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## EAD 340376-00-0111

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European Assessment Document for

# Prefabricated soil and water barrier systems made of polyvinyl chloride

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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) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

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## 1 SCOPE OF THE EAD

### **1.1** Description of the construction product

Prefabricated soil and water barrier systems made of polyvinyl chloride (hereinafter referred to as "barrier system(s)") are constituted by single pieces (hereinafter referred to as "screens") that are jointed together to form the barrier system by using connecting elements and finishing components.

The material of the barrier system is polyvinyl chloride (PVC), also recycled.

The screens, which are obtained by an extrusion or co-extrusion process or both, may have various shaped cross sections, with or without voids, with mechanical coupling systems. Some examples are shown in Figure 1.1.1. The screens may be provided with small slots, which allow water to filter through, while stopping soil (see Figure 1.1.2(c)).



Figure 1.1.1 - Example of PVC screens cross-sections

Examples of connecting elements and finishing components, like covers to be placed on the top of the connected screens, are shown in Figure 1.1.2 and Figure 1.1.3.



Figure 1.1.2 – Example of (a, b) finishing components, (c) screens with filters, and (d) connecting elements



Figure 1.1.3 - Example of assembly of two screens with connecting and finishing components

The product is not covered by a harmonised European standard (hEN).

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 the EAD are respected.

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

#### 1.2.1 Intended use(s)

The barrier systems made of PVC are intended to be used as retaining walls and bank protection of canals, rivers, lakes, marinas and ponds, for protection against piping and seepage water in dikes, aqueducts, dams and for level separations and soil decontamination.

#### 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 barrier systems for the intended use of 50 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<sup>1</sup>.

<sup>&</sup>lt;sup>1</sup> 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.

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.

## 1.3 Specific terms used in this EAD

1.3.1	Symbols	
$E_f$	[MPa]	Flexural modulus
$E_{f,UV}$	[MPa]	Flexural modulus after exposure to UV radiation
$E_{i,l}$	[J]	Impact energy of a large missile
$\overline{ ilde{E}}_{i,l}$	[J]	Mean value of the impact energy of a large missile
$E_{i,s}$	[J]	Impact energy of a small missile
$\bar{ ilde{E}}_{i,s}$	[J]	Mean value of the impact energy of a small missile
$E_t$	[MPa]	Tensile modulus
$E_{t,UV}$	[MPa]	Tensile modulus after exposure to UV radiation
$m_m$	[Kg]	Mass of the large missile
m <sub>sm</sub>	[Kg]	Mass of the small missile
$M_u$	[N m]	Bending moment at failure
R	[%]	Heat reversion
$v_m$	[m/sec]	Speed of the large missile
$v_{sm}$	[m/sec]	Speed of the small missile
VST	[°C]	Vicat softening temperature
$\alpha_{cN}$	[kJ/m <sup>2</sup> ]	Charpy impact strength for notched specimen
$\alpha_{cU}$	[kJ/m <sup>2</sup> ]	Charpy impact strength for unotched specimen
$\varepsilon_b$	[%]	Strain at break of the specimen
$\mathcal{E}_{b,UV}$	[%]	Strain at break of the specimen after exposure to UV radiation
$\varepsilon_y$	[%]	Strain corresponding to $\sigma_y$
$\mathcal{E}_{y,UV}$	[%]	Strain corresponding to $\sigma_y$ after exposure to UV radiation
$\sigma_{f,b}$	[MPa]	Ultimate flexural strength at break of the specimen
$\sigma_{f,b,UV}$	[MPa]	Ultimate flexural strength at break of the specimen after exposure to UV radiation
$\sigma_y$	[MPa]	Yield strength
$\sigma_{y,UV}$	[MPa]	Yield strength after exposure to UV radiation

### 2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

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

## 2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of barrier systems is assessed in relation to the essential characteristics.

