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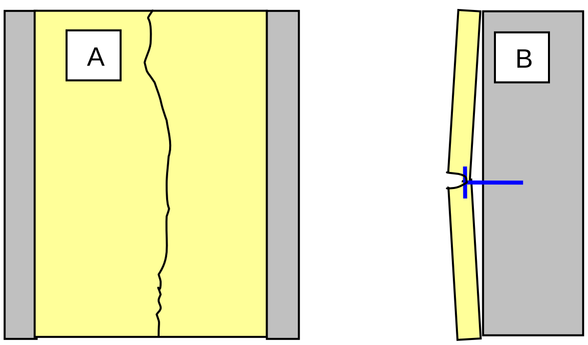
Wind Load and Adhesively Attached StoTherm® ci Systems

Wind pressure is one of many environmental loads that StoTherm® ci systems resist. Resistance to wind pressure is measured by performing standard tests[1,2] with loads applied perpendicular to the system. The support construction is often sheathing over wood or metal frame assemblies. Frame construction represents a worst case scenario for stiffness as compared to concrete or CMU wall construction. Sto Corp. has tested numerous frame assemblies with StoTherm® ci adhesively attached to gypsum-based sheathings. In general we have established that the limiting factor in the assembly is not the adhesive attachment of StoTherm® ci, but is the sheathing or its attachment.

Figure 1. Typical failure modes of gypsum-based sheathings attached to frame construction



A. On the left the back of a test panel and the effect of positive loading are shown – failure of the sheathing with cracks roughly parallel to and centered between studs. B. On the right a side view of a test panel and the effect of negative loading are shown – failure of the sheathing at a fastener penetration.

In over 20 years of independent laboratory testing neither the StoTherm® adhesive nor any component of the StoTherm® ci has been the source of failure. This kind of reliability is important since wind loads are often the source of building envelope failure during storms, and failure of the building envelope can result in catastrophic property loss and insurance claims.

In order to achieve reliable performance it is also important to design the frame assembly to resist wind loads and to install StoTherm® ci systems correctly. Finally, pay attention to the installation of sheathing, particularly the fastening pattern, since this can be the determinant of success or failure during severe wind storm events. In Table 1, attached, which describes many of the assemblies that have been tested with adhesively attached StoTherm® ci, the most common failure mode that occurs at lowest pressures is (2), separation of sheathing from studs under negative loading (assembly nos 1-5, 7-9, and 11). Increasing the frequency of fasteners (assembly no. 8 for example versus no. 2), or using wafer or pan head fasteners with increased bearing area as compared to bugle head fasteners (assembly no. 23 versus no. 3) will generally increase wind load resistance.

Table 1 is a good starting point for design verification of wind load resistance of proposed stud assemblies clad with StoTherm® ci. Testing in accordance with applicable ASTM or other appropriate standards should then be conducted for final verification of performance.

