Sun Silicates PTY LTD

Sun Perl

PERLITE FOR ENERGY EFFICIENT CONSTRUCTION

SunPerl is a product of Sun Silicates

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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/m^3 (1.1 g/cm^3), while typical expanded perlite has a bulk density of about 30–150 kg/m^3 (0.03-0.150 g/cm^3).

The expansion process also creates the perlite's white colour – which is one it's 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/m^3 to 240 kg/m^3, 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/m^3.

SunPerl is **harmless, non-toxc** 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:

- 16 mm loose fill - $R_{16\,mm} = \frac{0.016\,m}{0.05\,W/m{\cdot}K} = 0.32\,m^2 \cdot K/W$
- 20 mm loose fill - $R_{20\,mm} = \frac{0.020\,m}{0.05\,W/m{\cdot}K} = 0.60\,m^2 \cdot K/W$

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.

3. SunPerl Cement Mixtures

3.1 SunPerl – Cement Mixture Ratio Guideline

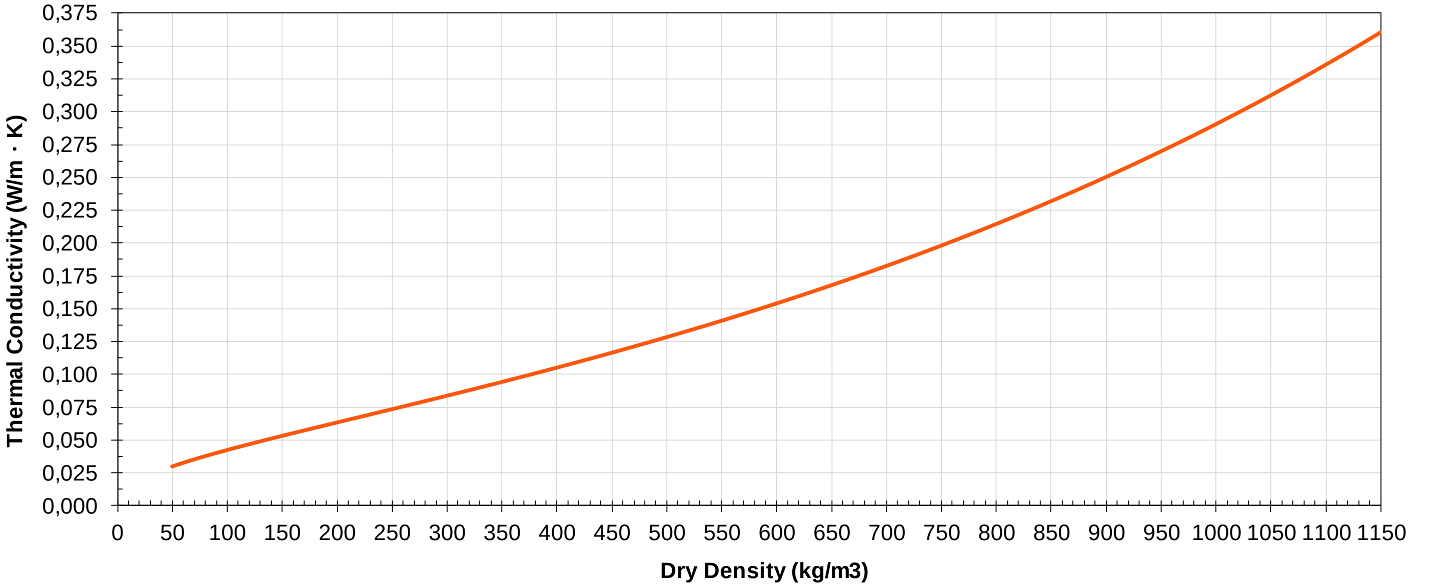
Sun Silicates recommends the use of ordinary 42,5N cement for SunPerl – Cement mixtures. In Table 2 different mix ratios (by **volume**) of SunPerl and Cement is shown, this should only be used as a guideline and any final decision should only be made after consulting Sun Silicates. Water addition will vary with cement type and care should be taken not to add too much water.

Table 2. SunPerl – Cement Mix ratio guideline. **<u>Ratios by Volume</u>**

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**	1Bag = 100L  Total: 100 L	1Bag = ±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					
Medium Strength Plaster - internal / external Lightweight screed Roof deck insulation Fire proofing Castable / spray able	SunPerl : Cement **3 Bags : 2 Bags**	1Bag = 100L  Total: 300 L	1Bag = ±33L or 50kg  Total: 100 kg or 66 L	120 L for Plaster  60 L for Screed	± 0,290 m^3 
6 : 1 by Volume					
Low Strength Roof deck insulation Fire proofing Castable / spray able Plaster – internal / external	SunPerl : Cement **2 Bags : 1 Bag**	1Bag = 100L  Total: 200 L	1Bag = ±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 admixture.



