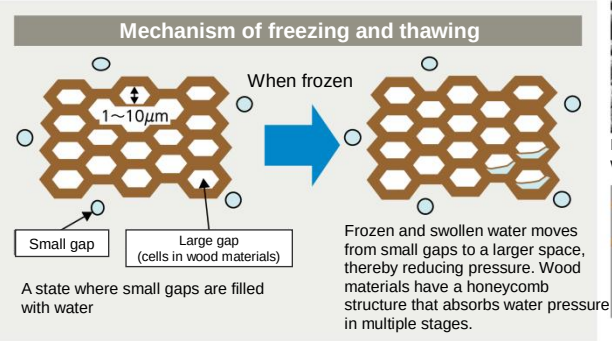
Characteristics of Offset Sidings (COOL/Nichiha EX Series/Nichiha Fiber Cement Facade Product W)

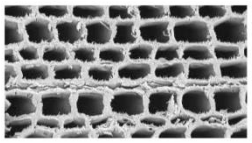
The Offset Sidings made by Nichiha are a base material having superior frost damage resistance, dimensional stability, and formability. It uses the dry mold method with wood-based materials as fiber reinforcements. The dry mold method is a press molding manufacturing method where wood-based materials and cement are mixed with a small amount of water.

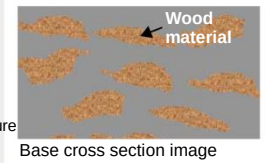
OS Offset Siding

1 Frost damage resistance

Water contained in minute gaps in the siding swells when frozen, and if there is no excess space for the increased volume, the siding will swell, causing frost damage.
The wood materials used for the Offset Sidings have a honeycomb structure, which absorbs and reduces the pressure from freezing.




Honeycomb structure of continuous wood material cells like pipes



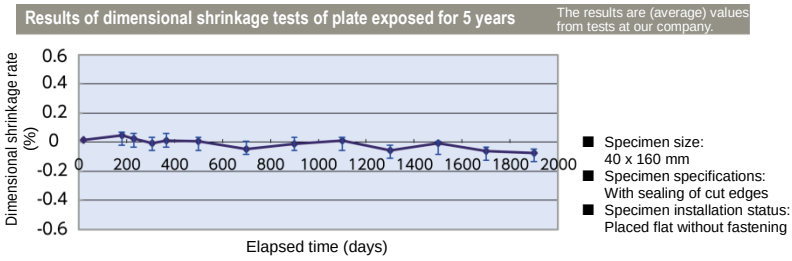
Base cross section image

Moreover, sidings may suffering cracking or peeling of the coating if they contain excessive moisture.
The Offset Sidings adopt a base design that minimizes water absorption, while the front and back surfaces are thoroughly painted, which makes it less affected by moisture.
After 600 cycles of a test for the resistance of outer materials to freezing and thawing (test method stipulated in JIS)*1, peeling of the surface coating or delamination, as well as change in thickness, hardly occur.

*1 Resistance to freezing and thawing of fiber reinforced cement sidings in JIS A 5422: In tests for the resistance of fiber reinforced cement sidings to freezing and thawing by repeating 200 cycles of freezing in air (at −20˚C) and thawing in water, the surface peeling area ratio shall be 2% or less, with no remarkable delamination, and the thickness change ratio shall be 10% or less.

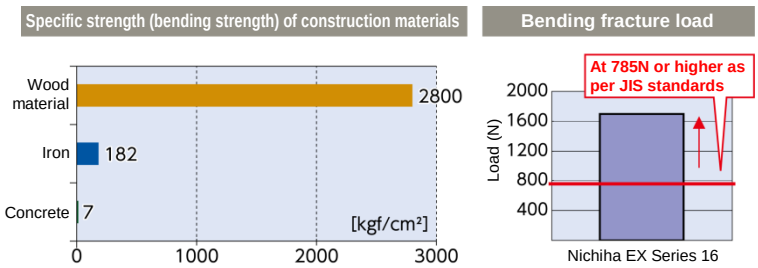
2 Dimensional stability

Using autoclave curing for rapid hardening in a high-temperature and high-pressure furnace, this product has a stable base material structure that is resistant to swelling due to heat/water absorption, as well as shrinkage by drying. Moreover, the front and back surfaces are thoroughly painted, making it resistant to effects from moisture or dryness.



