PROJECT RIO-2555-15
ENGINEERING EVALUATION REPORT FOR ATTACHING JAMES HARDIE® BRAND

FIBER-CEMENT SHINGLE SIDING TO WOOD OR 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

HardieShingle® Siding

James Hardie Product Trade Names covered in this evaluation:
HardieShingle® Nothched Panels, HardieShingle® Individual Cladding Shingles

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 HardieShingle siding fastened to wood or metal framing with nails or screws.

REFERENCE REPORTS:

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

2. Ramtech Laboratories, Inc. Report 11436-99/1602 (ASTM E330) Transverse Load Test, 1/4" Thick by 48 inch wide HardieShingle Notched Panels installed on 7/16 inch thick OSB rated sheathing nailed with a 1-1/2 inch long by 0.083 inch shank diameter by 0.187 inch head diameter ring shank nail

3. Ramtech Laboratories, Inc. Report 11436-99/1603 (ASTM E330) Transverse Load Test, 1/4" Thick by 48 inch wide HardieShingle Notched Panels installed on 2X4 Wood Studs SG = 0.40 spaced at 16 inches on center with a 1-1/2 inch long by 0.083 inch shank diameter by 0.187 inch head diameter ring shank nail

4. Ramtech Laboratories, Inc. Report 11436-99/1604 (ASTM E330) Transverse Load Test, 1/4" Thick by 48 inch wide HardieShingle Notched Panels installed on 2X4 Wood Studs SG = 0.40 spaced at 24 inches on center with a 1-1/2 inch long by 0.083 inch shank diameter by 0.187 inch head diameter ring shank nail

5. Intertek. Report 3108641COQ-002 (ASTM E330) Transverse Load Test, 1/4" Thick by 48 inch wide HardieShingle Notched Panels installed 2X4 18ga. Metal Studs spaced at 16 inches on center with a ET&F 2" long X 0.100" knurled shank X 0.313" head diameter

6. Ramtech Laboratories, Inc. Report 10794-97-1458 (ASTM E330) Transverse Load Test, 1/4" Thick by 12 inch wide HardieShingle Cladding Shingles installed on 15/32 inch APA rated sheathing nailed with a Number 11 gauge 1-1/4 inch long roofing nail

7. Ramtech Laboratories, Inc. Report 10794-97-1464 (ASTM E330) Transverse Load Test, 1/4" Thick by 12 inch wide HardieShingle Cladding Shingles installed on 7/16 inch OSB rated sheathing nailed with a 0.091 inch shank diameter by 2.5 inch long by 0.221 inch head diameter

TEST RESULTS:

Table 1, Results of Transverse Load Testing

Product	Report Number	Test Agency	Thickness (in.)	Frame Type	Frame Spacing (in.)	Weather Exposure (in.)	Fastener Spacing (in.)	Fastener Type	Ultimate Load (PSF)	Allowable Design Load[1] (PSF)
HardieShingle Notched Panel - Straight Installation	11436-99/1602	Ramtech	0.25	Minimum 7/16 in. thick OSB sheathing complying with DOC-PS2	-	7	13.75	1.5 in. long X 0.083 in. shank X 0.187 in. HD, ring shank nail	-68	-22.7
HardieShingle Notched Panel - Staggered Installation	11436-99/1602	Ramtech	0.25	Minimum 7/16 in. thick OSB sheathing complying with DOC-PS2	-	7	13.75	1.5 in. long X 0.083 in. shank X 0.187 in. HD, ring shank nail	-61	-20.3
HardieShingle Notched Panel	11436-99/1603	Ramtech	0.25	2X4 wood SG≥0.40	16	7	blind nailed at stud	1.5 in. long X 0.083 in. shank X 0.187 in. HD, ring shank nail	-192	-64.0
HardieShingle Notched Panel	11436-99/1604	Ramtech	0.25	2X4 wood SG≥0.40	24	7	blind nailed at stud	1.5 in. long X 0.083 in. shank X 0.187 in. HD, ring shank nail	-97	-32.3
HardieShingle Notched Panel	3108641COQ-002	Intertek	0.25	2X4 18ga. Metal	16	7	blind nailed at stud	ET&F 0.100 in. knurled shank X 2 in. long X 0.313 in. head diameter pin fastener	-168	-56.0
HardieShingle Individual Cladding Shingle	10794-97-1458	Ramtech	0.25	Minimum 15/32 in. thick plywood complying with DOC-PS1	-	8	2 roofing nails 9 inches from butt edge	No. 11ga. 1-1/4 in. long roofing nail	-100	-33.3
HardieShingle Individual Cladding Shingle	10794-97-1464	Ramtech	0.25	Minimum 7/16 in. thick OSB sheathing complying with DOC-PS2	-	8	2 siding nails 9 inches from butt edge	0.091 in. shank X 0.221 in. HD X 2.5 in.long siding nail	-89.4	-29.8

