

TEST REPORT

No. : XMIN2310001178CM02_EN

Date : 2023-12-28

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CUSTOMER NAME: ROYAL MANUFACTURE AND INVESTMENT JOINT STOCK COMPANY

ADDRESS: ROAD NO.8, NHON TRACH II INDUSTRIAL PARK, NHON PHU, HIEP PHUOC TOWN, NHON TRACH DIST., DONG NAI PROV., VIET NAM

Sample Name : PORCELAIN TILE - GROUP BIA

Product Specification : 60x60 cm thickness 20mm

Manufacturer : ROYAL MANUFACTURE AND INVESTMENT JOINT STOCK COMPANY

Intended use : Internal and external flooring, wall

Above information and sample(s) was/were submitted and confirmed by the client. SGS, however, assumes no responsibility to verify the accuracy, adequacy and completeness of the sample information provided by client.

Test Required : EN 14411:2012 Ceramic tiles - Definitions, classification, characteristics and marking
Annex G Requirements for dry-pressed ceramic tiles with low water absorption of Group BI_a ($E_b \leq 0.5\%$)

SGS Ref. No. : XMIN2310000061CPC01

Date of Receipt : 2023-10-11

Testing Period : 2023-10-11 ~ 2023-12-28

Test result(s) : For further details, please refer to the following page(s)
(Unless otherwise stated the results shown in this test report refer only to the sample(s) tested)

Signed for
SGS-CSTC Standards Technical
Services Co.,Ltd. Xiamen Branch.

Bryan Hong
Authorized signatory



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Sample description:

Glazed ceramic tiles, see the photo(s)

Test result(s):

Work size: 600mm×600mm×20mm

No.	Test item(s)	Test method(s)	Standard requirements EN 14411:2012 Annex G (Dry-pressed ceramic tiles $E_b \leq 0.5\%$ Group BI _a , nominal size $N \geq 15\text{cm}$)	Test result(s)	Conclusion	
1	Length and width	EN ISO 10545- 2:2018	Average value	600.02 mm	Pass	
			The permissible deviation of the average size for each tile (2 or 4 sides) from the work size: $\pm 0.6\%$, $\pm 2.0\text{mm}$	-0.03%~0.02% -0.18mm~0.11mm		
	Thickness		Average value	20.00 mm	Pass	
			The permissible deviation, of the average thickness of each tile from the work size thickness: $\pm 5.0\%$, $\pm 0.5\text{mm}$	-0.25%~+0.50% -0.05mm~+0.10mm		
	Straightness of sides		The maximum permissible deviation from straightness, related to the corresponding work sizes: $\pm 0.5\%$, $\pm 1.5\text{mm}$	-0.02%~+0.04% -0.14mm~+0.24mm	Pass	
	Rectangularity		The maximum permissible deviation from rectangularity, related to the corresponding work sizes: $\pm 0.5\%$, $\pm 2.0\text{mm}$	-0.05%~+0.17% -0.29mm~+1.04mm	Pass	
	Surface flatness		Centre curvature	The maximum permissible deviation related to diagonal calculated from the work sizes: $\pm 0.5\%$, $\pm 2.0\text{mm}$	-0.05%~+0.04% -0.45mm~+0.34mm	Pass
			Edge curvature	The maximum permissible deviation related to the corresponding work sizes: $\pm 0.5\%$, $\pm 2.0\text{mm}$	-0.05%~+0.03% -0.30mm~+0.19mm	Pass
			Warpage	The maximum permissible deviation related to diagonal calculated from the work sizes: $\pm 0.5\%$, $\pm 2.0\text{mm}$	-0.15%~+0.04% -1.28mm~+0.31mm	Pass
	Surface quality		A minimum of 95% of the tiles shall be free from visible defects that would impair the appearance of a major area of tiles	No visible defects	Pass	



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No.	Test item(s)	Test method(s)	Standard requirements EN 14411:2012 Annex G (Dry-pressed ceramic tiles $E_b \leq 0.5\%$ Group BI _a , nominal size $N \geq 15\text{cm}$)	Test result(s)	Conclusion
2	Water absorption	EN ISO 10545-3:2018	$E_b \leq 0.5\%$ Individual maximum 0.6%	Average: 0.01% Maximum: 0.02%	Pass
3	Breaking strength	EN ISO 10545-4:2019	Thickness $\geq 7.5\text{mm}$ Not less than 1300 N	Average: 14035 N	Pass
	Modulus of rupture		Minimum 35 N/mm ² Individual minimum 32 N/mm ²	Average: 54 N/mm ² Minimum: 53 N/mm ²	Pass
4	Coefficient of linear thermal expansion	EN ISO 10545-8:2014	Declared value	$\alpha_1: 4.7 \times 10^{-6}/^\circ\text{C}$ $\alpha_2: 4.9 \times 10^{-6}/^\circ\text{C}$	/
5	Thermal shock resistance	EN ISO 10545-9:2013	Pass according to EN ISO 10545-1	No visible defects	Pass
6	Crazing resistance	EN ISO 10545-11:1996	Pass according to EN ISO 10545-1	No crazing	Pass
7	Frost resistance	EN ISO 10545-12:1997	Pass according to EN ISO 10545-1	No visible defects	Pass



