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*EVALUATION
REPORT*

DIVISION 03820

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Re-Evaluation
in process

***Hardibacker (Square Edge), Hardiboard®
(Tapered Edge), Hardibacker Multilay® /
Hardiplank® Lap Siding / Hardie®
Shingleside® Cladding***

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1. Purpose of Evaluation

The proponent sought confirmation from the Canadian Construction Materials Centre (CCMC) that "Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®" can serve as a backerboard, wall and ceiling finish board and underlay, and "Hardiplank® Lap Siding, Hardie®

This Report contains no endorsement, warranty, or guarantee, expressed or implied, on the part of the National Research Council of Canada for any evaluated material, product, system or service described herein. NRC accepts no responsibility for the performance of any product described herein if manufactured and/or used outside the purpose of the CCMC evaluation. Readers should not infer that NRC has evaluated the product for any purpose or characteristic other than stated herein.

Shingleside® Cladding” as a cladding, in compliance with the intent of the National Building Code of Canada (NBC) 1995.

2. Opinion

Subject to the limitations and conditions stated in this report, test results and assessments provided by the proponent show that “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay® / Hardiplank® Lap Siding / Hardie® Shingleside® Cladding” complies with CCMC’s Technical Guide for Fibre Reinforced Cementitious Board, Masterformat number 03570, dated 96-04-04, and “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” provides a level of performance equivalent to that required in:

- NBC 1995 Article 9.29.5.2.
Article 9.29.10.4.
Article 9.30.2.2.

and “Hardiplank® Lap Siding / Hardie® Shingleside® Cladding” provides a level of performance equivalent to that required in:

- NBC 1995 Subsection 9.27.8.

Ruling No. 95-17-36-(12678-R) authorizing the use of “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on November 29, 1995 pursuant to s.29 of the *Building Code Act, 1992* (see Ruling for terms and conditions).

Canada Mortgage and Housing Corporation permits the use of this product in construction financed or insured under the National Housing Act.

3. Description

“Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay® / Hardiplank® Lap Siding / Hardie®

Shingleside® Cladding” are fibre-cement boards made mainly of hydraulic cement, and reinforced integrally with cellulose fibres.

“Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®”

“Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” boards are manufactured 1219, 1524, 2438, 2743, and 3048 mm long, 914 and 1219 mm wide, and 6, 7.5, 9, and 11 mm thick. “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” boards have a smooth finished surface and either square edges or tapered edges to provide closely butted joints.

“Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” fibre-cement boards and their installation are illustrated in Figures 1 and 2.

“Hardiplank Lap Siding”

“Hardiplank Lap Siding” boards are manufactured 3657 mm long and 101, 152, 190, 203, 209, 241, and 304 mm wide, and 7.5 mm thick. The boards are available in smooth, roughsawn and woodgrain face texture.

Additional product lengths and widths may be available from the manufacturer by special order.

“Hardiplank® Lap Siding” boards and their installation details are illustrated in Figures 3, 4, 5, 6 and, 7.

“Hardie® Shingleside® Cladding”

“Hardie® Shingleside® Cladding” cladding is manufactured 457 mm long and 152, 203, 304 mm wide, and 6 mm thick. The cladding is available in a woodgrain texture.

“Hardie® Shingleside® Cladding” cladding and its installation details are illustrated in Figures 8 and 9.

