

Addendum & corrigendum slip No. 4 to RDSO.

Specification No. ETI/OHE/13(4/84)

For

Hot dip zinc galvanisation of Steel Masts (Rolled & Fabricated),
Tubes & fittings used on 25 kv ac OHE

1. A & C slip No.3(4/90) - Para3 delete last line
(Structural tubes - all - 425) and the following is added in
the respective column.

Structural tubes:

Lightly polluted area

610

Medium and heavy polluted area

800

Specification No. ETI/OHE/13(4/84)

REFERENCE COPY

For

Hot Dip Zinc Galvanisation of Steel Mast (Rolled & Fabricated), Tubes & Fittings used on 25kV ac OHE

1. Clause 2.

Add new item as SN. VIII below the para VIII) ASTM: A 153 - Specification for Zinc coating (1982) (Hot-dip) on Iron and Steel hardware.

2. Clause 2.

SN(1) Read 'IS: 4759-1984' in place of " IS: 4759-1979".

3. Clause 4.1, Delete last line '(Structural----610)' and add the following in the respective columns:

Steel Components less than 5mm thick	all	460
Structural Tubes	all	425

DRAFT

(4/90)

Correction Slip No. 2 to RDSO specification

No. 311/OHE/13(4/84).

for

Hot Dip Zinc Galvanisation of Steel Masts (Rolled & Fabricated), Tubes & Fittings used on 25 kV a.c. OHE

1. Appendix B
 - 1.1 Clause B-1, 1st line, Read 'trichloro ethylene' in place of 'trichloro ethylen'
 - 1.2 Clause B-2, Read 'Stripping solution' in place of 'Stripping Solutions'
 - 1.3 Clause B-2.1, Read 'Hydrochloric Acid (Specific Gravity 1.16)' in place of 'Hydrochloric Acid (Specific Gravity 1.12)'
 - 1.4 Clause B-3, Line No. 3, Read 'Clause B-2.1' in place of 'Clause B-2.2'.
 - 1.5 Clause B-3, Insert the word 'ceases' in last line of the clause between 'hydrogen' and 'and'.

Approved by: _____ Date: 11-90

16-6-86

May 1986

Correction Slip No. 1 to RDSO Specification
No. EPI/OHE/13(4/84)

REFERENCE COPY

for

Hot Dip Zinc Galvanisation of Steel Masts (Rolled & Fabricated), Tubes & Fittings used on 25 kV a. c. OHE

1. Clause 6.1 Shall be revised as under:

6.1 LOT: All the material of the same type in a coating bath whose characteristics are intended to be uniform shall be grouped together to constitute a lot.

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

2. Table 1 under clause 6.2 shall be revised as under:

TABLE - 1.
Scale of Sampling

Lot size	Sample size	Permissible no. of Defective units
Upto 25	3	0
25-50	5	0
51-100	8	0
101 and above.	13	1



GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

**SPECIFICATION FOR
HOT DIP ZINC GALVANISATION OF STEEL
MASTS (ROLLED & FABRICATED), TUBES
AND FITTINGS USED ON 25 kV ac OHE**

No. ETI/OHE/13 (4/84)

Printed November, 1984

Issued by

**TRACTION INSTALLATION DIRECTORATE
RESEARCH DESIGNS AND STANDARDS ORGANISATION
MANAKNAGAR, LUCKNOW 226011**

Specification for Hot Dip Zinc Galvanisation of Steel Masts (Rolled & Fabricated) Tubes and Fittings Used on 25 kV ac OHE

SCOPE

This standard specifies the requirements of zinc coating on rolled/fabricated masts, tubes, and fittings applied by hot dip galvanising and the criteria for sampling and inspection of such galvanised members. This supersedes RDSO Specification No. ETI/OHE/13(9/82) issued in September, 1982 and No. ETI/OHE/13 (11/83) issued provisionally in November, 1983.

