

American National Standard

Particleboard



ANSI A208.1-2016 Particleboard

American National Standard

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Abstract

This Standard sets forth requirements and test methods for dimensional tolerances, physical and mechanical properties and formaldehyde emissions for particleboard. Methods of identifying products conforming to the Standard are specified. Property requirements are described in metric and English units.

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Foreword (This foreword is not part of ANSI A208.1-2016.)

The first standard for particleboard—Commercial Standard CS236—was developed by the U.S. Department of Commerce in 1961. This standard covered particleboard for interior applications. The Department published a revised Standard, CS236-66, in 1966.

The American National Standard for Mat-Formed Wood Particleboard, sponsored by the National Particleboard Association, was published as ANSI A208.1-1979. It was reaffirmed in 1986 as ANSI A208.1-1979(R1986). It was revised in 1987 as ANSI A208.1-1987, in 1989 as ANSI A208.1-1989, in 1993 as ANSI A208.1-1993, in 1999 as ANSI A208.1-1999 and in 2009 as ANSI A208.1-2009. In 1997 the National Particleboard Association and the Canadian Particleboard Association consolidated into the Composite Panel Association. The Standard was revised in 2009 in an effort to harmonize with other international product standards.

Major changes in the Standard include the following:

- moved Annex A References to the main text as Section 2 References and updated the listed standards (e.g. ASTM D1037-12 and ISO 17007);
- deleted the 0.18 ppm formaldehyde emission limit and -F18 designation in order to comply with CARB Phase 2 formaldehyde emission level for particleboard;
- clarified the issue that a single panel average falls above or below the specification limits will mean non-compliance to properties listed in Table A and B when using a sample size of 5 panels;
- added Section 6.2.1 Dispute resolution;
- added Annex E Bibliography (Informative).

This Standard has four Annexes. Annex A is normative and is part of this Standard. Annexes B, C, D and E are informative and are not part of this Standard.

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Consensus for this Standard was achieved by use of a canvass body and ANSI Essential Requirements for due process. The following organizations, recognized as having an interest in the Standard, were contacted prior to the approval of this Standard. Inclusion in this list does not necessarily imply that the organization concurred with the submittal of the proposed Standard to ANSI.

American Home Furnishings Alliance (AHFA)	MASISA S.A. de C.V.
APA—The Engineered Wood Association	Masonite Corporation
Arauco North America	Mississippi State University
Architectural Woodwork Manufacturers Association of Canada (AWMAC)	National Association of Home Builders (NAHB)
Architectural Woodwork Institute (AWI)	National Council for Air and Stream Improvement (NCASI)
BestBoard	Oregon State University
Boise Cascade Company	Panolam Industries
Business and Institutional Furniture Manufacturers Association (BIFMA)	Plummer Forest Products
California Air Resources Board (CARB)	Roseburg
Casey Industrial	Sauder Woodworking
Collins Products	Tafisa
Georgia-Pacific Wood Products LLC	Timber Products Co.
Hardwood Plywood and Veneer Association (HPVA)	Uniboard
Hexion	Universite Laval
Kimball International Inc.	U.S. Consumer Product and Safety Commission (CPSC)
Kitchen Cabinet Manufacturers Association (KCMA)	Virginia Tech
Maderas Conglomeradas S.A. de C.V. (MACOSA)	Webb Furniture Enterprises, Inc.
Marshfield DoorSystems, Inc.	Wilsonart
	Window and Door Manufacturers Association (WDMA)
	Woodwork Institute

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ISO/IEC 17007:2009 Conformity assessment—Guidance for drafting normative documents suitable for use for conformity assessment

1 Purpose and scope

1.1 Purpose

The purpose of this Standard is to establish a nationally recognized voluntary consensus standard for particleboard which provides a common basis for understanding throughout the particleboard industry and among and between those specifying and using industry products.

1.2 Scope

1.2.1 General

This Standard covers particleboard which is made primarily from cellulosic materials (usually wood). This Standard includes references, terms and definitions, dimensional tolerances, physical and mechanical property requirements, and maximum formaldehyde emissions for different grades of particleboard. Also included are test methods, inspection practices, and methods of identification. Throughout this Standard, the metric values represent the standard and English values are offered in parentheses for informational purposes. The mechanical property requirements are not engineering design values.

1.2.2 Suitability for certification

This Standard was revised with reference to ISO/IEC 17007 and is suitable for certification purposes.

