Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

Report No: 1905-02

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ThermalStar® Insulating Sheathing

Trade Secret Report Holder:

Atlas® Roofing Corporation

Website: www.atlasmoldedproducts.com

CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

Section: 06 12 00 - Structural Panels

Section: 06 12 19 - Shear Wall Panels

Section: 06 16 00 - Sheathing

DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION

Section: 07 21 00 - Thermal Insulation

Section: 07 25 00 - Water-Resistive Barriers/Weather Barriers

Section: 07 27 00 - Air Barriers

1 Innovative Products Evaluated[1]

1.1 ThermalStar Insulating Sheathings:

1.1.1 ThermalStar Structural Wall Insulation SWI R3 and SWI GPS R3

1.1.2 ThermalStar Structural Wall Insulation SWI R5 and SWI GPS R5

1.1.3 ThermalStar Laminated Wall Insulation LWI 10 and LWI GPS 10

1.1.4 ThermalStar Laminated Wall Insulation LWI 15 and LWI GPS 15

2 Product Description and Materials

2.1 The innovative products evaluated in this report are shown in **Figure 1** and **Figure 2**.

Figure 1. ThermalStar SWI Product

Figure 2. ThermalStar LWI Product

2.2 ThermalStar SWI products are structural insulating sheathing products composed of rigid foam insulation and fiberboard. A film is applied to the foam on the opposing side of the fiberboard.

2.2.1 ThermalStar SWI products are compliant with ASTM C578, Type I.

2.2.2 ThermalStar SWI products consist of the following materials:

2.2.2.1 *Expanded Polystyrene (EPS):*

2.2.2.1.1 $^{5}/_{8}$" (15.9 mm) or $1^{1}/_{8}$" (28.6 mm)

2.2.2.2 *Graphite Polystyrene (GPS):*

2.2.2.2.1 $^{5}/_{8}$" (15.9 mm) or $1^{1}/_{8}$" (28.6 mm)

2.2.2.3 *Fiberboard:*

2.2.2.3.1 0.108" (2.7 mm)

2.2.3 ThermalStar SWI products may have the insulation installed against the studs (foam in) with the fiberboard on the exterior face of the wall, or the fiberboard may be installed against the studs with insulation on the exterior face of the wall (foam out).

2.3 ThermalStar LWI products are non-structural insulating sheathing products composed of rigid foam insulation. Film is applied to the foam on both sides.

2.3.1 ThermalStar LWI 10 and LWI GPS 10 are compliant with ASTM C578, Type I.

2.3.2 ThermalStar LWI 15 and LWI GPS 15 are compliant with ASTM C578, Type II.

2.3.3 ThermalStar LWI products consists of the following materials:

2.3.3.1 *EPS:*

2.3.3.1.1 $^{3}/_{8}$" (9.5 mm) to 3" (76 mm)

2.3.3.2 *GPS:*

2.3.3.2.1 $^{3}/_{8}$" (9.5 mm) to 3" (76 mm)

2.4 *Material Availability*

2.4.1 *Thickness:*

2.4.1.1 ThermalStar SWI R3 Nominal: $^{13}/_{16}$" (20.6 mm)

2.4.1.2 ThermalStar SWI GPS R3 Nominal: $^{3}/_{4}$" (19.1 mm)

2.4.1.3 ThermalStar SWI R5 Nominal: $1^{3}/_{8}$" (34.9 mm)

2.4.1.4 ThermalStar SWI GPS R5 Nominal: $1^{1}/_{4}$" (31.8 mm)

2.4.1.5 ThermalStar LWI 10 and 15 Nominal: $^{3}/_{4}$" (19.1 mm) to 3" (76 mm)

2.4.1.6 ThermalStar LWI GPS 10 and 15 Nominal: $^{1}/_{2}$" (12.7 mm) to 4" (102 mm)

2.4.2 *Standard Widths:*

2.4.2.1 2' (610 mm)

2.4.2.2 4' (1,219 mm)

2.4.3 *Standard Lengths:*

2.4.3.1 8' (2,438 mm)

2.4.3.2 9' (2,743 mm)

2.4.3.3 10' (3,048 mm)

2.5 Where the name *"ThermalStar SWI"* is used in this report, the R3, GPS R3, R5, and GPS R5 products apply.

2.6 Where the name *"ThermalStar LWI"* is used in this report, the 10, GPS 10, 15, and GPS 15 products apply.

2.7 As needed, review material properties for design in **Section 6** and to regulatory evaluation in **Section 8**.

3 Definitions

3.1 New Materials[2] are defined as building materials, equipment, appliances, systems, or methods of construction not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.[3] The design strengths and permissible stresses shall be established by tests[4] and/or engineering analysis.[5]

3.2 Duly authenticated reports[6] and research reports[7] are test reports and related engineering evaluations, which are written by an approved agency[8] and/or an approved source.[9]

3.2.1 These reports contain intellectual property and/or trade secrets, which are protected by the Defend Trade Secrets Act (DTSA).[10]

3.3 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is listed in the ANAB directory.

3.4 An approved source is *"approved"* when a professional engineer (i.e., Registered Design Professional) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[11]

3.5 Testing and/or inspections conducted for this duly authenticated report were performed by an ISO/IEC 17025 accredited testing laboratory, an ISO/IEC 17020 accredited inspection body and/or a licensed Registered Design Professional (RDP).

3.5.1 The Center for Building Innovation (CBI) is ANAB[12] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[13] the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing[14] stating the nonconformance and the path to its cure.

3.7 The regulatory authority shall accept duly authenticated reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs, or methods of construction.[15]

3.8 ANAB is an International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) signatory where recognition of certificates, validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA with the appropriate scope, shall be approved.[16] Therefore, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent.[17]

3.9 Approval equity is a fundamental commercial and legal principle.[18]

4 Applicable Standards for the Listing; Regulations for the Regulatory Evaluation[19]

4.1 *Local, State, and Federal*

4.1.1 Approved in all local jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes the following featured local jurisdictions and is not limited to: Austin, Baltimore, Broward County, Chicago, Clark County, Dade County, Dallas, Detroit, Denver, DuPage County, Fort Worth, Houston, Kansas City, King County, Knoxville, Las Vegas, Los Angeles City, Los Angeles County, Miami, Nashville, New York City, Omaha, Philadelphia, Phoenix, Portland, San Antonio, San Diego, San Jose, San Francisco, Seattle, Sioux Falls, South Holland, Texas Department of Insurance, and Wichita.[20]

4.1.2 Approved in all state jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes the following featured states, and is not limited to: California, Florida, New Jersey, Oregon, New York, Texas, Washington, and Wisconsin.[21]

4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[22] and Part 3280[23] pursuant to the use of ISO/IEC 17065 duly authenticated reports.

4.1.4 Approved means complying with the requirements of local, state, or federal legislation.

4.2 *Standards*

4.2.1 *AATCC TM127: Water Resistance: Hydrostatic Pressure Test*

4.2.2 *ASTM C578: Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*

4.2.3 *ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials*

4.2.4 *ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials*

4.2.5 *ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference*

4.2.6 *ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*

4.2.7 *ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings*

4.2.8 *ASTM E2178: Standard Test Method for Air Permeance of Building Materials*

4.3 *Regulations*

4.3.1 *IBC – 15, 18, 21: International Building Code®*

4.3.2 *IRC – 15, 18, 21: International Residential Code®*

4.3.3 *IECC – 15, 18, 21: International Energy Conservation Code®*

5 Listed[24]

5.1 Equipment, materials, products or services included in a List published by a nationally recognized testing laboratory (i.e., CBI), approved agency (i.e., CBI and DrJ), and/or approved source (i.e., DrJ), or other organizations concerned with product evaluation (i.e., DrJ) that maintains periodic inspection (i.e., CBI) of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

6 Tabulated Properties Generated from Nationally Recognized Standards

6.1 Except as otherwise described in this report, ThermalStar Insulating Sheathings shall be installed in accordance with the applicable building codes listed in **Section 4** using the provisions set forth herein for the design and installation of Wood Structural Panels (WSP).

6.2 ThermalStar SWI is used as a wall sheathing in buildings constructed in accordance with the IBC and IRC for light-frame wood construction.

6.3 ThermalStar SWI is used as a wall sheathing in Type V construction in accordance with the IBC.

6.4 ThermalStar SWI shall be permitted to be designed in accordance with SDPWS for the design of shear walls using the methods set forth therein, excluding the perforated shear wall methodology and subject to the SDPWS boundary conditions except as specifically allowed in this report.

6.5 Anchorage for in-plane shear shall be provided to transfer the induced shear force into and out of each shear wall.

6.5.1 For wind design, anchor bolt spacing shall not exceed 6' o.c. (1,829 mm).

6.6 The maximum aspect ratio for ThermalStar SWI products shall be 4:1.

6.7 The minimum full height panel width shall be 24" (610 mm) in accordance with IRC Section R602.10.5.

6.8 All panel edges shall be blocked with a minimum 2" (51 mm) nominal lumber.

6.9 Fasteners shall be installed flush with the surface of the fiberboard for both foam in and foam out installation orientations.

6.10 Installation is permitted for single top plate (advanced framing method) or double top plate applications.

6.10.1 Single top plate walls shall be constructed in accordance with IBC Section 2308.5.3.2.

6.11 *Structural Applications*

6.11.1 *Simplified IRC Bracing Provisions:*

6.11.1.1 ThermalStar SWI is permitted to be used in accordance with the IRC simplified bracing method of IRC Section R602.12 as modified by **Table 1** for foam in orientations and **Table 2** for foam out orientations. All other provisions of the IRC simplified bracing method shall be met.

