EAD **190021-00-0502**

www.eota.eu

January 2021

European Assessment Document for

# Recycled plastic self-blocking paving units

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

# Contents

# 1 SCOPE OF THE EAD

## 1.1 Description of the construction product

The EAD applies to self-blocking paving units made of recycled plastics (in the following “recycled plastic self-blocking paving units”) for the utilization, dry assembled, as elements of flooring systems intended to be installed in external areas subject to both pedestrian and vehicular traffic, and also in internal areas.

The recycled plastic self-blocking paving units are manufactured from recycled waste plastic granules resulting, for example, from the grinding of electric cables with the separation of the metallic parts. The wear surface of the recycled plastic self-blocking paving units can be smooth or with small bulges. Internally, the recycled plastic self-blocking paving units can show formed voids and a strengthening “skeleton”, also devised to facilitate the laying of the units on a bed of fine aggregates for final use.

Recycled plastic self-blocking paving units, which can be of variable dimensions, are normally designed in different geometric shapes, and in any case in geometric shapes developed to allow the full interlocking between the prefabricated units.

The recycled plastic self-blocking paving units are further recyclable at the end of their working life, as they can be reduced to granules to produce new products.

The recycled plastic self-blocking paving units are not fully covered by the following harmonised technical specification: EN 1338[1]. The reasons are that EN 1338 does not cover paving blocks made of materials other than cement bound concrete and that the recycled plastic self-blocking paving units can internally present formed voids. Therefore, there are certain essential characteristics of the recycled plastic self-blocking paving units for which no assessment methods were established yet or that needed some modifications, as explained in the bullet list hereafter.

- Reaction to fire: the recycled plastic self-blocking paving units need to be tested in order to be classified, in deviation from Annex ZA, Tables ZA.1 of EN 1338, due to the presence of organic material.
- Content, emission and/or release of dangerous substances: this characteristic has been developed since recycled materials are used for the production of the recycled plastic self-blocking paving units; furthermore, in this respect, the essential characteristic “Emissions of asbestos” as of EN 1338/Annex ZA.1 is not relevant for the recycled plastic self-blocking paving units due to the nature of the materials compared to concrete.
- Breaking tensile splitting strength: the modifications brought to the method are due both to the material characteristics (the recycled plastic self-blocking paving units do not need to be pre-wetted before the test) and to the internal geometry of the recycled plastic self-blocking paving units. Furthermore, the ageing treatments envisaged for breaking tensile splitting strength and tensile strength (i.e., artificial weathering including acidic deposition and exposure to laboratory light source) have been added in relation to the inherent properties of plastics and their different behaviour compared to concrete (mechanically and also for aspects of durability).
- Characteristic resistance to low temperature and resistance to indentation: these characteristics have been introduced in relation, again, to the inherent properties of plastics and their different behaviour compared to concrete (mechanically and also for aspects of durability).
- Thermal transmittance: a method has been specifically developed since the method of EN 1338 only applies to concrete products.
- Abrasion resistance and slip/skid resistance: with respect to EN 1338, the choice of different methods in the EAD is supported by the different material properties of plastics versus concrete (in particular, the slip/skid resistance is normally satisfied by concrete paving blocks).
- Water absorption and freeze and thaw resistance (weathering resistance): these characteristics have not been included, differently from EN 1338, because the materials of the recycled plastic self-blocking paving units have an extremely low water absorption value and this also influences the freeze and thaw resistance.

1 All undated references to standards in this EAD are to be understood as references to the dated versions listed in chapter 4.

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations, e.g., with regard to the intended end use conditions, having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA as long as the details of the assessment methods as laid down in this EAD are respected.

## 1.2 Information on the intended use(s) of the construction product

### 1.2.1 Intended use(s)

The recycled plastic self-blocking paving units are intended to be used for floorings both for external and internal applications.

The recycled plastic self-blocking paving units form flooring systems which can be installed in external areas subject to both pedestrian and vehicular traffic (also heavy vehicles crossing), such as car parking areas, industrial and residential yards, pedestrian areas, footpaths, pathways for animals and alleys, and in internal areas such as industrial warehouses and garages.

The recycled plastic self-blocking paving units are dry assembled, they are laid down on a sub-base consisting of a bed of fine aggregates. They are laid next to each other, without leaving space for a line of the fine aggregates in between.

### 1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the recycled plastic paving units for the intended use of 20 years when installed in the works. These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[2].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

[2] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

## 1.3 Specific terms used in this EAD

### 1.3.1 Product loading factor

Ratio of exposed dimension of the test specimen to the empty test chamber volume.

### 1.3.2 Length l

Longer linear dimension of the major surface of the test specimen.

### 1.3.3 Width b

Shorter linear dimension of the major surface of the test specimen, measured at right angles to the length.

### 1.3.4 Overall length

Longer side of the rectangle with the smallest area able to enclose the recycled plastic self-blocking paving unit.

