SAE International™

SURFACE VEHICLE INFORMATION REPORT

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Design Guidelines for Fiberboard Materials

1. Scope

This document provides information on the various fiberboard products, which are available for automotive application. It is intended to give engineers and designers a better understanding of product usage, characteristics, properties and industry terminology.

The following sections cover these topics:
2. General Product Information
3. Design Characteristics
4. Physical/Mechanical Properties
5. Fiberboard Definitions

In sections 2, 3 and 4 the fiberboard products are categorized. These sections give an overview of product types, with general information about characteristics and properties. In cases where product categories encompass more than one material or material grade, ranges were established to cover all of the products in that category. The individual companies that supply fiberboard products should be consulted for specific information about a particular product or application.

2. References

2.1 Applicable Publications:

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of publications shall apply:

2.1.1 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J 315—Fiberboard Test Procedure

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.1.2 ASTM PUBLICATIONS

Available from ASTM, 25 West 43rd Street, New York, NY 10036-8003.

ASTM D 747—Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
ASTM D 790—D790-03 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 827—Method of Test for Edge Tearing Strength of Paper (Withdrawn 1980)
ASTM D 1037—Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

3. General Product Information

TABLE 1

	Hardboard	Moldable Mat	Paperboard	Direct Molded
Description	Board panel which is used flat or compression molded into shallow forms	Mat sheet which is compression molded into three-dimensional shapes	A sheet which is die cut, and/or converted into shapes by scoring, bending or shallow forming	A three- dimensional panel which is made by deposition of fibers onto a contoured form.
Composition	96 – 99% wood fiber 1 - 4% resin and wax	79 - 94% wood fiber 6 - 21% resin, wax or other fibers	75 -95% recycled fiber 5 -25% polyethylenes, resins or other fibers	77 - 80% wood fiber 17-20% recycled fiber 3% other chemical additives
Product Thicknesses Offered	1.5 - 5.6 mm	1.5 - 6.3 mm	.25 - 6.3 mm	2.3 - 4 mm
Product Densities Offered	0.96 gm/cm^3	0.6 - 1.0 gm/cm^3	0.75 gm/cm^3	0.60 gm/cm^3 0.80 gm/cm^3
Typical Automotive Applications	Spare tire covers Rear shelf panels Seat backs Door panels Headliners Door panel inserts Map pockets Load floor panels Sun-visors Quarter trim panels Trunk trim supports Seat cushion supports Head rest inserts Wire harness covers Van floor panels	Rear shelf panels Door panels Console panels Quarter trim panels Seat backs Spare tire covers Map pockets Door panel inserts Load floor panels Door panel inserts Wire harness covers Headliners	Door panel inserts Door panels Glove box Map pockets Floor console, side & rear Rear shelf panel Quarter trim panel Sun -visors Seat backs Trunk lining Headliners Load floors Van floor panels	Door panels Console panels Rear shelf panels Quarter trim panels Seat backs Instrument panels

4. *Design Characteristics*

TABLE 2

	Hardboard	Moldable Mat	Paperboard	Direct Molded
Draw Capabilities < 75 mm > 75 mm	 Limited One direction bends	 Good - Excellent Fair - Excellent (depends on part geometry)	 Limited	 Excellent Excellent
Minimum Draft Angle	10° - increases as draw depth increases	3° - increases as draw depth increases	Limited	3° - 5°
Radius Capabilities - minimum inside - minimum outside	 3 x material thick 4 x material thick	 0 mm 1 x material thick	 Limited	 3 mm 3 mm
Molded Return Flange	No	Yes	Yes	Yes
Score & Bend	No	No	Yes	No
Trimming Method	Die cut	In-mold Die cut	Die cut	Trim press In-mold
Fastener Attachment	In-mold Bonded Staked-on Riveted Keyhole slot	In-mold Bonded Staked-on Riveted Keyhole slot	Bonded Staked-on	In-mold Bonded Staked-on Riveted Keyhole slot Direct injection mold Vibration welded
Graining/Embossing	Fair	Good	Excellent	Excellent
Color	Natural	Natural & Black	Multiple	Natural & Black
Painting	Good	Fair-Good	Excellent	Good
Printable	No	No	Yes	No
In mold finishing - Overlays - Decorative scrims	 No No	 Yes Yes	 No No	 No No
Adhesion - Solvent base - Water base	 Excellent Excellent	 Excellent Excellent	 Excellent Excellent	 Excellent Excellent
Vacuum-formed covering capability	Excellent (porous material)	Excellent (porous material)	Good	Excellent (porous material)
Edge-fold coverings	Yes	Yes	Yes	Yes
Integral foam padding between substrate and covering	Yes	Yes	Yes	Yes
Dielectric bondable	Yes	Yes	Yes	Yes
Multiple thickness and density in same part	No	Yes	No	Yes

5. *Physical/Mechanical Properties*

(Typical for 2.5 mm thick board)

