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Doors Made of Wood-Plastic Composites

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Foreword

The technical team for " Plastics " of Saudi Standards, Metrology and Quality Organization (SASO) has prepared the Saudi Standard " **Doors Made of Wood-Plastic Composites** " based on relevant Standards and references.

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Doors Made Of Wood-Plastic Composites

1. SCOPE

This Saudi standard is concerned with the requirements, properties and test methods of wood-plastic composites (WPC) door. The guidelines herein are specifically applicable to WPC-PVC, which is primarily used as a building material, particularly for doors.

2. SUPPLEMENTARY REFERENCES

- 2.1 SASO- ISO 472 Plastics — Vocabulary
- 2.2 SASO ISO 20819-1 Plastics — Wood-plastic recycled composites (WPRC) — Part 1: Specification
- 2.3 SASO ISO 20819-2 Plastics — Wood-plastic recycled composites (WPRC) — Part 2: Test methods.
- 2.4 SASO-GSO-ISO-12460-4 Wood-based panels — Determination of formaldehyde release — Part 4: Desiccator method
- 2.5 ISO 16000-3 Indoor air Part 3: Determination of formaldehyde and other carbonyl compounds in indoor and test chamber air — Active sampling method
- 2.6 SASO ISO 16000-9 Indoor air Part 9: Determination of the emission of volatile organic compounds from samples of building products and furnishing — Emission test chamber method
- 2.7 SASO ISO 17294-2 Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) Part 2: Determination of selected elements including uranium isotopes
- 2.8 SASO ISO 12846 Water quality — Determination of mercury — Method using atomic absorption spectrometry (AAS) with and without enrichment
- 2.9 SASO UL-94 Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

3. Terms and definitions

For the purposes of this standard, the terms and definitions given in ISO 472 and the following apply.

3.1 wood-plastic composite WPC

mixture of woody material/natural fibre and thermoplastics, composited by means of plastic moulding .

3.2 virgin material

plastics and other material in the form of pellets, granules, powder, floc, etc., that has not been subjected to use or processing other than that required for its initial manufacture

3.3 woody raw material

plant-derived virgin woody or herb-based material, or plant-derived secondary product to which some processing such as selection, crushing, or grinding has been applied, or woody material included in a WPC for re-use, that is used as a raw material of *wood-plastic composite* ([3.1](#))

Note 1 to entry: Woody raw material does not include plant-derived plastic materials nor ashes of burned plant-derived materials.

3.4 non-foaming material

wood-plastic composite ([3.1](#)) that does not contain internal air voids

3.5 cellular material

wood-plastic composite ([3.1](#)) containing internal air voids scattered primarily for the purpose of weight reduction

Note 1: Cellular material can include material integrated with a non-foaming material using methods such as multilayer moulding.

3.6 Blowing Agents

Blowing agent is a kind of additive used for producing pores or cells throughout the polymer mass

3.7 Thermal Conductivity

It is the quantity of heat in the steady state condition flowing in unit time through a unit area of a slab of uniform material of infinite extent and of unit thickness, when unit difference of temperature is established between its face.

3.8 Warp

It is the dimensional distortion in a plastic material after moulding or other fabrication

4. Requirements

4.1 Raw material

4.1.1 Plastic raw materials

Plastic raw materials shall be thermoplastics raw materials as listed in Table 1.

4.1.2 woody raw material

plant-derived virgin woody or herb-based material, or plant-derived secondary product to which some processing such as selection, crushing, or grinding has been applied, or woody

material included in a WPC for re-use, that is used as a raw material of wood-plastic composite.

Note2: The percentage of wood content in WPC (Wood-Plastic Composite) products, including doors, isn't typically governed by a single global standard. Instead, it is influenced by industry practices, manufacturer formulations, and guidelines from specific standards organizations

4.1.3 Other raw materials

Other raw materials refer to additives such as lubricants, stabilizers, compatibilizers, pigments and plasticisers.

