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**SPECIFICATION NUMBER:
TI/SPC/OHE/ESP/000033/(8/85) **Rev.1****



**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

**SPECIFICATION
FOR
ENAMELLED STEEL PLATES
FOR**

25 KV AC TRACTION OVERHEAD EQUIPMENT

(For official use only)

ISSUED BY

**TRACTION INSTALLATION
DIRECTORATE RESEARCH DESIGN
AND STANDARDS ORGANISATION**

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FOR
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1. Scope:

1.1 This specification covers the requirements of vitreous enamelled steel plates used for number plates, danger notices, caution notices and warning boards etc. required for electric traction overhead equipment, switching/substation, transmission/distribution lines etc.

1.2 This specification supersedes RDSO specification No. ETI/OHE/33(2/78).

1.3 In preparation of this specification assistance has been taken from the following specifications:

- i) IS: 5 --~~1978~~ **2007** - Colours for ready mixed paints and enamels.
- ii) IS: 513 -~~1973~~ **2008** - Specification for cold-rolled carbon steel sheets
- iii) IS: 2551-1982 - Danger Notice Plates
- iv) IS: 2717-1979 - Glossary o terms relating to vitreous
(**Reaffirmed:2003**). enamel-ware and ceramic metal systems
- v) S 3972:~~1968~~-(Part 7/Sec 7) Method of tests for vitreous enamel ware
:1990 -(**Reaffirmed:2001**).
- vi) IS: 8709-1977 - Method of test for colour retention of vitreous
(**Reaffirmed:2006**). enamel coatings
- vii) ~~BS: 873 (pt-1)-1970~~ - Specification for the construction of Road
BS 8442:2006 Traffic signs and internally illuminated Bollards.
Pt-I Central Traffic Signs
- viii) ~~BS: 873 (Pt-2)-1973-~~ Specification for the construction of Road
BS 8442:2006 Traffic signs and internally illuminated Bollards.

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Pt-2: Misc. Signs

- ix. RR-F-516 Federal Specification for Enamel ware, porcelain, steel general requirements and test methods.

2. Terms and Definitions:

2.1 Abrasion Resistance:

The degree to which and enamel coating will resist attack by abrasive materials.

2.2 Acid Resistance:

The degree to which and enamel coating will resist attack by acid solutions.

2.3 Adherence:

The degree to which and enamel coating will remains attached to the metal substrate.

2.4 Alkali Resistance:

The degree to which and enamel coating will resist attack by aqueous alkali solutions.

2.5 Egg-shell finish (semi-matt finish):

The appearance of a correctly fused enamel which has a smooth but non glossy surface like an egg-shell.

2.6 Enamel (Vitreous enamel):

A substantially vitreous or glossy inorganic material bonded to any metal surface by fusion.

2.7 Ground Coat (Grip Coat):

The first layer of enamel applied to the metal sheet containing ingredients specially designed produce adherence to the metal.

2.8 Impact Resistance:

The degree of resistance of a vitreous enamel coating to fracture caused by a sudden blow or impact.

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2.9 Reflectance:

The percentage of the incident light which is reflected diffusively from an enamelled surface.

3. Deviation from Specifications:

3.1 Any deviation from this specification calculated to improve the performance, efficiency and utility of vitreous enamelled plates proposed by the manufacturer will be given due consideration provided full particulars with justification thereof are furnished.

4. Service Conditions:

4.1 The enamelled plates are fixed by galvanised steel fasteners on various types of overhead traction masts and structures, equipments, transmission line structure, switching station and substations structures and equipments for staff and public notice.

4.2 Weather Condition:

The weather conditions under which the vitreous enamel plates are used vary widely. The limiting conditions which have to be withstood in service are indicated below:

- Max. Temperature of air, in shade - 45°C
- Min. Temperature of air, in shade - 0°C
- Max. Temperature attainable by an object exposed to sun -65.5°C
- Max. Relative humidity - 100%
- Average annual rainfall - 1750 to 6250mm.
- No. of thunder storm days/annum - 85 days (Max.)
- No. of rainy days per annum - 120 days (Max.)
- Max. Wind pressure - 216kg/m²
- Attitude - Not exceeding 2500 meters

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4.3 In certain areas, the enamel plates may be subjected to chemical pollution from the effluent gases of chemical/fertiliser plants and exhaust gases of steam/diesel locomotives and to saline atmosphere near the sea.

