

BS EN 12326-1:2014



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Slate and stone for discontinuous roofing and external cladding

Part 1: Specifications for slate and
carbonate slate

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National foreword

This British Standard is the UK implementation of EN 12326-1:2014. It supersedes BS EN 12326-1:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/542, Roofing and cladding products for discontinuous laying.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Slate and stone for discontinuous roofing and external cladding - Part 1: Specifications for slate and carbonate slate

Ardoises et pierres pour toiture et bardage extérieur pour
pose en discontinu - Partie 1: Spécifications pour ardoises
et ardoises carbonatées

Schiefer und Naturstein für überlappende Dachdeckungen
und Außenwandbekleidungen - Teil 1: Spezifikationen für
Schiefer und carbonathaltige Schiefer

This European Standard was approved by CEN on 10 July 2014.

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Foreword

This document (EN 12326-1:2014) has been prepared by Technical Committee CEN/TC 128 “Roof covering products for discontinuous laying and products for wall cladding”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2015 and conflicting national standards shall be withdrawn at the latest by May 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12326-1:2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the EU Construction Products Regulation.

For relationship with EU Directive(s) and the Construction Products Regulation, see informative Annex ZA, which is an integral part of this document.

In comparison to the previous edition, the following sections have been modified: 3.1, 3.2, 3.3, 3.13, 5.1, 5.2.3, 5.3, 5.5, 5.6, 5.8, 5.9, 5.12.1, 5.12.5, 5.13, 5.14, Clause 6, Annex B, Annex C, Annex D, Annex E and Annex ZA.

This European Standard EN 12326-1 is one of a series of product standards for building materials. EN 12326 consists of the following parts:

- *Part 1: Specifications for slate and carbonate slate;*
- *Part 2: Methods of test for slate and carbonate slate.*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The evaluation of the performance of the products has been defined, as far as possible, in terms of a number of type tests. A distinction has been made between product appraisal (type test) and routine factory production control requirements.

The performance of a roof or wall constructed with these products depends not only on the properties of the product as required by this document, but also on the design, construction and performance of the roof or wall as a whole in relation to the environment and conditions of use.

1 Scope

This European Standard specifies requirements for slate and carbonate slate for discontinuous roofing and external cladding, as defined in 3.1, and 3.2, used for assembly into discontinuous roofing and external cladding.

For the purposes of this European Standard, slates and carbonate slates have been classified.

This European Standard does not apply to products for roofing or external cladding made from the following:

- a) stone other than those defined in 3.1 and 3.2;
- b) concrete;
- c) polymeric materials;
- d) fibre reinforced cement;
- e) metal;
- f) clay.

This European Standard is not applicable to roofing and cladding slates used internally.

This European Standard is not applicable to bonded cladding (cladding fixed with adhesives) and cladding fixed with dowels and cramps.

NOTE 1 Requirements for internal wall lining slate are specified in EN 1469.

This document does not include requirements for appearance.

NOTE 2 Some general guidance for appearance is given in Annex A.

This European Standard does not include installation rules for slates.

NOTE 3 References to national recommendations on methods of construction for slate roofs are given in Annex C.

NOTE 4 Where the term “slate” is used in this document it means slate and carbonate slate unless otherwise indicated.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12326-2:2011, *Slate and stone for discontinuous roofing and external cladding — Part 2: Methods of test for slate and carbonate slate*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

ISO 2859-1:1999, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

slate

rock originating from clayey sedimentary rocks, including sediments of volcanoclastic origin and belonging petrographically to a range which begins at the boundary between sedimentary and metamorphic formation and ends at the epizonal-metamorphic phyllite formations

Note 1 to entry: The predominant and most important components are the phyllosilicates and the cleavage resulting from a schistosity flux, caused by low or very low grade of metamorphism.

Note 2 to entry: Slate is distinguished from sedimentary stones, which invariably splits along a bedding or sedimentation plane.

Note 3 to entry: The origin of the metamorphism can be due to tectonic or lithostatic compression or a combination of the two.

3.2

roofing slate

slate used for roofing and external cladding, which easily splits into thin sheets along a plane of cleavage

3.3

carbonate slate

rock used for roofing and external cladding, containing phyllosilicates and a minimum apparent calcium carbonate content of 20 % and exhibiting a prominent slaty cleavage

3.4

vein

separately identifiable band of slate rock within the geological formation of a quarry or mine

3.5

slate vein

localized occurrence (in a roofing or external cladding slate), usually passing through the thickness of a slate, of minerals that have intruded or infiltrated into a joint or fissure in the parent rock

3.6

grain

orientation of the minerals in slate which results in an anisotropic bending strength

Note 1 to entry: In the bending strength test, grain is perpendicular to the load bar in the test that usually gives the highest failure result.

