Perlite Loose-Fill Masonry Insulation

Perlite, an inorganic mineral, is as permanent as the walls it insulates.

The physical character of expanded perlite lends itself to a variety of special purposes – including use as loose-fill masonry insulation. For a detailed explanation of perlite expansion, see Infosheet: "Why Perlite Works"

PROPERTIES & BENEFITS

Insulation: Thermal performance tests have shown significant energy savings when perlite is used to fill the cavities in concrete masonry structures.

Standards, Specifications and References:
Perlite is represented in the standards by ASTM product specification C549. The ASTM test methods used to evaluate loose-fill Perlite insulation are listed below.

- ASTM C549 "Specification for Perlite Loose-Fill Insulation"
- ASTM C520 "Test Methods for Density of Granular Loose Fill Insulations"
- ASTM C1363 "Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus"
- ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials"
- ASTM E 136 "Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C"

Non-Combustible: Perlite attributes—

- The temperature range for perlite fusion is 2,300-2,450°F (1,260-1343°C).
- Perlite is a Class A, Class 1 building material
- Flame spread 0; Smoke density 0

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 perlite. UL Designs U901, U904, and U907 also achieve 4 hour fire ratings.

TABLE 1

R AND U-VALUES FOR CONCRETE BLOCK ASSEMBLIES WITH AND WITHOUT PERLITE

BLOCK SIZE	BLOCK TYPE	Perlite Fill	R-Value	U-Value
6 in. (15cm)	Lightweight	No	2.59	0.39
		Yes	**5.24**	**0.19**
8 in. (20cm)	Lightweight	No	2.86	0.35
		Yes	**6.95**	**0.14**
10 in. (25cm)	Lightweight	No	3.06	0.33
		Yes	**8.46**	**0.12**
12 in. (30cm)	Lightweight	No	3.11	0.32
		Yes	**9.90**	**0.10**
6 in. (15cm)	Heavyweight	No	1.80	0.56
		Yes	**2.58**	**0.39**
8 in. (20cm)	Heavyweight	No	1.96	0.51
		Yes	**3.26**	**0.31**
10 in. (25cm)	Heavyweight	No	2.08	0.48
		Yes	**3.82**	**0.26**
12 in. (30cm)	Heavyweight	No	2.14	0.47
		Yes	**4.32**	**0.23**

1 R-values with units $ft^2 \cdot hr \cdot °F/Btu$ were calculated using the Isothermal Planes Method described in the *ASHRAE Handbook of Fundamentals*. The U-value with units $Btu/ft^2 \cdot hr \cdot °F$ is the reciprocal of the R-value. The R-values and U-values include interior and exterior air-film resistances that total R 0.85.

2 R-values are based on apparent thermal conductivity for loose-fill perlite of 0.32 $Btu \cdot in./ft^2 \cdot hr \cdot °F$, thermal conductivity of 2.97 $Btu \cdot in./ft^2 \cdot hr \cdot °F$ for light-weight concrete and 8.93 $Btu \cdot in./ft^2 \cdot hr \cdot °F$ for normal-weight concrete.

3 Block Density: Lightweight block nominal - 85 lbs/ft^3 (1.36 kg/l); Heavyweight block nominal -135 lbs/ft^3 (2.16 kg/l)

4 RSI = R/5.678

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

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.

TABLE 2

THERMAL RESISTANCE VALUES for VENEER and CAVITY WALL CALCULATIONS

	R Values ($^{\circ}F \cdot ft^2 \cdot h/Btu$)	R Values ($K \cdot m^2/W$)
Outside Air Film	0.17	0.03
Common Brick (w/ holes)	0.20	0.04
Face Brick (no holes)	0.44	0.08
Air Space in Cavity 3/4 to 4 in (19-102 mm)	0.97	0.17
1 inch (2.5 mm) cavity filled w/ perlite	3.12	0.55
2 inch (5.1 mm) cavity filled w/ perlite	6.25	1.10
3 inch (7.7 mm) cavity filled w/ perlite	9.38	1.65
4 inch (10.3 mm) cavity filled w/ 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 (13 mm)	0.45	0.08
Gypsum or Plaster Board 5/8 inch (16 mm)	0.56	0.10
Inside Air Film	0.68	0.12

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INSTALLATION GUIDE

TABLE 3

APPROXIMATE PERLITE MASONRY BLOCK LOOSE-FILL COVERAGE: BY AREA*
NUMBER OF 4 ft³ BAGS REQUIRED (4 ft³ EQUALS ~ 110 LITERS)

	CORE FILL: BLOCK SIZE			**CAVITY FILL**: CAVITY WIDTH		
WALL AREA ft² (m²)	6 INCH (15cm)	8 INCH (20cm)	12 inch (30cm)	1 INCH (2.5cm)	2 INCH (5.0cm)	3 INCH (7.5cm)
1,000 (93)	46	65	118	21	42	62

APPROXIMATE PERLITE MASONRY BLOCK LOOSE-FILL COVERAGE: BY BLOCK COUNT*
COVERAGE PER 4ft³ BAG (4 ft³ EQUALS ~ 110 LITERS)

	12-INCH (30cm) BLOCK	10-INCH (25cm) BLOCK	8-INCH (20cm) BLOCK	6-INCH (15cm) BLOCK
Number of Blocks Filled	9	13	17	23
	1 INCH (2.5cm) CAVITY	1.5 INCH (3.9cm) CAVITY	2 INCH (5.1cm) CAVITY	2.5 INCH (6.4cm) CAVITY
Square Feet of Wall Filled	48	32	24	19

*Adjust coverage to compensate for filled/reinforced cavities.

