

# PermaTherm

## Insulation Innovation

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## Expanded Polystyrene DataSheet

PermaTherm EPS is a closed cell, lightweight, resilient, foamed plastic composed of hydrogen and carbon atoms. PermaTherm EPS has a compressive strength of 10-60 psi for most construction applications. Within that range PermaTherm EPS can be molded to meet specific application requirements.

Applied in roofs, walls, and foundations, PermaTherm EPS has a successful history of efficient use in industrial, commercial, cold storage and residential construction. Where energy efficiency and cost effectiveness have long been primary design considerations, architects have made PermaTherm EPS the dominant thermal insulation.

### LONG-TERM INSULATION VALUE

PermaTherm EPS insulation (1.0 pcf) provides a typical R-value of 4.17 per inch (k-factor=0.24) at a mean temperature of 40°F, and a typical R-value of 3.85 per inch (k-factor=0.26) at a mean temperature of 75°F. The higher the R-value, the higher the insulating effect. When properly installed and protected from moisture, the R-value of PermaTherm EPS insulation remains constant. The R-value will not decrease with age. As a result, the thermal resistance, or R-value of PermaTherm EPS may be used without any adjustment for aging.

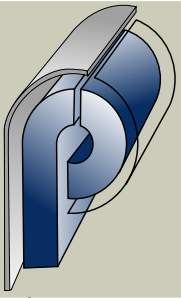
### MOISTURE RESISTANCE

A study by the Energy Materials Testing Lab (EMTL) has shown that EPS insulation material installed in well-constructed roofs does not absorb appreciable moisture, even under conditions characteristic of prolonged, cold, damp winters. The small amount of moisture absorbed (an average of 0.2% by weight) has little or no effect on the compressive or flexural strength and the EPS insulation retains between 95% and 97% of its thermal efficiency.

Though EPS has low water vapor transmission, EPS is not a vapor barrier. Rather, it "breathes" and, therefore needs no costly venting as do some other relatively impermeable insulation materials which could otherwise trap moisture within walls and roof assemblies.

### TEMPERATURE CYCLING

PermaTherm EPS is able to withstand the abuse of temperature cycling, assuring long-term performance. In a series of tests conducted by Dynatech Research and Development Co., Cambridge, MA, core specimens removed from existing freezer walls, some as old as 16 years, demonstrate EPS freeze thaw cycles without loss of structural integrity or other physical properties.



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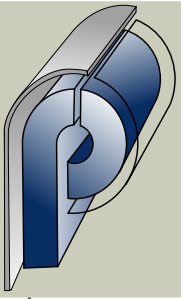
### Expanded Polystyrene Insulation Typical Physical Properties

Specification Reference: Property	ASTM C 578-92 Units		Type I ASTM Test	Type VIII	Type II	Type 1X
<b>Density, minimum</b>	(pcf)	D303 or D 1622	0.90	1.15	1.35	1.80
<b>Density Range</b>			0.90-1.14	1.15 – 1.34	1.35-1.79	1.80-2.20
<b>Thermal Conductivity</b> at 25 F	BTU/(hr.)	C177 Or C518	0.23	0.22	0.21	0.20
<b>K Factor</b> at 40 F	(sp.Ft.)(F/in.)		0.24	0.235	0.22	0.21
at 75 F			0.26	0.255	0.24	0.23
<b>Thermal Resistance</b>	at 25 F	at 1 inch	4.35	4.54	4.76	5.00
<b>R-value*</b> at 40 F	thickness		4.17	4.25	4.55	4.76
At 75 F			3.85	3.92	4.17	4.35
<b>Strength Properties</b>						
Compressive 10% Deformation	psi	D 1621	10 – 24	13 - 18	15 - 21	25 - 33
Flexural	psi	C 203	25 - 30	30 - 38	40 - 50	50 - 75
Tensile	psi	D 1623	16 - 20	17 - 21	18 - 22	23 - 27
Shear	psi	D 723	18 - 22	23 - 25	26 - 32	33 - 37
Shear Modulus	psi	----	280 - 320	370 - 410	460 - 500	600 - 640
Modulus of Elasticity	psi	----	180 - 220	250 - 310	320 - 360	460 - 500
<b>Moisture Resistance</b>						
WVT	perm. in.	E 96	2.0-5.0	1.5 – 3.5	1.0 – 3.5	0.6 – 2.0
Absorption (vol.)	%	C 272	<4.0	<3.0	<3.0	<2.0
Capillarity	----	----	none	none	none	none
<b>Coefficient of Thermal Expansion</b>	in./(in.)(f)	D 696	0.000035	0.000035	0.000035	0.000035
<b>Maximum Service Temperature</b>	F	----				
Long term exposure			167	167	167	167
Intermittent exposure			180	180	180	180
<b>Oxygen Index</b>	%	D 2863	24.0	24.0	24.0	24.0

\*R-value is a measure of resistance to heat flow. The higher the R-value, the greater the insulating effect.

Flame Spread and Smoke Development recorded while the material remained in the original test position. Surface Burning Characteristics derived from ASTM E-84 are not intended to reflect hazards presented by this product under actual conditions. The manufacturer in no event assumes liability beyond the purchase price or replacement of material proven to be defective and reported in a timely fashion, but not longer than six (6) months after shipment. Only the senior executive of PermaTherm has the authority to alter or extend these conditions.