3 High strength

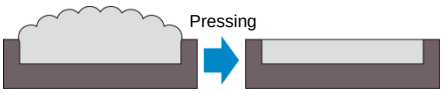
Wood-based materials are used as fiber reinforcements for Offset Sidings. Iron and concrete are generally considered to have higher strength than wood, but when comparing specific strength, wood is stronger against bending than iron or concrete, by 15.4 times and 400 times, respectively.
(The specific strength is calculated by dividing strength by specific gravity. Materials with a higher specific strength have a higher strength for the same specific gravity.)



Source: Wood and Japanese Housings, Japan Housing and Wood Technology Center

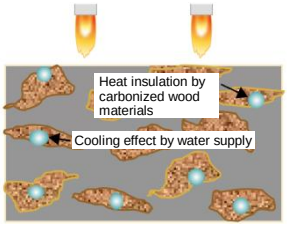
4 Formability

Offset Sidings as a base material for dry methods have little moisture in the material, causing a puffy cotton-like state, which enables higher bulkiness when sprinkling materials onto the frame plate. When sprinkling a bulky material onto the frame plate and pressing it, the material will extend through the fine embossed areas, thus achieving the sharp texture of stone materials, or strictly reproducing a wooden vessel.



5 Fire resistance

Wood materials are usually considered to be flammable, unlike iron materials. However, iron materials may experience a drop in strength to 20% or less when the flame heat exceeds a certain temperature. In contrast, wood materials are confirmed to maintain about 80% of their strength under the same conditions. This is due to the heat insulating property of the carbonized surface of a wood material, preventing heat from reaching the center of the material. Leveraging such property, sidings may have superior fire resistance as a semi-non-combustible material when the wood materials contained in sidings are carbonized, and serve as heat insulating materials.



Fiber reinforced cement sidings having excellent overall functionality required for outer walls

The outer walls of buildings are required to have various performances, such as fire-prevention, fire-resistance, wind- and water-proofing, heat insulation, durability and workability, in addition to complying with related laws and regulations including the Building Standards Act.

Easy work with a regular size outer wall material with the ship-lap (halving) connection

Sealing joints will be partially used at areas around doors, windows and corners.

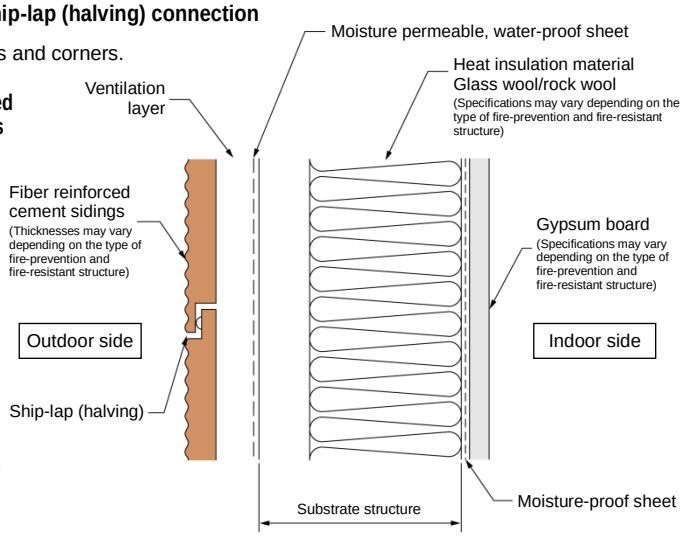
Certifications for fire-prevention and fire-resistance will be obtained for the entire wall structure, together with heat insulation materials and indoor fire prevention coatings (such as gypsum board).

Nichiha has standardized the "Outer wall ventilation structure method" to prevent rainwater from infiltrating and discharging moisture within the wall body.

