



ECO-innovation
WHEN BUSINESS MEETS THE ENVIRONMENT

**CIP Eco-innovation
Pilot and market replication projects
Call 2013**

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Deliverable 4.1 - Product characterization and UNI Keymark (EN)

**Project acronym WINCER
Contract ECO/13/630426**



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European
Commission

Executive Agency for
Small and Medium-sized Enterprises



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1. Introduction

A complete characterization of the 30x60 cm glazed WINCER tiles has been carried out in terms of their compliance with UNI EN 14411 (ISO 13006) for UNI Keymark.

The tested commercial series is named "STONEWORK GL SR, type WINCER, code K1EH".

According to the above mentioned Standard, ceramic tiles shall be classified into groups according to two parameters: by their method of manufacture (shaping) that is, by extrusion (group "A") or dry-pressing (group "B"), and by their water absorption level (see Table I). The groups do not presuppose the usage of the products. The requirements for each product group shall be as given in Annexes A to M of the Standard.

For the purpose of classification, the test method used to determine water absorption level is the boiling method according to EN ISO 10545-3.

These tiles can be glazed (GL) or unglazed (UGL).

Ceramic tiles belonging to group AI_a and BI_a can be designated as porcelain tiles (fully vitrified ceramic tiles with water absorption of 0.5% or less).

TABLE 1 - classification of ceramic tiles according to UNI EN 14411

Shaping	Water absorption (E_b)			
	Group I $E_b \leq 3\%$	Group II _a $3\% < E_b \leq 6\%$	Group II _b $6\% < E_b \leq 10\%$	Group III $E_b > 10\%$
Method A Extruded	Group AI _a $E_b \leq 0.5\%$ (Annex M) Group AI _b $0.5\% < E_b \leq 3\%$ (Annex A)	Group AII _{a-1} (Annex B) Group AII _{a-2} (Annex C)	Group AII _{b-1} (Annex D) Group AII _{b-2} (Annex E)	Group AIII (Annex F)
Method B Dry-pressed	Group BI _a $E_b \leq 0.5\%$ (Annex G) Group BI _b $0.5\% < E_b \leq 3\%$ (Annex H)	Group BII _a (Annex J)	Group BII _b (Annex K)	Group BIII (Annex L)

In particular, WINCER tiles are shaped by dry-pressing at room temperature followed by drying and firing at 1025°C. This temperature is sufficient to reach a water absorption below 0.5%. Therefore this series of tiles belongs to group BI_a and should fulfill with the requirements of Annex G of the Standard UNI EN 14411.

2. Technical tests

To verify the compliance with the standard EN 14411 for the 30x60 cm glazed tiles "STONEWORK GL SR, type WINCER, code K1EH", the following tests were carried out:

- 1) UNI EN ISO 10545-2: 2000: Determination of dimensions and surface quality
- 2) UNI EN ISO 10545-3: 2000: Determination of water absorption, apparent porosity, apparent relative density and bulk density
- 3) UNI EN ISO 10545-4: 2014: Determination of modulus of rupture and breaking strength
- 4) UNI EN ISO 10545-5: 2000: Determination of impact resistance by measurement of coefficient of restitution
- 5) UNI EN ISO 10545-7: 2000: Determination of resistance to surface abrasion for glazed tiles
- 6) UNI EN ISO 10545-8: 2014: Determination of linear thermal expansion
- 7) UNI EN ISO 10545-9: 2014: Determination of resistance to thermal shock
- 8) UNI EN ISO 10545-10: 2000: Determination of moisture expansion
- 9) UNI EN ISO 10545-11: 2000: Determination of crazing resistance for glazed tiles
- 10) UNI EN ISO 10545-12: 2000: Determination of frost resistance
- 11) UNI EN ISO 10545-13: 2000: Determination of chemical resistance
- 12) UNI EN ISO 10545-14: 2000: Determination of resistance to stains

Here following the results for each test together with the respective requirement specified in Annex G of the Standard UNI EN 14411, are reported.

