

SPECIFICATION NO. TI/SPC/OHE/FRPNP/0060 Rev.1



**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

**SPECIFICATION FOR
RETRO-REFLECTIVE STRUCTURE NUMBER PLATE
ON FRP BASE**

2020

**ISSUED BY
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SIGNATURE			
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INDEX

ITEM NO.	HEADING	PAGE
1	Scope	4
2	Deviations From Specification	4
3	Service Condition	4
4	Material	4
5	Manufacturing Method	5
6	Reflective Sheeting	5
7	Manufacturing process & properties	5
8	Brilliance	5
9	Finished Product	6
10	Tests	6
11	Guarantee	8
12	Packing and Marking	8

1. SCOPE:

This specification covers the requirement of 'Structure number plates' using retro-reflective sheeting of encapsulated lens category known as 'High Intensity Grade Sheeting' on Fibre Glass Reinforced Plastic (FRP) base.

The colour, configuration, size and all other requirement of structure number plates shall be in accordance with RDSO's drawing No.TI/DRG/OHE/FRPNP/RDSO/00001/06 Rev 0. The numerals/letters shall be characterized using retro-reflective sheeting of encapsulated lens category.

2. Deviations From Specification :

2.1 Any deviations from this specification to improve the performance, efficiency and utility of the equipment, proposed by the tenderer will be given due consideration on merits provided full particulars with justification therefore are furnished. In such a case the tenderer shall quote according to this specification and indicate the deviation(s) separately in a "Statement of Deviations" with the prices, if any, for such deviations.

3. Service Conditions :

The number plate shall be suitable for outdoor use in moist tropical climate and areas subjected to heavy rainfall and severe lightning in India. The limiting weather conditions which the material has to withstand in service are indicated below:

Max. Temperature of air in the shade	-	45° C
Min. temperature of air in the shade	-	0° C
Max. temp. attainable by an object exposed to sun	-	70° C
Average ambient temperature	-	35° C
Max. relative humidity	-	100%
Average annual rain fall	-	1750 to 6250 mm.
No. of thunder storms days/annum	-	35 Max.
No. of dust storms days/annum	-	35 Max.
No. of rainy days per annum	-	120
Max. wind pressure	-	216 kgf/m ²
Altitude	-	Not exceeding 2500m

4. MATERIAL

The plate shall be manufactured from FRP having resin rich smooth surface on both side and shall be free from visible defects such as fiber pattern, cracks, creasing, foreign inclusions and pin holes etc. Hard and corrosion resistant Fibre Reinforced Plastic sheets shall conform to IS: 12866 : 1989 (Reaffirmed 2003). The thickness of the FRP sheet shall be 3 mm.

5. MANUFACTURING METHOD

The FRP moulded sheet shall be manufactured from thermosetting polyester resin, premium grade having corrosion resistant properties and duly reinforced with fiberglass. The basic parameters as laid down in the relevant IS code, in respect of density, glass content, water absorption etc shall be maintained. The FRP sheet shall be opaque. The colour of the front side of the plate (on to which lettering shall be embedded) shall be Blue colour retro-reflecting sheeting (to ASTM D-4956). The FRP sheet should be UV resistant for the purpose of improved resistance to weathering conditions. The rear side of the plate shall be pigmented jet black.

6. REFLECTIVE SHEETING.

The retro-reflective sheeting used on the numerals/letters shall be of Yellow colour (to ASTM D-4956) having a smooth surface which has the property of retro-reflection over its entire surface. It shall be weather-resistant and show colour fastness. It shall show no evidence of cracking, peeling, pitting, blistering, edges lifting or curling and shall have no shrinkage or expansion.

7. MANUFACTURING PROCESS & PROPERTIES

Retro-reflective sheet will be "High Intensity Grade" conforming to 22000 series of colour as specified, type III as per ASTM D 4956 standard shall be press pasted and duly embedded onto the surface treated FRP plate substrate and the entire plate shall be given a seal coating thereby thoroughly embedding the lettering or sandwiching the same in between the bonded substrate and the top coating.

