Perlite concrete roof deck insulation

Insulation with the Permanence of Concrete
Lightweight and Durable
Smooth, Monolithic Surface Sloped to Drain
Excellent Nailable Roofing Base
Fire Retardant & Non-Combustible

Perlite Institute Inc.
PERLITE CONCRETE ROOF DECK INSULATION

ROOF INSULATION
Perlite concrete roof deck insulation is an ideal base for conventional built-up roofing membranes as well as single ply systems providing superior strength and fire safety over other roof insulation materials. Its rigid monolithic surface has a minimum compressive strength of 125 psi, compared with typical rigid board systems having strengths of only 10 to 35 psi. With the addition of polystyrene board sandwiched in the perlite concrete, R values in excess of 20 can be achieved at minimal cost.

Slope-to-drain is easily accomplished by varying the thickness of perlite concrete. It may also be accomplished by using stepping different thicknesses of polystyrene board and covering it with a uniform layer of lightweight perlite insulating concrete. This is a far more cost effective system than tapered rigid boards.

Perlite insulating concrete may be placed over side lap vented or slotted galvanized steel decking, poured-in-place concrete or precast concrete panels. Lightweight perlite concrete insulation is particularly suitable for use over pre-cast concrete construction as these systems often have uneven joints and camber differentials. Perlite concrete insulation levels any unevenness to provide a seamless, smooth, hard surface ready for application of roofing.

Even if leakage should occur in the roofing material, perlite concrete insulation remains unharmed and suffers little loss in efficiency. Perlite concrete roof insulation is reusable, re-roofable and provides insulation with the permanence of concrete.

REEROOFING
Perlite concrete roof insulation systems are ideally suited for re-roofing applications. They provide permanent, cost-effective, slope-to-drain designs with high R values over flat and often irregular substrates found in re-roofing projects. Using a perlite insulating concrete slurry coat the polystyrene insulation board is positively attached to the substrate. Polystyrene board sandwiched in perlite concrete may be stair-stepped to provide permanent slope-to-drain. Perlite concrete roof insulation is more economical than tapered board systems and depending on the condition of the existing roof, may be installed directly to a B.U.R. and gravel roof eliminating costly tear-offs. Perlite concrete roof insulation is easily placed around all types of protruding objects protruding through existing roofs and will pay for itself in maintenance and energy savings alone.

TESTING AND APPROVALS
Perlite roof deck insulation systems have been tested and approved by Underwriters Laboratories, Factory Mutual and Code Authorities throughout the nation. The system is rated as non-combustible by Factory Mutual which is a superior rating to their Class 1. U.L. Design P 920 successfully achieved the first 2 hour rating for any system of this kind under full scale fire conditions. Systems over galvanized steel form units meet the criteria for U.L. Class 90 Wind Uplift Resistance as well as F.M. I-60 and I-90.

CODE APPROVALS AND GUIDE REFERENCES
- International Conference of Building Officials (ICBO)
- Southern Building Code Congress (SBCC)
- Building Officials Conference of America (BOCA)
- South Florida Building Code
- U.S. Army Corps of Engineers Guide Specifications: CEGS 03510

TABLE 1 — TYPICAL PHYSICAL PROPERTIES OF PERLITE CONCRETE INSULATION

<table>
<thead>
<tr>
<th>CEMENT TO AGGREGATE RATIO</th>
<th>DRY DENSITY RANGE lb/ft³ (pcf)</th>
<th>MINIMUM COMPRESSIVE LOAD lb/in² (psi)</th>
<th>WET DENSITY RANGE lb/ft³ (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:4</td>
<td>36-42</td>
<td>300</td>
<td>46-56</td>
</tr>
<tr>
<td>1:5</td>
<td>30-36</td>
<td>200</td>
<td>42-50</td>
</tr>
<tr>
<td>1:6</td>
<td>24-30</td>
<td>125</td>
<td>36-44</td>
</tr>
<tr>
<td>1:8</td>
<td>18-24</td>
<td>80</td>
<td>34-40</td>
</tr>
</tbody>
</table>

*PITTSBURGH TESTING LAB AND R.W. HUNT CO. ENGINEERS.

