The Advanced Rigid Insulation Envelope

SPECIFICATION PACKAGE

BuildWithHalo.com

MANUFACTURED BY:

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Make the switch to today’s most advanced rigid insulation envelope.

Halo® is the insulating system perfectly designed for specific applications.

The Genius of Surround Science
Other insulating solutions offer a cookie-cutter approach. Halo® throws away the mold with a breakthrough insulating system featuring three customized applications:

- **HALO INTERRA®**
  Advanced Reflective Interior Rigid Insulation

- **HALO EXTERRA®**
  Advanced Breathable Exterior Insulating

- **HALO SUBTERRA®**
  Advanced Below-Ground Rigid Insulation

BuildWithHalo.com

Now Powered by R-5 Technology!
**HALO EXTERRA®**
Perfectly Designed for Exterior Applications

- Halo® GPS (graphite polystyrene) delivers a long-term R-5 per nominal inch*
- Breathable — walls stay dry and healthy
- Built-in weather barrier**

*Thermal performance claim based on thickness of 1 1/16”.
**When taped.

---

**HALO INTERRA®**
Perfectly Designed for Interior Applications

- Halo® GPS (graphite polystyrene) delivers a long-term R-5 per nominal inch*
- Built-in air and vapor barrier**
- Reflective laminate reflects heat back into the home or building***

*Thermal performance claim based on thickness of 1 1/16”.
**When taped.
***When an appropriate air space is provided.
HALO SUBTERRA®
Perfectly Designed for Below-Ground Applications

- Halo® GPS (graphite polystyrene) delivers a long-term R-5 per nominal inch*.
- Jobsite tough — able to withstand severe foot and equipment traffic without breaking.
- Built-in water-resistant barrier**

*Thermal performance claim based on thickness of 1 1/16”.
**When taped.

Zero thermal drift. Zero compromise.

- GPS (graphite polystyrene) provides R-5 per nominal inch*.
- GPS provides a permanent long-term R-value and won’t deteriorate over time like XPS and ISO.
- GPS delivers greater R-values at lower outside temperatures.
- Minimizes the energy loss from thermal bridging.
- Light yet durable — perfect for today’s demanding jobsites.
- Superior indoor air quality due to Greenguard certified Neopor® GPS core.
- GPS is 100% recyclable and ozone layer-friendly — no CFCs or HCFCs.

*Thermal performance claim based on thickness of 1 1/16”.
An innovation in insulation. Right to the very core.
Graphite Polystyrene (GPS) is the new standard in thermal insulation, thanks to millions of graphite infrared absorbers and heat reflectors that reduce thermal conductivity.

More choice means maximum performance.

<table>
<thead>
<tr>
<th>Halo® Element</th>
<th>Board Size</th>
<th>Standard Thicknesses</th>
<th>Zero Thermal Drift Guaranteed R-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBTERRA®</td>
<td>4’ x 8’</td>
<td>1.0”, 1.5”, 2.0”</td>
<td>R-5 per nominal inch (based on thickness of 1 1/16”)</td>
</tr>
<tr>
<td></td>
<td>1230mm x 2460mm</td>
<td>26mm, 38mm, 52mm</td>
<td>16 (110), 30 (210)</td>
</tr>
<tr>
<td>EXTERRA®</td>
<td>4’ x 8’</td>
<td>.625”, 1.0”, 1.5”, 2.0”</td>
<td>R-5 per nominal inch* (based on thickness of 1 1/16”)</td>
</tr>
<tr>
<td></td>
<td>1230mm x 2460mm</td>
<td>13mm, 26mm, 38mm, 52mm</td>
<td>10 (70)</td>
</tr>
<tr>
<td>INTERRA®</td>
<td>4’ x 8’</td>
<td>.625”, 1.0”, 1.5”, 2.0”</td>
<td>R-5 per nominal inch* (based on thickness of 1 1/16”)</td>
</tr>
<tr>
<td></td>
<td>1230mm x 2460mm</td>
<td>13mm, 26mm, 38mm, 52mm</td>
<td>10 (70)</td>
</tr>
</tbody>
</table>

1 Custom thicknesses and compressive strengths are available upon request. Please contact your local Halo® dealer or representative.
2 Typically, XPS and ISO insulation products are not guaranteed to maintain their published R-values over time. Halo® meets or exceeds most XPS-guaranteed R-values (check the guaranteed R-value with your XPS supplier).

Halo Packaging

Standard Bundle Size: 4’ wide x 8’ long x 1’ deep

<table>
<thead>
<tr>
<th>Board Thickness</th>
<th>No. of Boards/Bundle</th>
</tr>
</thead>
<tbody>
<tr>
<td>.625”</td>
<td>20</td>
</tr>
<tr>
<td>1.0”</td>
<td>12</td>
</tr>
<tr>
<td>1.5”</td>
<td>8</td>
</tr>
<tr>
<td>2.0”</td>
<td>6</td>
</tr>
</tbody>
</table>

Installation Instructions
Please refer to the Halo® Installation Guide, which may be downloaded from BuildWithHalo.com and is also available from your local Halo® dealer or representative.