Table 1. ThermalStar SWI Simplified Bracing Table – Foam In Orientation[1,2,3,4,5,6,7,8]

Structural Sheathing Product	Ultimate Design Wind Speed, V_{ult} (mph)	Story Level	Eave to Ridge Height (ft)	Minimum Number of Bracing Units Required (Long Side)						Minimum Number of Bracing Units Required (Short Side)					
				Length of Short Side (ft)						Length of Long Side (ft)					
				10	20	30	40	50	60	10	20	30	40	50	60
ThermalStar SWI R3 or R5 (Foam In)	115	One Story or Top of Two or Three Stories	10	1	1	2	2	3	3	1	1	2	2	3	3
		First of Two Story or Second of Three Stories		1	2	3	4	4	5	1	2	3	4	4	5
		First of Three Stories		2	3	4	6	7	8	2	3	4	6	7	8
		One Story or Top of Two or Three Stories	15	1	1	3	3	4	4	1	1	3	3	4	4
		First of Two Story or Second of Three Stories		1	2	3	5	5	6	1	2	3	5	5	6
		First of Three Stories		2	3	4	7	8	9	2	3	4	7	8	9
	130	One Story or Top of Two or Three Stories	10	1	2	2	3	3	4	1	2	2	3	3	4
		First of Two Story or Second of Three Stories		2	3	4	5	6	6	2	3	4	5	6	6
		First of Three Stories		2	4	6	7	9	11	2	4	6	7	9	11
		One Story or Top of Two or Three Stories	15	1	3	3	4	4	5	1	3	3	4	4	5
		First of Two Story or Second of Three Stories		2	3	5	6	7	7	2	3	5	6	7	7
		First of Three Stories		2	4	7	8	10	12	2	4	7	8	10	12

SI: 1 in = 25.4 mm

1. This simplified bracing table is based on the provisions of IRC Section R602.12. All provisions therein shall be observed, except that this table shall replace IRC Table R602.12.4, and ThermalStar SWI shall replace the sheathing material.
2. ThermalStar SWI R3 installed with butted joints on 2 x 4 studs spaced 16" o.c. and fastened with a minimum $1^{3}/_{4}$" x 0.120" nails installed 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of $^{3}/_{8}$". Nails with a head diameter and length greater than the $1^{3}/_{4}$" x 0.120" nails are also permissible. Alternatively for ThermalStar SWI R3, installation with butted joints on 2 x 4 studs spaced 16" o.c., and fastened with minimum 16-gauge, $^{15}/_{16}$" crown x $1^{3}/_{4}$" leg galvanized staples installed 3" o.c. along the edges and 3" o.c. in the field is permissible. Fastener edge distance shall be a minimum of $^{3}/_{8}$".
3. ThermalStar SWI R5 installed with butted joints on 2 x 4 studs spaced 16" o.c. and fastened with a minimum $1^{3}/_{4}$" x 0.120" ring shank nails installed 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of $^{3}/_{8}$". Nails with a head diameter and length greater than the $1^{3}/_{4}$" x 0.120" nails are also permissible.
4. Minimum $^{1}/_{2}$" gypsum wallboard attached to the interior side of the wall in accordance with IRC Section R702.3.5 and IRC Table R702.3.5.
5. Interpolation shall not be permitted.
6. Cripple walls or wood-framed basement walls in a walk-out condition shall be designated as the first story and the stories above shall be re-designated as the second and third stories respectively, and shall be prohibited in a three-story structure.
7. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.
8. For Exposure Category C, multiply bracing units by a factor of 1.20 for a one-story building, 1.30 for a two-story building, and 1.40 for a three-story building.
9. Maximum stud spacing is 16" o.c.

Table 2. ThermalStar SWI Simplified Bracing Table – Foam Out Orientation[1,2,3,4,5,6,7,8]

Structural Sheathing Product	Ultimate Design Wind Speed, V_{ult} (mph)	Story Level	Eave to Ridge Height (ft)	Minimum Number of Bracing Units Required (Long Side)						Minimum Number of Bracing Units Required (Short Side)					
				Length of Short Side (ft)						Length of Long Side (ft)					
				10	20	30	40	50	60	10	20	30	40	50	60
ThermalStar SWI (Foam Out)	115	One Story or Top of Two or Three Stories	10	1	1	2	2	2	3	1	1	2	2	2	3
		First of Two Story or Second of Three Stories		1	2	3	3	4	4	1	2	3	3	4	4
		First of Three Stories		2	3	4	5	6	7	2	3	4	5	6	7
		One Story or Top of Two or Three Stories	15	1	1	3	3	3	4	1	1	3	3	3	4
		First of Two Story or Second of Three Stories		1	2	3	3	5	5	1	2	3	3	5	5
		First of Three Stories		2	3	4	6	7	8	2	3	4	6	7	8
	130	One Story or Top of Two or Three Stories	10	1	1	2	2	3	3	1	1	2	2	3	3
		First of Two Story or Second of Three Stories		1	2	3	4	5	5	1	2	3	4	5	5
		First of Three Stories		2	4	5	6	8	9	2	4	5	6	8	9
		One Story or Top of Two or Three Stories	15	1	1	3	3	4	4	1	1	3	3	4	4
		First of Two Story or Second of Three Stories		1	2	3	5	6	6	1	2	3	5	6	6
		First of Three Stories		2	4	6	7	9	10	2	4	6	7	9	10

SI: 1 in = 25.4 mm

1. This simplified bracing table is based on the provisions of IRC Section R602.12. All provisions therein shall be observed, except that this table shall replace IRC Table R602.12.4, and ThermalStar SWI shall replace the sheathing material.
2. ThermalStar SWI installed with butted joints on 2 x 4 studs spaced 16" o.c. and fastened as follows with spacing 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of $^3/_8$".
   a. ThermalStar SWI R3: *"N"*-style 16-gauge galvanized staple (minimum $^1/_2$" crown x $1^1/_4$" leg).
   b. ThermalStar SWI R5: 16-gauge galvanized staple (minimum $^{15}/_{16}$" crown x 2" leg)
3. Minimum $^1/_2$" gypsum wallboard attached to the interior side of the wall in accordance with IRC Section R702.3.5 and IRC Table R702.3.5.
4. Interpolation shall not be permitted.
5. Cripple walls or wood-framed basement walls in a walk-out condition shall be designated as the first story and the stories above shall be re-designated as the second and third stories, respectively, and shall be prohibited in a three-story structure.
6. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.
7. For Exposure Category C, multiply bracing units by a factor of 1.20 for a one-story building, 1.30 for a two-story building, and 1.40 for a three-story building.
8. Maximum stud spacing is 16" o.c.

6.11.2 *Prescriptive IRC Bracing Applications:*

6.11.2.1 ThermalStar SWI may be used in the following applications:

6.11.2.1.1 On braced wall lines equivalent to the IRC Method WSP when installed in accordance with IRC Section R602.10.4 and this report.

6.11.2.1.2 To brace walls of buildings equivalent to the IRC Method CS-WSP (Continuously Sheathed Wood Structural Panel) when installed in accordance with IRC Section R602.10.4 and this report.

6.11.2.1.3 To brace walls of buildings equivalent to the IRC Method CS-PF (Continuously Sheathed Portal Frame) in lieu of WSP, when installed in accordance with IRC Section R602.10.6.4.

6.11.2.1.4 To brace walls of buildings equivalent to the IRC Method PHF (Portal Frame with Hold-Downs) when installed in accordance with IRC Section R602.10.6.2.

6.11.2.2 All other IRC prescriptive bracing minimums, spacing requirements and rules must also be met.

6.11.2.3 Where a building, or portion thereof, does not comply with one or more of the bracing requirements within the prescriptive section of the IRC, those portions shall be designed and constructed in accordance with IRC Section R301.1.

6.11.2.4 *Wind Bracing:*

6.11.2.4.1 Required braced wall panel lengths are provided in **Table 3** and **Table 4** for foam in orientations, and **Table 5** for foam out orientations. These tables shall be used in place of IRC Table R602.10.3(1). All adjustment factors from IRC Table R602.10.3(2) shall still be applied.

Table 3. IRC Bracing Requirements for ThermalStar SWI R3 (Foam In) – Wind[1,2,3,4,5]

Condition	Braced Wall Line Spacing (ft)	Minimum Total Length (ft) of Braced Wall Panels Required Along Each Braced Wall Line									
		Intermediate Sheathing					Continuous Sheathing				
		Ultimate Design Wind Speed,[6] V_{ult} (mph)									
		≤ 110	≤ 115	≤ 120	≤ 130	< 140	≤ 110	≤ 115	≤ 120	≤ 130	< 140
One Story or the Top of Two or Three Stories	10	1.7	1.7	2.2	2.2	2.6	1.3	1.7	1.7	2.2	2.2
	20	3.0	3.0	3.4	4.3	4.7	2.6	3.0	3.0	3.4	4.3
	30	4.3	4.7	5.2	6.0	6.9	3.9	3.9	4.3	5.2	6.0
	40	5.6	6.0	6.9	7.8	9.0	4.7	5.2	5.6	6.5	7.8
	50	6.9	7.8	8.2	9.5	11.2	6.0	6.5	6.9	8.2	9.5
	60	8.2	9.0	9.9	11.2	12.9	6.9	7.8	8.2	9.5	11.2
First Story of Two Stories or Second Story of Three Stories	10	3.0	3.4	3.9	4.3	5.2	2.6	3.0	3.0	3.9	4.3
	20	5.6	6.5	6.9	8.2	9.5	4.7	5.6	6.0	6.9	7.8
	30	8.2	9.0	9.9	11.6	13.4	6.9	7.8	8.2	9.9	11.2
	40	10.8	11.6	12.9	15.1	17.2	9.0	9.9	10.8	13.4	14.6
	50	13.4	14.2	15.5	18.5	21.1	11.2	12.1	13.4	15.5	18.1
	60	15.5	17.2	18.5	21.5	25.0	13.4	14.6	15.9	18.5	21.5

Table 3. IRC Bracing Requirements for ThermalStar SWI R3 (Foam In) – Wind[1,2,3,4,5]

