



PERLITE FOR ENERGY EFFICIENT/LIGHT WEIGHT CONSTRUCTION

SunPerl is a product of Sun Silicates that is a member of the MetteQ Group.

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1.

INTRODUCTION TO SUNPERL- CONSTRUCTION GRADE PERLITE

1.1 What is Perlite?

Perlite is a non-toxic, naturally occurring siliceous volcanic rock. Perlite is formed by the rapid cooling of viscous magma or lava. 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 (4) to approximately twenty (20) times its original volume. Perlite is an inert and odourless mineral and is 100% safe to use.

Perlite is a versatile and sustainable mineral that is mined and processed with a negligible impact on the environment. The green community recognizes perlite enhanced products – like insulation – as a high-performance solution drawn from natural material of nearly unlimited supply through the world. Sun silicates imports perlite from Turkey – which ensures that we deliver quality products to our clients.

1.2 Production of Perlite

This expansion process is due to the presence of two to six percent combined water in the crude perlite rock. When quickly heated to above 870°C, the crude rock pops (almost like popcorn) as the combined water vaporizes and creates countless tiny bubbles in the heat softened glassy particles. It is these tiny glass-sealed bubbles which account for the amazing light weight and other exceptional physical properties of expanded perlite. Unexpanded (“raw”) perlite has a bulk density around 1100 kg/m³ (1.1 g/cm³), while typical expanded perlite has a bulk density of about 30–150 kg/m³ (0.03-0.150 g/cm³).

The expansion process also creates the perlite’s white colour – which is one of its most distinguished characteristics. While the crude perlite rock may range from transparent to light grey to glossy black, the colour of expanded perlite ranges from snowy- to greyish white. Expanded perlite can be manufactured to weigh from 32 kg/m³ to 240 kg/m³, making it adaptable for numerous uses.



1.3 Perlite in construction

Because of the perlite mineral's low density and relatively low price, many commercial applications have developed over the past few years especially eco-friendly mixtures of perlite and cement.

Uses in the construction and manufacturing fields include:

- Lightweight insulating plasters
- Under floor insulation
- Insulation screed on concrete or corrugated steel roofs
- Lightweight Insulating concrete
- Loose filling of cavities for insulation
- Fireproofing of structural steel columns

2.

PROPERTIES OF SUNPERL

The thermal conductivity (k) of loose SunPerl is 0.04 to 0.05 W/m·K compared to 0.4 W/m·K which is the thermal conductivity of ordinary plaster sand. SunPerl has a very low bulk density of between 75 and 100 kg/m³.

SunPerl is harmless, non-toxic and safe to use, find our MSDS at www.sunsilicates.co.za

The thermal resistance or "R-value" for loose fill SunPerl is calculated by dividing the thickness of the fill layer by the thermal conductivity (k) of SunPerl thus for:

$$\bullet \text{ 16 mm loose fill - } R_{16 \text{ mm}} = \frac{0.016 \text{ m}}{0.05 \text{ W/m} \cdot \text{K}} = 0.32 \text{ m}^2 \cdot \text{K/W}$$

$$\bullet \text{ 20 mm loose fill - } R_{20 \text{ mm}} = \frac{0.020 \text{ m}}{0.05 \text{ W/m} \cdot \text{K}} = 0.60 \text{ m}^2 \cdot \text{K/W}$$

PROPERTIES OF SUNPERL

In Table 1 the expected thermal conductivity of SunPerl Cement mixtures is shown. Density and thermal conductivity decreases as the ratio of SunPerl to cement increases.

Table 1. Thermal conductivity of SunPerl Cement Mixtures by Volume

MIX Ratio (SunPerl : Cement)	Density (kg/m ³)	Thermal Conductivity* (W/m·K)
3.0 : 1	638.7	0.1390
4.5 : 1	459.3	0.1046
6.0 : 1	442.9	0.0962

**Tested at SABS by means of a Heat Flow Meter Apparatus in accordance with SANS 8301:2010. See Appendix A for test reports.*

As expected strength increases as density increases thus a low ratio of SunPerl to Cement will have the highest strength. The expected compressive strength of SunPerl and Cement mixtures is shown in Table 2.

Table 2. Compressive strength of SunPerl Cement Mixtures by Volume

MIX Ratio (SunPerl : Cement)	Wet Density (kg/m ³)	Dry Density (kg/m ³)	Compressive Strength* (MPa)
3.0 : 1	1000	800	±15
4.5 : 1	800	600	±10
6.0 : 1	650	500	±5

**Average of tests performed at SIKA*













3.