### 1.3.5 Overall width

Shorter side of the rectangle with the smallest area able to enclose the recycled plastic self-blocking paving unit.

### 1.3.6 Thickness t

Distance between the upper face and the bed face of the recycled plastic self-blocking paving unit.

### 1.3.7 Undisturbed specimen

Specimen selected as representative of the product prior to exposure used for comparison with the exposed specimen, for initial property determination purpose.

### 1.3.8 Photodegradation

Type of degradation caused in plastics by the absorption of UV light which leads to a chemical degradation of the plastic material.

### 1.3.9 Black-standard thermometer (BST)

Type of black surface temperature sensor in accordance with the description for this device given in clause 5.2.2.1 of EN ISO 4892-1.

### 1.3.10 Black standard temperature

The temperature of exposure cycles controlled by means of a black-standard thermometer.

### 1.3.11 Black-panel thermometer (BPT)

The type of black surface temperature sensor in accordance with the description for this device given in clause 5.2.2.2 of EN ISO 4892-1.

### 1.3.12 Black panel temperature

The temperature of exposure cycles controlled by means of a black-panel thermometer.

### 1.3.13 Indentation

Concave deformation of the surface of a test specimen from the action of an indenter.

### 1.3.14 Slip Resistance Value (SRV)

Value which gives the measure of the friction between a slider, incorporated in the pendulum friction tester, and the test surface, and can be for dry conditions (SRV “dry”) or for wet conditions (SRV “wet”).

### 1.3.15 Symbols

| | | |
|---|---|---|
| $P$ | [N] | Breaking load of the single recycled plastic self-blocking paving unit |
| $P_{aged}$ | [N] | Breaking load of the single recycled plastic self-blocking paving unit after artificial weathering including acidic deposition |
| $c_P$ | [N] | Mean change in the property (breaking load P) |
| $s_{cP}$ | [N] | Standard deviation of the mean change in the property (breaking load P) |
| $\sigma_b$ | [MPa] | Stress value at which the specimen breaks in the test of tensile strength |
| $c_{\sigma b}$ | [MPa] | Mean change in the property (tensile strength) |
| $s_{c\sigma b}$ | [MPa] | Standard deviation of the mean change in the property (tensile strength) |
| $E$ | [N·m] | Impact energy value |
| HB | [N/mm$^2$] | Hardness Brinell value |
| $R$ | [m$^2$·K/W] | Thermal resistance value |
| $\lambda$ | [W/m·K] | Thermal conductivity value |
| $\lambda_{dry,90/90}$ | [W/m·K] | λ fractile value at dry conditions, representing at least 90% of the production with a confidence limit of 90% |
| $R_{si}$ | [m$^2$·K/W] | Conventional surface resistance (internal) value |
| $R_{se}$ | [m$^2$·K/W] | Conventional surface resistance (external) value |
| $U$ | [W/(m$^2$·K)] | Thermal transmittance value |

# 2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

## 2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of the recycled plastic self-blocking paving units is assessed in relation to the essential characteristics.

**Table 2.1.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics**

| No | Essential characteristic | Assessment method | Type of expression of product performance |
|---|---|---|---|
| Basic Works Requirement 2: Safety in case of fire | | | |
| 1 | Reaction to fire | 2.2.1 | Class |
| Basic Works Requirement 3: Hygiene, health and the environment | | | |
| 2 | Content, emission and/or release of dangerous substances:<br>- Leachable substances<br>- SVOC and VOC | 2.2.2.1<br>2.2.2.2 | Description and level<br>- EC20-values for each dilution ratio<br>- [% within … hours/days]Specific emission rates [µg/(m2*h)] and air concentrations in the reference room [µg/m3](*) |
| Basic Works Requirement 4: Safety and accessibility in use | | | |
| 3 | Aptness of the self-blocking paving units to be interlocked and continuously laid | 2.2.3 | Level<br>*l*, *b*, *t* [mm] |
| 4 | Breaking tensile splitting strength | 2.2.4 | Level<br>P [N] |
| 5 | Resistance to indentation | 2.2.5 | Level<br>Hardness Brinell HB [N/mm$^2$] |
| 6 | Abrasion resistance | 2.2.6 | Level<br>*n* |
| 7 | Slip/skid resistance | 2.2.7 | Level<br>SRV “dry” [-], SRV “wet” [-] |
| Basic Works Requirement 6: Energy economy and heat retention | | | |
| 8 | Thermal transmittance of the product based on thermal conductivity | 2.2.8 | Level<br>U [W/(m$^2$·K)] |

| No | Essential characteristic | Assessment method | Type of expression of product performance |
|---|---|---|---|
| Aspects of durability | | | |
| 9 | Breaking tensile splitting strength after artificial weathering including acidic deposition | 2.2.9 | Level<br>$P_{aged}$ [N]<br>$c_P$ [N], $s_{cP}$ [N] |
| 10 | Tensile strength after artificial weathering through exposure to laboratory light source | 2.2.10 | Level<br>$\sigma_b$ [MPa]<br>$c_{\sigma b}$ [MPa], $s_{c\sigma b}$ [MPa] |
| 11 | Resistance to low temperature | 2.2.11 | Level<br>E [N·m] |

(*) accompanied by the information about the product loading factor used [$m^2/m^3$] (see Clause 1.3.1)

## 2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

### 2.2.1 Reaction to fire

*Purpose of the assessment*

The purpose of the assessment is the evaluation of the reaction to fire of recycled plastic self-blocking paving units.

