SLOVENSKI STANDARD
SIST EN 12326-2:2000

01-oktober-2000

Skrilavec in drugi izdelki iz naravnega kamna za polaganje streh in zidov - 2. del : Preskusne metode

Slate and stone products for discontinuous roofing and cladding - Part 2: Methods of test

Schiefer- und andere Natursteinprodukte für Dachdeckungen für überlappende Verlegung und Außenwandbekleidungen - Teil 2: Prüfverfahren

Ardoises et éléments en pierre pour toiture et bardage pour pose en discontinu - Partie 2: Méthodes d'essais

Ta slovenski standard je istoveten z: EN 12326-2:2000

ICS:

91.100.15	Mineralni materiali in izdelki	Mineral materials and products

SIST EN 12326-2:2000 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12326-2

February 2000

ICS 91.100.15

English version

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

Foreword

This European Standard 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 IBN.

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of an identical text or by endorsement, at the latest by August 2000, and conflicting national standards shall be withdrawn at the latest by August 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

EN 12326 is one of a series of standards for slate and stone products for roofing and is published in two parts as follows:

Part 1: Product specification
Part 2: Methods of test

1 Scope

This part of EN 12326 specifies test methods for roofing and wall cladding slates and other stones. It is applicable to natural roofing products as defined in prEN 12326-1:1999 used for assembly into discontinuous roofs and wall cladding.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references subsequent amendments to, or revisions of any of these publications apply to this European Standard only when incorporated into it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 196-21 *Methods of testing cement - Determination of the chloride, carbon dioxide and alkali content of cement*

prEN 12326-1:1999 *Slate and stone products for discontinous roofing and cladding – Part 1: Product specification*

3 Definitions and symbols

3.1 Definitions

For the purposes of this European Standard the following definitions apply:

3.1.1 test piece (of slate):
A piece sawn from a slate and prepared for testing as defined by the relevant test procedure.

3.1.2 powdered test piece (of slate):
A piece or pieces of a slate or slates prepared for testing by grinding to a powder of a defined particle size.

3.1.3 sampling:
The process of selecting a slate or a set of slates for testing.

3.1.4 constant mass:
Mass achieved when two successive weightings taken 24 h apart do not differ by more than 0,001 g.

3.1.5 Student's *t*-test:
A standard parametric statistical test used to test hypotheses about population means when the variance(s) are known (see ISO 3534-1:1993). In this European standard it is used to test for significant differences between the means of two populations.

3.1.6 modulus of rupture:
Maximum stress sustained by a slate test piece when a bending moment is applied. (In this standard the geometry of the test is three point bending).

3.2 Symbols

Symbol	Physical quantity	Unit
A_w	water absorption	%
A	rate of application of stress in the bend strength test	mPa/s
b	width of a slate or a test piece	mm
C_a	mass percentage of carbonate in a standard preparation of calcium carbonate and silica	%
C'_a	apparent mass percentage calcium carbonate in slate	%
C_c	carbonate carbon content of slate	%
$\overline{C}_c$	mean carbonate carbon content of a slate	%
C_d	carbon dioxide content of a test piece or standard preparation	%
C_{d1}	volume of carbon dioxide evolved from a powdered test piece in the determination of carbonate content by calcimetry	%
C_{d2}	volume of carbon dioxide evolved from a standard preparation in the determination of carbonate content by calcimetry	%
C_t	mass percentage carbonate content of a slate or a powdered test piece	%
$\overline{C}_t$	mean mass percentage carbonate content of a slate	%
C_T	total carbon in a slate	%
C_{nc}	non-carbonate carbon in a slate	%
e	thickness of a slate	mm
e_m	mean of three thickness measurements used to determine the rate of application of load in the bend strength test	mm
e_{max}	maximum of four thickness measurements carried out on one slate test piece	mm
$\overline{e}$	mean thickness of a slate test piece or series of test pieces	mm
E_d	maximum deviation of the thickness of a slate from the mean thickness	%
e_s	thickness of the softened layer in the SO_2 exposure test	mm
e_{1A} to e_{4A}	individual thickness measurements in the SO_2 exposure test	mm
E_1	conductivity reading for total carbon	S/m
E_2	conductivity reading for non-carbonate carbon	S/m