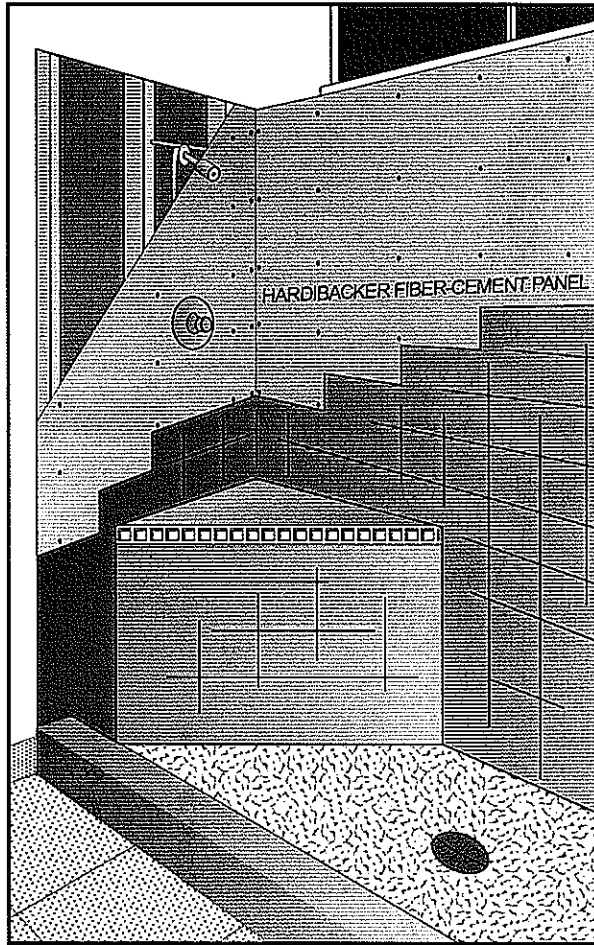


Figure 1. "Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®" board

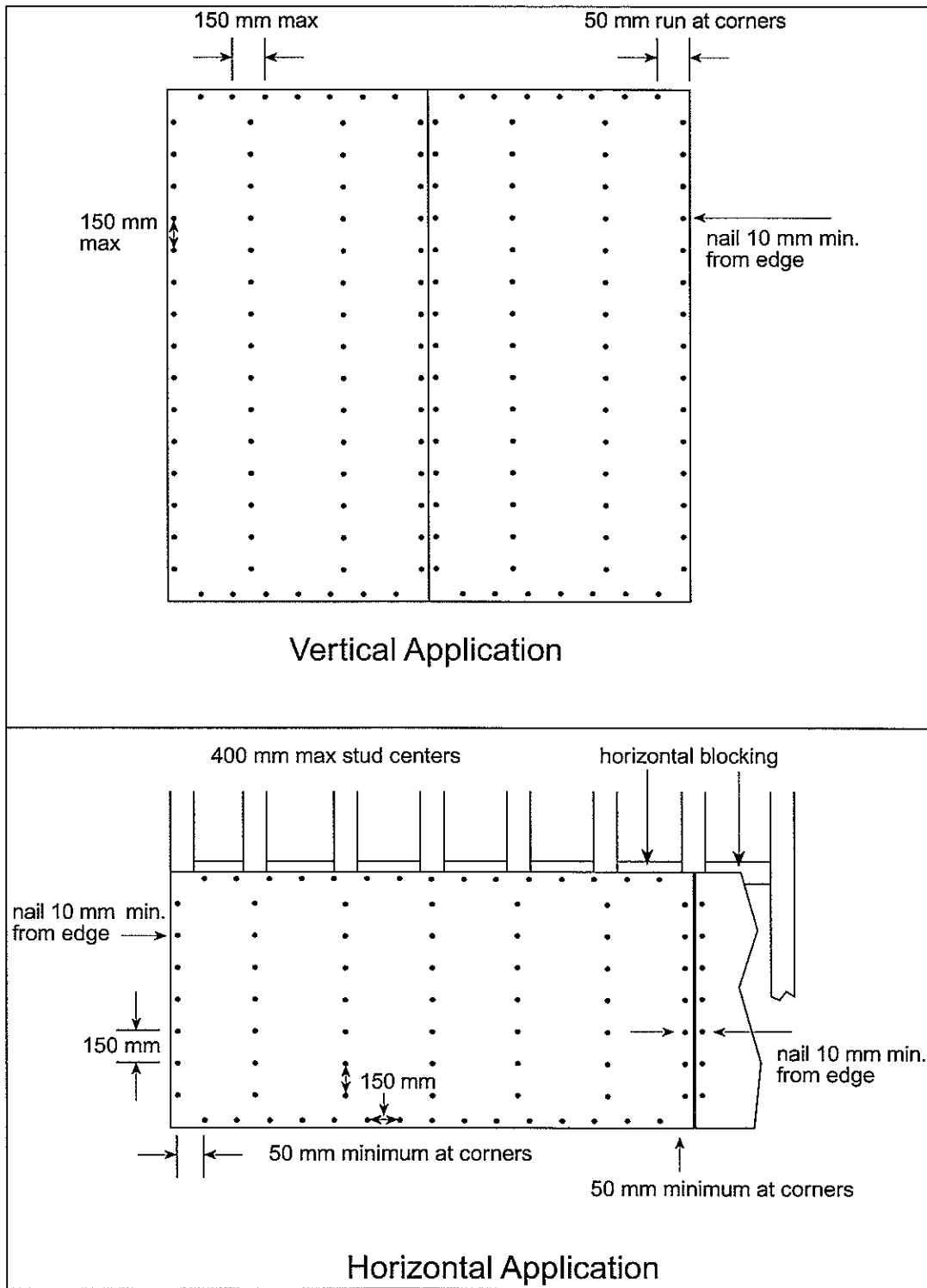


Figure 2. Detail of installation of "Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®" boards