4.4 The enamelled boards/plates may be subjected to vibrations due to passage of trains.

5. Size, Letter, Figure and Colour:

5.1 Size:

The overall dimensions, sizes and shapes of enamelled plates (i.e. number plates, danger/caution and warning boards) shall conform to the purchaser's drawing (s).

5.2 Letters and Figures:

The dimensions of the letters, figures and their respective positions shall be as per purchaser's drawing (s). The lettering in English Language shall be of GILLSON's medium type and in Hindi language as specified in the drawing(s). The lettering in regional language, wherever applicable, shall be as per drawing (s). The size of each letter in the word in each language and the spacing between them for the purpose of scribing shall be so chose that they are uniformly written in the space earmarked for them, if not otherwise mentioned in the drawing(s).

5.3 Colour:

5.3.1 The colours of background surface, letters and figures shall be as specified in the drawing (s). The colour/designation shall conform to IS: 5---~~1978~~ 2007. All colour shall be weather proofed and shall conform to the following shades:

S.No.	Shade	ISC No.	Name of colour shade
1.	Blue	169	Traffic blue
2.	Green	225	Light Brunswich green
3.	Yellow	355	Lemon Yellow
4.	Red	537	Signal Red
5.	Orange and Vermillion red	574	India Saffron
6.	Black and White	-	

6. Material:

6.1 The steel sheet used for the enamelled plate, shall conform to grade “EDD” with coarse or rough surface finish, as specified in clause 1.1 and 14.1 (a) of IS: 513 ~~-1973-2008~~. The thickness of the sheet shall be 2 mm. Two mm thick steel sheets of other description, with the same chemical composition may also be used after prior specific approval by the purchaser, if the specified steel sheet is not available in the market.

NOTE: 1.6 mm thick steel sheet conforming to above specification may be used after specific prior approval of purchaser, if 2 mm thick steel sheet is not available in the market.

7. Enamel Coating Requirements:

7.1 The steel plates shall be cleaned before enamelling.

7.2 Holes for fixing the plates shall be drilled before the enamel is applied on the plate. The edges and corners of steel plate including those on the holes shall be deburred or round/ filled before enamelling.

7.3 Vitreous enamel:

The steel plate shall first be coated with one grip (or ground) coat of enamel and finished with one, or more coats, depending on column range and sufficient to cover the grip (or ground) coat completely. The total thickness of the enamel shall be within the limit specified in para 7.4. to achieve the desired thickness, number of coats to be applied is left to the discretion of manufacturer.

7.4 Requirements:

The enamelled steel plate shall meet the following requirements when tested in accordance with the prescribed methods:

S.N.	Description	Requirements	Test methods
1	2	3	4
1.	Thickness of enamel (min)	0.35mm	Cl. 9.3
2.	Resistance to acid.	Grade ‘AA’ Or better	Cl. 6 of IS:3972-1988
3.	Resistance to Alkali loss in weight (max)	2mg/cm ²	Cl.7 of -do-
4.	Resistance to water loss in weight (max)	-do-	Cl.8 of -do-

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5.	Impact resistance	No damage to any spots.	Cl.12.1 of -do-
6.	Aherence Index(min)	55	Cl.12.2 of -do-
7.	Resistance to surface abrasion, loss in weight (max)	0.07mg/ cm ²	Cl.14 of -do-
8.	Resistance to sub-surface abrasion, loss in weight (Max)	1.75mg/minute.	Cl.14 of -do-
9.	Colour retention.	Shall not be any darkening of the treated area compared to untreated area.	Cl.7 of IS:8709-77(Reaffirmed:2006).
10.	Reflectivity (45 ^o direction)	50%(Min)	Cl.10 of IS: 3972-1968 IS : 3972 (Part 1/Sec 1) - 1982

7.5 Finish:

The enamel plates shall be of uniform thickness and the surface shall be smooth with egg shell flat finish and be free from defects. The rear side of the plate shall also be enameled in the colour specified in the drawing(s).

