Thermal 3Ht Technical Datasheet - 2011

Thermal 3Ht is a high performance, rigid insulation consisting of superior closed-cell lightweight and resilient expanded polystyrene (EPS) with advanced metallic polymer facers and/or white woven facers. Thermal 3Ht is an Energy Star qualified insulation and is eligible for LEED points. Thermal 3Ht may contain up to 25% recycled content.

Benefits of Thermal 3Ht

- In one product Thermal 3Ht is an air barrier, vapor barrier, radiant barrier and an insulator.
- Thermal 3Ht has excellent dimensional stability and is flexible and durable.
- Depending on thickness Thermal 3Ht can be bent to 90° angles. It does not easily crack, chip or break.
- Thermal 3Ht has NO thermal drift and will remain stable over its entire service life.
- Thermal 3Ht contains no dyes, formaldehyde, or ozone depleting blowing agents.
- Thermal 3Ht is produced with an inert additive that deters carpenter ants and termites.
- Thermal 3Ht does not promote mold.
- Thermal 3Ht is manufactured in a variety of thicknesses and densities.
- Thermal 3Ht is available in sheets, rolls and accordion fold. (Custom lengths offered.)
- Thermal 3Ht is eligible for a 20 Year Thermal Performance Warranty – a warranty that is not limited to a percentage of the published R-value.

Typical Physical Properties of Thermal 3Ht

Property	Type I	Test Method
Nominal Density (pcf)	1.0	ASTM C303
C-Value (Conductance) BTU/(hr•ft^2•°F) (per inch) @ 25 °F @ 40 °F @ 75 °F	 0.23 0.24 0.26	 ASTM C518 or ASTM C177
R-Value (Thermal Resistance) (hr•ft^2•°F)/BTU (per inch) @ 25 °F @ 40 °F @ 75 °F	 4.35 4.17 3.85	 ASTM C518 or ASTM C177
Compressive Strength (psi, 10% deformation)	13	ASTM D1621
Flexural Strength (psi)	33	ASTM C203
Dimensional Stability (maximum %)	<2%	ASTM D2126
*Water Vapor Transmission (perms)	<1.0	ASTM E96
Absorption (% vol.)	<1.0	ASTM C272
Capillary	none	–
Flame Spread	<20	ASTM E84
Smoke Developed	150 - 300	ASTM E84
Total Emissivity, ε (Facer) Silver (Reflective) White (Poly)	 0.03 0.18	ASTM E408

*The IRC defines a vapor barrier as having a perm rating of 1.0, or less. A vapor barrier is a Class I vapor control layer. The test procedure for classifying vapor barriers is ASTM E96 Test Method.

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ASTM C1363-05 Thermal Performance Testing – Thermal 3Ht

Architectural Testing Inc. (ATI) an independent test laboratory was commissioned to test Thermal 3Ht to ASTM C1363-05 "*Standard Test Method for Determination of the Steady State Thermal Performance of Building Assemblies"*. Construction materials include: sheetrock, vapor retarders where applicable, steel or wood framing, concrete, insulation(s), OSB, and steel sheathing.

The "*temperature range: 70 °F/21 °C warm side – 0 °F/-18 °C cold side"* was designed to determine the effective R-value of wall assemblies in predominately heating climates *i.e.*: Canada and North/Central USA.

Research from the US Department of Energy / Oak Ridge National Laboratory (ORNL) indicates fiberglass insulation declines as much as 40% in R-value as the ambient (outside) air temperature decreases.

Test Results	**Effective R-Value**
1" Thermal 3Ht - product R-value (no construction materials)	5.86

Wood Frame Assemblies / wall construction details	**Effective R-Value**
Oakridge National Laboratory / US Department of Energy claims the whole wall R-value of R-19 fiberglass insulation, 2X6 (16"O.C) wood frame wall as commonly installed	*R-13.7or 26% less than labeled R-value*
½" Sheetrock, 2" x 4" Studs, Empty Cavity, 7/16" OSB, 1" Thermal 3Ht	8.3
½" Sheetrock, 2" x 4" Studs, Empty Cavity, 7/16" OSB, ¾" Strapping, 1" Thermal 3Ht	10.6
½" Sheetrock, Vapor Retarder, 2" x 4" Studs, R-11 Batts, 7/16" OSB, 1" Thermal 3Ht	18.0
½" Sheetrock, ¾" Strapping, ¾" Thermal 3Ht, 2" x 4" Studs with R-11 Batts, 7/16" OSB	19.5
½" Sheetrock, 2" x 6" Studs with R-19 Batts, 7/16" OSB, ¾" Strapping, 1" Thermal 3Ht	26.3

*R-19 fiberglass insulation would enhance the effective R-value of the preceding R-11 fiberglass assemblies by approximately R-6.

