



Product Test Summaries

Nichiha Fiber Cement Products

Sierra Premium™ Boards

Sierra Premium Certifications

Test Summaries

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Nichiha Sierra Premium boards shall meet or exceed requirements of the following:

1. ICC Evaluation Service, Inc. (ICC-ES) Report No. ESR-1694.

ASTM C 1185 Physical Properties Tests

- Date Of Test:** November, 2001
- Test Agency:** RADCO, Inc., Listing & Testing Division (Resources, Applications, Designs and Controls, Inc.)
3220 East 59th Street, Long Beach, CA 90805
- Test Method:** ASTM C 1185 Durability tests including linear variations with change in moisture content, water tightness, wet flexural strength, freeze/thaw, warm water, and heat/rain.
- Test Specimen:** Nichiha SierraPremium™ Fiber Cement Boards
- Specimen Specifications:** *Thickness:* 12mm (nominal 1/2").
Width: Various.
Length: Various.
- Test Procedure:** The test was performed in accordance to ASTM requirements.
- Test Results:** The test results show the Nichiha SierraPremium™ Fiber Cement Boards successfully comply with the requirements specified in the ICC-ES Acceptance Criteria for Fiber Cement for use.

Property	Test Result	Requirement
Linear Variation with change in moisture content	Linear change: 0.098%	Maximum linear change: 3.0%
Water Tightness	No formation of water droplets on underside of the board.	No formation of water droplets on underside of the board.
Flexural Strength Dry Wet Freeze/Thaw (Rf) Warm Water (Rw)	1527 1450 1495 (0.98) 1459 (0.94)	580 580 80 Report Value
Water Absorption (%)	16.53	Report Value
Moisture Content (%)	4.8	Report Value
Freeze/Thaw	No cracks or delamination after 50 cycles.	No cracks or delamination after 50 cycles if freeze/thaw.
Warm Water Resistance	No cracks or delamination after 56 days of warm water conditioning.	No signs of cracks or delamination after 56 days of warm water conditioning.
Heat/Rain Resistance	No damage, cracking or structural failure should be present on the surface of the tested sheets after 25 cycles of heat and rain.	No damage, cracking or structural failure were present on the surface of the tested sheets after 25 cycles of heat and rain.

ASTM E 84/CAN/ULC S102-07 Surface Burning Characteristics

Date Of Test: November, 2001

Test Agency: RADCO, Inc., Listing & Testing Division (Resources, Applications, Designs and Controls, Inc.)
3220 East 59th Street, Long Beach, CA 90805

Test Method: ASTM E 84 Standard test method for surface burning characteristics of building materials, sometimes referred to as the Steiner Tunnel test.

Test Specimen: Nichiha Sierra Premium™ Fiber Cement Boards

Specimen *Thickness:* 12mm (nominal 1/2").

Specifications: *Width:* Various.

Length: Various.

Test Procedure: The boards were physically self-supporting and required no additional sample preparation. Each board measuring 9 inches in width and 96 inches in length were placed end-to-end on the ledges of the tunnel to mark up the 25 feet test sample.

Testing was performed in accordance with ASTM requirements.

Test Results: The test result is shown in the table below.

Test Sample	Maximum Flame Spread (ft.)	Smoke Density
Nichiha Sierra Premium™ Fiber Cement Boards	0	0

ASTM E 228 Physical Properties Tests

- Date Of Test:** January, 2002
- Test Agency:** RADCO, Inc., Listing & Testing Division (Resources, Applications, Designs and Controls, Inc.)
3220 East 59th Street, Long Beach, CA 90805
- Test Method:** ASTM E 228 Test measuring mean coefficient of linear thermal expansion.
- Test Specimen:** Nichiha SierraPremium™ Fiber Cement Boards
- Specimen Specifications:** *Thickness:* 12mm (nominal 1/2").
Width: Various.
Length: Various.
- Test Procedure:** The test was performed in accordance to ASTM requirements.
- Test Results:** The test results show the Nichiha SierraPremium™ Fiber Cement Boards successfully comply with the requirements specified in the ICC-ES Acceptance Criteria for Fiber Cement for use.