PermaTherm's EPS products were tested by Underwriters Laboratories, Inc. and meet the requirements of the Standard Mechanical Code and the International Mechanical Code.



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### ENVIRONMENTAL IMPACT

EPS insulation is an inert, organic material produced from petroleum and natural gas by-products. EPS insulation does not contain ozone depleting chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs). It is manufactured with hydrocarbon blowing agents. It provides no nutritive value to plants, animals or micro-organisms. It will not rot, and is highly resistant to mildew.

EPS is recyclable. After its original life as insulation, EPS could be recycled into a variety of consumer products. Many EPS molders have been reprocessing their own in-plant scrap for many years. An infrastructure for the collection of EPS is being developed, making it possible to produce products containing post-consumer recycled EPS materials. EPS molders can now provide you with a place to return scrap EPS construction insulation as well as offer recycled content products when specified or desired.

In addition, when disposed of through incineration EPS foam functions as an energy source contributing more than 15,000 btu's per pound as additional fuel. The products of complete combustion are carbon dioxide, water vapor and trace quantities of nonhazardous ash; similar by-products are produced when wood is burned. When landfilled, EPS does not biodegrade. It will not create methane gas or leachate, materials known to be harmful to air quality and ground water.

EPS insulation does not contain ozone depleting chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs).

### STRENGTH CHARACTERISTICS

For foundation and wall applications in which EPS insulation board provides reasonable absorption of building movement without transferring stress to the outer skins at the joints. Type I EPS (1 lb/ft<sup>3</sup>) material provides the dimensional stability and compressive strength necessary to withstand light roof traffic and equipment weight at reasonably high surface temperatures.

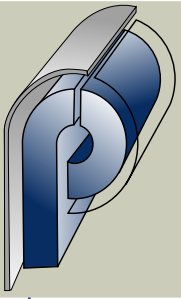
If greater rigidity and strength are needed, compressive strengths up to 60 psi are available. For recommendations, consult your with your PermaTherm representative.

### STANDARDS COMPLIANCE

EPS insulation may be manufactured to meet or exceed the requirements of major building codes, ASTM C578-07, HUD Use of Materials Bulletin #71, and DOE/RCS Standards.

### FABRICATION AND INSTALLATION

EPS insulation is easily fabricated during manufacture to meet specific design and dimensional requirements. Further, because of its light weight, it is easily stored, handled and installed on the job site. In addition, it can be cut to shape with ordinary tools to assure tight joints, thus eliminating heat loss.



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### TYPES AND SIZES

In addition to standard EPS board insulation, various types of laminated products are available. These laminates, such as film or foil facings, improve board strength weatherability and can provide additional R-value when used in conjunction with an air space. Prefabricated EPS core panels with metal facings are also available for wall and roof applications. EPS insulation is available in thicknesses ranging from ½" to 24", widths up to 48" and lengths up to 192".

### COST EFFICIENCY

EPS insulation typically costs less than other rigid board insulations when compared on the basis of R-value. When evaluating the cost efficiency of rigid insulations, compare the price of equal lengths and widths for the cost of the R-value per inch of thickness.

### COMBUSTIBILITY

Like many construction materials, EPS is combustible. It should not be left exposed to flame or other ignition sources. EPS insulation should be covered with a thermal barrier or otherwise installed in accordance with applicable building code requirements.

### SOLVENT ATTACK

EPS is subject to attack by petroleum-based solvents. Care should be taken to prevent contact between EPS and these solvents or their vapors.

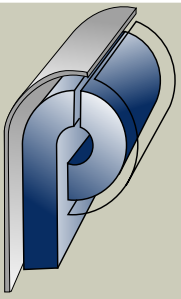
### ULTRAVIOLET DEGRADATION

Prolonged exposure to sunlight will cause slight discoloration and surface dusting of EPS insulation. The insulating properties will not be significantly affected under normal usage. EPS stored outside should be protected with a light-colored opaque tarpaulin.

### VAPOR BARRIERS

Although EPS provides a high level of moisture resistance and breathability, recommended design practices for walls and foundations should be followed in the selection of vapor and moisture barriers for severe exposures.

Each application should be studied to determine the need for a vapor retarder to control internal condensation.



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### INSTALLATION EXPOSURE

Following each day of application, all exposed insulation should be covered and temporarily sealed from moisture in accordance with good building practices. Insulation exposed to moisture should be replaced or thoroughly dried prior to application of finish or covering.

### APPLICATION TEMPERATURES

In roof construction requiring hot asphalt, temperatures should not exceed 250°F at the time for direct contact with EPS insulation. Avoid contact between EPS and high-temperature equipment, such as asphalt kettles and flame sealers.

### Warning

EPS products are manufactured with a fire retardant; however, EPS insulation will burn upon exposure to an adequate source of heat or flame. EPS should be kept away from flame or heat sources, including, but not limited to, open flames, welder's torches, or other sources of heat. Once ignited, EPS will burn with intense heat and smoke. It is the responsibility of the purchaser to warn all of those who may be in contact with EPS insulation about the need to adhere to these requirements when the product is stored on the jobsite. EPS insulation should not be used in exposed applications.

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