



SLOVENSKI STANDARD
oSIST prEN 1339:2010
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Betonski robniki - Zahteve in preskusne metode

Concrete paving flags - Requirements and test methods

Platten aus Beton - Anforderungen und Prüfverfahren

Dalles en béton - Prescriptions et méthodes d'essai

Ta slovenski standard je istoveten z: prEN 1339

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

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English Version

Concrete paving flags - Requirements and test methods

Dalles en béton - Prescriptions et méthodes d'essai

Platten aus Beton - Anforderungen und Prüfverfahren

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 178.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Contents	Page
Foreword.....	3
1 Scope.....	4
2 Normative references.....	4
3 Terms and definitions.....	5
4 Requirements for materials.....	7
5 Requirements for products.....	7
6 Evaluation of conformity criteria.....	13
7 Marking.....	19
8 Test report.....	20
Annex A (informative) Inspection schemes.....	21
Annex B (normative) Procedure for acceptance testing of a consignment at delivery.....	26
Annex C (normative) Measurement of the dimensions of a single flag.....	28
Annex D (normative) Determination of freeze/thaw resistance with de-icing salt.....	32
Annex E (normative) Measurement of abrasion resistance.....	38
Annex F (normative) Measuring of abrasion according to the Böhme test.....	46
Annex G (normative) Method for the determination of unpolished slip resistance value (USRV).....	50
Annex H (normative) Verification of visual aspects.....	57
Annex I (informative) Example of the application of the method for checking conformity of either bending strength or breaking load by variables (6.3.8.3.B).....	58
Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Directive (89/106/EEC).....	61

Foreword

This document (prEN 1339:2010) has been prepared by Technical Committee CEN/TC 178 “Paving units and kerbs”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1339:2003.

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prEN 1339:2010 (E)**1 Scope**

This European Standard specifies materials, properties, requirements and test methods for cement bound unreinforced concrete paving flags and complementary fittings.

It is applicable to precast concrete paving flags and complementary fittings that are for use in trafficked paved areas and roof coverings.

In case of regular use of studded tyres additional requirements are sometimes needed.

This standard does not deal with the tactility or visibility of flags nor with permeable flags.

This standard provides for the product marking and the evaluation of conformity of the product to this European Standard.

2 Normative references

This European Standard incorporates by dated and undated references, 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 in it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

EN 10083-2, *Quenched and tempered steels — Part 2: Technical delivery conditions for unalloyed quality steels*.

EN 13369, *Common rules for precast concrete products*.

EN ISO 4288, *Geometric product specification (GPS) — Surface texture - Profile method: Rules and procedures for the assessment of surface texture (ISO 4288:1996)*.

EN ISO 6506-1, *Metallic materials - Brinell hardness test - Part 1: Test method*.

EN ISO 6506-2, *Metallic materials - Brinell hardness test - Part 2: Verification and calibration of testing machines*.

EN ISO 6506-3, *Metallic materials - Brinell hardness test - Part 3: Calibration of reference blocks*.

ISO 48, *Rubber, vulcanised or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*.

ISO 4662, *Rubber — Determination of rebound resilience of vulcanizates*.

ISO 7619, *Rubber — Determination of indentation hardness by means of pocket hardness meters*.

ISO 7873, *Control charts for arithmetic average with warning limits*.

ISO 7966, *Acceptance control charts*.

ISO 8486-1, *Bond abrasives — Determination and designation of grainsize distribution — Macrogrits F4 to F220*.

3 Terms and definitions

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

3.1

arris

part of a flag where two faces meet. It can be bevelled, rounded, chamfered, radiussed or splayed

3.2

concrete paving flag

precast concrete unit used as a surfacing material that satisfies the following conditions:

- its overall length does not exceed 1 m;
- its overall length divided by its thickness is greater than four

NOTE These two conditions are not applicable to complementary fittings.