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No.	Test item(s)		Test method(s)	Standard requirements EN 14411:2012 Annex G (Dry-pressed ceramic tiles $E_p \leq 0.5\%$ Group BI _a , nominal size $N \geq 15\text{cm}$)	Test result(s)	Conclusion
8	Chemical resistance	Hydrochloric acid solution 3% (V/V)	EN ISO 10545-13:2016	Declared value	LA	/
		Citric acid solution (100g/L)			LA	/
		Potassium hydroxide solution (30g/L)			LA	/
		Household chemicals: Ammonium chloride solution (100g/L)		Minimum class B	A	Pass
		Swimming pool salts: Sodium hypochlorite solution (20mg/L)			A	Pass
9	Resistance to stains	Iodine: 13 g/L solution in alcohol	EN ISO 10545-14:2015	Minimum class 3	Class 5	Pass
		Green staining agent			Class 5	Pass
		Olive oil			Class 5	Pass
10	Slip Resistance		CEN/TS 16165:2012 Annex C	Declared value	SRV "dry": 82 SRV "wet": 38	/

Note: Pass : Meet the requirements;
Fail : Does not meet the requirements;
/ : Not Apply to the judgment.



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Original Sample Photo:



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1. Dimension and surface quality

Test method:

ISO 10545-2:2018 Ceramic tiles — Part 2: Determination of dimensions and surface quality

Test result(s):

1). Length, width and thickness

Specimens: ceramic tiles, 600mm×600mm×20mm, 10pcs

Work size: 600mm×600mm×20mm

Specimens identification No.	Average Length and Width (mm)	Deviation from work size (%)	Average Thickness (mm)	Deviation from work size (%)
1	600.04	0.01	20.10	0.50
2	600.11	0.02	20.00	0.00
3	600.08	0.01	20.00	0.00
4	600.09	0.02	20.00	0.00
5	600.10	0.02	20.02	0.10
6	599.86	-0.02	19.95	-0.25
7	599.82	-0.03	20.05	0.25
8	599.92	-0.01	19.99	-0.05
9	600.06	0.01	19.95	-0.25
10	600.08	0.01	19.98	-0.10
Average of 10 tiles	600.02	/	20.00	/



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2). Straightness of sides, rectangularity

Specimens: ceramic tiles, 600mm×600mm×20mm, 10pcs

Work size: 600mm×600mm×20mm

Specimens identification No.	Straightness of sides (max deviation related to the corresponding work sizes)		Rectangularity (max deviation related to the corresponding work sizes)	
	mm	%	mm	%
1	-0.14~0.19	-0.02~0.03	-0.29~0.75	-0.05~0.12
2	0.03~0.16	0.00~0.03	-0.29~0.40	-0.05~0.07
3	0.05~0.20	0.01~0.03	0.04~0.65	0.01~0.11
4	0.03~0.19	0.00~0.03	0.02~0.55	0.00~0.09
5	0.05~0.16	0.01~0.03	-0.22~0.42	-0.04~0.07
6	0.01~0.24	0.00~0.04	-0.20~1.04	-0.03~0.17
7	0.05~0.15	0.01~0.02	0.37~0.56	0.06~0.09
8	0.14~0.24	0.02~0.04	-0.27~0.52	-0.05~0.09
9	0.15~0.23	0.02~0.04	0.11~0.42	0.02~0.07
10	0.07~0.24	0.01~0.04	0.13~0.21	0.02~0.03



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3). Surface flatness

Specimens: ceramic tiles, 600mm×600mm×20mm, 10pcs

Work size: 600mm×600mm×20mm

Specimens identification No.	Surface flatness					
	Centre curvature (max deviation related to diagonal)		Edge curvature (max deviation related to the corresponding work sizes)		Warpage (max deviation related to diagonal)	
	mm	%	mm	%	mm	%
1	-0.45~-0.11	-0.05~-0.01	-0.30~0.19	-0.05~0.03	-0.78~-0.27	-0.09~-0.03
2	-0.20~0.21	-0.02~0.02	-0.18~0.19	-0.03~0.03	-0.78~-0.38	-0.09~-0.04
3	-0.09~0.22	-0.01~0.03	-0.22~-0.06	-0.04~-0.01	-0.74~0.20	-0.09~0.02
4	-0.26~0.05	-0.03~0.01	-0.30~-0.08	-0.05~-0.01	-1.28~0.31	-0.15~0.04
5	0.16~0.26	0.02~0.03	-0.11~0.08	-0.02~0.01	-0.95~-0.09	-0.11~-0.01
6	0.21~0.34	0.02~0.04	-0.12~0.09	-0.02~0.02	-1.00~-0.39	-0.12~-0.05
7	0.16~0.30	0.02~0.04	-0.10~0.16	-0.02~0.03	-0.66~-0.40	-0.08~-0.05
8	-0.31~-0.06	-0.04~-0.01	-0.12~0.17	-0.02~0.03	-0.57~-0.15	-0.07~-0.02
9	-0.12~0.11	-0.01~0.01	-0.21~-0.05	-0.03~-0.01	-0.54~-0.19	-0.06~-0.02
10	-0.23~-0.19	-0.03~-0.02	-0.19~-0.06	-0.03~-0.01	-0.60~-0.25	-0.07~-0.03

4). Surface quality

10 pcs of samples for test, 100% of the tiles were free from visible defects.