Condition	Braced Wall Line Spacing (ft)	Minimum Total Length (ft) of Braced Wall Panels Required Along Each Braced Wall Line									
		Intermediate Sheathing					Continuous Sheathing				
		Ultimate Design Wind Speed,[6] V_{ult} (mph)									
		≤ 110	≤ 115	≤ 120	≤ 130	< 140	≤ 110	≤ 115	≤ 120	≤ 130	< 140
First Story of Three Stories	10	4.7	5.2	5.6	6.5	7.3	3.9	4.3	4.7	5.6	6.5
	20	8.6	9.5	9.9	11.6	13.8	7.3	7.8	8.6	9.9	11.6
	30	12.1	13.4	14.6	16.8	19.8	10.3	11.2	12.5	14.6	16.8
	40	15.9	17.2	19.0	22.0	25.4	13.4	14.6	15.9	19.0	21.5
	50	19.4	21.1	23.3	27.1	31.4	16.4	18.1	19.8	22.8	26.7
	60	22.8	25.0	27.6	32.3	37.0	19.8	21.5	23.3	27.1	31.4

SI: 1 in = 25.4 mm, 1 mph = 1.61 km/h

1. Demonstrates equivalency to IRC Table R602.10.3(1). All adjustment factors from IRC Table R602.10.3(2) shall be applied.
2. ThermalStar SWI installed with butted joints on 2 x 4 studs spaced 16" o.c. and fastened with a minimum 1 3/4" x 0.120" nails installed 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of 3/8". Nails with a head diameter and length greater than the 1 3/4" x 0.120" nails are also permissible. Alternatively for ThermalStar SWI R3, installation with butted joints on 2 x 4 studs spaced 16" o.c., and fastened with 16-gauge, minimum 15/16" crown x 1 3/4" leg galvanized staples installed 3" o.c. along the edges and 3" o.c. in the field is permissible. Fastener edge distance shall be a minimum of 3/8".
3. Minimum 1/2" gypsum wallboard shall be installed as part of the wall assembly. Where gypsum wallboard is not applied to the interior side of the wall assembly, bracing lengths shall be multiplied by a factor of 1.4.
4. Linear interpolation is permitted.
5. Bracing lengths are the result of comparative equivalency testing and analysis using both tested and published design values as points of comparison. DrJ relies upon the design values published in the codes and standards listed in **Section 4** that are adopted into law and that the manufacturer of those products stand behind. DrJ performs all equivalency analysis based on legally defined design values, the responsibility for which is the manufacturer of those products or the members of the associations that publish those design values.
6. Wind speeds are V_{ult} in accordance with ASCE 7-22. Use $V_{asd} = V_{ult}\sqrt{0.6}$ to convert to equivalent V_{asd} wind speed in accordance with IBC Section 1609.3.1.

Table 4. IRC Bracing Requirements for ThermalStar SWI R5 (Foam In) – Wind[1,2,3,4,5]

Condition	Braced Wall Line Spacing (ft)	Minimum Total Length (ft) of Braced Wall Panels Required Along Each Braced Wall Line									
		Intermediate Sheathing					Continuous Sheathing				
		Ultimate Design Wind Speed,[6] V_{ult} (mph)									
		≤ 110	≤ 115	≤ 120	≤ 130	< 140	≤ 110	≤ 115	≤ 120	≤ 130	< 140
One Story or the Top of Two or Three Stories	10	1.9	1.9	2.3	2.3	2.8	1.4	1.9	1.9	2.3	2.3
	20	3.3	3.3	3.7	4.7	5.1	2.8	3.3	3.3	3.7	4.7
	30	4.7	5.1	5.6	6.5	7.5	4.2	4.2	4.7	5.6	6.5
	40	6.1	6.5	7.5	8.4	9.8	5.1	5.6	6.1	7.0	8.4
	50	7.5	8.4	8.9	10.3	12.2	6.5	7.0	7.5	8.9	10.3
	60	8.9	9.8	10.8	12.2	14.0	7.5	8.4	8.9	10.3	12.2

Table 4. IRC Bracing Requirements for ThermalStar SWI R5 (Foam In) – Wind[1,2,3,4,5]

Condition	Braced Wall Line Spacing (ft)	Minimum Total Length (ft) of Braced Wall Panels Required Along Each Braced Wall Line									
		Intermediate Sheathing					Continuous Sheathing				
		Ultimate Design Wind Speed,[6] V_{ult} (mph)									
		≤ 110	≤ 115	≤ 120	≤ 130	< 140	≤ 110	≤ 115	≤ 120	≤ 130	< 140
First Story of Two Stories or Second Story of Three Stories	10	3.3	3.7	4.2	4.7	5.6	2.8	3.3	3.3	4.2	4.7
	20	6.1	7.0	7.5	8.9	10.3	5.1	6.1	6.5	7.5	8.4
	30	8.9	9.8	10.8	12.6	14.5	7.5	8.4	8.9	10.8	12.2
	40	11.7	12.6	14.0	16.4	18.7	9.8	10.8	11.7	14.5	15.9
	50	14.5	15.4	16.8	20.1	22.9	12.2	13.1	14.5	16.8	19.6
	60	16.8	18.7	20.1	23.4	27.1	14.5	15.9	17.3	20.1	23.4
First Story of Three Stories	10	5.1	5.6	6.1	7.0	8.0	4.2	4.7	5.1	6.1	7.0
	20	9.4	10.3	10.8	12.6	15.0	8.0	8.4	9.4	10.8	12.6
	30	13.1	14.5	15.9	18.2	21.5	11.2	12.2	13.6	15.9	18.2
	40	17.3	18.7	20.6	23.9	27.6	14.5	15.9	17.3	20.6	23.4
	50	21.1	22.9	25.3	29.5	34.1	17.8	19.6	21.5	24.8	29.0
	60	24.8	27.1	29.9	35.1	40.2	21.5	23.4	25.3	29.5	34.1

SI: 1 in = 25.4 mm, 1 mph = 1.61 km/h

1. Demonstrates equivalency to IRC Table R602.10.3(1). All adjustment factors from IRC Table R602.10.3(2) shall be applied.
2. ThermalStar SWI installed with butted joints on 2 x 4 studs spaced 16" o.c. and fastened with a minimum 1¾" x 0.120" ring shank nails installed 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of ⅜". Nails with a head diameter and length greater than the 1¾" x 0.120" nails are also permissible.
3. Minimum ½" gypsum wallboard shall be installed as part of the wall assembly. Where gypsum wallboard is not applied to the interior side of the wall assembly, bracing lengths shall be multiplied by a factor of 1.4.
4. Linear interpolation is permitted.
5. Bracing lengths are the result of comparative equivalency testing and analysis using both tested and published design values as points of comparison. DrJ relies upon the design values published in the codes and standards listed in **Section 4** that are adopted into law and that the manufacturer of those products stand behind. DrJ performs all equivalency analysis based on legally defined design values, the responsibility for which is the manufacturer of those products or the members of the associations that publish those design values.
6. Wind speeds are V_{ult} in accordance with ASCE 7-22. Use $V_{asd} = V_{ult}\sqrt{0.6}$ to convert to equivalent V_{asd} wind speed in accordance with IBC Section 1609.3.1.

Table 5. IRC Bracing Requirements for ThermalStar SWI R3 and R5 (Foam Out) – Wind[1,2,3,4,5]

Condition	Braced Wall Line Spacing (ft)	Minimum Total Length (ft) of Braced Wall Panels Required Along Each Braced Wall Line									
		Intermediate Sheathing					Continuous Sheathing				
		Ultimate Design Wind Speed,[6] V_{ult} (mph)									
		≤ 110	≤ 115	≤ 120	≤ 130	< 140	≤ 110	≤ 115	≤ 120	≤ 130	< 140
One Story or the Top of Two or Three Stories	10	1.6	1.6	2.0	2.0	2.3	1.2	1.6	1.6	2.0	2.0
	20	2.7	2.7	3.1	3.9	4.3	2.3	2.7	2.7	3.1	3.9
	30	3.9	4.3	4.7	5.5	6.3	3.5	3.5	3.9	4.7	5.5
	40	5.1	5.5	6.3	7.0	8.2	4.3	4.7	5.1	5.9	7.0
	50	6.3	7.0	7.4	8.6	10.2	5.5	5.9	6.3	7.4	8.6
	60	7.4	8.2	9.0	10.2	11.7	6.3	7.0	7.4	8.6	10.2
First Story of Two Stories or Second Story of Three Stories	10	2.7	3.1	3.5	3.9	4.7	2.3	2.7	2.7	3.5	3.9
	20	5.1	5.9	6.3	7.4	8.6	4.3	5.1	5.5	6.3	7.0
	30	7.4	8.2	9.0	10.6	12.1	6.3	7.0	7.4	9.0	10.2
	40	9.8	10.6	11.7	13.7	15.6	8.2	9.0	9.8	12.1	13.3
	50	12.1	12.9	14.1	16.8	19.2	10.2	10.9	12.1	14.1	16.4
	60	14.1	15.6	16.8	19.5	22.7	12.1	13.3	14.5	16.8	19.5
First Story of Three Stories	10	4.3	4.7	5.1	5.9	6.6	3.5	3.9	4.3	5.1	5.9
	20	7.8	8.6	9.0	10.6	12.5	6.6	7.0	7.8	9.0	10.6
	30	10.9	12.1	13.3	15.2	18.0	9.4	10.2	11.3	13.3	15.2
	40	14.5	15.6	17.2	19.9	23.1	12.1	13.3	14.5	17.2	19.5
	50	17.6	19.2	21.1	24.6	28.5	14.9	16.4	18.0	20.7	24.2
	60	20.7	22.7	25.0	29.3	33.6	18.0	19.5	21.1	24.6	28.5

SI: 1 in = 25.4 mm, 1 mph = 1.61 km/h

1. Linear interpolation is permitted.
2. ThermalStar SWI installed with butted joints on 2 x 4 studs spaced 16" o.c. and fastened as follows with spacing 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of 3/8".
   a. ThermalStar SWI R3: *"N"*-style 16-gauge galvanized staple (minimum 1/2" crown x 1 1/4" leg).
   b. ThermalStar SWI R5: 16-gauge galvanized staple (minimum 15/16" crown x 2" leg).
3. Demonstrates equivalency to IRC Table R602.10.3(1). All adjustment factors from IRC Table R602.10.3(2) shall be applied.
4. Minimum 1/2" gypsum wallboard shall be installed as part of the wall assembly. Where gypsum wallboard is not applied to the interior side of the wall assembly, bracing lengths shall be multiplied by a factor of 1.4.
5. Bracing lengths are the result of comparative equivalency testing and analysis using both tested and published design values as points of comparison. DrJ relies upon the design values published in the codes and standards listed in **Section 4** that are adopted into law and that the manufacturer of those products stand behind. DrJ performs all equivalency analysis based on legally defined design values, the responsibility for which is the manufacturer of those products or the members of the associations that publish those design values.
6. Wind speeds are V_{ult} in accordance with ASCE 7-22. Use $V_{asd} = V_{ult}\sqrt{0.6}$ to convert to equivalent V_{asd} wind speed in accordance with IBC Section 1609.3.1.

