PROJECT RIO-2556-15
ENGINEERING EVALUATION REPORT FOR ATTACHING JAMES HARDIE® BRAND
FIBER-CEMENT PANELS TO WOOD AND METAL FRAMED WALLS WITH VARIOUS FASTENERS

JAMES HARDIE BUILDING PRODUCTS, INC.
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AS PRODUCT EVALUATOR, THE UNDERSIGNED CERTIFIES THAT THE LISTED PRODUCTS ARE IN COMPLIANCE WITH THE REQUIREMENTS OF THE ASCE 7-10, THE 2014 FLORIDA BUILDING CODE, AND THE 2012 INTERNATIONAL BUILDING CODE.

PREPARED BY:

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EVALUATION SUBJECT

HardiePanel® Siding

James Hardie Product Trade Names covered in this evaluation:
HardiePanel® Siding, Cempanel® Siding, Prevail™ Panel Siding

EVALUATION SCOPE:

ASCE 7-10
2014 Florida Building Code
2012 International Building Code®

EVALUATION PURPOSE:

This analysis is to determine the maximum design 3-second gust wind speed to be resisted by an assembly of HardiePanel (Cempanel, Prevail Panel) siding fastened to wood or metal framing with nails or screws.

REFERENCE REPORTS:

1. Intertek Report 3067913 (ASTM C1186) Material properties HardiePanel Siding

2. Ramtech Laboratories Report IC-1270-94 (ASTM E330) Transverse Load Test, 5/16" Thick by 48 inch wide HardiePanel Siding installed on 2X4 Hem-Fir wood studs spaced at 16 inches on center with a 6d common galvanized nail

3. Ramtech Laboratories Report IC-1271-94 (ASTM E330) Transverse Load Test, 5/16" Thick by 48 inch wide HardiePanel Siding installed on 2X4 Hem-Fir wood studs spaced at 24 inches on center with a 6d common galvanized nail

4. Ramtech Laboratories, Inc. Report 10868-97/1475 (ASTM E330) Transverse Load Test, 5/16" Thick by 48 inch wide HardiePanel Siding installed on 2X4 Group III SG=0.36 wood studs spaced at 16 inches on center with a 4d, 0.091 inch shank by 0.225 inch head diameter by 1.5 inch long ring shank nail

5. Ramtech Laboratories, Report IC-1054-89 (ASTM E330) Transverse Load Test, 1/4" Thick by 48 inch wide HardiePanel Siding installed on 20gauge Metal studs spaced at 16 inches on center with a No 8 X 1 in. long X 0.323 in head diameter ribbed bugle head screw

6. Ramtech Laboratories, Report IC-1055-89 (ASTM E330) Transverse Load Test, 1/4" Thick by 48 inch wide HardiePanel Siding installed on 20gauge Metal studs spaced at 24 inches on center with a No 8 X 1 in. long X 0.323 in head diameter ribbed bugle head screw

7. Ramtech Laboratories, Report 11149-98/1554d (ASTM E330) Transverse Load Test, 1/4" Thick by 48 inch wide HardiePanel Siding installed on 20gauge Metal studs spaced at 16 and 24 inches on center with a ET&F 0.100 in. knurled shank X 1.5 in. long X 0.25 in. head diameter pin fastener

8. Ramtech Laboratories Report IC-1273-94 (ASTM E72) Racking Shear Test, 5/16" Thick by 48 inch wide HardiePanel Siding installed on 2X4 Hem-Fir wood studs spaced at 16 inches on center with a 6d common galvanized nail

9. Ramtech Laboratories Report IC-1274-94 (ASTM E72) Racking Shear Test, 5/16" Thick by 48 inch wide HardiePanel Siding installed on 2X4 Hem-Fir wood studs spaced at 24 inches on center with a 6d common galvanized nail

10. Ramtech Laboratories, Inc. Report 10868-97/1475 (ASTM E72) Racking Shear Test, 5/16" Thick by 48 inch wide HardiePanel Siding installed on 2X4 Group III SG=0.36 wood studs spaced at 16 inches on center with a 4d, 0.091 inch shank by 0.225 inch head diameter by 1.5 inch long ring shank nail

11. Ramtech Laboratories Report IC-1057-89 (ASTM E72) Racking Shear Test, 5/16" Thick by 48 inch wide HardiePanel Siding installed on 2X4 Hem-Fir wood studs spaced at 16 and 24 inches on center with a No 8 X 1 in. long X 0.323 in head diameter ribbed bugle head screw