## Table 2.1.1Essential characteristics of the product and methods and criteria for assessing the<br/>performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance	
	Basic Works Requirer	ment 1: Mechanical res	istance and stability	
1	Vicat softening temperature	2.2.1	Level <i>VST</i> [°C]	
2	Impact resistance of the single screen	2.2.2	Level $\alpha_{cN}$ [kJ/m <sup>2</sup> ] or $\alpha_{cU}$ [kJ/m <sup>2</sup> ] or both	
3	Tensile properties of the single screen	2.2.3	Level $E_t$ [MPa]; $\sigma_y$ [MPa]; $\varepsilon_b$ [%]; $\varepsilon_y$ [%]	
4	Flexural properties of the single screen	2.2.4	Level $E_f$ [MPa]; $\sigma_{f,b}$ [MPa]	
5	Heat reversion of the single screen	2.2.5	Level and Description <i>R</i> [%]	
6	Tensile properties after exposure to UV radiation of the single screen	2.2.6	Level and Description $E_{t,UV}$ [MPa]; $\sigma_{y,UV}$ [MPa]; $\varepsilon_{y,UV}$ [%]; $\varepsilon_{b,UV}$ [%]	
7	Flexural properties after exposure to UV radiation of the single screen	2.2.7	Level and Description $E_{f,UV}$ [MPa]; $\sigma_{f,b,UV}$ [MPa]	
8	Impact resistance of the barrier system: impact of a large missile	2.2.8	Level and Description $\widetilde{E}_{i,l}$ [J]	
9	Impact resistance of the barrier system: impact of small missiles	2.2.9	Level and Description $\tilde{E}_{i,s}$ [J]	
10	Flexural strength of the barrier system	2.2.10	Level and Description $M_u$ [N m]	
Basic Works Requirement 3: Hygiene, health and the environment				
11	Content, emission and/or release of dangerous substances: leachable substances of the barrier system	2.2.11	Level and Description - EC20-values for each dilution ratio - [% within hours/days]	

## 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 Vicat softening temperature

#### Purpose of the assessment

The purpose of the assessment is the evaluation of the Vicat softening temperature of PVC.

#### Assessment method

The test shall be carried out in accordance with EN ISO 306 (method A120). The test shall be performed on specimens taken from single screens constituting the barrier system by mechanical cutting or removal, taking care not to overheat the material during the operation.

#### Minimum 2 tests shall be performed.

If the screen is obtained by a co-extrusion process, the Vicat Softening Temperature VST [°C] shall be measured at both sides of the specimen. The value of VST assigned to that specimen, i.e., the result of one test, is the arithmetic mean of the two obtained values.

If the range of individual results is greater than 2°C, record the individual results and repeat the test a second time using an additional set of at least two specimens.

#### Expression of results

The average value of the Vicat Softening Temperature *VST* [°C] and the number of tests made shall be reported in the ETA. If more than two tests are performed, the standard deviation shall be reported in the ETA, otherwise the difference between the two results shall be reported in the ETA.

In the case in which an additional set of specimens is needed, the individual values from both the first and second tests shall be stated in the ETA.

#### 2.2.2 Impact resistance of the single screen

#### Purpose of the assessment

The purpose of the assessment is the evaluation of Charpy impact strength of the single screen.

#### Assessment method

The test shall be carried out in accordance with EN ISO 179-1. Specimen shall be taken from single screens constituting the barrier system by mechanical cutting or removal, taking care not to overheat the material during the operation.

In accordance with EN ISO 179-1 Section 6.3, the test methods shall be "1eA" or "1eU" or both, where "1" indicates the specimen type in accordance with EN ISO 179-1 Table 1, "e" stands for edgewise in accordance with Figure 2 of EN ISO 179-1, "A" indicates the type of notch in accordance with EN ISO 179-1 Section 6.1.5 and "U" indicates the unnotched specimen. If specimens with type A notch do not break during the test, specimens with type C notch shall be used. The test method "1eU" is the reference method.

For every type of specimen (notched and unnotched), minimum 10 tests shall be performed. When the coefficient of variation reaches a value of less than 5%, a minimum number of 5 tests is sufficient.

#### Expression of results

The Charpy impact strength for notched specimens shall be calculated in accordance with EN ISO 179-1 Section 8.2, whereas in accordance with EN ISO 179-1 Section 8.1 for unnotched specimens.

The average value of the Charpy impact strength  $\alpha_{cN}$  [kJ/m<sup>2</sup>] or  $\alpha_{cU}$  [kJ/m<sup>2</sup>] or both and the standard deviation of the average value, using the procedure given in ISO 2602, shall be reported in the ETA, together with the test method (1eA or 1eU or both), the velocity of impact [m/s] and the nominal pendulum energy [J].