2.1 Determination of dimensions and surface quality (UNI EN ISO 10545-2: 2000)

Work size (W) (mm): 306.5 x 611.5

Thickness (mm): 9.5

➤ Length and width

	Side A (mm)	Side B (mm)	Side C (mm)	Side D (mm)	Average (A-C) (mm)	Deviat. % from W	Average (B-D) (mm)	Deviat. % from W
1	306.4	613.1	306.6	613.1	306.5	0.0	613.1	0.3
2	306.5	612.4	307.0	613.1	306.8	0.1	612.8	0.2
3	306.7	612.3	306.2	612.0	306.5	0.0	612.2	0.1
4	305.3	610.4	305.8	610.5	305.6	-0.3	610.5	-0.2
5	305.8	612.3	306.2	611.4	306.0	-0.2	611.9	0.1
6	306.5	611.6	305.8	611.5	306.2	-0.1	611.6	0.0
7	305.9	611.8	306.1	611.7	306.0	-0.2	611.8	0.0
8	305.9	611.1	305.8	611.9	305.9	-0.2	611.5	0.0
9	307.1	613.3	306.8	613.3	306.0	-0.1	613.3	0.3
10	306.2	612.0	306.3	612.1	306.3	-0.1	612.1	0.1

Average size of the 10 test specimens (A - C) x (B - D) :

306.2 x 612.0

Deviation (%) of the average size of each tile from the average size of the 10 test samples:

	1	2	3	4	5	6	7	8	9	10
A - C	0.1	0.2	0.1	-0.2	-0.1	0.0	-0.1	-0.1	0.2	0.0
B - D	0.2	0.1	0.0	-0.3	0.0	-0.1	0.0	-0.1	0.2	0.0



Test passed according to requirement in ANNEX G EN 14411:2016: the permissible deviation of the average size for each tile (2 or 4 sides) from the working size (W): $\pm 0.6\%$

➤ Thickness

	A (mm)	B (mm)	C (mm)	D (mm)	Average (mm)	Deviat % from thickness.
1	9.3	9.2	9.3	9.2	9.3	-2.6
2	9.2	9.2	9.3	9.2	9.2	-2.9
3	9.1	9.2	9.3	9.3	9.2	-2.9
4	9.3	9.2	9.2	9.3	9.3	-2.6
5	9.2	9.3	9.2	9.2	9.2	-2.9
6	9.2	9.3	9.2	9.3	9.3	-2.6
7	9.3	9.2	9.3	9.2	9.3	-2.6
8	9.3	9.3	9.2	9.3	9.3	-2.4
9	9.2	9.4	9.3	9.2	9.3	-2.4
10	9.1	9.2	9.2	9.1	9.2	-3.7



Test passed according to requirement in ANNEX G EN 14411:2016: the permissible deviation of the average thickness for each tile from the working size thickness: $\pm 5\%$

➤ Straightness of sides

	Side A (mm)	Side B (mm)	Side C (mm)	Side D (mm)
1	-0.1	0.0	0.1	0.4
2	0.1	0.2	0.0	0.2
3	0.2	0.0	0.0	0.0
4	-0.1	0.0	0.2	0.2
5	0.2	0.1	0.0	-0.1
6	0.2	0.0	0.0	0.0
7	0.2	0.4	-0.1	-0.1
8	0.0	-0.1	0.2	0.1
9	0.2	0.2	0.0	0.1
10	0.0	0.0	0.2	0.0

Maximum deviation from straightness (%):

0.1	0.1
-----	-----



Test passed according to requirement in ANNEX G EN 14411:2016: the maximum permissible deviation from straightness, related to the corresponding work sizes: $\pm 0.5\%$