REFERENCE SPECIFICATIONS: In preparation of this specification, assistance of the following Indian Standard and other specifications has been taken:—

- (a) IS:4759-1979 Specification for Hot Dip Zinc Coatings on Structural Steel and other allied Products.
- (b) IS: 209-1979 Specification for zinc.
- (c) IS 2629-1966 Recommended Practice for Hot Dip Galvanising of Iron and Steel.
- (d) IS:6158-1971 Recommended Practice for Safeguarding against Embrittlement of Hot Dip Galvanised Iron & Steel Products.
- (e) IS:2633-1972 Method for Testing Uniformity of Coating on Zinc Coated Articles.
- (f) IS:6745-1972 Methods for Determination of weight of Zinc Coating on Zinc coated iron and steel articles (with amendment No. 1).
- (g) ASTM A-123 (1978) Spec. for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips.

GENERAL REQUIREMENTS

QUALITY OF ZINC: Zinc conforming to at least grade Zn 99.95 specified in IS: 209-1979 shall be used for the purpose of galvanising.

BASE METAL: The steels and castings shall be in accordance with clause 2 of IS:6158-1971. Where steel is supplied by the fabricator, it is the responsibility of the fabricator to select suitable steel which will withstand normal galvanising operation without embrittlement.

The edges of tightly contacting surfaces should be completely sealed by welding. The residue of coated electrodes should be removed, prior to pickling, by brushing, chipping or sand blasting.

SURFACE PREPARATION: Surface shall be cleaned and prepared as per clause 4 of IS:2629-1966. Malleable iron castings shall be shot or grit blasted before galvanising.

GALVANISING: The members shall be galvanised in accordance with the practice contained in the IS:2629-1966 unless otherwise specified in the succeeding paragraphs.

COATING REQUIREMENTS

MASS OF ZINC COATING: Minimum average mass of zinc coating on different kinds of articles shall be as under:—

Class of material	Environment where used.	Minimum average weight of zinc coating (g/m ²).
Rolled steel masts, poles, channels and members fabricated therefrom, steel fittings.	Suburban and lightly polluted area.	610
-do-	Marine and chemically polluted areas.	1,000

Class of material	Environment where used.	Minimum average weight of zinc coating (g/m ²).
Malleable iron castings.	Suburban and lightly polluted areas.	610
-do-	Marine and chemically polluted areas.	1,000
Structural tubes	all	610

Note.—Articles galvanised with 1000 g/m² zinc coatings shall be identified by a band of green paint by the galvaniser.

4.2 FREEDOM FROM DEFECTS: The zinc coating shall be uniform, adherent, reasonably smooth and free from imperfections such as flux, ash and dross inclusions, bare patches, black spots, pimples, lumpiness and runs, rust stains, bulky white deposits and blisters etc. These terms have been defined in IS:2629-1966 which (duly amended wherever necessary) are given at Appendix 'A'.

4.3 STEEL EMBRITTLEMENT: The design of the product and the selection of steel, wherever steel is to be supplied by fabricator, for its suitability to withstand normal galvanising operations without embrittlement or the method of fabrication shall be the responsibility of the fabricator. Recommended precautions to properly design, fabricate and prepare the material for galvanising to prevent embrittlement shall be as per IS:6158-1971.

5. TESTS

5.1 TYPE TESTS

- (a) Visual inspection (Clause 7.1)
- (b) Adhesion of coating (Clause 7.2)
- (c) Uniformity of coating (Clause 7.3)
- (d) Mass of zinc coating (Clause 7.4)

Each test shall be conducted on three samples.

5.2 ACCEPTANCE TESTS

- (a) Visual inspection (Clause 7.1)
- (b) Adhesion of coating (Clause 7.2)
- (c) Uniformity of coating (Clause 7.3)
- (d) Mass of zinc coating (Clause 7.4)

5.3 RECURRING TESTS

- (a) Visual inspection (Clause 7.1)

6. SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

6.1 LOT: All the materials of same type and of the same steel, whose coating characteristics are intended to be uniform, shall be grouped together to constitute a lot. A lot shall not consist of more than one shift's production or 100 nos. whichever is lower.

