THERMAFIBER® RAINBARRIER® CI HIGH COMPRESSIVE INSULATION – CI-01

Deflection, Compressive Strength, and Density

Scope Statement

Owens Corning® Thermafiber® RainBarrier® ci High Compressive non-structural products may be used in continuous insulation (ci) applications where cladding and cladding attachments are placed on the outer surface of the ci and secured back to the structure with only fasteners penetrating ci. This application minimizes thermal bridging and requires that the continuous insulation maintain high compressive strength and stability. When comparing mineral wool insulations, compressive strength is directly correlated to the maximum allowable design cladding weights and wind loads.

Deflection Testing

The concept of continuous insulation is not new, however, there is an increasing effort to reduce thermal bridging by limiting the fasteners and attachments through the continuous insulation. Gaining in popularity is the method of attaching cladding and the system from which it is hung completely outboard of the continuous insulation, effectively limiting penetrations through the continuous insulation to only those fasteners attaching the cladding attachment system to the structural system behind. This method is still in the process of testing and gathering a body of data for standardization; therefore, Owens Corning conducted a series of deflection testing with their Thermafiber® RainBarrier® ci High Compressive insulation boards to demonstrate suitability for this application.

The deflection testing, conducted by a third-party research laboratory, was designed to isolate the impact of the insulation boards on the securement of the façade assembly. Both steel stud and wood stud assemblies were tested. The steel stud assembly, as shown in Figure one, was constructed as follows:

- 2 in. x 6 in. 18-gauge steel stud, 24 in. on center
- 5/8 in. gypsum sheathing
- 1 layer mechanically attached air and water barrier
- RainBarrier® ci High Compressive insulation (varied thickness 2 in. – 8 in.)
- 20-gauge Z-girt strapping with 1½ in. flanges and 1 in. depth installed vertically on the outer surface of the insulation with fasteners, 16 in. on center, installed through the insulation attaching directly to the studs
- Various fastener lengths (4 in. – 11 in.) and gauge (#8 – #14) based on thickness of insulation

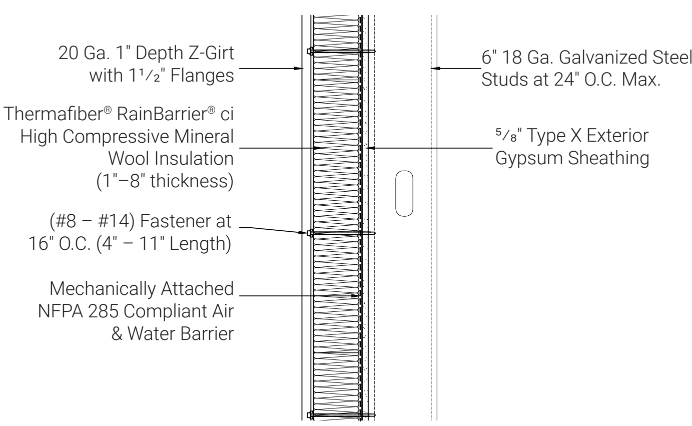

Fig. 1 Steel Stud Section Detail

The wood stud assembly was constructed as follows:

- 2 in. x 4 in. wood stud, 24 in. on center
- 7/16 in. OSB sheathing
- 1 layer mechanically attached air and water barrier
- RainBarrier® ci High Compressive insulation (varied thickness 2 in. – 8 in.)
- 1 in. x 3 in. wood strapping installed vertically on the outer surface of the insulation with fasteners, 16 in. on center, installed through the insulation attaching directly to the studs
- Various fastener lengths (4 in. – 11 in.) and gauge (#8 – #14) based on thickness of insulation

Fig. 2 Test Specimen Wall Installed

A load was attached to each specimen with sensors to record deflection as loads were increased. Figure two shows a test wall installed and ready for testing.

Table one lists a summary of the loads applied to the test walls using three different metrics to analyze performance with the approximate cladding weight. First, the total amount of load as measured by the load cell is shown in 100 lb. increments as it was applied to all of the test walls. Next, the load applied is listed as pounds per square foot, which is more easily comparable to approximate cladding loads such as metal composite material, high pressure laminate, and ceramic panels. Finally, a common way to compare cladding load tests is through the load per fastener.

LOAD APPLIED (Lbs.)	LOAD APPLIED (Lbs./Sq. Ft.)	LOAD APPLIED (Lbs./Fastener)	ASSOCIATED CLADDING TYPE* (ESTIMATED)
100	3.1	7.1	ACM, MCM, Fiber Cement Siding , High Pressure Laminate
200	6.2	14.3	
300	9.4	21.4	Glass, Hollow Terra Cotta, Hard Coat 3/4 in. Stucco
400	12.5	28.6	
500	15.6	35.7	Cement, Stone, Porcelain, Terra Cotta
600	18.8	42.9	
700	21.9	50.0	
800	25.0	57.1	
900	28.1	64.3	
1000	31.2	71.4	

Table 1 Loads Applied to Test Walls

*Based on averaged information. Does not include live loads and wind loads. Verify with cladding and attachment manufacturer prior to specification.