Property	Test Result	Requirement
Mean Coefficient of Linear Thermal Expansion	Maximum 3.55×10^{-6} in./in./F	Maximum 1.0×10^{-5} in./in./F

ASTM E 330 Positive & Negative Transverse Load Tests - Wood Frame, 16" o.c.– OSB Sheathing

- Date Of Test:** August, 2001
- Test Agency:** RADCO, Inc., Listing & Testing Division (Resources, Applications, Designs and Controls, Inc.)
3220 East 59th Street, Long Beach, CA 90805
- Test Method:** ASTM E 330 Standard test method for structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.
- Test Specimen:** Nichiha Sierra Premium™ Fiber Cement Boards.
- Specimen Specifications:** *Thickness:* 12mm (nominal 1/2").
Width: 9 inches.
Length: 8 feet.
- Test Panel Structure:** *Support Frame:* 4 feet (1,219mm) in width x 8 feet (2,438mm) in height frames were constructed from 2x4 nominal stud grade (38mm x 76mm) Spruce-Pine-Fir (SPF) placed on 16" o.c.
Frame Cover (Sheathing): 7/16 inch (11mm) Oriented Strand Board (OSB) sheathing was fastened to the frames using 8d nails at 12 inch (305mm) on center in the field and on the perimeter.
Sierra Premium™ Board: At each stud, one (1) 6d nail was used to fasten the Sierra Premium board.
- Test Procedure:**
- The panels were tested both in the positive and negative direction. In the positive direction the pressure was uniformly applied to the panels. In the negative direction the pressure was uniformly applied to the back of the studs and the OSB sheathing.
 - The load was applied by evacuating the air below the test specimen using a vacuum pump. The applied load was measured with a digital manometer capable of reading in 0.1 inch (2.54mm) increments of water column.
 - Deflections were taken using digital dial indicators capable of reading in 0.0001 inch (0.00254mm) increments. Deflection readings were taken at five locations.
 - The loads were applied in increments so that a minimum of six load increments were obtained. The load was held at each load increment for 30 seconds, and then released to zero. Deflection readings were taken at each load increment, and after the load was released (set).
- Test Result:**
- The ultimate loads achieved in each board and the allowable load is shown below.
 - Mode of Failure: In all specimens tested, failure occurred in the frame. The nails used to fasten the bottom plate to the studs withdrew.

Specimen	Positive Load (psf)	Negative Load (psf)
1	156.52	152.88
2	153.40	157.04
3	133.12	161.02
Average	147.68	156.98
Allowable Load	49.23	52.33

ASTM E 330 Positive & Negative Transverse Load Tests - Wood Frame, 16" o.c.– OSB Sheathing, Blind

Date Of Test: November, 2005

Test Agency: RADCO, Inc., Listing & Testing Division (Resources, Applications, Designs and Controls, Inc.)
3220 East 59th Street, Long Beach, CA 90805

Test Method: ASTM E 330 Standard test method for structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.

Test Specimen: Nichiha Sierra Premium™ Fiber Cement Boards.

Specimen *Thickness:* 12mm (nominal 1/2").

Specifications: *Width:* 9 inches.

Length: 8 feet.

Test Panel Structure: *Support Frame:* 4 feet (1,219mm) in width x 8 feet (2,438mm) in height frames were constructed from 2x6 nominal stud grade (38mm x 76mm) Spruce-Pine-Fir (SPF) placed on 16" o.c.
Frame Cover (Sheathing): 7/16 inch (11mm) Oriented Strand Board (OSB) sheathing was fastened to the frames using 6d nails at 4 inch (101.6mm) on center in the field and 12" on center on the perimeter.
Sierra Premium™ Board: At each stud, one (1) #6 wood screw, 2"-long was used to fasten the Sierra Premium™ board, every 8" on center; overlap was 1-1/4".

Test Procedure:

- The panels were tested both in the positive and negative direction. In the positive direction the pressure was uniformly applied to the panels. In the negative direction the pressure was uniformly applied to the back of the studs and the OSB sheathing.
- The load was applied by evacuating the air below the test specimen using a vacuum pump. The applied load was measured with a digital manometer capable of reading in 0.1 inch (2.54mm) increments of water column.
- Deflections were taken using digital dial indicators capable of reading in 0.0001 inch (0.00254mm) increments. Deflection readings were taken at five locations.
- The loads were applied in increments so that a minimum of six load increments were obtained. The load was held at each load increment for 30 seconds, and then released to zero. Deflection readings were taken at each load increment, and after the load was released (set).

Test Result:

- The ultimate loads achieved in each board and the allowable load is shown below.
- Mode of Failure: In all specimens tested, failure occurred in the frame. The nails used to fasten the bottom plate to the studs withdrew.