6.11.3 *ThermalStar SWI Method CS-PF – Continuously Sheathed Portal Frame:*

6.11.3.1 A *"ThermalStar SWI Structural Sheathing CS-PF"* was evaluated for use in IRC Method CS-PF in accordance with IRC Section R602.10.6.4 and IRC Table R602.10.6.4, and is approved for use as a contributing length of wall bracing in accordance with IRC Section R602.10.5.

6.11.3.2 The ThermalStar SWI Structural Sheathing CS-PF is described as follows in **Figure 3**:

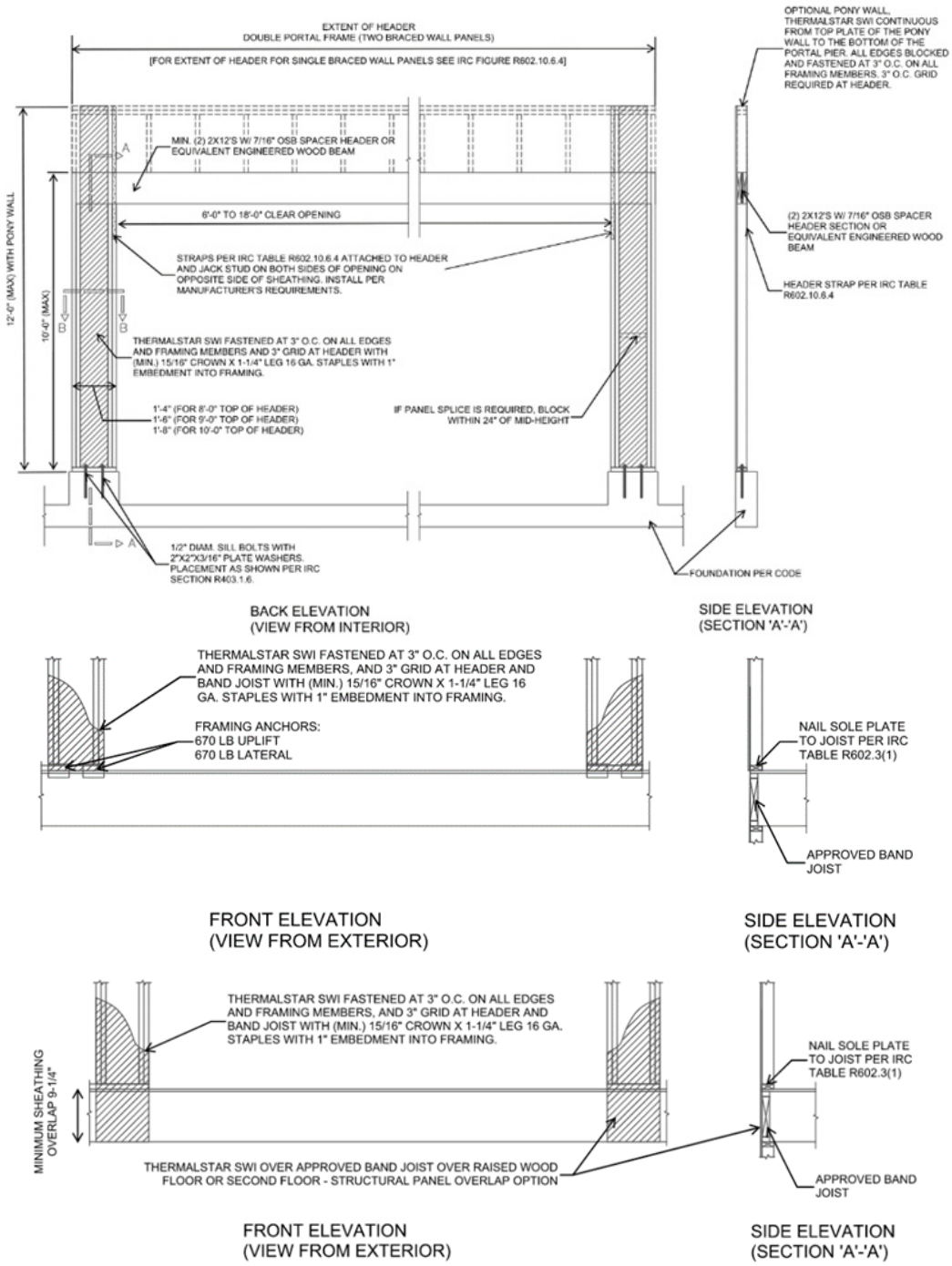

Figure 3. ThermalStar SWI Structural Sheathing CS-PF

6.11.4 *ThermalStar SWI Method PFH – Portal Frame with Hold-Downs:*

6.11.4.1 In accordance with IRC Section R602.10.6.2, the PFH referenced in the IRC is permitted to be an equivalent replacement for a 4' length of Method WSP bracing.

6.11.4.2 The ThermalStar SWI Structural Sheathing 12" PFH and 24" PFH is constructed in accordance with **Figure 4**, **Figure 5**, and **Figure 6**.