➤ Rectangularity

	Side A (mm)	Side B (mm)	Side C (mm)	Side D (mm)
1	-0.4	0.4	0.4	-1.1
2	0.0	-0.2	-0.1	-0.3
3	-0.2	-0.3	0.0	0.1
4	-0.1	-0.1	0.0	-0.6
5	0.1	-1.1	-0.2	0.6
6	-0.2	-0.6	0.1	0.1
7	0.4	-1.0	-0.5	0.4
8	-0.1	0.4	0.1	-1.0
9	0.0	-0.4	0.0	-0.5
10	0.1	0.1	-0.1	-0.6

Maximum deviation from rectangularity (%):

-0.2	-0.2
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Test passed according to requirement in ANNEX G EN 14411:2016: the maximum permissible deviation from rectangularity, related to the corresponding work sizes: $\pm 0.5\%$

➤ Surface flatness: centre curvature

Not applicable because of the tiles structured surface.

➤ Surface flatness: edge curvature

Not applicable because of the tiles structured surface.

➤ Surface flatness: warpage

Not applicable because of the tiles structured surface.

➤ Surface quality

Number of tiles tested:

30

THE VISIBLE SURFACE DEFECTS UNDER THE CONDITION REQUIRED BY THE STANDARD			
(cite the number of defected tiles for every defect type)			
Cracks	<input type="text"/>	Specks and spots	<input type="text"/>
Crazing	<input type="text"/>	Underglaze faults	<input type="text"/>
Glaze shrinkage	<input type="text"/>	Decorating faults	<input type="text"/>
Unevenness	<input type="text"/>	Shading	<input type="text"/>
Depressions	<input type="text"/>	Nipped edges	<input type="text"/>
Holes	<input type="text"/>	Nipped corners	<input type="text"/>
Glaze devitrification	<input type="text"/>		

Percentage of tiles without defects:

100



Test passed according to requirement in ANNEX G EN 14411:2016: a minimum of 95% of the tiles shall be free from visible defects that would impair the appearance of a major area of tiles.

2.2 Determination of water absorption, apparent porosity, apparent relative density and bulk density (UNI EN ISO 10545-3: 2000)

➤ BOILING METHOD

Water absorption (%) of each tiles:

Sample	1	2	3	4	5
E(b)	0.1	0.1	0.1	0.1	0.1

E(b) average (%):	0.1
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Test passed according to requirement in ANNEX G EN 14411:2016: $E(b) \leq 0.5\%$ and individual maximum 0.6%.

2.3 Determination of modulus of rupture and breaking strength (UNI EN ISO 10545-4: 2014)

d - diameter of rods (mm):

20

t - thickness of rubber (mm):

5

 l_1 - overlap of tile beyond the edge supports (mm):

10.5

 l_2 - span between the support rods (mm):

590

	1	2	3	4	5	6	7
F_{bl} - Breaking load (N)	846	784	858	848	831	845	773
F_{bs} - Breaking strength (N)	1637	1517	1660	1640	1608	1635	1495
σF_{bl} - Modulus of rupture (N/mm ²)	44.8	38.4	45.5	42.6	41.7	42.4	41.0

 F_{bl} - Average breaking load (N):

826

 F_{bs} - Average breaking strength (N):

1599

 σF_{bl} - Average modulus of rupture (N/mm²):

42.3



Test passed according to requirement in ANNEX G EN 14411:2016: breaking strength not less than 700 N; modulus of rupture average minimum 35 N/mm² and individual minimum 32 N/mm².

2.4 Determination of impact resistance by measurement of coefficient of restitution (UNI EN ISO 10545-5: 2000)

Specimens	1	2	3	4	5
Coefficient of restitution	0.71	0.69	0.74	0.72	0.77

Coefficient of restitution - Average value:

0.73

Description of defects after the test:

Surface detachment of materials.