By using outer wall materials and moisture-permeable, water-proof sheets as the primary and secondary water-proofing measures, respectively, and establishing a ventilation layer between the permeable, water-proof sheets and outer wall materials, the following benefits can be expected:

① Inhibiting rainwater infiltration
② Releasing moisture to inhibit condensation within the wall body
③ Insulating heat in the summer season

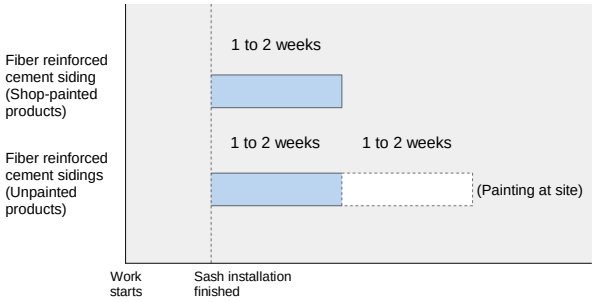
All of the above help improve building durability.
Nichiha's fiber reinforced cement sidings are outer wall materials that truly contribute to excellent overall wall performance.



Achieving speedy work by the dry construction method

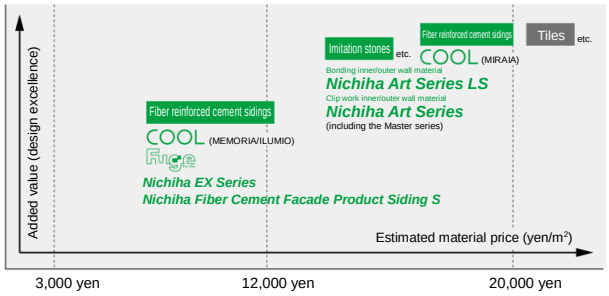
Fiber reinforced cement sidings using the dry construction method require only a short curing period at the construction site, thus speeding up the process without being affected by indoor work. Shop-painted products require no painting process, further shortening the work period.

■ Standard period for fiber reinforced cement sidings



High cost performance

Fiber reinforced cement sidings deliver excellent cost performance through an integrated balance with product performance and the dry construction method.
The series meets a wide range of needs with its diverse products suited to various applications and designs in price ranges of the same grade.



Materials of the same quality at outside corners, work-related materials, and work processes are separately required.

Rich textures and excellent designs

A combination of unique forming and painting technologies offers a rich variety of surface designs. We offer more than 800 color patterns suitable for almost all constructions.

Designer's Series
A new series of beautiful, durable products.
The series increases the versatility of designing spaces.

Stone pattern
Closely reproduces the delicate textures and tones of natural stones.

Brick/Tile
Luxury designs and sophisticated coloring create an elegant appearance.

Wooden texture/Line
A combination of soft texture and sharp design, where wooden textures are expressed naturally, and lines in a modern fashion.

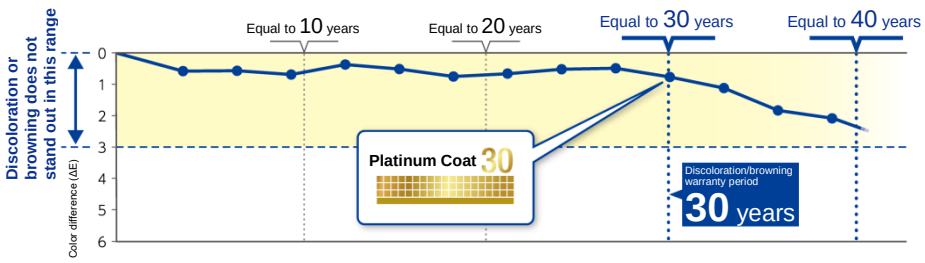
Bases/Flat
A lineup suited to a wide range of outer designs, from Japanese to Western style, and from classic to modern.

“Platinum Coat 30,” an ultra-weather-resistant state-of-the-art paint

Passing our unique strict test criteria!

In-house test results (our unique standards) [Accelerated weathering test (SWOM test)] A test to reproduce a harsh natural environment with strong sunlight, heat, or rain

The Platinum Coat 30 series have demonstrated high weather resistance by passing the strict criteria of our unique accelerated weathering test, and maintain a beautiful appearance for a long time.