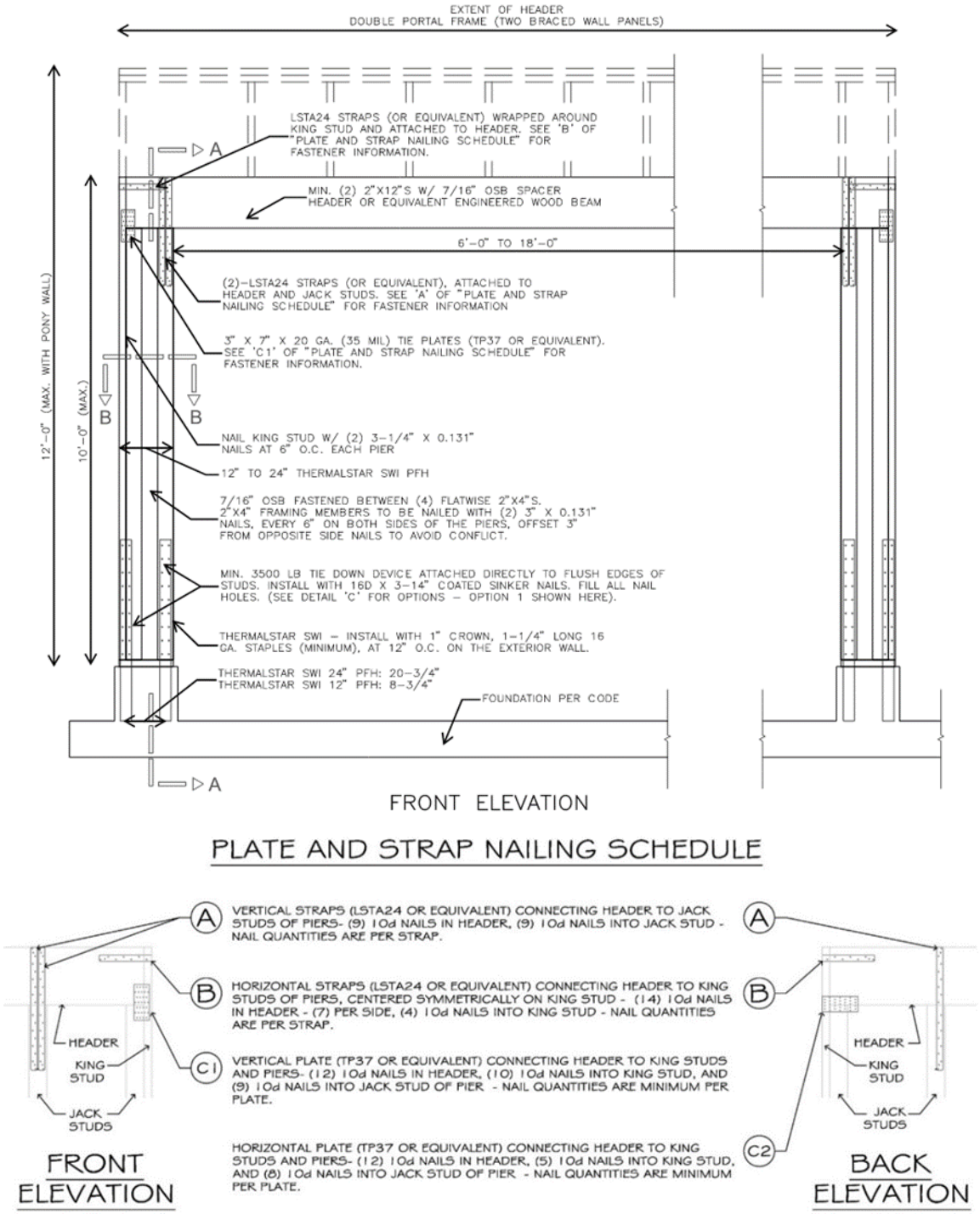

Figure 4. Construction Details of ThermalStar SWI 12" to 24" PFH

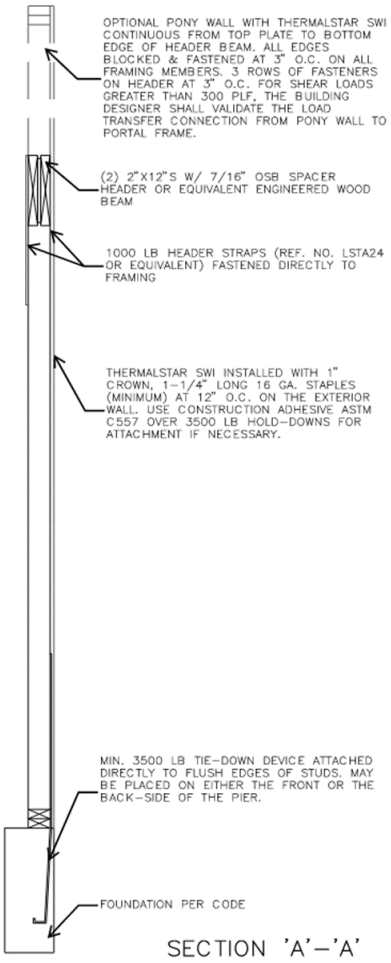

Figure 5. PFH Section A-A

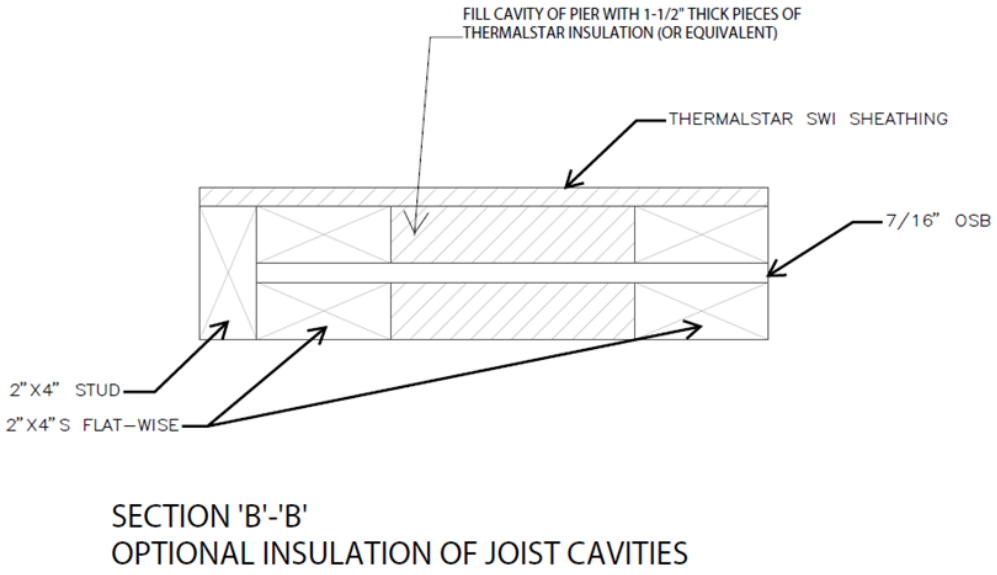

Figure 6. PFH Section B-B

6.11.4.3 A comparison of WSP braced wall lines and ThermalStar SWI 12" PFH and 24" PFH is presented in **Table 6**.

Table 6. ASD Allowable Design Values for PFH[1,2,3,4]

Test Name	Sheathing Material	Fastener Size and Spacing	Total Bracing Width (in)	Maximum Wall Height (ft)	ASD Allowable Design Value per Panel/Pier (lb) (wind)
IBC/IRC Benchmark	3/8" OSB isolated 4' x 8' panels	2 3/8" x 0.113" nails at 6:12 spacing	96	≤ 10	1,400
12" PFH	ThermalStar SWI	see **Figure 4**, **Figure 5**, and **Figure 6**	12	8	1,410
				10	1,060
24" PFH	ThermalStar SWI	see **Figure 4**, **Figure 5**, and **Figure 6**	24	8	2,560
				10	1,920

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Capacity derived from multiple full-scale tests constructed with SPF framing, as well as testing from other labs, showing the capacity of OSB sheathing in buildings constructed in accordance with the minimum requirements of the IRC.
2. The PFH bracing type in the IBC/IRC is defined as equivalent to a 4' BWP using 3/8" WSP. Equivalent capacity is based on comparison testing of the PFH and 3/8" OSB as compared to the published capacities as defined in the IBC and SDPWS.
3. Interpolation between the wall heights and pier widths for the 12" PFH and 24" PFH is permitted.
4. 10' high wall design values are provided here that use a seventy-five percent (75%) factor to reduce the 8' high wall design values generated by test data.

6.11.4.4 The test data and subsequent engineering analysis provides confirmation that the performance of the ThermalStar SWI 12" PFH and 24" PFH provide comparable equivalence to the Method WSP braced wall panels.

6.11.4.5 The maximum allowable compressive strength of the ThermalStar SWI 12" to 24" PFH is 11,156 lbs. per pier based on five SPF studs per pier (detailed in **Figure 4**, **Figure 5**, and **Figure 6**). Additional compressive capacity may be engineered into each pier. Structurally attaching full-height framing members within the pier cavity is one possible engineered option.

6.11.5 *Alternative Prescriptive IRC Bracing Applications:*

6.11.5.1 As an alternative to **Section 6.11.1**, the following provisions are permitted:

6.11.5.1.1 ThermalStar SWI may be used to brace walls of buildings as an alternative to the WSP and CS WSP provisions of IRC Section R602.10.4, when installed in accordance with this report.

6.11.5.1.2 These braced wall line length equivalency factors (see **Table 7**) are based on equivalency testing and are used to comply with Method WSP and CS-WSP of the IRC.

6.11.5.1.3 Required braced wall panel lengths for ThermalStar SWI shall be as determined by multiplying the equivalency factor shown in **Table 7** by the lengths in IRC Table R602.10.3(1) as modified by all applicable factors in IRC Table R602.10.3(2). All IRC footnotes shall apply.

Table 7. Braced Wall Line Length Equivalency Factor[1,2,3,4,5,6]

Wall Assembly	Orientation (in)	Fastener(s)	Fastener Spacing (in)	Max. Stud Spacing (in)	Equivalency Factor to IRC WSP and CS-WSP
ThermalStar SWI R3	Foam In	1 3/4" x 0.120" smooth nail[7]	3:3	16 o.c.	0.86
		16-gauge staple, minimum 15/16" crown x 1 3/4" leg			0.84
	Foam Out	"N"-style 16-gauge staple, minimum 1/2" crown x 1 1/4" leg			0.78
ThermalStar SWI R5	Foam In	1 3/4" x 0.120" ring shank nail[7]			0.94
	Foam Out	16-gauge staple, minimum 15/16" crown x 2" leg			0.78

SI: 1 in = 25.4 mm

1. Gypsum sheathing installed with Type W screws at 8":8" spacing.
2. Multiply the bracing lengths in IRC Table R602.10.3(1) and IRC Table R602.10.3(2) Method WSP or CS-WSP as applicable, including all footnotes, by the factors shown here to establish the required bracing length.
3. Where gypsum wallboard is not applied to the interior side of the ThermalStar SWI assembly, bracing lengths shall be multiplied by a factor of 1.4.
4. Valid for single and double top plate ThermalStar SWI installations.
5. Factors based on SPF framing materials.
6. These braced wall line length equivalency factors are based on equivalency testing and are used to comply with Method WSP and CS-WSP of the IRC.
7. Nails with a head diameter and length greater than the 1 3/4" x 0.120" nails are also permissible.

6.11.6 *Prescriptive IBC Conventional Light-Frame Wood Construction:*

6.11.6.1 ThermalStar SWI may be used to brace exterior walls of buildings as an equivalent alternative to WSP or CS-WSP bracing methods of the IBC when installed with blocked or unblocked 1/2" gypsum fastened with a minimum #6 Type W screw spaced a maximum of 8" o.c. at panel edges and 8" o.c. in the field. Bracing shall be in accordance with the conventional light-frame construction method of IBC Section 2308.6 and this report.

6.11.7 *Performance-Based IBC Wood-Frame Construction:*

6.11.7.1 ThermalStar SWI panels used in wall assemblies designed as shear walls are approved for the following applications:

6.11.7.1.1 Design in accordance with the methodology used in SDPWS for WSP using the capacities shown in **Table 8**.

6.11.7.1.2 Resistance to lateral wind load forces using the allowable shear loads (in pounds per linear foot) set forth in **Table 8**.

6.11.7.1.3 Resistance to transverse wind load forces using the allowable transverse loads (in pounds per square foot) set forth in **Table 9**. The transverse wind load forces correspond to the allowable basic wind speeds in **Table 10**.

Table 8. Allowable Stress Design (ASD) Capacity for Wind[1]

Product	Foam Board Orientation	Fastener(s) Schedule[2]	Fastener Spacing (edge:field) (in)	Maximum Stud Spacing (in)	Gypsum Wallboard[3] (GWB)	Gypsum Wallboard[3] Fastener Spacing (edge:field) (in)	Allowable Unit Shear Capacity (plf)
ThermalStar SWI R3	Foam In	16-gauge staple, minimum 15/16" crown x 1 3/4" leg	3:3	16 o.c.	None	-	270
					1/2" GWB	8:8	370
						12:12	345
						16:16	320
		1 3/4" x 0.120" smooth shank nail[4]			None	-	260
					1/2" GWB	8:8	360
						12:12	335
						16:16	310
	Foam Out	"N"-style 16-gauge staple minimum 1/2" crown x 1 1/4" leg			None	-	295
					1/2" GWB	8:8	395
						12:12	370
						16:16	345
ThermalStar SWI R5	Foam In	1 3/4" x 0.120" ring shank nail			None	-	230
					1/2" GWB	8:8	330
						12:12	305
						16:16	280
	Foam Out	16-gauge staple, minimum 15/16" crown x 2" leg			None	-	300
					1/2" GWB	8:8	400
						12:12	375
						16:16	350

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

1. Tested in accordance with ASTM E564.
2. ThermalStar SWI installed with butted joints on 2 x 4 studs spaced 16" o.c. and fastened as follows with spacing 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of 3/8".
3. Gypsum attached with minimum #6 type W or S screws 1 1/4" long
4. Nails with a head diameter and length greater than the 1 3/4" x 0.120" nails are also permissible.