This performance is only relevant for the internal uses of the product.

*Assessment method*

The recycled plastic self-blocking paving units shall be tested, using the method(s) relevant for the corresponding reaction to fire class according to EN 13501-1. The recycled plastic self-blocking paving units shall be classified according to the Commission Delegated Regulation (EU) No 2016/364 in connection with EN 13501-1.

*Expression of results*

The determined class shall be given in the ETA.

### 2.2.2 Content, emission and/or release of dangerous substances

*Purpose of the assessment*

The performance of the self-blocking paving units related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer[3] after identifying the release scenarios taking into account the intended use of the product and the Member States where the manufacturer intends his product to be made available on the market.

The identified release scenarios for this product and intended use with respect to dangerous substances are:

S/W1: Product with direct contact to soil, ground and surface water

S/W2: Product with indirect contact to soil, ground and surface water

IA1: Product with direct contact to indoor air

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3 The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (cf. Article 6(5) of Regulation (EU) No 305/2011).

The manufacturer is **not** obliged:
-to provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
-to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.

Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA, to other TABs or beyond.

#### 2.2.2.1 Leachable substances

For the intended use covered by the release scenarios S/W1 and/or S/W2, the performance of the self-blocking paving units regarding leachable substances shall be assessed.

*Assessment method*

A leaching test with subsequent eluate analysis shall take place, each in duplicate. Leaching tests of the self-blocking paving units shall be conducted according to EN 16637-2. The leachant shall be pH-neutral demineralised water and the ratio of liquid volume to surface area shall be (80 ± 10) l/m².

Specimens shall be prepared in accordance with clause 8.2 of EN 16637-2.

In eluates of „6 hours“ and „64 days“, the following biological tests shall be conducted:

- acute toxicity test with Daphnia magna Straus according to EN ISO 6341;
- toxicity test with algae according to EN ISO 15799;
- luminescent bacteria test according to EN ISO 11348-1, EN ISO 11348-2 or EN ISO 11348-3.

For each biological test, EC20-values shall be determined for dilution ratios 1:2, 1:4, 1:6, 1:8 and 1:16.

*Expression of results*

Determined toxicity in the leaching test (biological tests) of the self-blocking paving units shall be expressed as EC20-values for each dilution ratio. Maximum determined biological degradability shall be expressed as "…% within … hours/days“. The respective test methods for analysis shall be specified.

#### 2.2.2.2 SVOC and VOC

For the intended use covered by the release scenario IA1 (in internal areas), the performance of the self-blocking paving units regarding SVOC and VOC shall be assessed.

*Assessment method*

Volatile organic compounds and semi-volatile organic compounds (respectively: VOC and SVOC) shall be determined in accordance with EN 16516. In particular, clause 8.2 of EN 16516 which describes the determination of VOCs and SVOCs in test chamber air, is of concern. The following loading factor for emission testing for the intended use “floor” is applicable according to EN 16516: 0,4 $m^2/m^3$.

The installation of the test specimen in the test chamber should be done in accordance with the manufacturer’s product installation instructions, whenever possible; in absence of such instructions, with the usual practice of the building professionals.

*Expression of results*

A description of specific emission rates [µg/($m^2$*h)] and respective air concentrations in the reference room [µg/$m^3$] of the compounds, together with the information regarding the product loading factor used [$m^2/m^3$], in accordance with clause 10.6 of EN 16516, shall be given in the ETA.

### 2.2.3 Aptness of the self-blocking paving units to be interlocked and continuously laid

*Purpose of the assessment*

The purpose of this test is the assessment of the compatibility of the self-blocking paving units to be interlocked in order to produce an even and flat continuous flooring surface, without local misalignments, through the determination of the principal dimensions of the unit.

*Assessment method*

For the number of units to be tested for the aptness to be interlocked and continuously laid, Table 7 in clause 6.2.3 of EN 1338, for shape and dimensions, applies (number of blocks = number of units).

Dimensional tests of length and width. For rectangular units, the length and width shall be measured. For non-rectangular units, the overall length and overall width shall be measured. Test method is in accordance with EN ISO 29465, in detail: in accordance with clause 4, clause 5 (apparatus as in clause 5.2), clause 6 (excluding clause 6.2, since the number of test specimens is already defined in the EAD), clause 7 and clause 8.