What is Platinum Coat 30?

An ultra-weather-resistant state-of-the-art paint. Platinum Coat 30 products bear the following mark.

Platinum Coat 30

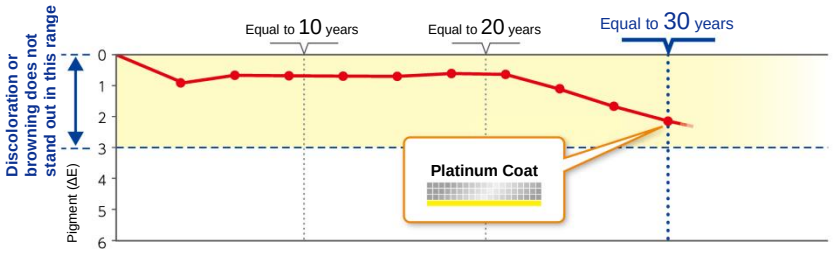
* The above graph shows the performance of a typical Platinum Coat 30. Color difference values may vary depending on the color hues of products.
* The situation may differ depending on the region, environment and usage conditions for buildings. Please consult housing or engineering firms for maintenance schedules.

“Platinum Coat” reduces maintenance repainting costs

Passing our unique strict test criteria!

In-house test results (our unique standards) [Accelerated weathering test (SWOM test)] A test to reproduce a harsh natural environment with strong sunlight, heat, or rain

The Platinum Coat uses an ultra-weather-resistant paint that is an evolution beyond conventional paints.
Its high durability significantly extends the time before repainting is necessary to 10 to 15 years, greatly reducing maintenance costs.



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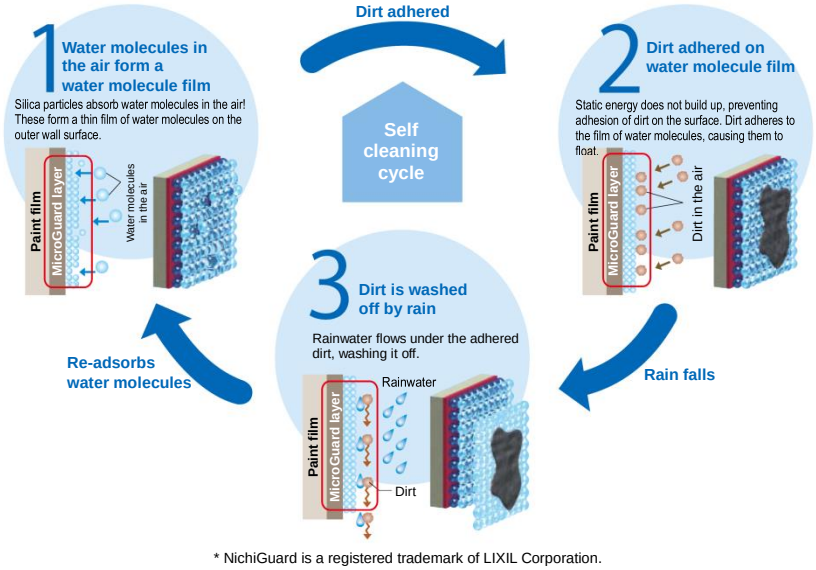
"Self-cleaning function” washing out dirt with rainwater

The “self-cleaning function” of NichiGuard absorbs water molecules in the air to form a thin film of water molecules on the outer wall surface, which prevents dirt from sticking to the wall and enables dirt to be washed off by rain.
Its washing effect does not work sufficiently for algae or mold, and so anti-algae and anti-fungal agents are included to suppress growth on the finished surface.
(Note that their effect was tested by in-house standards only; the anti-algae anti-fungal performance cannot be guaranteed, and may not be permanent.)



What is NichiGuard?

An outer wall material having a self-cleaning function (anti-stain function, or dirt-removing/preventing function). Products bear the following mark.

NichiGuard

* NichiGuard is a registered trademark of LIXIL Corporation.

Caution

NichiGuard effectively prevents staining by exhaust gases, smoke, dust, and soil; however, it may not show satisfactory performance in an environment with large amounts of these substances.
Also, it has less effect on rust and dirt with high density and viscosity. Please check and clean the outer walls frequently.

