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Synthetic sport systems — Leaching test

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National foreword

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Synthetische Sportsysteme - Auslaugungsprüfung

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EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (CEN/TS 16384:2012) has been prepared by Technical Committee CEN/TC 217 “Sport surfaces”, the secretariat of which is held by AFNOR.

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Introduction

To respond to the needs of buyers, end users and installers of synthetic sport systems for outdoor as well as to respond to the needs of producers of granulate as system constituents, CEN/TC 217 Working Group "Environmental Aspects" (WG 10) has worked on the following principles:

Firstly, define a laboratory test designed to assess the release of substances in ground water from a complete **"synthetic sport system for outdoor"**. The method of this test is based on the principle of large-scale in-situ tests (lysimeters). This test uses a sample of a sport surface similar to the sample used for laboratory type tests and representative of the system that will be installed.

Secondly, make it possible for integrators to assess specific leaching characteristics of relevant components and anticipate the results of the above laboratory test, specifying testing standards for a relative leaching assessment of system's constituents of different origins or nature, for instance granules (see Annex A).

NOTE This Technical Specification is based on the available knowledge and expertise. It is expected that it will be used in a harmonised way by the European Laboratories during the first three-years period and that this will result in an extended experience. Based on such experience, it is expected that the Technical Specification could be improved and transformed into an EN standard.

This document includes one normative annex and one informative annex. Additional information will be found in a guidance document in preparation.

1 Scope

This Technical Specification specifies testing methods concerning the release from synthetic sport systems for outdoor of substances in ground water, surface water and drainage water by performing a dedicated leaching test on a sample of a **"synthetic sport" system for outdoor**.

In addition, this Technical Specification provides tools for a relative leaching assessment of system's components (e.g. granules) of different origin or nature.

This Technical Specification does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 Normative references

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

EN ISO 3696, *Water for analytical laboratory use – specification and test methods (ISO 3696)*

EN ISO 5667-3, *Water quality – Sampling – Part 3: Guidance on the preservation and handling of water samples (ISO 5667-3)*

EN 12506, *Characterization of waste – Analysis of eluates – Determination of pH, As, Ba, Cd, Cl-, Co, Cr, Cr VI, Cu, Mo, Ni, NO2-, Pb, total S, SO42-, V and Zn*

EN 13370, *Characterization of waste – Analysis of eluates – Determination of Ammonium, AOX, conductivity, Hg, phenol index, TOC, easily liberatable CN-, F-*

EN 14877, *Synthetic surfaces for outdoor sports areas – Specification*

EN 15330-1, *Surfaces for sports areas – Synthetic turf and needle-punched surfaces primarily designed for outdoor use – Part 1 : specification for synthetic turf*

3 Terms and definitions

For the purposes of this document, the following term and definition applies.

3.1
synthetic sport system
system above groundwater level used as "synthetic sport" and incorporating all the components needed between the support layer and the atmosphere

4 Symbols and abbreviations

None

5 Principle

The principle of this test is to simulate the phenomena observed on outdoor synthetic sport systems. It ensures, in particular, a short contact time between the synthetic sport system and water, corresponding to the draining function of this surfaces. The spraying system is conventionally adjusted to alternate particularly dry and wet periods. Prior to the test performance, the sample may be submitted to standardised aging. Therefore in the testing report, it has to be noted if the sample was subjected to aging or not. If the sample was subjected to aging, the test used for the aging has to be mentioned as well.

NOTE The sample is of the same type as the one used for mechanical test and ensures testing on significant quantities of tested materials (EN 15306).

6 Apparatus and reagents

6.1 General

This clause defines the apparatus and reagent to be used. This is mainly done in normative terms. Therefore the informative Annex B provides an example of apparatus that meet the requirements specified in this clause.

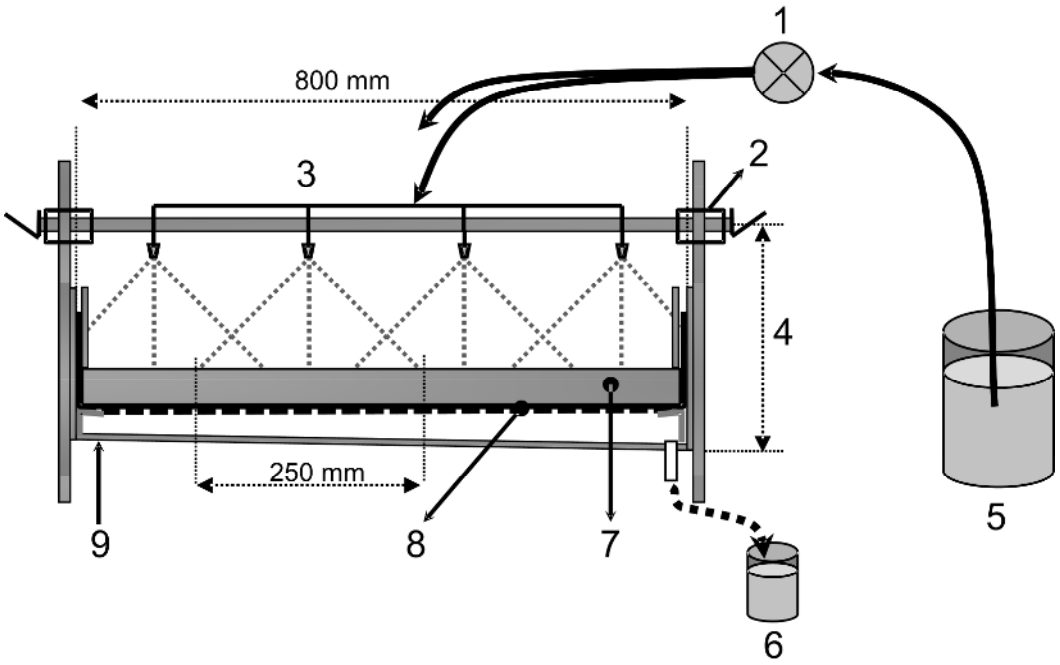
6.2 Tank

The tank (see Figure 1) and the vertical supports that allow the adjustment of rods and guide rods of the watering ramp are made of stainless steel or polycarbonate. The materials and fabrication method has to be such that the result of the blank test fulfils the requirements specified in 7.2. The tank dimensions are as follows: L = 800 mm (+/- 5 mm), W = 400 mm (+/- 5 mm), H = 150 mm and 160 mm (to slope the bottom a little) similar to the dimensions in EN 15306. A hole is drilled at the bottom point for the passage of the percolate drain pipe.