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 density as cast.

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

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. On-site training

Sun Silicates also provides on-site practical training on SunPerl – Cement mixture application. For more information, please contact us on or visit our website:

+27 11 824 4600
www.sunsilicates.co.za

Appendix A – SABS Thermal Conductivity Test Reports

Test Report for 3:1 mixtures

SABS

TEST REPORT

Your ref	: POA10009
Enquiries	: John Maswikaneng
Tel no	: 012 428-6010
Report	: BCT-170515-00034
Page	: 1 of 3
Date	: 2017/05/26

SUN SILICATES
Attention: Dudley Pohl
PO Box 10090
Dalview
1544

THERMAL INSULATION – DETERMINATION OF STEADY-STATE THERMAL RESISTANCE AND RELATED PROPERTIES – HEAT FLOW METER APPERATUS
SANS 8301:2010

1. **OBJECTIVE OF TEST**

Refer to the print on the bottom of this page.

The sample described was tested to determine its thermal resistance and related properties by means of a heat flow apparatus in accordance with SANS 8301: 2010 "Thermal Insulation – Determination of steady-state thermal resistance and related properties – heat flow meter apparatus"

2. **DESCRIPTION OF SAMPLE**

Manufacturer:	SUN SILICATES
Product trade name:	Unknown
Date received:	2017/03/03

One perlite/cement plaster mix specimen was submitted. The specimen consisted of aforementioned material cast and dried into section measuring ± 300 mm long, ± 300 mm wide and ± 28 mm thick. The date of manufacture and specimen history prior to delivery is unknown. The ratio (Perlite : Cement) by volume of the specimen/mixture was stated to be 3:1

1 Dr Lategan Road, Groenkloof, Private Bag X191, Pretoria, 0001.
Tel +27 12 428 7911. Fax +27 12 344 1568

SABS Commercial SOC Ltd conducted a conformity assessment pertaining to a sample of the product, commodity or system identified and the outcome recorded in this test report only relates to that specified sample. The conformity assessment outcomes recorded in the test report do not imply SABS Approval of the quality and/or performance of the sample(s) in question and the test results do not apply to any similar sample that has not been tested. (Refer also to the conditions of test printed on the back of this page.) This report may not be reproduced except in full. The authenticity of this report and its contents can be confirmed by contacting the person who signed it.

sanas
LAB T0026

T4C017121

1306M

3 NATURE AND METHOD OF TEST

Thermal Resistance and related properties determined in accordance to SANS 8301:2010.
The sample material was found to be homogenous with regards to length width and thickness.
The sample was conditioned at laboratory environmental conditions for a period of 72 hours prior to commencing with testing. No change in mass of the specimen was noted. The test specimen filled the entire test chamber during testing. The test chamber was sealed off from ambient for the entire duration of the test.

4 EQUIPMENT USED

4.1 The test was conducted with a Lasercomp Heat Flow Meter utilizing two Thin-Film Heat Flux Transducers symmetrically on one test specimen.

Dates of test	: 2017/04/03 - 2017/04/5
Duration of measurement portion of test	: 102 minutes
Laboratory environmental conditions	: 22 ± 5°C and 50 ± 10% RH
Date of last calibration of Lasercomp instrument	: 2016/11/11 using 1450d SRM ID 264
Position of the heat flow meter apparatus during testing	: Horizontal

4.2 Tape measure. Calibrated Calcert. No. 2020.9062-4
4.3 1500 g balance. Calibrated Calcert. No. 2016-B013

5 RESULTS

Table: 1

Specimen ID	3 : 1
Mass (g)	1621,10
Dimensions (mm)	300 x 300
Tested Thickness (mm)	28,2
Density (kg/m³)	638,7
Hot side temperature (°C)	36
Cold side temperature (°C)	10
Average temperature (°C)	23
Temperature difference (°C)	26
Temperature gradient (°C/m)	922
Thermal conductivity (W/m.K)	0,13900
Thermal resistance at tested thickness (m².K/W)	0,20

Note 1: The test was performed with the heat flow direction as downwards.
Note 2: All measured masses were the same before and after testing.

This report relates only to the specific sample(s) tested as identified herein. It does not imply SABS approval of the quality and/or performance of the item(s) in question and the test results do not apply to any similar item that has not been tested.
(Refer also the complete conditions printed on the back of the official test report).

