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CERTIFICATION TESTING INSPECTION

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BUILDING PRODUCTS LISTING PROGRAM

Customer: Greenstone Building Products Ltd.
Class: Insulated Structural Panels
Website: www.gsbp.ca

Locations: Brandon, Manitoba, Canada

Listing No. B1122-1
Project No. B1122-1 Edition 1

Effective Date: November 5, 2020
Last Revised Date: November 5, 2020
Expires: N/A

Standards:

ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
CAN/ULC-S701	Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials.
CAN/ULC-S102.2	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
CAN/ULC-S101	Standard Methods of Fire Endurance Tests of Building Construction and Materials.
ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials.
ASTM E72	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
ASTM E564	Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings.

Product: Greenstone Insulated Composite Envelope (ICE) Prefabricated Wall Panels.

Markings: Each panel is marked with a permanent label containing the following information:

a) Manufacturers name or recognized trademark
b) Product name
c) Date of manufacture
d) QAI file number: B1122
e) ASTM E84 / CAN/ULC S102.2 Flame Spread Index and Smoke Developed Index (E84 FSI ≤ 25 / SDI ≤ 450) (S102.2 FSI ≤ 250 SDI ≥ 500).
f) QAI logo shown here:

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Models / Ratings: **The following outlines Greenstone Building Products ICE panel performance determined in accordance with the noted standards.**

Greenstone Building Products ICE panel thermal insulation specifications per CAN/ULC-S701:

PROPERTY	Expanded Polystyrene Insulation TYPE 2
Thermal Resistance Minimum at 25 mm Thickness (m^2*^{o}C/W)	0.70
Water Vapour Permeance Maximum at 25 mm Thickness (Ng/Pa*s*m^2)	200
Dimensional Stability Maximum Linear Change (%)	1.5
Flexural Strength Minimum (kPa)	240
Water Absorption By Volume Maximum (%)	4.0
Compressive Strength Minimum at 10% Deformation (kPa)	110
Limiting Oxygen Index Minimum (%)	24

Greenstone Building Products ICE panel thermal insulation surface burning characteristics determined in accordance with CAN/ULC S102.2:

EXPANDED POLYSTYRENE (EPS) INSULATION	DENSITY	MAXIMUM THICKNESS	FLAME SPREAD INDEX (FSI)	SMOKE DEVELOPED INDEX (SDI)
Type 2 (Type II) EPS	Maximum 32 kg/m^3	100 mm Maximum	≤ 250	≥ 500

Greenstone Building Products ICE panel thermal insulation specifications per ASTM C578:

PROPERTY	Expanded Polystyrene Insulation TYPE II
Compressive Strength Minimum @ 10% Deformation (psi)	15.0
Thermal Resistance Minimum @ 1 inch Thick (F*ft^2*h/Btu)	4.0
Flexural Strength Minimum (psi)	35.0
Water Vapor Permeance @ 1 inch Thickness Maximum (Perms)	3.5
Water Absorption By Volume Maximum (%)	3.0
Dimensional Stability Linear Change Maximum (%)	2.0

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Oxygen Index Minimum (%)	24.0
Density Minimum (lbs/ft^3)	1.35

Greenstone Building Products ICE panel thermal insulation surface burning characteristics determined in accordance with ASTM E84:

EXPANDED POLYSTYRENE (EPS) INSULATION	DENSITY	MAXIMUM THICKNESS	FLAME SPREAD INDEX (FSI)	SMOKE DEVELOPED INDEX (SDI)
Type 2 (Type II) EPS	Maximum 2.0 lbs/ft^3	6.0 Inches Maximum	≤ 25	≤ 450

Greenstone Building Products ICE panels fire-resistance ratings per CAN/ULC-S101 & ASTM E119 – Loadbearing† Walls and Partitions:

QAI Design #	Fire Resistance Rating	Sheathing
B1122-1a	**CAN/ULC-S101/ASTM E119 1 Hour Restricted – Load Bearing[1] Fire Resistance-Rated Wall Assembly**	**2 Layers Gypsum Board facing interior**
B1122-1b	**CAN/ULC-S101/ASTM E119 2 Hour Non-Load Bearing Fire Resistance-Rated Wall Assembly**	**2 Layers Gypsum Board over 25 mm (1 inch) mineral wool insulation on interior face. 1 layer gypsum board on unexposed face.**

[1] Restricted-Load Bearing - Load rating for this assembly is 50% of the design load determined in accordance with CSA S136 or AISI S100.