6.3 Watering system

The watering system is aiming at wetting in an homogeneous way the sample by means of a spraying system (see Figures 1 and 2) which consists of 8 full cone spraying nozzles attached to each of the guiding rods. These nozzles are selected and arranged so that

a) the diameter of the spray on the sample surface has a diameter of 200 mm – 250 mm in order to obtain a complete coverage (see Figure 3).



Key

1 dosing pump
2 core tuning
3 watering ramp
4 adjustment height
5 water reserve tank
6 percolates recovery recipient
7 "artificial turf" system
8 stainless steel grid
9 stainless steel tank (80 cm x 40 cm)

Figure 1 — Functional diagram - Longitudinal view (informative)

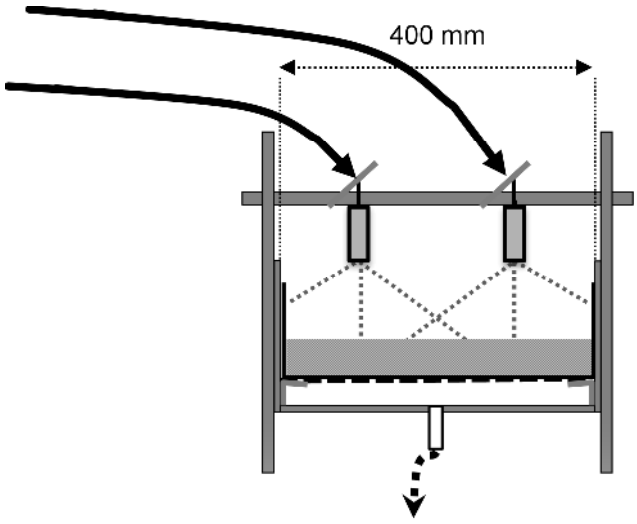


Figure 2 — Functional diagram - Transverse view (informative)

b) The spraying system is fed by a moving device (see Figure 1) either a dosing pump connected to a storage tank of water or a pressurised (with clean compressed air) storage tank of water. The water flow shall be maintained at the required flow ± 10 %.

c) The required flow shall be achieved with a water pressure at the spray nozzle in the range 1,4 bar – 1,6 bar, without visible haze. A cover may be used to minimise air draught and water carry over.

d) The quality of this water shall be in accordance with the following specification: Distilled water, demineralised water, de-ionised water or water of equivalent purity with a conductivity < 0,5 mS/m according to grade 3 specified in EN ISO 3696, and exhibiting a pH in a narrower range (6,5 < pH< 7,5) than the range of grade 3 specified in EN ISO 3696. If needed a dilute solution of sodium hydroxide may be used to adapt the pH range.

NOTE 1 This specification is defined as a convention relevant for the exposure of synthetic sport system. The experimental set up specified in this Technical Specification allows a relevant selection of the leachant since it is continuously renewed and therefore exposing the sample to the same liquid quality during the whole test. In order to secure repeatable and comparable results a selection of leachant should be made. The above specification is used in several CEN leaching standards with pH range (5 < pH < 7,5) which do not influence the leaching results under permanent and long lasting contact with the leachant. Such leaching tests are aiming at an equilibrium generally imposed by the sample. For synthetic sport systems a narrower pH range is needed (6,5 < pH < 7,5). The reason is that the pH is not influenced significantly during the short and intermittent contact with the leachant, due to the main function of the synthetic sport system securing a very fast water drainage.

NOTE 2 An impact of the surface tension of the leachant has been reported. It is therefore wise to determine and report this surface tension.

The "synthetic sport" system is laid on top of the stainless steel grid.

This grid is designed in order to avoid immersion of the synthetic sport sample and to facilitate drainage.

The selected spray nozzles shall have a maximum spraying angle of 110° (full cone angle) and a minimum spraying angle of 40° (full cone angle). This corresponds to a minimum height between the spray nozzles and the sport surface.

Qualification tests shall be carried out on the apparatus to verify that the spray pattern is homogeneous over the entire surface by checking the flow rate of each spray nozzle (e.g. by placing cups on the sport surface).

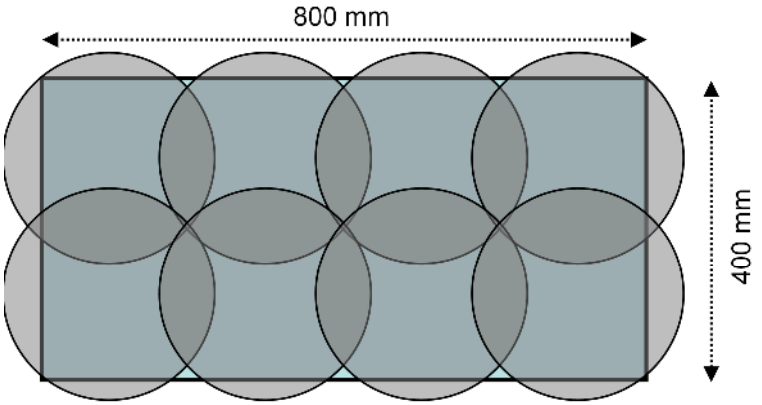


Figure 3 — Functional diagram - Spraying surface (informative)

A "blank test" is to be performed without the synthetic sport system to verify that the impact of the apparatus on the percolates is significantly below the regular test results.

