



Gulf Perlite^{LLC}

PERLITE LIGHTWEIGHT INSULATING CONCRETE FOR ROOF FILLS NATURAL THERMAL INSULATION WITH THE PERFORMANCE & DURABILITY OF CONCRETE

What is Perlite?







Perlite is a 100% natural siliceous volcanic glass mineral, which traps crystalline water into its mass. Perlite expands when rapidly heated in Gulf Perlite LLC's factory, in temperatures of 800°C–1,000°C. The abrupt, controlled rise of temperature forms a white mass of minuscule glass bubbles. Perlite melts and expands in an extremely porous surface and increasing its volume thirteen times. Gulf Perlite Construct lightweight aggregate has superior thermal and acoustic insulation properties, extreme lightness and it is non-combustible.

Gulf Perlite Construct Properties

| |
|---|
| Color: Pure white |
| Specific Gravity: 80-100 kg/m ³ |
| pH (of water slurry, 20°C): 6.5 - 7.5 |
| Moisture: 0.3% |
| Softening point: 850 –1,100°C |
| Melting Range: 1,260 –1,343°C |
| Thermal Conductivity: 0.032 W/mK |
| Non – flammable (class A1 - DIN 4102) |
| Explosion limits: None |
| Odorless, chemically inert |
| Asbestos contamination: None |
| SiO₂ Content: 76% |

Perlite lightweight insulating concrete for roof fills

Gulf Perlite construct lightweight aggregate with grain sizes 0.5-3 mm and density of 80-100Kgs/m³, mixed with cement, water and air entraining agent, according to mix designs, is the best value-for-money advantaged lightweight insulating concrete for high resistance substrates to fill roofs.

-  **ULTRA LIGHTWEIGHT**, Density 320 – 640 Kg/m³, the lightest of all lightweight concretes with aggregates.
-  **SUPERIOR THERMAL INSULATION**, Thermal conductivity (K) value is from $\lambda_{10}=0.07$ W/mK which offers 20 times more insulating power than ordinary concrete. Perlite concrete is the only thermal insulating concrete.
-  **HIGH COMPRESSIVE STRENGTH**, Up to 3.5 MPa, three times higher than foam concrete (1 MPa).
-  **DURABLE**, Perlite is chemically inert, with neutral pH. It prevents corrosion, it does not deteriorate, it is free of weeds and bacteria and it lasts for a lifetime.
-  **NON-FLAMMABLE / NON-COMBUSTIBLE**, Up to 3 hours fire resistance rating.
-  **REDUCES AIRBORNE AND IMPACT SOUND**: Adding cavities within the screed system which provides an excellent acoustic insulation property for given mass / unit area values.

Roof assembly design numbers and fire ratings

| | | |
|----------------|----------------|--------------------|
| P405 - 3 Hours | P902 - 2 Hours | P231 - 1-1/2 Hours |
| P406 - 3 Hours | P905 - 2 Hours | P513 - 1-1/2 Hours |
| P215 - 2 Hours | P907 - 2 Hours | P919 - 1-1/2 Hours |
| P241 - 2 Hours | P908 - 2 Hours | P214 - 1 Hour |
| P251 - 2 Hours | P910 - 2 Hours | P216 - 1 Hour |
| P407 - 2 Hours | P913 - 2 Hours | P246 - 1 Hour |
| P410 - 2 Hours | P916 - 2 Hours | P509 - 1 Hour |
| P708 - 2 Hours | P920 - 2 Hours | P511 - 1 Hour |
| P810 - 2 Hours | P921 - 2 Hours | P678 - 1 Hour |
| P812 - 2 Hours | P922 - 2 Hours | P903 - 1 Hour |
| | P923 - 2 Hours | |



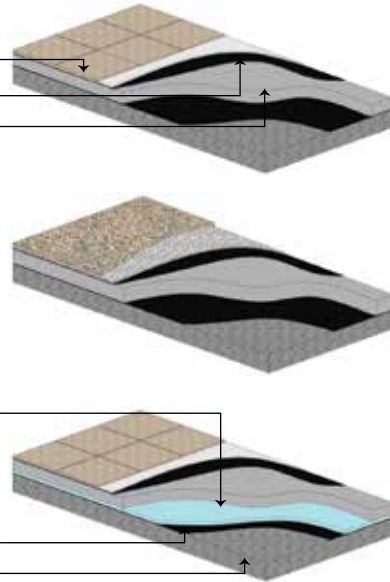
Member of Perlite Institute Inc.



