WELSH SLATE
Part of the Breedon Group

Welsh Slate, Penrhyn Quarry, Bethesda, Bangor,
Gwynedd, LL57 4YG
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# EN 12326-1:2014

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|---|---|---|---|
| Reference of this commercial document: | IMSD 8.2.4-22b | Date of issue | May 2018 (Issue 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 12326-1:2014. The tests referred to and the criteria are contained in EN 12326-1:2014 and EN 12326-2:2011 | | | |
| Date of sampling | December 2017 | Date of testing | Jan - April 2018 |
| Product description and commercial name<br>Relation between bedding and cleavage | Penrhyn County Roofing Slate<br>300x200mm<br>Beds parallel to cleavage | | Conformity |

| | | | | | |
|---|---|---|---|---|---|
| 1. Dimensional tolerances | | | | | |
| Format | Rectangular | | | | |
| Deviation from declared length | | | | ±0mm | YES |
| Deviation from declared width | | | | ±0mm | YES |
| Deviation from declared squareness | | | | 1.0% | 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 | | | 7.0mm, ± 35% | | YES |
| 3. Strength | | | | | |
| Characteristic MoR | Transverse | 54.9 N/mm² | Longitudinal | 79.1 N/mm² | NR |
| 4. Water absorption | | | | Code W1 (≤0.6): 0.21% | YES |
| 5. Freeze thaw | | | | | NR |
| 6. Thermal cycle test | | | | T1 | YES |
| 7. Apparent calcium carbonate content | | | | 0.0% | YES |
| 8. Sulfur dioxide exposure tests: ≤ 20% apparent calcium carbonate | | | | S1 | YES |
| 8. Sulfur dioxide exposure tests: > 20% apparent calcium carbonate | | | | | NA |
| 9. Non-carbonate carbon content | | | | 0.9% | YES |
| 10. External fire exposure | Deemed to satisfy class $B_{ROOF}$ | | | | 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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|---|---|
| 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.<br>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 |

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| 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 slates performance in the appropriate sulfur dioxide test (if required) as shown in 7 and 8 below. |
| 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);

*l* 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 | Longitudinal |
|---|---|---|---|---|---|
| Belgium | 1.0 | 1.0 | Czech Repub. | 1.2 | 1.2 |
| Ireland | 0.9 | 1.1 | Italy | 1.2 | 1.2 |
| France | 1.0 | 1.0 | Spain | 1.0 | 1.0 |
| Germany | 1.2 | 1.2 | UK | 0.9 | 1.1 |

Those member states 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 than 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 performance in the appropriate sulphur dioxide test as shown in 7 and 8 below.

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| 4. Water Absorption: | Code W1 (≤0.6), W1 (>0.6), or W2 |
| 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 sulfur dioxide exposure test procedure should be carried out and, together with the strength, the minimum nominal thickness of the product.<br><br>If the carbonate content is less than or equal to 20% then the sulfur dioxide exposure test procedure in EN 12326-2:2011, 14.1 applies. If the carbonate content is more than 20%, the sulfur 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 sulfur 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 | S1 | | ebi + 5% |
| | S2 | | ebi + 10% |
| ≤ 20.0 | 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 + 7t² |

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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# CE Marking



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 County Roofing Slate

| | |
|---|---|
| CE 0086 | |
| Welsh Slate Ltd, Penrhyn Quarry, Bethesda, Near Bangor, Gwynedd, Wales, UK, LL57 4YG | |
| 10 | |
| 002PQ-DoP2015-05-28 | |
| EN 12326-1:2014 | |
| Penrhyn County | |
| Intended to be used as discontinuous roofing and external cladding | |
| Dimensional variation | |
| Nominal thickness | 7.0mm |
| Individual thickness | 7.0mm (< +/- 35%) |
| Deviation of length and width | Complies |
| Deviation of edge straightness | Complies |
| Deviation of rectangularity | Complies |
| Mechanical resistance (Characteristic modulus of rupture) | |
| Transverse | 54.9 N/mm² |
| Longitudinal | 79.1 N/mm² |
| Water permeability - water absorption | **W1** (≤0.6%) |
| Apparent calcium carbonate content | ≤ 5% |
| Durability | |
| Water absorption | **W1** (≤0.6%) |
| Freeze-thaw cycling | Not required |
| Thermal cycling | **T1** |
| Sulfur dioxide exposure | **S1** |
| Non-carbonate carbon content | Complies: ≤ 2% |
| Release of dangerous substances: None in conditions of use as roofing or external cladding | |
| External fire performance: Deemed to satisfy | |