6.4 Choice and quantity of tested materials

The tested system is representative for the system defined by the system supplier. It integrates all the components used on a “synthetic sport” system as specified by the system supplier.

For example, for a synthetic sport system for outdoor and with performance infill, the elements to be considered are the following:

- The fibres, backing and coating: The sample integrates a white strip (marking line on the grounds) and the glue if it is present on the marketed system.
- The performance infill: To ensure the representativeness of the material, a representative sample has to be taken.
- The stabilising infill: To guarantee representativeness, the tested sample shall be representative of the production intended for the “synthetic sport” system
- The shockpad: The dimensions 800 mm x 400 mm are assumed to be representative of the production intended for a large-scale “synthetic sport” system.

7 Procedure

7.1 Testing conditions

7.1.1 Frequency/duration of the spraying/non-spraying periods and the flow rate

For a week there are two days without spraying and five days with spray twice a day (each of 10 L/m^2 i.e. 3,2 L = 0,4 L per nozzle and per spray) with the non-spraying period of each day being at least 6 h and less than 6 h and 15 min. The duration of each spraying period shall be at least 45 s and less than 120 s

NOTE This amount can be split over two weeks. Each week would consist of five consecutive days with spraying and two days without spraying and consequently without collection of percolate. For each day there would be two sprays, each of 10 L/m^2 (i.e. 3,2 L) with the non-spraying period of each day being at least 6 h and less than 6 h and 15 min.

7.1.2 Experiment duration

The duration of the experiment is two weeks

NOTE The number of weeks should take into account the time needed in the field to reach a "plateau" in the release. For instance a French study has shown a stabilisation of the results after a duration of 3 months. Also to be noted that, assuming 15 kg/m^2 of granules, the liquid/solid ratio will be 13 after these two weeks].

7.1.3 Kind of sprayed water as leachant

The kind of sprayed water as leachant should be as specified in 6.2.

7.1.4 Taking and sampling of collected percolates

A liquid sample is taken from the 64 l in the collecting tank, in accordance with EN ISO 5667-3 at the end of the second week, between 15 min and 30 min after the last spraying period, for analysis in accordance with EN 12506 and EN 13370. Additionally samples can be taken during each spray and analysed separately to verify the stabilisation over time.

NOTE 1 In the analytical standard EN 12506, standardised analytical methods are selected for the determination of pH, As, Ba, Cd, Cl-, Co, Cr, Cr VI, Cu, Mo, Ni, NO2-, Pb, total S, SO42-, V and Zn. In the analytical standard EN 13370, standardised analytical methods are selected for the determination of Ammonium, AOX, conductivity, Hg, phenol index, TOC, easily liberatable CN-, F-. An example of selected analytical method is EN ISO 11885. In the preparation standard EN 15002, guidance is given on the preparation of test portions from the laboratory sample i.e. the sample collected on the testing device as specified above.

NOTE 2 The above notes do not mean that all the above substance are to be determined. They only mean that there are available analytical methods for determining such substances that are specified in the prevailing regulation or in the test specification given by the customer to the testing laboratory.

7.1.5 Temperature and humidity conditions and storage

Laboratory temperature 23 °C ± 2 °C with relative humidity 50 % ± 5 % and water to be sprayed 23 °C ± 2 °C. The components have to be stored in the laboratory at least for 12 h before the start of the test.

7.2 Preliminary tests

Blank test: A full test will be held without the synthetic sport system sample to check that the impact of the apparatus on the percolates will be less than 10 % of the test result. The water collected will be analysed accordingly.

NOTE 1 In case of positive consecutive blank tests, a blank test may be omitted. However a subsequent negative blank test would compromise the regular test(s) not immediately following a blank test.

Before the start of the test, the synthetic sport system shall be sprayed with three spraying periods without stops.

NOTE 2 It has been considered that this amount will be for most cases enough so that saturation is reached and so that a stabilised flow is reached at the outlet of the system.

8 Synthetic sport systems for outdoor with no permeability capabilities

In case when the synthetic sport system for outdoor exhibit no draining capabilities in accordance with EN 14877 and EN 15330-1, the test specified in the above clauses shall be used with a slope of 1 %. One of the side of 40 cm is selected to be the higher point while the other one is complemented with a grove to collect the running water that is not penetrating the sample of synthetic sport system.

9 Performance characteristics

When this document was adopted by CEN, the test specified in the document had not been validated and no data on robustness, repeatability and reproducibility was available.

10 Report

10.1 General

In order to comply with this Technical Specification, the following information shall be documented in such a way that they are immediately available on request. In the following list, at least, the items marked with an asterisk (*) shall be included in the test report. All the deviation from the minimum requirements of this Technical Specification shall also be documented in the test report.

10.2 Sample preparation and testing facility

- Reference to this Technical Specification*;
- Description of the testing facility;
- Nature and specification of the synthetic sport system tested*;
- Date of reception in the laboratory of the material needed to prepare the test sample (synthetic sport system) to be tested*;
- Address of the laboratory and name(s) of the responsible person(s)*;
- Date of the preparation of the test sample for the leaching test;
- Statement of no aging before the test or any aging regime the sample has been subjected to before the test;
- Storage conditions between preparation of the test sample and the implementation of the leaching test.

10.3 Production of leachate

- Address of the laboratory and name(s) of the responsible person(s)* ;
- Sequences of watering and dates at which leachate sample are taken* ;
- Temperature at which the test was conducted ;
- Surface tension of the leachant water.