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

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With regards to HardieShingle Individual Shingles and based on results of testing 8 inch weather exposure, we prorate the area of 7 inch, 6 inch, and 5 inch weather exposure back to the original 8 inch weather exposure to determine the respective uplift resistance at reduced weather exposures. By using this proration, the design loads for various HardieShingle Individual Shingle weather exposures will be determined.

Table 2a, Calculated Allowable Design Loads for Reduction in Weather Exposure, HardieShingle Individual Shingle nailed to 15/32 inch plywood sheathing

Pressure	Weather Exposure (inches)	Ultimate Load (PSF)	Allowable Design Load[1] (PSF)
q_{test}	8	-100.0	-33.3
q_1	7	-127.0	-42.3
q_2	6	-166.7	-55.6
q_3	5	-228.6	-76.2

1. Allowable Design Load is the Ultimate Load divided by a Factor of safety of 3.

Check for results on Table 2a,
HardieShingle Individual Shingles installed on 15/32 inch plywood with two fasteners located 9 inches from the free end.
The assembly tested in Ramtech Report 10794-97-1458 has a weather exposure of 8 inches.

Proration of the areas:

1)

	Weather Exposure (inches)	Weather Exposure Area (sq ft)
A_{test}	8	0.667
A_1	7	0.583
A_2	6	0.500
A_3	5	0.417

2) By assuming the same resistance, we can set the moment for the tested configuration equal to the moment of the reduced exposure. Therefore,

$A_{test} \times (4 + 1) \times q_{test} = A_1 \times (3.5 + 1) \times q_1$
Solve for q_1, $q_1 = [A_{test} \times (4 + 1) \times q_{test}]/[A_1 \times (3.5 + 1)]$

$A_{test} \times (4 + 1) \times q_{test} = A_2 \times (3 + 1) \times q_2$
Solve for q_2, $q_2 = [A_{test} \times (4 + 1) \times q_{test}]/[A_2 \times (3 + 1)]$

$A_{test} \times (4 + 1) \times q_{test} = A_3 \times (2.5 + 1) \times q_3$
Solve for q_3, $q_3 = [A_{test} \times (4 + 1) \times q_{test}]/[A_3 \times (2.5 + 1)]$

q_{test}	q_1	q_2	q_3
-100	-126.98	-166.67	-228.57

Table 2b, Calculated Allowable Design Loads for Reduction in Weather Exposure, HardieShingle Individual Shingle nailed to 7/16 inch OSB sheathing

Pressure	Weather Exposure (inches)	Ultimate Load (PSF)	Allowable Design Load[1] (PSF)
q_{test}	8	-89.4	-29.8
q_1	7	-113.5	-37.8
q_2	6	-149.0	-49.7
q_3	5	-204.3	-68.1

1. Allowable Design Load is the Ultimate Load divided by a Factor of safety of 3.

Check for results on Table 2b,
HardieShingle Individual Shingles installed on 7/16 inch OSB with two fasteners located 9 inches from the free end.
The assembly tested in Ramtech Report 10794-97-1464 has a weather exposure of 8 inches.