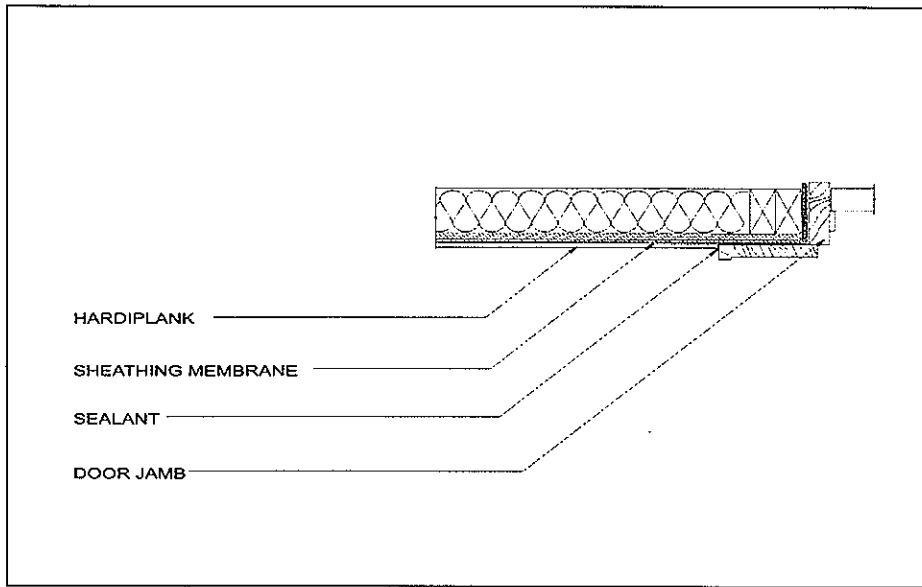


Figure 3. Section detail at door jamb with oversized door molding

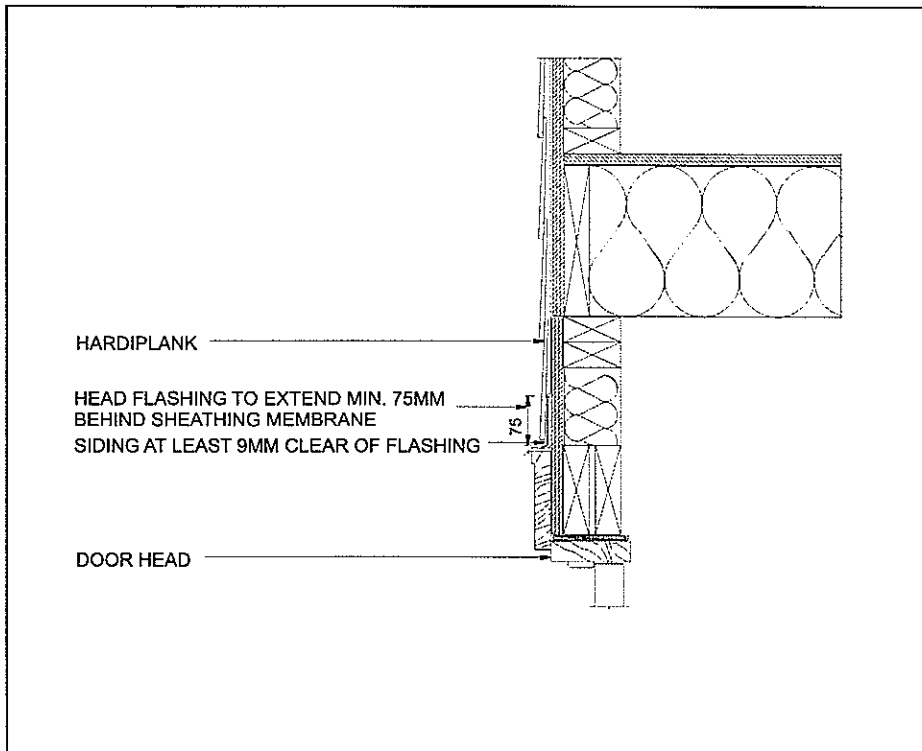


Figure 4. Section detail at door head with oversized door molding

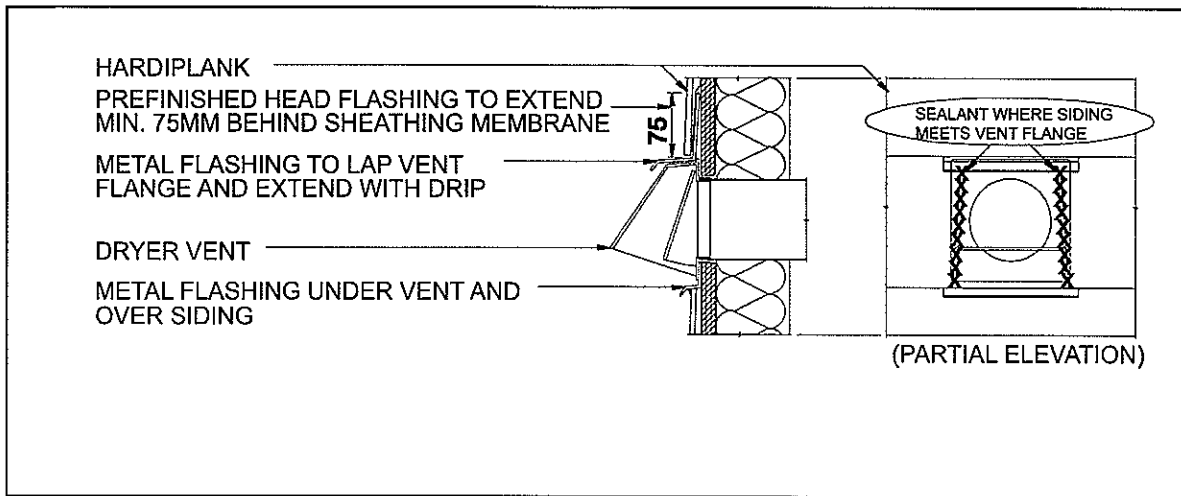


Figure 5. Section detail at dryer vent with lapped flashing under siding

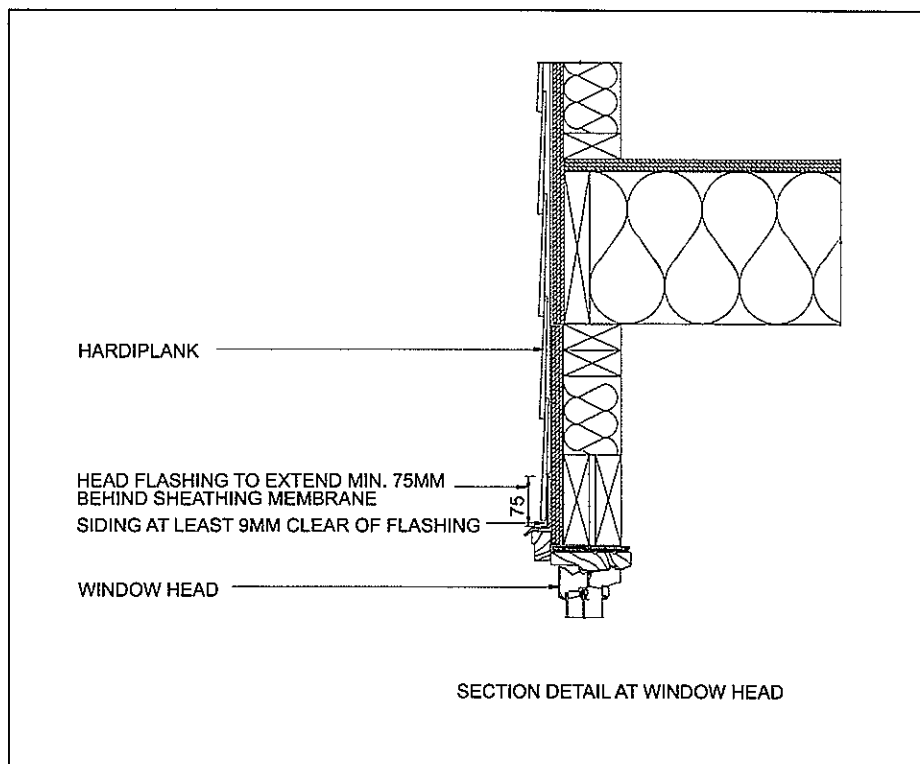


Figure 6. Section detail at window head with standard window molding

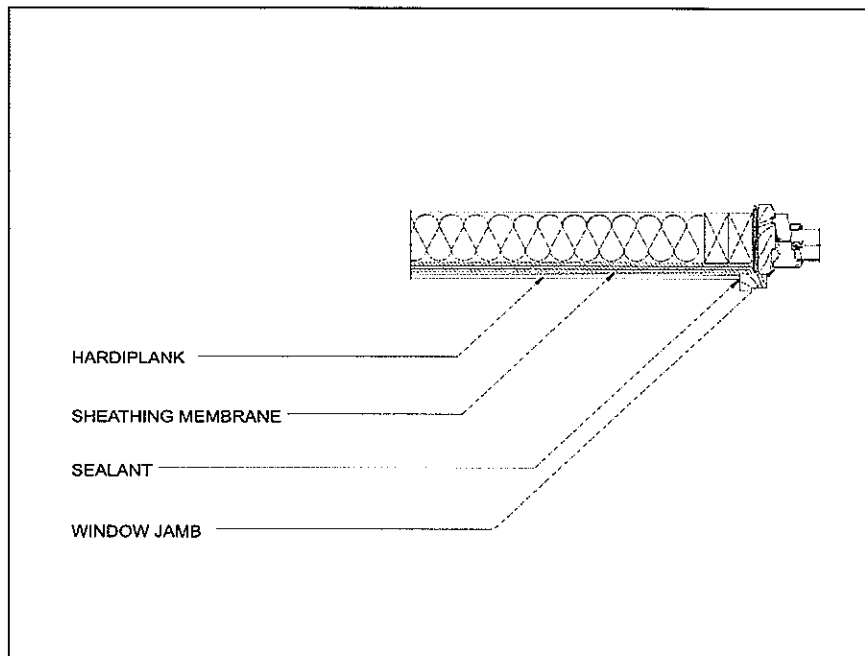


Figure 7. Section detail at window jamb with standard window molding

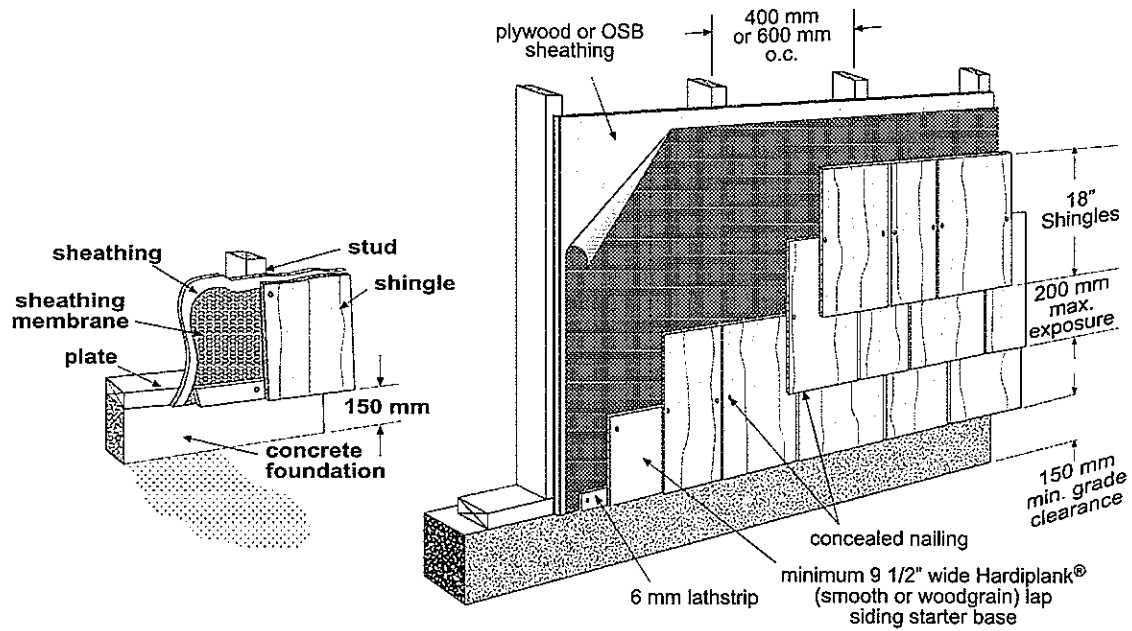


Figure 8. Detail of installation of Hardie® Shingleside® Cladding (Grade Clearance), (Framing Requirements)