#### 2.2.3 Tensile properties of the single screen

#### Purpose of the assessment

The purpose of the assessment is the evaluation of the tensile properties of the single screen.

#### Assessment method

The test shall be carried out in accordance with EN ISO 527-2 (type 1b specimens) at  $(23\pm2)$  °C and  $(50\pm10)$  % RH (relative humidity). Specimen shall be prepared in accordance with EN ISO 21306-2. The test speed shall be equal to 1 mm/min for strain < 0,3% and 50 mm/min for strain > 0,3%. The test shall be performed on specimens taken from single screens constituting the barrier system by mechanical cutting or removal, taking care not to overheat the material during the operation.

Minimum 5 tests shall be performed.

#### Expression of results

The average value and the standard deviation of the tensile modulus  $E_t$  [MPa], the average values, the Coefficient of Variations (CoVs), and characteristic values of the yield strength  $\sigma_y$  [MPa], the average value, the CoV, and characteristic value of the strain  $\varepsilon_y$  [%] (corresponding to  $\sigma_y$ ), and the average value and the CoV of the strain  $\varepsilon_b$  [%] at break shall be reported in the ETA.

The characteristic value shall be determined by using the appropriate value of  $k_n$  for unknown V<sub>x</sub> reported in EN 1990, Annex D, Table D1.

#### 2.2.4 Flexural properties of the single screen

#### Purpose of the assessment

The purpose of the assessment is the evaluation of the flexural properties of the single screen.

#### Assessment method

The test shall be carried out in accordance with EN ISO 178 at  $(23\pm2)$  °C and  $(50\pm10)$  % RH. Specimen shall be prepared in accordance with EN ISO 21306-2. The test shall be performed on specimens taken from single screens constituting the barrier system by mechanical cutting or removal, taking care not to overheat the material during the operation.

The specimen width shall be defined on basis of the values recorded in Table 3 of EN ISO 178, the length shall be 20 times the thickness, while the distance between the supports shall be 16 times the thickness.

The flexural properties shall be assessed under three-point bending and at constant test speed, calculated in accordance with EN ISO 178 Section 8.5.

Minimum 5 tests shall be performed.

#### Expression of results

The average value and the standard deviation of the flexural modulus  $E_f$  [MPa] and the average value, the CoV, and characteristic value of the ultimate flexural strength  $\sigma_{f,b}$  [MPa] shall be reported in the ETA.

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The characteristic value shall be determined by using the appropriate value of  $k_n$  for unknown V<sub>x</sub> reported in EN 1990, Annex D, Table D1.

#### 2.2.5 Heat reversion of the single screen

#### Purpose of the assessment

The purpose of the assessment is the evaluation of the heat reversion of the single screen.

#### Assessment method

The test shall be carried out in accordance with EN 479. The test shall be performed on specimens taken from single screens constituting the barrier system by mechanical cutting or removal, taking care not to overheat the material during the operation.

Minimum 3 tests shall be performed.

#### Expression of results

The average value and the standard deviation of the heat reversion *R* [%] shall be reported in the ETA.

After conditioning, any observed alterations, for example colour change, blistering or crack, shall be reported in the ETA.

#### 2.2.6 Tensile properties of the single screen after exposure to UV radiation

#### Purpose of the assessment

The purpose of the assessment is the evaluation of the tensile properties of the single screen after exposure to UV radiation.

#### Assessment method

The exposure to UV radiation shall be carried out in accordance with EN ISO 4892-2, Method A, Cycle 1. The test shall be performed on specimens taken from single screens constituting the barrier system by mechanical cutting or removal, taking care not to overheat the material during the operation.

The time of exposure 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 determination of the tensile properties after exposure to UV radiation shall be in accordance with Section 2.2.3 of this EAD. Minimum 5 tests shall be performed.

#### Expression of results

The average value and the standard deviation of the tensile modulus  $E_{t,UV}$  [MPa], the average value, the CoV, and characteristic value of the yield strength  $\sigma_{y,UV}$  [MPa], the average value, the CoV, and characteristic value of the strain  $\varepsilon_{y,UV}$  [%] (corresponding to  $\sigma_{y,UV}$ ), and the average value and the CoV of the strain  $\varepsilon_{b,UV}$  [%] at break shall be reported in the ETA for specimens exposed to UV radiation.