3.3

complementary fitting

unit, sometimes a part of a flag, which is used to infill and enable an area to be completely surfaced

3.4

permeable paving flag

flag intended, by its structure, to allow the passage of water through the flag

3.5

overall length

longer side of the rectangle with the smallest area able to enclose the flag excluding any spacer nibs

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3.6

overall width

shorter side of the rectangle with the smallest area able to enclose the flag excluding any spacer nibs

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3.7

thickness

distance between the upper face and the bed face of the flag

3.8

spacer nibs

small protruding profiles on a side face of a flag

3.9

upper face

surface intended to be seen when in use

3.10

bed face

surface generally parallel to the upper face and in contact with the bedding after laying

3.11

facing layer

layer of concrete on the upper face of a flag of different material and/or properties to the main body or backing layer of a flag

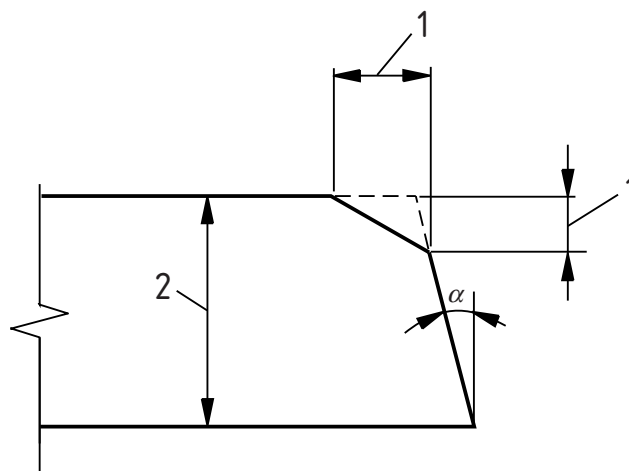
NOTE To be distinguished from wipe, being a fine cement mortar or slurry applied to the surface of the flag.

prEN 1339:2010 (E)

3.12

draw

intended angle of the side face from the vertical plane over the full height of a flag as shown in Figure 1

**Key**

1 Chamfer

2 Thickness

 α Draw

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Figure 1 — Example of chamfer and draw

3.13

chamfer

bevelled arris, as shown in Figure 1

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3.14

work dimension

any dimension of a flag specified for its manufacture to which the actual dimension should conform within specified permissible deviations

3.15

secondary processing

manufacturing process to texture the whole flag or any surface, carried out after basic manufacture before or after hardening

3.16

actual dimension

dimension of a flag as measured

3.17

chased side face

side face of a concrete paving flag, having a recessed profile

3.18

skid resistance

ability to resist relative movement between a vehicle tyre and the trafficked concrete paving flag surface

3.19

slip resistance

ability to resist relative movement between a pedestrian foot and the trafficked concrete paving flag surface

3.20**format**

work dimension of a flag specified in order of overall length, overall width and thickness

3.21**wipe**

fine cement mortar or slurry applied to the surface of the units prior to curing

4 Requirements for materials

4.1 General

Only materials with suitability established in terms of their properties and performance shall be used in the manufacture of concrete paving flags. The suitability requirements of the materials used shall be given in the manufacturer's production control documentation.

Where, by conformity with relevant specifications, the properties and performance of materials have been demonstrated, further testing need not be performed.

A reference scheme for materials inspection is given in annex A.

4.2 Asbestos

Asbestos, or materials containing asbestos, shall not be used.

5 Requirements for products

5.1 General

The performance requirements of concrete paving flags are defined by classes which have associated marking designations.

Flags may be produced with a single concrete throughout or with different facing and backing layers.

When flags are produced with a facing layer this shall have a minimum thickness of 4.0 mm over that area claimed by the manufacturer to be faced, when measured in accordance with annex C. Isolated particles of aggregate protruding into the facing layer shall be ignored. The facing layer shall be an integral part of the flag. A wipe shall only be carried out on a unit prior to curing, the constituents used shall be the same as in the body of the flag.

An arris described as square may be bevelled or rounded. The horizontal or vertical dimensions shall not exceed 2.0 mm.

A bevelled arris exceeding 2.0 mm shall be described as chamfered. Its dimensions shall be declared by the manufacturer.

Flags may be produced with functional and/or decorative profiles, which shall not be included in the work dimensions of a flag.

The surface of flags may be textured, secondary processed or treated chemically; these finishes or treatments shall be described and declared by the manufacturer.

prEN 1339:2010 (E)

5.2 Shape and dimensions

5.2.1 General

All references to dimensions in this subclause are to work dimensions.

The conformity criteria corresponding to each requirement taken separately are given in 6.3.8.1. The dimensions and deviations shall be measured according to annex C.

5.2.2 Work dimensions

The work dimensions shall be stated by the manufacturer.

5.2.3 Spacer nibs, draw or chased profiled side faces

Flags may be produced with spacer nibs, a draw or chased profiled side faces. When these are provided, the manufacturer shall declare their work dimensions. They are not included in the stated length or width of a block.

NOTE The size of the space allocated to the flag should include an allowance for joints and deviations.

