



TEST REPORT

Natural stone – Water absorption

REPORT Nº: **222918PN003** DATE: **19-12-2022** PAGE: **1/2**

PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **6 cubic specimens of nominal dimensions 50x50x50 mm**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**

\* Information declared by the petitioner

TEST METHOD: **EN 13755:2008 Natural stone test methods. Determination of water absorption at atmospheric pressure**

Deviations –  
Specimen preparation –  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **09-11-2022 / 17-11-2022**





## TEST REPORT

### Natural stone – Water absorption

REPORT Nº: **222918PN003**

DATE: **19-12-2022**

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#### RESULTS:

Specimen

Water absorption,  $A_b$  (%)

Mean value of water absorption,  $\bar{A}_b$

01	02	03	04	05	06
0,1	0,1	0,1	0,1	0,1	0,1
0,1 %					

Remarks: The uncertainties are calculated and at the client's disposal  
The results are expressed to the nearest 0,1 %

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Director Técnico

**Natural stone – Apparent density and open porosity**

REPORT Nº: **222918PN004A** DATE: **19-12-2022**

PAGE: **1/2**

PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

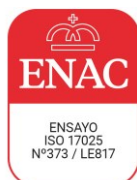
SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **6 cubic specimens of nominal dimensions 50x50x50 mm**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**

\* Information declared by the petitioner

TEST METHOD: **EN 1936:2007 Natural stone test methods. Determination of real density and apparent density, and of total and open porosity. Section 8.1**

Deviations –  
Specimen preparation –  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **07-11-2022 / 11-11-2022**





## TEST REPORT

### Natural stone – Apparent density and open porosity

REPORT Nº: **222918PN004A** DATE: **19-12-2022**

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#### RESULTS:

Specimen

Apparent density,  $\rho_b$  (kg/m<sup>3</sup>)

Open porosity,  $p_o$  (%)

Mean value of apparent density,  $\bar{\rho}_b$

Mean value of open porosity,  $\bar{p}_o$

07	08	09	10	11	12
3140	3140	3140	3140	3130	3170
0,2	0,2	0,2	0,2	0,2	0,2
3140 kg/m <sup>3</sup>					
0,2 %					

Remarks: The uncertainties are calculated and at the client's disposal  
The results of density are expressed to the nearest 10 kg/m<sup>3</sup>  
The results of porosity are expressed to the nearest 0,1 %

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**Natural stone – Abrasion resistance (Capon method)**

REPORT Nº: **222918PN006** DATE: **19-12-2022** PAGE: **1/2**

PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka. Finland**

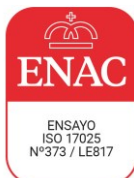
SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **6 honed slabs of 150x150x30 mm**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**  
Planes of anisotropy \* **–**

\* Information declared by the petitioner

TEST METHOD: **EN 14157:2017 Natural stone test methods. Determination of the abrasion resistance. Section 3**

Deviations **–**  
Specimen preparation **–**  
Calibration factor **-0,1 mm**  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **28-11-2022 / 30-11-2022**





## TEST REPORT

### Natural stone – Abrasion resistance (Capon method)

REPORT Nº: **222918PN006**

DATE: **19-12-2022**

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#### RESULTS:

Specimen	13	14	15	16	17	18
Groove lengths (mm)	34,0	33,5	33,0	30,5	35,0	34,0
	35,0	38,5	39,5	33,5	29,5	37,5
Mean value of groove length	36,5 mm					
Standard deviation	2,3 mm					
Higher expected value, $E_H$	42,0 mm					

Remarks: The uncertainties are calculated and at the client's disposal  
The results are expressed to the nearest 0,5 mm  
According to EN 14157, only the biggest grooves of each specimen are considered

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**Natural stone – Frost resistance (technological test)**

REPORT Nº: **222918PN008B** DATE: **19-12-2022** PAGE: **1/4**

PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

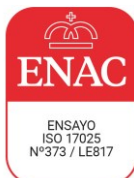
SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **2 sets of 10 specimens of nominal dimensions 300x50x50 mm**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**  
Planes of anisotropy \* **–**

\* Information declared by the petitioner

TEST METHOD: **EN 12371:2010 Natural stone test methods. Determination of frost resistance. Section 7.3.1**