2 References

The following documents are references in this Standard and are part of the Standard as applicable.

ASTM D1037-12 Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

ASTM D6007-02 Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber

ASTM E1333-96(2002) Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

California Air Resource Board (CARB) Airborne Toxic Control Measures (ATCM) to reduce formaldehyde emissions from composite wood products. California Code of Regulation (CCR) 93120 (CARB ATCM 93120)

3 Terms and Definitions

3.1 Additive: Any material added during the particleboard manufacturing process, other than the cellulosic material and a bonding system, which enhances the particleboard's dimensional stability, fire retardance, resistance to fungi and insects, or imparts other desired properties into the particleboard.

3.2 Bonding system: Any system used to bind particles of cellulosic material together to form particleboard.

3.3 Specified thickness: Thickness specified either by the manufacturer or by the purchaser.

3.4 Panel: A substantial, flat, rectangular piece of particleboard.

3.4.1 Panel average thickness: Average of the eight measurements taken 25.4 mm (1.0 inch) in from the edge at each panel corner and at the mid-length of each panel edge.

3.4.2 Panel average thickness from specified: The difference between the panel average thickness and the specified thickness.

3.5 Particleboard: A generic term for a composite panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from fibers, bonded together with a bonding system, and which may contain additives.

3.6 Particles: Discrete, small pieces of cellulosic material (usually wood).

3.7 Variance from panel average thickness: The difference between the panel average thickness and the individual thickness measurement that varies most from that average.

3.8 Moisture resistance (MR): The term moisture resistance (MR) refers to the thickness swell and bond integrity characteristics of particleboard, used in interior applications, when subjected to periodic exposure

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to moisture. The moisture resistance categories of particleboard are identified by the following designations:

- MR10** Particleboard that meets the reduced thickness swell criteria in Subsection 4.3.3.
- MR30** Particleboard that meets the modulus of rupture (MOR) criteria for advanced bond integrity in Subsection 4.3.4.
- MR50** Particleboard that meets both the reduced thickness swell criteria in Subsection 4.3.3 and the MOR criteria for advanced bond integrity in Subsection 4.3.4.

4 Requirements

4.1 General

Particleboard represented as conforming to any grade in this Standard shall meet, at the time of shipment from the manufacturer, the requirements specified for that grade when tested in accordance with the provisions of this section.

Panels represented as conforming to any grade in this Standard which, after shipment from the manufacturer, have been subjected to varying conditions of environment, storage, handling, or manufacture, may not continue to conform to the Standard when subsequently tested.

4.2 Dimensional tolerances

4.2.1 Width and length. The trimmed width and length of particleboard panels shall conform to the applicable dimensional tolerance requirements specified in Tables A and B. Width and length shall be determined in accordance with Section 8 *Size, Physical and Appearance of Panels* of the ASTM D 1037-12.

4.2.2 Thickness. Thickness of panels shall conform to the applicable tolerances specified in Tables A and B. Thickness shall be measured to the nearest 0.025 mm (0.001 inch).

4.2.3 Squareness. The two diagonal measurements of a trimmed panel shall not deviate more than 3 mm per meter (0.036 inch per foot) of panel width when trimmed to finished length and width.

4.2.4 Edge straightness. Trimmed edges of panels 600 mm (2 feet) wide or wider shall not deviate more than 1 mm per 1.5 meters (0.016 inch per 2 feet) of panel length or width. Edge straightness shall be determined by measuring to the nearest 0.5 mm (0.020 inch) the

maximum deviation from a straight line extending from corner to corner on the same trimmed panel edge.

4.3 Physical and mechanical properties

Particleboard shall conform to the applicable physical and mechanical property requirements in Tables A or B.

For Subsection 4.3.2, Table A values represent an upper specification limit. The upper 95th percentile value, calculated in accordance with Annex A, shall be equal to or less than the upper specification limit in the Table (refer to Section 6.2 for sampling).

For the properties in Subsections 4.3.4 through 4.3.9, Table A values represent lower specification limits. The lower 5th percentile values, calculated in accordance with Annex A, shall be equal to or greater than the lower specification limit in the Table (refer to Section 6.2 for sampling).

Property values in Table B represent 5 panel averages. However, for the properties in Subsections 4.3.2 and 4.3.3, no single panel average shall be more than 10% above the requirements shown for that grade. For the properties in subsections 4.3.4 to 4.3.10, no single panel average shall be more than 10% below the requirements shown for that grade.