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Greenstone Building Products ICE panels Transverse Load Resistance determined in accordance with ASTM E72:

Transverse Load Resistance Imperial[1,2,3,4]
Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels

PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
5.5	16	20	8	42.1	60.1	74.3	125.9
			10	26.4	39.7	48.6	94.5
			12	18.9	27.6	35.7	69.7
		18	8	39.7	59.0	77.9	130.6
			10	24.4	38.3	50.7	76.7
			12	21.5	32.0	40.2	76.7
		16	8	49.6	69.6	87.7	144.0
			10	30.7	45.2	57.5	79.4
			12	23.2	34.6	45.4	79.4
7.5	12	20	10	53.6	79.0	103.0	162.7
		16	8	81.8	120.8	157.0	240.7
			10	63.7	91.1	114.8	168.7
			12	45.1	69.4	88.4	158.8
7.5	16	20	8	55.8	78.5	99.6	174.5
			10	39.7	59.2	79.7	118.8
			12	32.8	47.4	60.2	94.0
		18	8	58.4	83.7	107.1	141.9
			10	38.2	57.0	76.4	106.1
			12	32.3	48.4	63.3	90.2
		16	8	59.9	85.9	107.9	159.5
			10	42.6	64.0	81.9	107.3
			12	37.8	54.5	70.5	95.9
9.25	12	20	8	85.5	121.6	153.9	267.2
			10	62.0	90.2	116.0	189.4
			12	50.7	74.0	93.9	151.5
11.5	12	20	12	62.5	91.0	113.5	173.3

Transverse Load Resistance Imperial[1,2,3,4]
Greenstone ICE Type 2 / Type II (32.0 kg/m³, 2.0 lbs/ft³ Density) Panels

PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
7.5	8	20	10	83.4	121.9	162.3	307.4
9.25	8	20	10	101.1	143.8	186.6	303.5

Transverse Load Resistance Imperial[1,2,3,4]
Greenstone ICE Type 2 / Type II (40.0 kg/m³, 2.5 lbs/ft³ Density) Panels

PANEL THICKNESS inches	STUD SPACING Inches	STEEL GAUGE	PANEL HEIGHT ft	DEFLECTION LIMIT lbs/ft²			MAX PRESSURE lbs/ft²
				L/360	L/240	L/180	
7.5	8	20	8	127.6	186.2	240.7	372.1
			10	94.7	139.9	181.7	352.7
7.5	12	20	10	76.1	107.6	138.0	230.4

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Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels							
PANEL THICKNESS mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
140	406	20	2438	2.0	2.9	3.6	6.0
			3048	1.3	1.9	2.3	4.5
			3658	0.9	1.3	1.7	3.3
		18	2438	1.9	2.8	3.7	6.3
			3048	1.2	1.8	2.4	3.7
			3658	1.0	1.5	1.9	3.7
		16	2438	2.4	3.3	4.2	6.9
			3048	1.5	2.2	2.8	3.8
			3658	1.1	1.7	2.2	3.8
191	305	20	3048	2.6	3.8	4.9	7.8
		16	2438	3.9	5.8	7.5	11.5
			3048	3.0	4.4	5.5	8.1
			3658	2.2	3.3	4.2	7.6
191	406	20	2438	2.7	3.8	4.8	8.4
			3048	1.9	2.8	3.8	5.7
			3658	1.6	2.3	2.9	4.5
		18	2438	2.8	4.0	5.1	6.8
			3048	1.8	2.7	3.7	5.1
			3658	1.5	2.3	3.0	4.3
		16	2438	2.9	4.1	5.2	7.6
			3048	2.0	3.1	3.9	5.1
			3658	1.8	2.6	3.4	4.6
235	305	20	2438	4.1	5.8	7.4	12.8
			3048	3.0	4.3	5.6	9.1
			3658	2.4	3.5	4.5	7.3
292	305	20	3658	3.0	4.4	5.4	8.3

Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (32.0 kg/m³, 2.0 lbs/ft³ Density) Panels							
PANEL THICKNESS mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
191	203	20	3048	4.0	5.8	7.8	14.7
235	203	20	3048	4.8	6.9	8.9	14.5

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Transverse Load Resistance Metric[1,2,3,4] Greenstone ICE Type 2 / Type II (40.0 kg/m^3, 2.5 lbs/ft^3 Density) Panels							
PANEL THICKNESS Mm	STUD SPACING mm	STEEL GAUGE	PANEL HEIGHT mm	DEFLECTION LIMIT kPa			MAX PRESSURE kPa
				L/360	L/240	L/180	
191	203	20	2438	6.1	8.9	11.5	17.8
			3048	4.5	6.7	8.7	16.9
191	305	20	3048	3.6	5.2	6.6	11.0