Table 9. Transverse (Out-Of-Plane) Wind Load Resistance[1,2,3,4] – Foam Out

Product	Maximum Stud Spacing (in)	Fastener Schedule	Allowable Design Value (psf)
ThermalStar SWI	16 o.c.	Minimum $^{15}/_{16}$" crown, $1^{1}/_{4}$" leg, 16-gauge galvanized staples, 3":3" o.c. spacing (edge:field)	120

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Tested in accordance with ASTM E330.
2. Applicable to both the positive and negative direction and both foam thicknesses of $^{5}/_{8}$" and $1^{1}/_{8}$". ThermalStar Insulating Sheathings shall be installed with the foam facing outwards (foam out).
3. ThermalStar Insulating Sheathings installed with butted joints on studs spaced 16" o.c. maximum and fastened with 16-gauge, $^{15}/_{16}$" crown x $1^{3}/_{4}$" leg galvanized staples spaced 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of $^{3}/_{8}$" (9.5 mm).
4. Staples shall be installed with the legs parallel to the length of the framing member. Staples shall be countersunk through the foam and the crown shall be flush with the structural backer.

Table 10. Basic Wind Speed for Use in Exterior Wall Covering Assemblies[1,2,3]

Product	Allowable Components and Cladding Basic Wind Speed (mph)	
	Basic Wind Speed, V_{ult}	Allowable Stress Design Wind Speed, V_{asd}
ThermalStar SWI	200	155

SI: 1 mph = 1.61 km/h

1. Calculated in accordance with ASCE 7 and the following assumptions:
   a. A building height of 30-feet, GC_p= -1.4 for Zone 5 and an Effective Wind Area of 10ft^2, Topographic Factor: K_{zt}=1.0, Ground Elevation Factor: K_e=1.0, Internal Pressure Coefficient, GC_{pi}=+/-0.18 for an enclosed building, K_d = 0.85 for 'Component and Cladding
   b. V_{ult} is limited to 200 mph.
2. Applicable for Exposure Category B, Exposure Category C, and Exposure Category D.
3. Allowable stress design wind speed shall be determined in accordance with IBC Section 1609.3.1: $V_{asd} = V_{ult}\sqrt{0.6}$
4. Applicable when installed in accordance with **Table 9**.

6.11.8 *Performance-Based IBC Steel-Frame Construction:*

6.11.8.1 Per IBC Section 2211.1, design and installation of structural walls or shear walls shall be in accordance with AISI S240.

6.11.8.1.1 For detached one and two-family dwellings, and townhouses less than or equal to three stories above grade, structural walls or shear walls shall be permitted to be designed and installed in accordance with AISI S230 per IBC Section 2211.1.2.

6.11.8.2 ThermalStar Insulating Sheathings are permitted be used as an alternative sheathing material to the ones prescribed in AISI S230, and AISI S240.

6.11.8.3 ThermalStar Insulating Sheathings panels used in steel-framed wall assemblies designed as shear walls are approved for the following applications:

6.11.8.3.1 Resistance to lateral wind load forces using the allowable shear loads (in pounds per linear foot) set forth in **Table 11**.

6.11.8.3.2 Resistance to transverse wind load forces using the allowable transverse loads (in pounds per square foot) set forth in **Table 12**. The transverse wind load forces correspond to the allowable basic wind speeds in **Table 13**.

Table 11. Allowable Stress Design (ASD) Capacity for Wind, Steel Studs[1]

Product	Foam Board Orientation	Fastener(s) Schedule[2]	Fastener Spacing (edge:field) (in)	Maximum Stud Spacing (in)	Gypsum Wallboard[3] (GWB)	GWB[3] Fastener Spacing (edge:field) (in)	Allowable Unit Shear Capacity (plf)
ThermalStar Structural Wall Insulation SWI R3	Foam In	0.100" x 1 1/2" Aerosmith® VersaPin® Gripshank Large Head Nail (0.303" Head Diameter)	3:3	24 o.c.	None	-	180
					1/2" GWB	8:8	250
			3:6		None	-	175
					1/2" GWB	8:8	240

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

1. Tested in accordance with ASTM E564.
2. ThermalStar Structural Wall Insulation SWI installed with butted joints on 18-gauge (50 ksi) steel studs spaced 24" o.c. and fastened as follows with spacing 3" o.c. along the edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of 3/8" (9.5 mm).
3. Gypsum attached with minimum #6 type W or S screws 1 1/4" long.

Table 12. Transverse (Out-Of-Plane) Wind Load Resistance, Steel Studs[1,2] – Foam In

Product	Maximum Stud Spacing (in)	Fastener Schedule	Allowable Design Value (psf)
ThermalStar Insulating Sheathings	24 o.c.	0.100" x 1 1/2" Aerosmith VersaPin Gripshank Large Head Nail (0.303" Head Diameter) 3":3" o.c. spacing (edge:field)	75

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Tested in accordance with ASTM E330.
2. The capacities shown are for the purpose of providing information on the hold-down capacity of the sheathing to the bottom plate connection independent of lateral loading. Where combined shear and uplift loading is needed, consult a professional engineer.

Table 13. Basic Wind Speed for Use in Exterior Wall Covering Assemblies, Steel Studs[1,2]

Product	Allowable Components and Cladding Basic Wind Speed (mph)	
	Basic Design Wind Speed, V_{ult}	Allowable Stress Design Wind Speed, V_{asd}
ThermalStar Insulating Sheathings	200	155

SI: 1 mph = 1.61 km/h

1. Calculated in accordance with ASCE 7 Chapter 30 and the following assumptions:
   a. A building height of 30-feet, GC_p= -1.4 for Zone 5 and an Effective Wind Area of 10ft^2, Topographic Factor: K_{zt}=1.0, Ground Elevation Factor: K_e=1.0, Internal Pressure Coefficient, GC_{pi}=+/-0.18 for an enclosed building, K_d = 0.85 for 'Component and Cladding
   b. V_{ult} is limited to 200 mph.
   c. Exposure Category B.
2. Allowable stress design wind speed shall be determined in accordance with IBC Section 1609.3.1: $V_{asd} = V_{ult}\sqrt{0.6}$
3. Applicable when installed in accordance with **Table 12**.

6.12 *Thermal Insulation*

6.12.1 ThermalStar Insulating Sheathings meet the continuous insulation requirements of IECC Section C402 and IECC Section R402 and have the thermal resistance provided in **Table 14**.

Table 14. Thermal Resistance Properties[1]

Product	R-Value (°F·ft²·hr/Btu)
ThermalStar SWI R3 and SWI GPS R3	3.0
ThermalStar SWI R5 and SWI GPS R5	5.0
ThermalStar LWI 10	3.6[2]
ThermalStar LWI GPS 10	4.7[2]
ThermalStar LWI 15	3.9[2]
ThermalStar LWI GPS 15	4.7[2]

1. Components tested in accordance with ASTM C518.
2. R-value is per inch.

6.13 *Water-Resistive Barrier (WRB)*

6.13.1 ThermalStar SWI may be used as a WRB as prescribed in IBC Section 1403.2[25] and IRC Section R703.2, when installed with foam facing in on exterior walls as described in this section.

6.13.1.1 ThermalStar SWI installed with the foam facing out shall be covered with a code-compliant WRB in accordance with IBC Section 1403.2[26] and IRC Section R703.2.

6.13.1.2 ThermalStar SWI shall be installed with board joints placed directly over exterior framing spaced a maximum of 16" (406 mm) o.c. The fasteners used to attach the board shall be installed in accordance with **Table 1** through **Table 12** and **Section 9**, as applicable.

6.13.1.3 A separate WRB may also be provided. If a separate WRB method is used, sealing of the sheathing joints is not required.

6.13.1.4 Flashing must be installed at all sheathing penetrations and shall comply with all the applicable code sections. Use ThermalStar Tape, Fortiflash® Butyl, or an approved equal.

6.13.1.5 ThermalStar SWI may be installed as a WRB in a non-structural capacity with the fasteners used to attach the board installed in accordance with **Section 9.8**. All joints between sheathing panels shall be covered by minimum 1½" (38 mm) wide tape (ThermalStar Tape or equivalent).

6.13.2 ThermalStar LWI may be used as a WRB as prescribed in IBC Section 1403.2[27] and IRC Section R703.2 when installed as described in this section.

6.13.2.1 Two (610 mm) and four (1,219 mm) foot wide LWI insulation boards that have tongue-and-groove joints must be oriented so the tongues face upward. Boards with squared edges may be oriented vertically or horizontally.

6.13.2.2 ThermalStar LWI boards shall be installed with board joints placed directly over exterior framing spaced a maximum of 24" (610 mm) o.c. The fasteners used to attach the board shall be installed spaced a maximum of 24" apart and must penetrate a minimum of ¾" into the framing members.

6.13.2.3 The following fasteners are approved for use during installation:

6.13.2.3.1 Corrosion-resistant roofing nails with a minimum $^{3}/_{8}$" diameter (9.5 mm) head

6.13.2.3.2 6d ring-shank nails and $^{15}/_{16}$" diameter (24 mm) plastic washers

6.13.2.3.3 Self-drilling screws with $^{3}/_{4}$" diameter (19 mm) cap washers

6.13.2.3.4 A minimum $^{15}/_{16}$" crown (23.8 mm), 16-gauge galvanized staples

6.13.2.4 All joints between sheathing panels shall be covered by minimum $1^{1}/_{2}$" (38 mm) wide tape (ThermalStar Tape or equivalent).

6.14 *Vapor Retarder*

6.14.1 ThermalStar SWI and ThermalStar LWI are Class II vapor retarders in accordance with IBC Section 1404.3 and as shown in **Table 15**.

Table 15. Water Vapor Barrier Properties[1]

Product	Water Vapor Transmission (perm)
ThermalStar SWI	<0.3
ThermalStar LWI	<0.3
1. Tested in accordance with ASTM E96, Desiccant Method.	

6.15 *Air Barrier*

6.15.1 ThermalStar Insulating Sheathings meet the requirements of IRC Section N1102.4.1.1 and IECC Section C402.5.1.3 for use as an air barrier material when installed in accordance with the manufacturer installation instructions and this report.

6.15.2 When used as part of a continuous air barrier assembly, ThermalStar Insulating Sheathings shall be installed in accordance with **Section 9.8.3**. When installed as part of a continuous air barrier assembly in a non-structural capacity, the fasteners used to attach the board may be installed in accordance with **Section 9.8**.

