

EN 12326-1:2014

Slate and stone products for discontinuous roofing and cladding

Reference of this commercial document	Valentia EN 12326-1:2014-test-results
Location of the quarry	Valentia Island, Co. Kerry, Ireland
Geological description	Middle Devonian (Givetian) purple to pale green-coloured fine-grained well-lithified slate comprising mainly quartz, mica and chlorite.
Date of sampling: March 2020	Date of testing: March 2020

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.

Product description and commercial name	Valentia Slate				Conformity
1. Dimensional tolerances					
Format	400 x 200mm x 8-10 mm				
Deviation from declared length	+/- 5mm				Yes
Deviation from declared width	+/- 5mm				Yes
Deviation from declared squareness	+/- 1%				Yes
Deviation from straightness of edges	+/- 5mm				Yes
Slate type for deviation from flatness	Very Smooth Smooth Normal Textured				Normal
Deviation from flatness					<1.5%
2. Thickness					
Slate type for packed thickness calculation	V.Smooth	Smooth	Normal	Textured	Normal
Nominal thickness and variation			+/- 35%		Yes
3. Strength					
Characteristic MoR (mean)	67.6 MPa				Yes
4. Water absorption	A1 0.1%				Yes
5. Freeze thaw					NR
6. Thermal cycle test	T1 (no changes)				Yes
7. Carbonate content	Negligible				Yes

8. Sulphur dioxide Exposure tests	≤20% carbonate	S1	Yes
	>20% carbonate		
9. Non-carbonate carbon content		Negligible	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	Yes
Date of sampling and testing		March 2020	

EN 12326-1:2014						
Product description			Slate for roofing and external cladding			
1. Dimensional Tolerances						
Length and width			Maximum deviation ± 5mm			
Deviation from square ness			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 flatness is defined for four types of slate. The beveled 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			
			Very smooth			
			Smooth			
			Normal			
			Textured			
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 slate's performance in the appropriate sulfur dioxide test (if required) as shown 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 tradition construction techniques.				
$e_l \propto \sqrt{\frac{l}{R_{cl}}}$ $x e_t \propto \sqrt{\frac{b}{R_{ct}}}$ $\propto x$			<p>Where</p> <p>e_l is the longitudinal thickness in millimeters(mm)</p> <p>e_t is the transverse thickness, in millimeters (mm)</p> <p>l is the length of slate, in millimeters (mm) b is the width of the slate, in millimeters(mm)</p> <p>R_{ct} is the characteristic transverse modulus of rupture in megapascals (MPa)</p> <p>R_{cl} is the characteristic longitudinal modulus of rupture in megapascals (Mpa)</p>			
National factor 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 a pair of values in relation to their countries climate and traditional construction techniques. It should not be less than the minimum value or pair of values given above.

e_l and e_t are determined by using the length/ and the width b of the slates. The maximum value determined is the basic e individual thickness of the slate bi . The basic individual thickness is increased in relation to the slates performance in the appropriate sulfur 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 2.021

4. Water absorption	The water absorption of slates shall not exceed 0.6% unless they can satisfy the requirements of the free-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 2.5% significant level (slates with a water absorption of 0.6% 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. Color changes that neither affect the structure nor form runs of discoloration.	Acceptable
T2	Oxidation or appearance changes of the metallic inclusions with runs of discoloration but without structural changes.	Acceptable
T3	Oxidation or appearance changes of 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.	<p>There is no limit on carbonate content. However, the carbonate content determines which sulfur dioxide exposure test procedure should be carried out and, together with the strength, the minimum nominal thickness of the product.</p> <p>If the carbonate content is less than 20% then the sulfur dioxide exposure test procedure in EN 12326-2:2000, 15.1, applies. If the carbonate content is 20% or more, the sulfur dioxide exposure tests procedure in EN 12326-2:2000, 15.2 apply. The minimum thickness is calculated using the table below.</p>	
8. Minimal nominal thickness in relation to carbonate content and sulfur dioxide exposure code.		

Carbonate content %	SO_2 exposure test code from EN 12326-2:2000, 15.1	Depth of softened layer from EN12326-2:2000, 15.2	Thickness adjustment
≤5.0	S1		None
	S2		$e_{bi} + 5\%$
	S3		$e_{bi} \geq 8.0$ mm or switch to the test in EN 12326-2:2000, 15.2
>5.0 <20.0	S1		$e_{bi} + 5\%$
	S2		$e_{bi} + 10\%$
	S3		$e_{bi} \geq 8.0$ mm or switch to the test in EN 12326-2:2000, 15.2
≥20.0		0-0.7mm	$e_{bi} + 0.5\text{mm} + 7t^2$
e_{bi} is the basic individual thickness obtained from 3 above in millimeters t is the thickness of the softened layer obtained from EN 12326-2:2000, 15.2 in millimeters			
9. Non-carbonate carbon content: The non-carbonate content shall be less than 2%			

EN 12326-1:2014 **Testing Explained**

EN 12326-1:2014 is the latest European standard for slate and stone products for discontinuous roofing or cladding.

Following is a brief explanation, explaining the tests and standards that Valentia Slate reaches in order to conform to the standard.

1. Dimensions

Tolerances are provided for the length, width, individual thickness, flatness, rectangularity and edge deviation, of the slate being tested.

2. Flexural Strength

The slate test samples are supported on two bars and a third central bar is pushed down on the slate until failure occurs. The test is carried out both parallel and perpendicular to the long edge of the roofing slate. From the results gained a characteristic modulus of rupture is calculated.

4. Water Absorption

The slate is dried to a constant weight; it is then immersed in water. The absorption percentage is determined via the difference in mass. If the value obtained is less than 0.6%, the slate is classed as A1, whereas, if it is above 0.6% it is classed A2.

5. Freeze-Thaw Test

This test is only required on A2 classed slates. The slate is submitted to 100 cycles of freezing in air, followed by thawing in water, once this is complete the flexural strength test is repeated. If there is a significant change in results, the slate is deemed not suitable and does not pass the European standard.

6. Non-Carbonate Content

This test verifies the amount of graphite present in the slate, as well as oils and other organic matter. If the slate contains in excess of 2% graphite, it fails the test and does not pass the European standard.

7. Carbonate Content

These groups determine the thickness of the slate. The groups also determine the method of sulphur dioxide testing,

8. Sulphur Dioxide Exposure for Slate With Less Than 20% Carbonate

The slate is exposed to sulphur dioxide at two different concentrations for a duration of 21 days. Depending upon changes during the test, one of 3 codes will be given. The code is then used to apply a thickness adjustment, depending on the carbonate content of the slate.

9. Sulphur Dioxide Exposure For Slates With More Than 20% Carbonate

The slate is subjected to surface scraping before and after exposure to sulphur dioxide vapor. After each exposure there is an increase in material removed, this carries on until the depth of softening is reached. A thickness adjustment is then applied to all slates, except for in the case where the softened layer is greater than 0.7mm.

10. Thermal Cycle Test



The slate is subjected to 20 cycles of immersion in water immediately followed by drying at 100 degrees Celsius, upon completion an inspection occurs for the presence of potentially harmful mineral components:

- T1- for slate with colour changes that do not affect the structure and form runs of discoloration.
- T2- for slates with colour runs that do not cause structural change.
- T3- for slates where holes may be formed from the oxidization of inclusion.

If exfoliation, splitting or other structural changes occur, the roofing slate does not pass the test and is therefore not up to European standard.

11. **Petrographic Examination**

Geological appraisal that includes optical microscopy. This examination determines the type of roofing slate and whether there is any presence of harmful or dangerous structures or minerals.