4.3.1 Moisture content. The average moisture content at the time of shipment from the manufacturer for all grades except “D” grades in Table B shall not exceed 10 percent (based on the oven dry weight of the board) except as otherwise may be agreed upon by the manufacturer and purchaser. For “D” grades average moisture content shall not exceed 9 percent or be less than 6 percent. The moisture content shall be determined in accordance with Section 8.4 *Moisture Content*, including Note 5, of ASTM D 1037-12. Three specimens shall be cut from different representative locations in the panel and their test results averaged.

4.3.2 Linear expansion. The linear expansion between 50 and 80 percent relative humidity shall be determined in accordance with Section 24 *Linear Expansion with Change in Moisture Content* and Notes 48 through 50 of ASTM D 1037-12. One specimen shall be cut parallel to the length of each panel to be tested, and one shall be cut perpendicular to the length of the same panel. The results of the two tests shall be averaged to determine the linear expansion for each panel.

4.3.3 Thickness swell. This section applies to the grades listed in Table B as well as moisture resistant categories MR10 and MR50. The particleboard thickness swell shall be determined in accordance with Section 23 *Water Absorption and Thickness Swelling* of ASTM D 1037-12 for 24-hour submersion. For grade PBU, one

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specimen shall be cut from each panel. For “D” grades and moisture resistance categories MR10 and MR50, two specimens shall be cut from each panel and the test results averaged to determine the thickness swell for the panel. Categories MR10 and MR50 shall not exceed 5.5 percent thickness swell.

4.3.4 Durability of exterior glue bonding system.

The average MOR after accelerated aging, when tested in accordance with Section 7 *Accelerated Aging* of ASTM D 1037-12, shall not be less than 50 percent of the MOR listed in Tables A and B for a particular grade. The MOR shall be calculated based upon the thickness before the bonding system durability test.

4.3.5 Internal bond (IB). The IB shall be determined in accordance with Section 11 *Tension Perpendicular to Surface (Internal Bond)* of ASTM D 1037-12. Three specimens shall be cut from each panel to be tested and their test results averaged to determine the IB for the panel.

4.3.6 Modulus of rupture (MOR) and modulus of elasticity (MOE). The values for MOR and MOE shall be determined in accordance with Section 9 *Static Bending* of ASTM D 1037-12. Six specimens shall be cut from each panel to be tested. Three specimens shall be cut parallel to the length of the panel and three specimens shall be cut perpendicular to the length of the same panel. The results of the six tests shall be averaged to determine the MOR and MOE of the panel.

4.3.7 Hardness. The hardness shall be determined in accordance with Section 17 *Hardness* of ASTM D 1037-12. Two specimens shall be cut from each panel and the test results averaged to determine the hardness for the panel.

4.3.8 Face screw-holding capacity. The face screw-holding capacity shall be determined in accordance with Section 16 *Direct Screw Withdrawal*, and Notes 34 and 35 of ASTM D 1037-12, except that: (1) Section 16.4 shall not apply; (2) if the panel is less than 19 mm (3/4 inch) thick, the specimen shall be made up of 2 thicknesses bonded together with an adhesive. Panels less than 10 mm (3/8 inch) thick shall not be tested; (3) lead holes shall be predrilled a minimum of 13 mm (0.5 inch) deep, using a bit 3.2 mm (0.125 inch) in diameter; and (4) the speed of testing shall be 0.6 inch per minute. Four tests shall be made on each panel to be tested. The results of the four tests shall be averaged to determine the face screw-holding capacity of the panel.

4.3.9 Edge screw-holding capacity. The average edge screw-holding capacity shall be determined in accordance with Section 16 *Direct Screw Withdrawal*, and Notes 34 through 36 of ASTM D 1037-12, except that: (1) Section 16.4 shall not apply; (2) panels less than 16 mm (5/8 inch) thick shall not be tested; and (3) lead holes shall be predrilled a minimum of 13 mm (0.5 inch) deep, using

a bit 3.2 mm (0.125 inch) in diameter; and (4) the speed of testing shall be 0.6 inch per minute. Four tests shall be made on each panel to be tested. The results of the four tests shall be averaged to determine the edge screw-holding capacity of the panel.

4.3.10 Concentrated loading

4.3.10.1 Requirement. This Subsection applies only to the “D” grades specified in Table B. The particleboard shall (a) support a 2670 N (600 pound) force and (b) not deflect more than 3.2 mm (0.125 inch), relative to the supports at an applied force of 890 N (200 pounds).