The characteristic value shall be determined by using the appropriate value of  $k_n$  for unknown V<sub>x</sub> reported in EN 1990, Annex D, Table D1.

After exposure to UV radiation, any observed alterations, for example colour change, blistering or presence of cracks, shall be reported in the ETA.

#### 2.2.7 Flexural properties of the single screen after exposure to UV radiation

#### Purpose of the assessment

The purpose of the assessment is the evaluation of the flexural properties of the single screen after exposure to UV radiation.

#### Assessment method

The exposure to UV radiation shall be carried out in accordance with EN ISO 4892-2, Method A, Cycle 1. The test shall be performed on specimens taken from single screens constituting the barrier system by mechanical cutting or removal, taking care not to overheat the material during the operation.

The time of exposure 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 determination of the flexural properties after exposure to UV radiation shall be in accordance with Section 2.2.4 of this EAD. Minimum 5 tests shall be performed.

#### Expression of results

The average value and the standard deviation of the flexural modulus  $E_{f,UV}$  [MPa] and the average value, the CoV, and characteristic value of the ultimate flexural strength  $\sigma_{f,b,UV}$  [MPa] shall be reported in the ETA for specimens exposed to UV radiation.

The characteristic value shall be determined by using the appropriate value of  $k_n$  for unknown  $V_x$  reported in EN 1990, Annex D, Table D1.

After exposure to UV radiation, any observed alterations, for example colour change, blistering or presence of cracks, shall be reported in the ETA.

#### 2.2.8 Impact resistance of the barrier system: impact of a large missile

#### Purpose of the assessment

The purpose of the test is to simulate the impact of large debris on the product when it is used as a water barrier system.

#### Assessment method

The test shall be carried out as reported in clause A.3 of this EAD on test specimens in accordance with Annex A.1 and with a test setup in accordance with Annex A.2.

Three tests shall be performed. The energy of any impact shall not deviate from the mean value of the impact energy  $\tilde{E}_{il}$  of more than 5%.

If the three test specimens reject at a certain impact energy of the nine missile impacts provided by clause A.3 without penetration and without the formation of cracks, that impact energy shall be assigned as the impact resistance of the barrier system. If only one of the three test specimens in a test fails to meet the criterion, one retest (another test sequence with three specimens) shall be permitted.

#### Expression of results

The impact energy  $\tilde{E}_{i,l}$  [J], calculated as the mean value of the impact energies of twenty-seven impacts (nine for each test), shall be reported in the ETA with a description of the nature of the damage recorded during the test.

Experimental values for such property can be specified for a group of barrier systems, if it can be proven that the experimental values determined are the least beneficiary values possibly present in the group of barrier systems. The groups of barrier systems shall be clearly defined in the ETA.

#### 2.2.9 Impact resistance of the barrier system: impact of small missiles

#### Purpose of the assessment

The purpose of the test is to simulate the impact of small debris on the product when it is used as a water barrier system or when one face of the system is exposed to atmospheric agents, even temporarily.

#### Assessment method

The test shall be carried out as reported in clause A.4 of this EAD on test specimens in accordance with Annex A.1 and with a test setup in accordance with Annex A.2.

Three tests shall be performed. The energy of any impact shall not deviate from the mean value of the impact energy  $\tilde{E}_{i,s}$  of more than 5%.

If the three test specimens reject at a certain impact energy the thirty missile impacts provided by clause A.4 without penetration and without the formation of cracks, that impact energy shall be assigned as the impact resistance of the barrier system. If only one of the three test specimens in a test fails to meet the criterion, one retest (another test sequence with three specimens) shall be permitted.

#### Expression of results

The impact energy  $\tilde{E}_{i,s}$  [J], calculated as the mean value of the impact energies of ninety impacts (thirty for each test), shall be reported in the ETA with a description of the nature of the damage recorded during the test.

Experimental values for such property can be specified for a group of barrier systems, if it can be proven that the experimental values determined are the least beneficiary values possibly present in the group of barrier systems. The groups of barrier systems shall be clearly defined in the ETA.