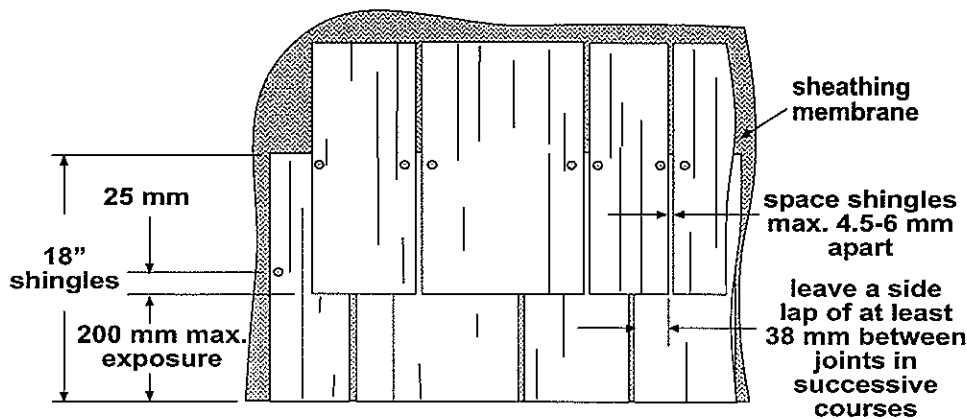


Figure 9. Detail of installation of Hardie® Shingleside® Cladding (Shingle Spacing)

4. Usage and Limitations

“Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®”

“Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” may be used on wood or metal studs as a backerboard for ceramic tile installations around showers, tubs and other wet areas; as a wall and ceiling finish board; and as an underlayment for tiles or resilient flooring subject to the following conditions:

- “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” is unaffected by water, but it is not impermeable. Any area behind the “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” board that must be kept totally dry must be protected by an impermeable membrane.
- When “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” is used as an interior wall finish, it shall not be considered as providing bracing as per Clause 9.23.10.2.(2)(a) of the NBC 1995.
- “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” may be used in applications where a board is required to have a surface flame-spread rating of not more than 25.

- “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” may be used in walls requiring a fire-resistance rating only if the wall assembly has been fire rated with “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®” board.