TABLE 2 — R-VALUE, U-VALUE & DEADLOAD TABLES — 1:5 MIX RATIO 24-30 pcf PERLITE INSULATION

<table>
<thead>
<tr>
<th>2 IN. OF PERLITE CONCRETE OVER POLYSTYRENE THICKNESS, INCHES</th>
<th>9/16 IN.</th>
<th>1¼ IN.</th>
<th>1¼ IN.</th>
<th>1¼ IN.</th>
<th>1¼ IN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R (1)</td>
<td>R (1)</td>
<td>R (1)</td>
<td>R (1)</td>
<td>R (1)</td>
<td></td>
</tr>
<tr>
<td>U (2)</td>
<td>U (2)</td>
<td>U (2)</td>
<td>U (2)</td>
<td>U (2)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>5.06</td>
<td>.198</td>
<td>5.03</td>
<td>5.35</td>
<td>.187</td>
</tr>
<tr>
<td>1</td>
<td>9.20</td>
<td>.109</td>
<td>5.34</td>
<td>9.49</td>
<td>.103</td>
</tr>
<tr>
<td>1¼</td>
<td>11.17</td>
<td>.089</td>
<td>5.38</td>
<td>11.46</td>
<td>.087</td>
</tr>
<tr>
<td>1¾</td>
<td>17.08</td>
<td>.059</td>
<td>5.51</td>
<td>17.37</td>
<td>.058</td>
</tr>
<tr>
<td>2</td>
<td>19.05</td>
<td>.052</td>
<td>5.55</td>
<td>19.34</td>
<td>.052</td>
</tr>
</tbody>
</table>

NOTES: 1. R values expressed as R-Thermal. U. 2. U values expressed as Btu/hr·ft²·°F. 3. Dead loads include weight of metal, polystyrene and perlite concrete roof insulation. Dead loads of structural concrete are not included. 4. Insulation values are for summer conditions, heat flow down. 5. Insulated water conditions, heat flow up. 

Thermal conductivity of roof deck components are based on 50°F mean temperature except perlite concrete which is based on 70°F. 6. The R values are calculated based on thermal conductivity data derived from laboratory testing dry materials in accordance with ASTM Specification C 177. The values shown are intended only as guidelines. Actual insulation performance for all materials and systems is affected by design of building, environment and installation and will be lower than calculated values.
TESTING AND APPROVALS

- FM Serial Report No. OC2AO.AC
  (Class 6232)
- U.L. Wind Uplift Construction No. 143
- U.L. Wind Uplift Construction No. 250
- U.L. Fire Rated Designs — Roof Assemblies

<table>
<thead>
<tr>
<th>ROOF ASSEMBLY DESIGN NUMBERS AND FIRE RATINGS *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Number</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>P405</td>
</tr>
<tr>
<td>P406</td>
</tr>
<tr>
<td>P407</td>
</tr>
<tr>
<td>P708</td>
</tr>
<tr>
<td>P810</td>
</tr>
</tbody>
</table>

REROOFING

Perlite insulating concrete reroofing base provides a fast, lightweight reroofing base that can be used to eliminate ponding and to correct slope to drain. In addition, it is cost effective, fire resistant and energy efficient. Perlite concrete reroofing base may be used to correct irregularities in uneven existing roofs of virtually any material and can often eliminate costly tear-offs.

If even higher thermal performance is desired, polystyrene board may be sandwiched in the perlite concrete reroofing base. When polystyrene board is employed in a slope to drain reroofing application, it may be stair stepped thereby enabling the designer to take full advantage of both the superior thermal performance and slope to drain benefits of perlite concrete roofdeck systems.

TABLE 5 - TYPICAL PROPERTIES(1) AND MIX PROPORTIONS FOR PERLITE INSULATING CONCRETE REROOFING BASE

<table>
<thead>
<tr>
<th>CEMENT TO AGGREGATE RATIO (By Vol.)</th>
<th>DRY DENSITY RANGE, lb/ft³</th>
<th>THERMAL RESISTANCE PER INCH °F·h·ft²/°R</th>
<th>COMPRESSIVE STRENGTH, lb/in²</th>
<th>MINIMUM THICKNESS, in.</th>
<th>ACHIEVES 40 lb NAIL PULL TEST(3)</th>
<th>CEMENT, SACKS</th>
<th>PERLITE, ft³</th>
<th>WATER, GALLONS</th>
<th>AEA, PINTS</th>
<th>FIBER(4) lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:4</td>
<td>34.0-40.0</td>
<td>1.20</td>
<td>350-400</td>
<td>1</td>
<td>Yes</td>
<td>6.75</td>
<td>27</td>
<td>61</td>
<td>a</td>
<td>1</td>
</tr>
<tr>
<td>1:5</td>
<td>28.0-34.0</td>
<td>1.41</td>
<td>180-250</td>
<td>1</td>
<td>Yes</td>
<td>5.40</td>
<td>27</td>
<td>59½</td>
<td>a</td>
<td>1</td>
</tr>
<tr>
<td>1:6</td>
<td>24.0-30.0</td>
<td>1.56</td>
<td>125-200</td>
<td>2</td>
<td>Yes</td>
<td>4.50</td>
<td>27</td>
<td>54</td>
<td>a</td>
<td>-</td>
</tr>
</tbody>
</table>