#### 2.2.10 Flexural strength of the barrier system

#### Purpose of the assessment

The purpose of the test is to determine the flexural strength of the assembled barrier system.

#### Assessment method

The test shall be carried out in accordance with EN 14509 Section A.5, by subjecting an assembled system, simply supported along two sides, to four line loads extending across the full width of the test specimen or to a uniformly distributed load.

The test shall be carried out on a specimen constituted by three elements along its width, assembled and connected together, i.e., the specimen shall be characterized by the presence of two joints. The specimen shall be symmetrical: the central element shall be a complete screen, while the external ones could be complete screens or pieces of screens of the same dimensions. The necessary span is dependent on several factors including the overall depth of the system and shall be chosen to give a bending failure. The screens constituting the specimen shall be assembled and connected together in accordance with the manufacturer installation specifications.

If a uniformly distributed load is applied, in order for the specimen to behave in a manner equivalent to a barrier of infinite length in plan, the points on the two unconstrained sides of the specimen shall be made integral at least every 50 cm through appropriate systems that prevent relative lateral displacements but do not give any constraints on vertical displacement. An example is shown in Figure 2.2.10.1.



Figure 2.2.10.1 - Example of a system useful to constrain the movements of the lateral points of the specimen

Minimum three tests shall be performed.

#### Expression of results

The average value of the bending moment at failure  $M_u$  [N m] and its standard deviation shall be reported in the ETA.

Assessment results obtained on a representative configuration with the lowest performance expected can be extended to other configurations.

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

#### 2.2.11.1 General

The performance of the barrier systems related to the emissions and/or release and, where appropriate, the content of dangerous substances will be assessed on the basis of any information provided by the manufacturer<sup>2</sup> 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 intended release scenario for barrier system and intended use with respect to dangerous substances is:

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

#### 2.2.11.2 Leachable substances of barrier systems

For the identified release scenario S/W1, the performance of the barrier systems 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 barrier system shall be conducted in accordance with EN 16637-2. The leachant shall be pH-neutral demineralised water and the ratio of liquid volume to surface area shall be  $(80 \pm 10)$  l/m<sup>2</sup>.

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 in accordance with EN ISO 6341;
- toxicity test with algae in accordance with EN ISO 15799;

<sup>&</sup>lt;sup>2</sup> The manufacturer may be asked to provide to the TAB the REACH related information which shall accompany the DoP (cf. Article 6(5) of Regulation (EU) No 305/2011).

The manufacturer is **not** obliged to:

<sup>-</sup> provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or

<sup>-</sup> provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous in accordance with Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS, taking into account the installation conditions of the construction product and the release scenarios resulting from there.

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

- luminescent bacteria test in accordance with EN ISO 11348-1, EN ISO 11348-2 or EN ISO 11348-3. The test method in accordance with EN ISO 11348-1 is the reference method.

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 barrier systems shall be expressed as EC20values for each dilution ratio. Maximum determined biological degradability shall be expressed as "...% within ... hours/days". The respective test methods for analysis shall be specified.

## **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 2003/728/EC.

The system is: 1.

## 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
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No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
[i	Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]				
1	Incoming materials	Documentation check	Control plan	-	Each delivery
2	Aspect	Visual check	Control plan	-	100% batch*
3	3 Dimensions Geometric measure (for the the Callipse accuracy <sup>3</sup>		Control plan	1	Every batch*
4	Vicat softening temperature	2.2.1	Control plan	3	Once a year/at a modification of production process. If the element is obtained by a co- extrusion process on both sides, the Vicat Softening Temperature VST [°C] shall be measured at only one side.
5	Impact resistance of the single screen	2.2.2	Control plan	10	At a modification of production process
6	Tensile properties of the single screen	2.2.3	Control plan	1	Once a week/at a modification of production process
7	Flexural properties of the single screen	2.2.4	Control plan	1	Once a week/at a modification of production process
8	Heat reversion of the single screen	2.2.5	Control plan	1	Once a day/at a modification of production process
9	Tensile properties of the single screen after exposure to UV radiation	2.2.6	Control plan	3	Three tests for each colour in a period of no more than three years /at a modification of production process

\* Batch: every quantity of material made in a single operation, or in the case of continuous production for a defined quantity (in linear meter or square meters or tons) which shall be demonstrated by the manufacturer to have a uniform composition and shall not exceed one day's production

 $<sup>^{3}</sup>$  Accuracy is here intended as the simple sum of the amount of the error plus the amount of the expanded measurement uncertainty.