Steel Frame Assemblies / wall construction details	**Effective R-Value**
(ASHRAE) / American Society of Heating, Refrigerating and Air-conditioning Engineers states the effective R-value of R-19 fiberglass insulation, 2" x 6" (16" O.C.) steel frame wall	*R-7.1 or 62% less than labeled R-value*
Steel Sheathing Interior, 2" x 6' Steel Stud Frame, Empty Cavity, Horizontal 2" x 4" Steel Studs (Simulates Steel Girts), ½" Thermal 3Ht, Exterior Steel Sheathing	5.22
Steel Sheathing Interior, 2" x 6" Steel Stud Frame, Empty Cavity, Horizontal 2" x 4" Steel Studs (Simulates Steel Girts), 1" Thermal 3Ht, Exterior Steel Sheathing.	6.85
Steel Sheathing Interior, 2" x 6" Steel Stud Frame, ½" Thermal, R-19 Fiberglass Batt squeezed between 2" x 4" Steel Studs (Simulates Steel Girts) and Exterior Steel Sheathing.	14.77

Concrete Assemblies / wall construction details	**Effective R-Value**
As tested to ASTM C1363-05 - the effective R-value of a concrete wall assembly containing ½" sheetrock, vapor retarder, 6" steel studs (16" O.C.), R-19 fiberglass, 3.5" concrete wall	*R-11.6 or 39% less than labeled R-value*
3.5" concrete wall, ½" Thermal 3Ht adhered to the outside (cold side) of wall	3.8
3.5" concrete wall, 1" Thermal 3Ht adhered to the outside (cold side) of wall	5.9
½" sheetrock, empty 6" steel stud cavity, 1" Thermal 3Ht (warm side), 3.5" concrete wall	9.8
½" sheetrock, 6" steel stud cavity with R-19 fiberglass, 1" Thermal 3Ht, 3.5" concrete wall	21.6

Observations:

- In building assemblies - the location of Thermal 3Ht affects the overall R-value of the assembly. Example: On the cold side of a 4" concrete wall the effective R-value of the wall combined with 1" Thermal 3Ht is R-5.9. However, when 1" Thermal 3Ht is installed on the warm side of the concrete wall with 6" steel studs and ½" sheetrock the effective R-value of the wall assembly becomes R-10.
- Additional LEED points may be achieved by utilizing 2" x 4" wood studs vs. 2" x 6" wood studs.
- Utilizing thicker Thermal 3Ht further enhances the effective R-value of building assemblies.

EXPANDED POLYSTYRENE (EPS) EARNS NEW RESPECT

15 Year In-Situ Research - EPS Outperforms XPS in R-Value Retention

Studies show that as much as 25% of energy loss from a structure can be attributed to a lack of insulation on below grade foundations, crawl spaces and under slabs. In below grade applications, foam insulation is exposed to moisture and could lose R-value over time if this moisture is absorbed.

As shown in an independent, third party test program expanded polystyrene (EPS) maintains its R-value even after long term exposure in northern climates. A competing insulation material, extruded polystyrene (XPS), was shown to have lost R-value over time.

- The results demonstrate that EPS Type I outperforms XPS Type X in both R-value retention and decreased water absorption.
- The in-service R-value of the XPS insulation was reduced by almost half.
- Expanded polystyrene still delivered 94% of its specified R-value after 15 years.

EPS: Below Grade Testing Confirms R-Value Retention

The Expanded Polystyrene Association of Canada (EPAC) conducted a joint research project with the National Research Council of Canada/Institute for Research in Construction (NRC/IRC) to evaluate the durability and performance of expanded polystyrene (EPS) insulation in below grade applications over a 30 month exposure period.

- Testing performed by NRC on samples confirmed that all types of EPS insulation retained their specified material properties even after being subjected to the durability test protocol.
- Testing confirmed that all types of EPS insulation retained their specified thermal and mechanical properties even after being subjected to in-situ freeze/thaw cycling.
- The moisture content of EPS insulation was found to be less than 0.5% by volume at the end of the exposure and there was no loss in thermal resistance.
- The NRC test protocol was subsequently developed into an ASTM standard test method to provide a means of assessing durability performance of all types of insulation.

EPS: Freeze-Thaw Cycling Tests Show No Loss of R-Value or Strength

The EPS Molders Association commissioned a study by Intertek EL SEMKO, an independent test laboratory. Intertek conducted environmental cycling tests using ASTM C1512-07, *Standard Test Method for Characterizing the Effect of Exposure to Environmental Cycling on Thermal Performance of Insulation Products*.

- Tests were performed on 1" (25mm) thick specimens of EPS product Type I, Type II and Type IX.
- Test results confirm no loss in R-value or change in compressive strength for EPS.
- The results clearly demonstrate that EPS insulation does not absorb excessive amounts of moisture.

**The preceding information is supported by the EPS Molders Association Technical Bulletins: 101, 102 and 103.*