*Test passed according to requirement in ANNEX G EN 14411:2016: declared value, see ANNEX O for additional information on applicability: determination of impact resistance by measurement of the coefficient of restitution (COR) is intended only for testing ceramic tiles according to EN ISO 10545-5 that are used in areas where impact resistance is considered to be of particular importance. **The normal requirement for light duty installation is a COR of 0.55.** For heavy duty applications, a higher figure would be required.*

2.5 Determination of resistance to surface abrasion for glazed tiles (UNI EN ISO 10545-7: 2000)

ABRASION STAGE:

PEI, failure visible at (rev.):

6000

Test solutions	RESISTANCE CLASS (ISO 10545-14)				
	Sample n. 1	Sample n. 2	Sample n.3	Sample n. 4	Sample n. 5
Stains					
Chrome green in light oil	----	----	----	----	----
Iodine (alcoholic solution 13g/l)	----	----	----	----	----
Olive oil (def. Olive Oil Agreement - 1979)	----	----	----	----	----

CLASSIFICATION:

Abrasion class:

4

Stain resistance class - References

Resistance class 1: Stain not removed.

Resistance class 2: Stain removed by dipping in a suitable solvent for 24 hours.

Resistance class 3: Stain removed by mechanical cleaning and strong cleansing agent.

Resistance class 4: Stain removed by manual cleaning with weak cleansing agent.

Resistance class 5: Stain removed by means of hot current water for 5 min.



Test passed according to requirement in ANNEX G EN 14411:2016: resistance to surface abrasion of glazed tiles intended for use on floors: abrasion class and cycles passed declared.

Where required, the abrasion class resistance according to ANNEX N may be declared. In ANNEX N, abrasion class 4 corresponds to floor coverings that are walked on by regular traffic with some scratching dirt so that conditions are more severe than Class 3 (e.g. entrances, commercial kitchen, hotel, exhibition and sale rooms).

2.6 Determination of linear thermal expansion (UNI EN ISO 10545-8: 2014)

Coefficient of linear thermal expansion ($10^{-6} \text{ }^{\circ}\text{C}^{-1}$):

7.9 ; 8.2



Test passed according to requirement in ANNEX G EN 14411:2016: declared value, see ANNEX O for additional information on applicability: most ceramic tiles have low levels of linear thermal expansion. Testing according to EN ISO 10545-8 is intended for ceramic tiles that are installed in conditions of high thermal variation.

2.8 Determination of moisture expansion (UNI EN ISO 10545-10: 2000)

	1	2	3	4	5
Moisture expansion (mm/m)	0.1	0.1	0.1	0.1	0.1

Average moisture expansion (mm/m):

0.1



Test passed according to requirement in ANNEX G EN 14411:2016: declared value, see ANNEX O for additional information on applicability: the majority of glazed and unglazed ceramic tiles have negligible moisture expansion as tested according to EN ISO 10454-10, which does not contribute to tiling problems when tiles are correctly installed. However, with unsatisfactory fixing practices or in certain climatic conditions, moisture expansion in excess of 0.6 mm/m may contribute to problems.

2.9 Determination of crazing resistance for glazed tiles (UNI EN ISO 10545-11: 2000)

Number of test specimens:

5

Number of test specimens showing crazing:

0



Test passed according to requirement in ANNEX G EN 14411:2016: to pass all 5 specimens should be without defect at the end of the test.

For uses where it is applicable, see Table 2 of EN 14411:2016:

THESE TILES ARE SUITABLE FOR INTERIOR AND EXTERIOR FLOORINGS AND INTERIOR AND EXTERIOR WALLS.

2.10 Determination of frost resistance (UNI EN ISO 10545-12: 2000)

Number of tiles in the test sample:

Water content before the freeze-thaw test:

Water content after the freeze-thaw test:

Description of defects before the test:

Damages on the glaze or proper surface and the edges of tiles after the freeze-thaw test:

Number of damaged tiles after 100 cycles from -5° C to +5° C:



Test passed according to requirement in ANNEX G EN 14411:2016: to pass all 10 specimens should be without defect at the end of the test.