Zero Thermal Drift Guarantee
The use of air as an insulating gas allows Neopor® to maintain its outstanding R-value performance over time and contributes to sustainable building practices. The air, graphite and polymer matrix in Neopor® are all stable, and no fluorocarbons are used to make, or are contained within, Neopor®. As a result, the R-value provided by Neopor® will not deteriorate. Neopor® has zero thermal drift and zero ozone depletion potential. For details, visit BuildWithHalo.com.
HALO® MATERIAL PROPERTY DATA SHEET
rev.051117

PRODUCT NAME
Halo® - The Advanced Rigid Insulation Envelope.

MANUFACTURER
• Beaver Plastics Ltd.
  7-26318-TWP RD 531A
  Acheson, Alberta
  Canada T7X 5A3
• AMC Foam Technologies Inc.
  35 Headingley St.
  Headingley Manitoba Canada
  R4H 0A8
• Form Solutions
  P.O. Box 358
  Port Hope, ON
  L1A 3W3, Canada

PRODUCT DESCRIPTION
Halo® products are rigid foam sheathing insulation made from GPS (graphite infused expanded polystyrene).

Halo® consists of three product lines:
1. Halo Exterra - coated with a perforated clear polypropylene laminate on both sides of the rigid insulation.
2. Halo Interra – coated with a reflective laminate on both sides of the rigid insulation.
3. Halo Subterra – made with denser rigid GPS to provide a minimum compressive strength of 16, 20, 25, 30 and 40 psi (Subterra 16, Subterra 20, Subterra 25, Subterra 30 and Subterra 40, respectively). Subterra is coated with a woven fabric on both sides.

BASIC USE
Halo products are suitable for use in residential, multi-residential, commercial, and industrial buildings.

Each Halo product is designed to seal and insulate specific walls, ceilings and floors of a building, as shown in Table 1.

STANDARDS
• ASTM C203 – Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
• ASTM C303 – Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
• CAN/ULC S102.2 - Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.
• NFPA 286 “Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth”.
• BASF Neopor Plus is recognized as a product that produces low chemical emissions by the Greenguard Environment Institute – Neopor Plus is Greenguard Indoor Air Quality Certified® and Greenguard Children & SchoolsSM Certified product.

FIRE INFORMATION
Halo products are made of combustible materials and may need to be protected from high heat sources. In addition, a thermal barrier may be required when used in the interior of a building. Refer to your local building codes for appropriate protection and thermal barrier requirements.

INSTALLATION
Halo products are light weight, which makes them easy to handle, cut, and install. Installation is simple and quick, but will vary depending on the application (see Table 1).

For detailed installation instructions refer to the Halo Installation Guide.

PRODUCT SIZES
Halo sheathing are available in 4x8 sheets in varying thicknesses. Contact your local Halo representative for more information.

Table 1: Halo® Applications

<table>
<thead>
<tr>
<th>Application</th>
<th>Exterra</th>
<th>Interra</th>
<th>Subterra</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Roof</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ceiling</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Exterior above-grade wall</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior above-grade wall</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior foundation wall</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Interior foundation wall</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above slab</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Below slab</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

not produce harmful emissions to the environment.

ENVIRONMENTAL DATA
Halo is produced without the use of chlorofluorocarbon (CFCs), hydrochlorofluorocarbon (HCFCs) or formaldehyde. As a result, Halo will not produce harmful emissions to the environment.

www.BuildWithHalo.com
## Table 2: Thermal Insulation

<table>
<thead>
<tr>
<th>Product</th>
<th>R-value @ 75°F (RSI @ 24°C)</th>
<th>R-value @ 40°F (RSI @ 4.4°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterra®</td>
<td>5 (0.88)</td>
<td>5.2 (0.92)</td>
</tr>
<tr>
<td>Inter®</td>
<td>5 (0.88)</td>
<td>5.2 (0.92)</td>
</tr>
<tr>
<td>Subterra® 16</td>
<td>5 (0.88)</td>
<td>5.2 (0.92)</td>
</tr>
<tr>
<td>Subterra® 30</td>
<td>5 (0.88)</td>
<td>5.3 (0.93)</td>
</tr>
</tbody>
</table>

1. In accordance with ASTM C578, “Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation”, and CAN/ULC S701, “Standard For Thermal Insulation, Polystyrene, Boards and Pipe Covering”, at 75°F (24°C), and at 40°F (4.4°C) from data provided by BASF. R-value of GPS increases with decreasing temperatures.