12. Ramtech Laboratories Report 11284-99/1580 (ASTM E72) Racking Shear Test, 5/16" Thick by 48 inch wide HardiePanel Siding installed on 2X4 Hem-Fir wood studs spaced at 16 and 24 inches on center with a ET&F 0.100 in. knurled shank X 1.5 in. long X 0.25 in. head diameter pin fastener

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TEST RESULTS:

Table 1a, Results of Transverse Load Testing

						Fastener Spacing (in.)				
Report Number	Test Agency	Thickness (in.)	Width (in.)	Frame Type	Frame Spacing (in.)	Perimeter Supports	Field Supports	Fastener Type	Ultimate Load (PSF)	Allowable Design Load[1] (PSF)
IC-1270-94	Ramtech	0.3125	48	2X4 wood Hem-Fir	16	6	6	6d common	-149	-49.7
IC-1270-94	Ramtech	0.3125	48	2X4 wood Hem-Fir	16	4	4	6d common	-236	-78.7
IC-1271-94	Ramtech	0.3125	48	2X4 wood Hem-Fir	24	6	6	6d common	-94	-31.3
IC-1271-94	Ramtech	0.3125	48	2X4 wood Hem-Fir	24	4	4	6d common	-143	-47.7
10868-97/1475	Ramtech	0.3125	48	2X4 wood, SG ≥ 0.36	16	4	8	4d, 0.091 in. shank X 0.225 in. HD X 1.5 in. long ring shank nail	-90	-30.0
IC-1054-89	Ramtech	0.25	48	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	16	6	6	Min. No 8 X 1 in. long X 0.323 in head diameter ribbed bugle head screw	-169.9	-56.6
IC-1055-89	Ramtech	0.25	48	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	24	6	6	Min. No 8 X 1 in. long X 0.323 in head diameter ribbed bugle head screw	-91.9	-30.6
11149-98/1554d	Ramtech	0.3125	48	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	24	4	8	ET&F 0.100 in. knurled shank X 1.5 in. long X 0.25 in. head diameter pin fastener	-170	-56.7
11149-98/1554d	Ramtech	0.3125	48	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	16	4	8	ET&F 0.100 in. knurled shank X 1.5 in. long X 0.25 in. head diameter pin fastener	-101	-33.7

1. Allowable Load is the Ultimate Load divided by a Factor of safety of 3.
2. HardiePanel Siding complies with ASTM C1186, *Standard Specification for Grade II, Type A Non-asbestos Fiber-Cement Flat Sheets.*

Table 1b, Shear Values Allowable Loads in Pounds Per Lineal Foot for Panel Shear Walls [1, 2]

						Fastener Spacing (in.)				
Report Number	Test Agency	Thickness (in.)	Width (in.)	Frame Type	Frame Spacing (in.)	Perimeter Supports	Field Supports	Fastener Type	Ultimate Load[3] (plf)	Allowable Load[3] (plf)
IC-1273-94	Ramtech	0.3125	48	2X4 wood Hem-Fir	16	6	6	6d common	603.8	201.3
IC-1273-94	Ramtech	0.3125	48	2X4 wood Hem-Fir	16	4	4	6d common	698.8	232.9
IC-1274-94	Ramtech	0.3125	48	2X4 wood Hem-Fir	24	6	6	6d common	460.0	153.3
IC-1274-94	Ramtech	0.3125	48	2X4 wood Hem-Fir	24	4	4	6d common	637.5	212.5
10868-97/1475	Ramtech	0.3125	48	2X4 wood, SG ≥ 0.36	16	4	8	4d, 0.091 in. shank X 0.225 in. HD X 1.5 in. long ring shank nail	595.4	198.5
IC-1057-89	Ramtech	0.25	48	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	16 & 24	6	6	Min. No 8 X 1 in. long X 0.323 in head diameter ribbed bugle head screw	990.0	123.8
11284-99/1580	Ramtech	0.3125	48	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	16	4	8	ET&F 0.100 in. knurled shank X 1.5 in. long X 0.25 in. head diameter pin fastener	1227.0	153.4
11284-99/1580	Ramtech	0.3125	48	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	24	4	8	ET&F 0.100 in. knurled shank X 1.5 in. long X 0.25 in. head diameter pin fastener	1060.0	132.5

1. All board edges shall be supported by framing. Panels shall be applied with the long dimension either parallel or perpendicular to studs.
2. The maximum height-to-length ratio for construction in this Table is 2:1.
3. In the steel framed assemblies the allowable load is based on the average load at 1/8 inch net deflection.