Dimensional test of thickness: the thickness of the recycled plastic self-blocking paving unit shall be measured at four points near to each side end of the unit (in three points whether the unit has a triangular shape) with a micrometre, dial gauge or calliper (permitting reading to an accuracy of 0,1 mm). The thickness shall be expressed in mm to the nearest millimetre, as the mean value for each test specimen.

*Expression of results*

The dimensions of the recycled plastic self-blocking paving units: length *l*, width *b* and other dimensions (for non-rectangular units) and thickness *t* (mean, minimum and maximum values) [mm], shall be given in the ETA.

### 2.2.4 Breaking tensile splitting strength

*Purpose of the assessment*

The purpose of the assessment is the evaluation of the breaking tensile splitting strength of recycled plastic self-blocking paving units.

*Assessment method*

The breaking tensile splitting strength of a recycled plastic self-blocking paving unit shall be assessed through the determination of the breaking load P of the single unit, which shall be carried out in accordance with the test method described in clause 5.3.3.1 of EN 1338 for the part which refers to Annex F of EN 1338, with the modifications described hereafter.

In clause F.2 of Annex F of EN 1338, the part which regards the immersion in water shall not be considered; in clause F.3, it is not required to finally calculate the area of the breaking plan, and in clause F.4 only the breaking load P [N] shall be determined.

If the unit presents internal voids and does not offer a continuous flat support, in the testing machine the lower face of the unit shall be rested on a flat plate.

For the number of units to be tested for breaking tensile splitting strength, Table 7 in clause 6.2.3 of EN 1338, for tensile splitting strength, applies (number of blocks = number of units).

Conditioning of the test specimens prior to determination of the breaking load P shall be performed in an atmosphere of (23±2) °C and (50±5) % R.H. for three days.

*Expression of results*

The mean value of the breaking load P [N] of the single recycled plastic self-blocking paving unit shall be given in the ETA.

### 2.2.5 Resistance to indentation

*Purpose of the assessment*

The purpose of the assessment is the evaluation of the resistance to indentation of recycled plastic self-blocking paving units.

*Assessment method*

In order to assess the surface hardness of the recycled plastic self-blocking paving units, the resistance to indentation shall be determined in accordance with the test method of EN 1534, with the following modification:

- the specimens shall be conditioned at 23°C / 50% RH for minimum 88 hours - maximum 96 hours (4 days) prior to testing;
- the test shall be performed at 23°C / 50% RH.

Test specimens, in the number of three, shall comply with clause 6.1 of EN 1534.

Indentations shall be carried out all over the surface area of the specimen, distributed at random, at a distance of not less than 20 mm from each other and at 10 mm from the edge of the test specimens. The minimum number of tests shall comply with clause 6.2 of EN 1534.

*Expression of results*

The average resistance to indentation calculated from all tests, expressed as the hardness Brinell HB [$N/mm^2$], shall be given in the ETA.

### 2.2.6 Abrasion resistance

*Purpose of the assessment*

The purpose of the assessment is the evaluation of the abrasion resistance of recycled plastic self-blocking paving units.

*Assessment method*

The determination of the abrasion resistance of the recycled plastic self-blocking paving units shall be carried out according to ISO 24338, tested in accordance with Method B. The procedure of Method B is described in clause 7 of ISO 24338.

In order to allow the fixing on the specimen holder, the test specimens, in the shape and dimensions envisaged by ISO 24338 in clause 5, shall be cut from the recycled plastic self-blocking paving units (take one test specimen from each unit), with flat faces and the wear surface of the paving unit as the wear surface of the specimen which shall be subjected to test.

*Expression of results*

The abrasion resistance shall be expressed as the number *n* of revolutions and shall be determined as described in clause 7.6 of ISO 24338. The average number *n* of corrected single test values for the three test specimens, shall be given in the ETA, accompanied by the indication of the calibration factor used for the correction, which is representative of the abrading capacity of the abrasive and is determined in accordance with clause 7.4.2 of ISO 24338.

### 2.2.7 Slip/skid resistance

*Purpose of the assessment*

The purpose of the assessment is the evaluation of the slip/skid resistance of recycled plastic self-blocking paving units.

*Assessment method*

The determination of the slip/skid resistance of the recycled plastic self-blocking paving units shall be carried out, for every surface structure type/texture of the recycled plastic self-blocking paving units, according to EN 14231. The number and dimensions of the test specimens shall be as in clause 7.1.1 and clause 7.2 of EN 14231 respectively.

Measurements shall be done both in dry and in wet conditions, and the slip/skid resistance calculated as described in clause 9 of EN 14231 (measurements both in longitudinal and in cross direction) both as SRV “dry” and as SRV “wet”.

The indications for the measurements on floors in service reported in any section of EN 14231 (specimen preparation, test procedure, expression of results) shall not be considered.