Wind-resistant performance

We checked the screw extraction strength for steel-frame fastener structures, and tested dynamic loads to confirm the safety of the wind-resistant performance of outer walls where Nichiha products are secured to a steel-frame C-shaped steel furring system fastener structure with clips (including long ones).

Wind pressure tolerance by fastening method

(1) For construction heights of 13 m or less (applying the design wind pressure stipulated by the Japan Fiber Reinforced Cement Sidings Manufacturers Association)

The following table shows the results of wind pressure-resistant tests by the Association.

■ Wind pressure tolerance for a Nichiha product with a height of 13 m or less (negative pressure, in Pa)

Work method / Stud spacing (mm)	General clip	General clip + screw reinforcement	Ventilation long clip*1 (JEL860)	5-mm floating long clip*1 (JEL560)
@606	1402	3521	3810	1685
@500	1699	4267	4600*2	2170*2

*1 The above figure for the long clip is calculated using the results of in-house tests.
*2 Figures calculated using the test results for @606 and @455.

(2) For construction heights over 13 m (applying the wind pressure force tolerance from in-house test results)

The wind pressure force tolerances for the ventilating clip and 5-mm floating clip (metal furring system 15) are as shown in the following table. These tolerances are calculated using the results of in-house tests related to wind pressure resistance.

■ Wind pressure tolerance for a Nichiha product with the height at over 13 m (negative pressure, in Pa)

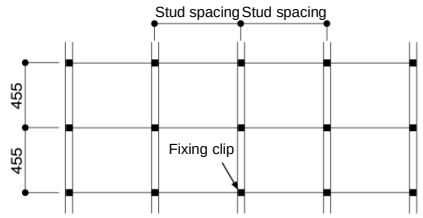
Work method / Stud spacing (mm)	5-mm floating clip (RC, assuming metal furring system)			Ventilation clip (assuming steel frame fastener)		
	Standard clip (JE555)	Long clip (JEL560)	Using clip and screw (JE555 + screw reinforcement)	Standard clip (JE825)	Long clip (JEL860)	Using clip and screw (JE825 + screw reinforcement)
@606	1125	1350	3150	1125	2065	3250
@500	1175*1	1735*1	3320*1	1280*1	2550*1	3700*1
@455	1200	1900	3400	1350	2750	3900
@303	1900	2750	–	1850	4130	–

*1 Figures calculated using the test results for @606 and @455. From in-house test results in 2018.

Overview of construction method

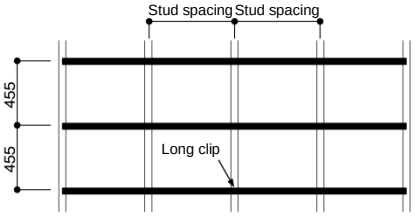
■ Standard clip fastening method

Construction method using a 5-mm floating clip (JE555) or ventilation clip (JE825)



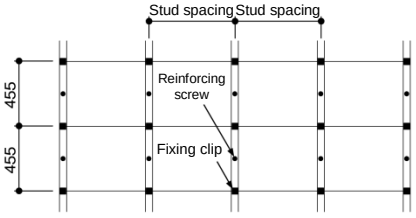
■ Long clip method

Construction method using a 5-mm floating clip (JEL560) or ventilation clip (JEL860)



■ Method of using clips and screws

Construction method combining standard clip fastening method and screw fastening method from the surface



(3) Checking screw extraction strength against steel frame fastener

The screw extraction strength for fastening was measured against the negative wind pressure by steel frame fastener thickness.
The retention strengths for fastening screws against steel frame fastener C-shaped steel with the thickness of 1.6 mm and 2.3 mm are as shown in the following table.