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DESIGN WIND LOAD PROCEDURES:

Fiber-cement siding transverse load capacity (wind load capacity) is determined via compliance testing to transverse load national test standards. Via the transverse load testing an allowable design load is determined based on a factor of safety of 3 applied to the ultimate test load.

Since the allowable design load is based on factor of safety of 3, allowable design loads on fiber-cement siding correlate directly to required design pressures for Allowable Stress Design, and therefore should be used with combination loading equations for Allowable Stress Design (ASD).

By using the combination loading equations for Allowable Stress Design (ASD), the tested allowable design loads for fiber-cement siding are aligned with the wind speed requirements in ASCE 7-10 Figure 26.5-1A, Figure 26.5-1B, and Figure 26.5-1C.

For this analysis, to calculate the pressures in Tables 3, 4, and 5, the load combination will be in accordance with ASCE 7-10 Section 2.4 *combining nominal loads using allowable stress design*, load combination 7. Load combination 7 uses a load factor of 0.6 applied to the wind velocity pressure.

Equation 1, $q_z=0.00256*K_z*K_{zt}*K_d*V^2$ *{ref. ASCE 7-10 equation 30.3-1}*

q_z , velocity pressure at height z
K_z , velocity pressure exposure coefficient evaluated at height z
K_{zt} , topographic factor
K_d , wind directionality factor
V , basic wind speed (3-second gust MPH) as determined from [2012 IBC, 2014 FBC] Figures 1609A, B, or C; ASCE 7-10 Figures 26.5-1A, B, or C

Equation 2,

$V=V_{ult}$ *{ref. 2012 IBC & 2014 FBC Section 1602.1 definitions}*

V_{ult} , ultimate design wind speeds (3-second gust MPH) determined from [2012 IBC, 2014 FBC] Figures 1609A, B, or C; ASCE 7-10 Figures 26.5-1A, B, or C

Equation 3, $p=q_z*(GC_p-GC_{pi})$ *{ref. ASCE 7-10 equation 30.6-1}*

GC_p , product of external pressure coefficient and gust-effect factor
GC_{pi} , product of internal pressure coefficient and gust-effect factor
p , design pressure (PSF) for siding (allowable desgn load for siding)

To determine design pressure, substitute q_z into Equation 3,

Equation 4, $p=0.00256*K_z*K_{zt}*K_d*V_{ult}^{2}*(GC_p-GC_{pi})$

Allowable Stress Design, ASCE 7-10 Section 2.4.1, load combination 7

Equation 5, 0.6D + 0.6W *{ref. ASCE 7-10 section 2.4.1, load combination 7}*

D , dead load
W , wind load

To determine the Allowable Stress Design Pressure, apply the load factor for W (wind) from Equation 4 to p (design pressure) determined from equation 4

Equation 6, $p_{asd} = 0.6*[p]$

Equation 7, $p_{asd} = 0.6*[0.00256*K_z*K_{zt}*K_d*V_{ult}^{2}*(GC_p-GC_{pi})]$

Equation 7 is used to populate Table 3, 4, and 5.

To determine the allowable ultimate basic wind speed for Hardie Siding in Table 6, solve Equation 7 for V_{ult},

Equation 8, $V_{ult} = (p_{asd}/0.6*0.00256*K_z*K_{zt}*K_d*(GC_p-GC_{pi}))^{0.5}$

Applicable to methods specified in Exceptions 1 through 3 of [2012 IBC, 2014 FBC] Section 1609.1.1., to determine the allowable nominal design wind speed (Vasd) for Hardie Siding in Table 6, apply the conversion formula below,

Equation 9, $V_{asd} = V_{ult} * (0.6)^{0.5}$ *{ref. 2012 IBC & 2014 FBC Section 1609.3.1}*

V_{asd} , Nominal design wind speed (3-second gust mph) *{ref. 2012 IBC & 2014 FBC Section 1602.1}*