5.2.4 Permissible deviations

The permissible deviations on the manufacturer's declared work dimensions are given in Tables 1, 2 and 3.

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Table 1 — Permissible deviations

Class	Marking	Flag work dimensions mm	Length mm	Width mm	Thickness mm
1	N	all	± 5.0	± 5.0	± 3.0
2	P	≤ 600	± 2.0	± 2.0	± 3.0
		> 600	± 3.0	± 3.0	± 3.0
3	R	all	± 2.0	± 2.0	± 2.0

The difference between any two measurements of the length, width and thickness of a single flag shall be ≤ 3 mm.

For non-rectangular flags the deviations of the other dimensions shall be declared by the manufacturer.

When the length of the diagonals exceeds 300 mm, the maximum permissible differences between the measurement of the two diagonals of a rectangular flag are given in Table 2.

Table 2 — Maximum differences between the measurement of the diagonals

Class	Marking	Diagonal Mm	Maximum difference mm
1	J	≤ 850	5
		> 850	8
2	K	≤ 850	3
		> 850	6
3	L	≤ 850	2
		> 850	4

When the maximum dimension of a flag exceeds 300 mm, the deviations for flatness and bow given in Table 3 shall apply to an upper face intended to be plane.

When the upper face is not intended to be plane, the manufacturer shall supply the information on deviations.

Table 3 — Deviations of flatness and bow

Length of gauge mm	Maximum convex Mm	Maximum concave mm
300	1,5	1,0
400	2,0	1,5
500	2,5	1,5
800	4,0	2,5

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5.3 Physical and mechanical properties

5.3.1 General

The flags shall conform to the following requirements at the time they are declared suitable for use by the manufacturer.

When complementary fittings cannot be tested according to this standard, they are considered to be in the same class as the standard flags, provided they have at least the same concrete quality and manufacturing process as flags complying with this standard.

5.3.2 Weathering resistance

5.3.2.1 Test method

The weathering resistance is determined by tests according to annex D for freeze-thaw resistance or annex E for water absorption and to the conformity criteria of 6.3.8.2.

5.3.2.2 Performance and classes

The flags shall conform to the requirements in Table 4.1 or Table 4.2.

Recommendations as to the class(es) of weathering resistance required to ensure durability for that country, for the uses for which the product is put on the market, may be made at a national level.

Table 4.1 — Water absorption

Class	Marking	Water absorption % by mass
1	A	no performance measured
2	B	≤ 6.5

Where specific conditions exist such as frequent contact of surfaces with de-icing salts under frost conditions, the requirements defined in Table 4.2 may have to be fulfilled.

Table 4.2 — Resistance to freeze-thaw with de-icing salts

Class	Marking	Mass loss after freeze/thaw test kg/m ²
3	D	≤ 1,0 as a mean with no individual value > 1,5

5.3.3 Bending strength

5.3.3.1 Test method

The characteristic bending strength shall be determined by testing according to annex F and to the conformity criteria given in 6.3.8.3.

5.3.3.2 Performance and classes

The characteristic bending strength shall not be less than the value corresponding to the class in Table 5.

None of the individual results shall be less than the corresponding minimum bending strength in Table 5.

Table 5 — Bending strength classes

Class	Marking	Characteristic bending strength Mpa	Minimum bending strength MPa
1	S	3,5	2,8
2	T	4,0	3,2
3	U	5,0	4,0

Guidance on application may be provided at a national level.

5.3.3.3 Complementary fittings

Complementary fittings are not to be tested but considered to be in the same class as the standard flags, provided they have at least the same concrete strength.

5.3.3.4 Durability of strength

Under normal exposure conditions of use precast concrete flags will continue to provide satisfactory strength, provided they conform to 5.3.3.2 and are subject to normal maintenance.

5.3.4 Abrasion resistance

5.3.4.1 Test method

Abrasion resistance is determined by the Wide Wheel Abrasion test (see annex G), or as an alternative by the Böhme test (see annex H). The Wide Wheel Abrasion test is the reference test.

5.3.4.2 Performance and classes

Requirements for abrasion resistance are given in Table 6.

No individual result shall be greater than the required value.