Table 1. — Plastic raw materials

Classification	Raw material name	Abbreviated
Plastics for general use	Polymethyl methacrylate	PMMA
	Polyvinyl chloride	PVC
	Polypropylene	PP
	Polyethylene	PE
	Polystyrene	PS
	Styrene/acrylonitrile	SAN
	Saturated polyester	SP
	Acrylonitrile/butadiene/styrene	ABS
Engineering plastics	Polycarbonate	PC
	Polyamide	PA
	Polyphenylene ether	PPE
Other plastics	PC/ABS alloy	PC/ABS
	High-impact acrylonitrile/styrene	ASA, AES, ACS
	PP/ethylene propylene diene monomer alloy	PP/EPDM
	Ethylene/vinyl acetate	EVAC
	Polybutene	PB
	Methyl methacrylate/acrylonitrile/butadiene/	MABS
	Polytetrafluoroethylene	PTFE
	Polylactic acid	PLA

4.2 Health and safety requirements for materials

The health and safety aspects of WPC shall conform to Table 2 when tested according to

the standard mentioned in item 2/3. The criteria for sampling of test pieces from both cellular and non-foaming materials are listed in Table 3.

Table 2 — Health and safety aspects

Test			Units	Use area symbol				Applicable test clause in ISO 20819-1
				EX		IN		
				1	2	1	2	
Amount of volatile substance emissions	Formaldehyde	Method A: Desiccator method	mg/l			Subject to the standards of each country		9.2.1
		Method B: Emission test chamber method	µg/(m ² · h)			Subject to the standards of each country		
	Toluene		µg/(m ² · h)	—		Subject to the standards of each country		9.2.1
	Xylene					Subject to the standards of each country		
	Ethylbenzene					Subject to the standards of each country		
	Styrene					Subject to the standards of each country		
	Amount of toxic sub-	Cadmium		mg/l	Subject to the standards of each country		9.2.2	
		Lead			Subject to the standards of each country			

stance eluted	Mercury		Subject to the standards of each country	
	Selenium		Subject to the standards of each country	
	Arsenic		Subject to the standards of each country	
	Hexavalent chromium		Subject to the standards of each country	

Table 3 — Criteria for sampling from cellular and non-foaming materials

Test			Sample origin	Sample set criteria	Number of sets of test pieces
Amount of volatile substance emissions	Formaldehyde	Method A: Desiccator method	Taken from a product	One set comprising equivalent test pieces closest to 15 cm × 5 cm and having a total surface area of 1 800 cm ²	2
		Method B: Emission test chamber method	Taken from the product surface	In accordance with ISO 16000-9	1
	Toluene		Taken from a product	In accordance with ISO 16000-9	1
	Xylene				
	Ethylbenzene				
	Styrene				

Amount of toxic substance eluted	Cadmium, lead, mercury, selenium, arsenic, hexa- valent chromium	Taken from the product surface	One set comprising equivalent test pieces closest to a total surface area of 2 000 cm ² , e.g. 18 test pieces of 10 cm × 5 cm × 0,5 cm	1
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4.2.1 Health and safety tests

4.2.1.1 Tests for the volume of volatile substances emitted

The amount of formaldehyde emitted shall be measured using either test Method A or B

Method A

(desiccator method), according to the standard mentioned in item 2.4 . The formaldehyde concentration shall be calculated to one decimal place, and the average of the values obtained from two sets of test pieces shall be rounded to one decimal place.

Method B

(emission test chamber method), according to the standard mentioned in item 2.5 and 2.6. The formaldehyde emission rate shall be calculated to the nearest whole integer.

For the volume of toluene, xylene, ethyl benzene, and styrene emitted, tests shall be conducted according to the standard mentioned in item 2.6 .

4.2.1.2 Toxic substance elution test

Immerse the test pieces in 1 l of distilled water at 23 °C for 24 h, and remove them. Treat the liquid left as the sample liquid. Analyse this sample liquid according to either test Method A or B

Method A

Elution of cadmium, lead, selenium, arsenic and hexavalent chromium shall be measured according to the standard mentioned in item 2.7 ; the elution of mercury shall be measured according to the standard mentioned in item 2.8.

Method B

The standard analytical method of each country allowing proper determination of each toxic substance (cadmium, lead, selenium, arsenic, hexavalent chromium and mercury) shall be carried out. Perform the same process without test pieces, as a blank test. Calculate the difference between the results of the analyses of the sample liquid and the blank test liquid.