Table 2, Coefficients and Constants used in Determining V and p,

	K_z						Wall Zone 5	
Height (ft)	Exp B	Exp C	Exp D		K_{zt}	K_d	GC_p	GC_{pi}
0-15	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
20	0.7	0.9	1.08		1	0.85	-1.4	0.18
25	0.7	0.94	1.12		1	0.85	-1.4	0.18
30	0.7	0.98	1.16		1	0.85	-1.4	0.18
35	0.73	1.01	1.19		1	0.85	-1.4	0.18
40	0.76	1.04	1.22		1	0.85	-1.4	0.18
45	0.785	1.065	1.245		1	0.85	-1.4	0.18
50	0.81	1.09	1.27		1	0.85	-1.4	0.18
55	0.83	1.11	1.29		1	0.85	-1.4	0.18
60	0.85	1.13	1.31		1	0.85	-1.4	0.18
100	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18

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Table 3, Allowable Stress Design - Component and Cladding (C&C) Pressures (PSF) to be Resisted at Various Wind Speeds - Wind Exposure Category B,

Wind Speed (3-second gust)	100	105	110	115	120	130	140	150	160	170	180	190	200	210
Height (ft)	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0-15	-14.4	-15.9	-17.5	-19.1	-20.8	-24.4	-28.3	-32.5	-37.0	-41.7	-46.8	-52.1	-57.8	-63.7
20	-14.4	-15.9	-17.5	-19.1	-20.8	-24.4	-28.3	-32.5	-37.0	-41.7	-46.8	-52.1	-57.8	-63.7
25	-14.4	-15.9	-17.5	-19.1	-20.8	-24.4	-28.3	-32.5	-37.0	-41.7	-46.8	-52.1	-57.8	-63.7
30	-14.4	-15.9	-17.5	-19.1	-20.8	-24.4	-28.3	-32.5	-37.0	-41.7	-46.8	-52.1	-57.8	-63.7
35	-15.1	-16.6	-18.2	-19.9	-21.7	-25.4	-29.5	-33.9	-38.6	-43.5	-48.8	-54.4	-60.2	-66.4
40	-15.7	-17.3	-19.0	-20.7	-22.6	-26.5	-30.7	-35.3	-40.1	-45.3	-50.8	-56.6	-62.7	-69.1
45	-16.2	-17.9	-19.6	-21.4	-23.3	-27.4	-31.7	-36.4	-41.5	-46.8	-52.5	-58.5	-64.8	-71.4
50	-16.7	-18.4	-20.2	-22.1	-24.1	-28.2	-32.7	-37.6	-42.8	-48.3	-54.1	-60.3	-66.8	-73.7
55	-17.1	-18.9	-20.7	-22.6	-24.7	-28.9	-33.6	-38.5	-43.8	-49.5	-55.5	-61.8	-68.5	-75.5
60	-17.5	-19.3	-21.2	-23.2	-25.2	-29.6	-34.4	-39.5	-44.9	-50.7	-56.8	-63.3	-70.1	-77.3
100	-25.6	-28.2	-31.0	-33.8	-36.9	-43.3	-50.2	-57.6	-65.5	-74.0	-82.9	-92.4	-102.4	-112.9

Table 4, Allowable Stress Design - Component and Cladding (C&C) Pressures (PSF) to be Resisted at Various Wind Speeds - Wind Exposure Category C,

Wind Speed (3-second gust)	100	105	110	115	120	130	140	150	160	170	180	190	200	210
Height (ft)	C	C	C	C	C	C	C	C	C	C	C	C	C	C
0-15	-17.5	-19.3	-21.2	-23.2	-25.2	-29.6	-34.4	-39.5	-44.9	-50.7	-56.8	-63.3	-70.1	-77.3
20	-18.6	-20.5	-22.5	-24.6	-26.7	-31.4	-36.4	-41.8	-47.5	-53.7	-60.2	-67.0	-74.3	-81.9
25	-19.4	-21.4	-23.5	-25.6	-27.9	-32.8	-38.0	-43.6	-49.6	-56.0	-62.8	-70.0	-77.6	-85.5
30	-20.2	-22.3	-24.5	-26.7	-29.1	-34.2	-39.6	-45.5	-51.8	-58.4	-65.5	-73.0	-80.9	-89.2
35	-20.8	-23.0	-25.2	-27.6	-30.0	-35.2	-40.8	-46.9	-53.3	-60.2	-67.5	-75.2	-83.3	-91.9
40	-21.5	-23.7	-26.0	-28.4	-30.9	-36.3	-42.0	-48.3	-54.9	-62.0	-69.5	-77.4	-85.8	-94.6
45	-22.0	-24.2	-26.6	-29.1	-31.6	-37.1	-43.1	-49.4	-56.2	-63.5	-71.2	-79.3	-87.9	-96.9
50	-22.5	-24.8	-27.2	-29.7	-32.4	-38.0	-44.1	-50.6	-57.6	-65.0	-72.9	-81.2	-89.9	-99.2
55	-22.9	-25.2	-27.7	-30.3	-33.0	-38.7	-44.9	-51.5	-58.6	-66.2	-74.2	-82.7	-91.6	-101.0
60	-23.3	-25.7	-28.2	-30.8	-33.6	-39.4	-45.7	-52.4	-59.7	-67.4	-75.5	-84.1	-93.2	-102.8
100	-32.6	-35.9	-39.4	-43.1	-46.9	-55.0	-63.8	-73.3	-83.4	-94.1	-105.5	-117.6	-130.3	-143.6