8. BRILLIANCE

The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection determined in accordance with ASTM D- 4956 Type III 22000 series, high intensity grade, extract of which is given in Table-1 below:

TABLE - 1

Minimum co-efficient of retro-reflection **in candela per lux per sqm.**

Observation angle in Deg.	Entrance angle in Deg.	White	Yellow	Blue
0.2	-4	250	170	20
0.2	+30	150	100	11
0.5	-4	95	62	7.5
0.5	+30	65	45	5.0

When totally wet the sheeting shall not show less than 90% of the above values of retro-reflectance. At the end of 10 years, the sheeting should have at least 75% of its original retro-reflectance.

The manufacturer of retro reflective sheet shall give certificate of having tested the sheeting for these properties in an unprotected outdoor exposed environment from a reputed laboratory. The purchaser shall be free to test the sheeting for which necessary means shall be provided by the supplier at his own cost. The manufacturer of retro reflective sheet should be ISO-9001 certified for consistent quality.

9. FINISHED PRODUCTS

The finished product shall have a background of blue colour (to ASTM D- 4956). There shall be no borders. Letters and figures shall be of high intensity retro reflective sheeting of Yellow colour (to ASTM D – 4956). The retro-reflective sheeting should cover the surface evenly and shall be free from twists, cracks and folds. The rear side of the plate shall be pigmented jet black in colour and plate shall be opaque while drilling on the FRP plate proper care should be taken to ensure that no fibre is exposed and that after the drilling drilled hole should be resin coated.

- 9.1 The manufacturer shall prepare their own drawings and shall be submitted for approval of RDSO before the manufacture of prototype.

Note: Each drawing shall carry the tabulation for item reference, item's name, drawing number, material, and material specification with grade, quantity and weight. Salient technical particulars of the assembly/components shall also be mentioned in the respective drawings. A block as indicated below shall be provided on each drawing for approval by Director General/TI, RDSO, Lucknow.

APPROVED IN PRINCIPLE
FOR DIRECTOR GENERAL/TI RDSO, LUCKNOW, INDIA

10 TEST

The manufacturer shall carry out the specified tests during production on the samples to ensure conformity to relevant specification.

- 10.1 **Type test** (On Fibre Reinforced Plastic sheet) as per IS: 12866

- i) Visual Examination.
- ii) Dimensional verification.

- iii) Density test.
- iv) Glass content.
- v) Load deflection test.
- vi) Water absorption.
- vii) Barcol Hardness.
- viii) Bolt shear test.
- ix) UV resistance test as per ASTM G53

10.2 Type test (on Retro-reflective sheet).

Retro-reflective sheets shall be tested in accordance with ASTM-D 4956 for S.No. 1 to 7 and 10, S.No. 8 & 9 shall be tested in accordance with IS: 9000. The following tests are to be conducted on retro-reflective sheet.

- 1. Day time colour.
- 2. Shrinkage.
- 3. Flexibility.
- 4. Adhesion test.
- 5. Gloss value (60° Angle)
- 6. Line Removal
- 7. Effect of change of temperature.(as per supplementary requirement S3)
- 8. Humidity test.
- 9. Salt spray test.
- 10. Co-efficient of retro-reflection.

10.3 Routine Test: These tests shall be done by manufacturer on all pieces and report shall be submitted at the time of acceptance test.

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

10.4 Acceptance test: The followings tests shall be done on lots offered for acceptance.

- 1. Visual examination.
- 2. Dimensional verification.

10.5 Sampling:

The sample size for acceptance tests shall be taken in random from the lot in accordance with the table below:

Lot size	Sample size	conforming for acceptance
<100	3	3
101-200	5	5
201-300	8	8
301-500	10	9
>501	12	10

Note: For acceptance of the lot, in each of the specified test, the number of samples conforming to specification shall be equal to or more than numbers indicated above.

11 GUARANTEE

Structure FRP base number plates with retro-reflective high intensity grade sheeting shall withstand normal vertical stationary exterior exposure condition and sheeting shall have an effective performance life at least of 20 years. A guarantee to this effect shall be furnished by the manufacturer and any defective structure number plate shall be replaced free of cost by the supplier.

12. Packing And Marking

The material shall be packed in proper wooden boxes to prevent damage during transit. Every box shall carry in legible and indelible lettering the following information:

- i) Manufacturer's trade name and brand mark.
- ii) Contact/purchase order number with date.
- iii) Consignee's address.
- iv) Date of inspection and inspecting authority.
- v) Any other particulars specified by the purchaser.

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