10.4 Characterisation of leachates

- Results of immediate measurements (pH* value, conductivity*, temperature* and redox) ;
- Conditioning method and storage conditions for the further analysis of the eluate, especially acidification, dilution…etc ;
- The analytical report specified in the standards dedicated to such analysis shall be incorporated, including the date of analysis, the storage conditions until the analysis is performed, the quantification limit of the analytical method being used, the address of the laboratory and name(s) of operator(s).

10.5 Presentation of the test results

- Concentration in mg of the constituents released per litre eluate with reference to the testing conditions.

Annex A
(normative)

Test of component (e.g. granule) of a synthetic sport system for outdoor use

A.1 Introduction

As indicated in the introduction of this Technical Specification, this annex describes three procedures that have been proposed for a relative leaching assessment of system's components (e.g. granules) of different origins or nature. This is intended on the one hand to facilitate production control of components and on the other hand to make possible for integrators to anticipate the results of the "reference" method described in the main part of this standard. Use of such indirect method requires that in the framework of this standard appropriate information is available on their comparability/traceability to the standardised "reference" method described in the main part of this standard.

NOTE 1 In the framework of this Technical Specification, these methods provides relative leaching assessment by establishing a typical "no change" situation in production control or in changing the type of granules. However, this information may be misleading if the indirect method is not sensitive enough to the real changes being considered.

NOTE 2 In the "reference" method described in the main part of this Technical Specification the amount of components tested is typically 4,8 kg resulting in a L/S ratio (with L in litre of liquid and S the mass in kg of solid material) over the entire test higher than 13. An L/S ratio of 2 is reached at the end of the third spay (i.e. beginning of the second day). This amount of material is considered as securing a good representativity of the tested sample and is the same as the one used in mechanical test. Also this "reference" method applies a similar leaching process as in the field, percolation with fast draining and wet-dry sequences.

NOTE 3 'Indirect test' methods (also called secondary, alternative, simplified, derived methods) provide within their specific field of application a result comparable or correlated to the result of the complete reference method specified in the main body of this document. Such methods may be easier to apply and/or cheaper e.g. for factory production control (FPC). They have to fulfil the requirements that. their comparability or correlation to the reference test method has been demonstrated in their specific field of application. The precision of this demonstration should be fit for purpose. A precise demonstration is needed when testing close to a limit to be verified and an un-precise demonstration is satisfactory when testing far below a limit to be verified. Also an indirect method derived from the reference method needs in general a simpler and cheaper demonstration. The term indirect is used since the result obtained with such a method results of the combination of a measurement combined with the use of a previously demonstrated correlation (precise or unprecise depending of the objectives).

A.2 Indirect methods with percolation and wet-dry sequences

In these methods the same apparatus is used as in the "reference" method described in the main part of this standard. And it is filled only with the tested component. Then the results do not include the contribution of the other components nor the interferences that may be caused by these other components.

The first possibility is to operate with the same watering sequence within a two weeks duration of the test. In this case the overall process is very close to the "reference" process and a good correlation could be expected (see A.1).

The second possibility is to operate with a shorter watering sequence within a few days duration of the test. In this case the process is similar (but shorter) and the counterpart of a shorter test is a lower correlation to be expected.

A.3 Indirect methods with percolation and without wet-dry sequences (column test)

A.3.1 General

In this method – an upward column test – the principle of the testing process is the same as in the "reference" method described in the main part of this standard, but it is an upward percolation with permanent contact of the components with the leachant (water) i.e. without wet-dry sequence. This test is proposed with L/S of 2 to 4 (with L in litre of liquid and S the mass in kg of solid material), hence a shorter test and as counterpart a low correlation with the "reference" could be expected. Also the small amount of components in the test portion submitted to the test may limit representativity and comparability (see A.1).

A.3 specifies a column test, which is aimed at determining the release of inorganic and organic constituents from components (e.g. granules) of synthetic sport system by up-flow percolation using demineralised water. Eluates are obtained and collected during the test. The results of eluate analysis are presented as a function of the liquid to solid (L/S with L in litre of liquid and S the mass in kg of solid material) ratio in terms of concentration (mg of the constituents released per litre eluate).

A.3.2 Principle

A test portion of the component under investigation is packed into a column in a specified manner and a pre-equilibration (saturation) is applied. The leachant - demineralised water - is percolated in up-flow direction through the column at a flow rate calculated from the fixed contact time between leachant and component. The eluate is collected in several separate fractions up to specified L/S ratios.

The resulting aqueous eluates can usually be analysed without further sample pre-treatment.

The leaching conditions in terms of pH, electrical conductivity or TOC and turbidity (optional) dictated by the material shall be recorded in order to evaluate the test results.

A.3.3 Apparatus and reagents

a) Column made of glass or plastic (appropriate to the released contaminants) with an internal diameter of 5 cm to 10 cm, column height at least three times the internal diameter, internal diameter at least twice the maximum grain size of tested materials.

b) Tubing material suitable to the released contaminants.

c) Inert filter material: quartz sand, 0,6 mm to 1,2 mm washed, if appropriate, but not annealed.

d) High quality glass bottles with an appropriate volume and screw caps with Teflon inlay, for eluate collection and preservation of eluate samples (If only inorganic contaminants are to be analysed, alternative bottle materials can be selected e.g. PFA, PTFE).

e) Peristaltic pump with an adjustable capacity between 0 mm and 60 ml/h (Other types of pumps can be used if the required capacity can be reached.).

f) Analytical balance with an accuracy of at least 0,1 g.

g) pH meter with accuracy of at least ± 0,05 pH units.

h) Electrical conductivity meter with accuracy of at least 0,1 mS/m.

i) Sample splitter for sub-sampling of laboratory samples.

j) Turbidity meter as specified in ISO 7027 (optional).

k) Centrifuge with at least 2 000 g.

l) Inert centrifuge container.

m) Membrane filter, 0,45 µm (e.g. syringe filter).

n) Leachant: demineralised water, deionised water or water of equivalent purity with a conductivity < 0,5 mS/m according to grade 3 specified in EN ISO 3696 and exhibiting a pH in a narrower range (6,5 < pH < 7,5) than the range of grade 3 specified in EN ISO 3696. If needed a dilute solution of sodium hydroxide may be used to adapt the pH range.

o) Rinsing solutions: Nitric acid (p.a.) 0,1 mol/L and an organic solvent (acetone, p.a.) or cyclohexane.

