## **Technical Properties 1**

### Frost resistance

All ranges of quarry tiles supplied by Natural Tiles Ltd are manufactured to comply with the requirements for tiles subjected to extremes of temperature.

The British/European/International standards include a frost resistance test which is described in BS EN ISO 10545: Part 12. The method involves testing a minimum of 10 tiles by impregnation with water and freeze/thaw cycling between  $+5^{\circ}$ C and  $-5^{\circ}$ C. A minimum of 100 such cycles without damage is required for classification as frost resistant.

All Natural Tiles Group AI and Group AIIa quarry tiles exhibit no signs of damage after 100 cycles of the above test and are classified as frost resistant.

Under BS EN 14411:2003 all products within Group A1 are required to be classified as frost resistant and suitable for use under all climatic conditions.

In general terms, frost resistance is related to water absorption and the following table may be used as a guide in relation to our three main ranges.

Water Absorption	Frost Resistance
≤ 2%	Extremely Frost Resistant (Industrials Range)
≤ 3%	Very Resistant (Specification Range)
≤ 6%	Resistant (Naturals range)



### **Chemical Resistance**

BS EN ISO 10545: Part 13 requires all products to be tested against a range of acids and alkalis and a variety of household cleaners, swimming pool chemicals, and acid and alkali solutions. The test solutions used in the ISO Standard are:

Ammonium Chloride solution (110g/l)

Sodium Hypochlorite solution (20mg/l)

Hydrochloric Acid (3%v/v and 18%v/v)

Lactic Acid (5%v/v)

Citric Acid (110g/l)

Potassium Hydroxide solution (30 and 200g/l)

Hydrochloric Acid solution (3% and 18% v/v)

Lactic Acid solution (5% v/v)

All Natural Tiles Ltd quarry tiles meet the requirements, although if in prolonged contact there may be a very slight attack from the potassium hydroxide solution. In general concentrated acids such as sulphuric, hydrochloric, acetic and lactic, and alkalis such as sodium and potassium hydroxides attack our products extremely slowly at room temperature. Corrosion, if any, would normally take place at such a slow rate that it would not significantly alter the life of the installation. In the case of strong alkalis there may be some discolouration of the tile after prolonged contact.

Our quarry tiles, in common with other ceramic materials, would not normally be specified for environments where they would be in prolonged contact with fluoride chemicals, especially hydrofluoric acid.

In addition to the chemical resistance properties of quarry tiles consideration must be given to the proposed completed installation taking into account the fixing products to be used. Further detailed information regarding chemical resistance of fixing products is contained in Technical Data Sheet No. 11.

#### Staining resistance

In the new International standard, as previously in BS 6431, unglazed tiles are not required to demonstrate staining resistance. However, a test method is to be included which can be used to indicate the ease of cleaning of quarry tiles.

The test requires the tiles to be subjected to a range of staining agents.

• Chrome green (or a red stain) in light oil (tracing stain)

• Iodine in alcoholic solution (chemical/ oxidising stain)

• Olive oil (filming stain)

Each staining agent is applied in turn to the surface of a tile and attempts are then made to remove the stain from the tile using a range of standard cleaning regimes. The severity of the cleaning regime required to remove the stain classifies the tile into a grade of between 1 to 5 (5 being the easiest to clean and 1 the hardest). The cleaning regimes are applied in the order shown until the stain is removed.

Class 5. Flowing hot water and hand wiped

**Class 4.** Hand cleaning using a weak cleaning agent and non-abrasive materials

**Class 3.** Mechanical cleaning using concentrated cleaning agents and abrasives

**Class 2.** 24-hour immersion in a suitable solvent (not used on tracing stains)

**Class 1.** Irreversible damage of the proper surface of the tile

All tiles demonstrate Class 5 ease of cleaning

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# **Technical Properties 2**

### **Technical Properties:**

Comparison of British/European/International Standards related to Natural Tiles Values.

To sheet as here a sector	ISO 10545 De series en t	National Tiles
Technical property	150 10545 Requirement	Natural Tiles
		Typical value
Water absorption	AI ≤ 3%	~ 2.4%
ISO 10545 - 3	AIIa 3-6%	~ 3.2%
Modulus of rupture	Group AI Ay $\geq 23N/mm^2$	$\frac{1}{1} \frac{1}{1} \frac{1}$
modulus of rupture		
ISO 10545 – 4	Group AIIa Av≥20N/mm²	Group AIIa Av > 20N/mm <sup>2</sup>
Abrasion resistance	Group AI < 275mm <sup>3</sup>	100mm <sup>3</sup>
150 10545 6	$\frac{1}{2}$	200
Scratch hardness EN 101	No requirement	>6 Moh's scale
Scratch hardness EN 101	No requirement	>6 Mon s scale
Moisture expansion ISO	Not finalised	Negligible
10545 – 10		00
Linear thermal expansion	10 x10 -6 ° C	<5x10 -6 ° C
ISO 10545 – 8 & En 103		
Thermal conductivity	No requirement	1wm -1 ° C
Thermal shock resistance		
ISO 10545 – 9 & EN 104	Required	Pass
Frost resistance ISO 10545 – 12	100 freeze thaw cycles	100 cycles
Chemical resistance		
ISO 10545 – 13		
(a) Household chemicals &		
pool cleaning salts – Sodium	Manufacturer to state	Class UA
Hypochlorite & Ammonium	classification	(no visible effect)
Chloride		
(b) Low concentration acids		
& alkalis – Hydrochloric Acid	Manufacturer to state	Class ULA
3% v/v & Citric Acid sol.	classification	(no visible effect)
		` '
(c) High concentration acids		
& alkalis – Hydrochloric Acid	Manufacturer to state	Class UHA
18% v/v, Lactic Acid 5% v/v	classification	(no visible effect)
& Potassium Hydroxide sol.		
Slip resistance ISO 10545 – 14	Stated co-efficient of	R11 - R13.
	iriction	Pendulum SRV's ranging
		from 47 to 65
		See Technical Data Sheet No.
		6 for full details
Staining resistance	Manufacturer to state	
Class 1 –5	classification	Class 5
	1 = not resistant	- 100 J
	5 = highly resistant	

### Technical Properties of extruded ceramic tiles:

All our quarry tiles are manufactured to achieve technical properties which comply with the highest requirements of BS EN 14411 Group A1 and Group A11a and are suitable for internal or external use.

The technical requirements are detailed in the table opposite. It can be seen that in general our quarry tiles meet the more stringent classifications of the standard.

Further details of dimensional specifications can be found on Technical Data Sheet No.3 (Quality Standards).

All our 1st quality products are subject to independent testing carried out at approved National Ceramics Laboratories.

### **Technical Support:**

Our Technical Services Department provides a full support service including advice and fixing specifications. Technical Data Sheets covering every aspect of quarry tiles from planning and preparation, through to maintenance and aftercare, can be freely viewed and downloaded from our website. Hard copies are available on request from our sales department.

Further detailed specifications for each of our ranges are detailed on the Technical Specifications section of our website.

For extremely arduous applications where severe impact, loading, or prolonged exposure to acids is envisaged our Industrials Range of tiles is highly recommended. This range of tiles possesses exceptional technical properties far exceeding standard specification requirements.