1. Transverse load capacity is determined based on minimum bearing of 3 inches at panel ends. Alternate bearing conditions for connection of panels for transferring loads to the underlying structure are outside the scope of this listing and are to follow the approved Engineering Design and project specifications.
2. Transverse loads are determined for Greenstone ICE panels only and do not consider the contribution from sheathing materials.
3. Allowable pressure determined based on CSA S136 Limit State Design (LS) methodology with $\Phi = 0.67$ for use in Canada.
4. Load capacities for Greenstone ICE panels used in the USA are directed to follow QAI Code Evaluation Report CER$_{US}$-1002.

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Greenstone Building Products ICE panels Axial Load Resistance determined in accordance with ASTM E72:

Axial Load Capacity Imperial[5,6,7,8,9] Greenstone ICE ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels					
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM HEIGHT ft	LOAD @ COMPRESSION LIMIT Δ = 1/8 inch lbs/ft	MAXIMUM ALLOWABLE LOAD [10] lbs/ft
5.5	16	20	≤ 12	6,571	6,571
		18		8,639	8,639
		16		10,674	`10,674
7.5	12	20	≤ 12	8,214	8,214
		18		10,799	10,799
		16		13,343	13,343
7.5	16	20	≤ 12	6,571	6,571
		18		8,639	8,639
		16		10,674	10,674

Axial Load Capacity Metric[5,6,7,8,9] Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels					
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM HEIGHT mm	LOAD @ COMPRESSION LIMIT Δ = 1/8 inch kN/m	MAXIMUM ALLOWABLE LOAD [10] kN/m
140	406	20	3658	95.9	95.9
		18		126.1	126.1
		16		155.8	155.8
191	305	20	3658	119.9	119.9
		18		157.6	157.6
		16		194.7	194.7
191	406	20	3658	95.9	95.9
		18		126.1	126.1
		16		155.8	155.8

5. Allowable loads are determined for Greenstone ICE panels without sheathing, thermal barrier or ignition barrier.
6. Allowable loads are determined for uniformly distrubuted load over Greenstone ICE panels. For point loads, top track (LBC) or additional reinforcing may be added where supported by by Engineering Design and approved by the authority having jurisdiction.
7. Connection details including attachment of floor and roof panels, and connection of wall panels to the underlying structure is outside the scope of this report, and is to be in accordance with Engineering Design and project specifications
8. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology with Φ = 0.67 for use in Canada.
9. Load capacities for Greenstone ICE panels used in the USA are directed to follow QAI Code Evaluation Report CER$_{US}$-1002.

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Greenstone Building Products ICE panels Racking Shear Load Resistance determined in accordance with ASTM E564:

Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels[10,11,12]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	153	180	226	414
Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels with 7/16 PS2 Rated Exterior Grade Oriented Strand Board on Exterior Face[10,11,12,13]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	594	594	594	594
Racking Shear Capacity Imperial Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels with 16 Gauge, 33 ksi G60 Steel Strapping Exterior Face[10,11,12,14]							
PANEL THICKNESS inches	STUD SPACING Inches	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT lbs/ft			MAXIMUM ALLOWABLE LOAD [10] lbs/ft
				H/500	H/360	H/240	
7.5	16	20	1:1	381	507	567	567

Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels[10,11,12]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	2.2	2.6	3.3	6.0
Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels with 7/16 PS2 Rated Exterior Grade Oriented Strand Board on Exterior Face[10,11,12,13]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	8.7	8.7	8.7	8.7
Racking Shear Capacity Metric Greenstone ICE Type 2 / Type II (24.0 kg/m³, 1.5 lbs/ft³ Density) Panels with 16 Gauge, 33 ksi G60 Steel Strapping Exterior Face[10,11,12,13,14]							
PANEL THICKNESS mm	STUD SPACING mm	GAUGE	MAXIMUM ASPECT RATIO	DRIFT LIMIT kN/m			MAXIMUM ALLOWABLE LOAD [10] kN/m
				H/500	H/360	H/240	
191	406	20	1:1	5.6	7.4	8.3	8.3

