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Welsh Slate

EN 12326-1:2004

Reference of this commercial document : R - ID - 8.2.4/4			Date of issue		March 2012 (Issue: 1 / Rev: 2)
Commercial document issued by : Welsh Slate, Penrhyn Quarry, Bethesda, Bangor, Gwynedd, LL57 4YG United Kingdom					
Location of mine quarry : Penrhyn Quarry, Bethesda, Bangor, Gwynedd					
This document records the conformity of the product described below and is incomplete without the explanation of the meaning of the test results and the requirements of EN 12326-1:2004. The tests referred to and the criteria are contained in EN 12326-1:2004 & -2:2000					
Date of sampling	Nov - Dec 2011		Date of testing		Jan - March 2012
Product description and commercial name	Penrhyn Heather Blue Roofing Slate, Capital Grade 500x300mm				Conformity
1. Dimensional tolerances					
Format	Rectangular				
Deviation from declared length				±0mm (0%)	YES
Deviation from declared width				±1mm (0.3%)	YES
Deviation from declared squareness				0.4%	YES
Deviation from straightness of edges	Slate length **≤** 500mm = **≤** 5mm deviation Slate length **>** 500mm = **≤** 1% deviation			0.1%	YES
Slate type for deviation of flatness	very smooth	smooth (Capital)	normal (County)	textured (Celtic)	
Deviation from flatness	0.1%				YES
2. Thickness					
Slate type for packed thickness calculation	very smooth	smooth (Capital)	normal (County)	textured (Celtic)	
Nominal thickness and variation	5.5mm, ± 0.9%				YES
3. Strength					
Characteristic MoR	Transverse	50.1MPa	Longitudinal	73.7MPa	NR
Mean failure load	Transverse	754N	Longitudinal	1146N	NR
4. Water absorption				A1 (0.15%)	YES
5. Freeze thaw					NR
6. Thermal cycle test				T1	YES
7. Carbonate content				1.51%	YES
8. Sulphur dioxide exposure tests — **≤** 20% carbonate				SI	YES
8. Sulphur dioxide exposure tests — **>** 20% carbonate					NA
9. Non-carbonate carbon content				0.5%	YES
10. External fire exposure	Deemed to satisfy				YES
11. Reaction to fire	Deemed to satisfy class A1				YES
12. Release of dangerous substances	None in conditions of use as roofing or external cladding				NR

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Welsh Slate

Date of sampling and testing	If more than one date is applicable to sampling or testing they should be indicated against the individual test results
Product description	Slate for roofing and external cladding or carbonate slate for roofing and external cladding
1. Dimensional tolerances	
Length and width	Maximum deviation ± 5mm
Deviation from squareness	Maximum deviation ± 1% of the length
Deviation from straightness of edges	Slate length ≤ 500mm Permitted deviation ≤ 5mm
	Slate length > 500mm Permitted deviation ≤ 1% of the length

Flatness : The limits of deviation from the flatness are defined for four types of slate. The bevelled edges shall be applied to the convex face. Slates with deviation from flatness in excess of the limit may be used for special applications.

Slate type	Maximum deviation from flatness as a % of the slate length
Very smooth	< 0.9
Smooth	< 1.0
Normal	< 1.5
Textured	< 2.0

2. Thickness :	The basic nominal thickness is determined as a function of the bending strength using the equations given in 3, local climate conditions and traditional construction techniques. The basic nominal thickness is increased in relation to the slates performance in the appropriate sulphur dioxide test (if required) as show in 7 and 8 below.
3. Strength :	Longitudinal and transverse bending strength and modulus of rupture; there is no limit for bending strength or modulus. However the basic nominal thickness is determined as a function of the bend strength using the equations given below, local climate conditions and traditional construction techniques.

$$el = X\sqrt{\frac{l}{Rcl}}$$

$$et = X\sqrt{\frac{b}{Rct}}$$

Where
el is the longitudinal thickness , in millimetres (mm);
et is the transverse thickness, in millimetres (mm);
l is the length of the slate, in millimetres (mm);
b is the width of the slate, in millimetres (mm);
Rcl is the characteristic longitudinal modulus of rupture in megapascals (MPa);
Rct is the characteristic transverse modulus of rupture in megapascals (MPa);
X is a constant determined as a function of climate and the traditional construction techniques in root newton.millimetres (N½.mm½). It may be different for each equation and is selected for the country of use according to the table below.

