

PERLITE LOOSE-FILL MASONRY INSULATION

Description, Properties, Benefits

DESCRIPTION

Perlite loose fill masonry insulation is an inert volcanic rock expanded by a special heat process and is often treated with water repellent material. The resulting granular product is lightweight with countless tiny, sealed air cells, which account for its excellent thermal performance and fire resistance.

Perlite insulation has been proven over a period of many years in the insulation of storage tanks for liquid gases at temperatures as low as -400°F (-240°C).

PROPERTIES AND BENEFITS

INSULATING - Reductions in heat transmission of masonry walls of 50% or more may be obtained with perlite loose fill insulation. Thermal performance tests using ASTM C236, *Test Method for Steady State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box* have shown perlite to be a superior concrete block insulation when compared to vermiculite, EPS inserts, EPS beads, and foamed-in-place insulations.

Recent testing of an 8 inch medium weight concrete block wall filled with perlite loose-fill insulation using dynamic temperature conditions simulated by a National Bureau of Standards 24 hour (diurnal) test cycle indicates that the measured total energy (total heat flow through a wall for a 24 hour period) was only 72 percent of the total energy predicted by steady-state analysis.

NON-COMBUSTIBLE - The fusion point of perlite is 2,300°F (1260°C)

ASTM E84 - Flame Spread 0, Fuel Contribution 0, Smoke Density 0.

FED. SPEC. HH-I-515D - Critical Radiant Flux greater than 1.07 Watts/cm². Smoldering Combustion, Flaming Combustion -None, Weight Loss- Nil

4 HOUR FIRE RATINGS - Underwriters' Laboratories Design No. U905 shows that a 2 hour rated 8, 10 or 12 inch (20, 25, or 30 cm) concrete block wall is improved to four hours when cores are filled with water repellent treated perlite. U.L. Designs U901, U904, and U907 also achieve 4 hour fire ratings.

PERMANENT - Perlite is an inorganic, naturally occurring mineral and it is as permanent as the walls which contain it. It supports its own weight and will not settle or bridge.

WATER REPELLENT - The nonflammable water repellent treatment significantly improves low water retention properties of perlite. Laboratory tests on water transmission by Structural Clay Products Research Foundation show that a cavity wall filled with treated perlite resists transmission of water to the interior wythe. Performance of overall wall was rated "excellent" in accordance with procedures established by the National Bureau of Standards in BMS 82. However, it should be noted that treated perlite insulation will not waterproof a poorly constructed masonry wall. Good construction practice should also incorporate the use of weep holes covered with copper, galvanized steel, or fiberglass screening.

SOUND REDUCTION - Perlite loose-fill insulation has the ability to fill all voids, mortar lines, and ear holes thus enabling it to reduce airborne sound transmission through walls. Lightweight 8 in. (20 cm) masonry block filled with perlite achieves an STC of 51 which exceeds HUD sound transmission standards.

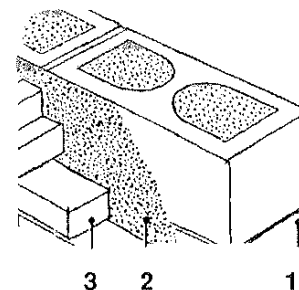
ECONOMICAL - Perlite loose-fill masonry insulation offers excellent thermal and fire resistant properties at an economical cost. It is lightweight and pours easily and quickly without requiring special equipment or skills.

STANDARDS, SPECIFICATIONS AND REFERENCES

- ASTM Specification C549 Perlite Loose Fill Insulation
- ASTM Specification C520 Density of Granular Loose Fill insulation
- ASTM Test Method C236 *Test Method for Steady State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box*
- ASTM Test Method E84 *Test for Surface Burning Characteristics of Building Materials*
- FHA Use of Materials Bulletin UM-37
- GSA Commercial Item Description A-903 - Insulation, Thermal (Expanded Perlite)
- Brick Institute of America Technical Notes No. 21A
- National Concrete Masonry Association Tek 101A
- Federal Specification I-IH- 1-51 SD for: Smoldering Combustion/Critical Radiant Flux

Block Size	Type ⁶	Perlite Filled	R ² Value	U ³ Value
6 inch (15cm)	Lightweight	No	2.64	.38
	Lightweight	Yes	6.75	.15
8 inch (20 cm)	Lightweight	No	2.86	.35
	Lightweight	Yes	9.07	.11
10 inch (25 cm)	Lightweight	No	3.00	.33
	Lightweight	Yes	11.02	.09
12 inch (30 cm)	Lightweight	No	3.12	.32
	Lightweight	Yes	13.44	.07
6 inch (15 cm)	Heavyweight	No	1.95	.51
	Heavyweight	Yes	3.40	.29
8 inch (20 cm)	Heavyweight	No	2.10	.48
	Heavyweight	Yes	4.40	.23
10 inch (25 cm)	Heavyweight	No	2.19	.46
	Heavyweight	Yes	5.14	.19
12 inch (30 cm)	Heavyweight	No	2.26	.44
	Heavyweight	Yes	6.18	.16

SAMPLE U FACTOR CALCULATIONS FOR VENEER AND CAVITY WALLS



1. 8 inch (20 cm) heavyweight concrete block filled with perlite (from Table 1).....4.40
2. 3 inch (8 cm) cavity filled with perlite (from Table 2).....9.38
3. 4 inch(10 cm) face brick (from Table 2).....0.44

$$R_t = 14.22$$

$$U = 1/R_t = 1/14.22 = 0.07$$

1. The values in this table represent typical R values of concrete block. The actual R value of a concrete block is influenced by the concrete constituents and by moisture content. More accurate estimates of thermal conductivity k or thermal resistance R of the specific block has been determined by tests. Procedures to make calculations for blocks of known conductivity are described in Perlite Institute Technical Data Sheet No. 2-6.