■ Screw extraction strength (in N/screws)

Types and thicknesses of furrings		1.6 mm-thick C-shaped steel	2.3 mm-thick C-shaped steel
Clip fastening screw Stainless steel tapping screw JK1140 (φ4 mm × 19 mm)	Avg.	1979	3874
	Standard deviation (SD)	189	379
Nichiha product fastening screw Stainless steel slimmer tapping screw JK1250 (φ5 mm × 60 mm)	Avg.	2091	4568
	Standard deviation (SD)	183	414

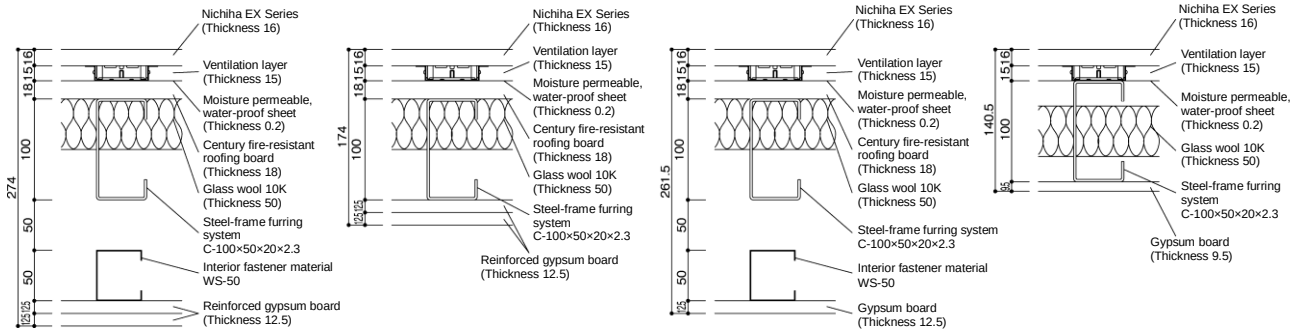
The values in the table show averages and standard deviation (SD) for the case of N=20, not considering the safety factor.

Soundproof performance

We measured sound transmission losses to check the sound insulation performance for the CenturyMoen outer wall fire-resistant structure for steel-frame fastener structure using Nichiha products for the following cases: ❶ 1 hour (with interior fastener material), ❷ 1 hour (without interior fastener material), ❸ 30 minutes (with interior fastener material), and ❹ other structures (samples).

Configuration of outer wall

A complex structure using C-shaped steel-frame furring for steel-frame structure, combined with Nichiha EX Series, Century fire-resistant roofing board, heat insulation material, reinforced gypsum board or gypsum board.



❶ CenturyMoen outer wall fire-resistant structure
1-hour fire-resistant structure (with interior fastener material)
(FP060NE-0194-2(2))

❷ CenturyMoen outer wall fire-resistant structure
1-hour fire-resistant structure (without interior fastener material)
(FP060NE-0194-2(2))

❸ CenturyMoen outer wall fire-resistant structure
30-minute fire-resistant structure (with interior fastener material)
(FP030NE-0192-2(2))

❹ Other structures (Example)

(Figure 1) Configuration of outer wall

Check of soundproof performance

We performed a test in accordance with JIS A 1416 “Acoustics − Method for laboratory measurement of airborne sound insulation of building elements.”

Soundproof performance

Sound transmission losses for CenturyMoen outer wall fire-resistant structures are shown in (Table 1).