4.3.10.2 Test specimens. The test specimens shall be 406 mm (16 inches) square by the thickness of the material. If Manufactured Home Decking is to be used with spans greater than 406 mm (16 inches) on center, the specimen size shall be increased so that the concentrated loading test will be conducted using the actual spans. One specimen shall be cut from each panel to be tested.

4.3.10.3 Test apparatus. A frame shall be used to support the test specimen along all four edges. The distance between supports shall be 38.1 mm (1.5 inch) less than the rated span. A method of rigidly fixing the specimen to the frame shall be provided. The test force shall be applied in the center of the specimen using the end of a loading bar having a 25.4 mm (1.0 inch) diameter with the end edges rounded to a radius of 1.25 mm (0.05 inch). A means of applying a force of up to 2670 N (600 pounds) to the bar shall be provided. The applied force shall be measurable within one percent.

A dial gauge for measuring specimen deflection relative to the supports shall be mounted across the frame members immediately adjacent to the loading bar.

4.3.10.4 Test procedure. With the specimen firmly fixed in place, set the deflection gauge at zero. Apply a force of 890 N (200 pounds). Maintain this force until the deflection stabilizes and then record the deflection. Gradually increase the force until a 2670 N (600 pound) force is reached or failure occurs.

4.4 Formaldehyde emissions provisions

Formaldehyde emissions from particleboard shall be tested in accordance with ASTM E1333-96 (2002). ASTM E1333-96(2002) shall be used when Sampling for Acceptance as required in Section 6.2.

As an alternative to ASTM E1333-96(2002), the average of three test results using the ASTM D6007-02 can be used for on-going compliance testing as described in Section 93120.9 of the CARB ATCM 93120.

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Formaldehyde emissions shall not exceed the maximum level of 0.09 ppm and the product shall be labeled in accordance to Section 5.1 Explanation of grades.

The loading ratios for grades H, M, D, and PBU shall be 0.425 m²/m³ (0.13 ft²/ft³) and for grade LD shall be 0.13 m²/m³ (0.04 ft²/ft³).

Note: The United States Department of Housing and Urban Development's Manufactured Home Construction and Safety Standards, 24 C.F.R. Part 3280, exempts particleboard bonded with a phenol-formaldehyde resin system from formaldehyde emission testing, for end use applications in manufactured homes.

5 Identification

5.1 Explanation of grades

The particleboard grades in this Standard are identified by letter designation, followed by a hyphen and a digit or letter. Formaldehyde emission maximum level and special performance characteristics are identified by the use of a letter(s), number, or term located immediately following the grade designation.

The first letter(s) designations have the following meanings:

H	High density (generally above 800 kg/m ³ (50 lb/ft ³))
M	Medium density (generally between 640–800 kg/m ³ (40–50 lb/ft ³))
LD	Low density (generally less than 640 kg/m ³ (40 lb/ft ³))
D	Manufactured Home Decking
PBU	Underlayment

The second digit or letter designation indicates the grade identification within a particular density or product description. For instance, "M-2" indicates medium density particleboard, Grade 2.

5.1.1 Formaldehyde emission designation

The maximum formaldehyde emission level is designated immediately after the grade with a hyphen and "-F09" for emission limit of 0.09 ppm.

5.1.2 Moisture resistance designation

Particleboard moisture resistant characteristics shall be identified by using a grade and formaldehyde emission

designation followed by a hyphen and a moisture resistance designation set forth in Subsection 3.8.

For products referenced in building code applications requiring enhanced moisture resistance the special suffix designation of "-Exterior Glue" shall be used. For instance, "M-3-Exterior Glue" indicates medium density particleboard, Grade 3 from Table B, made with exterior glue to comply with the durability requirements in Subsection 4.3.4.

5.2 Information to be provided

All particleboard which is represented as conforming to this American National Standard shall be identified with the following information:

- Manufacturer's name or trademark and mill identification
- "ANSI A208.1-2016"
- Grade
- Lot number or date of production
- For D grade products only, the words "MANUFACTURED HOME DECKING" and the certified load span if greater than 406 mm (16 inches) for compliance with Subsection 4.3.10 Concentrated loading "CONCENTRATED LOAD TESTED AT (INSERT SPAN IN INCHES)"
- For PBU grade products only, the word "UNDERLAYMENT".
- For products complying with Subsection 4.3.4 only, the words "EXTERIOR GLUE".