*Expression of results*

The slip/skid resistance values of the recycled plastic self-blocking paving units for a specific surface structure type/texture in dry condition (SRV “dry”) and in wet condition (SRV “wet”) [readings on the pendulum tester, dimensionless], as the mean values of the specimens (at least six specimens for each type), shall be given in the ETA.

### 2.2.8 Thermal transmittance of the product based on thermal conductivity

*Purpose of the assessment*

The purpose of the assessment is the evaluation of the thermal resistance and thermal conductivity of recycled plastic self-blocking paving units.

*Assessment method*

Thermal resistance R and consequently thermal conductivity λ in the dry state of the base material of the recycled plastic self-blocking paving units shall be determined by testing in accordance with the principles described in EN 12664 for the methods of the guarded hot plate and heat flow meter. The two methods can be considered equivalent and further specifications for the tests are given in the following.

The test procedure of EN 12664 applies to specimens made from the core material of the units; in case the units contained formed voids (for example: hollow units), it is possible to use this method for specimens made from the core material but formed voids are not permitted in the specimen. Thus, for products in which voids are shown, the test specimens, in the dimensions and number specified hereafter, shall be cut from the recycled plastic self-blocking paving units, with flat parallel faces. The surface of the test specimens shall be made flat by appropriate means, and shall meet the required dimensions. If it is not possible to cut specimens of suitable size from the units, plates made of homogeneous material shall be made. The specimens shall be of such size as to cover the heating unit surfaces completely, for this point see the specifications in clause 6.2 of EN 12664; in any case the specimens shall be prepared in accordance with chapter 6.3.2.1 of EN 12664.

The specimens for the guarded hot plate or heat flow meter test in accordance with EN 12664 shall have, as for thickness, the dimensions specified in Table A1 in Annex A clause A.3 of EN 12664 (common dimensions in laboratory apparatus sizes). The number of specimens is 4 from different raw material (= recycled plastic) batches, that is, 1 specimen from each different batch.

If the material is not known to have hygroscopic characteristics, the influence of humidity on thermal conductivity can be neglected.

The measurement of thermal conductivity of the dry material shall be performed after conditioning to the conventional dry state to constant mass. The specimen shall be heated for at least 72 hours in a well-ventilated oven at 70±2 °C or at the maximum temperature indicated by the manufacturer.

It is recommended the utilization of contact sheets and thermocouples mounted on the specimen surfaces.

The value of $\lambda_{dry,90/90}$ shall be determined taking at least 4 measurements (as a minimum) on the 4 specimens from different batches. The value of $\lambda_{dry,90/90}$ shall be calculated in accordance with Annex B and Annex C of EN ISO 10456. In particular, of EN ISO 10456:

- Annex B provides an example of calculation of λ declared value (= 90% fractile with 90% confidence) with 10 measurements;
- Table C.1 in Annex C “Statistical calculations” shall be consulted in order to calculate the coefficients $k_1$ and $k_2$ to be used for the corresponding number of measurements ($k_1$ when the standard deviation is known, $k_2$ when the standard deviation is estimated).

The thermal transmittance U of the recycled plastic self-blocking paving units in their actual and entire shape shall be determined by calculation, proceeding from the mean value of thermal conductivity $\lambda_{dry,90/90}$ of the material, measured according to EN 12664, and taking this value as input data for the calculation of the thermal transmittance. The calculation of the thermal transmittance U [W/(m$^2$·K)] is based on the rules set out in EN ISO 10211 for the 3-D modelling (three-dimensional geometrical modelling). In clause 9.1 of EN

ISO 10211 the reference to Annex C “Validation of calculation methods” shall be considered for the test reference cases for three-dimensional geometrical models.

In order to allow for the calculation of the thermal transmittance U [W/(m$^2$·K)], the values $R_{si}$ and $R_{se}$ of Table 7 in clause 6.8 of EN ISO 6946 (conventional surface resistances) for plane surfaces shall be used. For the direction of heat flow, see the instructions given therein.

*Expression of results*

The thermal transmittance U [W/(m$^2$·K)] of the recycled plastic self-blocking paving units shall be given in the ETA.

### 2.2.9 Breaking tensile splitting strength after artificial weathering including acidic deposition

*Purpose of the assessment*

The purpose of the test is to assess the variation in mechanical properties (breaking tensile splitting strength) of the recycled plastic self-blocking paving units, after artificial weathering cycles reproducing the effects of the exposure of plastics to a polluted outdoor environment.

*Assessment method*

For the variation of breaking tensile splitting strength, the determination of the breaking load P (breaking load of the single recycled plastic self-blocking paving unit) shall be carried out in accordance with clause 2.2.3 of this EAD on both aged specimens subjected to the cyclic treatment described in the procedure of clause 6 of EN ISO 29664, Method A (clause 6.1), and on undisturbed specimens.