Samples shall be taken from each bath for test. Where the galvanising is done without the presence of Purchaser, the manufacturer may prepare lots consisting of the articles of the same type and material and galvanised in the same bath. If there are more than one bath, separate lots shall be prepared for each bath.

6.2. SCALE OF SAMPLING: Samples in accordance with Table I shall be taken, at random, from each lot for tests.

TABLE I
Scale of Sampling

Lot size	Sample size	Permissible No. of defective units
Upto 25	3	0
26-50	5	0
51-100	8	0

6.2.1 For materials of inconvenient lengths such as OHE masts and from which it is not possible to cut a specimen for coating characteristics tests, two test pieces of same cross section and not less than 90 cms length shall be galvanised in the same bath alongwith

the masts for each lot upto 100 masts. In such case, the visual test shall be conducted on the main piece and the tests for the adhesion, uniformity and thickness of coating shall be conducted on the test piece.

6.3 The samples selected in accordance with Table-I above shall be subjected to the visual inspection (Clause 7.1).

If any sample fails to conform to the requirement, the lot shall be rejected. The galvaniser, however, may segregate the good pieces of the lot and submit them once again for inspection.

6.4 If the lot inspected for visual inspection, passes the test, 3 samples for coating characteristics (Clause 6.5) shall be taken from the samples, which were subjected to the visual tests. In case of masts and other long articles, these tests would be conducted on test specimen cut from 90 cm long test pieces galvanised in accordance with Clause 6.2.1.

6.5 Each of the 3 samples will be subjected to test for adhesion, uniformity, mass of zinc coating. Should any sample fail in any test, six more samples shall be taken from the lot and all the 3 tests repeated. Should any sample fail in any retest, the lot shall be rejected. If it is not possible to take six sample for re-test, the lot shall be rejected.

6.6 The material in a lot which has been rejected may be stripped and regalvanised and submitted for inspection and tests.

7. TEST METHODS

7.1 VISUAL INSPECTION: The material shall be inspected visually to observe that it is smooth, reasonably bright, continuous and free from such imperfections as flux/ash/dross inclusions, bare patches, black spots, pimples, lumpiness runs, bulky white deposits and blisters. The stains of flux, usually white in colour, shall not be regarded as flux inclusions (See Appendix 'A').

7.2 ADHESION OF GALVANISED COATING

7.2.1 Coating shall withstand the knife tests as prescribed in IS:2629-1966. When cut or pried into, such as with a stout knife applied with considerable pressure, in a manner tending to remove a portion of the coating, it shall only be possible to remove small particles of the coating; and it shall not be possible to peel any portion of the coating so as to expose iron or steel underneath.

7.2.2 On articles fabricated from angles, channels, beams and rolled sections of 8 mm or more thickness, the adhesion may, alternatively, be tested by pivoted hammer tests as per IS:2629-1966. This test is not suitable for curved and round surfaces.

7.3 UNIFORMITY OF GALVANISED COATING

7.3.1 On small articles, which can be conveniently handled the uniformity of the coating shall be determined by Preece Test in accordance with IS:2633-1966 by dipping the whole article in the copper sulphate solution. For sheets, strips and other fabricated articles a 10 cm x 10 cm specimen may be cut for tests. For tubes, 100 mm long piece shall be cut from each end of the product, after discarding 300 mm length from the end. The article shall withstand 5 dips of one minute each.

7.3.2 For long articles, such as masts etc., measurement of coating thickness at a number of places by magnetic method (Clause 7.4.4) shall be taken as a uniformity test.

Note:—The Preece Test is primarily meant for articles where surface is mechanically scrapped or wiped after dip in the galvanising baths, such as tubes, wires, etc.

7.4 MASS OF GALVANISED COATING

7.4.1 The average mass of galvanised coating shall be determined by any one of the following methods as agreed between the purchaser and the galvaniser

before the tests.

7.4.2 Mass before and after galvanising: The mass of coating may be determined by weighing the article before and after galvanising, subtracting the first mass from the second and dividing the result by the coated surface area. The first mass shall be determined after pickling, rinsing and drying; and the second after cooling to the ambient temperature.