2. At 1” nominal thickness (actual thickness = 1.06”).

## Table 3: Material Properties

### ASTM C578¹

<table>
<thead>
<tr>
<th>Property</th>
<th>Exterra</th>
<th>Inter</th>
<th>Subterra 16</th>
<th>Subterra 25</th>
<th>Subterra 30</th>
<th>Subterra 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Resistance at 10% def., Min., psi</td>
<td>10</td>
<td>10</td>
<td>16</td>
<td>25</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Flexural Resistance Min., psi</td>
<td>25</td>
<td>25</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Water Vapor Permeance Max., perms</td>
<td>1.34</td>
<td>0.03</td>
<td>0.04</td>
<td>0.1</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Water Absorption Max., %</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Dimensional Stability Max., %</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Oxygen Index Min., %</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

### CAN/ULC S701¹

<table>
<thead>
<tr>
<th>Property</th>
<th>Exterra</th>
<th>Inter</th>
<th>Subterra 16</th>
<th>Subterra 25</th>
<th>Subterra 30</th>
<th>Subterra 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Resistance at 10% def., Min., kPa</td>
<td>70</td>
<td>70</td>
<td>110</td>
<td>140</td>
<td>210</td>
<td>275</td>
</tr>
<tr>
<td>Flexural Resistance Min., kPa</td>
<td>170</td>
<td>170</td>
<td>483</td>
<td>483</td>
<td>483</td>
<td>483</td>
</tr>
<tr>
<td>Water Vapor Permeance Max., ng/Pa-s-m²</td>
<td>77</td>
<td>1.7</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Water Absorption Max., %</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Dimensional Stability Max., %</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Oxygen Index Min., %</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

1. Unless noted otherwise, properties are based on 1” thickness without laminate by data provided by BASF.

2. Based on indepent testing conducted by QAI. Water vapor permeance properties tested with laminate and 1.5” thick GPS.

3. Based on indepent testing conducted by QAI. Water vapor permeance properties tested with laminate and 1” thick GPS.

4. Based on independent testing conducted by QAI with laminate and 1” thick GPS.

## Table 4: Surface Burning Characteristics

<table>
<thead>
<tr>
<th>Test Standard</th>
<th>Flame Spread Index Max.</th>
<th>Smoke Developed Index Max.</th>
<th>Thickness Max.</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM E84</td>
<td>5</td>
<td>25</td>
<td>5 in.</td>
<td>2 pcf</td>
</tr>
<tr>
<td>CAN/ULC S102.2</td>
<td>230</td>
<td>500</td>
<td>102 mm</td>
<td>32 kg/m³</td>
</tr>
</tbody>
</table>

## Table 5: Additional Properties

<table>
<thead>
<tr>
<th>Product</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterra Weather Resistive Barrier, per ASTM E331</td>
<td>Complies as a weather resistive barrier at thicknesses of 5/8” or thicker.</td>
</tr>
<tr>
<td>Interra Air Leakage, per ASTM E2178</td>
<td>0.0010 L/s-m² at 1” thickness Complies as an air barrier in accordance with the National Building Code of Canada and the International Residential Code</td>
</tr>
<tr>
<td>Subterra Water Resistance: Hydrostatic Pressure Test, per AATCC Test Method 127, and ICC ES AC71</td>
<td>Passed - No water leakage was observed at the underside of the Subterra boards.</td>
</tr>
</tbody>
</table>
NOTE TO USERS: This document has been prepared for the Halo Sheathing products Exterra, Interra and Subterra, and has been prepared in accordance with the Construction Specifications Institute (CSI) Section Format 2004. The main intention of this document is to aid the Contractor/Installing Contractor in developing CSI specifications (of Halo) for use in combination with specific project specification manuals, which follow CSI formatting, as part of the overall project scope of work.

This document is a template and where appropriate, may require modifications to suit specific projects.

Italicized text enclosed in parenthesis, [], are intended for the user of this document to aid in determining where modifications may be required.

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   [This section may be modified to suit specific project details]
   1. Rigid board perimeter insulation
   2. Rigid board attic/ceiling insulation
   3. Rigid board roof insulation
   4. Rigid board on-slab insulation
   5. Rigid board under-slab insulation

B. Related Sections:
   [This section may be modified to suit specific project details]
   1. 072600 – Weather Barriers: insulation provided as vapor barrier
   2. 072700 – Air Barriers: insulation provided as an air barrier and air sealant materials

C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to all work of this Section.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
8. ASTM C203 – Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
9. ASTM C303 – Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation
   A. Underwriters Laboratories of Canada
      2. CAN/ULC S102.2 - Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

1.3 SUBMITTALS
   [Do not request submittals if drawings sufficiently describe the products of this section or if proprietary specifying techniques are used. The review of submittals increases the possibility of unintended variations to drawings, thereby increasing the Specifier's liability. The following submittals are intended for review and acceptability]
   A. Submit manufacturer’s product literature and installation instructions under provisions of Section 013300.
   B. Product Data: Submit product data for each type of insulation and accessories proposed for the work.

1.4 DELIVERY, STORAGE AND HANDLING
   A. Section 016600: Product Storage and Handling Requirements
   B. Store materials off ground and protect against sunlight, wind, moisture and accidental ignition.
   C. Deliver, store and handle materials in accordance with manufacturer’s instructions.
   D. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.
   E. Remove damaged or deteriorated products from site.