Table 5, Allowable Stress Design - Component and Cladding (C&C) Pressures (PSF) to be Resisted at Various Wind Speeds - Wind Exposure Category D,

Wind Speed (3-second gust)	100	105	110	115	120	130	140	150	160	170	180	190	200	210
Height (ft)	D	D	D	D	D	D	D	D	D	D	D	D	D	D
0-15	-21.2	-23.4	-25.7	-28.1	-30.6	-35.9	-41.6	-47.8	-54.4	-61.4	-68.8	-76.7	-85.0	-93.7
20	-22.3	-24.6	-27.0	-29.5	-32.1	-37.7	-43.7	-50.1	-57.0	-64.4	-72.2	-80.4	-89.1	-98.2
25	-23.1	-25.5	-28.0	-30.6	-33.3	-39.0	-45.3	-52.0	-59.1	-66.8	-74.9	-83.4	-92.4	-101.9
30	-23.9	-26.4	-29.0	-31.6	-34.5	-40.4	-46.9	-53.8	-61.3	-69.2	-77.5	-86.4	-95.7	-105.5
35	-24.5	-27.1	-29.7	-32.5	-35.3	-41.5	-48.1	-55.2	-62.8	-70.9	-79.5	-88.6	-98.2	-108.3
40	-25.2	-27.7	-30.5	-33.3	-36.2	-42.5	-49.3	-56.6	-64.4	-72.7	-81.5	-90.9	-100.7	-111.0
45	-25.7	-28.3	-31.1	-34.0	-37.0	-43.4	-50.3	-57.8	-65.7	-74.2	-83.2	-92.7	-102.7	-113.3
50	-26.2	-28.9	-31.7	-34.6	-37.7	-44.3	-51.3	-58.9	-67.1	-75.7	-84.9	-94.6	-104.8	-115.5
55	-26.6	-29.3	-32.2	-35.2	-38.3	-45.0	-52.2	-59.9	-68.1	-76.9	-86.2	-96.1	-106.4	-117.4
60	-27.0	-29.8	-32.7	-35.7	-38.9	-45.7	-53.0	-60.8	-69.2	-78.1	-87.6	-97.6	-108.1	-119.2
100	-37.0	-40.8	-44.7	-48.9	-53.2	-62.5	-72.5	-83.2	-94.6	-106.8	-119.8	-133.4	-147.9	-163.0

Tables 3, 4, and 5 are based on ASCE 7-10 and consistent with the 2012 IBC, 2012 IRC and the 2014 Florida Building Code

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Table 6, Allowable Wind Speed (mph) for HardiePanel Siding *(Analytical Method in ASCE 7-10 Chapter 30 C&C Part 1 and Part 3)*[8]

2012 IBC, 2014 FBC	*2012 IBC, 2014 FBC*
Allowable, Ultimate Design Wind, Speed, V_{ult}[4], (3-second gust mph)	Allowable, Nominal Design Wind, Speed, V_{asd}[5,6], (3-second gust mph)
Applicable to methods specified in [2012 IBC, 2014 FBC] Section 1609.1.1. as determined by [2012 IBC, 2014 FBC] Figures 1609A, B, or C.	Applicable to methods specified in Exceptions 1 through 3 of [2012 IBC, 2014 FBC] Section 1609.1.1.