3.7

rectangular slate

slate which is square or rectangular including such slates which have been shouldered

3.8

shouldering

removal of the upper (when installed) corner(s) of a roofing or external cladding slate to facilitate laying

Note 1 to entry: This description does not apply to special designs of slates.

3.9

shouldered slate

slate from which the upper corners have been removed

3.10

type test

product appraisal test concerned with one or more of the following, the effect of which cannot be anticipated on the basis of previous tests:

- the operation of a new quarry, mine or vein of slate for the first time;
- an unanticipated change in the geology of the rock

3.11

factory production control test

test performed on samples drawn from continuous production to establish whether a lot conforms to this document

3.12

nominal thickness

thickness of slates declared by the manufacturer

3.13

corrected packed thickness

thickness of 100 packed slates divided by 100 and reduced by a factor depending on the flatness characteristics of the slate declared by the manufacturer

Note 1 to entry: See Annex E.

3.14

basic individual thickness

thickness of slates determined from the modulus of rupture, as shown in Annex B, and/or from traditional construction methods

Note 1 to entry: See Annex B and Annex C.

3.15

minimum individual thickness

minimum thickness of slates determined by adjusting the basic individual thickness in accordance with 5.2.3

3.16

modulus of rupture

maximum stress sustained by a slate test piece when a bending moment is applied

Note 1 to entry: In this document, the arrangement of the test is three point bending.

3.17

random slates

slates or sets of slates produced to undefined dimensions

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

<i>AQL</i>	acceptable quality level
<i>W1, W2</i>	codes applied to the result of the water absorption test and if relevant the freeze-thaw test
<i>b</i>	width of a slate, in mm
<i>e_{bi}</i>	basic individual thickness of roofing slates determined from the modulus of

	rupture and/or traditional construction methods, in mm
e_i	individual thickness of roofing slates, in mm
e_l	thickness of a slate calculated as a function of its longitudinal modulus of rupture and the X factor, in mm
e_{mi}	minimum thickness of individual slates, in mm
e_p	thickness of packed slates, in mm
e_s	depth of softening in the sulfur dioxide exposure test for slates with an apparent calcium carbonate content more than 20 %, in mm
e_t	basic thickness of a slate calculated as a function of its transverse modulus of rupture and the X factor, in mm
l	length, in mm
R_{cl}	characteristic longitudinal modulus of rupture, in N/mm^2
R_{ct}	characteristic transverse modulus of rupture, in N/mm^2
S1, S2, S3	codes applied to the result of the sulfur dioxide exposure test for slates with an apparent calcium carbonate content of less than or equal to 20 %
S-3	inspection level defined in ISO 2859-1
T1, T2, T3	codes applied to the result of the thermal cycle test
X	nationally designated constant determined as a function of climate and/or construction techniques in $(\text{N}^{1/2} \cdot \text{mm}^{-1/2})$

5 Requirements

5.1 Origin and petrography

A petrographic examination as specified in EN 12326-2:2011, Clause 16, shall be carried out for identification purposes and to decide whether the slate falls within the scope of this document and to establish the relationship between the bedding and the cleavage.

Every slate in a consignment shall be supplied from the declared source quarry, mine or vein of slate and shall be of the declared slate type as defined in 3.1 and 3.2.

5.2 Thickness

5.2.1 General

A flow chart for the control of nominal and individual thickness of slates is given in Figure 1.

5.2.2 Nominal thickness

The nominal thickness of each roofing slate product, in millimetres, and the amount by which the individual thickness varies, as a percentage of the nominal thickness, shall be declared.

NOTE Annex E gives a quick method for estimating the nominal thickness.

5.2.3 Individual thickness

5.2.3.1 The measurement of individual thickness shall be carried out in accordance with EN 12326-2:2011, Clause 8. The individual thickness of the slates shall not be less than 2,0 mm.

5.2.3.2 The minimum individual thickness of slates (e_{mi}) shall be determined as a function of their mechanical resistance — the bending strength and modulus of rupture (determined in accordance with EN 12326-2:2011, Clause 10) — and the climatic conditions or the traditional construction techniques in the country of use, increased by the appropriate value given in 5.2.3.3, 5.2.3.4 and/or 5.2.3.5. The minimum individual thickness shall be the largest value determined using any of the above factors.