1.5 PROJECT/SITE CONDITIONS
   A. Section 016100: Common Product Requirements.
   B. Do not install insulation adhesives and sealants when temperature or weather conditions are detrimental to successful installation.
2.1 MANUFACTURERS

A. Beaver Plastics Ltd, 7-26318-TWP RD 531A, Acheson, AB, Canada, T7X 5A3, 1-888-453-5361
B. AMC Foam Technologies, 35 Headingly St, Headingly, MB, Canada, R4H 0A8, 204-633-8800
C. Form Solutions, 840 Division St, Cobourg, ON, Canada, K9A 5V2, 1-888-706-7709

2.2 EXISTING PRODUCTS

[This section may be modified to suit specific project details]

A. [Attics and ceiling, interior above-grade perimeter, interior foundation perimeter, and above-slab insulation]

1. Interra
   a. Standard: ASTM C578, Type I EPS, CAN ULC/S701, Type 1 EPS
   b. Thermal Resistance: Minimum R per nominal inch of 5.0 (actual thickness = 1 1/16") when tested in accordance with ASTM C518 at 75 degrees F. mean temperature.
   c. Compressive Strength at 1” thickness: Minimum 10 psi [70 kPa under CAN/ULC S701] when tested to ASTM D1621
   d. Water Absorption: Maximum 1.1% [3.8% under CAN/ULC S701]
   e. Water Vapor Permeance at 1” thickness: <1.0 perms [<57 ng/Pa-s-m²]

B. Exterior insulation above-grade perimeter

1. Exterra
   a. Standard: ASTM C578, Type I EPS, CAN ULC/S701, Type 1 EPS
   b. Thermal Resistance: Minimum R per nominal inch of 5.0 (actual thickness = 1 1/16") when tested in accordance with ASTM C518 at 75 degrees F. mean temperature.
   c. Compressive Strength at 1” thickness: Minimum 10 psi [70 kPa under CAN/ULC S701] when tested to ASTM D1621
   d. Water Absorption: Maximum 1.1% [3.8% under CAN/ULC S701]
   e. Water Vapor Permeance at 1” thickness: >1.0 perms [>57 ng/Pa-s-m²]

C. [Exterior foundation perimeter, and below-slab insulation]

1. Subterra 16
   a. Standard: ASTM C578, Type II EPS, CAN ULC/S701, Type 2 EPS
   b. Thermal Resistance: Minimum R per nominal inch of 5.0 (actual thickness = 1 1/16") when tested in accordance with ASTM C518 at 75 degrees F. mean temperature.
   c. Compressive Strength at 1” thickness: Minimum 16 psi [110 kPa under CAN/ULC S701] when tested to ASTM D1621
   d. Water Absorption: Maximum 1.1% [3.8% under CAN/ULC S701]
   e. Water Vapor Permeance at 1” thickness: <1.0 perms [<57 ng/Pa-s-m²]

2. Subterra 30
   a. Standard: ASTM C578, Type IX EPS, CAN ULC/S701, Type 3 EPS
   b. Thermal Resistance: Minimum R per nominal inch of 5.0 (actual thickness = 1 1/16") when tested in accordance with ASTM C518 at 75 degrees F. mean temperature.
   c. Compressive Strength: Minimum 30 psi [210 kPa under CAN/ULC S701] when tested to ASTM D1621
   d. Water Absorption: Maximum 2%
   e. Water Vapor Permeance at 1” thickness: <1.0 perms [<57 ng/Pa-s-m²]
2.3 MATERIALS
[This section may be modified to suit specific project details]
A. Block molded expanded polystyrene (EPS) made of BASF Neopor Plus beads
B. Perforated clear polypropylene laminate: for use with Exterra
C. Reflective laminate: for use with Interra

2.4 MANUFACTURED UNITS
A. Board size: 4 ft x 8 ft
B. Board thickness: [This section may be modified to suit specific project details]
   [Interra and Exterra]: 0.625 in [16 mm], 1.0 in [25 mm], 1.5 in [38 mm], 2.0 in [51 mm]
   [Subterra 16 and Subterra 30]: 1.0 in [25 mm], 1.5 in [38 mm], 2.0 in [51 mm]

2.5 ACCESSORIES
A. Adhesives:
   [This section may be modified to suit specific project details]
   1. Type recommended by insulation manufacturer for application.
   2. Gun grade, mastic type, compatible with insulation and substrate.
   3. Tape: Bright aluminum, polyethylene, or polyester self-adhering type.
   4. Insulation fasteners: Impaling clip of [unfinished, galvanized steel, plastic or nylon] with washer retainer [and clips] to be [adhered][mechanically fastened] to surface to receive board insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
   5. Protective boards: [Cementitious][Wood fiberboard]
3.0 EXECUTION

3.1 EXAMINATION
   A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation [and adhesive].
   B. Verify substrate surface is flat, free of [honeycomb,] [fins,] [irregularities,] [materials or substances that may impede adhesive bond].

3.2 RIGID BOARD PERIMETER INSULATION ABOVE-GRADE
   [This section may be modified to suit specific project details]
   A. Use [Interra for interior perimeter insulation][Exterra for exterior insulation]
   B. Follow Halo recommended installation instructions.
   C. Minimum vertical height: as detailed.

3.3 RIGID BOARD PERIMETER INSULATION BELOW-GRADE
   [This section may be modified to suit specific project details]
   A. Use [Interra for interior perimeter insulation][Subterra 16 or Subterra 30 for exterior insulation]
   B. [Coordinate with Section 31 20 00 for installation of Subterra 16 or Subterra 30]
   C. Follow Halo recommended installation instructions.
   D. Minimum vertical height: as detailed.