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10. Connection details including attachment of floor and roof panels, and connection of wall panels to the underlying structure is outside the scope of this report, and is to be in accordance with Engineering Design and project specifications.
11. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology with $\Phi = 0.50$ for use in Canada.
12. Load capacities for Greenstone ICE panels used in the USA are directed to follow QAI Code Evaluation Report CER_{US}-1002.
13. OSB is to be installed with minimum #6- 1-1/2 in. (38 mm) self-tapping screws, spaced at 6 in. (153 mm) around the perimeter, and 12 in. (305 mm) in the field with minimum 1 in. (25 mm) distance from OSB panel edges at perimeter installation. OSB joints are to be blocked with 16 Ga. steel straps, with fasteners staggered along each panel joint at 6 in. (152 mm) where OSB joints are not over studs.
14. Steel straps are required to be minimum 5-1/4 in. (133 mm) width and extend from panel corner to panel corner at maximum 8 ft (2432 mm) lengths. Steel straps are required to be connected to Greenstone ICE panels with three minimum #10-3/4 in. (19 mm) self-tapping screws at each strap end, and two #10-3/4 in. (19 mm) self-tapping screws installed at each stud location

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Greenstone Building Products ICE panel header components have the following structural capacities:

Header Z-Channel Strength [15]														
Z-Channel Designation	Height (h)		Gauge Thickness (t)		S_{x+}		I_x		A_w	F_v	Moment Resistance		Shear Resistance	
Height-Shape-Gauge	inches	mm	inches	mm	in^3	mm^3	in^4	mm^4	mm^2	mPa	kN m	ft lbs	kN	lbs
4Z16	4	101.6	0.063	1.588	0.441	7.23E+03	0.954	4.0E+05	161.29	412.27	1.48	1089	59.85	13.4
4Z14	4	101.6	0.078	1.984	0.540	8.85E+03	1.169	4.9E+05	201.61	644.18	1.81	1333	116.89	26.2
4Z12	4	101.6	0.109	2.778	0.727	1.19E+04	1.574	6.6E+05	282.26	1262.59	2.44	1795	320.74	71.9
6Z16	6	152.4	0.063	1.588	0.808	1.32E+04	2.578	1.1E+06	241.94	183.23	2.71	1995	39.90	8.9
6Z14	6	152.4	0.078	1.984	0.994	1.63E+04	3.173	1.3E+06	302.42	286.30	3.34	2454	77.92	17.5
6Z12	6	152.4	0.109	2.778	1.349	2.21E+04	4.305	1.8E+06	423.39	561.15	4.53	3331	213.82	48.0
8Z16	8	203.2	0.063	1.588	1.261	2.07E+04	5.302	2.2E+06	322.58	103.07	4.23	3114	29.92	6.7
8Z14	8	203.2	0.078	1.984	1.555	2.55E+04	6.543	2.7E+06	403.23	161.04	5.22	3839	58.44	13.1
8Z12	8	203.2	0.109	2.778	2.120	3.47E+04	8.923	3.7E+06	564.52	315.65	7.11	5234	160.37	36.0
10Z16	10	254	0.063	1.588	1.797	2.94E+04	9.378	3.9E+06	403.23	65.96	6.03	4437	23.94	5.4
10Z14	10	254	0.078	1.984	2.221	3.64E+04	11.592	4.8E+06	504.03	103.07	7.45	5484	46.75	10.5
10Z12	10	254	0.109	2.778	3.039	4.98E+04	15.864	6.6E+06	705.64	202.01	10.20	7504	128.29	28.8
12Z16	12	304.8	0.063	1.588	2.418	3.96E+04	15.056	6.3E+06	483.87	45.81	8.11	5970	19.95	4.5
12Z14	12	304.8	0.078	1.984	2.992	4.90E+04	18.634	7.8E+06	604.84	71.58	10.04	7388	38.96	8.7
12Z12	12	304.8	0.109	2.778	4.105	6.73E+04	25.567	1.1E+07	846.77	140.29	13.77	10136	106.91	24.0
14Z16	14	355.6	0.063	1.588	3.122	5.12E+04	22.585	9.4E+06	564.52	33.65	10.48	7708	17.10	3.8
14Z14	14	355.6	0.078	1.984	3.868	6.34E+04	27.980	1.2E+07	705.64	52.59	12.98	9550	33.40	7.5
14Z12	14	355.6	0.109	2.778	5.317	8.71E+04	38.470	1.6E+07	987.90	103.07	17.84	13128	91.64	20.6

15. Allowable loads determined based on CSA S136 Limit State Design (LS) methodology.

Notes: Products must be installed with the manufacturer's published installation instructions and in accordance with the building codes recognized by the authority having jurisdiction.

Product is to be installed in accordance with the QAI Design Listing and manufacturer's published installation instructions by qualified installing personnel.

Listed manufacturers are subject to on-going inspections by QAI to ensure that the products outlined above remains as it is listed.

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