2. R values expressed in °F·ft²·h/Btu include inside and outside air film resistances.

3. U factors expressed in Btu/h·ft²·°F are calculated using thermal conductivity k factor of 0.32 Btu·in/h·ft²·°F. Different densities of perlite in the core spaces of concrete block have only a slight effect on the overall U factor. For estimates of this effect see Perlite Institute Technical Data Sheet No. 2-6 which provides the calculation techniques.

4. **Metric:** To determine R values and U factors in SI (metric) units use the following conversion factors.

Thermal Resistance, R: °F·ft²·h/Btu x 1.761 102E-01 = K·m²/W

Thermal Transmittance, U: Btu/h·ft²·°F x 5.687 263E + 00 = W/m²·K

5. R values and U values from NCMA Tek Sheet 101A

6. Lightweight masonry units 80 lb/ft³ (1280 kg/m³), Heavyweight masonry units 135 lb/ft³ (2160 kg/m³)

GUIDE SPECIFICATIONS

Part 1- General

Scope

The work covered by this section of the specification includes supplying and installing loose-fill material for the thermal insulation of all masonry walls in accordance with these specifications and applicable drawings.

Part 2- Products

Materials

Perlite loose-fill insulation. Each package shall be clearly marked such. The insulation material shall conform to the requirements of ASTM Designation C549 and shall be a product of a member of Perlite Institute, Inc. Prior to installation of the insulation, the manufacturer shall furnish a certificate to the architect or owner stating that the product conforms to the Standard Specifications for Loose Perlite Fill Insulation as adopted and published by Perlite Institute, Inc.

TABLE 2.-THERMAL RESISTANCE VALUES FOR VENEER AND CAVITY WALL CALCULATIONS

	R Values (°F·ft ² ·h/Btu)	R Values (K·m ² /W)
Outside Air Film	0.17	0.03
Common Brick (with holes)	0.20	0.04
Face Brick (no holes)	0.44	0.08
Air Space in Cavity 3/4 to 4 inch (19-102 mm)	0.97	0.17
1 inch (2.5 cm) cavity filled with perlite	3.12	0.55
2 inch (5.1 cm) cavity filled with perlite	6.25	1.10
3 inch (7.7 cm) cavity filled with perlite	9.38	1.65
4 inch (10.3 cm) cavity filled with perlite	12.5	2.20
Reflective Air Space	3.08	0.54
Furring (Nonreflective Air Space)	1.01	0.18
Gypsum or Plaster Board 1/2 inch (13mm)	0.45	0.08
Gypsum or Plaster Board 5/8 inch (16 mm)	0.56	0.10
Inside Air Film	0.68	0.12

TABLE 3.-APPROXIMATE PERLITE MASONRY BLOCK LOOSE-FILL COVERAGE*

Coverage per 4 ft³ (110 litre) bag

	12 inch (25 cm) Block	10 inch (25 cm) Block	8 inch (20 cm) Block	6 inch (15 cm) Block
Number of Blocks Filled	9	13	17	23
	1 in. (2.5 cm) Cavity	1.5 in. (3.9 cm) Cavity	2 in. (5.1 cm) Cavity	2.5 in. (6.4 cm) Cavity
Square Feet of Wall Filled	48	32	24	19

* Data based on actual field conditions

**TABLE 4.-APPROXIMATE PERLITE MASONRY BLOCK LOOSE-FILL COVERAGE
(Number of 4 ft³ bags required-4 ft³ equals approximately 110 litres)**

Wall Area ft ² (m ²)	Core Fill			Cavity Fill		
	Block Size			Cavity Width		
	6 inch (15 cm)	8 inch (20 cm)	12 inch (25 cm)	1 in. (2.5 cm)	2 in. (5.0 cm)	3 in. (7.5 cm)
1,000 (93)	46	65	118	21	42	62

Part 3- Execution

Installation

- The insulation shall be installed in the following locations:
 - In the cores of all exterior (and interior) hollow masonry walls.
 - In the cavity between all exterior (and interior) masonry walls.
 - Between exterior masonry walls and interior furring.
- The insulation shall be poured directly (or via a hopper) in the top of the wall at any convenient interval (not in excess of 20 ft [6 m]). Wall sections under doors and windows shall be filled before sills are placed. Rodding or tamping is not necessary.

3. All holes and openings in the wall through which insulation can escape shall be permanently sealed or caulked prior to installation of the insulation. Copper, galvanized steel, or fiber glass screening shall be used in all weep holes. (The inclusion of weep holes is considered good construction design practice to allow passage of any water which might penetrate the cavities or core spaces of wall construction.)
4. Insulation must remain dry. Cavity caps or other suitable means should be used as the work progresses to insure that the insulation is protected from inclement weather.



Technical data given herein are from sources considered reliable, but no guarantee of accuracy can be made or liability assumed. Your supplier may be able to provide you with more precise data. Certain compositions or processes involving perlite may be the subject of patents.

Perlite Institute, Inc.
4305 North Sixth Street, Suite A, Harrisburg, PA 17110
717.238.9723 / fax 717.238.9985 / www.perlite.org