3.4 ABOVE-SLAB INSULATION
   [This section may be modified to suit specific project details]
   A. Use Interra.
   B. Follow Halo recommended installation instructions.

3.4 BELOW-SLAB INSULATION
   [This section may be modified to suit specific project details]
   A. Use Subterra 16 or Subterra 30.
   B. Ensure that granular sub base is properly leveled to ensure uniform contact with insulation boards.
   C. Follow Halo recommended installation instructions.

3.5 ATTIC AND CEILING INSULATION
   [This section may be modified to suit specific project details]
   A. Use Interra.
   B. Substrates shall be free of dust, oil, dirt, and debris, and substantially free of moisture.
   C. Follow Halo recommended installation instructions.

3.6 WORKMANSHIP
   [This section may be modified to suit specific project details]
   A. Install insulation to maintain continuity of thermal protection to building elements and spaces.
   B. Keep insulation minimum [75 mm][3 inches] from heat emitting devices such as recessed light fixtures, and minimum [50 mm] [2 inches] from sidewalls of CAN4-
S604 type A chimneys] [and] [CAN/CGA-B149.1 and CAN/CGA-B149.2 [type B] [and] [L] vents].

C. Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

D. Offset both vertical and horizontal joints in multiple layer applications.

END OF SECTION
The LEED v4 for Building Design and Construction (LEED BD+C) was finalized in 2013. Rather than product focused, LEED v4 places more emphasis on building system performance in an effort to produce buildings with a lower environmental impact, compared to previous LEED versions, by promoting more sustainable materials and environmentally friendly design, construction and manufacturing methods.

Rather than adopting a stand-alone rating system, as was done in previous versions, the Canada Green Building Council (CaGBC) will be adopting LEED v4. However, because LEED v4 was developed in the United States, which mainly references US standards, the CaGBC will be providing Canadian options to show compliance – termed Alternative Compliance Path (ACP). For example, where an equivalent Canadian standard exists, the ACP can allow the use of that standard, in lieu of the standard required in the LEED requirements.

While some of the building types may seem familiar from previous LEED versions, LEED v4 BD+C now include 8 building types:

1. New Construction
2. Core and Shell
3. Schools
4. Retail
5. Data Centers
6. Warehouses and Distribution Centers
7. Hospitality
8. Healthcare

A minimum of 40 points are required to achieve LEED v4 certification. The point system for LEED v4 certification is listed below:

- Certified LEED – 40 to 49
- Silver – 50 to 59
- Gold – 60 to 79
- Platinum – 80 to 110
LEED v4 BD+C include 8 categories. Each category may vary in points based on the building types. The categories total 109 possible LEED points plus additional point under “Integrative Process. The categories include:

1. Location and Transportation (16 points)
2. Sustainable Sites (10 points)
3. Water Efficiency (11 points)
4. Energy and Atmosphere (33 points)
5. Material and Resources (13 points)
6. Indoor Environmental Quality (16 points)
7. Innovation (6 points)
8. Regional Priority (4 points)

The categories where Halo can potentially contribute to gaining LEED points are items 1, 2, 4, 5, and 6, as listed above. The potential LEED point contribution when using Halo is listed below, with details shown on the next page.

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Potential LEED Potential Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Construction &amp; Major Renovations</td>
<td>34</td>
</tr>
<tr>
<td>Core &amp; Shell</td>
<td>32</td>
</tr>
<tr>
<td>Schools</td>
<td>32</td>
</tr>
<tr>
<td>Retail</td>
<td>34</td>
</tr>
<tr>
<td>Data Centers</td>
<td>34</td>
</tr>
<tr>
<td>Warehouses &amp; Distribution Centers</td>
<td>34</td>
</tr>
<tr>
<td>Hospitality</td>
<td>34</td>
</tr>
<tr>
<td>Healthcare</td>
<td>35</td>
</tr>
</tbody>
</table>
### POTENTIAL LEED POINTS CONTRIBUTION WITH HALO

#### Sustainable Sites
<table>
<thead>
<tr>
<th>Applicable Building Types</th>
<th>Maximum Points Contribution</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>2 (1 for healthcare)</td>
<td>The insulation and reflective properties of Interra can help to reduce heat island effects when used on roofs.</td>
</tr>
</tbody>
</table>

#### Energy & Atmosphere
<table>
<thead>
<tr>
<th>Applicable Building Types</th>
<th>Maximum Points Contribution</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>n/a (required)</td>
<td>The continuous insulation and air barrier properties of Halo can help meet required minimum levels of efficiency for the building.</td>
</tr>
<tr>
<td>All</td>
<td>18 points except Schools and Healthcare (16 for Schools, 20 for Healthcare)</td>
<td>The continuous insulation and air barrier properties of Halo can help achieve the levels of energy performance that go beyond the prerequisite standard.</td>
</tr>
</tbody>
</table>