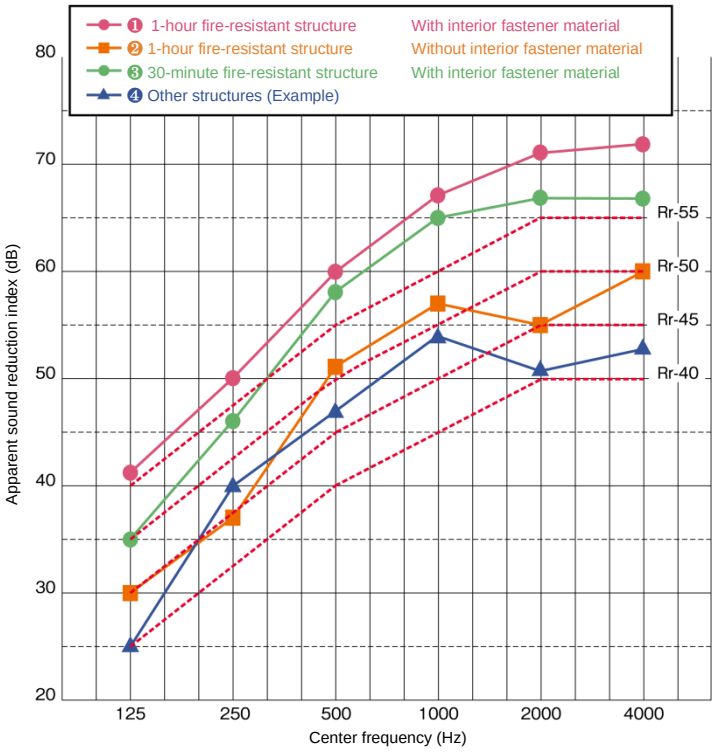


Table 1: Sound Transmission Loss by Structure (in dB)

Center Frequency (Hz)	CenturyMoen outer wall fire-resistant structure			❹ Other structures (Example)
	❶ 1-hour fire-resistant structure With interior fastener material	❷ 1-hour fire-resistant structure Without interior fastener material	❸ 30-minute fire-resistant structure With interior fastener material	
100	40.1	27.0	33.1	21.9
125	39.3	34.3	36.2	27.6
160	42.9	32.7	38.5	33.1
200	47.3	33.2	43.7	36.8
250	50.3	41.9	47.4	41.5
315	54.3	44.9	51.3	42.9
400	58.1	49.3	55.7	45.8
500	59.3	52.6	57.6	47.5
630	62.6	53.0	60.7	50.2
800	64.7	56.4	63.1	54.1
1000	67.1	57.0	64.7	54.5
1250	69.0	57.9	66.4	54.6
1600	69.9	55.0	66.9	51.1
2000	71.3	55.7	68.0	50.7
2500	71.3	55.1	65.6	51.0
3150	71.3	56.8	64.8	50.9
4000	73.4	62.3	68.2	52.2
5000	71.8	66.7	68.8	56.8
Soundproof performance	Rr-55	Rr-45	Rr-50	Rr-40

Testing organization: General Building Research Corporation of Japan

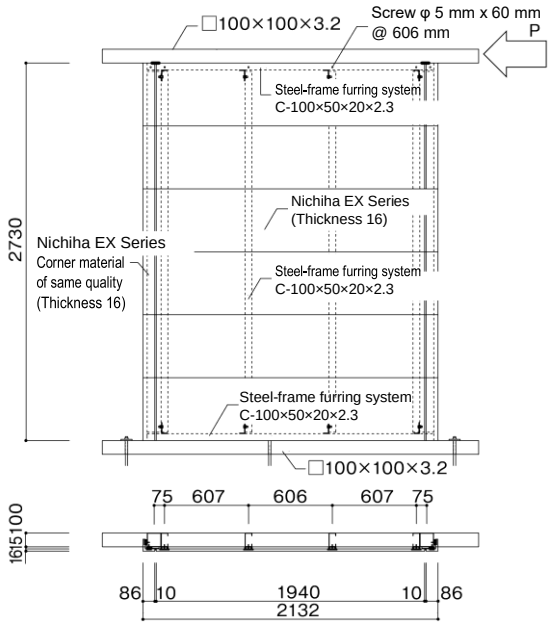
Seismic performance

For seismic safety with the Nichiha product ventilation fixing clip, we checked the trackability of interlaminar deformation for a structure where a buffering effect works for a one-side fixing method with clips used for the siding furring.

Check of seismic performance

We performed a test in accordance with the tie-rod type in-plane shearing method as stipulated in “Procedures for Performance Evaluation of Wooden Bearing Walls and Their Scale Factors” (Japan Housing and Wood Technology Center).
At interlaminar deformation angles of 1/300 rad, 1/200 rad, 1/150 rad, 1/100 rad, 1/75 rad, and 1/50 rad, falling-off of siding or any other abnormality was checked visually.
Specimens have a width of 2132 mm and a height of 2730 mm, and the steel-frame furring system material and sidings were tested using a ventilation fixing clip.
(Figure 1, Table 1)