5.3 Methods of identification

For grades in Table A, the information required by Section 5.2 shall be provided either by (a) stamping it on each panel or (b) providing a written statement thereof in a unit label, invoice or other document associated with each panel. For grades in Table B the information required by Section 5.2 shall be stamped on each panel.

6 Conformity Assessment

6.1 Manufacturers' inspection and testing.

Each manufacturer who represents products as conforming to this Standard shall utilize statistically based sampling plans and appropriate quality control procedures to assure compliance with this Standard.

6.2 Sampling for acceptance.

Should a buyer or third party desire to perform the inspections and tests specified in this Standard, five panels for physical and mechanical testing and three

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panels for formaldehyde emission testing of each grade and thickness, selected at random from the shipment, shall be used as the sample. This Standard cannot be used to properly evaluate single panels, but as an approximation, the upper or lower specification limits may be taken as maximum or minimum values. In the five panels sampling applicable for Table A properties, note that statistically if any single panel average falls above or below the specification limits, the calculated $U_{95\%}$ percentile or $L_{5\%}$ percentile value will not be in compliance. Annex A provides the statistical equations required to perform the compliance calculation.

ASTM E1333-96(2002) test method for formaldehyde emissions shall be used for Sampling for Acceptance.

Panels which have been allowed to exceed the specified moisture content after shipment may not conform to the physical and mechanical property requirements of the Standard when subsequently tested.

Should a dispute arise, the metric values, not the English unit values, shall be used as the standard.

6.2.1 Dispute resolution

If there is a dispute between the supplier and buyer regarding the lot acceptance, then an additional 15 samples will be collected randomly from the entire lot and tested to approximate the $L_{5\%}$ or $U_{95\%}$ values for the lot. The acceptance will be based on the following:

- No more than 1 panel of the 20 being outside the Table A specifications.
- The new 20-panel sample $L_{5\%}$ or $U_{95\%}$ shall meet the Table A specification limits.

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Table A Requirements for Grades of Particleboard^{1,2}

Grade ³	Dimensional Tolerances						Physical and Mechanical Properties ⁴										
	Length & Width		Thickness Tolerance ⁵				Modulus of Rupture		Modulus of Elasticity		Internal Bond		Screw-holding				Linear Expansion max. avg.
			Panel Average Thickness from Specified		Variance from Panel Average Thickness								Face		Edge		
	mm	(inch)	mm	(inch)	mm	(inch)	N/mm ²	(psi)	N/mm ²	(psi)	N/mm ²	(psi)	N	(lb)	N	(lb)	%
H-1	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	14.9	(2161)	2160	(313300)	0.81	(117)	1600	(360)	1200	(270)	NS ⁶
H-2	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	18.5	(2683)	2160	(313300)	0.81	(117)	1700	(382)	1400	(315)	NS
H-3	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	21.1	(3060)	2475	(359000)	0.90	(131)	1800	(405)	1400	(315)	NS
M-0	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	7.6	(1102)	1380	(200200)	0.31	(45)	NS		NS	NS	
M-1	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	10.0	(1450)	1550	(224800)	0.36	(52)	NS		NS	0.40	
M-S	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	11.0	(1595)	1700	(246600)	0.36	(52)	800	(180)	700	(157)	0.40
M-2	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	13.0	(1885)	2000	(290100)	0.40	(58)	900	(202)	800	(180)	0.40
M-3i ⁷	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	15.0	(2176)	2500	(362600)	0.50	(73)	1000	(225)	900	(202)	0.40
LD-1	±2.0	(±0.080)	+0.125 +0.125	(+0.005) (-0.015)	±0.125	(±0.005)	2.8	(406)	500	(72500)	0.10	(15)	360	(81)	NS		0.40
LD-2	±2.0	(±0.080)	+0.125 -0.375	(+0.005) (-0.015)	±0.125	(±0.005)	2.8	(406)	500	(72500)	0.14	(20)	520	(117)	NS		0.40

¹ Particleboard shall conform to requirements as specified in Section 4.4 Formaldehyde emissions provisions. Note: The United States Department of Housing and Urban Development's Manufactured Home Construction and Safety Standards, 24 C.F.R. Part 3280, exempts particleboard bonded with a phenol-formaldehyde resin system from formaldehyde emission testing, for end use applications in manufactured homes.

² Grades listed in this table shall also comply with the appropriate requirements listed in Section 4 of this Standard. Panels designated as "Exterior Glue" must maintain 50% MOR after ASTM D 1037-12 accelerated aging (Subsection 4.3.4).