(1) All values based on 28 day test results.
(2) From 1985 ASHRAE Guide at 75°F mean temperature.
(3) American Standards Testing Laboratories reports 3512-3516.
(4) Polypropylene fiber 15 denier, 1½ to 1¾ in. long.
(a) Consult perlite manufacturer for recommended type and proportioning of air entraining agent.

PERLITE INSTITUTE INC.
6268 Jericho Turnpike, Commack, NY 11725
(516) 499-6384

Perlite Institute Catalog 30-86/Printed in U.S.A.
ROOF DRAINAGE

An important benefit of perlite insulating concrete roofs is that they may be sloped to drain. This feature eliminates standing water which is a major factor in premature roof failure. When polystyrene insulation board is a component of the roof deck design, it is also possible to provide drainage by stepping boards of different thicknesses and covering with a 2 inch minimum layer of perlite concrete screeded to the final drainage profile. Perlite insulating concrete roof decks solve drainage problems while meeting insulation requirements.

AVERAGE THICKNESS

In order to calculate thermal resistance values for a sloping perlite concrete roof deck, the average thickness of the perlite concrete is necessary. The following relationship will enable the calculation of the average thickness.

\[ A_t = \frac{1}{2} (HP - LP) + LP \]

Where

- \( A_t \) = Average Thickness
- \( HP \) = Thickness at High Point
- \( LP \) = Thickness at Low Point

When perlite concrete is to be placed over steel form units, one-half the depth of the corrugations must be added to the average thickness to estimate the volume of concrete required and for accurate calculation of thermal resistance (R) values. The following Table contains the average thickness of perlite concrete in the corrugations of various, commonly used, steel decking.

<table>
<thead>
<tr>
<th>Gauge/Type</th>
<th>Nominal Dimensions in.</th>
<th>Average Thickness of Perlite Concrete, in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 ga</td>
<td>9/16</td>
<td>0.26</td>
</tr>
<tr>
<td>26 ga</td>
<td>15/16</td>
<td>0.47</td>
</tr>
<tr>
<td>24 ga</td>
<td>1-5/16</td>
<td>0.66</td>
</tr>
<tr>
<td>&quot;B&quot;</td>
<td>1-1/2</td>
<td>0.52</td>
</tr>
</tbody>
</table>

ROOFING MEMBRANE

BASE SHEET

PERLITE INSULATING CONCRETE

FASTENER

SLURRY COAT

POLYSTYRENE BOARD

CORRUGATED STEEL

NAIL HOLDING POWER

A major advantage of perlite insulating concrete is the fact that it readily accepts mechanical fasteners (self-clinching nails or specialized staple systems). In general, the force required to remove such fasteners from perlite concrete depends on the type of fastener used, density and compressive strength of the concrete, and the age of the concrete at the time the fasteners were driven and tested.

Although a minimum nail holding power of 40 lbs per fastener is recommended, Perlite Institute, Inc. does not recommend or specify any brand or type of nail. Such recommendations are the prerogative of the roofing manufacturer. However, various nails and mechanical fastener systems such as: E.G. Insuldeck Loc-Nail, Simplex Tube-Loc Nail, Zonotite Nail, ES Capped Nail and the Berryfast Tape/Staple system have demonstrated excellent holding ability.
PERLITE CONCRETE ROOF INSULATION
NEW CONSTRUCTION AND REROOFING

SECTION 07200 — PERLITE CONCRETE ROOF DECK INSULATION

1.00 GENERAL

1.01 Scope
An applicator, approved by a perlite manufacturer, shall furnish all labor, materials and equipment for installing the perlite concrete roof insulation and metal deck- ing (where applicable) in accordance with these specifications.