f	gas volume reduction factor of the pump in the determination of non-carbonate carbon content by coulometry	-
f'	gas volume reduction factor of the pump in the blank determination of non-carbonate content by coulometry	-
$f_1 f_2$	means of three dial gauge readings in the flatness test	mm
f_d	deviation from flatness of a slate	mm
F_d	deviation from flatness of a slate as a percentage of its length	%
I	number of pulses recorded in the determination of non-carbonate carbon content by coulometry	-
I'	number of pulses recorded in the blank determination of non-carbonate carbon content by coulometry	-
k	proportionality factor specific to the apparatus in the determination of non-carbonate carbon content by coulometry	-
$\lambda K\alpha$	wavelength of the α radiation used in the x-ray diffraction analysis	nm
l_s	length of a slate	mm
l_t	distance between the bending supports to base	mm
m_o	dry mass of a test piece in the water absorption test	g
m_p	mass of a powdered test piece of slate	mg
m_c	mass of a powdered test piece used for total carbon in the determination of carbonate content by the conductivity of sodium hydroxide	mg
m_{nc}	mass of a powdered test piece for non-carbonate carbon in the determination of carbonate content by the conductivity of sodium hydroxide	mg
m_s	mass of calcium carbonate used in the determination of carbonate content by conductivity of sodium hydroxide	mg
m_w	wet mass of a test piece in the water absorption test	g
m_1	total carbon content in the determination of carbonate content by catalytic thermal decomposition	%
m_2	content of non-carbonate carbon in the determination of carbonate content by catalytic thermal decomposition	%
m_3	content of carbonate carbon in the determination of carbonate content by catalytic thermal decomposition	%
n	number of slates subject to a test	-
P_i	failure load of individual slates in the bending strength test	N

r_d	individual measurements of the deviation of a slate from a rectangle	mm
r_{dmax}	maximum deviation of a slate from a rectangle	mm
R_d	deviation of a test slate from a rectangle as a percentage of its length	%
RR_i	modulus of rupture of test slates	MPa
$\overline{R}$	sample mean modulus of rupture of test slates	MPa
$\overline{R}_l$	sample mean modulus of rupture of test slates measured in the longitudinal orientation	MPa
$\overline{R}_t$	sample mean modulus of rupture of test slates measured in the transverse orientation	MPa
R_c	characteristic modulus of rupture of test slates	MPa
$\overline{R}_1$	sample mean modulus of rupture of the control test pieces in the freeze-thaw test	MPa
$\overline{R}_2$	sample mean modulus of rupture of the frost exposed test pieces in the freeze-thaw test	MPa
s	sample standard deviation of the modulus of rupture	-
s_l	sample standard deviation of the modulus of rupture in the longitudinal orientation	-
s_t	sample standard deviation of the modulus of rupture in the transverse orientation	-
s_1	sample standard deviation of the modulus of rupture of the control test pieces after the freeze-thaw test	-
s_2	standard deviation of the modulus of rupture of the frost exposed test pieces after the freeze-thaw test	-
s_d	deviation of the edge of a slate from a straight edge -	mm
S_d	deviation of the edge of a slate from a straight edge as a percentage of its length	%
v_l	rate of application of the load in the bend strength test	N/s
α	deviation of a slate from rectangle	°
θ	angle of incidence of the beam in the X-ray diffraction analysis	°

NOTE: MPa ≡ MN/m^2 ≡ N/mm^2

4 Surveillance sampling procedure

Sampling shall be carried out by selecting slates from each lot separately in a random way so that every slate has an equal chance of being selected. Selected slates or stones shall be marked so as to identify which lot they came from. Table 1 indicates the number of slates or stones required for each test. In the case of disputes test slates need only be taken for those tests which are in doubt.

Table 1 — The number of slates required to carry out each test

Test	Number of slates required from each lot for each test
Length and width	1
Straight edges	1
Rectangularity	1
Thickness of packed slates	100
Individual thickness	1
Curvature	1
Bend strength	20/40*
Water absorption	5
Freeze thaw	20/40*
Carbon content	3
Carbonate content	3
Sulfur dioxide exposure less than 20 % carbonate	12
Sulfur dioxide exposure 20 % or greater carbonate	6 or 12*
Thermal cycle	6

NOTE 1 : Because many of the tests do not require whole slates it is possible to carry out a full set of tests with fewer than the total number of slates listed in this table.

NOTE 2 : For the tests marked * the number of slates required depends on their size.

NOTE 3 : The individual tests indicate the size and number of test pieces or powdered test pieces required.

NOTE 4 : Where there is a possibility that the slates being tested may contain localised harmful inclusions such as calcite veins or oxidisable minerals the preparation of the test pieces or powdered test pieces should be modified to ensure sufficient inclusions are contained in the test piece to provide a representative result.

NOTE 5 : Sampling should preferably be carried out by the recipient or his representative in the presence of the supplier.

5 Determination of the length and width and the deviation from the specified length and width

5.1 Principle

The dimensions of slates are measured using a steel rule placed on the midline of the length and the width. The percentage deviation from the specified dimension is calculated.

