Centro Tecnológico del mármol

TEST REPORT

Natural stone – Water absorption

REPORT Nº: **222925PN003** 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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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**

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Asociación Empresarial de Investigación Centro Tecnológico del Mármol, la Piedra y Materiales
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Centro Tecnológico del mármol

TEST REPORT

Natural stone – Water absorption

REPORT Nº: **222925PN003** DATE: **13-02-2023** PAGE: **2/2**

RESULTS:

Specimen	01	02	03	04	05	06
Water absorption, A_b (%)	0,1	0,1	0,1	0,1	0,1	0,1
Mean value of water absorption, $\bar{A}_b$	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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Antonio Molina
Director Técnico

Centro Tecnológico del mármol

TEST REPORT

Natural stone – Apparent density and open porosity

REPORT Nº: **222925PN004A** 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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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	**–**
Place of testing	**Centro Tecnológico del Mármol**
Dates of testing	**03-01-2023 / 10-01-2023**

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TEST REPORT

Natural stone – Apparent density and open porosity

REPORT Nº: **222925PN004A** DATE: **13-02-2023**

RESULTS:

Specimen	07	08	09	10	11	12
Apparent density, ρ_b (kg/m^3)	**2750**	**2710**	**2720**	**2720**	**2720**	**2720**
Open porosity, p_o (%)	**0,3**	**0,3**	**0,3**	**0,3**	**0,3**	**0,3**
Mean value of apparent density, $\bar{\rho}_b$	**2720 kg/m^3**					
Mean value of open porosity, $\bar{p}_o$	**0,3 %**					

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

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TEST REPORT

Natural stone – Abrasion resistance (Capon method)

REPORT Nº: **222925PN006** DATE: **13-02-2023**

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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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**

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TEST REPORT

Natural stone – Abrasion resistance (Capon method)

REPORT Nº: **222925PN006** DATE: **13-02-2023** PAGE: **2/2**

RESULTS:

Specimen	13	14	15	16	17	18
Groove lengths (mm)	12,5	12,5	12,5	12,0	11,5	13,0
	12,5	12,0	13,5	12,5	12,5	13,0
Mean value of groove length	**13,0 mm**					
Standard deviation	**0,5 mm**					
Higher expected value, E_H	**14,0 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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Centro Tecnológico del mármol

TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222925PN008B** DATE: **13-02-2023**

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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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±5ºC to constant mass**
Load direction	**–**
Place of testing	**Centro Tecnológico del Mármol**
Dates of testing	**12-12-2022 / 19-01-2023**

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TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222925PN008B** DATE: **13-02-2023**

RESULTS:

Set 1 (not subjected to freeze-thaw cycles)

Specimen	49	50	51	52	53	54	55	56	57	58
Breaking thickness, h (mm)	49,2	49,5	50,0	50,0	49,1	50,1	49,1	49,6	49,9	49,4
Breaking width, b (mm)	49,8	49,5	49,8	49,8	50,1	50,2	50,0	49,2	49,6	49,9
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)	0,26	0,26	0,25	0,25	0,26	0,25	0,26	0,26	0,25	0,26
Breaking load, F (N)	6940	7390	6680	7840	7400	6470	6810	6340	7260	6890
Distance fracture to centre (mm)	12,1	6,3	6,4	13,0	1,9	8,8	7,3	6,8	3,7	4,9
Flexural strength, R_{tf} (MPa)	21,6	22,8	20,1	23,6	23,0	19,3	21,2	19,6	22,1	21,2

Set 2 (subjected to 56 freeze-thaw cycles)

Specimen	19	20	21	22	23	24	25	26	27	28
Breaking thickness, h (mm)	50,1	49,1	50,4	49,1	49,6	49,9	50,6	49,8	49,9	50,3
Breaking width, b (mm)	50,1	49,9	49,8	49,9	49,4	50,1	50,2	50,0	50,2	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	0,26	0,25	0,26	0,26	0,25	0,24	0,25	0,25	0,25
Breaking load, F (N)	6950	7760	8970	6970	6840	7430	8310	6590	6590	5430
Distance fracture to centre (mm)	2,2	5,3	11,2	4,7	6,3	4,4	12,5	7,7	8,4	4,6
Flexural strength, R_{tf} (MPa)	20,8	24,2	26,6	21,8	21,1	22,4	24,2	19,9	19,8	16,2