PERLITE LIGHTWEIGHT INSULATING CONCRETE ROOF APPLICATIONS

Concrete slab roofing system

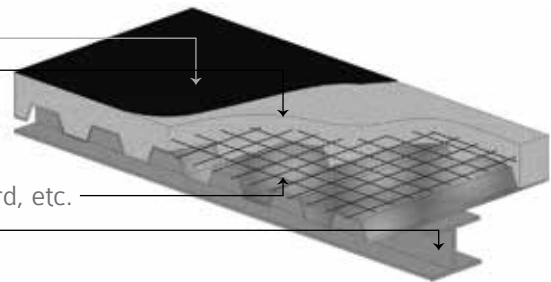
- Adhesive layer and tiles or exposed waterproofing or gravel.
- Waterproofing (Bitumen, PVC, liquid or spray).
- Perlite lightweight insulating concrete
Slope-to-drain. 1/6 mix design:
1 bag Cement+2 bags Gulf Perlite Construct + A.E.A.
Wet density < 700 Kg/m³
Dry density < 450 Kg/m³
Compressive strength 1.38 MPa
Thermal conductivity 0.08 W/m °K
U factor at 150mm = 0.53 W/m² °K
U factor at 200mm = 0.40 W/ m² °K
- EPS if required by the Consultant
U factor at 150mm on EPS= 0.21 W/ m² °K
U factor at 200mm on EPS= 0.185 W/ m² °K
Surpasses all ESTIDAMA requirements.
- Vapor control layer
- Concrete slab



Perlite concrete forms a strong, monolithic slope-to-drain surface that is ideal for any kind of waterproofing (bitumen, PVC, spray, paint, etc.). This is the only durable natural thermal insulation that will last for a lifetime.

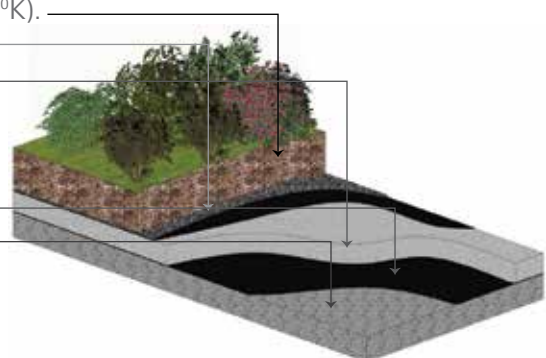
Lightweight structural metal decks

- Build up roofing (Waterproof layer)
- Perlite lightweight insulating concrete
Slope-to-drain. 1/6 mix design.
U factor at 400mm = 0.20 W/ m² °K
With wire mesh reinforcement.
- Open-ribbed steel deck, corrugated steel deck, form board, etc.
- Steel beams.



Roof gardening with combination of Horticultural Perlite

- Mix Horticultural Perlite and peat moss that weighs only 1/4 of the conventional wet and sandy loam and adds thermal insulation (Perlite's K=0.032 W/m °K).
- Geo textile
- Root proof waterproofing (Bitumen, PVC, etc).
- Perlite lightweight insulating Concrete
Slope-to-drain. 1/6 mix design.
U factor at 200mm = 0.40 W/ m² °K
- Vapor control layer
- Concrete slab



MIX PROPORTIONS OF PERLITE LIGHTWEIGHT INSULATING CONCRETE

| MIX DESIGNS | | | | TECHNICAL PROPERTIES | | | | | |
|-----------------------------------|--------------|-------------------------------|------------|---------------------------|---------------------------|----------------------------------|-----------------------------------|------------------------------|------------------------------|
| Cement to Perlite Ratio (by vol.) | O.P.C. (Kgs) | Gulf Perlite Construct (bags) | Water (m3) | Wet Density Range (Kg/m3) | Dry Density Range (Kg/m3) | Compressive Strength Range (MPa) | Thermal Conductivity K (W / m 0K) | U factor / 150mm (W / m2 0K) | U factor / 200mm (W / m2 0K) |
| 1/4 | 375 | 10 | 0.30 | 808 +/- 100 | 640 +/- 100 | 2.41-3.45 | 0.10-0.12 | 0.66-0.8 | 0.50-0.60 |
| 1/5 | 300 | 10 | 0.29 | 728 +/- 100 | 544 +/- 100 | 1.59-2.35 | 0.09-.010 | 0.60-0.66 | 0.45-0.50 |
| 1/6 | 250 | 10 | 0.27 | 648 +/- 100 | 448 +/- 100 | 0.97-1.38 | 0.08-0.09 | 0.53-0.60 | 0.40-0.45 |
| 1/8 | 190 | 10 | 0.27 | 584 +/- 100 | 384 +/- 100 | 0.55-0.86 | 0.07-0.08 | 0.47-0.53 | 0.35-0.40 |