SUNPERL CEMENT MIXTURES

3.1 SunPerl – Cement Mixture Ratio Guideline

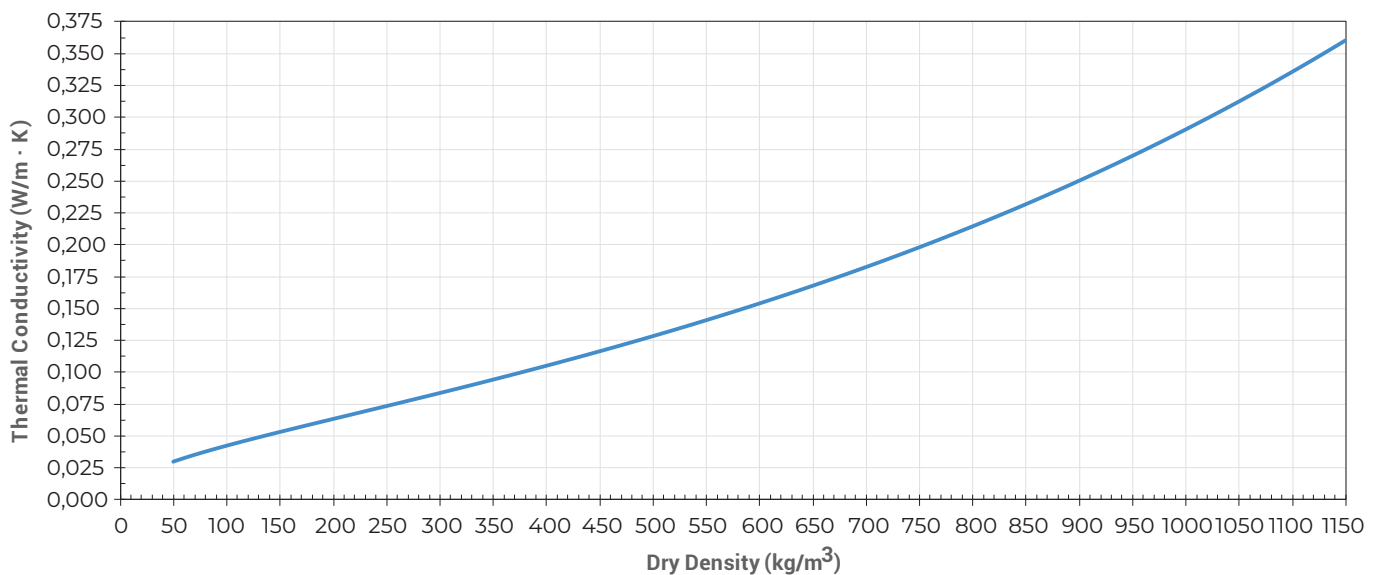
Sun Silicates recommends the use of ordinary 42,5N cement for SunPerl – Cement mixtures. In Table 3 different mix ratios (by volume) of SunPerl and Cement is shown, this should only be used as a guideline and any final decision should only be made after consulting Sun Silicates. Water addition will vary with cement type and care should be taken not to add too much water.

Table 3. SunPerl – Cement Mix ratio guideline. Ratios by Volume

3 : 1 by Volume					
Recommended Use	Ratio	SunPerl	Cement	Water	Approximate Yield
High Strength Plaster - internal / external Lightweight screed Roof deck insulation Fire proofing Castable / spray able	SunPerl : Cement 1 Bag : 1 Bag	1 Bag = 100L  Total : 100L	1 Bag = ±33L or 50kg  Total: 50 kg or 33 L	60 L for Plaster  30 L for Screed	± 0,098 m ³ 
4.5 : 1 by Volume					
Recommended Use	Ratio	SunPerl	Cement	Water	Approximate Yield
Medium Strength Plaster - internal / external Lightweight screed Roof deck insulation Fire proofing Castable / spray able	SunPerl : Cement 3 Bags : 2 Bags	1 Bag = 100L  Total : 300L	1 Bag = ±33L or 50kg  Total: 100 kg or 66 L	120 L for Plaster  60 L for Screed	± 0,290 m ³ 
4.5 : 1 by Volume					
Recommended Use	Ratio	SunPerl	Cement	Water	Approximate Yield
Low Strength Roof deck insulation Fire proofing Castable / spray able Plaster – internal / external	SunPerl : Cement 2 Bags : 1 Bags	1 Bag = 100L  Total : 200L	1 Bag = ±33L or 50kg  Total: 50 kg or 33 L	100 L for Plaster  40 L for Screed	± 0,195 m ³ 

3.2 SunPerl – Cement Mixture Properties

Expected thermal conductivity vs as cast density for perlite – Cement mixtures is shown in Figure 1; this may vary when using admixtures.