In order to simulate the effects of the exposure to a polluted indoor environment, the provisions of EN ISO 29664 clause 6.1 Method A shall be followed. In particular, the weathering cycles to be performed are described in Table 1 – Test conditions “Type J” in clause 6.1.2 of EN ISO 29664. As clause 6.1.2 provides for this possibility, should there be an experimental evidence that the photodegradation of the specimens is not sensitive to humidity, the test shall be performed as described in Table 3 – Test conditions “Type U” in clause 6.1.2 of EN ISO 29664, without controlling relative humidity.

All clauses of EN ISO 29664 are relevant with the exclusion of clause 6.2 (which refers to Method B).

Test duration shall be as indicated in clause 6.1.3 of EN ISO 29664.

The test of breaking tensile splitting strength shall then be performed on five specimens for each group: five undisturbed specimens and five specimens exposed to the artificial weathering treatment.

Condition the specimens as specified in clause 2.2.3 of this EAD prior to breaking tensile splitting testing.

Comparison between measurements of the breaking tensile splitting strength on the exposed specimens and on the specimens tested prior to exposure, that is, undisturbed, in order to determine the changes in mechanical properties (breaking tensile splitting strength), shall be made in accordance with clause 6.2.3 letter c) of ISO 4582 and clause A4 of ISO 4582.

As values of initial breaking load P[N] expressing the breaking tensile splitting strength of undisturbed specimens, the results of the specimens formerly subjected to the test performed in accordance with clause 2.2.3 of this EAD can be taken.

*Expression of results*

The mean value of the breaking load $P_{aged}$ [N], after artificial weathering including acidic deposition, of the single recycled plastic self-blocking paving unit shall be given in the ETA.

The mean value and standard deviation for the change in such property ($c_P$ [N] and $s_{cP}$ [N]) after artificial weathering including acidic deposition, determined using the equations given in A4 of ISO 4582, shall also be given in the ETA.

### 2.2.10 Tensile strength after artificial weathering through exposure to laboratory light source

*Purpose of the assessment*

The purpose of the test is to assess the variation in mechanical properties (tensile strength) of the recycled plastic self-blocking paving units, after artificial weathering cycles reproducing the effects on the recycled plastic paving units of the exposure to daylight.

*Assessment method*

The determination of the tensile strength shall be carried out on both aged specimens, subjected to the cyclic treatment described in the procedure of EN ISO 4892-2 clauses from 7.1 to 7.4, with the exposures conducted with daylight filters (called Method A in EN ISO 4892-2), and on undisturbed specimens.

The specimens shall be cut from the recycled plastic self-blocking paving units. The shape and dimensions of test specimens, of type 1B in accordance with clause 6.1 of EN ISO 527-2, are defined in clause 6.1 of EN ISO 527-2 (dumb-bell-shaped type 1B as shown in Figure 1 and Table 1 of EN ISO 527-2).

In order to simulate daylight, the specimens shall be subjected to an irradiance treatment with laboratory light source. The treatment is based on a number of cycles performed in accordance with EN ISO 4892-2, proceeding as in Method A and Cycle 1 if black-standard thermometers (BST) are used (EN ISO 4892-2, Table 3) or as in Method A and Cycle 4 if black-panel thermometers (BPT) are used (EN ISO 4892-2, Table 4). The time of exposure (the time of exposure defines the number of cycles to be performed) to the artificial weathering shall be calculated as reported in Annex B of EN 12608-1 for severe climate and corresponding to 1 year's equivalent of solar radiant exposure.

The test of tensile strength shall then be performed on five specimens for each group: five undisturbed specimens and five specimens exposed to the artificial weathering treatment.

Condition the specimens as specified in clause 2.2.3 of this EAD prior to tensile testing.

The test of tensile strength shall be performed according to EN ISO 527-1, clause 9, with the test speed of 1 mm/min (EN ISO 527-2, Clause 8). The value of tensile strength (stress at break) $\sigma_b$ [MPa] according to EN ISO 527-1, clause 10.1, shall be calculated.

Comparison between measurements of the tensile strength on the exposed specimens and on the specimens tested prior to exposure, that is, undisturbed, in order to determine the changes in mechanical properties (tensile strength), shall be made in accordance with clause 6.2.3 letter c) and clause A4 of ISO 4582.

*Expression of results*

The mean value of the stress at break $\sigma_b$ [MPa], calculated in accordance with clause 10.1 of EN ISO 527-1, after artificial weathering shall be given in the ETA.

The mean value and standard deviation for the change in such property ($c_{\sigma b}$ [MPa] and $s_{c\sigma b}$ [MPa]) after artificial weathering, determined using the equations given in clause A4 of ISO 4582, shall also be given in the ETA.

The total exposure duration, the specific radiant exposure, the spectral passband in which it was measured and the cycle and temperature used (if black-standard temperature or black-panel temperature) are to be reported in the ETA when expressing the performance of the recycled plastic self-blocking paving units, beside the level of the performance.

