565 : 1986	Acceptance standards for ultrasonic inspection of steel castings (*first revision*)
10724 : 1983	Acceptance standard for magnetic particle inspection of steel castings
11732 : 1986	Acceptance standard for dye penetrant inspection of steel castings
12938 : 1990	Acceptance standard for radiographic inspection of steel castings

ANNEX B

(*Clause* 7.1)

INFORMATION TO BE SUPPLIED BY THE PURCHASER

B-1 BASIS FOR ORDER

B-1.1 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;

g) Test report, if required; and

h) The rules or codes of the classification society applicable, if relevent (*see* **1.2**).

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard 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 devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.