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Your Ref: DO No: M25066
Dated 10/06/2013

Our Ref: CT-24173/RT
TEST REPORT

Date: 11/07/2013

Page 1 of 9

(This Report is issued subject to the terms & conditions set out below)

Subject : Testing of Unglazed Porcelain Tiles submitted by Niro Ceramic Malaysia Sdn Bhd on 11/06/2013.

Tested For : **NIRO CERAMIC MALAYSIA SDN BHD**
PLO 316 Jalan Perak 4
Pasir Gudang
Johor 81700 Malaysia
Attn: Ms Shanice Lee

Method of Test : Surface Quality Test - BS EN ISO 10545 – 2: 1997
Dimensional Test - BS EN ISO 10545 – 2: 1997
Straightness of Sides Test - BS EN ISO 10545 – 2: 1997
Rectangularity Test - BS EN ISO 10545 – 2: 1997
Flatness of Surface Test - BS EN ISO 10545 – 2: 1997
Water Absorption Test - BS EN ISO 10545 – 3: 1997
Modulus of Rupture Test - BS EN ISO 10545 – 4: 1997
Resistance to Deep Abrasion Test - BS EN ISO 10545 – 6: 1997
Chemical Resistance Test - BS EN ISO 10545 – 13: 1997
Stain Resistance Test - BS EN ISO 10545 – 14: 1997
Oil-Wet Ramp Test - SS 485: 2011 (Annex D)

Specification : BS EN 14411: 2006 (Annex G)
SS 485: 2011

Sample Reference : The details as furnished by client are as follows:
Material: Unglazed Porcelain Tiles, Brand: Niro Granite
Ref: Regal (GMR) Matt
Country of Origin: China
Work size: 600mm x 600mm x 10mm.

Description of Sample : 50 pieces of Tiles were received
Nominal size: 600mm x 600mm x 10mm
(See photograph attached).

Results : Refer to pages 2 to 8 for the results

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Results:**1) Surface Quality Test**

30 pieces of the batch of the tile sample were inspected in accordance with BS EN ISO 10545 -2:1997 and found to be free from cracks, crazing, dry spots, unevenness, holes, glaze devitrification, specks, spots, underglaze faults, decorating faults, chips, blisters, rough edges and welts on the surfaces.

(2) Dimension Test

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										Status	
	1	2	3	4	5	6	7	8	9	10		BS EN 14411: 2006 Specification
Date of Test	20/06/2013											
Dimension (mm)	Length / Width	599.6	599.6	599.6	599.6	599.7	599.8	599.8	599.6	599.5	599.6	
	Average	599.6										
	Work Size	600										
	Deviation of measurement size from Average, (%)	0.00	0.00	0.00	0.00	0.02	0.03	0.03	0.00	-0.02	0.00	± 0.5%
Thickness (mm)	Deviation of measurement size from Work Size, (%)	-0.07	-0.07	-0.07	-0.07	-0.05	-0.03	-0.03	-0.07	-0.08	-0.07	± 0.6%
	Measured	9.7	9.6	9.7	9.7	9.9	9.7	9.7	9.6	9.6	9.6	
	Average	9.7										
	Work Size	10										
Deviation of measurement size from Work Size, %	-3.00	-4.00	-3.00	-3.00	-1.00	-3.00	-3.00	-4.00	-4.00	-4.00	-4.00	± 5.0%

Results:**(3) Straightness of Sides Test**

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										BS EN 14411: 2006 Specification	Status	
Specimen Reference	1	2	3	4	5	6	7	8	9	10			
Date of Test	02/07/2013												
Maximum Deviation, L_{max} (Work Size) (%)	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	± 0.5 %	Passed

(4) Rectangularity Test

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										BS EN 14411: 2006 Specification	Status	
Specimen Reference	1	2	3	4	5	6	7	8	9	10			
Date of Test	02/07/2013												
Maximum Deviation, L_{max} (Work Size) (%)	-0.02	-0.04	-0.01	-0.01	-0.06	-0.02	-0.04	-0.02	-0.01	-0.05	-0.05	± 0.6%	Passed

(5) Centre Curvature Test

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										BS EN 14411: 2006 Specification	Status	
Specimen Reference	1	2	3	4	5	6	7	8	9	10			
Date of Test	02/07/2013												
Related to diagonal calculated from the work sizes (%)	-0.12	-0.15	0.05	0.04	-0.06	0.04	-0.09	-0.06	-0.11	-0.07	-0.07	± 0.5 %	Passed