Specimen	Positive Load (psf)	Negative Load (psf)
1	413.92	276.12
2	408.72	282.36
3	401.96	272.48
Average	408.20	276.99
Allowable Load	136.067	92.33

ASTM E 330 Positive & Negative Transverse Load Tests - Wood Frame, 16" o.c.– OSB Sheathing, Face

- Date Of Test:** November, 2005
- Test Agency:** RADCO, Inc., Listing & Testing Division (Resources, Applications, Designs and Controls, Inc.)
3220 East 59th Street, Long Beach, CA 90805
- Test Method:** ASTM E 330 Standard test method for structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.
- Test Specimen:** Nichiha Sierra Premium™ Fiber Cement Boards.
- Specimen Specifications:** *Thickness:* 12mm (nominal 1/2").
Width: 9 inches.
Length: 8 feet.
- Test Panel Structure:** *Support Frame:* 4 feet (1,219mm) in width x 8 feet (2,438mm) in height frames were constructed from 2x6 nominal stud grade (38mm x 76mm) Spruce-Pine-Fir (SPF) placed on 16" o.c.
Frame Cover (Sheathing): 7/16 inch (11mm) Oriented Strand Board (OSB) sheathing was fastened to the frames using 6d nails at 4 inch (101.6mm) on center in the field and 12" on center on the perimeter.
Sierra Premium™ Board: At each stud, one #8, 2 1/2"-long wood screw was used to fasten the Sierra Premium™ board through the overlap; overlap was 2".
- Test Procedure:**
- The panels were tested both in the positive and negative direction. In the positive direction the pressure was uniformly applied to the panels. In the negative direction the pressure was uniformly applied to the back of the studs and the OSB sheathing.
 - The load was applied by evacuating the air below the test specimen using a vacuum pump. The applied load was measured with a digital manometer capable of reading in 0.1 inch (2.54mm) increments of water column.
 - Deflections were taken using digital dial indicators capable of reading in 0.0001 inch (0.00254mm) increments. Deflection readings were taken at five locations.
 - The loads were applied in increments so that a minimum of six load increments were obtained. The load was held at each load increment for 30 seconds, and then released to zero. Deflection readings were taken at each load increment, and after the load was released (set).
- Test Result:**
- The ultimate loads achieved in each board and the allowable load is shown below.
 - Mode of Failure: In all specimens tested, failure occurred in the frame. The nails used to fasten the bottom plate to the studs withdrew.

Specimen	Positive Load (psf)	Negative Load (psf)
1	406.64	381.68
2	420.68	347.88
3	426.92	379.60
Average	418.08	369.72
Allowable Load	139.4	123.24

ASTM E 119/CAN/ULC S101-07 Fire Resistance of Wall Assembly—Metal Construction

- Date Of Test:** August, 2008
- Test Agency:** Intertek Testing Services
1500 Brigantine Drive, Coquitlam, B.C. V3K 7C1
- Test Method:** ASTM E/CAN/ULC S101-07 Standard practicing for fire tests of building construction and materials.
- Test Specimen:** Nichiha Sierra Premium™ Fiber Cement Boards.
- Specimen Specifications:** *Thickness:* 10mm (nominal 1/2").
Width: 9" trimmed as needed for tests.
Length: 8' trimmed as needed for tests.
- Test Panel Structure** 20-gauge steel studs on 3 5/8" deep track, placed at 16 in. on center. R-13 fiberglass un-faced insulation (4-in thickness) was installed within each stud cavity. Both sides of wall assembly were faced with 5/8" Type-X gypsum wallboards oriented horizontally with joints staggered. Drywall tape was applied to all joints. 15-lb felt paper was installed over gypsum board on the exposed surface with 1/4" staples. Sierra boards were installed, per installation instructions, using 1-5/8" self-tapping screws at each stud.
- Test Procedure:** The test panel was secured to the test fixture in accordance with the requirements of ASTM. The test exposes a wall assembly to a standard fire exposure controlled to achieve specified temperatures throughout a specified time period. The fire exposure may be followed by a standard hose steam test, which subjects the specimen to impact, erosion, and cooling effects of the water stream.
- Test Result:** The wall was evaluated with the exterior (Nichiha face) exposure. The walls successfully endured a 60 minute fire exposure without developing excessive surface temperatures or allowing flaming on the unexposed side of the assembly.

