

Saudi Standards, Metrology and Quality Org (SASO)

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Fiber Reinforced Plastic (FRP) Sign Boards for Permanent Vertical Road Traffic Signs

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Introduction

The Saudi Standards, Metrology and Quality Organization (SASO) has prepared the Saudi Standards for fiber reinforced plastic (FRP) sign boards for permanent vertical road traffic signs after reviewing the specifications of Arab, foreign and international standards and reviewing the related reference literature.

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Fiber Reinforced Plastic (FRP) Sign Boards for Permanent Vertical Road Traffic Signs

1. SCOPE

This standard specifies requirements for fiber reinforced plastic sign boards for permanent vertical road traffic signs.

Not covered by this standard:

- a) Temporary Traffic Signs
- b) Complete sign assemblies
- c) Sign Gantries and Cantilever Structures
- d) Sign Faces (Laminates)

2. NORMATIVE REFERENCE

- 2.1** SASO-ISO-75-3 – Determination of Temperature of Deflection under Load - Part 3: High-strength thermosetting laminates and long-fibre-reinforced plastics
- 2.2** SASO-ISO-62 – Determination of Water Absorption
- 2.3** SASO-ISO-175 – Methods of Test for the Determination of the Effects of Immersion in Liquid Chemicals
- 2.4** UL94 – Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
- 2.5** ASTM D2583-13 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- 2.6** SASO-ISO-178 – Determination of Flexural Properties
- 2.7** SASO-ISO-4892-2 – Methods of Exposure to Laboratory Light Sources – Part 2: Xenon-arc lamps

3. TERMS AND DEFINITIONS

3.1 Traffic Signs

Signs conveying information, instructions, or warnings about traffic laws, hazards, or directions to drivers and pedestrians such as speed limit signs, stop signs, etc.

3.2 Fiber Reinforced Plastic (FRP) Sign Boards

Boards made of a fiber reinforced plastic (FRP) composition typically produced through compression molding, used as the base plate of traffic signs, and typically laminated with a sign face to produce the finished sign.

3.3 Fiber Reinforced Plastic (FRP) Composition

A composite that is typically made as a mixture of reinforcing materials, thermosetting resin, additives and or fillers used to produce fiber reinforced sign boards.

3.4 Reinforcement Materials

Fibers including glass or carbon fibers used to reinforce sign boards and improve its mechanical properties.

3.5 Thermosetting Resin

A plastic resin that cannot be melted after curing by heat and/or chemical means, used in the production of fiber reinforced composites used for traffic sign boards.

3.6 Unsaturated Polyester Resin

A cross-linkable/cure-able polymeric material, commonly used to produce fiber reinforced composites.

3.7 Additives

Functional substances added to the FRP composition for the purpose of coloring, hardening, and/or improving the physical and chemical properties of the composition. Those can include pigments/dyes; curing agents; flame-retardants; and/or UV stabilizers.

3.8 Fillers

Non-functional (Inert) substances used in the FRP composition for the purpose of improving properties, and/or reducing costs.

4. SAMPLING**4.1 Batch/Lot**

Boards of the same type and size, produced in the same production cycle that are submitted for inspection at one time are considered one batch/lot.

4.2 Number of Samples

Unless specified, the number of samples from a batch/lot to be tested and evaluated for compliance of the specifications described within this standard shall be in accordance with Table 1

Table 1. Number of Samples and Acceptable Defective Samples per Batch/Lot Size

Batch/Lot Size (Pieces)	Number of Samples	Acceptable Defective Samples
Up to 100	4	0
101-300	5	1
301-500	11	2
501-1500	21	3
501-3000	32	3
3001-8000	52	4
8001 and above	63	4

5. REQUIREMENTS

5.1 Appearance

The boards should not have surface defects such as holes, cracks, pits, and areas with low resin, which will affect the strength and use of the product. The surface of the board should be smooth enough to stick retroreflective material on it. There shall be no substances on the surface that would prevent the retroreflective material from adhering to the surface, such as oil, styrene, and acetone. Boards should be opaque and uniform in color. Both sides and edges of the boards should be smooth.

5.2 Dimensions and Tolerances

5.2.1 Board Length-Width-Diameter

Unless specified by the purchaser the dimensions of the board must comply with Ministry of Interior requirements. The tolerances of the board's dimensions shall be within 2% of the specified value.

5.2.2 Board Thickness

The thickness of the board shall be a minimum of 4 mm, typically specified by the purchaser. The tolerance of the board's thickness shall be within 2% of the agreed upon value.

5.3 Heat Deflection Temperature

When boards are tested in accordance with SASO-ISO-75-3, the heat deflection temperature (HDT) shall be at least 150 °C.

5.4 Water Absorption

When boards are tested in accordance with SASO-ISO-62, the water absorption percentage by mass shall not be more than 0.4%.

5.5 Chemical Resistance

5.5.1 Methodology

The chemical resistance of the sign boards shall be tested according to the SASO-ISO-175 standard.

5.5.2 Testing Conditions

The testing conditions shall be as follows:

Testing Temperatures – 23 ± 2 °C; 70 ± 2 °C

Immersion Time – 7 Days; Up to 2 months when necessary

Testing Liquids – Sodium Chloride; gasoline; diesel; turpentine; kerosene; trichloroethylene; and 3% sulfuric acid solution.

5.5.3 Evaluation

The boards shall be evaluated qualitatively and on a visual basis. There shall be no changes in the appearance of the board. Moreover, the test solution shall not change color, and no precipitation should form in the solution.

