Indian Standard

SPECIFICATION FOR HOT-DIP ZINC COATINGS ON STRUCTURAL STEEL AND OTHER ALLIED PRODUCTS

(Second Revision)

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0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Indian Standards Institution on 20 December 1984, after the draft finalized by the Hot-Dip, Sprayed and Diffusion Coatings Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was earlier published in 1968 and was subsequently revised in 1979. In this revision, the post treatment requirement and the standard marking clauses have been incorporated.

0.3 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 specifies requirements for zinc coating applied by hot-dip galvanizing on iron and steel products, fabricated or assembled from cast, rolled, pressed and forged shapes, such as structural steel sections, plates and bars.

1.2 This standard makes no reference to the quality of iron and steel products themselves.

*Rules for rounding off numerical values (*revised*).

Section Officer

2. SUPPLY OF MATERIAL

2.1 General requirements relating to the supply of material shall conform to IS : 1387-1967*.

3. GENERAL REQUIREMENTS

3.1 **Quality of Zinc** — Zinc conforming to any grade specified in IS : 209-1979† shall be used for the purpose of galvanizing.

3.2 **Galvanizing Bath** — The molten metal in the galvanizing bath shall contain not less than 98·5 percent by mass of zinc.

3.3 **Galvanizing** — The steel products may, as far as practicable, be galvanized in accordance with IS : 2629-1984‡.

4. COATING REQUIREMENTS

4.1 **Mass of Zinc Coating** — Requirements for the mass of zinc coating for different classes of materials are given in Table 1.

TABLE 1 MASS OF ZINC COATING

Sl No.	Product	Minimum Value of Average Mass of Coatings
(1)	(2)	(3) g/m²
i)	Castings — grey iron, malleable iron	610
ii)	Fabricated steel articles:	
	a) 5 mm thick and over	610
	b) Under 5 mm, but not less 2 mm	460
	c) Under 2 mm, but not less than 1·2 mm	340
iii)	Threaded work other than tubes and tube fittings:	
	a) 10 mm dia and over	300
	b) Under 10 mm dia	270

NOTE 1 — The requirements for the minimum mass of coating are for normal or rural atmospheres. In case of special atmosphere like marine and industrial atmospheres, the minimum mass of coating shall be increased as agreed to between the galvanizer and the purchaser.

NOTE 2 — In case of fabricated steel structures, plates, etc, the coating mass is defined in terms of grams per square metre of the total surface area.

*General requirements for the supply of metallurgical materials (*first revision*).
†Specification for zinc (*third revision*).
‡Recommended practice for hot-dip galvanizing of iron and steel (*first revision*).

4.2 **Freedom from Defects** — The zinc coating shall be uniform, adherent, reasonably smooth and free from such imperfections as flux, ash and bare patches, black spots, pimples, lumpiness, runs, rust stains, bulky white deposits, and blisters (the terms have been specified in Appendix A of IS : 2629-1984*).

4.3 **Steel Embrittlement** — The design of the product and the selection of the steel for its suitability to withstand normal galvanizing operations without embrittlement or the method of fabrication shall be the responsibility of the fabricator.

NOTE — Recommended precautions to properly design, fabricate and prepare the material for galvanizing to prevent embrittlement are given in IS : 6158-1984†.

5. POST-TREATMENT

5.1 Most galvanized products do not require any post-treatment. Where required by the purchaser, treatment such as chromating or phosphating may be applied to reduce the risk of wet storage staining or to assist subsequent painting, respectively.

6. SAMPLING AND CRITERIA FOR CONFORMITY

6.1 Unless otherwise agreed to, the following sampling plan shall be followed for ascertaining the conformity of galvanized coating on structural steel and other allied products.

6.2 **Lot** — All the material of the same type in a coating bath whose coating characteristics are intended to be uniform shall be grouped together to constitute a lot.

6.2.1 Sample shall be taken from each bath and tested for conformity of coating.

6.3 **Scale of Sampling** — The number of units to be selected from a bath shall be in accordance with col 1 and 2 of Table 2. These units shall be selected at random.

6.4 Test for Visual Inspection

6.4.1 Visual inspection of the material in a lot shall be made to determine the conformity with the requirements of 4.2. If the inspection warrants rejection of the lot the galvanizer may seggregate the good pieces of the lot and submit it once again for inspection.

6.4.2 If the lot inspected for visual inspection passes then the lot shall be declared as conforming to the requirements of 4.2.

*Recommended practice for hot-dip galvanizing of iron and steel (*first revision*).
†Recommended practice for safeguarding against embrittlement of hot-dip galvanized iron and steel products (*first revision*).