Impartial laboratory test data of Robert W. Hunt Co. Engrs under sponsorship of the Perlite Institute INC. Strength data based on ASTM Type I Portland Cement. Neutralized vinsol resin or other air entrainment agent is used in all mix designs, according to manufacturer's recommendation. Exact quantity of water depends on mixer, pump and site conditions and can be adjusted to achieve the required density. The 1:6 mix ratio is the standard mix used for most roof deck applications.

PERLITE LIGHTWEIGHT INSULATING CONCRETE ROOF FILLS CONSTRUCTION

- Step 1. Clean from dust and spray with water the roof surface.
- Step 2. Apply a 20 – 25mm expansion joint in the perimeter and fill it using bulk expanded Perlite.
- Step 3. Mark level using laser levels and install aluminum straight edges, slope to drain can easily be formed.
- Step 4. First mix cement with water and air entraining agent until a slurry is formed. Add Gulf Perlite Construct and mix manually or using a mixer for 3 - 4 minutes. Add as water as necessary to produce a mix with required density. Use a pump to deliver a substrate of 250 – 300 m² per shift.
- Step 5. Apply Perlite Screed in a continuous operation until a section is completed, exactly as when applying the cement screed. Construct the screed on site in temperatures between +4°C and +40°C, like the common concrete. If fill width is up to 15 cm, apply the Perlite Concrete in one phase. For higher thickness, apply in two phases (after 2 – 3 hours within the same day).
- Step 6. Level the Perlite Concrete when screeding it using an aluminum straight edge.
- Step 7. Separate large surfaces using construction joints in distances up to 3.5 meters in both directions to avoid expansion cracks.
- Step 8. On the next day, scratch in both directions the Perlite concrete surface with an aluminum line scratcher to clean & level it. Use a small scratcher for the corners. Spray with water or cover with nylon for curing.
- Step 9. After 3 - 4 days, when it dries, apply any type of water proofing, like bitumen, PVC, spray or paint.

MIXING ON SITE USING A MIXER, A SCREEDING PUMP OR READY MIXED





Perlite lightweight insulating Concrete in Abu Dhabi Airport roof fill – 3,500m²

Workability

- Easy to handle, transfer and install due to its ultra lightness. Lower labor costs.
- One instant construction phase up to 150 mm thickness screed.
- All mix designs are pumpable up to 30 floors high.
- It can be nailed, sawed and worked with carpentry tools.
- Mixes with 36 % to 43 % less water than other aggregates.
- Mixing time is only 2 - 4 minutes.
- Dries within 3 days and forms a monolithic self-leveled surface to apply any waterproofing.

Technical comparison perlite concrete to foam concrete (600 Kg/m³)

- 350% HIGHER COMPRESSIVE STRENGTH (Perlite Concrete 3.5MPa - Foam Concrete 1MPa)
- 100% NATURAL PERLITE AGGREGATE FOR BUILDING INSULATION IS ASBESTOS FREE, CHEMICALLY INERT, WITH NEUTRAL pH AND REPLACES CHEMICALS LIKE FOAM AND POLYSTYRENE.
- 100 % SUITABLE FOR ALL KINDS OF WATERPROOFING (BITUMEN, PVC, SPRAY, PAINT, etc.)
- IT FORMS A STRONG, MONOLITHIC, SELF-LEVELED & SLOPE-TO-DRAIN SURFACE.
- 300 % HIGHER FIRE RESISTANCE (Perlite Concrete 3 hours - Foam Concrete < 1 hour)
- 2,000 % HIGHER THERMAL INSULATION THAN ORDINARY CONCRETE

References:

1. Perlite Institute, Inc. Harrisburg, Pennsylvania, USA (www.perlite.org).
2. The Schundler Company, New Jersey, USA (www.schundler.com).
3. ASTM C 332 -09 – Standard Specification for Lightweight Aggregates for Insulating Concrete.



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