Coefficients used in Table 6 calculations for V_{ult}

								Wind exposure category			Wind exposure category			Siding	K_z							
Product	Product Thickness (inches)	Width (inches)	Fastener Type	Fastener Spacing	Frame Type	Stud Spacing (inches)	Building Height[3,7] (feet)	B	C	D	B	C	D	Allowable Design Load (PSF)	Exp B	Exp C	Exp D		K_{zt}	K_d	GC_p	GC_{pi}
HardiePanel®	5/16	48	6d common	6	2X4 wood Hem-Fir	16	0-15	186	168	153	144	130	118	-49.7	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	186	164	149	144	127	116	-49.7	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	186	160	147	144	124	114	-49.7	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	186	157	144	144	121	112	-49.7	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	182	154	142	141	120	110	-49.7	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	178	152	141	138	118	109	-49.7	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	175	150	139	136	117	108	-49.7	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	172	149	138	134	115	107	-49.7	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	170	147	137	132	114	106	-49.7	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	168	146	136	130	113	105	-49.7	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	139	124	116	108	96	90	-49.7	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardiePanel®	5/16	48	6d common	4	2X4 wood Hem-Fir	16	0-15	233	212	192	181	164	149	-78.7	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	233	206	188	181	159	146	-78.7	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	233	201	185	181	156	143	-78.7	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	233	197	181	181	153	140	-78.7	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	229	194	179	177	151	139	-78.7	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	224	192	177	174	148	137	-78.7	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	220	189	175	171	147	136	-78.7	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	4	187	173	3	145	134	-78.7	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	214	185	172	166	144	133	-78.7	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	212	184	171	164	142	132	-78.7	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	175	155	146	136	120	113	-78.7	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardiePanel®	5/16	48	6d common	6	2X4 wood Hem-Fir	24	0-15	147	134	121	114	103	94	-31.3	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	6-7	130	119	32659	101	92	-31.3	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	7	127	116	5	98	90	-31.3	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	147	124	114	114	96	89	-31.3	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	144	123	113	112	95	87	-31.3	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	141	121	112	109	94	86	-31.3	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	139	119	110	108	92	86	-31.3	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	137	118	109	106	91	85	-31.3	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	135	117	108	105	91	84	-31.3	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	134	116	108	103	90	83	-31.3	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	111	98	92	86	76	71	-31.3	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardiePanel®	5/16	48	6d common	4	2X4 wood Hem-Fir	24	0-15	182	165	150	141	128	116	-47.7	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	182	160	146	141	124	113	-47.7	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	182	157	144	141	121	111	-47.7	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	182	154	141	141	119	109	-47.7	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	178	151	139	138	117	108	-47.7	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	174	149	138	135	116	107	-47.7	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	172	147	136	133	114	106	-47.7	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	169	146	135	131	113	105	-47.7	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	167	144	134	129	112	104	-47.7	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	165	143	133	128	111	103	-47.7	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	137	121	114	106	94	88	-47.7	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardiePanel®	5/16	48	4d, 0.091 in. shank X 0.225 in. HD X 1.5 in. long ring shank nail	4 edge 8 field	2X4 wood SG≥0.36	16	0-15	144	131	119	112	101	92	-30.0	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	144	127	116	112	98	90	-30.0	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	144	124	114	112	96	88	-30.0	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	144	122	112	112	94	87	-30.0	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	141	120	111	109	93	86	-30.0	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	138	118	109	107	92	85	-30.0	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	136	117	108	105	91	84	-30.0	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	134	116	107	104	89	83	-30.0	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	132	114	106	103	89	82	-30.0	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	131	113	105	101	88	82	-30.0	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	108	96	90	84	74	70	-30.0	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18