NOTE Acetone has the advantage that the last trace of rinsing fluid can be removed easily by evaporation.

A.3.4 Procedure

A.3.4.1 General

The materials and equipment specified shall be checked before use for proper operation and absence of interfering substances, which can affect the result of the test.

Quartz sand layers built in top and bottom of the column ensure constant water flow.

NOTE Quartz wool (maximum 5 mm) can be placed directly in front of the tubing to avoid blocking of the tubes.

Glass bottles for the collection and preservation of eluates should be closed with screw caps containing an inert seal and should have a venting to avoid excessive pressure.

The percolation test shall be carried out at a temperature of (23 ± 3) °C.

A.3.4.2 Sample preparation

The state-of-the-art sampling and sample pre-treatment procedures for the component have to be applied. The component has to be examined in unaltered condition i.e. in normal in-use condition. Air-drying (< 40°C) is only allowed for sieving and sample partitioning.

A.3.4.3 Determination of dry matter content/water content

The water content of the component has to be determined by means of drying a test specimen at 105 °C (± 5 °C) till constant weight is achieved. The water content can be calculated using Formula (1).

$$w = \frac{M_W - M_D}{M_W} \quad (1)$$

with

w: water content [-],

M_W : mass of undried specimen [g],

M_D : mass of dried sample [g].

A.3.4.4 Packing of the column

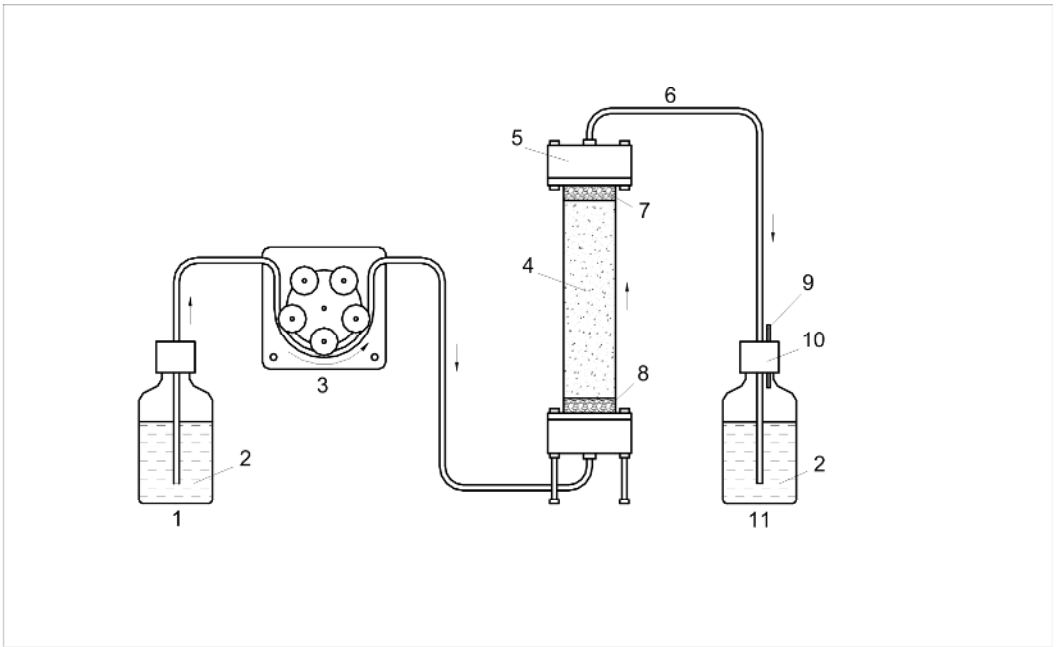
Rinse the column with nitric acid and/or an organic solvent and water respectively. Weigh the dry column as well as top and bottom sand filter material to an accuracy of 1 g.

It is recommended to introduce the component into the column opposite to the flow direction. Place the column with an attached closing cap in such a way that the designated outlet points downward.

Apply quartz wool in front of the outlet tubing if necessary. Introduce a filter sand layer of approximately 1 cm. Subsequently fill the column with the test portion in consecutive layers. After introducing each layer level it separately. Slight ramming may be applied if appropriate. If applicable, pack the column as realistic as possible in comparison to field conditions (particularly considering the bulk density). Determine the dry mass of the test portion in the column to an accuracy of 1 g.

Assemble a quartz sand filter layer on top such that no open space (dead volume) is left above the material. Close the column using a cap and turn it (180°). Attach inlet and outlet tubings.

A typical test set-up is shown in Figure A.1.



Key

1 stock bottle
2 leachate
3 multichannel peristaltic pump
4 glass column with sample material
5 column cap (PTFE)
6 inert tubing material
7 layer of quartz sand
8 layer of quartz sand
9 ventilation cannula
10 screw cap with PTFE inlay
11 glass collection bottle

Figure A.1 — Typical test assembly for a column percolation experiment

Calculate the porosity on the basis of the volume of the test material und the volume of the filled column section according to Formula (2):

$$n = 1 - \frac{M_D}{\rho_p - \left(l \cdot \pi \cdot r^2\right)} \quad (2)$$

with

M_D: dry mass of the test material [g],

n: porosity [-],

ρ_P: grain density of the test material in gram per cubic centimetre [g/cm^3],

r: inner radius of column [cm].

