



# GYPSUM BOARD TYPICAL MECHANICAL AND PHYSICAL PROPERTIES (GA-235-10)

The properties described herein were either obtained from laboratory tests conducted under controlled test conditions as set forth in appropriate standards, compiled from manufacturers' literature, or taken from the minimum requirements of appropriate ASTM Standard Specifications. The values reported below are provided for information and convenience only. Consult manufacturer for more specific values.

## MECHANICAL PROPERTIES

<b>Flexural Strength (minimums)</b> (ASTM C 473; tested face up and face down)									
Type of Gypsum Board <small>(Note 1)</small>	Thickness in. (mm)	Method A <small>(Note 2)</small>				Method B <small>(Note 2)</small>			
		Bearing Edges Perpendicular to Length		Bearing Edges Parallel to Length		Bearing Edges Perpendicular to Length		Bearing Edges Parallel to Length	
		lbf	N	lbf	N	lbf	N	lbf	N
a, b	1/4 (6.4)	50	222	20	89	46	205	16	71
a,	5/16 (7.9)	65	289	25	111	62	276	21	93
g	3/8 (9.5)	60	267	25	111	56	249	21	93
a, b, e, f	3/8 (9.5)	80	356	30	133	77	343	26	116
e	4/10 (10.2)	88	391	32	142	85	378	28	125
g	1/2 (12.7)	100	445	35	156	97	431	31	138
a, b, c, d, e, f, h	1/2 (12.7)	110	489	40	178	107	476	36	160
a, c, d, e, f	5/8 (15.9)	150	667	50	222	147	654	46	205
b	5/8 (15.9)	140	622	50	222	137	609	46	205
a,	3/4 (19.0)	170	756	60	267	167	743	56	249
b	1 (25.4)	230	1020	80	356	228	1010	77	343
<sup>1</sup> ASTM C 1396 specification: a = Gypsum Wallboard and Predecorated Gypsum Board b = Gypsum Backing Board and Gypsum Coreboard c = Water-Resistant Gypsum Backing Board d = Exterior Gypsum Soffitt Board e = Gypsum Sheathing Board f = Gypsum Base for Veneer Plaster g = Gypsum Lath h = Gypsum Ceiling Board  <sup>2</sup> See ASTM C 473 for a description of Methods A and B									

<b>Effective Stiffness (EI)*</b> (typical range)		
Board Thickness (in.)	Lb-in <sup>2</sup> /in of width	kN-mm <sup>2</sup> /mm of width
1/2	1500 to 4000	220 to 580
5/8	3000 to 8000	440 to 1,160
* EI is dependent on board density, relative humidity, type of board, paper type, direction of board during testing and the amount of handling prior to measurement. In general the value of EI follows the following relationships: Type X Gypsum Board > Regular Gypsum Board Denser Gypsum Board > Less Dense Gypsum Board Machine Direction > Cross Direction Low Relative Humidity > High Relative Humidity		

<b>Effective Modulus of Rupture (MOR) (minimums)</b> (Based on Flexural Strengths per ASTM C 1396)				
Thickness in. (mm)	Machine Direction		Cross Direction	
	psi	MPa	psi	MPa
3/8 (9.5)	970	6.7	350	2.4
1/2 (12.7)	750	5.2	260	1.8
5/8 (15.9)	660	4.6	220	1.5

<b>Core, End, and Edge Hardness (minimums)</b> (ASTM C 473)	
Method A*	Method B*
15 lbf (67 N)	11 lbf (49 N)
* See ASTM C 473 for a description of Methods A and B.	