Deviations **–**  
Specimen preparation **–**  
Date of preparation **–**  
Conditioning **Drying in oven at 70±5°C to constant mass**  
Load direction **–**  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **07-11-2022 / 16-12-2022**



**Natural stone – Frost resistance (technological test)**

REPORT Nº: **222918PN008B** DATE: **19-12-2022**

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RESULTS:

Set 1 (not subjected to freeze-thaw cycles)

Specimen	49	50	51	52	53	54	55	56	57	58
Breaking thickness, $h$ (mm)	50,0	49,6	50,1	50,0	50,2	50,2	49,4	49,8	50,5	50,1
Breaking width, $b$ (mm)	50,2	49,9	50,4	50,5	50,0	50,0	49,9	49,9	49,7	50,4
Span, $l$ (mm)	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0
Load increase (MPa/s)	0,25	0,25	0,25	0,25	0,25	0,25	0,26	0,25	0,25	0,25
Breaking load, $F$ (N)	6590	6800	1970	1550	4680	4260	5550	6630	4140	1880
Distance fracture to centre (mm)	10,6	26,2	5,3	2,2	43,5	1,6	9,6	15,5	54,9	16,3
Flexural strength, $R_{tf}$ (MPa)	19,7	20,8	5,8	4,6	13,9	12,7	17,1	20,1	12,3	5,6

Set 2 (subjected to 56 freeze-thaw cycles)

Specimen	19	20	21	22	23	24	25	26	27	28
Breaking thickness, $h$ (mm)	49,8	49,8	49,6	50,4	50,2	50,3	50,6	50,0	50,2	50,4
Breaking width, $b$ (mm)	50,4	50,2	50,0	49,9	49,8	50,0	50,0	50,3	49,9	49,8
Span, $l$ (mm)	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0
Load increase (MPa/s)	0,25	0,25	0,25	0,25	0,25	0,25	0,24	0,25	0,25	0,25
Breaking load, $F$ (N)	1750	7210	5630	3090	4800	5210	5130	1840	4300	4800
Distance fracture to centre (mm)	7,8	2,0	20,7	20,3	10,1	20,7	22,8	14,9	27,0	9,0
Flexural strength, $R_{tf}$ (MPa)	5,2	21,8	17,2	9,2	14,3	15,5	15,1	5,5	12,8	14,2





TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222918PN008B** DATE: **19-12-2022**

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Mean value of flexural strength,  $F_0$

**13,3 MPa**

Standard deviation,  $s$

**6,2 MPa**

Mean value of flexural strength after 56 cycles,  $F_{56}$

**13,1 MPa**

Standard deviation,  $s$

**5,2 MPa**

Decrease of flexural strength after 56 cycles

**2,0 %**

Remarks: Las incertidumbres están calculadas y a disposición del cliente

*The sample received consisted of 20 undifferentiated specimens. The separation between the two sets of 10 specimens to be tested, was carried out at random by the laboratory*