NOTE In case the actual grain densities are not known, typical grain densities (ρ_P) of selected materials can be used for the calculation of the porosity. For mixtures of less permeable test materials with quartz sand, the mass of the mixture and the grain density of quartz can be used.

Calculate the dry mass of the test material in the column on the basis of the mass of the undried test material and the respective water content following Formula (3):

$$M_D = M_W \cdot (1 - w) \quad M_D = M_W \cdot \left(1 - w\right) \quad (3)$$

A.3.4.5 Saturation phase

Saturate the column with the leachant from bottom to top using the pump. Calculate the flow rate q for the saturation phase according to Formula (4) by setting a saturation time t of 2 h.

NOTE The saturation time excludes the quartz sand filter layers.

A.3.4.6 Percolation phase

Connect the outlet hose to an eluate collection bottle of appropriate size. Start the percolation immediately after saturation. Calculate the flow rate according to Formula (4), taking into account a contact time t of 5 h.

$$q = \frac{l \cdot \pi \cdot r^2 \cdot n}{t \cdot 60} \quad (4)$$

with

q: flow rate [mL/min],

r: inner radius of column [cm],

l : length of specimen in the column [cm],

n: porosity of the specimen in the column [-],

t: duration of saturation phase (2 h) and contact time during percolation phase (5 h) respectively [h].

In case of deviations of the flow during the experiment, adjust the flow rate to reduce the deviation to 10 % at most.

A.3.4.7 Eluate collection

Change the collection bottles with a new one as soon as a specified quantity of leachant (eluate) according to specified L/S ratio following Table 1 has passed through. Measure time and volume of the eluate fraction at each eluate collection and calculate the L/S-ratio and the average flow rate of the leachant over the collection period of that fraction. Report all these values.

NOTE Turbidity, electric conductivity, pH value and DOC should be determined immediately.

A.3.4.8 Special test options

Depending to the objectives of the test two L/S options are available

a) Test at L/S up to 4 with four fractions

Tests at L/S up to 4 are used to obtain more information on the release of substances.

Collect eluates at the L/S ratios (with L in litre of liquid and S the mass in kg of solid material) given in Table A.1.

Table A.1 – L/S ratios for tests up to L/S =4

Fraction no.	L/S [L/kg] and tolerance	Eluate volume [L]
1	0,3 ± 0,05	(0,3 ± 0,05) × M_D
2	1,0 ± 0,2	(0,7 ± 0,2) × M_D
3	2,0 ± 0,4	(1,0 ± 0,4) × M_D
4	4,0 ± 0,8	(2,0 ± 0,8) × M_D

NOTE 1 The test duration and the time required to reach a certain L/S ratio depends on bulk density and porosity of the component.

NOTE 2 The L/S ratios might be altered or additional fractions might be added to address special questions.

NOTE 3 Eluates of multiple experiments might be combined if more eluate is needed for analytical purposes.

b) Test at L/S = 2 with one fraction

Test at L/S = 2 are used to determine regular release for comparison at fixed testing conditions.

Collect the complete eluate up to an L/S ratio of (2 ± 0,05) L/kg.

NOTE 4 The test result at L/S =2 can be calculated from the test results up to L/S 4 provided that fraction 3 was taken at L/S (2 ± 0,05) L/kg. The concentration results from the added released amounts of fractions 1 to 3 divided by the exact L/S ratio of fraction 3.

NOTE 5 If required by special regulations or national legislation, other specified L/S ratios can be adopted.

Exemplary test conditions for the test option L/S = 2 are given in Table 2.

Table A.2 – Exemplary test conditions

	Test conditions for SBR granulate
Dry mass of specimen (M_D) **[g]**	268
Particle density of sample material (ρ_P) **[g/cm³]**	1,173
Inner diameter of the column (r) **[cm]**	5,86
Length of specimen in the column (l)**[cm]**	25,0
Volume of the specimen in the column (V) **[cm³]**	674,3
Bulk density of the specimen in the column (ρ_B) **[g/cm³]**	0,397
Porosity (n) **[-]**	0,66
Test flow rate (q) **[mL/min]**	1,49
Contact time leachant/specimen (t_C)**[h]**	5
Saturation time (t_S) **[h]**	2
Flow rate of saturation phase (q_S)**[mL/min]**	3,71
Test duration up to L/S of 2 L/kg [h] (incl. saturation phase)	8

A.3.4.9 Further preparation of the eluates for analysis

If necessary, divide the eluate into an appropriate number of sub-samples for different chemical analysis and store them according to the requirements in EN ISO 5667-3.

The obtained eluates are usually free of particulate matter and can be used without further pre-treatment. Centrifuge the eluate if organic constituents are measured and the turbidity exceeds 100 FNU. If only inorganic constituents are measured the eluate can be filtered using 0,45 µm membrane filters.

A.3.4.10 Blank test

In order to check, as far as possible, how the whole procedure is performed, blank tests shall be carried out on a regular basis. The eluate of this blank test shall fulfil the following minimum requirements: in the eluate of the blank test the concentration of each considered substance shall be less than 10 % of the concentration determined in the first eluate of the tested material. If the blank measurement is below the detection limit and the detection limit is the same or less than that for the eluates, the requirement is also fulfilled. If the requirement is not fulfilled, it is necessary to reduce the contamination.

A.3.5 Test report

The test report shall include the following details:

a) any information necessary for the complete identification of the sample;

b) preparation of the eluates for analysis;

c) the test results as concentration at specific L/S ratios;

d) any details that are optional or deviations from the specifications and any effects which may have affected the results.