“Hardiplank® Lap Siding / Hardie® Shingleside® Cladding”

“Hardiplank® Lap Siding / Hardie® Shingleside® Cladding” are intended for use as an exterior cladding applied directly to vertical walls of masonry/concrete as well as cementitious and wood sheathing boards that are attached to wood or steel framing, in new and retrofit construction subject to the following conditions:

- “Hardiplank® Lap Siding / Hardie® Shingleside® Cladding” are permitted in the construction of buildings required to be of combustible or noncombustible construction in accordance with Articles 3.2.3.7. and 9.10.14.11. of the NBC 1995.
- At least one layer of wall sheathing membrane conforming to Article 9.23.17.1. of the NBC 1995 must be applied beneath “Hardiplank® Lap Siding / Hardie® Shingleside® Cladding”
- The air space between the substrate and the “Hardiplank® Lap Siding / Hardie® Shingleside® Cladding” that is created as a

result of the overlap of the cladding boards shall remain unobstructed.

- The installation of "Hardiplank® Lap Siding / Hardie® Shingleside® Cladding" must meet the requirements of the NBC 1995, Subsection 9.27.3., Flashing, Subsection 9.27.4., Caulking and Subsection 9.27.5., Attachment of Cladding.
- "Hardiplank® Lap Siding / Hardie® Shingleside® Cladding" must be used in conjunction with materials conforming to Subsections 9.23.17., Wall Sheathing Membrane, 9.27.3., Flashing, 9.27.4., Caulking, and Subsection 9.27.5., Attachment of Cladding.
- The possibility of moisture accumulation within the wall construction is mainly a function of the level of workmanship related to the elements constituting the second line of defence* such as wall sheathing membrane, flashing, caulking and attachment of siding. A high level of quality control at all stages of the exterior wall construction is imperative for obtaining an acceptable performance.
- The requirements of the NBC 1995, Subsection 9.10.15. for Fire Stops in Concealed Spaces, shall be respected.
- The designer shall ensure that the wind pressure indicated in Table 9, when suitably factored in accordance with Part 4 of the NBC 1995, shall not be exceeded.
- This evaluation covers textured, uncoated or painted products. Low permeance coatings may affect the drying potential of the product as well as the substrate on which it is installed. Such a situation could lead to premature deterioration of the substrate and other elements in the wall assembly. The manufacturer's recommendations for type and characteristics of coatings to be used in conjunction with the cladding must be followed.
- The product must be installed in accordance with the manufacturer's current instructions.

- This Evaluation Report is applicable only to products identified with the following: "CCMC # 12678-R."

5. Performance

Testing and assessments were conducted by independent laboratories and consultants recognized by the Canadian Construction Materials Centre.

The results of testing "Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®" are summarized in Tables 1, 2, 3, 4, and 5.

The results of testing "Hardiplank Lap Siding" are summarized in Tables 6, 7, 8, and 9.

The results of testing "Hardie® Shingleside® Cladding" are summarized in Tables 6, 7, 8, 10 and 11.

- * Cladding provides the "primary line of defence" against the ingress of water into a wall assembly. Careful installation and detailing of the cladding helps ensure the cladding's ability to provide adequate control of water penetration.

However, experience has shown that no matter how much precaution is taken, water penetration can occur through the cladding. If this water is not managed and drained towards the outside by a "second line of defence" to protect the inner fabric of the wall assembly, premature failure of the assembly can occur. Coastal and wet, humid areas are particularly prone to building envelope failures when cladding is installed without, or with an inadequate, "second line of defence" to protect the inner fabric of the wall assembly.

The "Hardiplank Lap Siding" cladding system design was assessed as to having a suitable second line of defence (i.e. an airspace behind the cladding). A field investigation by a third party having expertise in building envelope design was conducted on several buildings located in areas with high annual rainfall.

Note. For further information on rain penetration control see the following articles published by the Institute for Research in Construction: "Evolution of Wall Design for

Controlling Rain Penetration," Construction Technology Update No. 9, and "CCMC evaluation of exterior claddings," Construction Innovation, Volume 2, Number 2, Fall 1996.

Table 1. Test Results for material physical properties "Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®

Backerboard, Wall and Ceiling Finish, Underlayment

Property	Requirements	Results
Length and Width Tolerances (mm)	± 3.3	2 1
Thickness Tolerance (mm)		0.8
(3.5 - 5)	± 0.5	
(>5 - 10)	± 1.0	
(>10 - 16)	± 1.3	
(>16 - 20)	± 1.5	
Squareness (mm/m)	± 3.0	0.81
Water Absorption % (by mass)	≤ 40	29.9
Density (kg/m ³)	≥ 950	1358

Backerboard

Table 2. Test Results of "Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®

Property	Requirements	Results
Humidified Deflection	1/360	Passed
Dimensional Change at 50 - 90% RH (%)	< 0.20	MD 0.22* XD 0.20
Flexural Strength (MPa)	> 5.17	11.9
Lateral Fastener Resistance (N)	≥ 400	1056
Fastener Pull Resistance (N)	28 Z **	551.1

* The product is deemed to have met the intent of the Dimensional Change requirements.