### 2.2.11 Resistance to low temperature

*Purpose of the assessment*

The purpose of the test is to assess the resistance to low temperatures of the recycled plastic self-blocking paving units and this shall be determined by testing it to hard body impact at the temperature of (-20 ± 2) °C.

*Assessment method*

For the test method and number of specimens the provisions of clause 2.2.13 of EAD 220010-01-0402, except for the parts concerning the test for the determination of the coefficient of freeze/thaw resistance of flexural strength, and Annex B of EAD 220010-01-0402 shall be followed. The term “FPRS” shall be replaced by “recycled plastic self-blocking paving units”.

*Expression of results*

The impact energy E [N·m] which will not cause any damage on the product at the temperature of (-20 ± 2) °C shall be given in the ETA.

# 3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

## 3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is Commission Decision 97/808/EC, as amended by Commission Decision 1999/453/EC and Decision 2001/596/EC and Decision 2006/190/EC.

The applicable AVCP system is 4 for any use except for uses subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire the applicable AVCP systems regarding reaction to fire are 1, or 3, or 4 depending on the conditions defined in the said Decision.

## 3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

**Table 3.2.1 Control plan for the manufacturer; cornerstones**

| No | Subject/type of control | Test or control method | Criteria, if any | Minimum number of samples | Minimum frequency of control |
|---|---|---|---|---|---|
| **Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]** | | | | | |
| 1 | Type and quality of the incoming secondary raw material | Check of raw material specifications | Conformity with the order | All delivered shipment | Each delivery |
| 2 | Visual inspection of the constituent material “recycled plastic granules” | According to the control plan | According to the control plan | According to the control plan | Each batch |
| 3 | Particle size of the constituent material “recycled plastic granules” | According to the control plan | According to the control plan | According to the control plan | Each batch |
| 4 | Residual moisture content of the constituent material “recycled plastic granules” | According to the control plan | According to the control plan | According to the control plan | Each batch |
| 5 | Apparent density of the constituent material “recycled plastic granules” | EN ISO 61 | According to the control plan | According to the control plan | Each batch |
| 6 | Content by weight of the plastic fraction in the constituent material “recycled plastic granules” | According to the control plan | According to the control plan | According to the control plan | Each batch |
| 7 | Release of dangerous substances: percolation test on the constituent material “recycled plastic granules” | EN 16637-3 | According to the control plan | According to the control plan | Each delivery |
| 8 | Reaction to fire of the product, check of indirect parameters: density of the recycled plastic granules | EN ISO 1183-1 Method B – Liquid pycnometer method | According to the control plan | According to the control plan | Once each production week |
| 9 | Reaction to fire of the product: ignitability test | EN ISO 11925-2 | According to the control plan | According to the control plan | Once per year |
| 10 | Reaction to fire of the product: determination of the burning behaviour | EN ISO 9239-1 | According to the control plan | According to the control plan | Once per 3 years |
| 11 | Content, emission and/or release of dangerous substances of the product: SVOC and VOC | 2.2.2.2 | According to the control plan | According to the control plan | Once per 3 years |
| 12 | Dimensions of the product: thickness | 2.2.3 | According to the control plan | 3/each type | Once per day |
| 13 | Visual inspection of the surface finish of the product | According to the control plan | According to the control plan | 3/each type | Once per day |
| 14 | Breaking tensile splitting strength of the product | 2.2.4 | According to the control plan | 3/each type | Once per 3 years |
| 15 | Abrasion resistance of the product | 2.2.6 | According to the control plan | 3/each type | Once per 3 years |
| 16 | Slip/skid resistance of the product | 2.2.7 | According to the control plan | 3/each type | Once per 3 years |
| 17 | Thermal conductivity of the base material | In clause 2.2.8: test according to EN 12664 | According to the control plan | 3/each type | Once per 5 years |

| No | Subject/type of control | Test or control method | Criteria, if any | Minimum number of samples | Minimum frequency of control |
|---|---|---|---|---|---|
| 18 | Breaking tensile splitting strength after artificial weathering including acidic deposition of the product | 2.2.9 | According to the control plan | 3/each group | At modification of production process |
| 19 | Tensile strength after artificial weathering through exposure to laboratory light source of the product | 2.2.10 | According to the control plan | 3/each group | At modification of production process |
| 20 | Resistance to low temperatures of the product | 2.2.11 | According to the control plan | 3/each type | At modification of production process |

## 3.3 Tasks of the notified body

The intervention of the notified body under AVCP system 1 is only necessary for reaction to fire for products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g., an addition of fire retardants or a limiting of organic material).

In this case the cornerstones of the tasks to be undertaken by the notified body under AVCP system 1 are laid down in Table 3.3.1.