## 3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for barrier systems 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					
1	Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the barrier systems.	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	According to control plan	According to control plan	When starting the production or a new line	
	Continuous surveillance, assessment and evaluation of factory production control					
1	The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan.	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 the product as indicated in Table 3.2.1	According to control plan	According to control plan	1/year	

## 4 **REFERENCE DOCUMENTS**

[1]	EN ISO 178:2019	Plastics - Determination of the flexural properties
[2]	EN ISO 179-1:2023	Plastics –Determination of Charpy impact properties – Part 1: Non- instrumented impact test
[3]	EN ISO 306:2022	Plastics – Thermoplastic materials – Determination of Vicat softening temperature (VST)
[4]	EN 479:2018	Plastics - Poly(vinyl chloride) (PVC) based profiles – Determination of heat reversion
[5]	EN ISO 527-2:2012	Plastics - Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics
[6]	EN 1990:2023	Eurocode - Basis of structural and geotechnical design
[7]	ISO 2602:1980	Statistical interpretation of test results - Estimation of the mean - Confidence interval
[8]	EN ISO 4892- 2:2013+A1:2021	Plastics - Methods of exposure to laboratory light sources- Part 2: Xenon-arc lamps – Amendment 1: Classification of daylight filters
[9]	EN ISO 6341:2012	Water quality – Determination of the inhibition of the mobility of Daphnia magna Straus (Cladocera, Crustacea) – Acute toxicity test
[10]	EN ISO 11348- 1:2008/A1:2018	Water quality – Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test) – Part 1: Method using freshly prepared bacteria – Amendment 1
[11]	EN ISO 11348- 2:2007/A1:2018	Water quality – Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test) – Part 1: Method using liquid-dried bacteria – Amendment 1
[12]	EN ISO 11348- 3:2007/A1:2018	Water quality – Determination of the inhibitory effect of water samples on the light emission of <i>Vibrio fischeri</i> (Luminescent bacteria test) – Part 1: Method using freeze-dried bacteria – Amendment 1
[13]	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
[14]	EN 14509:2013	Self-supporting double skin metal faced insulating panels - Factory made products - Specifications
[15]	EN ISO 15799:2022	Soil quality – Guidance on the ecotoxicological characterization of soils and soil materials
[16]	EN 16637-2:2023	Construction products: Assessment of release of dangerous substances – Part 2: Horizontal dynamic surface leaching test
[17]	EN ISO 21306-2:2019	Plastics - Unplasticized poly(vinyl chloride) (PVC-U) moulding and extrusion materials - Part 2: Preparation of test specimens and determination of properties

### ANNEX A TEST METHOD FOR THE ASSESSMENT OF THE IMPACT RESISTANCE OF THE BARRIER SYSTEM

#### A.1 Test specimens

The test shall be carried out on at least two adjacent screens, assembled and connected together.

The minimum height and width of the specimen shall be 1500 mm. The screens constituting the specimen shall be assembled and connected together in accordance with the manufacturer installation instructions.

#### A.2 Test setup

Behind the specimen a formwork shall be assembled, to be filled with sand of typical particle size finer than 0,5 mm. The formwork shall be designed in such a way that the layer of sand is not less than 20 cm at any point and that this pushes the specimen against rigid plates, to which this shall not be fixed, but simply supported. The preparation procedure shall be such that that the formwork is first closed with the screens and then the sand is poured from the top in the empty space. A schematic example of the specimen inserted into the formwork is shown in Figure A.2.1.



Figure A.2.1 - Schematic example of the test specimen and the formwork

The system for launching the missile shall consist of the following main components:

- a supply of compressed air (if possible with a maximum operating pressure of 8 bar) enabling the achievement of certain velocities in relation to the type of missile;
- pressure release valves;
- control panel with remote controls for regulation and launching of missiles, equipped with a video synoptic of the valves with indication of the valve status and safety system to prevent unintentional missile launch;
- two aluminium conduits with a support structure that allows flat and height movement to facilitate missile guidance and equipped with a laser aiming system: one for small missiles, i.e., solid steel balls with a mass of 2±0,1 g and a nominal diameter of 7,9 mm; the other for launching large missiles consisting of a tube with a nominal internal diameter of 100±20 mm and a length at minimum equal to that of the missile. The total length of the conduit shall be equal to the distance measured from the pressure release valve to the vent openings (in front of the timing system) or to the conduit mouth.