5.2 Apparatus

5.2.1 A steel rule capable of reading to 0,5 mm.

5.2.2 Two steel bars longer and thicker than the slates under test. Each bar shall have one edge which shall not deviate from a straight edge by more than ± 0,1 mm.

5.3 Preparation of test pieces

Whole slates are used and do not need any preparation unless any corners are oversized within 50 mm of the corner. In this case remove the over size corner(s) at an angle of approximately 45° from a point 50 mm from the corner, using a suitable cutting tool.

5.4 Procedure

Place the slate with the chamfered edge facing down. Align the straight edges of the two steel bars along the long edges of the slate. Using a steel rule find the midpoints of the length of the slate on each side to the nearest 1,0 mm at each end and mark the positions on the slate. Place the steel rule across the distance between the bars at the marked points. Read off and record the width to the nearest 1,0 mm.

Repeat for the length.

5.5 Expression of the results

Calculate the difference of the length from the specified length as a percentage.

Calculate the difference of the width from the specified width as a percentage.

5.6 Test report

Report the length and width in millimetres and the deviation in percentage from the specified length and width.

The test report shall also include the identification of the product, reference to this method and the identifier of this European Standard, i.e. EN 12326-2 : 2000.

6 Determination of the amount by which the edges deviate from a straight edge.

6.1 Principle

The deviation of the long edges of slates from a straight edge is measured using a steel rule. For slates 500 mm long or longer the deviation is calculated as a percentage of the length.

6.2 Apparatus

6.2.1 A steel rule capable of reading to 0,5 mm.

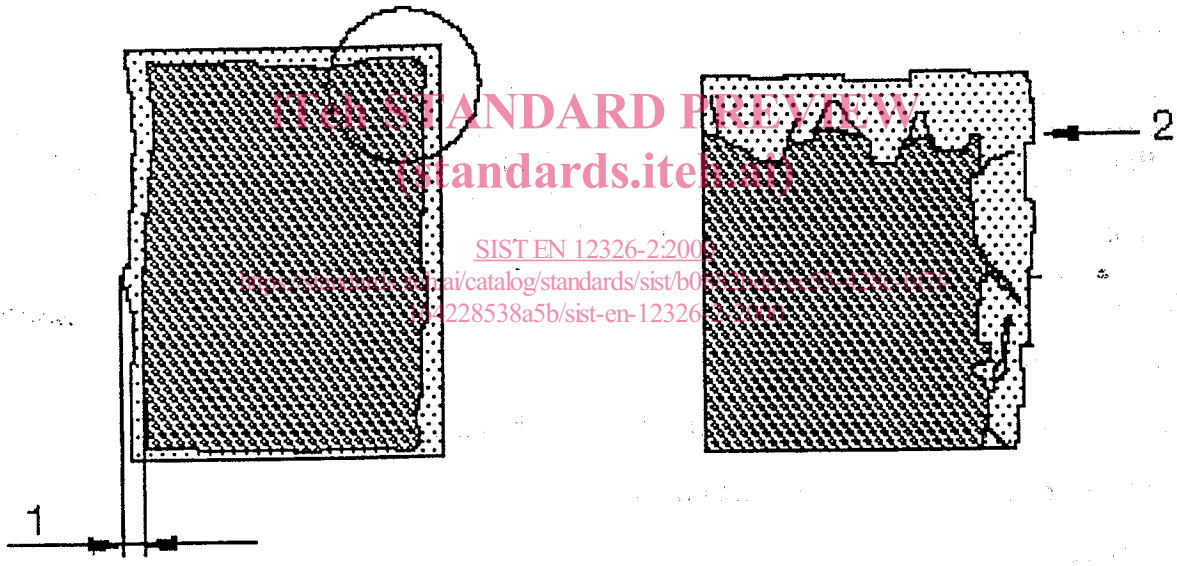
6.2.2 A steel bar longer and thicker than the slates under test with one edge which shall not deviate from a straight edge by more than ± 0,1 mm.

6.3 Preparation of test pieces

Whole slates are used and do not need any preparation unless any corners are oversized within 50 mm of the corner. In this case the over size corner(s) shall be removed at an angle of approximately 45° from a point 50 mm from the corner, using a suitable cutting tool.

6.4 Procedure

Place the slate with the chamfered edge facing down and position the straight edge of the steel bar alongside one edge of the slate. Using the steel rule measure the maximum deviation (s_{d1}) of the edge of the slate from the steel bar to the nearest 0,5 mm. Ignore small deviations and flaking resulting from the dressing of the edges (see Figure 1). Repeat and record the deviation for the other edge (s_{d2}).