The reported uncertainty of measurement of ± 3 % is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%, the uncertainty of measurement has been estimated in accordance with the principles defined in
The GUM, Guide to Uncertainty of Measurement, ISO, Geneva, 1st edition, 1993
Assessment of Uncertainties of measurement for calibration and testing laboratories, RR Cook, 2nd edition, 2002
EAL-R2, Expression of Uncertainties of Measurement in calibration, European co-operation for Accreditation, 1999

A Van Der Walt
Technical signatory
FENESTRATION AND HEAT TRANSFER

J Maswikaneng
Manager
CIVIL TESTING

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(Refer also the complete conditions printed on the back of the official test report).

Test Report for 4.5:1 & 6:1 mixtures

SABS

TEST REPORT

Your ref : POA10008
Enquiries : John Maswikaneng
Tel no : 012 428-6010
Report : BCT-170523-00052
Page : 1 of 3
Date : 2017/05/26

SUN SILICATES
Attention: Dudley Pohl
PO Box 10090
Dalview
1544

THERMAL INSULATION – DETERMINATION OF STEADY-STATE THERMAL RESISTANCE AND RELATED PROPERTIES – HEAT FLOW METER APPERATUS
SANS 8301:2010

1. OBJECTIVE OF TEST

Refer to the print on the bottom of this page.

The sample described was tested to determine its thermal resistance and related properties by means of a heat flow apparatus in accordance with SANS 8301: 2010 "Thermal Insulation – Determination of steady-state thermal resistance and related properties – heat flow meter apparatus"

2. DESCRIPTION OF SAMPLE

Manufacturer: SUN SILICATES
Product trade name: Unknown
Date received: 2017/03/03

Two perlite/cement plaster mix specimens with varying densities were submitted. Each specimen consisted of aforementioned material cast and dried into sections measuring ± 300 mm long, ± 300 mm wide and ± 28 mm thick. The date of manufacture and specimen history prior to delivery is unknown. The ratios (Perlite : Cement) by volume of the two specimens/mixtures was stated to be 6:1 and 4,5:1

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sanas
LAB T0026

TP40041877

0242M

3 NATURE AND METHOD OF TEST

Thermal Resistance and related properties determined in accordance to SANS 8301:2010.
The sample material was found to be homogenous with regards to length width and thickness.
The samples were conditioned at laboratory environmental conditions for a period of 72 hours prior to commencing with testing. No change in mass of the specimen was noted. The test specimens filled the entire test chamber during testing. The test chamber was sealed off from ambient for the entire duration of the test.

4 EQUIPMENT USED

4.1 The test was conducted with a Lasercomp Heat Flow Meter utilizing two Thin-Film Heat Flux Transducers symmetrically on one test specimen.

Dates of test	: 2017/04/03 - 2017/04/5
Duration of measurement portion of test	: 107 and 110
Laboratory environmental conditions	: 22 ± 5°C and 50 ± 10% RH
Date of last calibration of Lasercomp instrument	: 2016/11/11 using 1450d SRM ID 264
Position of the heat flow meter apparatus during testing	: Horizontal

4.2 Tape measure. Calibrated Calcert. No. 2020.9062-4
4.3 1500 g balance. Calibrated Calcert. No. 2016-B013

5 RESULTS

Table: 1

Specimen ID	6 : 1	4,5 : 1
Mass (g)	1159,85	1136,70
Dimensions (mm)	300 x 300	300 x 300
Tested Thickness (mm)	29,1	27,5
Density (kg/m³)	442,9	459,3
Hot side temperature (°C)	36	
Cold side temperature (°C)	10	
Average temperature (°C)	23	
Temperature difference (°C)	26	
Temperature gradient (°C/m)	893	945
Thermal conductivity (W/m.K)	0.09615	0,10460
Thermal resistance at tested thickness (m².K/W)	0,30	0,26

Note 1: The test was performed with the heat flow direction as downwards.
Note 2: All measured masses were the same before and after testing.

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The reported uncertainty of measurement of ± 3 % is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%, the uncertainty of measurement has been estimated in accordance with the principles defined in
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Assessment of Uncertainties of measurement for calibration and testing laboratories, RR Cook, 2nd edition, 2002
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(Refer also the complete conditions printed on the back of the official test report)

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2. A test report relates only to a sample submitted for the actual test. It furnishes or implies no guarantee whatsoever in respect of a similar sample that has not been tested by the SABS.

3. This test report does not imply that the user has obtained pre-approval to apply the SABS certification mark nor does it imply approval by SABS, of the quality and/or performance of the sample that has been tested. No person may falsely claim or declare that any commodity, product or service complies with a South African National Standard or other publication of the SABS.

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