³ Refer to Annex B for general use and grade information.

⁴ Physical and mechanical property values represent a minimum or maximum value representing 5 (lower) or 95 (upper) percentile expressions; respectively.

⁵ Thickness tolerance values are only for sanded panels. Unsanded panels shall be in accordance with any thickness tolerances specified by agreement between the manufacturer and the purchaser.

⁶ NS—Not Specified

⁷ Grade M-3i has an "i" for "Industrial" to differentiate it from Grade M-3 found on Table B that is commonly referenced to in building codes for structural applications.

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**Table B
Requirements of Particleboard Flooring Products and Building Code Grades^{1,2}**

Grade ³	Dimensional Tolerances						Physical and Mechanical Properties ⁴													
	Length & Width Tolerance		Thickness Tolerance ⁵				Modulus of Rupture		Modulus of Elasticity		Internal Bond		Hardness		Concentrated ⁶ Loading		Thickness Swell max. avg.			Linear Expansion max. avg.
			Panel Average from Specified		Variance from Panel Average															
mm	(inch)	mm	(inch)	mm	(inch)	N/mm ²	(psi)	N/mm ²	(psi)	N/mm ²	(psi)	N	lb	N	lb	mm	(inch)	%		
PBU	+0 -4.0	(+0) (-0.160)	±0.375	(±0.015)	±0.250	(±0.010)	11.0	(1595)	1725	(250200)	0.40	(58)	2225	(500)	NS ⁷		1.6	(0.063)	NS	0.35
D-2	±2.0	(±0.080)	±0.375	(±0.015)	±0.250	(±0.010)	16.5	(2393)	2750	(398900)	0.55	(80)	2225	(500)	2670	(600)	NS		8	0.30
D-3	±2.0	(±0.080)	±0.375	(±0.015)	±0.250	(±0.010)	19.5	(2828)	3100	(449600)	0.55	(80)	2225	(500)	2670	(600)	NS		8	0.30

	Length & Width		Thickness Tolerance ⁵				Modulus of Rupture		Modulus of Elasticity		Internal Bond		Hardness		Screw-holding				Linear Expansion max. avg.
			Panel Average from Specified		Variance from Panel Average										Face		Edge		
	mm	(inch)	mm	(inch)	mm	(inch)	N/mm ²	(psi)	N/mm ²	(psi)	N/mm ²	(psi)	N	lb	N	lb	N	lb	%
M-3	±2.0	(±0.080)	±0.200	(±0.008)	±0.100	(±0.004)	16.5	(2393)	2750	(398900)	0.55	(80)	2225	(500)	1100	(247)	1000	(225)	0.35

- ¹ Particleboard shall conform to requirements as specified in Section 4.4 Formaldehyde emissions provisions. Note: The United States Department of Housing and Urban Development’s Manufactured Home Construction and Safety Standards, 24 C.F.R. Part 3280, exempts particleboard bonded with a phenol-formaldehyde resin system from formaldehyde emission testing, for end use applications in manufactured homes.
- ² Grades listed in this table shall also comply with the appropriate requirements listed in Section 4 of this Standard. Panels designated as “Exterior Glue” must maintain 50% MOR after ASTM D 1037-12 Accelerated Aging (Subsection 4.3.4).
- ³ Refer to Annex B for general use and grade information.
- ⁴ Physical and mechanical property values represent a five panel average.
- ⁵ Thickness tolerance values are only for sanded panels. Unsanded panels shall be in accordance with any thickness tolerances specified by agreement between the manufacturer and the purchaser.
- ⁶ In addition to supporting 2670 Newtons, “D” grades shall not deflect more than 3.2 mm (0.125 inch), relative to the supports at an applied force of 890 N (200 pounds). See Subsection 4.3.10 Concentrated loading.
- ⁷ NS—Not Specified

Annex A
Calculation of Lower 5th Percentile (L_{5%}) and Upper 95th Percentile (U_{95%}) Values
(Normative)

A.1 Mean value of each individual panel (panel mean)

$$\bar{x}_i = \frac{\sum x_n}{n}$$

\bar{x}_i = panel mean (mean value of the n single test values)

x_n = single test value

n = number of test pieces cut from each individual panel

A.2 Grand mean (mean of panel means)

$$\bar{\bar{x}}_j = \frac{\sum \bar{x}_i}{j}$$

$\bar{\bar{x}}_j$ = 5 or 20-panel average (grand mean of panel means)

j = number of panels (i.e. 5 or 20)