TABLE 2 SCALE OF SAMPLING

(*Clause* 6.3)

Lot Size (No. of Unit in a Bath)	Sample Size	Permissible No. of Defective Units
(1)	(2)	(3)
Up to 25	3	0
26 to 50	5	0
51 to 100	8	0
101 and above	13	1

6.3 Number of Tests for Coating Characteristics

6.3.1 From each of the samples taken according to col 1 and 2 of Table 2 suitable test specimen shall be selected. If the material is of inconvenient length, shorter pieces of the same section under the same steel composition, not less than 90 cm length may be taken as test specimen. Three test specimens shall be cut from each sample for the determination of the mass coating as described in 7.2.

6.3.2 Each sample shall be tested by testing one test specimen as prepared in 6.3.1. In case a test specimen representing a sample unit fails to conform to the requirements specified in 7.2 with respect to mass of coating the second or third specimen shall be tested. If any one of the second or third specimen fails to conform to the requirements, the sample unit shall be called a defective unit. If the number of defective units in a lot exceeds the permissible number of defective unit specified in col 3 of Table 2, the lot shall be rejected.

6.3.3 The materials in a lot which have been rejected may be stripped and galvanized and again submitted for the test and inspection. Sample shall be taken in accordance with Table 2.

6.3.4 The lot shall be declared as conforming to the specification if 6.3.1 and 6.3.2 are satisfied.

7. TEST PROCEDURE

7.1 Test Specimen

7.1.1 Test specimens shall be selected from the material galvanized but if the material is of inconvenient length, shorter pieces of the same section and of the same steel composition, not less than 90 cm long, may be introduced as test specimens.

7.1.2 All test specimens shall be treated in the same manner, in the same bath and at the same time as the material, whose coating characteristics they are intended to represent.

7.1.3 Three representative specimens may be selected from each lot for carrying out the determination of the mass of coating as described in 7.2 (*see also* 8.2).

7.2 Mass of Galvanized Coating

7.2.1 The mass of zinc coating shall be determined in accordance with IS : 6745-1972*. The following methods (a) and (b) may also be used subject to agreement between the purchaser and the galvanizer. However, the method (a) gives the actual mass of zinc coating, hence the average mass per unit area is realistic:

a) *Mass before and after galvanizing* — The mass of coating may be determined by weighing the article before and after galvanizing, subtracting the first mass from the second and dividing the result by the surface area. The first mass shall be determined after pickling, rinsing and drying, the second after cooling to ambient temperature.

b) The magnetic or microscopic methods as described in IS : 4360-1982† or eddy-current (*see* IS : 6012-1971‡) may be employed to determine the thickness of coating. The mass of coating in grams per square metre shall then be calculated by multiplying the thickness in millimetres by a factor 7 047.

7.2.2 In the case of long pieces when test specimens are not available, the mass of the coating shall be the average of the determinations made at each end and the middle of the article. In the case of composite assemblies, each part shall be tested separately as they may fall in different classification.

7.3 Determination of Uniformity of Galvanized Coating — Where practicable, the uniformity of galvanized coating shall be determined by the Preece test as prescribed in IS : 2633-1972§. The article should withstand four 1-minute dips.

NOTE 1 — The use of the Preece test should be agreed to between the purchaser and the galvanizer.

*Methods for determination of weight of zinc coating on zinc coated iron and steel articles.

†Method of testing local thickness of electroplated coatings (*first revision*).

‡Method for measurement of coating thickness by eddy current.

§Methods of testing uniformity of coating on zinc coated articles (*first revision*).

NOTE 2 — In the case of large articles of inconvenient lengths, the determination of coating thickness as done in 7.2.1(b) may be taken as a uniformity test.

7.4 **Adhesion of Galvanized Coating** — The coating shall withstand the pivoted hammer and knife tests as prescribed in IS : 2629-1984* for testing adhesion of zinc coatings on fabricated products and hardware respectively.

8. INSPECTION

8.1 Visual inspection of material shall be made to determine conformity with the requirement of 4.2. When partial inspection warrants rejection of a lot, the galvanizer may re-sort the lot and submit it once again for inspection.

8.2 Should one specimen fail to conform to the requirements specified in 7.2 for the coating, the second and third specimens shall be tested. Failure of either the second or third specimen to conform to the requirements shall be the cause for rejection of the lot which the samples represent.

8.3 Materials that have been rejected may be stripped and galvanized and again submitted for test and inspection when they shall conform to the requirements of this specification, otherwise the entire lot shall be rejected.

9. MARKING

9.1 The galvanized articles may be marked with the name or trade-mark of the manufacturer.

9.1.1 The articles may also be marked with 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 devised and supervised 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.

*Recommended practice for hot-dip galvanizing of iron and steel (*first revision*).