4.3 Appearance

The appearance of WPC shall conform with the requirements in Table 4 and according to the standard mentioned in item 2.3 .

Table 4 — Appearance

Defect types	Judgment
Dirtiness and flaws ^a	Should be free from remarkably conspicuous defects. ^c
Warps and twists	Should be free from remarkably conspicuous defects. ^c
Mixture of foreign matter ^b	Should be free from remarkably conspicuous defects. ^c
Chipping, cracks, breakage, and through-cracks	Should not be allowed.
^a Influences of raw materials are not included. ^b Foreign matter shall mean substances other than raw materials. ^c Subject to consultation between the partners.	

4.4 Requirements for WPC(PVC)

The performance requirements of WPC (PVC) for doors are crucial to ensure the material meets the high standards necessary for both residential and commercial applications.

Table 5 — Material performance standard of WPC- (PVC) material (reference)

Performance classification	Performance item		Test methods		Unit	Minimum Requirements
			Test methods	Measurement		
Basic physical properties	Density		Method	—	g/cm ³	0.7 min
			Method	—		
	Water absorptio	Water ab-	Method A	—	%	10 or more (non-Foaming)

	n propertie s	Lengt h chang		Method A	—	%	3 or less
	Strength	Flexural propertie s		Method A	Flexural stress with cut out test	MPa	10 or more
				Method B	Flexural stress with actual size	MPa	
		Impact resistanc e		Method A	Impact strength with cut out test	kJ/m ²	0.5 or more
				Method C	Impact re- sistance with actual size test	-	No cracks or breakage in the surface
		Screw Withdra wal Strength		IS 15931:2 012	Screw Withdrawal Strength Face and	N	Face 2200 Edge 1100
	Thermal properties			Method A	Temperatur e of deflection	°C	40 or more
				Method B	Residual ratio of thermal	%	60 or more
Burning tests	flammability			UL-94 standard	Vertical Burning		V-0

5. Sampling

The collection method, dimensions, and number of test specimens for non-foaming material and cellular material are shown in Table 4 and Table 5 .

Test specimens for hollow products with non-foaming material shall be collected from the surface of hollow products, except for test items of the water absorption property and actual size test specimens. Test specimens for cellular material shall not be collected from the vicinity of both ends of the product in the width direction.

6. TEST METHODS

6.1 Basic physical properties and durability

The basic physical properties and durability tests for WPC which are (Density, Water Absorption Properties, Strength, Impact Resistance and Screw withdrawal Strength) must be conducted according to the standard mentioned in item 2/3 . The performance criteria for basic physical properties of non-foaming and cellular materials should comply with the requirements outlined in Table 2 and Table 3. The durability performance should be determined through consultation between the relevant partners.

Note: *The cross section of WPC-PVC door features a hollow structure with vertical ribs. It must include a top layer , bottom layer and ribs which are all made from WPC-PVC using extrusion technology.*

6.2 Burning tests

The **UL-94** standard is used for the safety testing of plastic materials, including those used in products like WPC (Wood-Plastic Composite) doors made with PVC. The test measures the **flammability** of plastic materials and classifies them into different categories based on their burn characteristics when exposed to flame.

For WPC (Wood Plastic Composite) doors, achieving a **V-0** classification is usually the desired standard, indicating a high level of fire resistance and controlled flame spread. This classification means that the material self-extinguishes within 10 seconds after the ignition source is removed and does not produce flaming drips.

7. Marking

The following information shall be indicated in Arabic or in Arabic and English on door in a clear place that is difficult to remove:

- 7.1 Symbol of classification by molding method
- 7.2 Symbols of use area and major use
- 7.3 Year and month, or abbreviation, of manufacture
- 7.4 Manufacturer's name or abbreviation
- 7.5 Type of raw material, indicated
- 7.6 country of origin

References

ASTM D7031 Standard Guide for Evaluating Mechanical and Physical Properties of Wood-Plastic Composite Products

IS 15931 : 2012: Solid Panel Foam UPVC Door Shutters - Specification"

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

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