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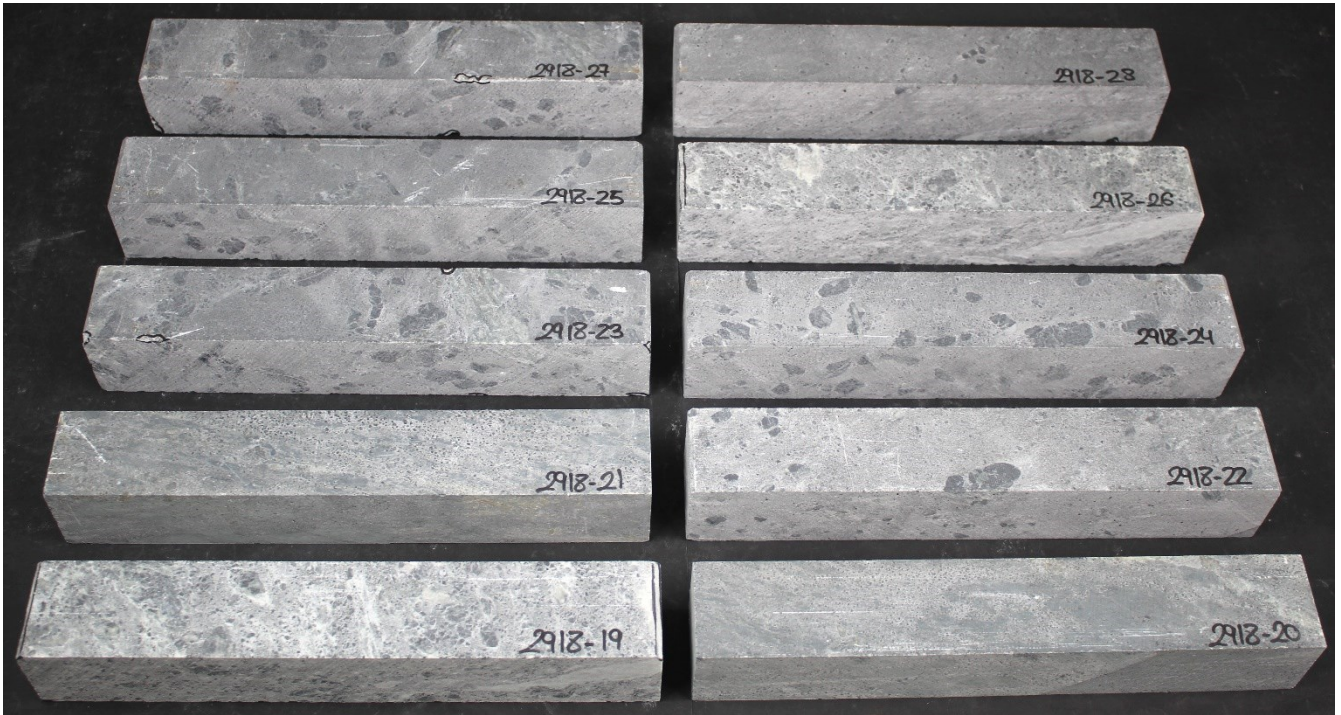
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Natural stone – Frost resistance (technological test)

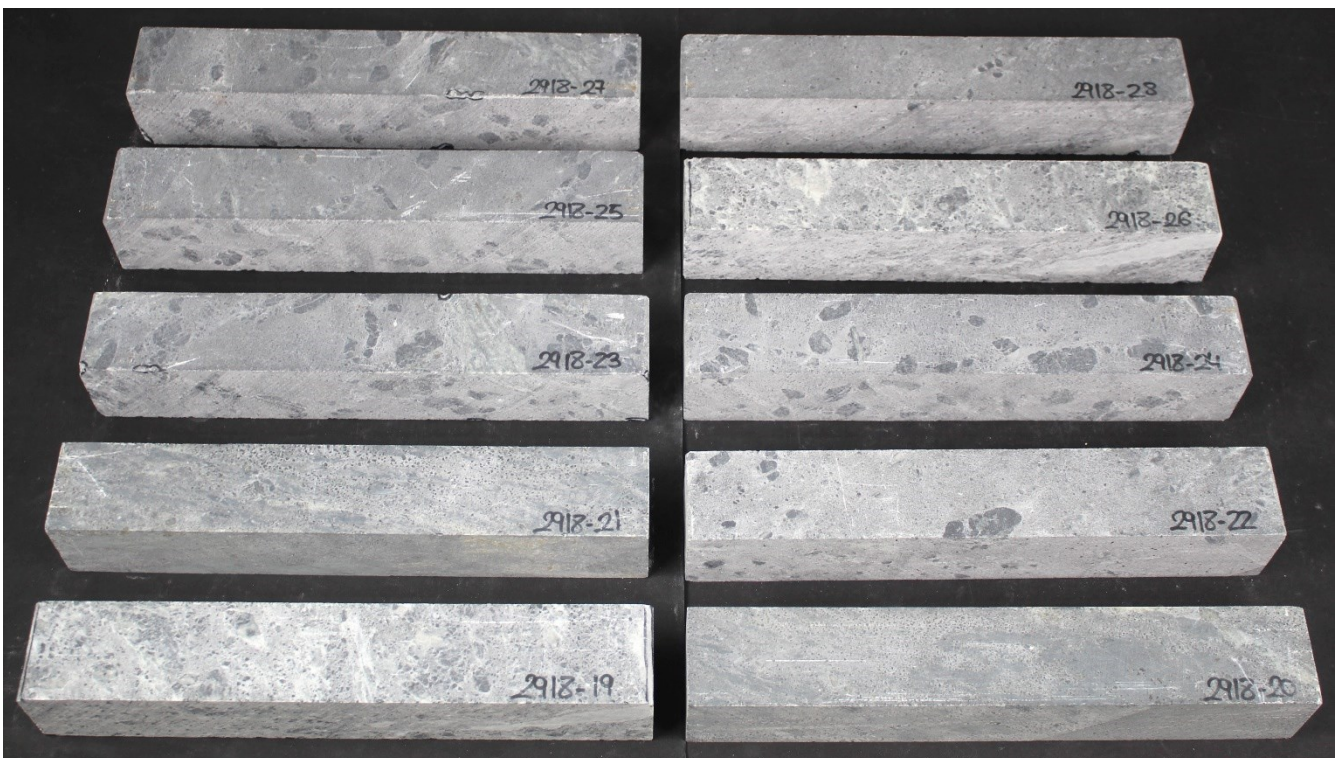
REPORT Nº: 222918PN008B DATE: 19-12-2022