<b>Compressive Strength (typical)</b> Ultimate compressive strength at 70°F (21°C) and 50% Relative Humidity (RH) (Determinations were made from 2" x 2" (50 x 50 mm) or 4" x 4" (100 x 100 mm) samples cut from across the full board width (excluding taper). Samples were conditioned for a minimum of 24 hours and tested in compressive strength machines. Load was applied at a uniform rate until the end point was reached.)			
Thickness in. (mm)	Board Type	psi	kPa
5/16 (7.9)	MH gypsum board	400	2750
1/2 (12.7)	regular gypsum board	350	2400
5/8 (15.9)	type X gypsum board	400	2750

<b>Impact Resistance (typical)</b> (ASTM E 695) (Using 50 lb (22.7 kg) leather bag, one test per specimen. Impact point located at midpoint between studs. Impact Resistance - Drop height at penetration through impacted membrane.)									
Thickness in. (mm)	Board Type	Tested on 2x4 (nominal) wood studs 16" (400mm) o.c.				Tested on 3 5/8" (92 mm), 25 gage steel studs 24" (610 mm) o.c.			
		1 Layer		2 Layers		1 Layer		2 Layers	
		in.	mm	in.	mm	in.	mm	in.	mm
1/2 (12.7)	regular	12	300	30	760	12	300	42	1070
1/2 (12.7)	type X	24	610	54	1370	24	610	54	1370
5/8 (15.9)	type X	30	760	72	1830	24	610	60	1520

<b>Nail Pull Resistance (minimums)</b> (ASTM C 473)				
<b>Thickness in. (mm)</b>	<b>Method A*</b>		<b>Method B*</b>	
	<b>lbf</b>	<b>N</b>	<b>lbf</b>	<b>N</b>
1/4 (6.4)	40	178	36	160
5/16 (7.9)	50	222	46	205
3/8 (9.5)	60	267	56	249
4/10 (10.2)	70	312	67	298
1/2 (12.7)	80	356	77	343
5/8 (15.9)	90	400	87	387
3/4 (19.0)	100	445	94	432
1 (25.4)	not required		not required	
* See ASTM C 473 for a description of Methods A and B.				

<b>Negative Wind Load Resistance (typical)</b> (ASTM E 330, Procedure A)			
(Based on tests conducted on single specimens, nominal 4' wide x 8' high. Each specimen constructed of a single 4' x 8' panel of treated core gypsum sheathing, with no joints, applied parallel to studs spaced 16" o.c. with fasteners spaced 8" o.c. at edges, ends, and intermediate framing members.)			
<b>Thickness In. (mm)</b>	<b>Framing</b>	<b>Fasteners</b>	<b>Negative Wind Load psf (kPa)</b>
1/2 (12.7)	18 gage steel	1" (25 mm) Type S-12 screws	60 (425)
5/8 (15.9)	18 gage steel	1-1/4" (32 mm) Type S-12 screws	100 (700)
1/2 (12.7)	2 x 4 wood	1-1/2" (38 mm) long 11 gage galvanized roofing nails	80 (550)
5/8 (15.9)	2 x 4 wood	1-3/4" (44 mm) long 11 gage galvanized roofing nails	130 ( 885)

## MOISTURE & HUMIDITY RELATED PROPERTIES

<b>Humidified Deflection (maximums)</b> (ASTM C 473)					
<b>Gypsum Board (except exterior gypsum soffit board)</b>			<b>Exterior Gypsum Soffit Board</b>		
<b>Thickness in. (mm)</b>	<b>Deflection</b>		<b>Thickness in. (mm)</b>	<b>Deflection</b>	
	<b>Eighths of an Inch</b>	<b>mm</b>		<b>Eighths of an Inch</b>	<b>mm</b>
1/4 (6.4)	Not Applicable	Not Applicable	1/2 (12.7)	7	22
5/16 (7.9)	Not Applicable	Not Applicable	5/8 (15.9)	4	13
3/8 (9.5)	15	48	<b>Gypsum Ceiling Board</b>		
4/10 (10.2)	12	38			
1/2 (12.7)	10	32			
5/8 (15.9)	5	16			
3/4 (19.0)	5	16			
1 (25.4)	Not Applicable	Not Applicable	1/2 (12.7)	2.5	8

