



Natural stone – Water absorption

REPORT Nº: **222926PN003** DATE: **13-02-2023** PAGE: **1/2**

PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**
Description **6 cubic specimens of nominal dimensions 50x50x50 mm**
Commercial name * **Aarni**
Petrographic definition * **Granite**
Place of quarrying * **Kiuruvesi, Finland**
Supplier * **Kaavin Kivi Oy**
Sampled by * **Jani Toivanen (03-10-2022)**

* 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 **03-01-2023 / 12-01-2023**





TEST REPORT

Natural stone – Water absorption

REPORT Nº: **222926PN003**

DATE: **13-02-2023**

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RESULTS:

Specimen

Water absorption, A_b (%)

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

01	02	03	04	05	06
0,2	0,2	0,2	0,2	0,2	0,2
0,2 %					

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: **222926PN004A** DATE: **13-02-2023**

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PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

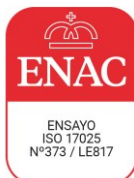
SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**
Description **6 cubic specimens of nominal dimensions 50x50x50 mm**
Commercial name * **Aarni**
Petrographic definition * **Granite**
Place of quarrying * **Kiuruvesi, Finland**
Supplier * **Kaavin Kivi Oy**
Sampled by * **Jani Toivanen (03-10-2022)**

* 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 –
Date of preparation –
Place of testing **Centro Tecnológico del Mármol**
Dates of testing **03-01-2023 / 10-01-2023**





TEST REPORT

Natural stone – Apparent density and open porosity

REPORT Nº: **222926PN004A** DATE: **13-02-2023**

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RESULTS:

Specimen	07	08	09	10	11	12
Apparent density, ρ_b (kg/m ³)	2720	2710	2720	2730	2740	2720
Open porosity, p_o (%)	0,5	0,5	0,5	0,5	0,5	0,5
Mean value of apparent density, $\bar{\rho}_b$	2720 kg/m ³					
Mean value of open porosity, \bar{p}_o	0,5 %					

Remarks: The uncertainties are calculated and at the client's disposal
The results of density are expressed to the nearest 10 kg/m³
The results of porosity are expressed to the nearest 0,1 %

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Natural stone – Abrasion resistance (Capon method)REPORT Nº: **222926PN006**DATE: **13-02-2023**PAGE: **1/2**

PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**

Description **6 polished slabs of 150x150x30 mm**

Commercial name * **Aarni**

Petrographic definition * **Granite**

Place of quarrying * **Kiuruvesi, Finland**

Supplier * **Kaavin Kivi Oy**

Sampled by * **Jani Toivanen (03-10-2022)**

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 **03-01-2023 / 09-01-2023**





TEST REPORT

Natural stone – Abrasion resistance (Capon method)

REPORT Nº: **222926PN006**

DATE: **13-02-2023**

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RESULTS:

Specimen	13	14	15	16	17	18
Groove lengths (mm)	10,0	11,5	10,0	11,5	10,0	11,0
	11,5	11,5	11,0	11,5	10,5	10,5
Mean value of groove length	11,0 mm					
Standard deviation	0,4 mm					
Higher expected value, E_H	12,5 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: **222926PN008B** DATE: **13-02-2023**

PAGE: **1/4**

PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

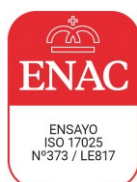
SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**
Description **2 sets of 10 specimens of nominal dimensions 300x50x50 mm**
Commercial name * **Aarni**
Petrographic definition * **Granite**
Place of quarrying * **Kiuruvesi, Finland**
Supplier * **Kaavin Kivi Oy**
Sampled by * **Jani Toivanen (03-10-2022)**
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 **12-12-2022 / 19-01-2023**



Natural stone – Frost resistance (technological test)