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								2012 IBC, 2014 FBC Allowable, Ultimate Design Wind, Speed, V_{ult}[4], (3-second gust mph) Applicable to methods specified in [2012 IBC, 2014 FBC] Section 1609.1.1. as determined by [2012 IBC, 2014 FBC] Figures 1609A, B, or C.			2012 IBC, 2014 FBC Allowable, Nominal Design Wind, Speed, V_{asd}[5,6], (3-second gust mph) Applicable to methods specified in Exceptions 1 through 3 of [2012 IBC, 2014 FBC] Section 1609.1.1.			Coefficients used in Table 6 calculations for V_{ult}							
								Wind exposure category			Wind exposure category			Siding	K_z							
Product	Product Thickness (inches)	Width (inches)	Fastener Type	Fastener Spacing	Frame Type	Stud Spacing (inches)	Building Height[3, 7] (feet)	B	C	D	B	C	D	Allowable Design Load (PSF)	Exp B	Exp C	Exp D		K_{zt}	K_d	GC_p	GC_{pi}
HardiePanel®	1/4	48	Min. No 8 X 1 in. long X 0.323 in head diameter ribbed bugle head screw[1]	6	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	16	0-15	198	180	163	153	139	126	-56.6	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	198	175	159	153	135	123	-56.6	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	198	171	157	153	132	121	-56.6	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	198	167	154	153	130	119	-56.6	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	194	165	152	150	128	118	-56.6	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	190	162	150	147	126	116	-56.6	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	187	161	148	145	124	115	-56.6	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	184	159	147	143	123	114	-56.6	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	182	157	146	141	122	113	-56.6	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	180	156	145	139	121	112	-56.6	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	149	132	124	115	102	96	-56.6	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardiePanel®	1/4	48	Min. No 8 X 1 in. long X 0.323 in head diameter ribbed bugle head screw[1]	6	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	24	0-15	146	132	120	113	102	93	-30.6	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	146	128	117	113	99	91	-30.6	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	146	126	115	113	97	89	-30.6	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	146	123	113	113	95	88	-30.6	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	143	121	112	110	94	86	-30.6	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	140	119	110	108	93	85	-30.6	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	137	118	109	106	91	85	-30.6	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	135	117	108	105	90	84	-30.6	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	134	116	107	104	90	83	-30.6	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	132	115	106	102	89	82	-30.6	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	109	97	91	85	75	70	-30.6	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardiePanel®	5/16	48	ET&F 0.100 in. knurled shank X 1.5 in. long X 0.25 in. head diameter pin fastener[2]	4 edge 8 field	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	16	0-15	198	180	163	153	139	127	-56.7	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	198	175	160	153	135	124	-56.7	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	198	171	157	153	132	121	-56.7	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	198	167	154	153	130	119	-56.7	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	194	165	152	150	128	118	-56.7	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	190	163	150	147	126	116	-56.7	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	187	161	149	145	124	115	-56.7	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	184	159	147	143	123	114	-56.7	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	182	157	146	141	122	113	-56.7	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	180	156	145	139	121	112	-56.7	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	149	132	124	115	102	96	-56.7	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardiePanel®	5/16	48	ET&F 0.100 in. knurled shank X 1.5 in. long X 0.25 in. head diameter pin fastener[2]	4 edge 8 field	Min. No. 20 gauge X 3.625 in. X 1.375 in metal stud	24	0-15	153	139	126	118	107	98	-33.7	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	153	135	123	118	104	95	-33.7	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	153	132	121	118	102	94	-33.7	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	153	129	119	118	100	92	-33.7	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	150	127	117	116	99	91	-33.7	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	147	125	116	114	97	90	-33.7	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	144	124	115	112	96	89	-33.7	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	142	122	113	110	95	88	-33.7	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	140	121	113	109	94	87	-33.7	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	139	120	112	107	93	87	-33.7	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	115	102	95	89	79	74	-33.7	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18

1. Screws shall penetrate the metal framing at least three full threads.
2. Knurled shank pins shall penetrate the metal framing at least 1/4 inch.
3. Building height = mean roof height (in feet) of a building, except that eave height shall be used for roof angle Θ less than or equal to 10° (2-12 roof slope).
4. Vult = the ultimate design wind speed (3-second gust mph) as determined by [2012 IBC, 2014 FBC] Figures 1609A, 1609B, or 1609C; ASCE 7-10 Figures 26.5-1A, 26.5-1B, or 26.5-1C.
5. Vasd = the nominal design wind speed applicable to methods specified in Exceptions 1 through 3 of [2012 IBC, 2014 FBC] Section 1609.1.1.
6. The wind speeds in [2012 IBC, 2014 FBC] Figures 1609A, 1609B and 1609C are ultimate design wind speeds, Vult, and shall be converted in accordance with [2012 IBC, 2014 FBC] Section 1609.3.1 to nominal design wind speeds, Vasd, when the provisions of the standards referenced in [2012 IBC, 2014 FBC] Section 1609.1.1. Exceptions 1 through 3 are used.
7. Linear interpolation of building height and wind speed is permitted.
8. Wind speed design assumptions per Analytical Method in ASCE 7-10 Chapter 30 C&C Part 1 and Part 3: K_{zt}=1, K_d=0.85, GC_p=-1.4 (h≤60), GC_p=-1.8 (h>60), GC_{pi}=0.18.

LIMITATIONS OF USE:

1) Fastener pullout must be evaluated when installed a species of wood studs other than that which was tested.