Atlas Laminated Continuous Insulation – Structural Sheathing (LCi-SS)

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Section: 06 12 00 – Structural Panels
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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

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1. Products Evaluated:

1.1. Atlas Laminated Continuous Insulation – Structural Sheathing (LCi-SS)

1.2. For the most recent version of this Technical Evaluation Report (TER), visit drjengineering.org. For more detailed state professional engineering and code compliance legal requirements and references, visit drjengineering.org/statelaw. DrJ is fully compliant with all state professional engineering and code compliance laws.

1.3. This TER can be used to obtain product approval in any country that is an IAF MLA Signatory (all countries found here) and covered by an IAF MLA Evaluation per the Purpose of the MLA (as an example, see letter to ANSI from the Standards Council of Canada).

DrJ is a Professional Engineering Approved Source

Learn more about DrJ's Accreditation

- DrJ is an ISO/IEC 17065 accredited product certification body through ANSI Accreditation Services.
- DrJ provides certified evaluations that are signed and sealed by a P.E.
- DrJ's work is backed up by professional liability insurance.
- DrJ is fully compliant with *IBC* Section 1703.

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Manufacturers can go to jurisdictions in the U.S., Canada and other IAF MLA Signatory Countries and have their products readily approved by authorities having jurisdiction using DrJ's ANSI accreditation.

1.4. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements. Any agency accredited in accordance with ANSI ISO/IEC 17065 meets this requirement within ANSI's scope of accreditation. For a list of accredited agencies, visit ANSI's website. For more information, see drjcertification.org.

1.5. Requiring an evaluation report from a specific organization (ICC-ES, IAPAMO, CCMC, DrJ, etc.) can be viewed as discriminatory and is a violation of international, federal, state, provincial and local anti-trust and free trade regulations.

2. Applicable Codes and Standards:[1]

2.1. *2009, 2012* and *2015 International Building Code* (*IBC*)

2.2. *2009, 2012* and *2015 International Residential Code* (*IRC*)

2.3. *2009, 2012* and *2015 International Energy Conservation Code* (*IECC*)

2.4. *ANSI/AWC SDPWS – Special Design Provisions for Wind and Seismic*

2.5. *ASCE/SEI 7 – Minimum Design Loads for Buildings and Other Structures*

2.6. *ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*

2.7. *ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*

2.8. *ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environment Chamber*

2.9. *ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials*

2.10. *ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials*

2.11. *ASTM E564 – Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings*

2.12. *ASTM E2178 – Standard Test Method for Air Permeance of Building Materials*

2.13. *ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi*

3. Performance Evaluation:

3.1. LCi-SS was evaluated to determine its:

3.1.1. Structural performance under lateral load conditions for use as an alternative to the *IRC* bracing methods using wood structural panels (WSP), including portal frames in accordance with *IRC* Section R602.10 and R602.12[2].

3.1.2. Structural performance under lateral load conditions for use as an alternative to the *IBC* Conventional Wall Bracing provisions, Section 2308.6[3], Method 3, for Type V construction and the alternative bracing methods in accordance with Section 2308.6.5[4] and Table 2308.6.3(2)[5].

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

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[1] Unless otherwise noted, all references in this code compliant research report (TER) are from the 2015 version of the codes and the standards referenced therein, including, but not limited to, *ASCE 7*, *SDPWS* and *WFCM*. This product also complies with the 2000-2012 versions of the *IBC* and *IRC* and the standards referenced therein. As required by law, where this research report is not approved, the building official shall respond in writing, stating the reasons this research report was not approved. For variations in state and local codes, if any, see Section 8.

[2] *2015 IRC* Section R602.12 has changed provisions.

[3] *2012 IBC* Section 2308.9.3

[4] *2012 IBC* Section 2308.9.3.1

[5] *2012 IBC* Table 2308.9.3(2)

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3.1.4. Resistance to transverse loads for wall assemblies used in light-frame wood construction in accordance with *IRC* Section R301.2.1 and R602.3,[6] and *IBC* Section 1609.1.1, 2304.6.1 and 2304.10.6[7].

3.1.5. Uplift performance in accordance with *IRC* Section R602.3.5[8] and *IBC* Section 1604.9.

3.1.6. Performance for use as foam plastic insulation in accordance with the *IRC* Section 316 and *IBC* Section 2603.

3.1.7. Performance for use as insulated sheathing in accordance with the *IECC* Section 402.1.

3.1.8. Performance for use as an air barrier in accordance with the *IECC* Section 402.5.1.1.[9]

3.1.9. Performance for use as a water-resistive barrier (WRB) in accordance with the *IRC* Section 703.2 and *IBC* Section 1404.2.