Table 6 — Abrasion resistance classes

Class	Marking	Requirement	
		Measured in accordance with the test method described in annex G	Alternatively measured in accordance with the test method described in annex H
1	F	No performance measured	No performance measured
2	G	≤ 26 mm	$\leq 26\ 000$ mm ³ /5 000 mm ²
3	H	≤ 23 mm	$\leq 20\ 000$ mm ³ /5 000 mm ²
4	I	≤ 20 mm	$\leq 18\ 000$ mm ³ /5 000 mm ²

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5.3.5 Slip/skid resistance

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5.3.5.1 Test Method

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Slip /skid resistance is determined by testing in accordance with the test method as described in *ENV 12633*

NB If ENV 12633 is published separately as a CEN TS, the reference will need to be changed editorially before final publication

5.3.5.2 Performance and classes

Requirements for slip/skid resistance are given in Table 5.3. Both the unpolished and polished values shall, satisfy the requirements for the class

Table 5.3 Skid Resistance classes

If the ridges, features the is	Class	Marking	Slip/skid resistance values	surface of a flag contains grooves or other surface which prevent testing by pendulum friction equipment, the product deemed to satisfy the requirements of this
	1	P	No performance measured	
2	Q	≥ 35		
3	R	≥ 45		
4	S	≥ 55		

standard without testing. Where the flag is too small to provide a test area, the manufacturer shall test a larger flag having the same surface finish as the flag in question.

prEN 1339:2010 (E)

NOTE The slip/skid resistance value relates to flags as manufactured and helps to ensure adequate slip/skid resistance on installation.

5.3.6 Breaking load**5.3.6.1 Test method**

The breaking load shall be determined in accordance with the test method described in annex F.

The conformity criteria are given in 6.3.8.2.

5.3.6.2 Performance and classes

The flags shall conform to the values indicated in Table 7.

Table 7 — Breaking load classes

Class number	Marking	Characteristic breaking load kN	Minimum breaking load kN
30	3	3,0	2,4
45	4	4,5	3,6
70	7	7,0	5,6
110	11	11,0	8,8
140	14	14,0	11,2
250	25	25,0	20,0
300	30	30,0	24,0

NOTE For design considerations special attention should be given to the possible loading conditions on flags larger than 600 mm.

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5.3.7 Fire performance**5.3.7.1 Reaction to fire**

Concrete paving flags are Class A1 reaction to fire without testing¹⁾.

5.3.7.2 External fire performance

Concrete paving flags used as roof covering are deemed to satisfy the requirements for external fire performance without the need for testing²⁾.

5.3.8 Thermal conductivity

If concrete flags are intended to contribute to the thermal performance of an element, then the manufacturer shall declare the thermal conductivity using design data from EN 13369.

¹⁾ Reference is made to the Commission Decision 96/603/EC as amended.

²⁾ See Commission Decision 2000/553/EC.

5.4 Visual aspects

5.4.1 Appearance

The upper faces of the concrete flags shall not exhibit defects such as cracking, or flaking, when examined in accordance with annex J.

In the case of two-layer flags and when examined in accordance with annex J there shall be no delamination (i.e. separation) between the layers.

NOTE When efflorescence occurs it is not deleterious to the performance of the flags in use and is not considered significant.

5.4.2 Texture

In the case of flags produced with special surface textures, the texture shall be described by the manufacturer.

If examined in accordance with annex J, conformity shall be established if there are no significant differences in texture to any samples supplied by the manufacturer and approved by the purchaser.

NOTE Variations in the texture consistency of the flags can be caused by unavoidable variations in the properties of the raw materials and by variations in hardening and are not considered significant.

5.4.3 Colour

Colours may be provided in a facing layer or throughout the flag at the manufacturer's discretion.

If examined in accordance with annex J, conformity shall be established if there are no significant differences in colour to any samples supplied by the manufacturer and approved by the purchaser.

NOTE Variations in the colour consistency of the flags can be caused by unavoidable variations in the shade and properties of the raw materials and by variations in hardening and are not considered significant.

6 Evaluation of conformity criteria

6.1 General

For the purpose of testing, the manufacturer may group products into families, where it is considered that the value of a selected property is common to all products within that family. Such families are:

- 1) strength family: flags manufactured using the same type of materials and production methods, irrespective of dimensions and colours;

NOTE Breaking load is dependent upon flag dimensions

- 2) surface family: flags with face mixes having the same main aggregate used in the mix (e.g. natural river gravel, crushed granite, porphy, basalt or limestone) and the same surface treatment of the finished product, irrespective of dimensions and colours.

6.1.1 Demonstration of conformity

Conformity of the product with the requirements of this standard and with the declared values (levels or classes) for the product properties shall be demonstrated by carrying out both:

- type testing of the product (see 6.2);