NOTE 1 The mechanical resistance of a slate is a function of both the inherent strength of the rock from which it is made and its thickness. Annex B provides a method of calculating the basic individual thickness (e_{bi}).

NOTE 2 The usual construction techniques can be given in national regulations or national standards for execution. A list of documents is given in Annex C.

NOTE 3 Member states can explain their national rules used to determine the minimum thickness of slates in an informative national document.

5.2.3.3 The increase in the basic individual thickness of slates (e_{bi}) with an apparent calcium carbonate content equal to or less than 20 % (determined in accordance with EN 12326-2:2011, Clause 13) shall not be less than the appropriate value shown in Table 1 for the relevant sulfur dioxide exposure code S1 or S2 in 5.9.1 (as determined in accordance with EN 12326-2:2011, 14.1).

5.2.3.4 Slates with an apparent calcium carbonate content equal to or less than 20 %, (determined in accordance with EN 12326-2:2011, Clause 13) and achieving a sulfur dioxide exposure code S3 in 5.9.1 (determined in accordance with EN 12326-2:2011, 14.1) shall have a minimum individual thickness of not less than 8,0 mm or the thickness determined in accordance with EN 12326-2:2011, 15.2, and 5.2.3.5 of this document.

5.2.3.5 The increase in basic individual thickness of slates (e_{bi}) with an apparent calcium carbonate content more than 20 % (determined in accordance with EN 12326-2:2011, Clause 13) or of slates achieving a sulfur dioxide exposure code S3 (determined in accordance with EN 12326-2:2011, 14.1) shall not be less than the value obtained using the following formula:

$$e_{mi} = e_{bi} + 0,5 + (7e_s^2)$$

where

- e_{mi} is the minimum individual thickness, in millimetres;
- e_{bi} is the basic individual thickness, in millimetres (see Annex B);
- e_s is the thickness of the softened layer, in millimetres.