7.4.3 Stripping method: In case of materials galvanised without purchasers' inspection, average mass of coating shall be determined by stripping the entire article in accordance with IS:6745-1972 (See Appendix 'B'). If the surface area of the entire article cannot be measured easily or if the article is inconveniently large, a specimen of 100 sq. cm. area may be cut from each of the three samples (90 cm long test-piece in case of masts) and stripped.

7.4.4 Magnetic thickness gauge method:

7.4.4.1 For large products such as poles, towers, structural shapes and castings the average weight of the coating shall be determined by a magnetic thickness gauge.

7.4.4.2 Before making the measurement the gauge shall be calibrated by measuring the thickness of zinc coating on a test panel and comparing the measured value with the value obtained by stripping method on the same piece.

7.4.4.3 In case of masts etc. readings shall be taken along the length at 100 mm interval and in approximate centre of the flange and then averaged to give a single figure for thickness of coating. For castings etc. at least 5 readings may be taken at convenient locations nearly in the centre. Thickness, in micrometers, when multiplied by 7.047 would give the average mass of zinc coating (g/m^2). Three articles in each lot of upto 100 shall be tested in this manner. Thickness shall not be less than the minimum value specified in Clause 4.1.

8. RECTIFICATION OF DAMAGE

8.1 Normally all fabrication work in the case of galvanised articles shall be completed prior to galvanising. If, for any reason, fabrication such as cutting, drilling or welding has to be undertaken after galvanising, protection of metal exposed as a result of fabrication, and rectification of damaged galvanised areas shall be done in accordance with either of the following methods or any other method approved by the Purchaser.

8.2 USE OF ZINC BASED SOLDERS: The surface to be protected, or the surface where galvanising has been damaged, shall be cleaned and any oxides removed with a weak acid solution and a wire brush. The surface shall be thoroughly washed with water to make it free from any traces of acid. The cleaned area shall be heated with a welding torch and rubbed with white sal ammoniac. A piece of zinc stick or rod 5-10 mm diameter of high purity shall be melted on this area and spread out with a heated piece of sal ammoniac. The areas shall then be washed down by water and lightly wire brushed. The workmanship shall be such that the finished surface is smooth and non-porous.

8.3 USE OF ZINC RICH PAINTS: The damaged surface after cleaning, as mentioned in para 7.2 shall be painted with two or more coats of zinc rich primer followed by a finishing coat of a zinc rich paint as per the painting schedule recommended by the manufacturers. It is to be ensured that the dry film thickness of zinc rich primer shall not be less than the average thickness of the galvanised coating. The complete painting system, i. e. zinc rich primer with the finishing zinc rich paint for this purpose shall be procured from a source of repute and approved by the Purchaser.