8. Tests:

8.1 The manufacturer shall carry out the specified tests, during production, on the samples taken at regular intervals, to ensure conformity to relevant specification as also to maintain proper control over the process of manufacture. The manufacturers shall produce at the time of inspection certificates/records showing the inspections/tests which have been conducted by him during manufacturing process.

8.2 Then the purchaser requires additional tests, related to his order but not specified hereunder such test shall be subject of agreement between the purchaser and the manufacturer:

8.3 All the tests on the enamel plates shall be carried out at manufacturer's works. The manufacturer shall arrange without making claim or charge all the necessary apparatus, labour, assistance etc. required to get the prescribed test conducted in the presence of purchaser's representative.

8.4 Type test:

- i) Visual examination
- ii) Measurement of dimensions

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- iii) Thickness of enamel coating
- iv) Acid resistance.
- v) Alkali resistance
- vi) Water resistance.
- vii) Impact Resistance.
- viii) Adherence.
- ix) Surface abrasion resistance.
- x) Sub-surface abrasion resistance.
- xi) Colour retention.
- xii) Reflectivity.

8.5 Routine tests:

These tests shall be done by the manufacturer on all pieces. The inspector shall test 10% (Min.5) samples.

- i) Visual examination.
- ii) Measurement of dimensions.

8.6 Acceptance tests:

- i) Measurement of dimensions.
- ii) Thickness of coating.
- iii) Impact resistance.

8.7 Sampling and inspection procedure and criteria for acceptance:

8.7.1 The enamelled plates shall be offered in lots. One lot shall contain the enamelled plates of only one size and type.

8.7.2 The lot shall first be subjected to the routine tests (Cl.8.5) for ascertaining their conformity to the requirements of this specification. If any sample is found not conforming to the specification, the lot shall be deemed not conforming to the specification.

8.7.3 The lot which has been found satisfactory in routine tests shall be subjected to acceptance test (Cl.8.6).

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8.7.4 The sample for acceptance shall be taken from the lot in accordance with the table given below. Such sample shall be subjected to all the acceptance tests.

Lot size	No. of samples.	Acceptance no.(a)	Rejection no. (R)
Upto 100	3	0	1
100-200	5	0	1
201-300	8	1	2
301-500	10	1	2
501-above	12	2	3

8.7.5 Criteria for acceptance:

For any of the specified test, if the number of defective items is less than or equal to corresponding acceptance number (s), the lot shall be deemed as conforming to the requirement of that test. If the number of defectives is greater than or equal to the corresponding rejection number (R), the lot shall be deemed as not meeting the requirement of the specification (para 7.4) and the lot shall be rejected.

9. Method of tests:

9.1 Visual examination:

The enamelled plates shall be examined visually for conformity to the requirements of this standard in respect of the size/shape of letters and figures and their relative position. The colour of the enamelling shall be visually compared with the colour specified in IS:5-1978 2007. The edges, corners etc. shall be deburred.

9.2 Measurement of dimension:

The dimensions of the enamelled plate, its thickness, size of holes etc. shall be checked for conformity to the specified requirement.

9.3 Thickness of enamel coating:

Thickness of enamel coating shall be measured at least at 4-5 locations on each of the samples by elcometer (magnetic thickness measurement). The average thickness shall not be less than the requirement specified in para 7.4.

9.4 Colour retention:

The specimen shall be considered to have failed in the test if any darkening of the treated area in relation to the untreated area is observed when tested as per Cl.7 of IS:8709-1977 (Reaffirmed:2006).

10. Marking:

The necessary identification mark of the manufacture shall be marked in such a manner and position on the plates that it does not interfere with the other information.

11. Packing:

The plates shall be suitably packed in wooden cases according to accepted practice to ensure their being free from any damage in transit. Every case shall bear in legible and

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in-delible lettering the name and address of the consignee, order, number along with quantity and also legend "Contents "FRAGILE: in red paint.

12. All the provisions contained in RDSO's ISO procedures laid down in document No.- QO-D-

7. 1-1.1 dated 19.07.2016 (Titled " Vendor- change in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor//vendors in the contracts floated by Railways to maintain quality of products supplied to Railways"

13. The "Make in India" policy of Government of India shall be applicable.