TABLE 3

	Hardboard	Moldable Mat	Paperboard	Direct Molded
Nominal Density (gm/cm^3)	0.96	0.90 - 1.00	0.75	0.60 - 0.80
Flexural Strength, MOR				
- ASTM D 1037 (MPa)	42	42 - 59	NA	NA
(psi)	6000	6000 - 8500		
- ASTM D 790 (MPa)	NA	NA	NA	15 -27
(psi)				2200 - 4000
Flexural Stiffness				
- MOE, ASTM D 1037 (MPa)	3800	4200 - 5500	NA	3100
(psi)	550,000	600,000- 800,000		450,000
- Stiffness, ASTM D 747 (MN/m)	NA	NA	560 MD 220 CD	NA
Tensile Strength				
- ASTM D 1037 (MPa)	25	28 - 31	NA	20 - 22
(psi)	3600	4000 - 4500		2900 - 3200
-ASTM D 828 (MPa)	NA	NA	47 MD 16 CD	NA
(psi)			6830 MD 2400CD	
Burst (MPa)	2.4	2.4 - 2.6	3.4	> 0.84
SAE J315 (psi)	350	350 - 380	500	> 120
Moisture Content (%) SAE J315	4.5	3 - 5	4 - 7	3 - 6
Dimensional Stability (%)				
- Expansion[1] (38 °C, 98% RH)	0.2	0.2	0.2 MD 0.6 CD	0.2
- Expansion[2] (24 hr H_2O soak)	0.4	0.4	0.2 MD 0.6 CD	0.2
- Contraction[3] (88 °C, 24 hr)	0.2	0.2	0.2 MD 0.6 CD	0.2
- Contraction[4] (88 °C, 24 hr)	0.4	0.4	0.2 MD 0.6 CD	0.2
Water Absorption, 24 hr (%) SAE J315	34	25 - 35	<18	< 50
Thickness Swell, 24 hr (%) SAE J315	17	10 - 25	6-10	< 25
Flammability (mm/min) FMVSS 302	25	SE - 30	SE/NBR	SE/NBR
Coefficient of Thermal Expansion (10^{-6} /C°)	6.8	6.8 - 8.3	NA	NA
Maximum Service Temp. (C°)	150	150	100 - 150	150
Biodegradable	Yes	Yes	Yes	Yes
Thermally Recyclable[5]	Yes	Yes	Yes	Yes

1. SAE J315 Method A
2. SAE J315 Method B
3. SAE J315 Method C - following expansion method A
4. SAE J315 Method C - following expansion method B
5. Can be safely and efficiently used as fuel for energy generation

6. Fiberboard Definitions

6.1 Bending Board

A paperboard that can be creased or scored and subsequently bent to varying degrees, with little or no fracture of the surface fibers. In some cases, the visual requirements of the bent score area is obtained by covering the surface with an extensible coating or by laminating a pliable film to the surface prior to scoring and bending.

6.2 Chipboard

A type of paperboard produced primarily from mixed grades of waste paper and most often produced on a cylinder machine. The final product may be single ply or laminated.

6.3 Contraction

A measure of the reduction in linear dimensions of fiberboard due to the removal of water vapor or liquid water.

6.4 Creasing

A method of scoring paperboard, without bending.

6.5 Cross Machine Direction

The opposite of machine direction. (See machine direction.)

6.6 Direct Molded Board

A molded fiberboard that is produced by depositing fibers directly on a contoured form. This fibrous structure is then compressed and heat cured to attain its final thickness, density and strength. Fibers can be deposited on the form by either an air stream or water solution.

6.7 Dry-Process Board

A fiberboard made by transporting, distributing and felting the fiber mixture in an air medium. The fibers are felted into a mat with an air-lay machine. Moldable mat and some hardboards are made by this process.

6.8 Embossed Board

A fiberboard which has surface relief or texture which has been applied with an embossing roll or plate.

6.9 Expansion

A measure of the increase in linear dimensions of fiberboard due to the absorption of water vapor or liquid water.

6.10 Fiberboard

A general term for fibrous structures produced on any of several types of fiber felting machines. The primary composition of these boards is normally refined cellulose or matted wood fibers that may be supplemented by the use of synthetic materials or chemical additives. The manufacture of fiberboards involves the formation of a web of fibers, which is subsequently pressed or calendered and sometimes laminated to develop desired end-use properties.

6.11 Forming Board

A paperboard or hardboard which is suitable for shallow forming into three-dimensional shapes through the use of heat and pressure applied in a set of matched dies.

6.12 Foundation Board

A fiberboard which is used as a structural foundation or supporting member in a trim panel assembly.

6.13 Furnish

The formula of ingredients used for manufacturing a fiberboard. Most commonly used when referring to wet process board manufacture.

6.14 Grained Board

Another term for embossed board. (See embossed board.)

6.15 Grain Direction

Another term for machine direction. (See machine direction.)

6.16 Hardboard

A fiberboard manufactured primarily from inter-felted wood fibers which are consolidated under heat and pressure in a hot press. Other materials (i.e. bonding resins, sizing agents, colorants) may be added during manufacture to improve certain physical properties.

6.17 Kraft Paper

A type of unbleached paper that is made from sulfate chemical pulps. It is sometimes used as a liner for laminated paperboard.

6.18 Laminated Board

A paperboard that is comprised of two or more plies of paper, or other sheet materials, which are bonded together by an adhesive between the plies. The adhesion of the finished structure is such that it will function as a single unit.