A.3 Standard deviation of panel means

$$S_{\bar{x}} = \sqrt{\frac{\sum (\bar{x}_i - \bar{\bar{x}}_j)^2}{j - 1}}$$

$S_{\bar{x}}$ = standard deviation between panel means

A.4 Lower 5th Percentile (L_{5%}) of a normally distributed panel property

$$L_{5\%} = \bar{\bar{x}}_j - t_j (S_{\bar{x}})$$

A.5 Upper 95th Percentile (U_{95%}) of a normally distributed panel property

$$U_{95\%} = \bar{\bar{x}}_j + t_j (S_{\bar{x}})$$

t_j = single-sided 5% t-value of a normally distributed sample

$t_5 = 2.13$

$t_{20} = 1.73$

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Annex B General Use and Grades (Informative)

Use	Grade or classification	Table
Commercial	M-0, M-1, M-S	A
Industrial	M-2, M-3i	A
High density industrial	H-1, H-2, H-3	A
Door core	LD-1, LD-2	A
Interior Stair Tread ¹	M-3	B
Exterior construction	M-1-Exterior glue	
	M-S-Exterior glue	A
	M-2-Exterior glue	
	M-3i-Exterior glue	
Exterior industrial	M-1-Exterior glue	
	M-S-Exterior glue	A
	M-2-Exterior glue	
	M-3i-Exterior glue	
High density exterior industrial	H-1-Exterior glue	
	H-2-Exterior glue	A
	H-3-Exterior glue	
Underlayment	PBU	B
Manufactured Home Decking	D-2, D-3	B
Interior applications of high humidity or intermittent wetting	-MR10, -MR30, -MR50	A
Manufactured HUD Homes	-F09	A
CARB ATCM 93120	-F09	A,B

¹ Product requirements for particleboard interior stair tread are specified in the U.S. Department of Housing and Urban Development (HUD), Use of Materials Bulletin No. 70b that is available from the Composite Panel Association or HUD.

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Annex C Conversion Values (Informative)

The dimensional, physical and mechanical property requirements of this Standard are expressed in metric units with English units shown in parentheses for informational purposes. English values, in most circumstances, are rounded to a practical degree of precision.

The conversion factors for the units found in this Standard are as follows:

Dimensions

1 inch	= 0.0254 meter (m)
1 inch	= 25.4 millimeters (mm)
1 m	= 39.370 inch

Mass

1 gram (g)	= 0.0022046 pound (lb)
1 lb	= 453.5924 g

Force

1 newton (N)	= 101.9716 g
1 N	= 0.2248089 lb
1 g	= 0.0098067 N
1 lb	= 4.448222 N

Stress (Force/area)

1 pascal (Pa)	= 1 N/m ²
1 kilopascal (kPa)	= 0.001 N/mm ²
1 megapascal (MPa)	= 1 N/mm ²
1 N/mm ²	= 145.0377 pounds per square inch (psi)
1 psi	= 0.0068948 N/mm ²

Metric Values

Conversions for:

force (Newtons)

less than 100 N
greater than 100 N

Rounded to:

nearest 1 N
nearest 10 N

stress (N/mm²)