5.6 Flame Resistance

The boards shall meet the horizontal burning “HB” flammability classification set by the UL 94 standard.

5.7 Impact Resistance

5.7.1 Apparatus

- Steel Ball (1Kg)
- Support structure, (the same or similar structure to that used in service), on which the test sample can be placed horizontally.
- A mechanism on which the steel ball can be dropped on the sample piece at 90° angle from a height of 1.20 m.

5.7.2 Test Specimens

Samples taken in compliance to Article 4. Shall be conditioned in laboratory conditions for 24 hours before the test.

5.7.3 Test Procedure

After the sample is placed on the support, the steel ball is allowed to fall freely from a height of 1.20 m at the center of the board. Sag shall be measured manually from the board’s main plane to the lowest point due to impact.

5.7.4 Evaluation

After the end of the test, the samples are visually inspected for any breakages, holes, or splits in the sample.

There shall be no more than 2 mm of sag on the board’s surface. Moreover, there shall be no damage or cracks beyond a diameter of 5 mm around the impact point.

5.8 Shear Strength

5.8.1 Apparatus

- Tensile testing device with shaft bolts of $6 \text{ mm} \pm 0.130 \text{ mm}$ diameter.

5.8.2 Test Specimens

The test shall be carried out using 6 samples. The board shall be cut into a 150 mm x 30 mm specimen, ensuring that the cut on the long side of the specimen is parallel to the long side of the board, and the distance from the edges shall not be less than 50 mm.

The test specimen is prepared by drilling two holes with an 8 mm drill bit at a distance of 38 mm from the lower and upper edges along the long side.

5.8.3 Test Procedure

The specimens are placed in the tensile testing device, and the bolts are screwed into the drilled holes of the test specimens. Tension is applied to the specimen at a speed of $13 \text{ mm} \pm 0.65 \text{ mm}$ per minute. The load at the which the sample breaks is recorded as force (N).

5.8.4 Evaluation

The average shear load for the 6 samples shall not be less than 500 N, and the shear load of each sample shall not be less than 350 N.

5.9 Torsional Strength

This test shall apply to boards not exceeding 1.25 m in any dimension.

5.9.1 Apparatus

- Test structure with the same fixings to be used while in service in its intended use, on which the board can be placed.
- A mechanism to apply moment to the end points of the board.
- A device capable of measuring temporary deformation.

5.9.2 Test Procedure

A Total load of 625 N is applied to the end points of the sign at a loading speed of 6 – 8 N/s. The load shall be held for 5 minutes, and temporary deformation shall be measured within 5 minutes of the load is removal.

5.9.3 Evaluation

The samples shall be visually inspected for any breakage or splitting in the board. The temporary deformation of the board shall be less than 5% of the sample/board length.

5.10 Surface Hardness

When boards are tested in accordance with ASTM D2583-13, the Barcol surface hardness shall be a minimum of 40 and the change in Barcol hardness in the conditioned sample shall not be more than 30%.

5.11 Flexural Strength

When boards are tested in accordance with SASO-ISO-178, the flexural strength shall be a minimum of 150 MPa.

5.12 Accelerated Artificial Weathering

5.12.1 Apparatus

- A xenon-arc weather-ometer with chamber temperature and humidity control

5.12.2 Test Specimens

The test shall be carried out on samples of 150 mm X 100 mm size, and in compliance with Article 4.

5.12.3 Test Procedure

The boards shall be tested accordance with SASO-ISO-4892-2, with exposure conditions as outlined in Article 5.12.4.

5.12.4 Exposure Conditions

The testing shall be done using daylight filters, described as method A in SASO-ISO-4892-2, for a total exposure time of 2000h, and using cycle parameters outlined in Table 2.

Table 2. Exposure cycles and parameters for accelerated artificial weathering

Cycle	Irradiance		Black-panel temperature °C	Chamber temperature °C	Relative humidity %
	Broadband (300 nm to 400 nm) W/m ²	Narrowband (340 nm) W/(m ² .nm)			
102 min light/dry	60 ± 2	0.51 ± 0.02	63 ± 3	47 ± 3	50 ± 10
18 min light/water spray	60 ± 2	0.51 ± 0.02	-	-	-
[repeat]					

5.13 Resistance to Temperature Changes

5.13.1 Apparatus

- Deep Freezer – Capable of keeping the sample at -35 °C ± 5 °C.
- Oven – Capable of keeping the sample at 80 °C ± 5 °C.

5.13.2 Test Specimens

Samples shall be taken in compliance with Article 4.

5.13.3 Test Procedure

The samples shall be exposed to the temperature cycles below and repeated 5 times per sample.

- a) Deep freezer at $-35\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ for 2 hours
- b) Laboratory conditions for 1 hour
- c) Oven at $80\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ for 2 hours
- d) repeat

5.13.4 Evaluation

After the end of the test, the samples are visually inspected for any separation, cracking, breakages, or deterioration in the samples.

6. LABELLING AND MARKING

Each pole shall be legibly and indelibly marked in Arabic and/or English with the following information:

- 6.1 Manufacturer's name and/or trademark.
- 6.2 Production serial number.
- 6.3 Country of origin.
- 6.4 Total length of pole.
- 6.5 Mounting height.
- 6.6 Dimensions of the sign, arm (if any) or mentioned barcode for its

BIBLIOGRAPHY

TS 10381:1992 – Traffic Sign Boards Made of Glass Fiber Reinforced Plastics

EN 12899-1:2007 – Fixed, vertical road traffic signs – Part 1: Fixed signs