REPORT Nº: **222926PN008B** DATE: **13-02-2023**

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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)	50,1	50,2	50,2	50,1	50,1	49,7	50,2	50,0	50,1	50,2
Breaking width, b (mm)	49,7	50,3	50,1	49,6	49,6	50,1	49,7	50,2	50,0	50,3
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	0,25	0,25	0,25	0,25
Breaking load, F (N)	3920	2830	3180	3670	3340	3640	3170	2680	3180	3340
Distance fracture to centre (mm)	19,6	6,7	26,5	8,0	13,0	0,9	2,1	5,2	9,0	15,6
Flexural strength, R_{tf} (MPa)	11,8	8,4	9,5	11,1	10,1	11,0	9,5	8,0	9,5	9,9

Set 2 (subjected to 56 freeze-thaw cycles)

Specimen	19	20	21	22	23	24	25	26	27	28
Breaking thickness, h (mm)	50,0	50,2	49,7	50,5	50,1	50,1	50,4	50,2	50,3	50,1
Breaking width, b (mm)	50,6	50,5	50,3	50,1	50,2	50,2	50,2	50,3	50,0	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	0,24	0,25	0,25	0,25
Breaking load, F (N)	3590	3510	3310	3470	3390	3340	3420	2480	2890	3480
Distance fracture to centre (mm)	21,0	6,1	7,7	26,1	12,2	4,3	2,7	6,8	3,5	10,1
Flexural strength, R_{tf} (MPa)	10,6	10,4	10,0	10,2	10,1	9,9	10,1	7,3	8,6	10,3



TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222926PN008B** DATE: **13-02-2023**

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Mean value of flexural strength, F_0

9,9 MPa

Standard deviation, s

1,2 MPa

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

9,7 MPa

Standard deviation, s

1,0 MPa

Decrease of flexural strength after 56 cycles

2,0 %

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

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)

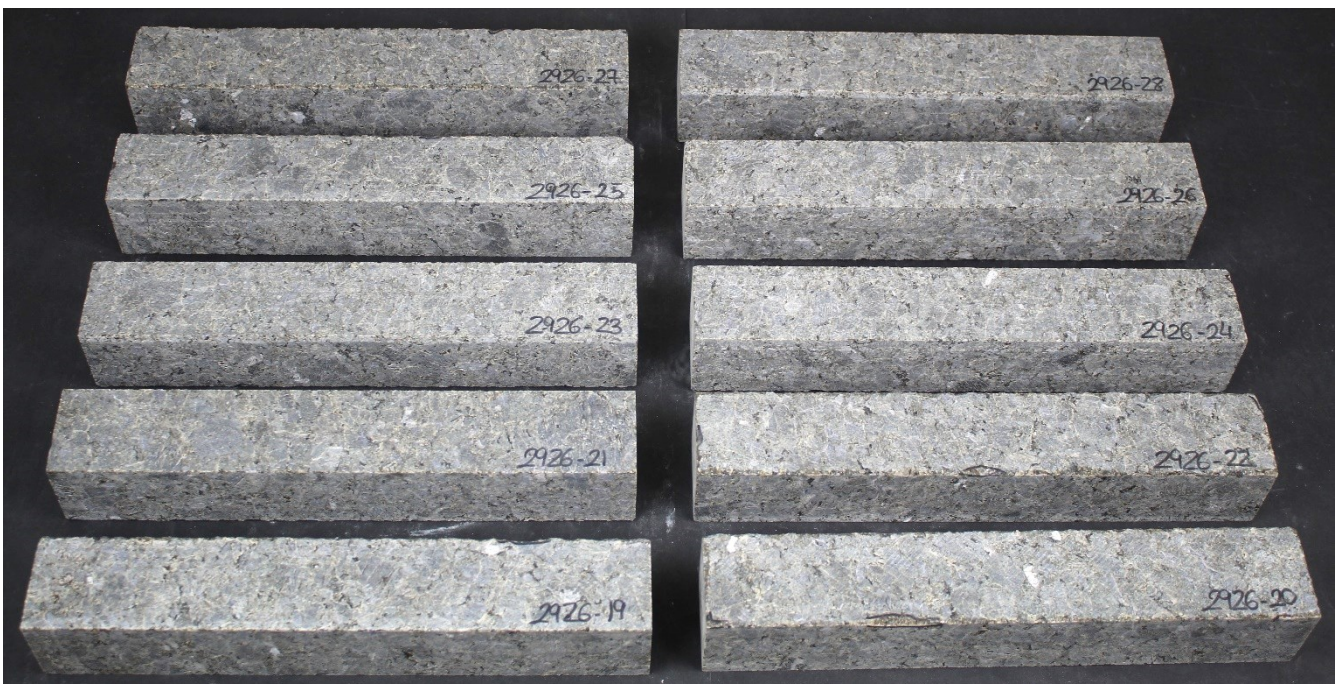
REPORT Nº: 222926PN008B DATE: 13-02-2023