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Set 2 before freeze-thaw cycles



Set 2 after 56 freeze-thaw cycles



**Natural stone – Frost resistance (technological test)**

REPORT Nº: **222918PN008D** DATE: **19-12-2022**

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PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **2 sets of 10 cubic specimens of nominal dimensions 70x70x70 mm**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**  
Planes of anisotropy \* **–**

\* Information declared by the petitioner

TEST METHOD: **EN 12371:2010 Natural stone test methods. Determination of frost resistance. Section 7.3.1**

Deviations **–**  
Specimen preparation **–**  
Conditioning **Drying in oven at 70±5°C to constant mass**  
Load direction **–**  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **07-11-2022 / 16-12-2022**

TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222918PN008D** DATE: **19-12-2022**

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RESULTS:

Set 1 (not subjected to freeze-thaw cycles)

Specimen	39	40	41	42	43	44	45	46	47	48
Average width of faces, $\bar{l}$ (mm)	70,3	70,4	70,3	70,4	70,4	70,2	70,1	70,3	70,3	70,4
Height, $h$ (mm)	70,7	70,9	70,4	70,3	70,3	70,2	70,4	70,3	70,3	70,5
Breaking load, $F$ (kN)	120	130	150	160	160	90	210	150	170	180
Compressive strength, $R$ (MPa)	24	25	30	31	32	19	43	29	35	36

Set 2 (subjected to 56 freeze-thaw cycles)

Specimen	29	30	31	32	33	34	35	36	37	38
Average width of faces, $\bar{l}$ (mm)	70,2	70,2	70,1	70,1	70,3	70,3	70,4	70,2	70,4	70,3
Height, $h$ (mm)	69,9	70,0	70,2	70,1	70,2	70,3	70,1	70,1	70,1	70,1
Breaking load, $F$ (kN)	140	150	220	130	120	120	80	80	140	130
Compressive strength, $R$ (MPa)	29	31	45	27	25	24	17	16	29	26



## TEST REPORT

### Natural stone – Frost resistance (technological test)

REPORT Nº: **222918PN008D** DATE: **19-12-2022**

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Mean value of compressive strength,  $R_0$

**30 MPa**

Standard deviation,  $s$

**7 MPa**

Mean value of compressive strength after 56 cycles,  $R_{56}$

**27 MPa**

Standard deviation,  $s$

**8 MPa**

Decrease of compressive strength after 56 cycles

**10,0 %**

Remarks: Las incertidumbres están calculadas y a disposición del cliente

*The sample received consisted of 20 undifferentiated specimens. The separation between the two sets of 10 specimens to be tested, was carried out at random by the laboratory*

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## Natural stone – Frost resistance (technological test)

REPORT Nº: 222918PN008D DATE: 19-12-2022

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Set 2 before freeze-thaw cycles



Set 2 after 56 freeze-thaw cycles



Natural stone – Compressive strength

REPORT Nº: **222918PN009A** DATE: **19-12-2022**

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PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

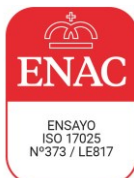
SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **10 cubic specimens of nominal dimensions 70x70x70 mm**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**  
Planes of anisotropy \* **–**