Centro Tecnológico del mármol

TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222925PN008B** DATE: **13-02-2023**

Mean value of flexural strength, F_0	**21,4 MPa**
Standard deviation, s	**1,5 MPa**
Mean value of flexural strength after 56 cycles, F_{56}	**21,7 MPa**
Standard deviation, s	**2,9 MPa**
Decrease of flexural 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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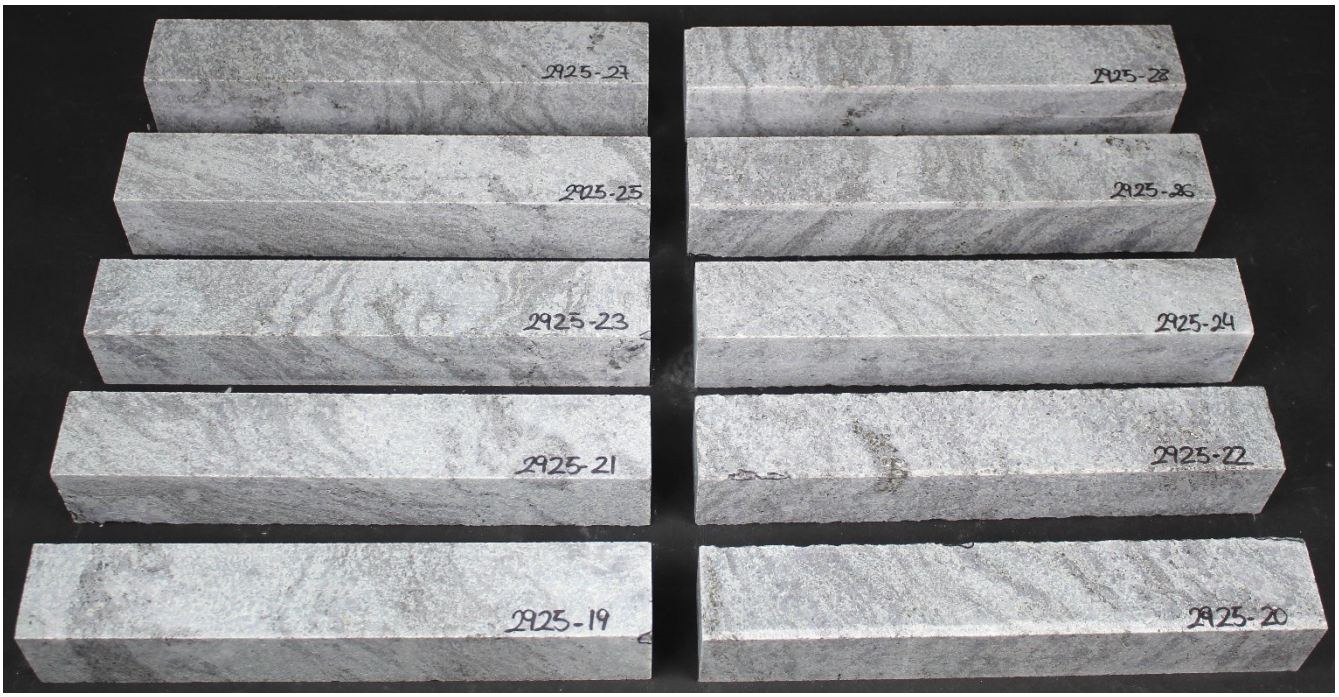
Director Técnico