6.15.3 All sheathing panel edges at the top and bottom of wall assemblies, and all joints between sheathing panels, shall be sealed in accordance with IRC Section N1102.4.1.1, IECC Section R402.4.1.1, and IECC Section C402.5.1. All joints between sheathing panels shall be covered by minimum $1^{1}/_{2}$" (38 mm) wide tape (ThermalStar Tape or equivalent).

Table 16. Air Barrier Properties[1]

Product	Air Permeability (cfm/ft^2)
ThermalStar SWI	< 0.004
ThermalStar LWI	< 0.004
1. Tested in accordance with ASTM E2178.	

6.16 *Surface Burning Characteristics*

6.16.1 ThermalStar Insulating Sheathings have the flame spread and smoke developed characteristics shown in **Table 17** when tested in accordance with ASTM E84 per IBC Section 2603.3.

Table 17. Surface Burn Characteristics[1]

Product	Flame Spread	Smoke Developed	Classification
ThermalStar SWI	≤ 25	≤ 450	Class A
ThermalStar LWI	≤ 25	≤ 450	Class A

1. Tested in accordance with ASTM E84.

6.17 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science and fire science.

7 Certified Performance[28]

7.1 All construction methods shall conform to accepted engineering practices to ensure durable, livable, and safe construction and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.[29]

7.2 The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.[30]

8 Regulatory Evaluation and Accepted Engineering Practice

8.1 ThermalStar Insulating Sheathings comply with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 Structural performance under lateral load conditions for wind loading for use as an alternative to the IRC Intermittent Wall Bracing provisions of IRC Section R602.10 WSP method.

8.1.2 Structural performance under lateral load conditions for wind loading for use with the IRC Continuous Wall Bracing provisions of IRC Section R602.10.4 CS-WSP and CS-PF methods.

8.1.3 Structural performance under lateral load conditions for use as an alternative to the IRC Continuous Wall Bracing provisions of IRC Section R602.10.6.2 PFH method.

8.1.4 Structural performance under lateral load conditions for wind loading for use with the IBC performance based provisions, IBC Section 2306.1 and IBC Section 2306.3, for light-frame wood wall assemblies.

8.1.5 Structural performance under lateral load conditions for use as an alternative to the IRC simplified bracing provisions of IRC Section R602.12.

8.1.6 Structural performance under lateral load conditions for use as an alternative to SDPWS Section 4.3 Sheathed Wood Frame Shear Walls.

8.1.7 Resistance to transverse loads for wall assemblies used in light-frame wood construction in accordance with IBC Section 1609.1.1 and IRC Section R301.2.1.

8.1.8 Performance for use as insulated sheathing in accordance with the IECC Section C402.1 and IECC Section R402.1.

8.1.9 Performance for use as a WRB in accordance with the IBC Section 1403.2[31] and IRC Section R703.2.

8.1.10 Performance for use as a vapor retarder in accordance with IBC Section 202, IBC Section 1404.3,[32] IRC Section R202, and IRC Section R702.7.

8.1.11 Performance for use as an air barrier in accordance with IRC Section N1102.4.1.1, IECC Section R402.4.1.1, and IECC Section C402.5.1.3.[33]

8.1.12 Surface burning characteristics in accordance with IBC Section 2603.3 and IRC Section R316.3.

8.2 Performance under seismic loading is outside the scope of this report.

8.2.1 Use of design values for buildings exempt from seismic loading provisions in IBC Section 1613.1 is permitted.

8.2.2 For buildings designed in accordance with the IRC, use in Seismic Design Categories (SDC) A, B, and C for detached dwellings and in SDC A and B for townhouses is permitted, using the wind bracing design provisions in accordance with IRC Table R602.10.1.3.

8.3 Use with steel studs is outside the scope of this report.

8.4 ThermalStar LWI complies with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.4.1 Performance for use as insulated sheathing in accordance with the IECC Section C402.1 and IECC Section R402.1.

8.4.2 Performance for use as a WRB in accordance with the IBC Section 1403.2[34] and IRC Section R703.2.

8.4.3 Performance for use as a vapor retarder in accordance with IBC Section 202, IBC Section 1404.3,[35] IRC Section R202, and IRC Section R702.7.

8.4.4 Performance for use as an air barrier in accordance with IRC Section N1102.4.1.1, IECC Section R402.4.1.1, and IECC Section C402.5.1.3.[36]

8.4.5 Surface burning characteristics in accordance with IBC Section 2603.3 and IRC Section R316.3.

8.5 Any building code, regulation and/or accepted engineering evaluations (i.e., research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ Engineering, LLC (DrJ), an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP/approved sources. DrJ is qualified[37] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise, respectively.

8.6 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope of expertise, which are also its areas of professional engineering competence.

8.7 Any regulation specific issues not addressed in this section are outside the scope of this report.

9 Installation

9.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report and the applicable building code.

9.2 In the event of a conflict between the manufacturer installation instructions and this report, the more restrictive shall govern.

9.3 Fasteners shall conform to those listed in **Table 1** through **Table 8** and **Section 9.8**, as applicable.

9.4 Always fasten staples parallel to the framing member.

9.5 Fasteners shall be installed with a minimum edge distance of $^{3}/_{8}$".

9.6 For joints butted at framing members, a single row of fasteners must be applied to each panel edge into the stud.

9.7 *Installation Procedure*

9.7.1 Fasten ThermalStar SWI structural in the order shown in **Figure 7** through **Figure 11**.

9.7.1.1 Do ***not*** fasten the four corners first.

9.7.2 Do not tack ThermalStar Insulating Sheathings to framing, but fasten each panel completely once fastening begins.

9.7.3 ***Step 1:*** Fasten all sheets around the perimeter every 3" using approved staples or nails. All perimeter edges must be installed over framing members and fastened for structural use. (**Figure 7**).

Figure 7. Installation: Step 1

9.7.4 ***Step 2:*** Begin nailing pattern across the top and bottom of the panel from Step 1 until you reach the next stud (**Figure 8**).

9.7.5 ***Step 3:*** Fasten all sheets in the field every 3" using approved staples or nails on next stud (**Figure 8**).

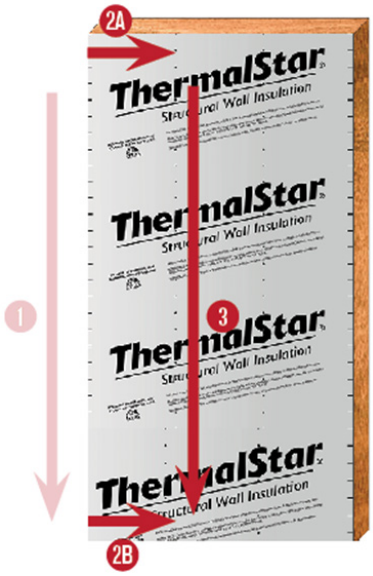

Figure 8. Installation: Step 2 and Step 3

9.7.6 ***Steps 4-7:*** Repeat Steps 2 and 3 on sequential studs remaining in panel (**Figure 9** and **Figure 10**).

Figure 9. Installation: Step 4 and Step 5

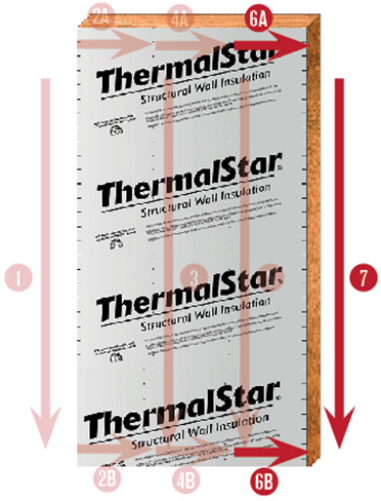

Figure 10. Installation: Step 6 and Step 7

9.7.7 ***Step 8:*** To achieve a WRB, all seams must be taped in shingle fashion. Use ThermalStar Tape, Fortiflash Butyl or an approved equivalent. Seams must be dry and clear of debris (**Figure 11**).

Figure 11. Installation: Step 8

9.8 *Minimum Fastening Requirements for Non-Structural Applications*

9.8.1 Where other means of wall bracing are provided or are not required, and an approved exterior wall covering capable of separately resisting loads perpendicular to the face of the walls is installed over the sheathing, ThermalStar Insulating Sheathings may be used.

9.8.2 The sheathing panels are applied to wall framing with minimum 0.120" x 1¼" (3 mm x 32 mm) galvanized roofing nails or 16-gauge galvanized staples having a 7/16" (11 mm) crown and 1¼" (32 mm) leg lengths.

9.8.3 Fastener spacing shall be a maximum of 12" (152 mm) at the edges and 12" (305 mm) on intermediate members.

9.8.3.1 Stud spacing shall be a maximum of 24" (610 mm) o.c.

9.8.4 Minimum fastener penetration into the framing members is ¾" (19 mm).

10 Substantiating Data

10.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

10.1.1 Lateral wall testing performed in accordance with ASTM E564

10.1.2 Transverse wind pressure resistance testing performed in accordance with ASTM E330

10.1.3 Material property testing for EPS and GPS in accordance with ASTM C578

10.1.4 Water-resistive barrier testing conducted in accordance with ASTM E331

10.1.5 Water vapor transmission testing performed in accordance with ASTM E96

10.1.6 Air barrier testing performed in accordance with ASTM E2178

10.1.7 Surface burning characteristics testing performed in accordance with ASTM E84

10.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies, approved sources and/or RDPs. Accuracy of external test data and resulting analysis is relied upon.

10.3 Where applicable, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as being equivalent to the regulatory provision in terms of quality, strength, effectiveness, fire resistance, durability and safety.

10.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, or duly authenticated reports from approved agencies and/or approved sources provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this duly authenticated report, may be dependent upon published design properties by others.

10.5 Testing and engineering analysis: The strength, rigidity, and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.[38]

10.6 Where additional condition of use and/or regulatory compliance information is required, please search for ThermalStar Insulating Sheathings on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, ThermalStar Insulating Sheathings have performance characteristics that were tested and/or meet applicable regulations and are suitable for use pursuant to its specified purpose.