A.4 Indirect methods without percolation and without wet-dry sequences (one stage batch test)

A.4.1 General

In this method – a one stage batch test – the principle of the testing process is not the same as in the "reference" method described in the main part of this standard. It is dedicated to leaching behaviour of inorganic substances at a liquid to solid ratio L/S = 2 (with L in litre of liquid and S the mass in kg of solid material). The solvent is demineralised water. The eluates are collected and analysed after a shaking time of 24 h. In this test there is a permanent contact of the component with the leachant (water) i.e. without wet-dry sequence (see A.1)

This test may be applied for production control purposes.

A.4.2 Procedure

Apply EN 12457-1 without size reduction in order to remain in the in-use conditions during the test.

NOTE If the test is applied for shockpad and synthetic turf, samples with a diameter of approximately 8 cm may be used.

Annex B
(informative)

Construction specification for the testing apparatus

B.1 General

Some of the normative requirements given in the clauses of this standard are expressed in description terms. This annex provides informative description for elements of the testing apparatus that are defined in the clauses of the standard in term of performance requirement. Such informative description determines an apparatus that fulfil the corresponding performance requirements. This is intended to allow the potential user of the standard to construct directly a possible apparatus fulfilling the standard requirements.

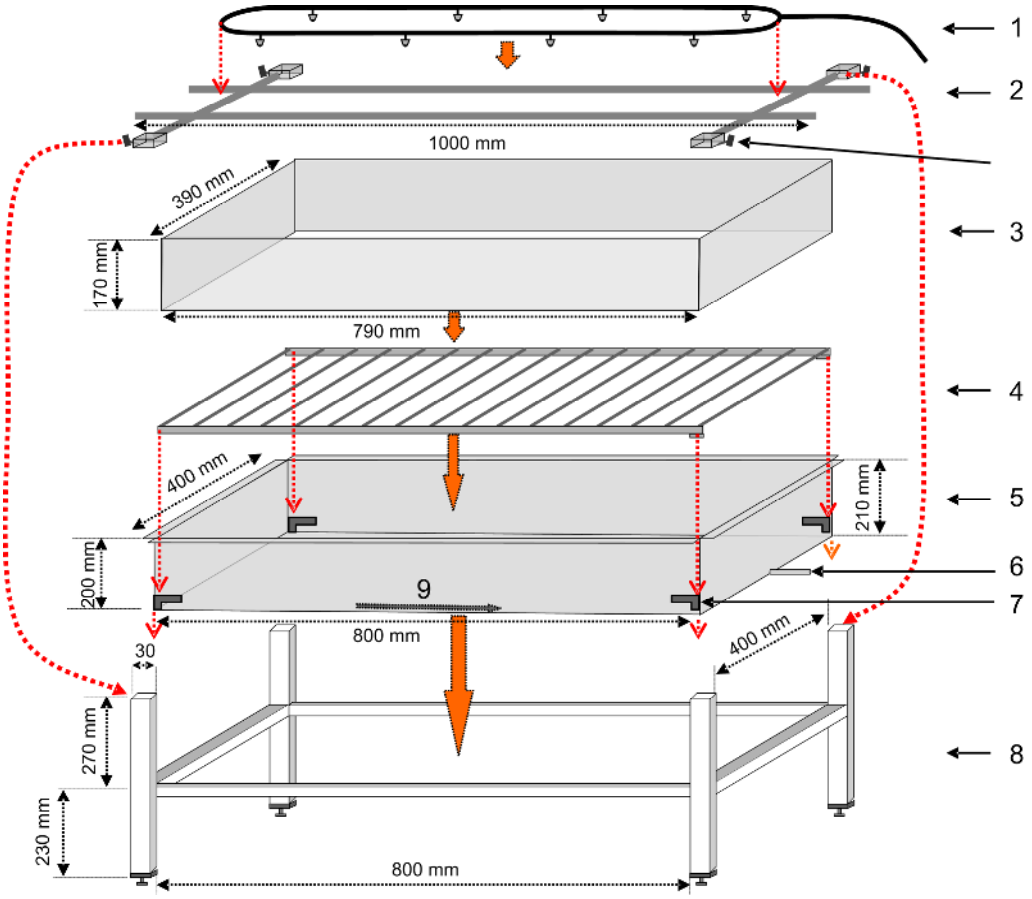
B.2 Tank

The tank (see Figure B.1) is made of stainless steel, as well as the vertical supports that allow the adjustment of rods and guide rods of the watering ramp.

For memory, the tank main dimensions are as follows: L = 800 mm, W = 400 mm.

The height is H = 200 mm and 210 mm (to slope the bottom a little) similar to the dimensions in EN 15306.

A hole is drilled at the bottom point for the passage of the percolate drain pipe.



Key

1 vatering ramp
2 system of regulation of the height of watering (stainless steel)
3 stainless steel casing
4 stainless steel grid
5 stainless steel tank
6 pipe for recovery of eluates
7 wedges for grid location
8 stainless steel frame
9 slope: 1,25 %

Figure B.1 – Developed plan of the apparatus

B.3 Spaying feed

The spraying system of watering (see Figure B.2) is connected to a storage tank of water which is put under pressure with some compressed air. A regulation of pressure up to 2 bars is provided by a manometer regulator.