Centro Tecnológico del mármol

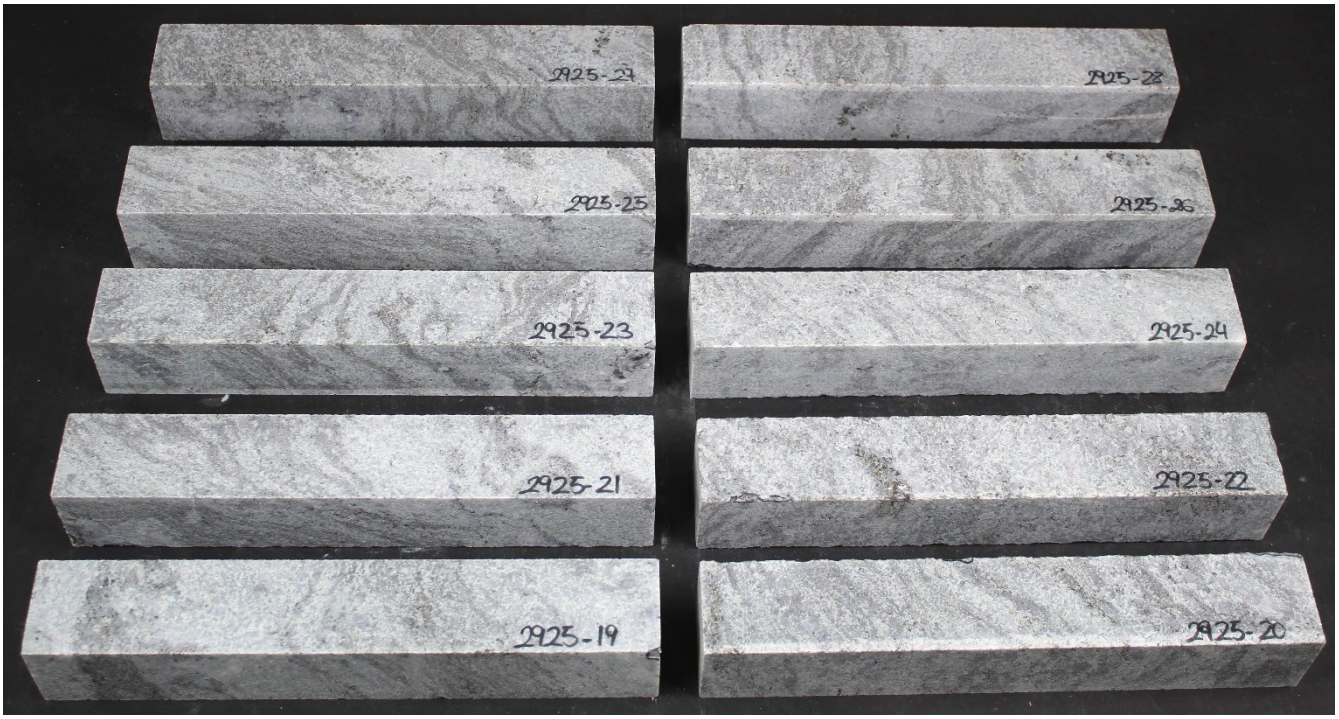
TEST REPORT

Natural stone – Frost resistance (technological test)

Set 2 before freeze-thaw cycles



Set 2 after 56 freeze-thaw cycles



Centro Tecnológico del mármol

TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222925PN008D** 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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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±5ºC to constant mass**
Load direction	**–**
Place of testing	**Centro Tecnológico del Mármol**
Dates of testing	**12-12-2022 / 18-01-2023**

ENAC ENSAYO ISO 17025 Nº373 / LE817

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Centro Tecnológico del mármol

TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222925PN008D** DATE: **13-02-2023**

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	69,7	69,8	69,9	69,8	69,8	70,1	69,9	69,8	70,0
Height, h (mm)	70,0	69,8	69,5	70,0	69,8	69,6	69,8	69,8	70,1	69,9
Breaking load, F (kN)	990	970	880	990	920	1020	940	980	1030	970
Compressive strength, R (MPa)	200	199	182	202	189	209	192	202	211	198

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)	69,6	69,9	69,8	69,9	69,9	69,8	69,9	69,9	69,7	70,0
Height, h (mm)	69,9	69,9	69,9	70,0	69,8	69,7	69,6	69,8	70,1	70,1
Breaking load, F (kN)	1080	750	950	990	960	830	910	970	1060	1000
Compressive strength, R (MPa)	223	154	196	202	197	170	187	198	218	204

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TEST REPORT

Natural stone – Frost resistance (technological test)