3.2. Any code compliance issues not specifically addressed in this section are outside the scope of this evaluation.

4. Product Description and Materials:

4.1. LCi-SS is an insulated structural sheathing product with a polymeric film facer on one side and an OSB facer on the opposite side. The OSB side of LCi-SS faces inward, with the EPS on the exterior side. Standard features include:

4.1.1. $^{5}/_{8}$", $1^{3}/_{16}$" or $1^{9}/_{16}$ EPS, laminated to a $^{7}/_{16}$" Exposure I 24/16 rated OSB, for total thicknesses of $1^{1}/_{16}$" (R3), $1^{5}/_{8}$" (R5), and 2" (R7.5)

4.1.2. Meets *IRC* and *IECC* requirements for continuous insulation

4.1.3. Marked for nail spacing

4.1.4. Impregnated with a termiticide for long-term protection above grade

4.2. LCi-SS is installed with a patent pending SENCO nailer. This nailer and the specified SENCO nails ensure that the sheathing nails are secured with the head seated on the surface of the OSB. STANDARD NAILERS MAY NOT BE USED FOR INSTALLATION OF LCi-SS. Consult with ATLAS EPS for other approved models.

4.3. Material Availability

4.3.1. LCi-SS total thickness: 2", $1^{5}/_{8}$" and $1^{1}/_{16}$"

4.3.2. Standard product width: 48"

4.3.3. Standard lengths: 96", 108" and 120"

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[6] *2015 IRC* Section R602.3 features updated table specifications for fasteners and fastener spacing and location.
[7] *2012 IBC* Section 2304.9.6
[8] *2015 IRC* Section R602.3.5 has changed provisions.
[9] *2009 IECC* Section 402.4.2, *2012 IECC* Section C402.4.1.1

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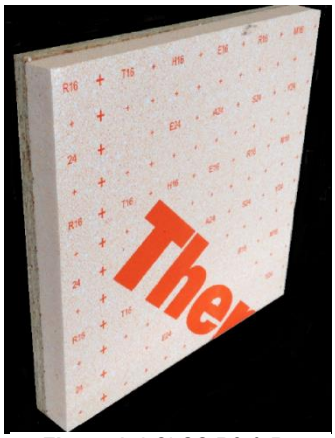


Figure 1: LCi-SS R3 & R5



Figure 2: LCi-SS R7.5

5. Applications:

5.1. Bracing requirements for LCi-SS are the same as the prescriptive bracing in the codes for WSP. Information in this report for structural and wind resistance is as found in the *IBC* and *IRC*.

5.2. General

5.2.1. LCi-SS is a structural insulated sheathing product for use in conventional light-frame wood construction, braced wall panels within braced wall lines, and continuously sheathed braced wall lines. This product is used in structures complying with the *IRC* and in buildings of Type V construction per the *IBC*.

5.2.2. LCi-SS is used as structural wall sheathing to provide resistance to transverse loads for wall assemblies used in wood construction in accordance with *IRC* Section R301.2.1 and R602.3,[10] and *IBC* Section 1609.1.1, 2304.6.1 and 2304.10.6[11].

5.2.3. LCi-SS is used as continuous insulation in accordance with *IRC* Section N1102 and *IECC* Section 402.1.

5.2.4. LCi-SS contains foam plastics complying with *IRC* Section 316 and *IBC* Section 2603.

5.2.5. LCi-SS contains OSB rated 24/16 Exposure 1 complying with PS 2 manufactured in accordance with *IRC* Section R604.

5.2.6. When LCi-SS is installed as an approved WRB in accordance with *IRC* Section R703.2 and *IBC* Section 1404.2 all joints must be taped using ThermalStar 007 tape or equivalent.

5.2.7. When LCi-SS is installed as an approved air barrier component in accordance with *IECC* Section 402.5.1.1[12], all joints and seams must be sealed including top and bottom edges of panels using ThermalStar 007 tape or equivalent.

5.2.8. LCi-SS is a Class II vapor retarder, when tested in accordance with *ASTM E96* Section 11 (dry cup) and 12 (wet cup), and shall be installed in accordance with *IRC* Section R702.7.1. LCi-SS has a permeance ranging from 0.5 to 0.8 (wet cup), depending on the permeance of the OSB layer. LCi-SS product should be selected based on the climate zone and framing, in accordance with *IRC* Table R702.7.1[13], to assure necessary condensation control. Depending on the application and internal vapor retarder selection, additional continuous insulation over LCi-SS may be required.