#### Material & Resources
<table>
<thead>
<tr>
<th>Applicable Building Types</th>
<th>Maximum Points Contribution</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>n/a (required)</td>
<td>Halo products produce little waste compared to wood, which should ease the waste management planning. In addition, EPS recycling programs can be implemented as part of the waste management planning.</td>
</tr>
<tr>
<td>All</td>
<td>3</td>
<td>Halo can help contribute to 3 points under “Option 4. Whole-Building-Life-Cycle Assessment.”</td>
</tr>
<tr>
<td>All</td>
<td>1</td>
<td>Can help contribute 1 point under “Option 1. Environmental Product Declaration (EPD).” Logix uses EPS which carries EPD documents, which conform to ISO 14025.</td>
</tr>
<tr>
<td>All</td>
<td>2</td>
<td>Halo products are made with up to 10% recycled pre-consumer EPS.</td>
</tr>
<tr>
<td>All</td>
<td>1</td>
<td>Contributes to 1 point under “Option 3. Product Manufacturer Supply Chain Optimization.” Halo products are certified under a third party program with Quality Auditing Institute (QAI).</td>
</tr>
<tr>
<td>All</td>
<td>2</td>
<td>Programs can be put in place to recycle EPS from job sites. EPS is also light in weight, and produces less waste than wood products.</td>
</tr>
</tbody>
</table>
### Indoor Environmental Quality

<table>
<thead>
<tr>
<th>Minimum Acoustic Performance</th>
<th>Applicable Building Types</th>
<th>Maximum Points Contribution</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td>N/a (required)</td>
<td>Halo can help increase the acoustical performance of wall and ceiling assemblies.</td>
<td></td>
</tr>
</tbody>
</table>

| Low-emitting Materials       | All                        | 3                            | Halo is made with BASF Neopor Plus which is Greenguard Certified. In addition, the EPS used for Halo has been tested to show no signs of harmful emissions. |

| Thermal Comfort             | All except Core & Shell    | 1                            | Halo offers continuous insulation in wall and ceiling assemblies, and is made with BASF Neopor Plus which offer the highest thermal value of any EPS material. |

| Acoustic Performance        | All except Core & Shell    | 1                            | Halo can contribute to the STC ratings of wall and ceiling assemblies. |

1 The total LEED point contribution from Halo is a best estimate based on available information and test data. The actual LEED point contribution may change based on project specifics, and should be determined by a LEED Accredited Professional for each project seeking LEED accreditation.

For more information about the LEED green building rating system visit [www.usgbc.org](http://www.usgbc.org) or [www.cagbc.org](http://www.cagbc.org).
Exterra™ is a rigid insulation foam board made of Type 1 Neopor® Plus EPS, and coated with a clear polypropylene film that is perforated. The perforations allow Exterra™ to maintain a higher air and vapour permeance, which makes it suitable for use as exterior continuous insulation, and as a weather barrier. The higher air and vapour permeance of Exterra™ lets moisture vapour escape the wall assembly and dry towards the outside.

In comparison, a comparable leading XPS rigid insulation product exhibits properties of low air and vapour permeance. This XPS product is a vapour barrier by code1 (less than 60 ng/Pa-m²-s), and because a vapour barrier on the warm side of the wall assembly is still required by code, a double vapour barrier wall assembly is created when this XPS product is used on the exterior. This can result in more moisture trapped within the wall assembly, and hinder the rate of drying to the exterior.

As shown in the table below, this XPS product has a vapour permeance less than 60 ng/Pa-m²-s and an air leakage rate less than 0.1 L/s-m² @ 75 Pa, which according to the National Building Code of Canada 2010 (NBCC) is considered a low permeance material2.

The NBCC requires low permeance materials to be placed on the warm side of the wall assembly – the interior side of the wall. However, this XPS product does not comply with this requirement. Therefore, in accordance with the NBCC, wall assemblies using this XPS product on the exterior must then show compliance by determining the outboard to inboard ratio of the wall assembly.

Because Exterra™ is not a low permeance material, Exterra™ as exterior insulation is readily code compliant, and does not require outboard to inboard calculations. (The controlling air and vapour barrier, or low permeance material, in an Exterra™ wall assembly is the polyethylene vapour barrier located on the warm side of the wall assembly, as required by code).

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1. NBCC 2010, Section 9.25.4.2, defines a vapour barrier to have a permeance not greater than 60 ng/Pa-s-m².
2. NBCC 2010, Section 9.25.5.1, defines low permeance materials and requirements.
The low permeance properties of this XPS product can have a negative affect on the overall health of the wall assembly when used as exterior insulation. Exterra™ was designed to have higher air and vapour permeance to allow for a more breathable, healthier wall assembly.

1. Based on independent testing.
2. Source: Available data from leading XPS product.

<table>
<thead>
<tr>
<th>Comparable leading XPS product</th>
<th>Exterra</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 psi (140 kPa), Type 3, R-5/in</td>
<td>15 psi (100 kPa), Type 1, R-4.7/in</td>
</tr>
<tr>
<td>R-value</td>
<td>5</td>
</tr>
<tr>
<td>Vapour perm² (ng/Pa-m²-s)</td>
<td>45</td>
</tr>
<tr>
<td>Air leakage (L/s-m² @ 75Pa)</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thickness, in</th>
<th>1</th>
<th>1.5</th>
<th>1.625</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapour Barrier</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Air Barrier</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