1 Hour Steel-Stud Assembly		
Time (min.)	Exposed Side	Unexposed Side
2:00	Gypsum paper has ignited	
3:45	Gypsum paper is charred and flaking off	
18:00	Drywall mud has fallen off the seams	
20:00	No change	No change
22:45	Flaming at gypsum joints	
25:45		Wall is bowing in
35:00	Gypsum wallboard is cracking	
37:00		Wall is distorting
45:00	No change	2% behind curve
49:00	Gypsum wallboard is still intact	
54:00	No change	
60:00	No change, test discontinued	No change

ASTM E 119/CAN/ULC S101-07 Fire Resistance of Wall Assembly—Wood Construction

- Date Of Test:** August, 2008
- Test Agency:** Intertek Testing Services
1500 Brigantine Drive, Coquitlam, B.C. V3K 7C1
- Test Method:** ASTM E/CAN/ULC S101-07 Standard practicing for fire tests of building construction and materials.
- Test Specimen:** Nichiha Sierra Premium™ Fiber Cement Boards.
- Specimen Specifications:** *Thickness:* 10mm (nominal 1/2").
Width: 9" trimmed as needed for tests.
Length: 8' trimmed as needed for tests.
- Test Panel Structure:** 2" x 4" Douglas Fir studs placed at 16" on center. R-13 fiberglass un-faced insulation was installed within each stud cavity. Both sides of the wall were faced with 5/8" Type-X gypsum wallboard with staggered joints. Drywall tape was applied to all joints. 15-lb felt paper was installed horizontally, with 6 inch overlap, over the gypsum wallboards on the fire side of the wall assembly using 1/4" staples. Sierra boards were installed, per installation instructions, using 8D common nails over each stud.
- Test Procedure:** The test panel was secured to the test fixture in accordance with the requirements of ASTM. The test exposes a wall assembly to a standard fire exposure controlled to achieve specified temperatures throughout a specified time period. The fire exposure may be followed by a standard hose steam test, which subjects the specimen to impact, erosion, and cooling effects of the water stream.
- Test Result:** The wall was evaluated with the exterior (Nichiha face) exposure. The walls successfully endured a 60 minute fire exposure without developing excessive surface temperatures or allowing flaming on the unexposed side of the assembly. The data is shown below. At the conclusion of the 60 minute fire exposure, the maximum unexposed surface temperature was 163°F, and the maximum average surface temperature was 156°F. The wall met the requirements for a 1 hour fire resistance rating under load bearing conditions of 300 lb./ft.

1 Hour Wood-Stud Wall Assembly		
Time (min.)	Exposed Side	Unexposed Side
0:00		3150 psi load applied
0:50		Unexposed temperatures started
5:30	Gypsum surface charred	
9:00	Gypsum tape is beginning to fall away	
29:30	Flaming at the seam	Holding 3150 psi load
45:00	Area behind curve is 0%	Holding 3150 psi load
56:00		Wall is bowing slightly
58:00		Load reduced to 2850 psi
60:00	No change, test discontinued	

WUI 12-7A-1 Exterior Wildlife Exposure—Exterior Wall Siding and Sheathing

Date Of Test: March, 2009

Test Agency: Intertek Testing Services
16015 Shady Falls Road, Elmendorf, TX 78112

Test Method: ASTM E/CAN/ULC S101-07 Standard practicing for fire tests of building construction and materials.

Test Specimen: Nichiha Sierra Premium™ Fiber Cement Boards.

Specimen Specifications: *Thickness:* 10mm (nominal 1/2").
Width: 9" trimmed as needed for tests.
Length: 8' trimmed as needed for tests.

Test Panel Structure: Frame was built using #2 SYP 2 x 4 studs at 16" on center. Vertical seams in the OSB were located over both of the interior studs. A layer of Type-X Gypsum Wall board was installed over the OSB and was secured with Grabber 2" screws along edged and along studs. 15-lb felt paper was installed horizontally over the wallboard with a 4" overlap using 1/2" staples. The shake boards were cut in half and installed over the outer surface of the wall, per installation instructions, using 2"-long 6D nails in a blind-nailing technique.

Test Procedure: The test was conducted in ambient airflow, with the 40" burner positioned in the center of the exterior wall of the assembly 3/4" from the cladding, in compliance with the standard. The propane gas flow to the burner was monitored constantly with a flow meter for the length of the test.

Test Results: Starting time, ambient temperature and humidity at the beginning of test, and observations for test are presented below.

Ambient Temperature and Humidity - 63 °F and 76% RH, respectively	
Time (min.)	Test Observation
0:00	Test Initiated at 8:49 am on March 4th
0:20	The propane flow setting was 4.3 SCFM, corresponding with 150 +/- kW output.
3:00	Flames on the cladding side ranged from 3 1/2' to 4 1/2' high; the cladding was blackening; there was no evidence of flame penetration through the wall
10:00	There was no flame penetration through the wall or evidence of glowing combustion on the interior surface
70:00	There was no flame penetration through the wall or evidence of glowing combustion on the interior surface