5.3. Structural Applications

[10] *2015 IRC* Section R602.3 features updated table specifications for fasteners and fastener spacing and location.
[11] *2012 IBC* Section 2304.9.6
[12] *2009 IECC* Section 402.4.2, *2012 IECC* Section C402.4.1.1
[13] *2015 IRC* Table R702.7.1 calls for continuous insulation instead of insulated sheathing.

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5.3.1. General Wall Bracing Provisions

5.3.1.1. Except as otherwise described in this TER, LCi-SS shall be installed in accordance with the applicable building codes listed in Section 2 using the provisions set forth therein for the design and installation of wood structural panels (WSP).

5.3.1.1.1. LCi-SS shall be permitted to be designed in accordance with *SDPWS* for the design of shear walls using the methods set forth therein, including the perforated shear wall methodology, and subject to the *SDPWS* boundary conditions, except as specifically allowed in this TER.

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

5.3.1.2.1. For wind design, anchor bolt spacing shall not exceed 6' o.c.

5.3.1.2.2. For seismic design, anchor bolt spacing shall not exceed 4' o.c.

5.3.1.3. The maximum aspect ratio for LCi-SS shall be 3.5:1.

5.3.1.4. The minimum full height panel width shall be 24".

5.3.1.5. All panel edges shall be blocked with a minimum 2" nominal lumber, except where noted in Section 6.

5.3.1.6. Only High Performance Building Systems approved nail guns modified for proper installation of LCi-SS shall be used to install LCi-SS.

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

5.3.1.8. Where LCi-SS is installed with ½" gypsum wallboard on the interior side of the wall, the gypsum sheathing shall be applied to the interior side of the wall assembly and fastened with a minimum 5d cooler nails or 1¼" #6 type W or S screws spaced 16" o.c. at panel edges and 16" o.c. in the field of the panels.

5.3.1.9. Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with code-defined accepted engineering procedures, experience and good technical judgment.

5.3.2. Prescriptive *IRC* Bracing Applications

5.3.2.1. LCi-SS may be used on braced wall lines as an equivalent alternative to any method utilizing wood structural panels listed in the *IRC* for wind or seismic, when installed in accordance with *IRC* Section R602.10 and this TER.

5.3.2.2. Required braced wall panel lengths for LCi-SS shall be as determined by *IRC* Table R602.10.3 (1) and R602.10.3(3)[14], including all footnotes and as summarized in Table 1 and Table 2.

5.3.2.2.1. All *IRC* prescriptive bracing minimums, spacing requirements and rules must still be met.

5.3.2.2.2. 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 2 that are adopted into law and that the manufacturers 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.

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[14] *2009 IRC* Table R602.10.1.2(1) and R602.10.1.2(2). *2015 IRC* Table R602.10.3(1) and (3) feature updated ultimate design wind speeds and exposure category specifications.

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Required Bracing Lengths for LCi-SS with OSB (Method WSP) – Wind (Max. 24" o.c. Stud Spacing)											
Condition	Braced Wall Line Spacing (ft.)	Intermittent Sheathing					Continuous Sheathing				
		Nails 6" o.c. Edges & 12" o.c. in the Field					Nails 6" o.c. Edges & 12" o.c. in the Field				
		Length of Wall Line to be Braced (ft.)					Length of Wall Line to be Braced (ft.)				
		≤ 110 mph	≤ 115 mph	≤ 120 mph	≤ 130 mph	≤ 140 mph	≤ 110 mph	≤ 115 mph	≤ 120 mph	≤ 130 mph	≤ 140 mph
One Story or Top of Two Stories or Top of Three Stories	10'	2.0	2.0	2.5	2.5	3.0	1.5	2.0	2.0	2.5	2.5
	20'	3.5	3.5	4.0	5.0	5.5	3.0	3.5	3.5	4.0	5.0
	30'	5.0	5.5	6.0	7.0	8.0	4.5	4.5	5.0	6.0	7.0
	40'	6.5	7.0	8.0	9.0	10.5	5.5	6.0	6.5	7.5	9.0
	50'	8.0	9.0	9.5	11.0	13.0	7.0	7.5	8.0	9.5	11.0
	60'	9.5	10.5	11.5	13.0	15.0	8.0	9.0	9.5	11.0	13.0
First Story of Two Stories or Second Story of Three Stories	10'	3.5	4.0	4.5	5.0	6.0	3.0	3.5	3.5	4.5	5.0
	20'	6.5	7.5	8.0	9.5	11.0	5.5	6.5	7.0	8.0	9.0
	30'	9.5	10.5	11.5	13.5	15.5	8.0	9.0	9.5	11.5	13.0
	40'	12.5	13.5	15.0	17.5	20.0	10.5	11.5	12.5	15.0	17.0
	50'	15.5	16.5	18.0	21.5	24.5	13.0	14.0	15.5	18.0	21.0
	60'	18.0	20.0	21.5	25.0	29.0	15.5	17.0	18.5	21.5	25.0
First Story of Three Stories	10'	5.5	6.0	6.5	7.5	8.5	4.5	5.0	5.5	6.5	7.5
	20'	10.0	11.0	11.5	13.5	16.0	8.5	9.0	10.0	11.5	13.5
	30'	14.0	15.5	17.0	19.5	23.0	12.0	13.0	14.5	17.0	19.5
	40'	18.5	20.0	22.0	25.5	29.5	15.5	17.0	18.5	22.0	25.0
	50'	22.5	24.5	27.0	31.5	36.5	19.0	21.0	23.0	26.5	31.0
	60'	26.5	29.0	32.0	37.5	43.0	23.0	25.0	27.0	31.5	36.5