less than 2 N/mm²
between 2 and 30 N/mm²
greater than 30 N/mm²

nearest 0.01 N/mm²
nearest 0.1 N/mm²
nearest 1 N/mm²

dimensions

less than 50 mm
between 50 and 500 mm
greater than 500 mm

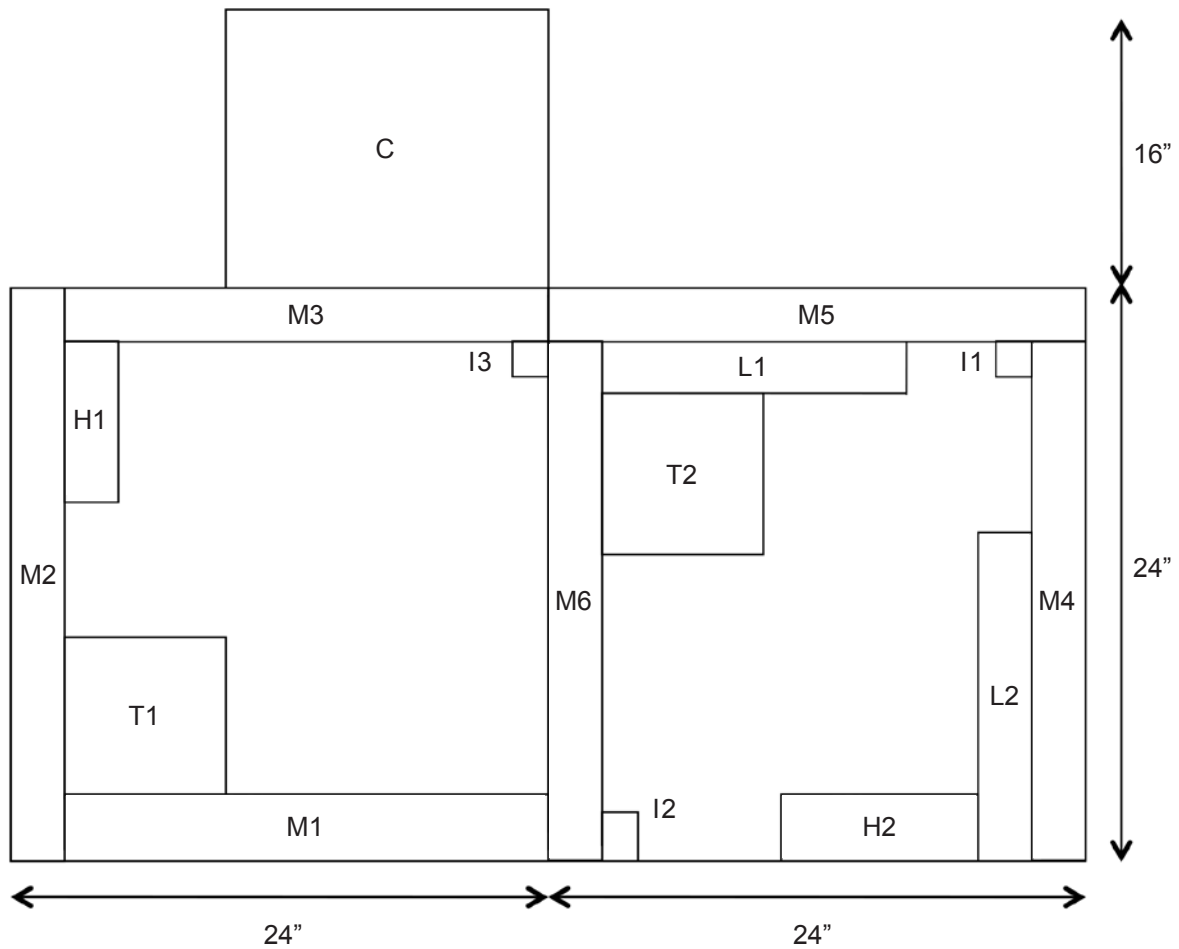
nearest 0.025 mm
nearest 0.1 mm
nearest 1 mm

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Annex D Cut-up Pattern (Informative)

Sample cut-up pattern¹

- H — Hardness
- I — Internal Bond
- L — Linear Expansion
- M — Modulus of Rupture/Modulus of Elasticity (MOR/MOE)^{2,3,4}
- T — Thickness Swell (Required only for grades PBU, D-2 and D-3)
- C — Concentrated Load (Required only for grades D-2 and D-3)



¹ Refer to the appropriate ASTM D 1037-12 test procedure for information on specimen size requirements.

² Screw-holding specimens may be cut from MOR specimens after breaking.

³ The exact dimension of MOR/MOE specimens is dependent on specimen thickness.

⁴ Moisture content samples may be cut from broken MOR specimens.

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Annex E Bibliography (Informative)

- Composite Panel Association (CPA). 2016. Standard Method for Measurement of Warp in Composite Panels.
- CPA. 2000. Storage and Handling of Particleboard and MDF. Technical Bulletin.



COMPOSITE PANEL ASSOCIATION

Founded in 1960, the Composite Panel Association (CPA) is dedicated to advancing the North American wood-based panel and decorative surfacing industries. CPA represents both industries on technical, regulatory, quality assurance and product acceptance issues. CPA General Members include the leading manufacturers of particleboard, medium density fiberboard (MDF) and hardboard, representing about 95% of North American manufacturing capacity.

CPA Associate Members include manufacturers of decorative surfaces, furniture, cabinets, mouldings, doors and equipment, along with laminators, distributors, industry media and adhesive suppliers. All are committed to product advancement and industry competitiveness.