Obtained from data published in the Oak Ridge National Laboratory Report ORNL/sub/86 - 22020/1

Figure 1. Average thermal conductivity of mixtures of perlite and cement vs as cast density.

The thermal conductivity (k) of SunPerl – Cement mixtures range from 0.09 to 0.14 W/m·K compared to 0.72 W/m·K which is the thermal conductivity of ordinary cement plaster with sand aggregate. The thermal conductivity of SunPerl – Cement mixtures is even lower than predicted by Figure 1.

The thermal resistance or “R-value” for SunPerl – Cement mixture is calculated by dividing the thickness of the applied layer by the thermal conductivity (k) of the specific SunPerl – Cement mixture; thus for example a 4.5 : 1 ratio:

- 16 mm plaster or screed- $R_{16\text{ mm}} = \frac{0.016\text{ m}}{0.1046\text{ W/m}\cdot\text{K}} = 0.153\text{ m}^2\cdot\text{K/W}$
- 20 mm plaster or screed - $R_{20\text{ mm}} = \frac{0.020\text{ m}}{0.1046\text{ W/m}\cdot\text{K}} = 0.191\text{ m}^2\cdot\text{K/W}$

The R value for 16 and 20 mm ordinary plaster would be 0.02 and 0,03 respectively thus more than 6 times the insulation that ordinary plaster would provide.

4.

MIXING INSTRUCTIONS FOR SUNPERL IM100 CONSTRUCTION PERLITE

- 01 Type off cement: 42.5N Cement is recommended.
- 02 Use mix ratios by volume: page 4 off catalogue.
- 03 Clean the area where the perlite and cement is to be mixed.
- 04 Pour the perlite onto the floor.
- 05 Spread the cement on top of the perlite.
- 06 One will notice that the perlite is white in color and the cement is grey.
- 07 The two has to be mixed in the dry state first until the mix is uniformly grey in color.
- 08 Now the mix can be opened to make space for the water.
- 09 Don't add all the water at the same time. Mix 2 x 20 L buckets at a time. See correct water ratio on page 4 of catalouge.
- 02 For screeds the mix is a relative dry mix.
- 02 For plaster the mix is a wet mix.





5.

PLASTER APPLICATION PROCEDURE

01

Dampen the wall with water before plastering. This will prevent the plaster from drying prematurely and prevent cracking.

02

For smooth surfaces; a keying agent is required. Mixing some SunPerl IM100 Construction Perlite with the keying agent. Apply this slush to the smooth surface. Previously plastered surfaces should be chipped. This will ensure good adhesion.

03

SunPerl IM100 Construction Perlite should not be thrown on to the wall. It must be smeared onto the wall in an upwards motion. Because SunPerl is so light this will ensure that no air is trapped between the wall and the plaster.

04

Allow the plaster to set for an hour before the straight edge is applied. A good test is to check if the plaster has set enough. Use your thumb and press the plaster. If the plaster makes a small indentation and is firm. It is ready to cut. When you press with your thumb on the plaster and it indents easily and moves when pressing with your thumb then the plaster needs more time to cure.

05

Once the plaster has been leveled. Use a skim plaster float. This will ensure a cement and fine perlite layer appears on the surface. Then apply a steel float. This will ensure a very smooth finish.