1. Demonstrates equivalency to *IRC* Table R602.10.3(1). All adjustment factors from *IRC* Table R602.10.3(2) shall be applied. Except when used with method CS-PF, a minimum of ½" gypsum sheathing shall be applied to the interior side of the wall assembly and fastened with a minimum 5d cooler nails or 1¼" #6 type W or S screws spaced 16" o.c. at panel edges and 16" o.c. in the field of the panels.
2. Demonstrates equivalency to *2009 IRC* Table R602.10.1.2(1). All adjustment factors from *IRC* Table R602.10.1.2(1) shall be applied. Except when used with method CS-PF, a minimum of ½" gypsum sheathing shall be applied to the interior side of the wall assembly and fastened with a minimum 5d cooler nails or 1¼" #6 type W or S screws spaced 8" o.c. at panel edges and 8" o.c. in the field of the panels.
3. 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. The addition of gypsum wallboard to LCi-SS wall assemblies provides a benefit greater than the SDPWS additive method for wood structural panels.
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 2 that are adopted into law and that the manufacturers 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.

Table 1: Required *IRC* Bracing Lengths for LCi-SS for Lateral Wind Loads

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Required Bracing Lengths for LCi-SS with OSB (Method WSP) – Seismic (Max. 24" o.c. Stud Spacing)									
Condition	Braced Wall Line Length (ft.)	Intermittent Sheathing				Continuous Sheathing			
		Nails 6" o.c. Edges & 12" o.c. in the Field				Nails 6" o.c. Edges & 12" o.c. in the Field			
		Minimum Length of Braced Wall Panels Required Along Each Braced Wall Line (ft.)				Minimum Length of Braced Wall Panels Required Along Each Braced Wall Line (ft.)			
		SDC C (townhouses only)	SDC D_0	SDC D_1	SDC D_2	SDC C (townhouses only)	SDC D_0	SDC D_1	SDC D_2
One Story or Top of Two Stories or Top of Three Stories	10'	1.6'	1.8'	2.0'	2.5'	1.4'	1.6'	1.7'	2.1'
	20'	3.2'	3.6'	4.0'	5.0'	2.7'	3.1'	3.4'	4.3'
	30'	4.8'	5.4'	6.0'	7.5'	4.1'	4.6'	5.1'	6.4'
	40'	6.4'	7.2'	8.0'	10.0'	5.4'	6.1'	6.8'	8.5'
	50'	8.0'	9.0'	10.0'	12.5'	6.8'	7.7'	8.5'	10.6'
First Story of Two Stories or Second Story of Three Stories	10'	3.0'	3.8'	4.5'	5.5'	2.6'	3.2'	3.8'	4.7'
	20'	6.0'	7.5'	9.0'	11.0'	5.1'	6.4'	7.7'	9.4'
	30'	9.0'	11.3'	13.5'	16.5'	7.7'	9.6'	11.5'	14.0'
	40'	12.0'	15.0'	18.0'	22.0'	10.2'	12.8'	15.3'	18.7'
	50'	15.0'	18.8'	22.5'	27.5'	12.8'	16.0'	19.1'	23.4'
First Story of Three Stories	10'	4.5'	5.3'	6.0'	NP	3.8'	4.5'	5.1'	NP
	20'	9.0'	10.5'	12.0'	NP	7.7'	9.0'	10.2'	NP
	30'	13.5'	15.8'	18.0'	NP	11.5'	13.4'	15.3'	NP
	40'	18.0'	21.0'	24.0'	NP	15.3'	17.9'	20.4'	NP
	50'	22.5'	26.3'	30.0'	NP	19.1'	22.3'	25.5'	NP