REPORT Nº: **222925PN008D** DATE: **13-02-2023**

Mean value of compressive strength, R_0	**198 MPa**
Standard deviation, s	**9 MPa**
Mean value of compressive strength after 56 cycles, R_{56}	**195 MPa**
Standard deviation, s	**21 MPa**
Decrease of compressive 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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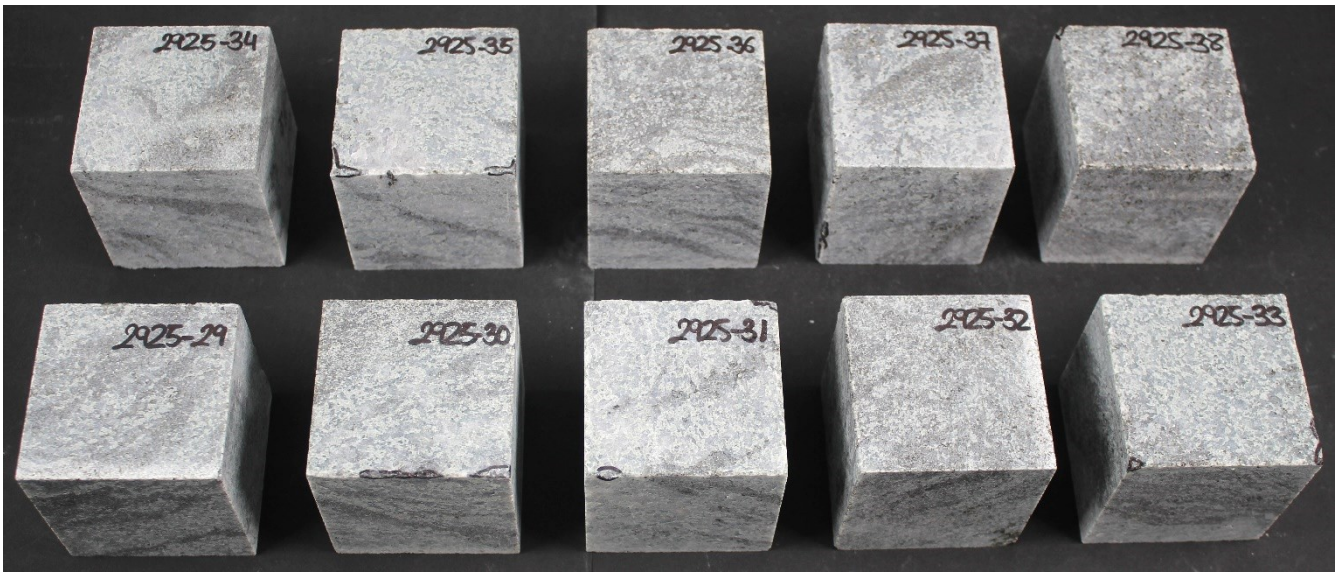
Centro Tecnológico del mármol

TEST REPORT

Natural stone – Frost resistance (technological test)

Set 2 before freeze-thaw cycles



Set 2 after 56 freeze-thaw cycles

Centro Tecnológico del mármol

TEST REPORT

Natural stone – Compressive strength

REPORT Nº: **222925PN009A** 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 cubic specimens of nominal dimensions 70x70x70 mm**
Commercial name *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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±5ºC to constant mass**
Load direction	**–**
Place of testing	**Centro Tecnológico del Mármol**
Dates of testing	**11-01-2023 / 16-01-2023**

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TEST REPORT

Natural stone – Compressive strength

REPORT Nº: **222925PN009A** DATE: **13-02-2023** PAGE: **2/2**

RESULTS:

Specimen	39	40	41	42	43	44	45	46	47	48
Average width of faces, $\bar{l}$ (mm)	70,3	69,7	69,8	69,9	69,8	69,8	70,1	69,9	69,8	70,0
Height, h (mm)	70,0	69,8	69,5	70,0	69,8	69,6	69,8	69,8	70,1	69,9
Breaking load, F (kN)	990	970	880	990	920	1020	940	980	1030	970
Compressive strength, R (MPa)	200	199	182	202	189	209	192	202	211	198
Average compressive strength, $\bar{R}$	198 MPa									
Standard deviation, s	9 MPa									
Coefficient of variation, v	0,04									
Lower expected value, E	180 MPa									

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

DISCLAIMER:

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Centro Tecnológico del mármol

TEST REPORT

Natural stone – Flexural strength

REPORT Nº: **222925PN010** 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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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±5ºC to constant mass**
Load direction	**–**
Place of testing	**Centro Tecnológico del Mármol**
Dates of testing	**11-01-2023 / 16-01-2023**