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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: **222926PN008D** DATE: **13-02-2023**PAGE: **1/4**PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**

Description **2 sets of 10 cubic specimens of nominal dimensions 70x70x70 mm**

Commercial name * **Aarni**

Petrographic definition * **Granite**

Place of quarrying * **Kiuruvesi, Finland**

Supplier * **Kaavin Kivi Oy**

Sampled by * **Jani Toivanen (03-10-2022)**

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 **–**

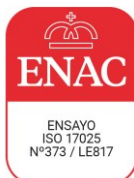
Specimen preparation **–**

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

Load direction **–**

Place of testing **Centro Tecnológico del Mármol**

Dates of testing **12-12-2022 / 18-01-2023**



TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222926PN008D** DATE: **13-02-2023**

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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)	69,9	69,9	69,9	70,4	70,0	70,0	70,0	69,9	70,0	70,0
Height, h (mm)	69,9	69,8	69,8	70,0	69,9	69,9	69,9	69,9	69,9	69,9
Breaking load, F (kN)	950	940	810	960	890	950	950	890	850	940
Compressive strength, R (MPa)	194	193	165	193	181	195	193	181	173	193

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)	70,5	69,8	69,9	70,0	70,3	70,1	70,0	70,4	69,9	70,0
Height, h (mm)	69,7	69,9	70,0	69,9	70,0	69,9	70,0	70,2	69,9	70,0
Breaking load, F (kN)	940	910	910	960	960	990	950	960	960	960
Compressive strength, R (MPa)	189	187	186	196	193	201	194	193	197	196



TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222926PN008D** DATE: **13-02-2023**

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Mean value of compressive strength, R_0

186 MPa

Standard deviation, s

10 MPa

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

193 MPa

Standard deviation, s

5 MPa

Decrease of compressive strength after 56 cycles

0,0 %

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

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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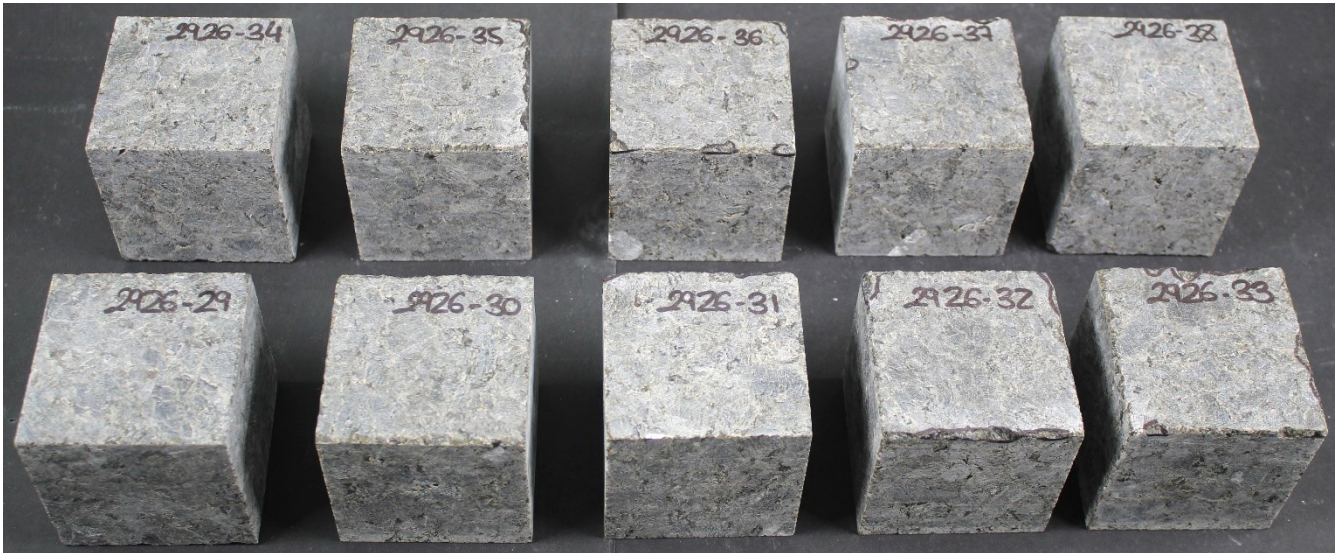
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Natural stone – Frost resistance (technological test)