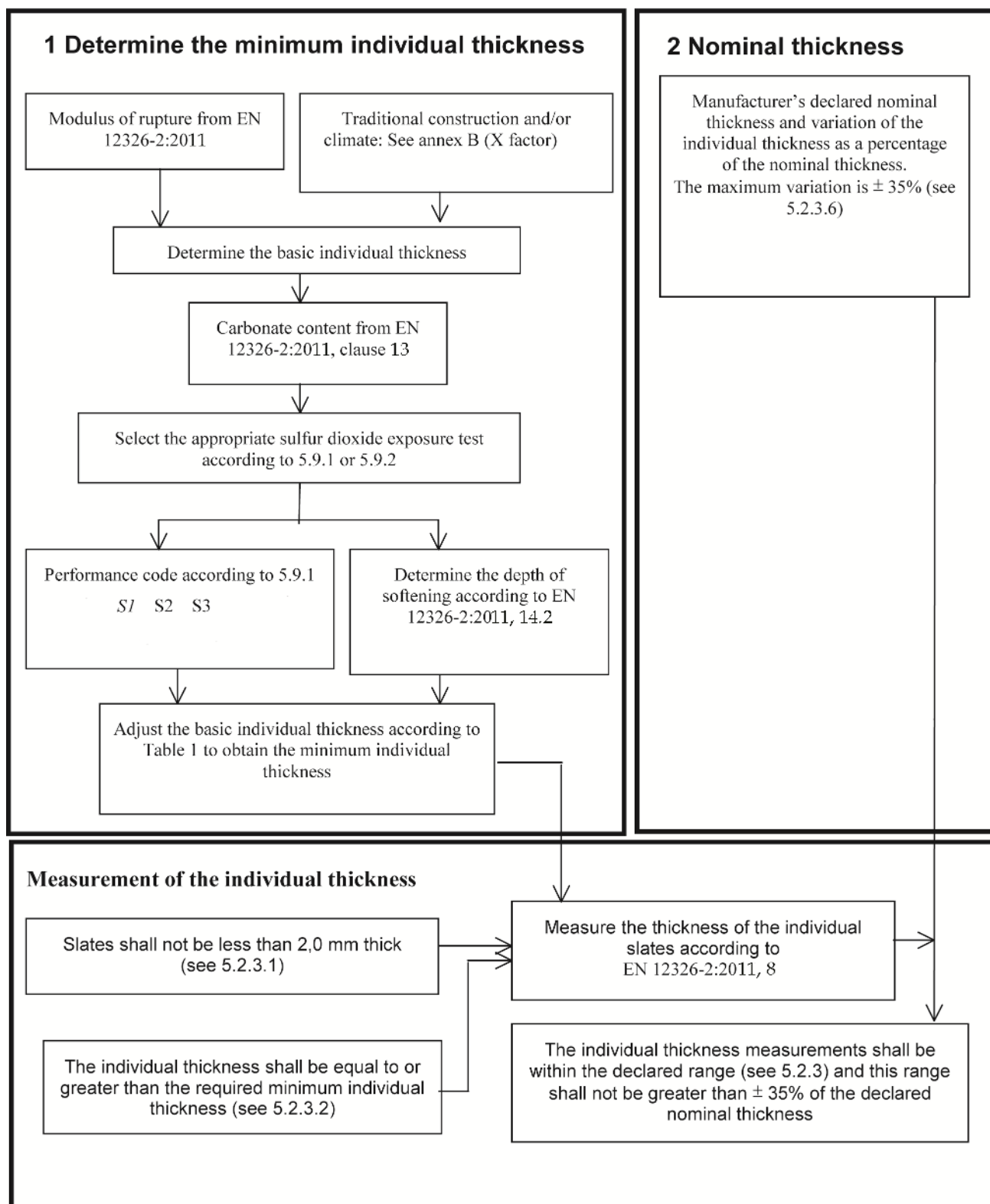


Figure 1 — Flow chart for the control of the nominal and individual thickness of slates

Table 1 — Minimum individual thickness of slates in relation to the apparent calcium carbonate content and the sulfur dioxide exposure code

Apparent calcium carbonate content %	Sulfur dioxide exposure code determined in accordance with EN 12326–2:2011, 14.1	Depth of softened layer e_s determined in accordance with EN 12326–2:2011, 14.2 mm	Formulas for thickness adjustment
≤ 5,0	S1	NA ^a	None
	S2	NA	$e_{bi} + 5 \%$
	S3	NA	$e_{bi} \geq 8,0$ mm or switch to the test in EN 12326–2:2011, 14.2
> 5,0 ≤ 20,0	S1	NA	$e_{bi} + 5 \%$
	S2	NA	$e_{bi} + 10 \%$
	S3	NA	$e_{bi} \geq 8,0$ mm or switch to the test in EN 12326–2:2011, 14.2
> 20,0	NA	0 to 0,70	$e_{bi} + 0,50 + (7 \cdot e_s^2)$
		> 0,70	Not suitable for roofing or external cladding slates
^a Not applicable.			

5.2.3.6 The variation of individual thickness shall be within the declared range, which shall not be more than $\pm 35 \%$ of the nominal thickness.

5.3 Characteristic modulus of rupture

The characteristic modulus of rupture, determined in accordance with EN 12326-2:2011, Clause 10, shall be declared.

5.4 Grain

If the characteristic modulus of rupture, determined in accordance with EN 12326-2:2011, Clause 10, indicates different bending strengths in the longitudinal and transverse orientations, the direction of the largest value shall be declared.

NOTE Grain is not always visible to the naked eye. In this case, petrographic analysis can be used to determine grain orientation.

5.5 Water absorption

When tested in accordance with EN 12326-2:2011, Clause 11, slates shall be classified and declared as code W1($\leq 0,6$), W1($> 0,6$) or W2 from Table 2.

Table 2 — Water absorption requirements

Water absorption (%)	Code
$\leq 0,6$	W1($\leq 0,6$)
$> 0,6$ and tested according to 5.6	W1($> 0,6$)
$> 0,6$ and not tested according to 5.6	W2

5.6 Freeze–thaw resistance (for slates with water absorption $> 0,6$)

When tested in accordance with EN 12326-2:2011, Clause 12,

- the mean modulus of rupture for each orientation before and after the freeze–thaw test are reported in addition to the code W1($> 0,6$) from Table 2.

5.7 Thermal cycle resistance

When tested in accordance with EN 12326-2:2011, Clause 15, slates shall be declared with a code according to Table 3.

Table 3 — Thermal cycle requirements

Code	Observation in test
T1	No changes in appearance
	Surface oxidation of metallic minerals
	Colour changes that neither affect the structure nor form runs of discolouration
T2	Oxidation or appearance changes of the metallic inclusions with runs of discolouration but without structural changes
T3	Oxidation or appearance changes of metallic minerals that penetrate the slate and risk forming holes
It shall not be acceptable for slates to exhibit exfoliation, splitting or other major structural changes. Slates within code T3, which potentially can result in water penetration, should only be used selectively with suitable methods of construction which avoid such penetration (see Annex C).	