For uses where it is applicable, see Table 2 of EN 14411:2016:

THESE TILES ARE SUITABLE FOR EXTERIOR APPLICATIONS.

2.11 Determination of chemical resistance (UNI EN ISO 10545-13: 2000)

Test solution used	RESISTANCE CLASS OF THE 5 SAMPLES				
	1	2	3	4	5
Household Chemicals: Ammonium Chloride 100 g/l	GA(V)	GA(V)	GA(V)	GA(V)	GA(V)
Swimming pool salts: Sodium hypochlorite 20 mg/l	GA(V)	GA(V)	GA(V)	GA(V)	GA(V)
Acids: Hydrochloric acid 3 % V/V Citric acid 100 g/l	GLA(V) GLA(V)	GLA(V) GLA(V)	GLA(V) GLA(V)	GLA(V) GLA(V)	GLA(V) GLA(V)
Alkali: Potassium Hydroxide 30 g/l	GLA(V)	GLA(V)	GLA(V)	GLA(V)	GLA(V)
Acids: Hydrochloric acid 18 % V/V Lactic acid 5 % V/V	GHA(V) GHA(V)	GHA(V) GHA(V)	GHA(V) GHA(V)	GHA(V) GHA(V)	GHA(V) GHA(V)
Alkali: Potassium Hydroxide 100 g/l	GHA(V)	GHA(V)	GHA(V)	GHA(V)	GHA(V)

Pencil test is applicable:

NO

Reflexion test is applicable:

NO

CLASSIFICATION

U = Unglazed tiles

G = Glazed tiles

L = Low concentration chemicals

H = High concentration chemicals

Pencil test and/or reflection test are applicable:

- Class A: no visible effect
- Class B: definitive change in appearance
- Class C: partial or complete loss of the surface

Pencil test and/or reflection test not applicable:

- Class A (V): no visible effect
- Class B (V): definitive change in appearance
- Class C (V): partial or complete loss of the surface



Test passed according to requirement in ANNEX G EN 14411:2016:

- *resistance to low concentrations of acids and alkalis: declared value**
- *resistance to high concentrations of acids and alkalis: declared value**
- *resistance to household chemicals and swimming pool salts: MINIMUM class B*

** See ANNEX O for additional information on applicability: ceramic tiles are normally resistant to common chemicals. The test performed according to EN ISO 10545-13 for high concentrations of acids and alkalis, is intended for ceramic tiles which are to be used in potentially corrosive conditions.*

2.12 Determination of resistance to stains (UNI EN ISO 10545-14: 2015)

Test solutions	RESISTANCE CLASS				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Stains					
Chrome green in light oil	5	5	5	5	5
Iodine (alcoholic solution 13g/l)	5	5	5	5	5
Olive oil (def. Olive Oil Agreement - 1979)	5	5	5	5	5

Stain resistance class - References

Resistance class 1: Stain not removed.

Resistance class 2: Stain removed by dipping in a suitable solvent for 24 hours.

Resistance class 3: Stain removed by mechanical cleaning and strong cleansing agent.

Resistance class 4: Stain removed by manual cleaning with weak cleansing agent.

Resistance class 5: Stain removed by means of hot current water for 5 min.



Test passed according to requirement in ANNEX G EN 14411:2016: Minimum Class 3, see ANNEX O for additional information on applicability: the test performed according to EN ISO 10545-14 is compulsory for glazed ceramic tiles. This method does not address the temporary color changes that may occur in certain types of glaze tile due to the absorption of water in the body under glaze.

2.13 Determination of lead and cadmium given off by glazed tiles (UNI EN ISO 10545-15: 2000)

To the tile samples surface it is applied a silicon boundary of about 6 mm and the samples are filled of acetic acid solution (4%).