1. Demonstrates equivalency to *IRC* Table R602.10.3(3). All adjustment factors from *IRC* Table R602.10.3(4) shall be applied. Except when used with method CS-PF, a minimum of ½" gypsum sheathing shall be applied to the interior side of the wall assembly and fastened with a minimum 5d cooler nails or 1¼" #6 type W or S screws spaced 16" o.c. at panel edges and 16" o.c. in the field of the panels.
2. Demonstrates equivalency to *2009 IRC* Table R602.10.1.2(2). All adjustment factors from *IRC* Table R602.10.1.2(2) shall be applied. Except when used with method CS-PF, a minimum of ½" gypsum sheathing shall be applied to the interior side of the wall assembly and fastened with a minimum 5d cooler nails or 1¼" #6 type W or S screws spaced 16" o.c. at panel edges and 16" o.c. in the field of the panels.
3. Tabulated bracing lengths are based on the following:
   a. Soil Class D
   b. Wall height = 10'
   c. 10 psf floor dead load
   d. 15 psf roof/ceiling dead load
   e. Braced wall line spacing ≤ 25'
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 2 that are adopted into law and that the manufacturers 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.

Table 2: Required *IRC* Bracing Lengths for LCi-SS for Lateral Seismic Loads

5.3.3. Prescriptive *IBC* Conventional Light-Frame Wood Construction

5.3.3.1. LCi-SS may be used to brace exterior walls of buildings as an equivalent alternative to the conventional light-frame construction provisions, Method 3, of the *IBC* when installed with ½" gypsum in accordance with *IBC* Section 2308.6[15] and this TER.

5.3.4. Performance-Based Wood-Framed Construction

5.3.4.1. LCi-SS panels used in wall assemblies designed as shear walls are permitted to be designed in accordance with the methodology used in *SDPWS* for wood structural panels.

5.3.4.2. LCi-SS panel shear walls are permitted to resist horizontal wind and seismic load forces using the allowable shear loads (in pounds per linear foot) for OSB.

5.3.4.3. LCi-SS panels are permitted to resist transverse wind load forces using the allowable transverse loads (in pounds per linear foot) for OSB.

[15] *2012 IBC* Section 2308.9.3

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5.3.5. Transverse Loads

5.3.5.1. LCi-SS installed over exterior framing and spaced a maximum of 24" o.c. without an interior covering can resist the wind loads as shown in Table 3. Where panel design is required, use of *SDPWS* Section 3.2 is permitted. Required components and cladding loads to be resisted are found in IRC Table R301.2(2)[16] and R301.2(3), and *IBC* Section 1609.1.1.

Basic Wind Speed (mph) for LCi-SS Used in Exterior Wall Covering Assemblies									
Type of Structural Sheathing	Maximum Stud Spacing (in.)	Fastener Size	Minimum Fastener Penetration into the Stud (in.)	Allowable Components & Cladding Basic Wind Speed V_{asd} per *ASCE 7-05* (mph)			Allowable Components & Cladding Basic Wind Speed V_{ult} per *ASCE 7-10* (mph)		
				Wind Exposure Category					
				B	C	D	B	C	D
LCi-SS	16" o.c.	0.113" x 2.0"	1.5"	110	100	90	139	126	114
		0.131" x 2.5"	1.75"	130	110	105	164	139	133
	24" o.c.			110	90	85	139	114	108
1. Allowable wind speeds are based on the following: Mean roof height 30', 10 sq. ft. effective wind area. See the applicable building code for any adjustment needed for specific building location and configuration.									

Table 3: Basic Wind Speed (mph) for LCi-SS Used in Exterior Wall Covering Assemblies

5.3.6. Uplift Performance

5.3.6.1. LCi-SS installed over exterior framing and spaced a maximum of 24" o.c. without an interior covering shall be designed to resist uplift loads using *SDPWS* Section 4.4.2.

5.4. Water-Resistive Barrier

5.4.1. LCi-SS may be used as a water-resistive barrier (WRB) as prescribed in *IBC* Section 1404.2 and *IRC* Section R703.2 when installed on exterior walls as described in this section.

5.4.2. LCi-SS shall be installed with board joints placed directly over exterior framing spaced a maximum of 24" o.c. The fasteners used to attach the board shall be installed in accordance Section 6 as applicable.

5.4.3. All joints between boards shall be sealed by ThermalStar 007 tape or other approved equivalent.

5.4.4. Where a separate WRB is provided, taping of the sheathing joints is not required.

5.4.5. Flashing of penetrations shall comply with the applicable code and must be installed at all sheathing penetrations. ThermalStar 007 tape or an equivalent adhesive-backed flashing tape shall be used.