GUIDELINES FOR USE:

Materials

It is recommended that the loose-fill perlite shall conform to the requirements of ASTM Designation C549. Ask your supplier to provide documentation that the product conforms to ASTM C549 Standard Specification for Loose Fill Insulation.

Installation

1. The loose-fill perlite should be installed in the following locations:

a. In the cores of all exterior (and interior) hollow masonry walls.

b. In the cavity between all exterior (and interior) masonry walls.

c. Between exterior masonry walls and interior furring.

2. The loose-fill perlite should 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 should be filled before sills are placed. Rodding or tamping is not recommended.

3. All holes and openings in the wall through which loose-fill perlite can escape should be permanently sealed or caulked prior to installation. Screening should 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. The loose-fill perlite must remain dry. Suitable means should be used as the work progresses to insure that the insulation is protected from inclement weather.

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Origin and Characteristics...

Perlite is not a trade name but a generic term for naturally occurring silicous rock. The distinguishing feature which sets perlite apart from other volcanic glasses is that when heated to a suitable point in its softening range, it expands from four to twenty times its original volume.

This expansion is due to the presence of two to six percent combined water in the crude perlite rock. When quickly heated to above 1600°F (871°C), the crude rock pops in a manner similar to popcorn as the combined water vaporizes and creates countless tiny bubbles which account for the amazing light weight and other exceptional physical properties of expanded perlite.

The expansion process also creates one of perlite's most distinguishing characteristics: its white color. While the crude rock may range from transparent light gray to glossy black, the color of expanded perlite ranges from snowy white to grayish white.

Expanded perlite can be manufactured to weigh as little as 2 pounds per cubic foot (32 kg/m^3) making it adaptable for numerous applications.

Since perlite is a form of natural glass, it is classified as chemically inert and has a pH of approximately 7.

Typical Elemental Analysis

Silicon	33.8
Aluminum	7.2
Potassium	3.5
Sodium	3.4
Iron	0.6
Calcium	0.6
Magnesium	0.2
Trace	0.2
Oxygen (by difference)	47.5
Net Total	97.0
Bound Water	3.0
Total	100.0

*All analyses are shown in elemental form even though the actual forms present are mixed glassy silicates. Free silica may be present in small amounts, characteristic of the particular ore body. More specific information may be obtained from the ore supplier involved.

Typical Physical Properties

Color	White
Refractive Index	1.5
Free Moisture, Maximum	0.5%
pH (of water slurry)	6.5-8.0
Specific Gravity	2.2-2.4
Bulk Density (loose weight)	As desired, but usually in the 2-25 lb/ft^3 range(32-400 kg/m^3)
Mesh Size Available	As desired, 4-8 mesh and finer
Softening Point	1600-2000°F (871-1093°C)
Fusion Point	2300-2450°F (1260-1343°C)
Specific Heat	0.2 Btu/lb•°F (837 J/kg•K)
Thermal Conductivity at 75°F (24°C)	.27-.41 Btu•in/h•ft^2•°F(.04-.06 W/m•K)
Solubility	Soluble in hot concentrated alkali and HF Moderately soluble (<10%) in 1N NaOH Slightly soluble (<3%) in mineral acids (1N) Very slightly soluble (<1%) in water or weak acids

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WHITTEMORE TECHNICAL DATA SHEET

Product: Whittemore Perlite

Grade: Loose Fill Insulation

Composition: Perlite, Amorphous Alumina Silicate

Density: 2-11 lbs per cubic foot (loose)

PH Range: 6.5-7.3

Sieve Analysis (% Retained; by weight)

Sieve # 4 (4.75 mm)--------5 % Maximum

Plus
4
0-5

Market Applications: Construction (Concrete Block, Insulation)

- Complies with the Requirements of **ASTM C 549-06** Standard Specifications for Perlite Loose Fill Insulation.

Note: The Construction Specifications Institute Format-Spec Data Sheet written for conformity for: Perlite Loose Fill Insulation (Published by the Perlite Institute)

- **Perlite Loose Fill Insulation**-Product Application and Marketing Brochure is available from Whittemore Company, upon request.

Handling: Respiratory protection suitable for inert dust.

The physical properties of Whittemore Perlite products represent typical values obtained from accepted test procedures and are subject to manufacturing variations. Technical data supplied as a technical service and subject to change without notice.

Amended 3/20/12