REPORT Nº: 222926PN008D DATE: 13-02-2023

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Set 2 before freeze-thaw cycles



Set 2 after 56 freeze-thaw cycles



Natural stone – Compressive strength

REPORT Nº: **222926PN009A** DATE: **13-02-2023**

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PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**
Description **10 cubic specimens of nominal dimensions 70x70x70 mm**
Commercial name * **Aarni**
Petrographic definition * **Granite**
Place of quarrying * **Kiuruvesi, Finland**
Supplier * **Kaavin Kivi Oy**
Sampled by * **Jani Toivanen (03-10-2022)**
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 **11-01-2023 / 16-01-2023**





TEST REPORT

Natural stone – Compressive strength

REPORT Nº: **222926PN009A** DATE: **13-02-2023**

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RESULTS:

Specimen	39	40	41	42	43	44	45	46	47	48
Average width of faces, \bar{l} (mm)	69,9	69,9	69,9	70,4	70,0	70,0	70,0	69,9	70,0	70,0
Height, h (mm)	69,9	69,8	69,8	70,0	69,9	69,9	69,9	69,9	69,9	69,9
Breaking load, F (kN)	950	940	810	960	890	950	950	890	850	940
Compressive strength, R (MPa)	194	193	165	193	181	195	193	181	173	193
Average compressive strength, \bar{R}	186 MPa									
Standard deviation, s	10 MPa									
Coefficient of variation, v	0,06									
Lower expected value, E	165 MPa									

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

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Natural stone – Flexural strength

REPORT Nº: **222926PN010** DATE: **13-02-2023** PAGE: **1/2**

PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**
Description **10 specimens of nominal dimensions 300x50x50 mm**
Commercial name * **Aarni**
Petrographic definition * **Granite**
Place of quarrying * **Kiuruvesi, Finland**
Supplier * **Kaavin Kivi Oy**
Sampled by * **Jani Toivanen (03-10-2022)**
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 **11-01-2023 / 17-01-2023**





TEST REPORT

Natural stone – Flexural strength

REPORT Nº: **222926PN010**

DATE: **13-02-2023**

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RESULTS:

Specimen	49	50	51	52	53	54	55	56	57	58
Breaking thickness, h (mm)	50,1	50,2	50,2	50,1	50,1	49,7	50,2	50,0	50,1	50,2
Breaking width, b (mm)	49,7	50,3	50,1	49,6	49,6	50,1	49,7	50,2	50,0	50,3
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	0,25	0,25	0,25	0,25
Breaking load, F (N)	3920	2830	3180	3670	3340	3640	3170	2680	3180	3340
Distance fracture to centre (mm)	19,6	6,7	26,5	8,0	13,0	0,9	2,1	5,2	9,0	15,6
Flexural strength, R_{tf} (MPa)	11,8	8,4	9,5	11,1	10,1	11,0	9,5	8,0	9,5	9,9
Average flexural strength, \bar{R}_{tf}	9,9 MPa									
Standard deviation, s	1,2 MPa									
Lower expected value, E	7,6 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: **222926PN012A** DATE: **13-02-2023**