**Table 3.3.1 Control plan for the notified body; cornerstones**

| No | Subject/type of control | Test or control method | Criteria, if any | Minimum number of samples | Minimum frequency of control |
|---|---|---|---|---|---|
| **Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire** *(for system 1 only)* | | | | | |
| 1 | Where the intervention of the Notified Body is necessary only because the conditions for the applicability of system 1 are fulfilled for reaction to fire, the notified body shall consider especially the clearly identifiable stage in the production process which results in an improvement of the reaction to fire classification (e.g., an addition of fire retardants or a limiting of organic material). | Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer | As defined in the control plan agreed between the TAB and the manufacturer | As defined in the control plan agreed between the TAB and the manufacturer | When starting the production or a new line |
| **Continuous surveillance, assessment and evaluation of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire** *(for system 1 only)* | | | | | |
| 2 | Where the intervention of the Notified Body is necessary only because the conditions for the applicability of system 1 in the Decisions regarding reaction to fire are fulfilled, the notified body shall consider especially the clearly identifiable stage in the production process which results in an improvement of the reaction to fire classification (e.g., an addition of fire retardants or a limiting of organic material). | Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to | As defined in the control plan agreed between the TAB and the manufacturer | As defined in the control plan agreed between the TAB and the manufacturer | Once per year |

| No | Subject/type of control | Test or control method | Criteria, if any | Minimum number of samples | Minimum frequency of control |
|---|---|---|---|---|---|
| | | the product as indicated in Table 3.2.1. | | | |

# 4 REFERENCE DOCUMENTS

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|---|---|
| EAD 220010-01-0402 | Flat plastic sheets for fully supported discontinuous roofing and external cladding. |
| EN ISO 527-1:2019 | Plastics – Determination of tensile properties – Part 1: General principles. |
| EN ISO 527-2:2012 | Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics. |
| EN ISO 29465:2022 | Thermal insulating products for building applications – Determination of length and width. |
| EN 1338:2003+AC:2006 | Concrete paving blocks – Requirements and test methods. |
| EN 1534:2020 | Wood flooring and parquet– Determination of resistance to indentation – Test method. |
| EN 12608-1:2016+A1:2020 | Unplasticized poly(vinyl chloride) (PVC-U) profiles for the fabrication of windows and doors – Classification, requirements and test methods – Part 1: Non-coated PVC-U profiles with light coloured surfaces. |
| EN 12664:2001 | Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Dry and moist products of medium and low thermal resistance. |
| EN 13501-1:2018 | Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests. |
| EN 14231:2003 | Natural stone test methods – Determination of the slip resistance by means of the pendulum tester. |
| EN 16516:2017+A1:2020 | Construction products: Assessment of release of dangerous substances – Determination of emissions into indoor air. |
| EN 16637-2:2023 | Construction products: Assessment of release of dangerous substances – Part 2: Horizontal dynamic surface leaching test. |
| EN 16637-3:2023 | Construction products: Assessment of release of dangerous substances – Part 3: Horizontal up-flow percolation test. |
| EN ISO 61:2023 | Plastics – Determination of apparent density of moulding material that cannot be poured from a specified funnel. |
| EN ISO 1183-1:2019 | Plastics – Methods for determining the density of non-cellular plastics – Part 1: Immersion method, liquid pycnometer method and titration method. |
| EN ISO 4892-1:2016 | Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance. |
| EN ISO 4892-2:2013/A1:2021 | Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps. |
| EN ISO 6341:2012 | Water quality. Determination of the inhibition of the mobility of Daphnia magna Straus (Cladocera, Crustacea). Acute toxicity test. |
| EN ISO 6946:2017 | Building components and building elements – Thermal resistance and thermal transmittance – Calculation methods. |
| EN ISO 9239-1:2010 | Reaction to fire tests for floorings – Part 1: Determination of the burning behaviour using a radiant heat source. |
| EN ISO 10211:2017 | Thermal bridges in building construction – Heat flows and surface temperatures – Detailed calculations. |

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|---|---|
| EN ISO 10456:2007/AC:2009 | Building materials and products – Hygrothermal properties – Tabulated values and procedures for determining declared and design thermal values. |
| EN ISO 11348-1:2008+A1:2018 | Water quality. Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test). Part 1: Method using freshly prepared bacteria. |
| EN ISO 11348-2:2008+A1:2018 | Water quality. Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test). Part 2: Method using liquid-dried bacteria. |
| EN ISO 11348-3:2008+A1:2018 | Water quality. Determination of the inhibitory effect of water samples on the light emission of Vibrio fischeri (Luminescent bacteria test). Part 3: Method using freeze-dried bacteria. |
| EN ISO 11925-2:2020 | Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test. |
| EN ISO 15799:2022 | Soil quality – Guidance on the ecotoxicological characterization of soils and soil materials. |
| EN ISO 29664:2017 | Plastics – Artificial weathering including acidic deposition. |
| ISO 4582:2017 | Plastics – Determination of changes in colour and variations in properties after exposure to glass-filtered solar radiation, natural weathering or laboratory radiation sources. |
| ISO 24338:2022 | Laminate floor coverings – Determination of abrasion resistance. |