Penrhyn Capital Grade Roofing Slate – EN 12326-1:2014

Reference of this commercial document:	**BPWS 109**	Date of issue	**July 2020**

Commercial document issued by: **Welsh Slate, Penrhyn Quarry, Bethesda, Bangor, Gwynedd, LL57 4YG United Kingdom**

Location of quarry: Penrhyn Quarry, Bethesda, Bangor, Gwynedd, LL57 4YG United Kingdom

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 12326-1:2014.
The tests referred to and the criteria are contained in EN 12326-1:2014 and EN 12326-2:2011

Date of sampling	**February 2020**		**Date of testing**		**Feb - March 2020**
Product description and commercial name Relation between bedding and cleavage	Penrhyn Capital Grade Roofing Slate Beds parallel to cleavage				Conformity
1. Dimensional tolerances					
Format	Rectangular				
Deviation from declared length	±0mm				YES
Deviation from declared width	±0mm				YES
Deviation from squareness	0.3%				YES
Deviation from straightness of edges	1.0mm				YES
Slate type for deviation of flatness	Very Flat	Flat (Capital)	Normal (County)	Non-Flat (Celtic)	
Deviation from flatness	0.1%				YES
2. Thickness					
Nominal thickness and variation of individual thickness against nominal thickness	5.5 mm, ± 35%				YES
3. Strength					
Characteristic MoR	Transverse	74.1 N/mm²	Longitudinal	55.1 N/mm²	NR
4. Water absorption	Code A1 (≤0.6): 0.30%				YES
5. Freeze thaw					NR
6. Thermal cycle test	T1				YES
7. Apparent calcium carbonate content	0.0%				YES

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8. Sulphur dioxide exposure tests	**≤ 20% apparent calcium carbonate**	S1	YES
	> 20% apparent calcium carbonate		NA
9. Non-carbonate carbon content		1.0%	YES
10. External fire exposure		Deemed to satisfy class BROOF	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

Meaning of the Test Results

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. Slate type and origin	
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 flat	< 0.9
	Flat	< 1.0
	Normal	< 1.5
	Non-flat	< 2.0
2. Thickness	The basic nominal thickness is determined as a function of the bending strength using the formulae given in 3, local climate conditions and traditional construction techniques. The basic nominal thickness is increased in relation to the slate's performance in the appropriate sulphur dioxide test (if required) as shown in 7 and 8 below.	

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3. Strength	Longitudinal and transverse characteristic modulus of rupture; there is no limit for characteristic modulus. However, the basic nominal thickness is determined as a function of the bend strength using the formulae given below, local climate conditions and traditional construction techniques.

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

And

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

Where

el is the longitudinal thickness, (in mm);
et is the transverse thickness, (in mm);
/ is the length of the slate, (in mm);
b is the width of the slate, (in mm);
Rcl is the characteristic longitudinal modulus of rupture, (in N/mm²);
Rct is the characteristic transverse modulus of rupture, (in N/mm²);
X is a constant determined as a function of climate and the traditional construction techniques (in N½.mm-½).

NOTE: It may be different for each formula and is selected for the member state of use according to the table below.

National X Factors:

Member state	Transverse	Longitudinal	Member state	Transverse
Belgium	1.0	1.0	Czech Repub.	1.2
Ireland	0.9	1.1	Italy	1.2
France	1.0	1.0	Spain	1.0
Germany	1.2	1.2	UK	0.9

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

el and et are determined by using the length / 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 slate's performance in the appropriate sulphur dioxide test as shown in 7 and 8 below.

4. Water Absorption	Code A1 (≤0.6), A2 (>0.6)
5. Freeze-thaw test	Slates tested indicate the mean value of the modulus of rupture after 50 cycles in transverse and longitudinal directions before and after the freeze/thaw test, if relevant, (test (if W1(>0.6)), or not required
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: It is best only to use slates within code T3, which potentially may result in water penetration selectively with suitable methods of construction that avoid such penetration. Slates showing exfoliation splitting or other structural changes in this test are not acceptable.

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7. Apparent calcium carbonate content	There is no limit on apparent calcium carbonate content. However, the apparent calcium 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 or equal to 20% then the sulphur dioxide exposure test procedure in EN 12326-2:2011, 14.1 applies. If the carbonate content is more than 20%, the sulphur dioxide exposure test procedure in EN 12326-2:2011, 14.2 applies. The minimum thickness is calculated using the table below

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

Carbonate content %	SO2 exposure test code from EN 12326-2:2011, 14.1	Depth of softened layer from EN12326-2:2011, 14.2	Thickness adjustment
≤ 5.0	S1		None
	S2		ebi + 5%
	S3		ebi ≥ 8.0mm or switch to the test in EN 12326-2:2011, 14.2
> 5.0 ≤ 20.0	S1		ebi + 5%
	S2		ebi + 10%
	S3		ebi ≥ 8.0mm or switch to the test in EN 12326-2:2011, 14.2
> 20.0		0mm to 0.70mm	ebi + 0.50mm + $7t^2$

ebi is the basic individual thickness obtained from 3 above (in mm)

t is the thickness of the softened layer obtained from EN 12326-2:2011, 14.2 (in mm)

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

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