5.5. *International Energy Conservation Code* Compliance

5.5.1. LCi-SS meets the continuous insulated sheathing requirements complying with the provisions of *IECC* Section 402.

5.5.2. LCi-SS has thermal resistance as shown in Table 4.

LCi-SS R-value	
Thickness	R-Value (h·ft.²·°F/Btu)
2" (1 9/16" EPS + 7/16" OSB)	7.5
1 5/8" (1 3/16" EPS + 7/16" OSB)	5.0
1 1/16" (5/8" EPS +7/16" OSB)	3.0
1. Tested in accordance with *ASTM C518* @ 75°F mean temperature.	

Table 4: LCi-SS Thermal Resistance Properties

[16] *2015 IRC* Table 301.2(2) features updated table values.

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5.5.3. LCi-SS meets the requirements of *IECC* Section C402 for use as a component of the air barrier assembly, when installed in accordance with the manufacturer's installation instructions and this TER, with all seams, including the top and bottom edges, taped. LCi-SS complies with *IECC* Section C402.5.1.2.1[17] materials deemed to comply, since it incorporates $^{7}/_{16}$" OSB, which is thicker than the minimum required $^{3}/_{8}$" OSB. In addition, the foam sheathing portion of LCi-SS was tested in accordance with *ASTM E2178* and meets the requirements for use as an air barrier material in accordance with *IECC* Section C402.5.1.2.1.

5.6. Fire Resistance Properties Applications

5.6.1. Surface Burn Characteristics

Structural Sheathing –Code Performance	Flame Spread	Smoke Developed
LCi-SS[1] – U.S. Codes	< 25	< 450
LCi-SS[2] – Canadian Codes	< 175	> 500

1. Tested in accordance with *ASTM E84*, foam core only.
2. Tested in accordance with *CAN ULC S102.2*, foam core only.

Table 5: Flame Spread & Smoke Developed Indexes of LCi-SS

5.7. Thermal Barrier Requirements – Attic, Crawlspace or Other Uninhabitable Space Applications

5.7.1. When installed inside an attic, crawlspace or other uninhabited space, the OSB backing on LCi-SS qualifies as an approved ignition barrier, and thus may be used without a thermal barrier installed in accordance with *IRC* Section R316.5.3. The following conditions must be observed:

5.7.1.1. Access to the space is required by *IRC* Section R807.1 or R408.4.

5.7.1.2. Entry is made only for the purposes of repairs or maintenance.

5.7.2. When installed in an attic and the foam is exposed to the interior of the building, such as in a kneewall application, a thermal barrier is not required in accordance with *IRC* Section R316.5.3 and R316.5.4, and *IBC* Section 2603.9[18].

6. Installation:

6.1. General

6.1.1. LCi-SS shall be installed in accordance with the manufacturer's published installation instructions and this TER. In the event of a conflict between the instructions within this TER and the manufacturer's instructions, the more restrictive shall govern.

6.1.2. LCi-SS R3 and R5 shall be installed with a Senco model SCN63LDXP nail gun. Use the $^{3}/_{8}$" thick R3 spacer when fastening LCi-SS R3.

6.1.3. LCi-SS R7.5 shall be install with a SENCO SCN75LDXP nail gun.

6.1.4. LCi-SS shall be fastened with 0.113" x $2^{3}/_{8}$" 15° SENCO GD24APBF or 0.131" x 2½" 15° SENCO KD25APBF nails.

6.1.5. Use of these guns and nails provide code compliant fastening. STANDARD NAIL GUNS MAY NOT BE USED FOR INSTALLATION OF LCi-SS.

6.1.6. Always check the installation to ensure fastener heads are seated against the structural OSB backing material to obtain the expected braced wall capacity.

6.1.7. Where required, gypsum wallboard shall be a minimum ½" thickness.

6.2. Orientation

6.2.1. LCi-SS may be installed vertically or horizontally over studs, with framing that has a nominal thickness of not less than 2" and spaced a maximum of 24" o.c.

[17] *2012 IECC* Section C402.4.1.2.1
[18] *2012 IBC* Section 2603.10

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6.2.2. The OSB backing shall be installed with a small gap, about 1/8", to allow for normal expansion of the OSB. Where used as a braced wall panel or shear wall, all panel edges shall be blocked, except blocking shall not be required on the mid-height horizontal panel edges when installed horizontally and fastening is in accordance with Section 6.4.1.2.