1. Based on independent testing.
2. Source: Available data from leading XPS product.

<table>
<thead>
<tr>
<th>Comparable Leading XPS Product Wall Assembly</th>
<th>Exterra Wall Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creates a double vapour barrier wall assembly, which can trap more moisture within the wall assembly, and hinder the drying rate to the exterior.</td>
<td>Perforated to be more breathable allowing moisture in the wall assembly to dry properly to the exterior.</td>
</tr>
<tr>
<td>Not readily code compliant. Must meet outboard to inboard ratio requirements, and will only apply to specific climate zones.</td>
<td>Readily code compliant. Controlling air and vapour barrier is the polyethylene vapour barrier placed on the warm side of the wall assembly, per code. Can apply to all climate zones.</td>
</tr>
</tbody>
</table>
The insulation in a home is the biggest contributor to increasing energy efficiency - the higher the R-value of the insulation the greater the energy savings that can be expected. Over time, insulation can be exposed to moisture, especially below-grade, which can result in a reduction in R-value, and subsequent reduction in energy savings. So it’s critical that the insulation chosen can retain its R-value even after long term exposure to moisture.

XPS and EPS are the main types of rigid insulation used for insulating the exterior of a building, including roofs, below slabs, crawl spaces and foundation walls. Both offer high R-values but differ in water absorption rates. Based on standards test methods, XPS absorbs less water than EPS. Because XPS absorbs less water than EPS one would expect XPS to retain a higher R-value. However, the standard test methods do not tell the whole story.

The standard test method requires a small sample size of 1” or 2” thick, 12”x12”. The samples are submerged in water for up to 96 hours. Afterwards, the samples are measured for water absorption by volume. The test may indicate short term water absorption, but there is no test standard that accounts for long term water absorption and its effect on R-value – real end-use product performance.

As the standards note, these test methods are meant as a means to specify product performance, product evaluations and quality control – but not meant as a good indication for end-use product performance. Hence, the effect on R-value due to long term exposure to moisture should be considered.
Independent research\(^2\) has shown that over time XPS will actually absorb and retain more moisture than EPS resulting in a significant decrease in R-value. One of the studies showed XPS retained 19% water absorption compared to 5% for EPS after being buried below grade for 15 years. As a result, the XPS samples only retained 52% of its initial R-value, whereas EPS retained 94% of its R-value. The reason for the higher R-value retention of EPS is likely due to the comparatively higher vapour permeance property, which allows moisture absorbed in the EPS to escape more readily than XPS – most of the moisture absorbed in XPS will be retained in the XPS reducing the R-value.

Ironically, a good demonstration of this is featured in an Owen Corning video “XPS vs EPS: Science Doesn’t Lie.” The video, available on Youtube, shows water injected into a sample of EPS and XPS. As expected, the EPS sample allowed the water to escape retaining its R-value, whereas the XPS sample showed little to no water escaping resulting in a reduction in R-value.

The XPS industry has long marketed XPS rigid insulation as having higher retained R-values than EPS because it has a lower water absorption property based on these standards. However, as these standards indicate, the water absorption properties do not reflect real end-use product performance. Just as the XPS insulation industry is required to provide long term thermal resistance values to consumers (due to its loss in R-value over time); it should also provide long term water absorption values, which also affects the long term R-value.

2. EPS Industry Alliance, “15-Year In-situ Research Shows EPS Outperforms XPS in R-Value Retention”  
   EPS Industry Alliance, “XPS Insulation Extracted After Field Exposure Confirms High Water Absorption & Diminished R-value”
HALO™ INSULATION PRODUCTS

15 Year Limited Warranty (Canada and United States)

The Manufacturer gives the following Limited Warranty to the first owner of a structure (the "Owner") in which the following Halo insulation products (the "Product" or "Products") have been installed:

* Halo Interra™
* Halo Exterra™
* Halo Subterra™

EXTENT OF LIMITED WARRANTY:

Subject to the terms and conditions contained in this Limited Warranty, the Manufacturer warrants that if the representative thermal insulation value of the Neopor bead in the Products varies from the published R-Value, the Manufacturer will, when a claim under this Limited Warranty is made within fifteen (15) years from the date of manufacture printed on the Product, refund the original purchase price to the Owner. For the purposes of this Limited Warranty, the original purchase price of the Product shall be exclusive of taxes and all other costs, including builder mark ups, labour costs and costs to remove the original Product and replace it with new product.

TERMS AND CONDITIONS:

PROOF OF PURCHASE. The Owner agrees to retain documentary proof of purchase that is satisfactory to the Manufacturer and to submit such documentation to the Manufacturer in the event of a claim under this Limited Warranty.

HANDLING AND INSTALLATIONS. The Products must be handled and installed according to the instructions outlined in the applicable Product installation guide. This Limited Warranty shall only apply if the Product is installed in strict accordance with all Halo specifications, recommendations, and guidelines which were in effect at the time of such installation. The Manufacturer will not be liable under this Limited Warranty if the Product is damaged due to the failure of any other building component. This Limited Warranty is effective only if the Product is used for the particular purposes recommended in the Halo Product literature. This Limited Warranty shall be void if, in the Manufacturer's judgment, the Product's performance has been compromised by abuse, misuse, damage, neglect or by alteration to the Product without prior written consent of the Manufacturer.