11.2 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, ThermalStar Insulating Sheathings shall be approved for the following applications:

11.2.1 Use as an alternative to the WSP and CS-WSP wall bracing in accordance with IRC Section R602.10.

11.2.2 Use to resist wind loading in accordance with the IBC performance-based provisions IBC Section 2306.1 and IBC Section 2306.3 for light-frame wood wall assemblies.

11.2.3 Use to resist transverse loads on wall assemblies used in light-frame wood construction in accordance with IBC Section 1609.1.1 and IRC Section R301.2.1.

11.2.4 Use as insulated sheathing in accordance with the IRC Section N1102.4.1.1, IECC Section R402.1, and IECC Section C402.1.

11.2.5 Use as a WRB in accordance with the IBC Section 1403.2[39] and IRC Section R703.2.

11.2.6 Use as a Class II vapor retarder in accordance with IBC Section 1404.3 and IRC Section R702.7.

11.2.7 Use as an air barrier in accordance with the IRC Section N1102.4.1.1, IECC Section R402.4.1.1, and IECC Section C402.5.1.3.[40]

11.3 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, ThermalStar LWI shall be approved for the following applications:

11.3.1 Use as insulated sheathing in accordance with the IRC Section N1102.4.1.1, IECC Section R402.1, and IECC Section C402.1.

11.3.2 Use as a WRB in accordance with the IBC Section 1403.2[41] and IRC Section R703.2.

11.3.3 Use as a Class II vapor retarder in accordance with IBC Section 1404.3 and IRC Section R702.7.

11.3.4 Use as an air barrier in accordance with the IRC Section N1102.4.1.1, IECC Section R402.4.1.1, and IECC Section C402.5.1.3.[42]

11.4 Unless exempt by state statute, when ThermalStar Insulating Sheathings are to be used as a structural and/or building envelope component in the design of a specific building, the design shall be performed by an RDP.

11.5 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from Atlas Roofing Corporation.

11.6 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10[43] are similar) in pertinent part states:

> **104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons the alternative was not approved.

11.7 **Approved**:[44] Building regulations require that the building official shall accept duly authenticated reports.[45]

11.7.1 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited.

11.7.2 An approved source is *"approved"* when an RDP is properly licensed to transact engineering commerce.

11.7.3 Federal law, Title 18 US Code Section 242, requires that where the alternative product, material, service, design, assembly and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

11.8 DrJ is a licensed engineering company, employs licensed RDPs and is an ANAB-Accredited Product Certification Body – Accreditation #1131.

11.9 Through the IAF Multilateral Agreements (MLA), this duly authenticated report can be used to obtain product approval in any jurisdiction or country because all ANAB ISO/IEC 17065 duly authenticated reports are equivalent.[46]

12 Conditions of Use

12.1 Material properties shall not fall outside the boundaries defined in **Section 6**.

12.2 As defined in **Section 6**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

12.3 As listed herein, ThermalStar Insulating Sheathings shall not be used:

12.3.1 As a nailing base for claddings, trim, windows, or doors. Fastening through the ThermalStar Insulating Sheathings into the framing is acceptable.

12.3.2 To resist horizontal loads from concrete and masonry walls. When used behind masonry, devices such as masonry ties shall be used to transfer the load to the main force resisting system.

12.4 When used as part of a continuous air barrier assembly, all sheathing panel edges at the top and bottom of the wall assemblies and all joints between sheathing panels, shall be sealed with an approved construction tape.

12.5 When ThermalStar Insulating Sheathings are installed as a wall sheathing but is not installed per structural requirements, light framed walls shall be braced by other means. When used as a WRB, installation shall be in accordance with **Section 9.8**.

12.6 When ThermalStar Insulating Sheathings are not installed as a WRB, other means of providing a WRB are required per the code.

12.7 When used in accordance with the IBC in high wind areas, special inspections shall comply with IBC Section 1705.12.[47]

12.8 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.

12.8.1 Allowable shear loads shall not exceed the values in **Table 8** for wind loads.

12.8.2 Transverse design loads shall not exceed those described in **Table 9**, unless an approved exterior wall covering capable of separately resisting loads perpendicular to the face of the walls is installed over the sheathing.

12.8.3 Allowable wind speeds do not exceed values in **Table 10**.

12.9 All panel edges shall be supported by wall framing or solid blocking a minimum of 2" (51 mm) nominal in thickness.

12.10 In areas where the probability of a termite infestation is labeled *"very heavy"* for ThermalStar Insulating Sheathings boards that are installed on buildings or structures of wood-framed construction, the installation shall follow the provisions of IBC Section 2603.8 and IRC Section R318.4, where applicable.

12.11 When required by adopted legislation and enforced by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed:

12.11.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an approved source, shall be approved when signed and sealed.

12.11.2 This report and the installation instructions shall be submitted at the time of permit application.

12.11.3 These innovative products have an internal quality control program and a third-party quality assurance program.

12.11.4 At a minimum, these innovative products shall be installed per **Section 9**.

12.11.5 The review of this report by the AHJ shall comply with IBC Section 104 and IBC Section 105.4.

12.11.6 These innovative products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.4, IBC Section 110.4, IBC Section 1703, IRC Section R104.4, and IRC Section R109.2.

12.11.7 The application of these innovative products in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2, and any other regulatory requirements that may apply.

12.12 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, "*the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new material or assemblies as provided for in Section 104.11*," all of IBC Section 104, and IBC Section 105.4.

12.13 Design loads shall be determined in accordance with the regulations adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (i.e., owner or RDP).

12.14 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

13 Identification

13.1 The innovative products listed in **Section 1.1** are identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number and other information to confirm code compliance.

13.2 Additional technical information can be found at www.atlasmoldedproducts.com.

14 Review Schedule

14.1 This report is subject to periodic review and revision. For the latest version, visit drjcertification.org.

14.2 For information on the status of this report, please contact DrJ Certification.

Notes

1 For more information, visit drjcertification.org or call us at 608-310-6748.

2 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1702

3 Alternative Materials, Design and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review https://www.justice.gov/atr/mission and https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104.11

4 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706:~:text=the%20design%20strengths%20and%20permissible%20stresses%20shall%20be%20established%20by%20tests%20as

5 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice. https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706:~:text=shall%20conform%20to%20the%20specifications%20and%20methods%20of%20design%20of%20accepted%20engineering%20practice

6 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies

7 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1703.4.2

8 https://up.codes/viewer/wyoming/ibc-2021/chapter/2/definitions#approved_agency

9 https://up.codes/viewer/wyoming/ibc-2021/chapter/2/definitions#approved_source

10 https://www.law.cornell.edu/uscode/text/18/1832 (b) Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of $5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. To follow DTSA and comply state public records and trade secret legislation requires approval through ANAB ISO/IEC 17065 accredited certification bodies or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

11 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/

12 https://www.cbitest.com/accreditation/

13 https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104:~:text=to%20enforce%20the%20provisions%20of%20this%20code

14 https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104.11:~:text=Where%20the%20alternative%20material%2C%20design%20or%20method%20of%20construction%20is%20not%20approved%2C%20the%20building%20official%20shall%20respond%20in%20writing%2C%20stating%20the%20reasons%20why%20the%20alternative%20was%20not%20approved AND https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#105.3.1:~:text=If%20the%20application%20or%20the%20construction%20documents%20do%20not%20conform%20to%20the%20requirements%20of%20pertinent%20laws%2C%20the%20building%20official%20shall%20reject%20such%20application%20in%20writing%2C%20stating%20the%20reasons%20therefore

15 https://up.codes/viewer/colorado/ibc-2021/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies%20in%20respect%20to%20the%20quality%20and%20manner%20of%20use%20of%20new%20materials%20or%20assemblies%20as%20provided%20for%20in%20Section%20104.11

16 https://iaf.nu/en/about-iaf-mla/#:~:text=it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope

17 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.

18 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

19 Unless otherwise noted, all references in this Listing are from the 2021 version of the codes and the standards referenced therein. This material, product, design, service and/or method of construction also complies with the 2000-2021 versions of the referenced codes and the standards referenced therein.

20 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by the local jurisdiction. https://up.codes/codes/general

21 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by state. https://up.codes/codes/general

22 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14

23 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

24 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#p-3280.2(Listed%20or%20certified); https://up.codes/viewer/colorado/ibc-2021/chapter/2/definitions#listed AND https://up.codes/viewer/colorado/ibc-2021/chapter/2/definitions#labeled

25 2015 IBC Section 1404.2

26 2018 IECC Section C402.5.1.2.1

27 2015 IBC Section 1404.2

28 https://up.codes/viewer/colorado/ibc-2021/chapter/17/special-inspections-and-tests#1703.4

29 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=All%20construction%20methods%20shall%20be%20in%20conformance%20with%20accepted%20engineering%20practices%20to%20insure%20durable%2C%20livable%2C%20and%20safe%20housing%20and%20shall%20demonstrate%20acceptable%20workmanship%20reflecting%20journeyman%20quality%20of%20work%20of%20the%20various%20trades

30 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=The%20strength%20and%20rigidity%20of%20the%20component%20parts%20and/or%20the%20integrated%20structure%20shall%20be%20determined%20by%20engineering%20analysis%20or%20by%20suitable%20load%20tests%20to%20simulate%20the%20actual%20loads%20and%20conditions%20of%20application%20that%20occur

31 2015 IBC Section 1404.2

32 2015 IBC Section 1405.3

33 2018 IECC Section C402.5.1.2.1

34 2015 IBC Section 1404.2

35 2015 IBC Section 1405.3

36 2018 IECC Section C402.5.1.2.1

37 Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

38 See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition.

39 2015 IBC Section 1404.2

40 2018 IECC Section C402.5.1.2.1

41 2015 IBC Section 1404.2

42 2018 IECC Section C402.5.1.2.1

43 2018 IFC Section 104.9

44 Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

45 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1

46 Multilateral approval is true for all ANAB accredited product evaluation agencies and all International Trade Agreements.

47 2018 IBC Section 1705.11