6.3. Fastener Type

6.3.1. LCi-SS

6.3.1.1. Minimum 0.113" diameter and a 1½" penetration into studs

6.3.2. Gypsum Wallboard

6.3.2.1. Where required, gypsum wallboard shall be installed with a minimum:

6.3.2.1.1. #6 x 1 1/4" Type W or S screws

6.3.2.1.2. 5d cooler nails

6.4. Fastener Spacing

6.4.1. LCi-SS

6.4.1.1. Maximum of 6" o.c. along the edge and 12" o.c. in the field, as required for WSP installation per code.

6.4.1.2. When installed horizontally without blocking along the mid-height panel joint, fastener spacing shall be a maximum of 6" o.c. along the edge and 6" o.c. in the field. Additionally, at each location where the horizontal panel crosses a stud, a second fastener shall be installed within 4" of the mid-height panel edges.

6.4.2. Gypsum Wallboard

6.4.2.1. Nails – 16" or 24" o.c. framing; maximum of 8" o.c. at panel edges and 8" o.c. in the field.

6.4.2.2. Screws – 16" o.c. framing; maximum of 16" o.c. at panel edges and 16" o.c. in the field.

6.4.2.3. Screws – 24" o.c. framing; maximum of 12" o.c. at panel edges and 12" o.c. in the field.

6.5. Fastener Edge Distance

6.5.1. Fastener edge distance is a minimum of 3/8" for LCi-SS and gypsum.

6.5.2. Fastener installation must be periodically inspected to ensure complete penetration to studs and seating of fastener head to OSB.

6.6. Treatment of Joints

6.6.1. LCi-SS sheathing joints must be butted at framing members, and a single row of fasteners must be applied to each panel edge into the stud below.

6.7. Window Treatments

6.7.1. LCi-SS must be installed with appropriate flashing and counter flashing in conformance with accepted building standards and in compliance with local building codes and the flashing manufacturer's installation instructions.

6.7.2. Where the application exceeds the limitations set forth herein, design shall be per permitted in accordance with accepted engineering practice.

7. Test and Engineering Substantiating Data:

7.1. Single panel lateral wall research and development testing conducted by for lateral loading equivalency of LCi-SS to OSB in accordance with *ASTM E564* – Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings, where applicable.

7.2. Tests on ThermalStar Joint Tape for use with LCi-SS when used as a water-resistive barrier conducted by Radco.

7.3. Water vapor permeance testing in accordance with *ASTM E96* conducted by Intertek.

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7.4. Air permeance testing in accordance with *ASTM E2178 – Standard Test Method for Air Permeance of Building Materials* conducted by QAI Laboratories.

7.5. Thermal resistance values determined in accordance with *ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus* conducted by Underwriters Laboratories.

7.6. Surface burning characteristics performed in accordance with *ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials* conducted by Intertek, and *CAN ULC S102.2 – Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies* conducted by UL. See also UL BRYX.R16529 listing.

7.7. Physical property testing of foam sheathing component in accordance with *ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation* conducted by Underwriters Laboratories.

7.8. Mildew challenge testing in accordance with *ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi* and *ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber* conducted by LanXESS.

7.9. LCi-SS Quality Control Manual in accordance with a third-party quality control program with inspections conducted by an approved agency.

7.10. The product(s) evaluated by this TER falls within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.

7.11. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineered alternative means of compliance. This TER assesses compliance with defined standards, generally accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.

7.12. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate as it undertakes its engineering analysis.

7.13. DrJ has reviewed and found the data provided by other professional sources credible. This information has been approved in accordance with DrJ's procedure for acceptance of data from approved sources.

7.14. DrJ's responsibility for data provided by approved sources is in accordance with professional engineering law.

7.15. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards (e.g., *IRC*, *WFCM*, *IBC*, *SDPWS*, etc.). This includes review of code provisions and any related test data that helps with comparative analysis or provides support for equivalency to an intended end-use application.

8. Findings:

8.1. When installed in accordance with the manufacturer's installation instructions and this TER, LCi-SS complies with, or is a suitable alternative to, the applicable sections of the codes listed in Section 2 for the following applications:

8.1.1. Lateral load resistance due to wind and seismic loads carried by shear in accordance with the *IBC* performance-based provisions, Section 2306.1 and 2306.3 for light-frame wood wall assemblies.

8.1.2. Use as an equivalent alternative to any of the bracing methods using WSP as described in *IRC* Section R602.10.

8.1.3. Transverse load resistance due to components and cladding pressures on building surfaces in accordance with *IRC* Section R301.2.1 and R602.3[19], and *IBC* Section 1609.1.1, 2304.6.1 and 2304.10.6[20].