\* Information declared by the petitioner

TEST METHOD: **EN 1926:2006 Natural stone test methods. Determination of uniaxial compressive strength**

Deviations **–**  
Specimen preparation **–**  
Conditioning **Drying in oven at 70±5°C to constant mass**  
Load direction **–**  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **14-11-2022 / 16-11-2022**





## TEST REPORT

### Natural stone – Compressive strength

REPORT Nº: **222918PN009A** DATE: **19-12-2022**

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#### RESULTS:

Specimen	39	40	41	42	43	44	45	46	47	48
Average width of faces, $\bar{l}$ (mm)	70,3	70,4	70,3	70,4	70,4	70,2	70,1	70,3	70,3	70,4
Height, $h$ (mm)	70,7	70,9	70,4	70,3	70,3	70,2	70,4	70,3	70,3	70,5
Breaking load, $F$ (kN)	120	130	150	160	160	90	210	150	170	180
Compressive strength, $R$ (MPa)	24	25	30	31	32	19	43	29	35	36
Average compressive strength, $\bar{R}$	30 MPa									
Standard deviation, $s$	7 MPa									
Coefficient of variation, $v$	0,23									
Lower expected value, $E$	18 MPa									

Remarks: The uncertainties are calculated and at the client's disposal

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Natural stone – Flexural strength

REPORT Nº: **222918PN010** DATE: **19-12-2022** PAGE: **1/2**

PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

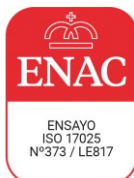
SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **10 specimens of nominal dimensions 300x50x50 mm**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**  
Planes of anisotropy \* **–**

\* Information declared by the petitioner

TEST METHOD: **EN 12372:2006 Natural stone test methods. Determination of flexural strength under concentrated load**

Deviations **–**  
Specimen preparation **–**  
Conditioning **Drying in oven at 70±5°C to constant mass**  
Load direction **–**  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **13-12-2022 / 15-12-2022**





## TEST REPORT

### Natural stone – Flexural strength

REPORT Nº: **222918PN010**

DATE: **19-12-2022**

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#### RESULTS:

Specimen	49	50	51	52	53	54	55	56	57	58
Breaking thickness, $h$ (mm)	50,0	49,6	50,1	50,0	50,2	50,2	49,4	49,8	50,5	50,1
Breaking width, $b$ (mm)	50,2	49,9	50,4	50,5	50,0	50,0	49,9	49,9	49,7	50,4
Span, $l$ (mm)	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0	250,0
Load increase (MPa/s)	0,25	0,25	0,25	0,25	0,25	0,25	0,26	0,25	0,25	0,25
Breaking load, $F$ (N)	6590	6800	1970	1550	4680	4260	5550	6630	4140	1880
Distance fracture to centre (mm)	10,6	26,2	5,3	2,2	43,5	1,6	9,6	15,5	54,9	16,3
Flexural strength, $R_{tf}$ (MPa)	19,7	20,8	5,8	4,6	13,9	12,7	17,1	20,1	12,3	5,6
Average flexural strength, $\bar{R}_{tf}$	13,3 MPa									
Standard deviation, $s$	6,2 MPa									
Lower expected value, $E$	3,5 MPa									

Remarks: The uncertainties are calculated and at the client's disposal

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Natural stone – Breaking load at dowel hole

REPORT Nº: **222918PN012A** DATE: **19-12-2022**

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PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**

Description **10 slabs of nominal dimensions 200x200x30 mm with honed surface finish (exposed face)**

Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**

Petrographic definition \* **Soapstone**

Place of quarrying \* **Juuka, Finland**

Supplier \* **Tulikivi Oyj**

Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**

Planes of anisotropy \* **–**

\* Information declared by the petitioner

TEST METHOD: **EN 13364:2001 Natural stone test methods. Determination of the breaking load at dowel hole**

Deviations **–**

Specimen preparation **–**

Conditioning **Drying in oven at 70±5°C to constant mass**

Load direction **–**

Place of testing **Centro Tecnológico del Mármol**

Dates of testing **23-11-2022 / 01-12-2022**





TEST REPORT

Natural stone – Breaking load at dowel hole

REPORT Nº: **222918PN012A** DATE: **19-12-2022**

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RESULTS:

Specimen	59	60	61	62	63	64	65	66	67	68
Thickness, $d$ (mm)	30	30	30	30	30	29	30	30	30	29
Breaking thickness, $d_1$ (mm)	9,1	9,1	9,6	10,2	9,5	9,2	10,2	10,5	10,1	10,8
Breaking load, $F$ (N)	1150	1750	850	1800	1200	800	900	1600	1650	1100
Maximum fracture length, $b_A$ (mm)	74,3	56,6	45,2	42,3	47,8	56,6	67,0	47,5	55,8	51,8
Mean value of breaking load, $\bar{F}$	1300 N									
Standard deviation, $s$	400 N									
Lower expected value, $E$	634 N									
Mean value of breaking thickness, $\bar{d}_1$	9,8 mm									
Mean value of maximum fracture lengths, $\bar{b}_A$	54,5 mm									

Remarks: The uncertainties are calculated and at the client's disposal  
The results of breaking load and standard deviation are expressed to the nearest 50 N

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TEST REPORT

Natural stone – Slip resistance

REPORT Nº: **222918PN020A** DATE: **19-12-2022**

PAGE: **1/2**

PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

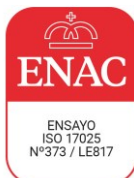
SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **2 slabs of 300x300x30 mm and 1 slab of 300x300x60 mm**  
Surface finish \* **Tulikivi Classic**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**

\* Information declared by the petitioner

TEST METHOD: **EN 14231:2003 Natural stone test methods. Determination of the slip resistance by means of the pendulum tester**

Deviations –  
Specimen preparation –  
Slider used **76,2 x 25,4 mm**  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **12-12-2022**





## TEST REPORT

### Natural stone – Slip resistance

REPORT Nº: **222918PN020A** DATE: **19-12-2022**

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#### RESULTS:

Specimen	69.1	69.2	70.3	70.4	71.5	71.6
Individual values of the slip resistance, in dry condition	65	65	64	64	64	64
Individual values of the slip resistance, in wet condition	40	42	37	35	35	39
Average slip resistance, in dry condition (SRV “dry”)	64		Uncertainty		± 4	
Average slip resistance, in wet condition (SRV “wet”)	38		Uncertainty		± 3	

Remarks: The expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $K=2$ , which for a normal distribution provides a level of confidence of about 95%

#### DISCLAIMER:

The laboratory is not responsible for the sampling or for the information declared by the client. The results refer only to the sample received at the laboratory, on the expressed date.

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Antonio Molina  
Director Técnico



TEST REPORT

Slip resistance (slipperiness)

REPORT Nº: **222918PN020J** DATE: **19-12-2022** PAGE: **1/2**

PETITIONER: **Tulikivi Oyj**  
**Kuhnustantie 22. FIN83900 Juuka (Finland)**

SAMPLE IDENTIFICATION:

Date of delivery **28-10-2022**  
Description **1 natural stone slab of 300x300x60 mm**  
Surface finish \* **Tulikivi Classic**  
Commercial name \* **TULIKIVI SOAP STONE TILE / TULIKIVI VUOLUKIVILAATTA**  
Petrographic definition \* **Soapstone**  
Place of quarrying \* **Juuka, Finland**  
Supplier \* **Tulikivi Oyj**  
Sampled by \* **Tulikivi Oyj, production of Juuka (27-09-2022)**

\* Information declared by the petitioner

TEST METHOD: **EN 16165:2021 Determination of slip resistance of pedestrian surfaces - Methods of evaluation. Annex C Pendulum test**  
Deviations **–**  
Type of slider used **57**  
Place of testing **Centro Tecnológico del Mármol**  
Dates of testing **12-12-2022**





## TEST REPORT

### Slip resistance (slipperiness)

REPORT Nº: **222918PN020J** DATE: **19-12-2022**

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#### RESULTS:

Test conditions	Dry	Wet
Slipperiness measured towards 0°	65	40
Slipperiness measured towards 90°	64	41
Slipperiness measured towards 45°	65	40
Value of the slipperiness, <i>PTV</i>	64	40
Uncertainty	± 4	± 1

Remarks: The expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor K=2, which for a normal distribution provides a level of confidence of about 95%

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