1 Deviation from a straight edge
2 Acceptable minor deviations and flaking

Figure 1 — Illustration of acceptable small variations and flaking resulting from the dressing of the edges of slates. The chamfer is shown facing upwards

Measure the length of the slate (l_s) by the method given in clause **5**.

6.5 Expression of the results

For slates of 500 mm or longer and for each edge calculate the percentage deviation from a straight edge (S_d) using the equation :

$$S_d = \frac{s_{dx} \cdot 100}{l_s}$$

where

s_{dx} is the deviation for each edge, s_{d1} and s_{d2} in millimetres,

l_s is the length of the slate in millimetres.

6.6 Test report

For slates less than 500 mm long report for each edge the deviation in mm from a straight edge.

For slates 500 mm long or longer report for each edge the deviation in mm from a straight edge and the percentage deviation.

The test report shall also include the identification of the product, reference to this method and the identifier of this European Standard, i.e. EN 12326-2 : 2000.

7 Determination of the rectangularity of slates

7.1 Principle

The deviation from a right angle of the angles enclosing any two sides is measured using a goniometer or an engineering set square. The deviation is calculated as a percentage of the length.

7.2 Apparatus

7.2.1 A try square with blades longer and thicker than the slates under test calibrated to an accuracy of 0,1°.

7.2.2 Alternatively, a goniometer (calibrated adjustable square) with blades longer and thicker than the slates under test capable of being read to 0,1°.

7.3 Preparation of test pieces

Whole slates are used and do not need any preparation unless any corners are oversized within 50 mm of the corner. In this case remove the over size corner(s) at an angle of approximately 45° from a point 50 mm from the corner using a suitable cutting tool.

7.4 Procedure

Place the slate in the set square with one end tightly against the blade so that the long edge of the slate touches the opposite blade. Using the steel rule measure the maximum

deviation (r_{d1}) of the long edge from the opposing blade of the set square to the nearest 0,5 mm.

Repeat for all four corners to obtain the values (r_{d2}), (r_{d3}) and (r_{d4}).

Alternatively, if a goniometer is used read the deviation in degrees to the nearest 0,1°.

Measure the length of the slate (l_s) by the method given in clause **5**.

7.5 Expression of the results

For each edge calculate the percentage deviation (R_d) from a rectangle using the equation :

$$R_d = \frac{r_{d\,\max} .100}{l_s}$$

where

r_{dmax} is the maximum value of (r_{d1}) to (r_{d4}) in millimetres

l_s is the slate length in millimetres

Alternatively, if a goniometer has been used calculate the percentage deviation using the equation

$$R_d = \tan \alpha .100$$

where

α is the maximum angle measured in 7.4.

7.6 Test report

Report the maximum percent deviation.

The test report shall also include the identification of the product, reference to this method and the identifier of this European Standard, i.e. EN 12326-2 : 2000.

8 Determination of thickness

8.1 Thickness of packed slates

8.1.1 Principle

The thickness of 100 closely packed slates in a pallet is measured in millimetres with a steel rule. The value obtained is divided by 100 and adjusted by an amount dependent on the flatness characteristics of the slate type.

8.1.2 Apparatus

Metal rule, or similar equipment, capable of measurements to 1 mm.

8.1.3 Preparation of test pieces

Slates are measured close packed in a pallet but do not need any preparation.

8.1.4 Procedure

Count 100 slates and measure their total thickness using the metal rule.

8.1.5 Expression of results

Divide the measured thickness by 100. Determine the packed thickness by applying the appropriate reduction shown in Table 2.

Table 2 — Thickness reduction

Calculated thickness	Thickness reduction for slate type*		
	Smooth	Normal	Textured
mm	%	%	%
2 to 4	10	15	20
> 4	15	20	25
*As specified by the manufacturer.			

8.1.6 Test report

Report the packed slate thickness to 0,1 mm.

The test report shall also include the identification of the product, reference to this method and the identifier of this European Standard, i.e. EN 12326-2 :2000.

8.2 Thickness of individual slates

8.2.1 Principle

The thickness of individual slates is measured at four points using a micrometer, or similar equipment. The thickness is expressed as the mean of the four readings.

8.2.2 Apparatus

Dial gauge, micrometer or similar equipment capable of measuring thickness to 0,05 mm with a contact area of 5 mm to 10 mm diameter.

8.2.3 Preparation of test pieces

Whole slates are used. They do not require any preparation.

8.2.4 Procedure

Measure the thickness of the slate to 0,1 mm at four points avoiding all dressed edges and any localised thick or thin areas.

NOTE : Figure 2 indicates the approximate points of measurement for various slate shapes.