8.1.4. Performance of the foam plastic component of LCi-SS for conformance to *IRC* Section R316 and *IBC* Section 2603.

[19] *2015 IRC* Section R602.3 features updated table specifications for fasteners and fastener spacing and location.
[20] *2012 IBC* Section 2304.9.6

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8.1.5. Performance for use as insulating sheathing in accordance with *IRC* Section N1102.1 and N1102.2, and *IECC* Section 402.

8.1.6. Performance for use as a WRB in accordance with *IRC* Section R703.2 and *IBC* Section 1404.2.

8.1.7. Performance for use as an air barrier component in accordance with *IRC* Section N1102.4 and *IECC* Section 402.

8.2. *IBC* Section 104.11 and *IRC* Section R104.11 (*IFC* Section 104.9 is similar) state:

> **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, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in 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*.[21]

8.3. This product has been evaluated with the codes listed in Section 2, and is compliant with all known state and local building codes. Where there are known variations in state or local codes that are applicable to this evaluation, they are listed here:

8.3.1. No known variations

8.4. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

9. Conditions of Use:

9.1. Where required by the authority having jurisdiction (AHJ) in which the project is to be constructed, this report and the installation instructions shall be submitted at the time of permit application.

9.2. Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the code official for review and approval.

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

9.3.1. LCi-SS described in this TER complies with, or is a suitable alternative to, the applicable sections of the *IBC*, *IRC*, and *IECC* listed in Section 2 of this TER and are subject to the following conditions:

9.3.2. Walls sheathed with LCi-SS shall not be used to resist horizontal loads from concrete and masonry walls.

9.3.3. When LCi-SS is not installed for use as wall bracing, as described in this TER, the stud walls shall be braced by other materials, in accordance with the applicable code.

9.3.4. When used as a WRB, LCi-SS seams shall be taped with ThermalStar 007 tape or equivalent.

9.3.5. When used as an air barrier component, all LCi-SS panel edges, including top and bottom edges, shall be sealed with ThermalStar 007 tape or equivalent.

9.3.6. When used in accordance with the *IBC* in high wind areas, special inspections shall comply with *IBC* Section 1705.11[22].

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

9.3.8. The manufacturer's installation instructions shall be shipped to the jobsite with the materials or otherwise be available on the jobsite for inspection.

9.3.9. Where used as wall bracing or as part of a shear wall, all panel edges shall be supported by wall framing or solid blocking a minimum of 2" nominal in thickness.

[21] The last sentence is adopted language in the 2015 codes.
[22] *2009 IBC* Section 1705.4, *2012 IBC* Section 1705.10

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9.3.10. The foam core of LCi-SS is manufactured in Byron Center, MI; Tijuana, Mexico; Martinsville, VA; or Perryville, MO, under a quality control program with quality control inspections in accordance with *IRC* Section R109.2 and *IBC* Section 110.3.8 and 110.4.

9.4. Design

9.4.1. Building Designer Responsibility

9.4.1.1. Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer (e.g., Owner, Registered Design Professional, etc.) for the Building and shall be in accordance with *IRC* Section R106 and *IBC* Section 107.

9.4.1.2. The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with *IRC* Section R301 and *IBC* Section 1603.

9.4.2. Construction Documents

9.4.2.1. Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.

9.5. Responsibilities

9.5.1. The information contained herein is a product, engineering or building code compliance technical evaluation report performed in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering procedures, experience and technical judgment.

9.5.2. DrJ technical evaluation reports provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated section.

9.5.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.

9.5.4. This product is manufactured under a third-party quality control program in accordance with *IRC* Section R104.4 and R109.2 and *IBC* Section 104.4 and 110.4.

9.5.5. The actual design, suitability and use of this TER for any particular building is the responsibility of the Owner or the Owner's authorized agent, and this TER shall be reviewed for code compliance by the Building Official.

9.5.6. The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party inspection process, proper installation per the manufacturer's instructions, the Building Official's inspection and any other code requirements that may apply to assure accurate compliance with the applicable building code.

10. Identification:

10.1. LCi-SS boards described in this TER are identified by a label on the board or packaging material bearing the manufacturer's name, product name, label of the third-party inspection agency and other information to confirm code compliance.

10.2. Additional technical information can be found at atlaseps.com.

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11. Review Schedule:

11.1. This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjengineering.org.

11.2. For information on the current status of this TER, contact DrJ Engineering.

- Mission and Professional Responsibilities
- Product Evaluation Policies
- Product Approval – Building Code, Administrative Law and P.E. Law

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