Proration of the areas:

1)

	Weather Exposure (inches)	Weather Exposure Area (sq ft)
A_{test}	8	0.667
A_1	7	0.583
A_2	6	0.500
A_3	5	0.417

2) By assuming the same resistance, we can set the moment for the tested configuration equal to the moment of the reduced exposure. Therefore,

$A_{test} \times (4 + 1) \times q_{test} = A_1 \times (3.5 + 1) \times q_1$
Solve for q_1, $q_1 = [A_{test} \times (4 + 1) \times q_{test}]/[A_1 \times (3.5 + 1)]$

$A_{test} \times (4 + 1) \times q_{test} = A_2 \times (3 + 1) \times q_2$
Solve for q_2, $q_2 = [A_{test} \times (4 + 1) \times q_{test}]/[A_2 \times (3 + 1)]$

$A_{test} \times (4 + 1) \times q_{test} = A_3 \times (2.5 + 1) \times q_3$
Solve for q_3, $q_3 = [A_{test} \times (4 + 1) \times q_{test}]/[A_3 \times (2.5 + 1)]$

q_{test}	q_1	q_2	q_3
-89.4	-113.52	-149.00	-204.34

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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 4, 5, and 6, 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 design 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 (load due to wind pressure)

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 4, 5, and 6.

To determine the allowable ultimate basic wind speed for Hardie Siding in Table 7, 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 (V_{asd}) for Hardie Siding in Table 7, 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 3, 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 4, 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 5, 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 6, 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 4, 5, and 6 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 7, Allowable Wind Speed (mph) for HardiePlank Lap Siding *(Analytical Method in ASCE 7-10 Chapter 30 C&C Part 1 and Part 3)*[8]

								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)	Fastener Type	Fastener Spacing (inches)	Frame Type	Stud Spacing (inches)	Weather Exposure (in.)	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}
HardieShingle Notched Panel - Straight Installation	1/4	1.5 in. long X 0.083 in. shank X 0.187 in. HD, ring shank nail	13.75	Minimum 7/16 in. thick OSB sheathing complying with DOC-PS2	-	7	0-15	125	114	103	97	88	80	-22.7	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	125	111	101	97	86	78	-22.7	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	125	108	99	97	84	77	-22.7	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	125	106	97	97	82	75	-22.7	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	123	104	96	95	81	74	-22.7	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	120	103	95	93	80	74	-22.7	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	118	102	94	92	79	73	-22.7	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	117	100	93	90	78	72	-22.7	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	115	100	92	89	77	72	-22.7	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	114	99	92	88	76	71	-22.7	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	94	83	78	73	65	61	-22.7	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardieShingle Notched Panel - Staggered Installation	1/4	1.5 in. long X 0.083 in. shank X 0.187 in. HD, ring shank nail	13.75	Minimum 7/16 in. thick OSB sheathing complying with DOC-PS2	-	7	0-15	119	108	98	92	83	76	-20.3	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	119	105	95	92	81	74	-20.3	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	119	102	94	92	79	73	-20.3	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	119	100	92	92	78	71	-20.3	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	116	99	91	90	76	70	-20.3	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	114	97	90	88	75	70	-20.3	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	112	96	89	87	74	69	-20.3	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	110	95	88	85	74	68	-20.3	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	109	94	87	84	73	68	-20.3	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	108	93	87	83	72	67	-20.3	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	89	79	74	69	61	57	-20.3	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardieShingle Notched Panel	1/4	1.5 in. long X 0.083 in. shank X 0.187 in. HD, ring shank nail	blind nail at stud	2X4 wood SG≥0.40	16	7	0-15	211	191	174	163	148	134	-64.0	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	211	186	169	163	144	131	-64.0	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	211	182	166	163	141	129	-64.0	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	211	178	164	163	138	127	-64.0	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	206	175	161	160	136	125	-64.0	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	202	173	159	157	134	124	-64.0	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	199	171	158	154	132	122	-64.0	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	196	169	156	152	131	121	-64.0	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	193	167	155	150	130	120	-64.0	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	191	166	154	148	128	119	-64.0	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	158	140	132	122	109	102	-64.0	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardieShingle Notched Panel	1/4	1.5 in. long X 0.083 in. shank X 0.187 in. HD, ring shank nail	blind nail at stud	2X4 wood SG≥0.40	24	7	0-15	150	136	123	116	105	96	-32.3	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	150	132	120	116	102	93	-32.3	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	150	129	118	116	100	92	-32.3	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	150	126	116	116	98	90	-32.3	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	146	125	115	113	96	89	-32.3	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	144	123	113	111	95	88	-32.3	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	141	121	112	109	94	87	-32.3	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	139	120	111	108	93	86	-32.3	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	137	119	110	106	92	85	-32.3	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	136	118	109	105	91	85	-32.3	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	112	100	93	87	77	72	-32.3	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardieShingle Notched Panel	1/4	ET&F 0.100 in. knurled shank X 2 in. long X 0.313 in. head diameter pin fastener	blind nail at stud	2X4 18ga. Metal Stud	16	7	0-15	197	179	162	153	138	126	-56.0	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	197	174	159	153	135	123	-56.0	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	197	170	156	153	132	121	-56.0	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	197	166	153	153	129	118	-56.0	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	193	164	151	149	127	117	-56.0	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	189	162	149	146	125	116	-56.0	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	186	160	148	144	124	114	-56.0	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	183	158	146	142	122	113	-56.0	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	181	156	145	140	121	112	-56.0	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	179	155	144	138	120	112	-56.0	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	148	131	123	115	102	95	-56.0	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18