<b>Water Absorption</b> (maximums) (ASTM C 473 – following 2 hours immersion)
Gypsum Sheathing Board - 10 weight %
Water-Resistant Gypsum Backing Board - 5 weight %

### DIMENSIONAL STABILITY

<b>Thermal Coefficient of Linear Expansion</b> (typical) Unrestrained 38°- 90°F (3.3°- 32°C)
$9.3 \times 10^{-6}$ in./in.°F ( $16.7 \times 10^{-6}$ mm/mm•°C)
<b>Hygrometric Coefficient of Expansion</b> (typical) Unrestrained (10% - 90% RH)
$6.5 \times 10^{-6}$ in./in.%RH (mm/mm/%RH)

### FIRE PROPERTIES

<b>Surface Burning Characteristics</b> (Independent of thickness) (ASTM E 84 - CAN/ULC-S102)		
<b>Board Type</b>	<b>Flame Spread</b>	<b>Smoke Developed</b>
Gypsum board	15	0
<b>Fire Resistance</b> (ASTM E 119 – CAN/ULC-S101-M)		
See the Gypsum Association <i>Fire Resistance Design Manual</i> .		
<b>Noncombustibility</b> (core) (ASTM E 136 – CAN/ULC-S114-M)		
Pass		

<b>Potential Heat</b> (From NFPA 220, Appendix C)			
Thickness in. (mm)	Board Type	Potential Heat, Weight Basis	
		(Btu/lb)	(kJ/kg)
3/8 (9.5)	gypsum lath	310	721
3/8 (9.5)	gypsum wallboard	760	1770
3/8 (9.5)	gypsum wallboard, paper removed	-270	-628
1/2 (12.7)	gypsum wallboard	650	1512

## MISCELLANEOUS

<b>Thermal Properties (typical)</b> (R and C values developed using ASTM C 177 at 75°F (24°C) mean temperature; Specific Heat from ASHRAE Handbook of Fundamentals.)						
Thickness in. (mm)	Resistance (R)		Conductance (C)		Specific Heat	
	°F·ft <sup>2</sup> ·hr/Btu	K·m <sup>2</sup> /W	Btu/hr·ft <sup>2</sup> ·°F	W/m <sup>2</sup> ·K	Btu/lb·°F	J/kg·K
3/8 (9.5)	0.33	0.058	3.03	17.2	0.26	1090
1/2 (12.7)	0.45	0.079	2.22	12.6	0.26	1090
5/8 (15.9)	0.48	0.085	2.08	11.8	0.26	1090
3/4 (19.0)	0.64	0.12	1.67	8.3	0.26	1090
1 (25.4)	0.83	0.16	1.20	6.3	0.26	1090

<b>Weight per Unit Area</b> (for use in calculating dead loads)		
Thickness in. (mm)	Weight	
	psf	kg/m <sup>2</sup>
1/4 (6.4 mm)	1.2	6.0
5/16 (7.9 mm)	1.3	6.4
3/8 (9.5 mm)	1.4	6.8
1/2 (12.7 mm)	2.0	9.8
5/8 (15.9 mm)	2.5	12
3/4 (19.0 mm)	3.0	15
1 (25.4 mm)	4.0	20

<b>Permeance (typical)</b> (ASTM E 96)				
Board Type and Thickness	Permeance, Method A		Permeance, Method B	
	Perms	ng/Pa·s·m <sup>2</sup>	Perms	ng/Pa·s·m <sup>2</sup>
3/8" (9.5 mm) Gypsum Board	31	1800	49	2800
1/2" (12.7 mm) Gypsum Board	27	1600	45	2600
5/8" (15.9 mm) Gypsum Board	25	1400	37	2100
Foil-backed Gypsum Board (from ASHRAE Handbook, 1989)	0.30	17		

The values reported herein are typical values; values derived from samples other than those actually tested may vary from these values. The Gypsum Association and its member companies make no warranties or other representations as to the characteristics, properties, or performance of any materials or systems in actual construction.