** Z is the board thickness in millimetres.

Wall and Ceiling Finish

Table 3. Test Results of "Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®

Property	Requirements	Results
Humidified Deflection	1/360	Passed
Dimensional Change at 50 - 90% RH (%)	< 0.20	MD 0.22* XD 0.20
Hardness (N)	≥ 67	
Core		217.0
End		437.8
Edge		398.2
Lateral Fastener Resistance (N)	≥ 400	1056
Fastener Pull Resistance (N)	≥ 89	551.1
Flexural Strength (MPa)	> 5.17	11.9
Edge Formation (mm)	0.4 to 1.9 less than average thickness	Passed
Mildew and Fungus Resistance	No growth	Passed
Concentrated Load (N)	> 750 max. residual deflection < 10% of total deflection or 1/4000 of span	Passed**
Uniform Load (Pa)	> 479 max. deflection 1/240 & residual deflection < 10% of max. deflection	Passed***
Impact Loads (mm)	1.9 max. indentation for easily repairable surfaces 1 mm otherwise min. failure load No damage min. failure load	Passed†

* The product is deemed to have met the intent of the Dimensional Change requirements.

** This test has been conducted in accordance with a different test method than the one specified in the Technical Guide; however, the test results obtained are deemed to meet the specified requirements of the Guide.

*** The 11.9 (MPa) in Flexural Strength of the product is deemed to meet the requirements for the Uniform Load.

† The product has been subjected to hard body impact of 5.42 N·m, and 10.85 N·m and soft body impact of 10.17 N·m, and 20.34 N·m. The product is deemed to have met the intent of the specified requirements.

Underlayment

Table 4. Test Results of “Hardibacker (Square Edge), Hardiboard® (Tapered Edge), Hardibacker Multilay®

Property	Requirements	Results
Hardness (N)	≥ 2200	Passed
Edge Thickness Swelling (%)	≤ 1	0.01
Compressive Strength (N)	> 450 2 mm max. residual indentation	Passed*
Fastener Pull Resistance (N)	≥ 89	551.1
Lateral Fastener Resistance (N)	≥ 400	1056
Dimensional Change at 50 - 90% RH (%)	< 0.20	MD 0.22 XD 0.20
Impact loads (mm)	1.9 max. indentation for easily repairable surfaces 1 mm otherwise min. failure load no damage min. failure load	Passed**

* This test has been conducted in accordance with a different test method than the one specified in the Technical Guide; however, the test results obtained are deemed to meet the specified requirements of the Guide.

** The product has been subjected to hard body impact of 5.42 N·m, and 10.85 N·m, and soft body impact of 10.17 N·m and 20.34 N·m. The product is deemed to have met the intent of the specified requirements.

Table 5. Fire Performance Characteristics

Property	Requirement	Results
Noncombustibility	Meets the acceptance criteria of CAN4-S114	Noncombustible*
Flame Spread Rating and Smoke Developed Classification	Report Value as determined in Conformance with CAN/ULC-S102	≤ 5** ≤ 10**

* This test has been conducted in accordance with ASTM E 136, “Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.” In the opinion of Inchcape Testing Services, Warnock Hersey, the data provided indicate that the samples tested would meet the requirements of CAN 4-S114 and can be classified as noncombustible.

** This test has been conducted in accordance with ASTM E 84, "Test Method for Surface Burning Characteristics of Building Materials." In the opinion of Inchcape Testing Services, Warnock Hersey, the samples tested will produce the above indicated results if tested in accordance with CAN/ULC-S102, "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies."

Hardiplank Lap Siding/Hardie® Shingleside® Cladding

Table 6. Test Results for material physical properties of "Hardiplank Lap Siding/Hardie® Shingleside® Cladding"

Property	Requirements	Results
Dimensional Tolerance		
Length and Width (mm)	± 5.0	2 1
Thickness Tolerance (mm)	± 1.6	0.8
Squareness (mm/m)	± 4.0	0.81
Water Absorption % (by mass)	≤ 40	29.9
Density (kg/m ³)	≥ 950	1358

Table 7. Test Results for performance requirements of “Hardiplank® Lap Siding/Hardie® Shingleside® Cladding”

Property	Requirements	Results
Dimensional Change at 50 - 90% RH (%)	< 0.20	MD 0.22* XD 0.20
Flexural Strength (MPa)	> 7.0	11.9
Lateral Fastener Resistance (N)	≥ 400	1056
Fastener Pull Resistance (N)	28 Z **	551.1
Freeze-Thaw Cycling (100 cycles as per ASTM C666-92 Method B)	Loss of mass <3% & loss in Flexural Strength <15%	Passed
Watertightness	No formation of drops of water on underside	Passed
Warm Water Resistance	No visible cracks & Reduction in Flexural Strength <15%	Passed
Rain Penetration Resistance	Prevent water entry into the innermost face of the wall	Passed

* The product is deemed to have met the intent of the Dimensional Change requirements.