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Coefficients used in Table 6 calculations for V_{ult}

Product	Product Thickness (inches)	Fastener Type	Fastener Spacing (inches)	Frame Type	Stud Spacing (inches)	Weather Exposure (in.)	Building Height[3, 7] (feet)	*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. Wind exposure category			*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. Wind exposure category			Siding	K_z						
								B	C	D	B	C	D	Allowable Design Load (PSF)	Exp B	Exp C	Exp D		K_{zt}	K_d	GC_p	GC_{pi}
HardieShingle Individual Cladding Shingles	1/4	No. 11ga. 1-1/4 in. long roofing nail	2 roofing nails 7.5 inches from exposedbutt edge	Minimum 15/32 in. thick plywood complying with DOC-PS1	-	7	0-15	171	155	141	133	120	109	-42.3	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	171	151	138	133	117	107	-42.3	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	171	148	135	133	114	105	-42.3	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	171	145	133	133	112	103	-42.3	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	168	142	131	130	110	102	-42.3	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	164	140	130	127	109	100	-42.3	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	162	139	128	125	107	99	-42.3	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	159	137	127	123	106	98	-42.3	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	157	136	126	122	105	98	-42.3	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	155	135	125	120	104	97	-42.3	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	129	114	107	100	88	83	-42.3	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardieShingle Individual Cladding Shingles	1/4	No. 11ga. 1-1/4 in. long roofing nail	2 roofing nails 6.5 inches from butt edge	Minimum 15/32 in. thick plywood complying with DOC-PS1	-	6	0-15	196	178	162	152	138	125	-55.6	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	196	173	158	152	134	122	-55.6	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	196	169	155	152	131	120	-55.6	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	196	166	152	152	128	118	-55.6	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	192	163	150	149	127	117	-55.6	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	188	161	149	146	125	115	-55.6	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	185	159	147	144	123	114	-55.6	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	182	157	146	141	122	113	-55.6	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	180	156	145	140	121	112	-55.6	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	178	154	143	138	120	111	-55.6	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	147	131	123	114	101	95	-55.6	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardieShingle Individual Cladding Shingles	1/4	No. 11ga. 1-1/2 in. long roofing nail	2 roofing nails 5.5 inches from butt edge	Minimum 15/32 in. thick plywood complying with DOC-PS1	-	5	0-15	230	208	189	178	161	147	-76.2	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	230	203	185	178	157	143	-76.2	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	230	198	182	178	154	141	-76.2	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	230	194	178	178	150	138	-76.2	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	225	191	176	174	148	136	-76.2	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	220	188	174	171	146	