- VOLUME ACETIC ACID 4%

V 150 ml

- ANALYZED AREA

S 3.53 dm²

- DETECTED LEAD IN THE SOLUTION

Pb 1.5 mg/l

- DETECTED CADMIUM IN THE SOLUTION

Cd < 0.01 mg/l

- NUMBER OF TESTED SAMPELS

N° 4 specimens

Results:

LEAD RELEASED:	0.1	mg/dm ²
CADMIUM RELEASED:	< 0.001	mg/dm ²



Test passed according to requirement in ANNEX G EN 14411:2016: declared value.

For uses where it is applicable, see Table 2 of EN 14411:2016:

RELEASE OF LEAD: for glazed ceramic tile only, when intended to be used on worktops and on wall surfaces where food preparation takes place and food may be in direct contact with the glazed tile surface. As indicative limits, reference could be made to Directive 2005/31/CE.

(For lead the limit is 0.8 mg/dm²).

3. UNI certification

The product "STONEWORK GL SR, type WINCER, code K1EH" obtained the UNI-Keymark certification, as following shown.

		
CERTIFICATO DI CONCESSIONE DEL DIRITTO D'USO DEL MARCHIO CERTIQUALITY-UNI E CEN KEYMARK DI CONFORMITA' ALLA NORMA UNI EN 14411:20012 PER LE PIASTRELLE DI CERAMICA		
<u>ORGANIZZAZIONE:</u> MARAZZI GROUP S.r.l. Viale Regina Pacis, 39- 41049 Sassuolo		
CONTRATTO N. P 0053		
<u>CONCESSIONE N.</u> PT 0269		
STABILIMENTO: MARAZZI – Via Carazzoli, 22 – 41042 Fiorano Modenese (MO) Brand: MARAZZI Gruppo di prodotto: B I a Superficie: smaltata Resistenza al gelo: garantita		
 		
Serie commerciali oggetto della concessione: STONEWORK GL SR		
I prodotti della serie STONEWORK GL SR, Tipo: Wincer non risultano idonei nel caso in cui l'impiego previsto è soggetto a sbalzi termici localizzati (rif. Tab. 2 B6 nota f UNI EN 14411:2012)		
La Concessione del diritto d'uso del marchio è soggetto al rispetto del Regolamento Certiquality DOC 32 e della norma di riferimento EN 14411:2012. Il presente certificato non è da ritenersi valido se non accompagnato dal relativo allegato. La concessione del diritto d'uso del marchio si intende estesa a tutti i prodotti riportati in Allegato. La validità del presente certificato è subordinata a sorveglianza periodica almeno annuale.		
CERTIFICAZIONE "SYSTEM 3" SECONDO ISO/IEC 17067:2013		
Il presente certificato non è da ritenersi valido se non accompagnato dal relativo allegato This certificate is not valid without the relative Annex		



IGO N° 008 A 221 N° 007 G
 IGA N° 008 D SGE N° 001 M
 SCR N° 002 F ISF N° 006 E
 FSM N° 006 I GAG N° 001 O
 PRD N° 008 B IMA N° 008 P
 CAP N° 003 H IRE N° 004 L
 Membro degli Accordi di Mutuo Riconoscimento
 EA, IAF e IAC
 Signatory of EA, IAF and IAC
 Mutual Recognition Agreements

16/10/2017
 Emissione corrente


 Certiquality S.r.l. - Il Presidente

		ALLEGATO AL CERTIFICATO PT0269				Pagina 1 di 1
<small>Il presente Allegato non è da ritenersi valido se non accompagnato dal relativo Certificato. La concessione del diritto d'uso del marchio si intende estesa a tutti i prodotti riportati in Allegato</small>						
SERIE COMMERCIALE			CODICE			
1	STONWORK GL SR (9,5 mm) Wincer		30x60 cm			
			>K1EH			
<small>> serie commerciali su cui sono state eseguite le prove</small>						

Data di emissione 16/10/2017

Il Presidente