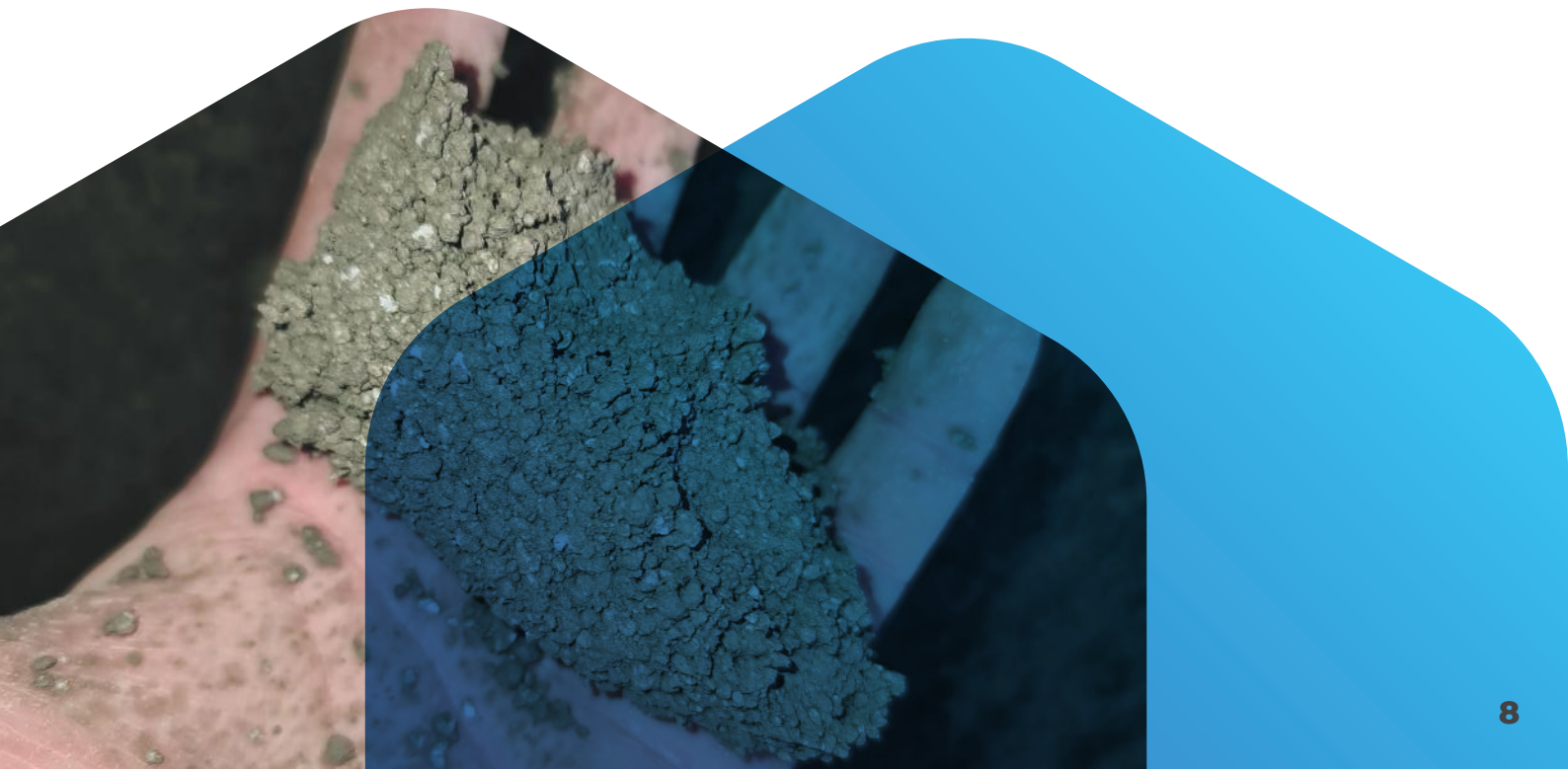
06

SunPerl plaster should be kept damp for 3 days (recommended for 7 days). This will ensure the cement has enough time to hydrate.

6.

SCREED APPLICATION PROCEDURE.

- 01 Ensure the area that needs to be screeded is clean and free of dust, oil, and loose particles.
- 02 When Screeding smooth areas like IBR and Corrugate sheets a keying agent is required. Mix some SunPerl and keying agent and apply to the smooth surface to create a slush. This slush will ensure a rough surface with good adhesion. The slush should be tacky when the screed is applied - NOT dry.
- 03 When screeding concrete roofs and floors a keying agent and cement slush is required.
- 04 Place the SunPerl screed material on the surface.
- 05 Compact the screed lightly by tamping the screed. Do NOT over compact.
- 06 After compacted, level the screed with a straight edge and spirit level.
- 07 Now the screed can be floated with a wooden float. Use a block brush to apply water to the surface and float.
- 08 The screed needs to be kept damp for 3 days (recommended 7 days).
- 09 The screed need to be a 100% cured before you can tile , lay carpets or laminating flooring.
- 10 The screed needs to be 100% cured before you can tile



7.

ON-SITE TRAINING

Sun Silicates provides on-site practical training for SunPerl – Cement mixture application.

For more information, please contact us on or visit our website:

+27 11 824 4600

www.sunsilicates.co.za

SABS

SABS Thermal Conductivity Test Reports

Test Report for 3:1 mixtures

Report: BCT-170515-00034

Test Report for 4.5:1 & 6:1 mixtures

Report: BCT-170523-00052

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