NOTICE AND INSULATION TESTING. In order to make a claim under this Limited Warranty, the Owner shall provide written notice to the Manufacturer within sixty (60) days after any decline in the R-Value of the Product becomes apparent. The Owner shall take samples of the Product in accordance with the Manufacturer's sampling procedures and shall test the installed Product to determine the actual R-Value of the Product. Testing of the Product samples shall be in accordance with ASTM Test Method C 518 or such other test method as is then in effect. All sampling related costs (including, but not limited to costs of insulation, its removal and repair costs) shall be at the Owner's expense, without recourse to the Manufacturer. Procurement of Product samples must be witnessed by a representative of the Manufacturer. All testing of the
Product samples will be conducted at a SCC or IAS accredited independent testing laboratory, approved by the Manufacturer. Results of the testing will be final and binding on all parties concerned.

REPLACEMENT PRODUCT. Where new Product is purchased as replacement for original Product during the Limited Warranty period, the new Limited Warranty shall apply to the new Product but only for the unexpired portion of the Limited Warranty period relating to the original Product.

SOLE WARRANTY. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER GUARANTEES AND WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND SHALL NOT BE EXTENDED OR ALTERED EXCEPT BY WRITTEN INSTRUMENT SIGNED BY THE MANUFACTURER AND THE OWNER. THERE ARE NO WARRANTIES OR GUARANTEES WHICH EXTEND BEYOND THE DESCRIPTION SET FORTH IN THIS LIMITED WARRANTY. This Limited Warranty contains all of the provisions of the Owner's remedies from the Manufacturer. The Manufacturer's liability is limited to the provisions of this Limited Warranty, whether any claim against the Manufacturer is based upon strict liability, negligence, breach of warranty or any other theory or cause of action. No agent, salesperson, employee, or representative of the Manufacturer is authorized to give any representation or warranty regarding the Product beyond that given in the Halo Product literature, or to assume any further obligation on behalf of the Manufacturer, either orally or in writing.

LIMITATION OF LIABILITY. Obligations under this Limited Warranty are applicable to Products manufactured by the Manufacturer on or after January 1, 2014. THE TOTAL MANUFACTURER OBLIGATION TO THE OWNER FOR THE DURATION OF THIS LIMITED WARRANTY SHALL BE LIMITED TO THE ORIGINAL PURCHASE PRICE FOR THE ELIGIBLE PRODUCTS. IN NO INSTANCE SHALL THE MANUFACTURER BE RESPONSIBLE FOR OTHER DIRECT DAMAGES, OR ANY SPECIAL, INDIRECT, INCIDENTAL, PUNITIVE, EXEMPLARY OR CONSEQUENTIAL DAMAGES, OF ANY NATURE OR KIND, ARISING FROM THE USE OF THE PRODUCT, EVEN IF THE MANUFACTURER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE. IN NO EVENT SHALL THE MANUFACTURER BE LIABLE FOR DIRECT, SPECIAL, INDIRECT, INCIDENTAL, PUNITIVE, EXEMPLARY OR CONSEQUENTIAL DAMAGES, OF ANY NATURE OR KIND, TO THE STRUCTURE OR BUILDING UPON WHICH THE PRODUCT IS INSTALLED OR TO ITS CONTENTS, OR OCCUPANTS. THIS LIMITED WARRANTY DOES NOT COVER ANY DAMAGE TO THE PRODUCTS DIRECTLY OR INDIRECTLY, OR WHOLLY OR PARTIALLY ATTRIBUTABLE TO PROLONGED EXPOSURE TO NATURAL ELEMENTS OR LIGHTNING, FIRE, HURRICANE, TORNADO OR OTHER ACT OF GOD.

ASSIGNABILITY. The Owner shall not assign this Limited Warranty to any party, except with the written consent of the Manufacturer. To the maximum extent permitted under applicable law, and at its sole discretion, the Manufacturer may assign its obligations hereunder to a third party.

COMPLETE AGREEMENT. To the extent permitted by law of the applicable jurisdiction, this Limited Warranty includes the complete and exclusive agreement between the Owner and the Manufacturer, and supersedes any and all prior, oral or written, agreements or representations, made by or between them. This Limited Warranty shall be binding only on the Manufacturer and its permitted assigns, and shall not be binding on any other manufacturer, including, without limitation, the Manufacturer's parent, subsidiary, sister or affiliated companies.
As with most building products certain precautions should be taken to minimize potential problems with thermal expansion or contraction during installation and/or storage caused by direct exposure to sunlight, particularly during hot summer months.

On rare occasions, with the right combination of heat, sunlight and humidity, Halo® Exterra products may thermally expand causing an increase in dimensions by about 0.25%. To avoid thermal expansion the following precautions are recommended during installation and storage of Halo® Exterra during the summer months.

1. Ensure stored Halo® Exterra products on the job site are always placed in a shaded area, or provide shade with a secure protective cover, such as tarps or cardboard.

2. Plan your Halo Exterra installation to “follow the shade”, whenever possible, and avoid installing Halo Exterra in direct sunlight.

For more information contact your local Halo representative or email info@buildwithhalo.com.