1.02 Work by Others
All framings for openings, edge angles, pitch pans, wood nailing, structural expansion joints, vented flashing and vent stacks shall be installed by others.

1.03 Inspection
The applicator shall be responsible for inspection and acceptance of the substrate as being suitable to receive the perlite concrete roof insulation system.

2.00 PRODUCTS

2.01 Materials
A. Perlite: shall conform to ASTM C 332 Group 1.
B. Portland Cement: shall conform to ASTM C 150 Type 1 or 111.
C. Water: shall be clean and free of deleterious substances.
D. Polystyrene: shall conform to ASTM C 578 and shall include keying holes of approximately 3% of the gross area.
E. Metal Deck (when applicable): shall be galvanized, ASTM A 525, G-60 minimum, high tensile steel with vented side laps or slots. The deck shall be __________ type, ________ gauge.
F. Reinforcing Mesh (only on some fire rated systems): shall be style 2160-2-1619 with a minimum cross sectional area of .026 in² per linear foot.
G. Control joints: shall compress to one half thickness under a load of 25 psi.

2.02 Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Standard Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Cement to Aggregate Ratio</td>
<td>1:6 cf</td>
</tr>
<tr>
<td>B. Min. Compressive Strength</td>
<td>125 psi</td>
</tr>
<tr>
<td>C. Density at Placement</td>
<td>38-44 pcf</td>
</tr>
<tr>
<td>D. Oven Dry Density</td>
<td>24-30 pcf</td>
</tr>
</tbody>
</table>

3.00 EXECUTION

3.01 Installation
A. The perlite concrete roof insulation shall be installed by a properly equipped and trained applicator or under the direction of the perlite manufacturer. The perlite concrete shall be screeded to a surface suitable for application of the roofing. Thickness of perlite concrete shall be as shown on the drawings. (Note: 2 in. minimum thickness recommended.)
B. Polystyrene boards shall be placed in a slurry coat (1/8" minimum thickness above the substrate) and covered with the top layer of perlite concrete as soon as practical.
C. Metal deck (where applicable) shall be installed in accordance with manufacturers recommendations and local building codes.
D. Reinforcing mesh (in some fire rated assemblies) shall be placed at right angles to structural supports with 6" end laps and no side laps.
E. Control Joints. A minimum 1 in. (1 in. per 100 lin. ft.) thick control joint shall be installed through the thickness of the perlite concrete around the perimeter of the roof deck and at through the building expansion joints. Delete control joints when using diaphragm design.

4.00 NOTES TO THE SPECIFIER

4.01 Design For Slope
A minimum slope of ½"/ft. is recommended for proper drainage and maximum roofing performance. Sloping the perlite concrete roof insulation system is most economically accomplished by stairstepping the polystyrene boards in maximum 1" increments. Indicate the high and low point elevations desired on the roof plan.

4.02 Metal Decks
Permanent steel form units, designed for use with perlite concrete roof insulation shall be galvanized high tensile steel with a minimum yield of 80 ksi. Consult the deck manufacturer's catalog for load tables or the perlite manufacturer for recommendations.

4.03 Seismic or Diaphragm Design
When roof deck is designed for diaphragm, consult metal deck or perlite manufacturer regarding welding patterns and other design criteria.

4.04 Admixtures
Calcium chloride, any admix containing chloride salts or regenerated foam shall not be used in perlite concrete roof insulation systems. Use only admixtures recommended by the perlite manufacturer.

4.05 Roofing
A. Consult built-up roofing or single-ply manufacturers for their specific recommendations and specifications for roofing over perlite concrete roof insulation.
B. Provisions must be made for perimeter edge venting at gravel stop, parapet flashing and with vent stacks over non-vented substrates. For details contact the perlite manufacturer.
C. Nail holding power of perlite concrete roof insulation is a prime criteria. Type of nail to be used is the prerogative of the roofing manufacturer. However, a minimum nail holding power of 40 lb. per fastener is recommended.
D. Perlite concrete roof insulation may be roofed within 48-72 hours from time of placement if the insulation can support workman without causing surface damage.

4.06 Re-Roofing (when applicable)
Existing roof insulation should be inspected for soundness and moisture content and may have to be removed. Pay particular care to the support structure of the building to determine it is capable of safely supporting new roof loads. All loose gravel and dirt shall be swept off existing roof. For maximum roofing performance, it is recommended that drainage be provided by stair stepping polystyrene board away from the drains.