The results confirm previous studies of the same methods and similar materials. Therefore, when comparing mineral wool insulations, the compressive strength of the insulation is directly correlated with the amount of cladding weight that can be supported at a given deflection amount, meaning higher compressive strength mineral wool insulation can withstand attachment of heavier cladding weights.

While this test method demonstrates loads resisted within acceptable deflection, it is always recommended that the cladding and attachment manufacturers be contacted to verify load and fastener requirements for specific projects.

Compressive Strength

To measure compressive strength, the ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulation is utilized. This test method measures compressive resistance of thermal insulation along a load deformation curve. As a load is increased, the specimen will decrease in thickness. This compressive deformation impacts the ability for cladding and attachment to remain secure to the structure. In Procedure A, at least four 6 in. x 6 in. sample specimens are tested individually. They are measured for averaged thickness per specimen and then placed in the standardized compression testing machine. The compression crosshead is then lowered at a standardized speed and measurement of the specimen is taken to record deformation at increasing pressures.

Fig. 3 Photo of Standard Compressive Testing Machine

These deformations are then recorded in a load-deformation curve and load is identified at the chosen deformation point(s). If the specimen did not yield at the chosen deformation point(s), the load at % deformation is reported. If the specimen yielded before these points, the load at yield is reported. ASTM C165 allows for deformation points of 10% and/or 25%. RainBarrier® ci High Compressive boards are reported at 10% compression, as this is more relevant for their application. In a façade application that utilizes the cladding attachment outboard of the continuous insulation, façade movement more than 10% of the thickness of the insulation could create aesthetic and performance issues with the cladding. It is recommended that the cladding manufacturer be contacted to verify allowable façade deflection.

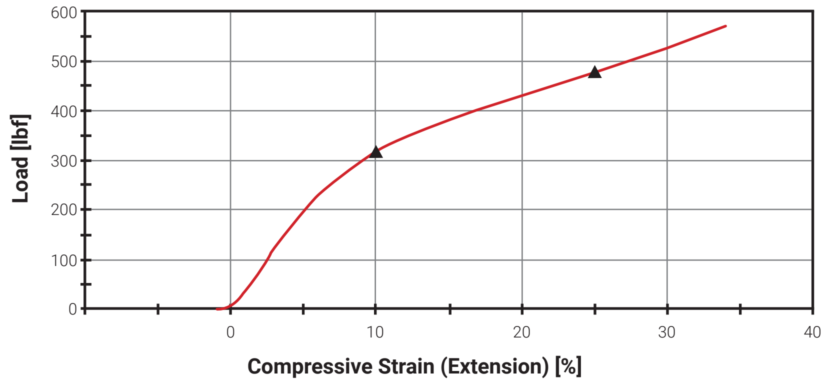

Table 2 Thermafiber Load-Deformation Curves

The **Compressive Resistance** (S) in psf is reported as S=W/A, where (W) is the load at a given deformation in pound-force and (A) is the average original area computed from the measurements of the specimen in square inch.

(ASTM C165)	THERMAFIBER® RAINBARRIER® CI HIGH COMPRESSIVE (80)	THERMAFIBER® RAINBARRIER® CI HIGH COMPRESSIVE PLUS (110)	THERMAFIBER® RAINBARRIER® CI HIGH COMPRESSIVE MAX
10%	475 lbs./sq. ft.	720 lbs./sq. ft.	1296 lbs./sq. ft.
Yield	None at 25%	None at 25%	None at 25%

Table 3 Compressive Resistance of Thermafiber® ci High Compressive Portfolio of Products

Density

Historically, density, as measured by ASTM C303, has been used as a proxy for the strength of mineral wool boards. While it is true that adding density to mineral wool boards increases the compressive strength, Thermafiber® RainBarrier® ci High Compressive boards utilize new ThermaCrimp™ technology to add the needed strength without increasing density while minimizing impact to thermal resistance. The result is a board with the strength to secure a wide range of claddings without adding unnecessary weight to the continuous insulation.

Footnotes

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Test standards:
ASTM C165
ASTM C303

Product literature and samples:
RainBarrier® HC (80) Data Sheet, Pub. No. 10023723
RainBarrier® HC Plus (110) Data Sheet, Pub. No. 10023499
RainBarrier® HC Max Data Sheet, Pub. No. 10023500
RainBarrier® Insulation Guide, Pub. No. 10021356
RainBarrier® HC (80) Sample, Pub. No. 10023727
RainBarrier® HC Plus (110), Pub. No. 10023548
RainBarrier® HC Max, Pub. No. 10023549

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Always follow appropriate safety and industrial hygiene practices during installation. Wear appropriate personal protective equipment. Review SDS and literature before specification and installation.

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