135	-76.2	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	217	186	172	168	144	133	-76.2	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	214	184	171	165	143	132	-76.2	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	211	182	169	163	141	131	-76.2	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	208	181	168	161	140	130	-76.2	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	173	153	144	134	118	111	-76.2	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardieShingle Individual Cladding Shingles	1/4	0.091 in. shank X 0.221 in. HD X 1.5 in.long siding nail	2 siding nails 7.5 inches from exposedbutt edge	Minimum 7/16 in. thick OSB sheathing complying with DOC-PS2	-	7	0-15	162	147	133	125	114	103	-37.8	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	162	143	130	125	111	101	-37.8	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	162	140	128	125	108	99	-37.8	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	162	137	126	125	106	97	-37.8	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	158	135	124	123	104	96	-37.8	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	155	133	123	120	103	95	-37.8	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	153	131	121	118	102	94	-37.8	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	150	130	120	117	100	93	-37.8	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	149	128	119	115	100	92	-37.8	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	147	127	118	114	99	92	-37.8	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	122	108	101	94	83	78	-37.8	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18
HardieShingle Individual Cladding Shingles	1/4	0.091 in. shank X 0.221 in. HD X 1.5 in.long siding nail	2 siding nails 6.5 inches from butt edge	Minimum 7/16 in. thick OSB sheathing complying with DOC-PS2	-	6	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

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								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.										
								Wind exposure category			Wind exposure category			Siding	K_z						
Product	Product Thickness (inches)	Fastener Type	Fastener Spacing (inches)	Frame Type	Stud Spacing (inches)	Weather Exposure (in.)	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}
HardieShingle Individual Cladding Shingles	1/4	0.091 in. shank X 0.221 in. HD X 1.5 in.long siding nail	2 siding nails 5.5 inches from butt edge	Minimum 7/16 in. thick OSB sheathing complying with DOC-PS2	-	5	0-15	217	197	179	168	153	139	-68.1	0.7	0.85	1.03	h≤60	1	0.85	-1.4	0.18
							20	217	192	175	168	148	135	-68.1	0.7	0.9	1.08		1	0.85	-1.4	0.18
							25	217	187	172	168	145	133	-68.1	0.7	0.94	1.12		1	0.85	-1.4	0.18
							30	217	184	169	168	142	131	-68.1	0.7	0.98	1.16		1	0.85	-1.4	0.18
							35	213	181	167	165	140	129	-68.1	0.73	1.01	1.19		1	0.85	-1.4	0.18
							40	208	178	164	161	138	127	-68.1	0.76	1.04	1.22		1	0.85	-1.4	0.18
							45	205	176	163	159	136	126	-68.1	0.785	1.065	1.245		1	0.85	-1.4	0.18
							50	202	174	161	156	135	125	-68.1	0.81	1.09	1.27		1	0.85	-1.4	0.18
							55	199	172	160	154	134	124	-68.1	0.83	1.11	1.29		1	0.85	-1.4	0.18
							60	197	171	159	153	132	123	-68.1	0.85	1.13	1.31		1	0.85	-1.4	0.18
							100	163	145	136	126	112	105	-68.1	0.99	1.26	1.43	h>60	1	0.85	-1.8	0.18

Coefficients used in Table 6 calculations for V_{ult}

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.