DEFECTS, THEIR CAUSES AND REMEDIAL MEASURES

Defects	Causes	Recommended actions	Ground for rejection
Bare spots	Paint grease or oil residues	Check cleaning practices	Yes, if bare spots are bigger than 8 mm dia or 8 mm diagonal.
	Scale or rust residues.	Check pickling practices.	
	Residual welding slag.	Blast-clean welds; avoid coated rods.	
	Break-down of preflux coating	Check preflux and drying conditions.	
	Aluminium content of bath too high. Rolling defects in basic steel.	Regulate aluminium additions Check steel supply.	
General roughness	Articles in contact during galvanising.	Keep articles separated.	No
	Analysis or original surface condition of steel. Over-pickling	Check steel supply. Reduce pickling use inhibitor	
	High galvanising temperature or long immersion time or both.	Adjust galvanising conditions	
Pimples	Entrapped dross particles	Avoid agitation of dross layer ; check carry over of pickle salt.	No, unless dross contamination is heavy.
	Withdrawal speed too high	Remove work slowly.	
	Cold galvanising bath.	Increase temperature.	
Lumpiness and runs (uneven drainage)	Delayed run-off from seams, joints, bolt holes etc.	Remove work slowly.	No
	Articles in contact during withdrawal.	Keep articles separated.	
Flux inclusions	Stale flux burnt on during dipping. Surface residues on steel.	Refresh or renew flux blanket. Check steel preparation.	Yes
	Flux picked up from top of bath.	Skim before withdrawal.	
Ash inclusion	Ash burnt on during dipping	Skim bath before dipping.	Yes, if in gross lumps
	Ash picked up from top of bath.	Skim bath before withdrawal.	
Black spots	Includes flux particles from flux 'dusting'. Dirt smuts, splash marks.	Confine fluxing to top of bath. Check storage conditions.	Yes No
	Steel composition (high silicon, phosphorus or carbon) severe cold work. Slow cooling after galvanising. Release of absorbed hydrogen during solidification of coating.	Check steel supply for composition order to adjust for galvanising. Avoid hot stacking quench. Avoid over pickling; use inhibitor.	No
Rust stains.	Weeping of acid etc. from seams and folds. Storage near rusty material.	Check product design and fabrication. Check storage condition.	No
Bulky white deposit (wet storage stain, white rust).	Confinement of close packed articles under damp conditions. Packing of articles while damp.	Storage dry well-ventilated conditions, separate articles with spacer. Dry before packing; include desiccant.	No
Blisters	Expansion of entrapped hydrogen and moisture in flaws. Driving off of hydrogen absorbed during pickling. Improper malleabilizing (for malleable iron castings only).	Check steel quality Use shot blast instead of pickle; Check steel supply. Check malleabilising practice.	Yes, if general.
	Effect sometimes observed on quenched work notably malleable castings. May be caused by gas evolved from the work resulting from absorbed hydrogen or break-down of combined carbon near surface.	Use shot blast instead of pickle. Check malleabilising treatment. Should have no combined carbon near surface of casting.	Yes, if blistering is generally wide spread.
Tiny blisters			

STRIPPING METHOD

(Extracted from IS: 6745-1972.)

- B-1. **Cleaning of Test Piece** : The test pieces shall be washed with solvent naphtha, trichloroethylene or any other suitable organic solvent, then with alcohol and finally dried thoroughly.
- B-2. **Stripping Solutions** :
- B-2.1 Dissolve 20 g of antimony trioxide (Sb_2O_3) or 32 g of antimony trichloride ($SbCl_3$) in 1000 ml of concentrated hydrochloric acid (specific gravity 1.12).
- B-2.2 Immediately before tests, prepare the stripping solution by adding 5 ml of the solution prepared under clause B-2.1 to 100 ml of concentrated hydrochloric acid (specific gravity 1.16). Mix well.
- B-3 **Procedure**.—Weigh the cleaned test specimen whose mass is less than 200 g nearest to 0.01 g; for test piece whose mass is between 300 to 1000 g to the nearest 0.1 g; and for test specimen over 1000 g to the nearest 0.5 g. After weighing immerse each test piece singly in test solution prepared as per clause B-2.2 and allow to remain there until the violent evolution of hydrogen and only a few bubbles are being evolved. This requires about 15 to 30 seconds.
- B-4 The mass of zinc coating (in g/m^2) of surface may be calculated as per the following formula:

$$M = \frac{M_1 - M_2}{A} \times 10^6$$

Where,
 M = mass of zinc coating, in g/m^2 , of surface.
 M1 = original mass, in g, of test piece.
 M2 = mass in g, of stripped test piece, and
 A = coated area of the test piece, in mm^2 .

Research Designs & Standards Organisation
(Traction Installation Directorate)

Note

Note No. TI/CIV/GCP/18
Dated: 26.03.2018

S.N.	Contents of uploaded Specification	Comments received from the firms	RDSO (TI) Remarks
A.	Specification no. ETI/OHE/13 (4/84) on RDSO website on 30.01.2018	CORE/Allahabad as well as CORE's vendors.	
1.	The structural tubes coating size is proposed as 610 gm/m ² and 800 gm/m ² for lightly polluted area and heavily polluted area respectively in place of presently specified as 425 gm/m ² through A&C slip No. 4/(4/90) to above specified Specification.	Nil.	Nil.