National factors X	Country	Transverse	Longitudinal	Country	Transverse	Longitudinal
	Belgium	1.35	1.35	Italy	1.2	1.2
	France	1.25	1.4	Spain	1.2	1.2
	Germany	1.2	1.2	UK	0.9	1.1

Those countries that have not declared a national value should select a value or pair of values in relation to their countries climate and traditional construction techniques. It should not be less the minimum value or pair of values given above.

el and et are determined by using the length *l* and the width b of the slates. The maximum value determined is the basic individual thickness of the slate, ebi. The basic individual thickness is increased in relation to the slates performances in the appropriate sulphur dioxide test as shown in 7 and 8 below. For a significant difference between the longitudinal and transverse modulus of rupture the t-statistic is greater than 2021.

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4. Water Absorption :	The water absorption of slate shall not exceed 0.6% unless they can satisfy the requirements of the freeze-thaw test.
5. Freeze-thaw test :	Slates with a water absorption greater than 0.6% shall show no significant reduction in bending strength using a one-sided Student's t-test at the 25% significance level (slates with a water absorption of 0.60% or less are not required to undergo a freeze-thaw test)
6. Thermal cycle test :	The following table explains the meaning of the test codes

Code	Observation in the test	Conformity to the standard
T1	No changes in appearance. Surface oxidation of metallic minerals. Colour changes that neither affect the structure nor form runs of discolouration.	Acceptable
T2	Oxidation or appearance changes of the metallic inclusions with runs of discolouration but without structural changes.	Acceptable
T3	Oxidation or appearance changes of the metallic minerals which penetrate the slate and risk the formation of holes.	Acceptable subject to the note below

NOTE : Slates within code T3, which potentially may result in water penetration should only be used selectively with suitable methods of construction, that avoid such penetration. Slates showing exfoliation splitting or other structural changes in this test are not acceptable.

7. Carbonate content :	There is no limit on carbonate content. However, the carbonate content determines which sulphur dioxide exposure test procedure should be carried out and, together with the strength, the minimum nominal thickness of the product. If the carbonate content is less than 20% then the sulphur dioxide exposure test procedure in EN 12326-2:2000, 15.1 applies. If the carbonate content is 20% or more, the sulphur dioxide exposure test procedure in EN 12326-2:2000, 15.2 applies. The minimum thickness is calculated using the table below.

8. Minimal nominal thickness in relation to carbonate content and sulphur dioxide exposure code

Carbonate content %	SO2 exposure test code from EN 12326-2:2000, 15.1	Depth of softened layer from EN 12326-2:2000, 15.2	Thickness adjustment
≤ 5.0	S1		None
	S2		ebi + 5%
	S3		ebi ≥ 8.0mm or switch to the test in EN 12326-2:2000, 15.2
> 5.0 < 20.0	S1		ebi + 5%
	S2		ebi + 10%
	S3		ebi ≥ 8.0mm or switch to the test in EN 12326-2:2000, 15.2
≥ 20.0		0 - 0.70mm	ebi + 0.50mm + $7t^2$

ebi is the basic individual thickness obtained from 3 above in millimetres
t is the thickness of the softened layer obtained from EN 12326-2:2000, 15.2 in millimetres

9. Non-carbonate carbon content : The non-carbonate content shall be less than 2%

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Welsh Slate roofing products conform to the requirements of the CE mark.

The following table provides the necessary information required to demonstrate conformity of

Penrhyn Heather Blue Roofing Slate, Capital Grade

CE 0086					
Welsh Slate Ltd, Penrhyn Quarry, Bethesda, Near Bangor, Gwynedd, Wales, UK, LL57 4YG					
10					
EN 12326-1					
Roofing and external cladding slate					
Dimensions and dimensional variation		Complies (deviation: < +/- 5mm)			
Nominal thickness and variation		5.5mm (< +/- 35%)			
Mechanical resistance	Characteristic MoR	Transverse	50.1MPa	Longitudinal	73.7MPa
	Mean failure load	Transverse	754N	Longitudinal	1146N
Water permeability - water absorption		Complies < 0.6%			
Carbonate content		≤ 5%			
Durability water absorption		Complies < 0.6%			
Durability freeze thaw cycling		Not required			
Durability thermal cycling		Complies with code T1			
Durability sulphur dioxide exposure		Complies with code S1			
Durability non-carbonate carbon content		Complies: < 2%			
Release of dangerous substances		None in conditions as roofing or external cladding			
External fire performance		Deemed to satisfy			
Reaction to fire		Deemed to satisfy class A1			