(6) Edge Curvature Test

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										BS EN 14411: 2006 Specification	Status	
Specimen Reference	1	2	3	4	5	6	7	8	9	10			
Date of Test	02/07/2013												
Related to the corresponding work sizes (%)	-0.07	-0.10	-0.07	-0.05	-0.07	-0.02	-0.08	-0.05	-0.09	-0.08	-0.08	± 0.5 %	Passed

M
A

Results:

(7) Warpage Test

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										Status
	BS EN 14411: 2006 Specification										
Specimen Reference	1	2	3	4	5	6	7	8	9	10	Status
Date of Test	02/07/2013										
Related to diagonal calculated from the work sizes.	0.19	0.18	0.21	0.15	0.20	0.15	0.19	0.17	0.22	0.21	

(8) Water Absorption, Apparent Porosity, Apparent Relative Density & Bulk Density Tests

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China									
Specimen Reference	1	2	3	4	5	6	7	8	9	10
Date of Test Commencement	26/06/2013									
Water Absorption By Boiling (%)	0.07	0.05	0.05	0.07	0.05	0.04	0.04	0.04	0.04	0.05
Average Water Absorption By Boiling (%)	0.05									
Water Absorption By Vacuum (%)	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02
Average Water Absorption By Vacuum (%)	0.02									
Apparent Porosity (%)	0.05	0.04	0.03	0.03	0.04	0.05	0.03	0.02	0.04	0.04
Average Porosity (%)	0.04									
Apparent Relative Density	2.29	2.34	2.28	2.27	2.28	2.35	2.41	2.35	2.43	2.36
Average Relative Density	2.34									
Bulk Density (g/cm ³)	2.29	2.34	2.28	2.27	2.28	2.35	2.41	2.35	2.43	2.36
Average Bulk Density (g/cm ³)	2.34									

Individual Maximum : 0.07% (by boiling)

Water Absorption E : ≤ 0.5%

Classification Group : Group Bla, (refer to BS EN 14411:2006 (Annex G))

Remark: The above results were found under the Bla group with water absorption ≤ 0.5% and their individual absorption within 0.6% (maximum)



Results:

(9) Modulus of Rupture Test

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										Status	
	1	2	3	4	5	6	7	8	9	10		BS EN 14411: 2006 Specification
Date of Test	20/06/2013											
Diameter of rod, d (mm)	20.4											
Thickness of rubber, t (mm)	5.3											
Span, l ₂ (mm)	280											
Overlap, l ₁ (mm)	10											
Width (mm)	301.0	301.0	301.0	301.1	301.1	301.1	301.2	301.2	301.1	301.1	301.1	
Min. Thickness along broken edge (mm)	8.65	8.63	8.51	8.41	8.71	8.36	8.46	8.36	8.36	8.56	8.44	
Breaking Load (N)	2495	2472	2418	2489	2473	2476	2449	2410	2453	2466		
Average Breaking Load (N)	2460											
Breaking Strength (N)	2320.9	2299.5	2249.3	2314.6	2299.7	2301.7	2276.6	2241.1	2281.1	2293.2		
Average Breaking Strength (N)	2287.8										Not less than 1300	
Modulus of Rupture (N/mm ²)	46.5	46.3	46.6	49.1	45.5	49.4	47.7	48.1	46.7	48.3	Minimum Individual 32	Passed
Average Modulus of Rupture (N/mm ²)	47.4										Minimum 35	Passed

Dimension of tile, L (mm)	Diameter of rod, d (mm)	Thickness of rubber, t (mm)	Overlap of tile beyond the edge support, l ₁ (mm)
18 ≤ L < 48	5	1 ± 0.2	2
48 ≤ L < 95	10	2.5 ± 0.5	5
L ≥ 95	20	5 ± 1	10

M
A

Results:**(10) Resistance to Deep Abrasion Test**

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										BS EN 14411: 2006 Specification
	1	2	3	4	5						
Date of Test	21/06/2013										-
Chord Length L (mm)	23.0	22.5	23.0	22.5	22.0	22.0	22.0	22.0	22.5	22.5	22.5
Volume of Material removed V (mm ³)	102	95	102	95	89	89	89	89	95	95	95
Average Volume of Material removed V _m (mm ³)	94.6										Max 175 (for unglazed type)