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2. Water absorption

Test method:

EN ISO 10545-3:2018 Ceramic tiles — Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density

Specimens: ceramic tiles, 200mm×200mm×20mm, 5pcs

Test result(s):

Specimens identification No.	1	2	3	4	5
Water absorption (%)	0.01	0.01	0.01	0.02	0.01
Mean value (%)	0.01				

3. Modulus of rupture and Breaking strength

Test method:

EN ISO 10545-4:2019 Ceramic tiles — Part 4: Determination of Modulus of rupture and Breaking strength

Specimens: ceramic tiles, 600mm×600mm×20mm, 7pcs

Test result(s):

Specimens identification No.	1	2	3	4	5	6	7
Breaking strength (N)	14369	13692	14305	13981	13761	14292	13842
Mean value (N)	14035						
Modulus of rupture (N/mm ²)	56	53	55	54	53	55	53
Mean value (N/mm ²)	54						



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4. Coefficient of linear thermal expansion

Test method:

EN ISO 10545-8:2014 Ceramic tiles — Part 8: Determination of linear thermal expansion

Specimens: ceramic tiles, 50mm×10mm×6mm, 2pcs

Test result(s):

Heating rate: 5°C /min

Specimens identification No.	1	2
Coefficient of linear thermal expansion ($\times 10^{-6}/^{\circ}\text{C}$)	4.7	4.9

5. Thermal shock resistance

Test method:

EN ISO 10545-9:2013 Ceramic tiles — Part 9: Determination of resistance to thermal shock

Specimens: ceramic tiles, 300mm×300mm×20mm, 5pcs

Test result(s):

Specimens identification No.	1	2	3	4	5
Description of damage	No visible defects				

6. Crazeing resistance

Test method:

EN ISO 10545-11:1996 Ceramic tiles — Part 11: Determination of crazeing resistance for glazed tiles

Specimens: ceramic tiles, 200mm×200mm×20mm, 5pcs

Test result(s):

Specimens identification No.	1	2	3	4	5
Description of damage	No crazeing				



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7. Frost resistance

Test method:

EN ISO 10545-12:1997 Ceramic tiles — Part 12: Determination of frost resistance

Specimens: ceramic tiles, 300mm×300mm×20mm, 10pcs

Test result(s):

Specimens identification No.	1	2	3	4	5
Description of damage	No visible defects				
Specimens identification No.	6	7	8	9	10
Description of damage	No visible defects				

8. Chemical resistance

Test method:

EN ISO 10545-13:2016 Ceramic tiles — Part 13: Determination of chemical resistance

Specimens: ceramic tiles, 50mm×50mm×20mm, 25pcs

Test result(s):

Specimens identification No.		1	2	3	4	5
Resistance to chemicals	Hydrochloric acid solution 3% (V/V)	LA	LA	LA	LA	LA
	Citric acid solution (100g/L)	LA	LA	LA	LA	LA
	Potassium hydroxide solution (30g/L)	LA	LA	LA	LA	LA
	Household chemicals: Ammonium chloride solution (100g/L)	A	A	A	A	A
	Swimming pool salts: Sodium hypochlorite solution (20mg/L)	A	A	A	A	A



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9. Resistance to stains

Test method:

EN ISO 10545-14:2015 Ceramic tiles — Part 14: Determination of resistance to stains

Specimens: ceramic tiles, 100mm×100mm×20mm, 15pcs

Test result(s):

Specimens identification No.		1	2	3	4	5
Resistance to stains	Iodine: 13 g/L solution in alcohol	Class 5				
	Green staining agent	Class 5				
	Olive oil	Class 5				

10. Pendulum friction test

Test Method:

CEN/TS 16165:2012 Determination of slip resistance of pedestrian surfaces - Methods of evaluation

Annex C Pendulum friction test

Specimens: 200mm×150mm×20mm, 6pcs

Type of slider: slider 57 (CEN rubber)

Testing surface: see photo

Test result(s):

Specimens identification No.	1	2	3	4	5	6
Mean pendulum value (Dry condition)	81	82	82	83	82	81
Slip resistance value (SRV "dry")	82					
Mean pendulum value (Wet condition)	38	40	37	37	36	37
Slip resistance value (SRV "wet")	38					

Note: The test results in this test report were transferred from test report No.: XMIN2310001178CM01_EN dated: 2023-10-30.

*****End of report*****



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