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TEST REPORT

Natural stone – Flexural strength

REPORT Nº: **222925PN010** DATE: **13-02-2023**

RESULTS:

Specimen	49	50	51	52	53	54	55	56	57	58
Breaking thickness, h (mm)	49,2	49,5	50,0	50,0	49,1	50,1	49,1	49,6	49,9	49,4
Breaking width, b (mm)	49,8	49,5	49,8	49,8	50,1	50,2	50,0	49,2	49,6	49,9
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)	0,26	0,26	0,25	0,25	0,26	0,25	0,26	0,26	0,25	0,26
Breaking load, F (N)	6940	7390	6680	7840	7400	6470	6810	6340	7260	6890
Distance fracture to centre (mm)	12,1	6,3	6,4	13,0	1,9	8,8	7,3	6,8	3,7	4,9
Flexural strength, R_{tf} (MPa)	21,6	22,8	20,1	23,6	23,0	19,3	21,2	19,6	22,1	21,2
Average flexural strength, $\bar{R}_{tf}$	**21,4 MPa**									
Standard deviation, s	**1,5 MPa**									
Lower expected value, E	**18,5 MPa**									

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

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TEST REPORT

Natural stone – Breaking load at dowel hole

REPORT Nº: **222925PN012A** 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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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±5ºC to constant mass**
Load direction	**–**
Place of testing	**Centro Tecnológico del Mármol**
Dates of testing	**09-01-2023 / 18-01-2023**

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TEST REPORT

Natural stone – Breaking load at dowel hole

REPORT Nº: **222925PN012A** DATE: **13-02-2023**

RESULTS:

Specimen	59	60	61	62	63	64	65	66	67	68
Thickness, d (mm)	29	30	30	30	30	29	30	30	30	30
Breaking thickness, d_1 (mm)	10,3	11,5	10,3	10,2	10,9	10,4	10,0	11,1	10,9	11,2
Breaking load, F (N)	2950	3600	3500	3050	2700	3750	3050	3750	3250	4100
Maximum fracture length, b_A (mm)	32,5	51,9	50,2	44,7	42,4	46,9	43,6	50,0	38,7	40,7

Mean value of breaking load, $\bar{F}$	**3350 N**
Standard deviation, s	**450 N**
Lower expected value, E	**2532 N**
Mean value of breaking thickness, $\bar{d}_1$	**10,7 mm**
Mean value of maximum fracture lengths, $\bar{b}_A$	**44,2 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: **222925PN020A** DATE: **13-02-2023**

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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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**

ilac-MRA ENAC ENSAYO ISO 17025 Nº373 / LE817

Asociación Empresarial de Investigación Centro Tecnológico del Mármol, la Piedra y Materiales
Ctra. de Murcia s/n. 30430 Cehegín, Murcia, Spain
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Centro Tecnológico del mármol

TEST REPORT

Natural stone – Slip resistance

REPORT Nº: **222925PN020A** DATE: **13-02-2023** PAGE: **2/2**

RESULTS:

Specimen	69.1	69.2	70.3	70.4	71.5	71.6
Individual values of the slip resistance, in dry condition	75	81	80	80	74	77
Individual values of the slip resistance, in wet condition	57	58	57	56	55	53

Average slip resistance, in dry condition (SRV “dry”)	**78**	Uncertainty	**± 5**
Average slip resistance, in wet condition (SRV “wet”)	**56**	Uncertainty	**± 2**

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%

Digitally signed by

Antonio Molina
Director Técnico

Centro Tecnológico del mármol

TEST REPORT

Slip resistance (slipperiness)

REPORT Nº: **222925PN020J** 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 *	**Silver Green (Pohjolan Loimu)**
Petrographic definition *	**Gneiss**
Place of quarrying *	**Varpaisjärvi, 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**

ilac-MRA ENAC ENSAYO ISO 17025 Nº373 / LE817

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TEST REPORT

Slip resistance (slipperiness)

REPORT Nº: **222925PN020J** DATE: **13-02-2023** PAGE: **2/2**

RESULTS*:*

Test conditions	Dry	Wet
Slipperiness measured towards 0°	**80**	**57**
Slipperiness measured towards 90°	**81**	**55**
Slipperiness measured towards 45°	**80**	**55**
Value of the slipperiness, *PTV*	**80**	**55**
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%

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