Att: Table 1. StoTherm® ci Wind Load Data – Adhesively Attached Systems

1. ASTM E 330, *Test Method for Structural Performance of Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference*

2. ASTM E 1886, *Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials*

Table 1. StoTherm™ ci Wind Load Data - Adhesively Attached Systems

Assembly No.	Stud Spacing	Sheathing & Thickness or Substrate	Metal Stud Gage	Stud Depth	Fastener Spacing Perim/Field, Type	Ultimate Positive (Failure Mode)	Ultimate Negative (Failure Mode)	Note No.	Test Report No.	Code Report No.
1	16	5/8" Gyp	18	3-5/8	6/8	180 (1&3)	116 (2&3)	(7)	UST	ICC ESR # 1720. # 1748
2	16	5/8" Gyp	16	6	6/8	200 (5)	101 (2)	(7)	UST	ICC ESR # 1720. # 1748
3	16	5/8" DGG	16	6	6/6, bugle	161 (3)	163 (2)	(7)	US 185961	ICC ESR # 1720
4	16	½·Gyp	18	3-5/8	6/8, bugle	111 (3)	65 (2)	(7)	US 185877-9,10	ICC ESR # 1720, # 1748
5	16	½ - Gyp	18	3-5/8	6/B, bugle	106 (3)	60 (2)	(7)	US 185877-7,8	ICC ESR # 1720, # 1748
6	N/A	CMU	N/A	N/A	N/A	161 (N/A)	163 (N/A)	(6)	US 185961	ICC ESR # 1720, # 1748
7	16	5/8" Gyp	16	6	4/4, bugle	200 (5)	166 (2)	(7)	US 193002-15, 16	ICC ESR # 1720, # 1748
8	16	5/8" Gyp	16	6	4/4, bugle	200 (5)	166 (2)	(7)	US 193002-17,18	ICC ESR # 1720, # 1748
9	12	5/8" DGG	16	6	4/4	395 (5)	395 (2)	(8)	Proprietary	N/A
10	12	5/8" DGG	16	3-5/8	4/4	323 (3)	239 (3)	(B)	Proprietary	N/A
11	16	½ - Gyp	18	3-5/8	6/8	173 (3)	68 (2)	(7)	UST	N/A
12	16	5/8" Gyp x 2	18	3-5/8	8/8 bugle	187 (5)	187 (5)	(9)	CTL, Inc. No. CTLA 599W	Miami-Dade NOA # 06-0510.03
13	16	5/8" Gyp	16	6	6/6 panhead	120 (5)	120 (5)	(9)	CTL, Inc. No. CTLA 660W	Miami-Dade NOA # 06-0522.14
14	16	5/B" Gyp	16	6	6/6wafer	186 (5)	186 (5)	(9)	HTL No. 0064-0711-95	Miami Dade NOA # 02-0919.01
15	16	½" Gyp	18	3-5/8	8/8 bugle	97 (5)	87 (5)	(9)	CTL, Inc. No. CTLA 470W-1	Miami-Dade NOA # 03-0829.07
16	N/A	B" CMU	N/A	N/A	N/A	NIT	100 (5)	(9)	CTL, Inc. No. CTLA 470W-1	Miami-Dade NOA # 07-0104.05
17	16	5/8" Plywd	N/A	2x4 wood	8/8 10d	150 (5)	150 (5)	(9)	HTL No. G064-0605-06	Miami-Dade NOA # 07-0104.04
18	16	5/8" Plywd	20	3-5/8	BIB bugle	150 (6)	150 (6)	(9)	HTL No. G064-0605-06	Miami-Dade NOA # 07-0104.04
19	16	5/8" Plywd+½"Gyp	18	3-5/8	12/12 bugle	105 (5)	106 (5)	(9)	CTL, Inc. No. CTLA 470W	Miami Dade NOA # 03-0829.08
20	16	½" AT	18	3-5/8	6/6 wafer	105 (5)	105 (5)	(9)	CTL, Inc. No. CTLA B63W	Miami-Dade NOA # 03-0527.12
21	16	½" AT	18	3-5/8	6/6 wafer	105 (5)	105 (5)	(9)	HTL No. 0064-1020,25,26,27-02	Miami-Dade NOA # 03-0422.01
22	16	5/B" AT	16	6	6/6 wafer	218 (5)	218 (5)	(9)	CTC No. 05-041	Miami-Dade NOA # 07-0710.13
23	16	5/8" DGG	16	6	6/6, wafer	188 (5)	188 (5)	(9)	HTL No. G-064-0103-08	Miami-Dade NOA # pending

Notes:

(1). Crack in sheathing parallel to studs
(2). Separation of sheathing from studs
(3). Stud failure
(4). EIFS failure
(5). Loads not taken to failure
(6). Load limit derived by analysis
(7). All tests follow ASTM E330, Method B with minimum 10 second load duration and minimum 6 load increments. All tests include 3 positive and 3 negative 4' x 8' (1.2 x 2.4m) panels. Average of taken as applicable load value or lowest value if any load is less than 15% of average.
(8). Proprietary test. Only one panel tested. Back of specimen sheathed with 5/8" GWB
(9). All tests follow Miami-Dade County protocol PA or TAS 201, 202, and 203 with wind load testing at 1.5 x DP followed by water and air infiltration resistance tests; and cyclic wind load testing to 1.3 x DP preceded by missile impact.