Figure 1: Specimen drawing



Testing organization: Japan Housing and Wood Technology Center

Table 1: Siding Work Method

Work method	Fastener requirement	Siding size (mm)
Horizontally sticking	Ventilation fixing clip	16×455×1940

Table 2: Test Results for Interlaminar Deformation Angles

Interlaminar deformation angle (rad)					
1/300	1/200	1/150	1/100	1/75	1/50
No siding falling-off No other abnormality					

With the interlaminar deformation angle of up to 1/50 rad, no siding fell off and no other abnormality was found.
This result satisfies the requirement for the interlaminar deformation angle of 1/200 rad or less during medium-scale earthquakes. Therefore, steel frame structures having a mitigated requirement of 1/120 rad from the perspective of structural resistance can be considered to satisfy the same performance requirement. Thus, the ventilating clip work method has a high deformation tracking performance and excellent seismic resistance.

Heat insulation performance

We checked the heat transmission resistances and coefficients for heat insulation performance of steel-frame fastener structure using Nichiha products for the following cases: ❶ CenturyMoen outer wall fire-resistant structure (1 hour), ❷ CenturyMoen outer wall fire-resistant structure (30 minutes) and ❸ Other structures (Example).

Configuration of outer wall

A complex structure using C-shaped steel-frame furring for steel-frame structure, combined with Nichiha EX Series, Century fire-resistant roofing board, heat insulation material, reinforced gypsum board or gypsum board.

Calculation of heat insulation performance

Heat transmission resistance and coefficient were calculated with the following formula, using thicknesses and heat conductivities for various materials.

Heat resistance (R)
= Material thickness (d)/Material heat conductivity (λ)

Heat transmission resistance (R_t)
= Heat transfer resistance (indoor side) (R_{si}) +
∑ Heat resistance (R_n) + Heat transfer resistance (R_{so})

Heat transmission coefficient (K)
= 1/Heat transmission resistance (R_t)

The higher the heat transmission resistance (R_t), or the lower the heat transmission coefficient (K), the higher the heat insulation performance will become.

Heat insulation performance

Table 2 shows the heat transmission resistances and heat transmission coefficients for the following cases: ❶ CenturyMoen outer wall fire-resistant structure (1 hour), ❷ CenturyMoen outer wall fire-resistant structure (30 minutes) and ❸ Other structures

Table 1: Heat Conductivity of Materials

Material used (mm)	Material thickness (d) (m)	Heat conductivity (λ) (W/(m·K))	Heat resistance (R) (m^2·K/W)
Nichiha EX Series	0.016	0.26*1	0.061
Ventilation layer (thickness 15)	0.015	–	0.066
Century fire-resistant roofing board (thickness 18)	0.018	0.15	0.12
Gypsum board (thickness 9.5)	0.0095	–	0.043
Gypsum board (thickness 12.5)	0.0125	–	0.060
Reinforced gypsum board (thickness 12.5)	0.0125	–	0.060
Ventilation layer (thickness 25)*2	0.025	–	0.075
Insulation material (glass wool 10K) (thickness 50)	0.05	0.043	1.163
Heat transfer resistance (indoor side) (Rsi)	–	–	0.111
Heat transfer resistance (outdoor side) (Rsi)	–	–	0.043

*1 Test method: JIS A 1412 Test organization: Nagoya Municipal Industrial Research Institute
*2 The ventilation layer (Thickness 25) is multiplied by 2 (Ventilation layer (thickness 50) for calculation.

Reference: Compilation of Architectural Design Materials (edited by Architectural Institute of Japan), Condensation in Construction (by Masashi Yamada) (Institute for Building Environment and Energy Conservation)

Table 2: Heat Transmission Resistance and Coefficient for Nichiha Product Outer Wall Structure

	❶ CenturyMoen outer wall fire-resistant structure (1 hour)	❷ CenturyMoen outer wall fire-resistant structure (30 minutes)	❸ Other structures (Example)
Heat transmission resistance (Rt) (m^2·K/W)	1.83	1.77	1.64
Heat transmission coefficient (K) (W/(m^2·K))	0.55	0.56	0.61

(Example).