** Z is the board thickness in millimetres.

Table 8. Test Results for Impact Resistance

Impact Body	Dynamic Mass (kg)	Energy (N·m)	Result
Safety Impact			
Large Soft	50	100	Passed
Hard	1	10	Passed*
Retention of Performance Impact			
Large Soft	50	34	Passed
Small Soft	3	60	Passed
Hard	1	10	Passed**

Note: The test was conducted on Hardipanel, a 1220 mm by 2440 mm by 8 mm panel; the studs spacing was 400 mm on centre. The most unfavorable point for impact was considered to be the point located in the centre of the panel between the studs.

* The impact produced a small indentation less than 5 mm in diameter and less than 1 mm deep. The indentation was not visible but was noticeable to the touch.

** The impact produced a small indentation less than 10 mm in diameter and less than 1 mm deep. The indentation was slightly visible.

Table 9. Test Results for Wind Load Resistance Hardiplank® Lap Siding

Product Width (mm)	Product Thickness (mm)	Fastener Type	Fastener Spacing	Frame Type	Stud Spacing (mm)	Pressure @ Failure (kPa)
≤ 241	7.5	51 mm long with head dia. 7 mm and shank dia. 2.9 mm galvanized siding nail	Through Overlap	2 x 4 wood ²	400	5.08
≤ 241	7.5	50 mm long 6d common galvanized siding nail	Through Overlap	2 x 4 wood ¹	400 600	9.53 4.5
305	7.5	50 mm long 6d common galvanized siding nail	Through Overlap	2 x 4 wood ¹	600	3.60
≤ 305	7.5	Min. No. 8- 18 41 mm long with head dia. 8.2 mm Hi-lo [®] S [®] or S-12 [™] ribbed bugle screws	Through Overlap	Min. No. 16 ga. 35 mm x 75 mm metal C-stud	600	4.43
≤ 191	7.5	64 mm long with head dia. 5.6 mm and shank dia. 2.4 mm galvanized siding nail	Through top edge of plank	2 x 4 wood ²	400	4.39
≤ 210	7.5	50 mm long with head dia. 5.6 mm and shank dia. 2.4 mm galvanized siding nail	Through top edge of plank	2 x 4 wood ²	400	3.93
≤ 241	7.5	No.11 ga. 32 mm long with head dia. 9.5 mm galvanized roofing nail	Through top edge of plank	2 x 4 wood ¹	400 600	6.77 4.41
≤ 241	7.5	Min. No. 8- 18 32 mm long with head dia. 9 mm Hi-lo [®] S [®] or S-12 [™] ribbed Phillips waferhead screws	Through top edge of plank	Min. No. 20 ga. 35 mm x 75 mm metal C-stud	400	8.10

Table 9. Test Results for Wind Load Resistance Hardiplank® Lap Siding (cont'd)

Product Width (mm)	Product Thickness (mm)	Fastener Type	Fastener Spacing	Frame Type	Stud Spacing (mm)	Pressure @ Failure (kPa)
≤ 241	7.5	38 mm long with head dia. 5.7 mm and shank dia. 2.3 mm galvanized siding nail	Through Overlap @ 305 mm on centre	11.1 mm OSB rated Sheathing	NA	3.45

1: Values are for species of wood having a specific gravity of 0.42 or greater.

2: Values are for species of wood having a specific gravity of 0.36 or greater.

Table 10. Test Results for Wind Load Resistance of "Hardie® Shingleside® Cladding"

Fastener Type	Weather Exposure & Number of Fasteners	Ultimate Wind Load (kPa)
Corrosion-resistance siding nails, having a minimum of 2.4 mm shank x 5.6 mm HD x 38 mm long	200 mm exposure 2 siding nails @ 225 mm from butt edge	3.30
	180 mm exposure 2 siding nails @ 205 mm from butt edge	4.64
	150 mm exposure 2 siding nails @ 175 mm from butt edge	5.98

Note: The above ultimate wind load values are based on tests conducted on "Hardie® Shingleside® Cladding" cladding applied to a minimum 11 mm thick OSB sheathing. The ultimate wind load resistance values need to be suitably factored in accordance with Part 4 of the NBC 1995.

Table 11. Test Results for Wind Load Resistance of "Hardie® Shingleside® Cladding"

Fastener Type	Weather Exposure & Number of Fasteners	Ultimate Wind Load (kPa)
Corrosion-resistance siding nails, having a minimum of No. 11 ga. shank x 9.4 mm HD x 32 mm long	200 mm exposure 2 siding nails @ 225 mm from butt edge	4.78
	180 mm exposure 2 siding nails @ 205 mm from butt edge	6.78
	150 mm exposure 2 siding nails @ 175 mm from butt edge	7.99

Note: The above ultimate wind load values are based on tests conducted on "Hardie® Shingleside® Cladding" cladding applied to a minimum 11.5 mm thick plywood sheathing. The ultimate wind load resistance values need to be suitably factored in accordance with Part 4 of the NBC 1995.

For more information contact:

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Note: Readers are asked to refer to limitations imposed by NRC on the interpretation and use of this report. These limitations are included in the introduction to CCMC's Registry of Product Evaluations, of which this report is part.

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