5.8 Apparent calcium carbonate content

The apparent calcium carbonate content, determined in accordance with EN 12326-2:2011, Clause 13, shall conform to the appropriate classification according to Table 1, as declared by the manufacturer.

5.9 Sulfur dioxide exposure test

5.9.1 Slates with an apparent calcium carbonate content of $\leq 20\%$, determined in accordance with EN 12326-2:2011, Clause 13, shall be tested according to EN 12326-2:2011, 14.1, and shall be allocated a code as shown in Figure 2 depending upon the assessment criteria reported in the test. Slates shall conform to the apparent calcium carbonate content as declared by the manufacturer. The minimum individual thickness of a slate shall be in accordance with the sulfur dioxide exposure code S or the depth of softened layer in e_s , determined in accordance with EN 12326-2:2011, 14.2, as defined in Table 1.

Any slates which achieve a code S3 may be tested according to EN 12326-2:2011, 14.2, to determine their minimum individual thickness according to 5.2.3.5.

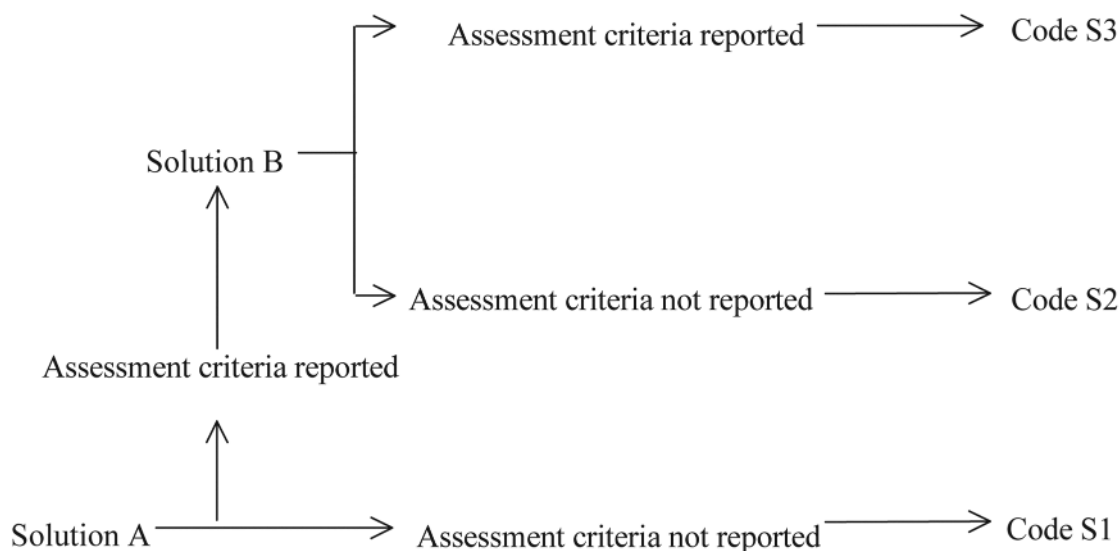


Figure 2 — Coding for sulfur dioxide exposure test

5.9.2 Slates with an apparent calcium carbonate content of > 20 %, determined in accordance with EN 12326-2:2011, Clause 13, shall be tested according to EN 12326-2:2011, 14.2. The depth of softening measured (e_s) shall be used to determine the minimum individual thickness according to 5.2.3.5.

5.10 Non-carbonate carbon content

When tested in accordance with EN 12326-2:2011, 13.5.2, the non-carbonate carbon content of slates shall be equal to or less than 2 %.

5.11 Defects

When subjected to a macroscopic examination according to EN 12326-2:2011, 16.6.1, slates shall be free of physical or petrographic features, as listed in EN 12326-2:2011, 16.6.1 b) and c), and damage which would be detrimental to their performance.

Small cracks and loosely attached flakes that are the result of the method of manufacture are permissible in so far as they do not prejudice the other requirements of this document.

5.12 Other dimensions

5.12.1 General

The requirements of 5.12.2, 5.12.3, 5.12.4 and 5.12.5 shall not apply to slates made to undefined dimensions or non-rectangular formats.

Requirements for rectangular slates, including shouldered rectangular roofing and external cladding slates, are specified in 5.12.2, 5.12.3, 5.12.4 and 5.12.5. Requirements for roofing and external cladding slates of other shapes or undefined dimensions are specified in 5.12.6.

5.12.2 Deviation of length and width

When tested in accordance with EN 12326-2:2011, Clause 5, rectangular slates shall not deviate from the manufacturer's declared length or width by more than ± 5 mm.