PAGE: **1/2**

PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

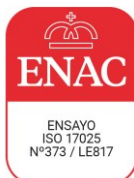
SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**
Description **10 slabs of nominal dimensions 200x200x30 mm**
Commercial name * **Aarni**
Petrographic definition * **Granite**
Place of quarrying * **Kiuruvesi, Finland**
Supplier * **Kaavin Kivi Oy**
Sampled by * **Jani Toivanen (03-10-2022)**
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 **09-01-2023 / 18-01-2023**





TEST REPORT

Centro Tecnológico
del mármol

Natural stone – Breaking load at dowel hole

REPORT Nº: **222926PN012A** DATE: **13-02-2023**PAGE: **2/2**

RESULTS:

Specimen	59	60	61	62	63	64	65	66	67	68
Thickness, d (mm)	30	30	30	30	30	30	30	30	30	30
Breaking thickness, d_1 (mm)	10,4	10,1	11,4	10,4	10,7	11,2	10,1	11,9	10,9	10,6
Breaking load, F (N)	1900	1800	2250	1600	1600	1800	1800	1750	2050	1850
Maximum fracture length, b_A (mm)	60,4	48,1	48,9	51,9	33,4	41,5	47,3	48,9	60,0	41,1
Mean value of breaking load, \bar{F}	1850 N									
Standard deviation, s	200 N									
Lower expected value, E	1465 N									
Mean value of breaking thickness, \bar{d}_1	10,8 mm									
Mean value of maximum fracture lengths, \bar{b}_A	48,1 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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Natural stone – Slip resistance

REPORT Nº: **222926PN020A** DATE: **13-02-2023**

PAGE: **1/2**

PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

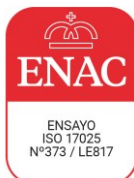
SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**
Description **3 slabs of 300x300x30 mm**
Surface finish * **Sawn**
Commercial name * **Aarni**
Petrographic definition * **Granite**
Place of quarrying * **Kiuruvesi, Finland**
Supplier * **Kaavin Kivi Oy**
Sampled by * **Jani Toivanen (03-10-2022)**

* 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 **04-01-2023 / 05-01-2023**





TEST REPORT

Natural stone – Slip resistance

REPORT Nº: **222926PN020A** DATE: **13-02-2023**

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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	96	96	91	93	95	94
Individual values of the slip resistance, in wet condition	70	71	71	72	70	69
Average slip resistance, in dry condition (SRV “dry”)	94		Uncertainty		± 5	
Average slip resistance, in wet condition (SRV “wet”)	71		Uncertainty		± 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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PN020JE2201

TEST REPORT

Slip resistance (slipperiness)

REPORT Nº: **222926PN020J** DATE: **13-02-2023**

PAGE: **1/2**

PETITIONER: **Kaavin Kivi Oy**
Kirjekuorentie 6. 73600 Kaavi (Finland)

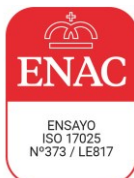
SAMPLE IDENTIFICATION:

Date of delivery **02-12-2022**
Description **1 natural stone slab of 300x300x30 mm**
Surface finish * **Sawn**
Commercial name * **Aarni**
Petrographic definition * **Granite**
Place of quarrying * **Kiuruvesi, Finland**
Supplier * **Kaavin Kivi Oy**
Sampled by * **Jani Toivanen (03-10-2022)**

* 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 **04-01-2023 / 05-01-2023**



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TEST REPORT

Slip resistance (slipperiness)

REPORT Nº: **222926PN020J** DATE: **13-02-2023**

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RESULTS:

Test conditions	Dry	Wet
Slipperiness measured towards 0°	95	70
Slipperiness measured towards 90°	95	69
Slipperiness measured towards 45°	96	70
Value of the slipperiness, <i>PTV</i>	95	69
Uncertainty	± 5	± 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.

This report shall not be reproduced, except in full, without the written consent of the laboratory.

Digitally signed by

Antonio Molina
Director Técnico