The timing system, which is comprised of two, through-beam photoelectric sensors spaced at a known distance apart and used to start and stop an electronic clock, shall be capable to measure speeds accurate

to 2%. The speed of the missile shall be measured anywhere between the point where 90% of the missile is outside of the cannon, to the point where the missile is 30 cm away from the test specimen.

The missile speed shall not be measured while the missile is accelerating. The through beam photoelectric sensors shall be of the same model. The electronic clock shall be activated when the reference point of the missile passes through the timing system. The electronic clock shall have an operating frequency of no less than 10 kHz with a response time not to exceed 0,15 milliseconds. The speed of the missile shall be determined by dividing the distance between the two through-beam photoelectric sensors by the total time interval counted by the electronic clock.



Figure A.2.2 - Top view of a missile propulsion device

#### A.3 Test procedure – Impact of large missile

The large missile shall be comprised of a piece of timber (pine or spruce) of prismatic shape having nominal dimensions of  $50\pm10$  mm by  $100\pm20$  mm, weighing about 4 kg. It shall have a length not less than 2100 mm and not more than 2750 mm. The surfaces of the missile shall be sawn and planned. No further treatments for the edges shall be provided. A sabot shall be attached to the trailing edge of the missile to facilitate launching (see Figure A.3.1). The weight of the sabot shall not exceed 220 g.

The combined weight of the timber and sabot, which constitutes the missile, shall be between 4 kg and 4,5 kg. The missile shall be propelled through cannon as follows.

Each test specimen shall receive nine impacts:

- the first three within a 127 mm radius circle having its centre at a non-flat part of the element, at mid-height of the test specimen;
- the second three within a 127 mm radius circle having its centre at a plane zone of one element, at mid-height of the test specimen;
- the third three within a 127 mm radius circle having its centre in correspondence of the joint between the elements, at mid-height of the test specimen.

An example of the choice of the impact points is shown in Figure A.3.2.



Figure A.3.1 – Rear view and sections of a sabot nailed to the missile



Figure A.3.2 - Example of the choice of the impact points.

The impact energy is given by

$$E_{i,l} = \frac{1}{2}m_m v_m^2 \tag{A.3.1}$$

where  $m_m$  is the mass of the missile, determined with an accuracy (see footnote 2 in the EAD) of 1%, while  $v_m$  is its speed. The energy of any impact shall not deviate from the mean value of the impact energy  $\bar{E}_{i,l}$  of more than 10%.

#### A.4 Test procedure 2 – Impact of small missiles

The small missiles shall consist of solid steel balls each having a mass of  $2\pm0.1$  grams with a 7,9 mm nominal diameter. The mass shall be measured with an accuracy<sup>3</sup> of 0,01 grams, while the diameter of 0,1 mm. The missiles shall be propelled through cannon as follows. The small missile shall be launched in such a manner that each specimen shall be impacted over an area not exceeding 0,19 m<sup>2</sup> per impact. Each test specimen shall receive 30 small missile impacts in groups of 10:

- the first 10 distributed uniformly over a 0,19 m<sup>2</sup> area in correspondence of a non-flat part of the element, to be identified on basis of the shape of cross section of the element, at mid-height of the test specimen;
- the second 10 distributed uniformly over a 0,19 m<sup>2</sup> area located at a plane zone of one element, at mid-height of the test specimen;
- the third 10 distributed uniformly over a 0,19 m<sup>2</sup> in correspondence of the joint between the elements, at mid-height of the test specimen.

The impact energy is given by

$$E_{i,s} = \frac{1}{2}m_{sm}v_{sm}^2$$

where  $m_{sm}$  is the mass of the small missile, while  $v_{sm}$  is its speed. The energy of any impact shall not deviate from the mean value of the impact energy  $\overline{E}_{i,s}$  of more than 10%.

(A.4.1)