Note: ⊥ denotes perpendicular groove
/ denotes parallel groove

(11) Chemical Resistance Test

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China										BS EN 14411: 2006 Specification
	1	2	3	4	5						
Date of Test Commencement	21/06/2013										
Ammonium Chloride Solution (100g/l)	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
Sodium Hypochlorite Solution (20mg/l)	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
Hydrochloric Acid Solution (3% (V/V))	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA
Citric Acid Solution (100g/l)	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA
Potassium Hydroxide Solution (30g/l)	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA	ULA

CLASSIFICATION

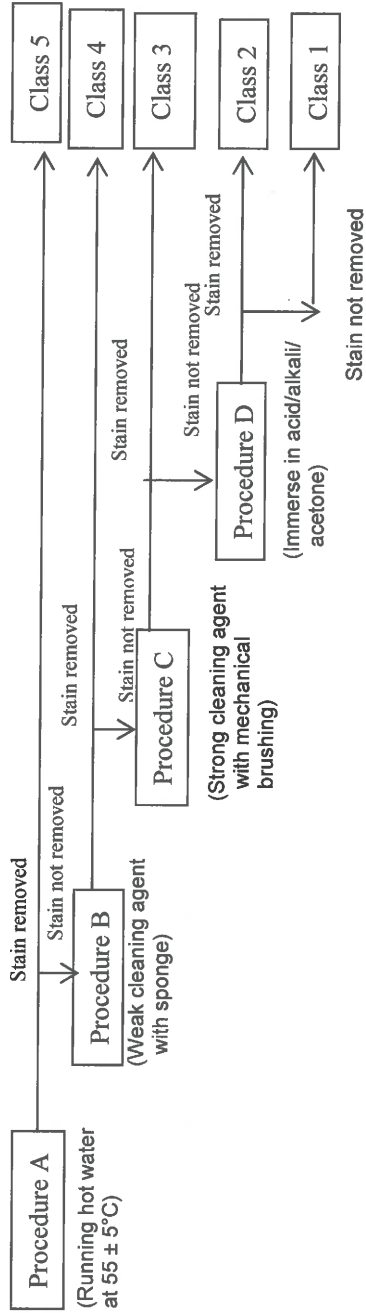
Test Solutions	Classification	Description
(1) Ammonium Chloride	UA	No visible effect.
(2) Sodium Hypochlorite	UB	Visible effects on cut sides.
	UC	Visible effects on cut & non-cut sides & on the proper surface.
Low Concentration	ULA	No visible effects.
(3a) Hydrochloric Acid	ULB	Visible effects on cut sides.
(3b) Citric Acid	ULC	Visible effects on cut & non-cut sides & on the proper surface.
(3c) Potassium Hydroxide		

Results:

(12) Stain Resistance Test

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China				BS EN 14411: 2006 Specification	
Specimen Reference	1	2	3	4	5	
Date of Test Commencement	24/06/2013					
Staining Agents	Class	Class	Class	Class	Class	Class
Green Test paste	5	5	5	5	5	5
Iodine solution	5	5	5	5	5	5
Olive Oil	5	5	5	5	5	5
						Test method available

Classification



M *R*

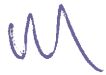
Results:

(13) Oil-Wet Ramp Test (Slip Resistance By Inclined Platform)

Sample Reference	600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China					
Date of Test	21/06/2013					
Surface Structure	Smooth					
Test Temperature	24°C / 57% RH					
Test No.	First Person			Second Person		
	1	2	3	4	5	6
Critical Angle (°)	10.9	11.3	10.8	10.6	10.8	10.7
Average Angle (°)	10.9					

Remarks:

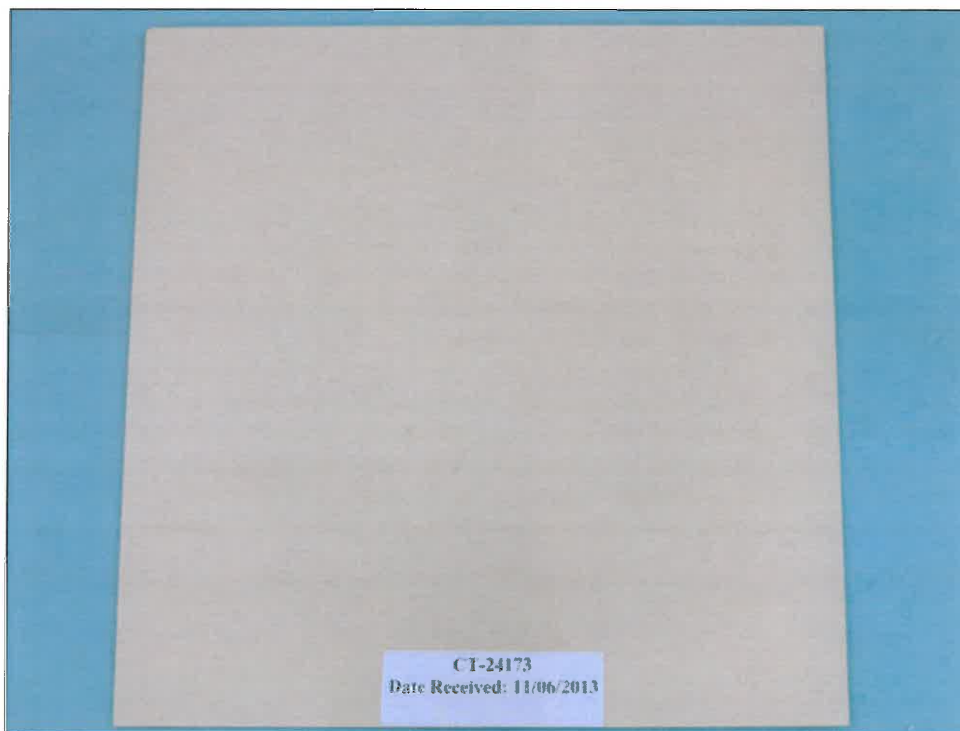
- 1) The result met R10 classification.
- 2) Refer to Appendix A for classification.



Muniyapan A/L Krishnan
Testing Officer



Raymond Tan
Principal Engineer (CMTD)
Construction Technology Division



Photograph showing 600 x 600 x 10mm, Unglazed Porcelain Tiles, Brand: Niro Granite, Ref: Regal (GMR) Matt, Country of Origin: China as received on 11/06/2013

APPENDIX B
Classification Extracted From SS 485: 2011

Table 1: Classification of pedestrian surface materials according to the oil wet ramp test

Classification	Angle (Degrees)
R9	6 up to less than 10
R10	10 up to less than 19
R11	19 up to less than 27
R12	27 up to less than 35
R13	≥ 35

Selection of pedestrian surface materials

It should be noted that compliance with the recommendations of this appendix will not necessarily alleviate all hazards. However, it will reduce certain pedestrian risks.

Other design considerations include the amount and type of expected traffic (vehicles, trolleys, people hurrying, elderly, disabled people with or without walking aids, and children); the product characteristics (wear resistance and cleanability) and the consequences of exposure to the types of contamination minimization); management policy and maintenance practices (types of cleaning equipment, frequency and effectiveness of cleaning); compliance with occupational, health and safety requirements; special provisions for slip hazards (guards and handrails); and alternative information sources (use of contrasting colours and warning signs).

Table 2: Pedestrian flooring selection guide – minimum pendulum or ramp recommendation for specific locations

Location	Pendulum	Ramp
External colonnade, walkways and pedestrian crossings	W	R10
External ramps	V	R11
Entry foyers hotel, office, public buildings – wet	X	R10
Entry foyers hotel, office, public buildings – dry	Z	R9
Shopping centre excluding food court	Z	R9
Internal ramps, slopes (greater than 2 degrees) – dry	X	R10
Lift lobbies other than entry foyers	Z	R9
Other shops with external entrances – entry area	X	R10
Food outlets including fast food outlets, buffet food servery areas	X	R10
Hospitals and aged care facilities – dry areas	Z	R9
Hospitals and aged care facilities – ensuites	X	A or R10
Shop and supermarket aisles except fresh food areas	Z	R9
Shop and supermarket fresh food areas	X	R10
Communal changing rooms	X	A
Swimming pool surrounds and communal shower rooms	W	B
Swimming pool ramps and stairs leading into water	V	C
Toilet facilities in offices, hotels, shopping centres	X	R10
Undercover concourse areas of sports stadium	X	R10
Accessible internal stair nosings (dry) – handrails present	X	R10
Accessible internal stair nosings (wet) – handrails present	W	B or R11
External stair nosings	W	R11

Note 1 - Appropriate measures need to be taken to exclude casual water from dry areas.

Note 2 - All floors with a wet pendulum classification of Z should have a dry floor friction of F unless normal usage dictates that the floor should have a low dry coefficient of friction, e.g dance floors.