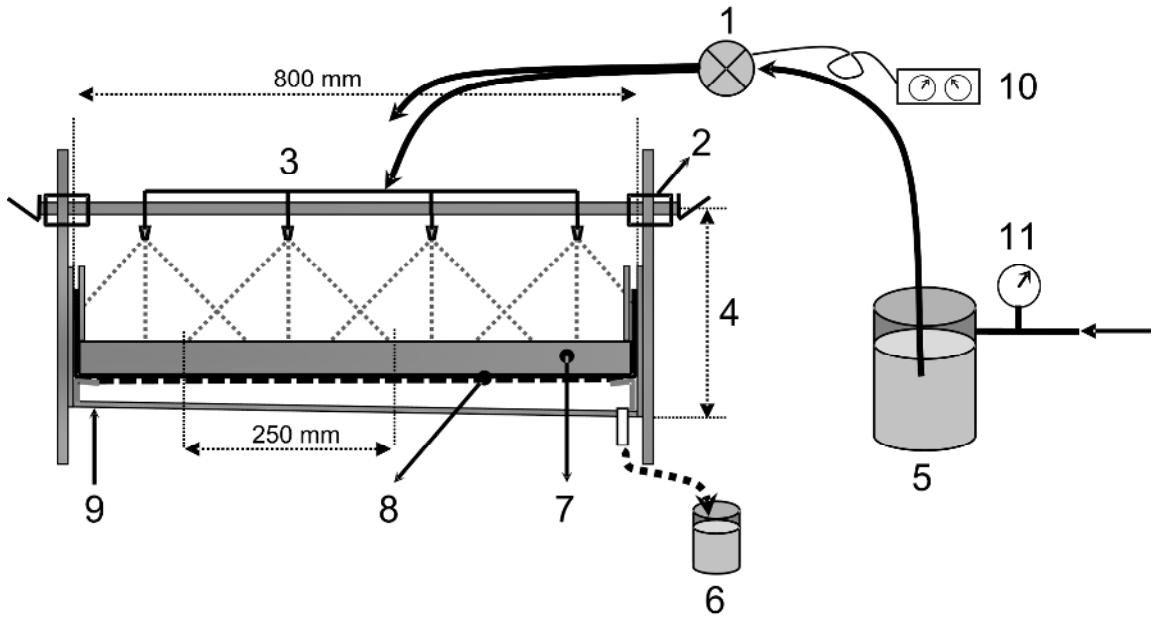
The hour and the duration of watering are adjusted by means of 2 timers (of which one with a precision of 0,1 s connected to a solenoid valve.

The "synthetic sport" system is laid on top of the stainless steel grid.

The grid permeability and the drain tube avoid immersion of the synthetic sport sample.

B.4 Watering system

The spraying system (see Figures B.1 and B.2) consists of 8 full cone spraying nozzles attached to each of the guiding rods. These nozzles are selected and arranged so that the diameter of the spray on the sample surface has a diameter of 220 mm in order to obtain a almost complete coverage (see Figures B.3, B.4 and B.5). The selected spray nozzles shall have a maximum spraying angle of 45°. This corresponds to a minimum height between the spray nozzles and the sport surface.



Key

1 solenoid valve
2 core tuning
3 watering ramp
4 adjustment height
5 water reserve tank
6 percotates recovery recipient
7 "artificial turf" system
8 stainless steel grid
9 stainless steel tank (80X40cm)
10 standard timer and time with accuracy = 0,1 s
11 compressed air with manometer / regulator fitted to 2 bars

Figure B.2– Longitudinal view

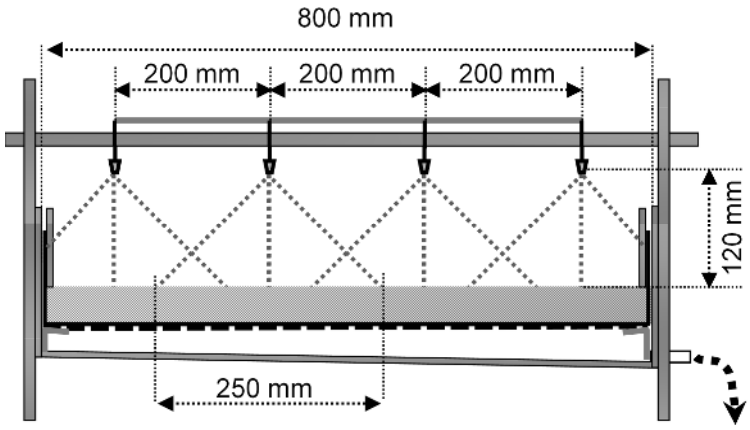


Figure B.3 – Longitudinal view

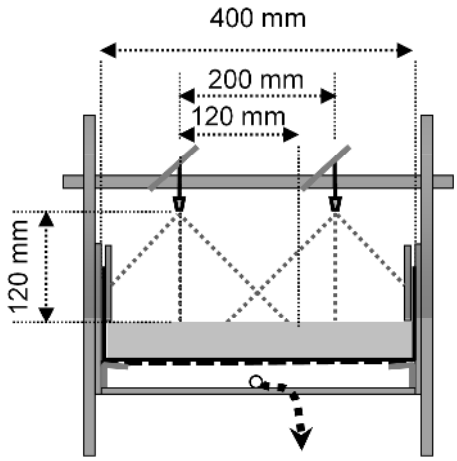


Figure B.4 – Transverse view

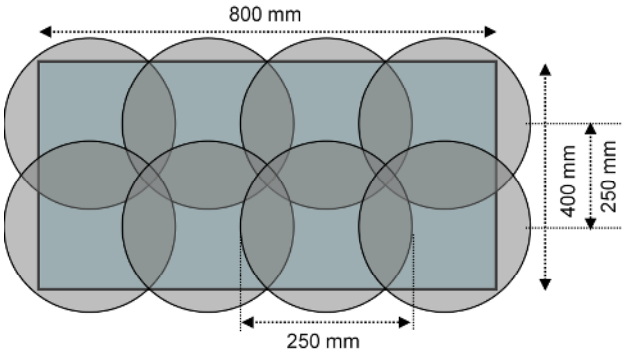
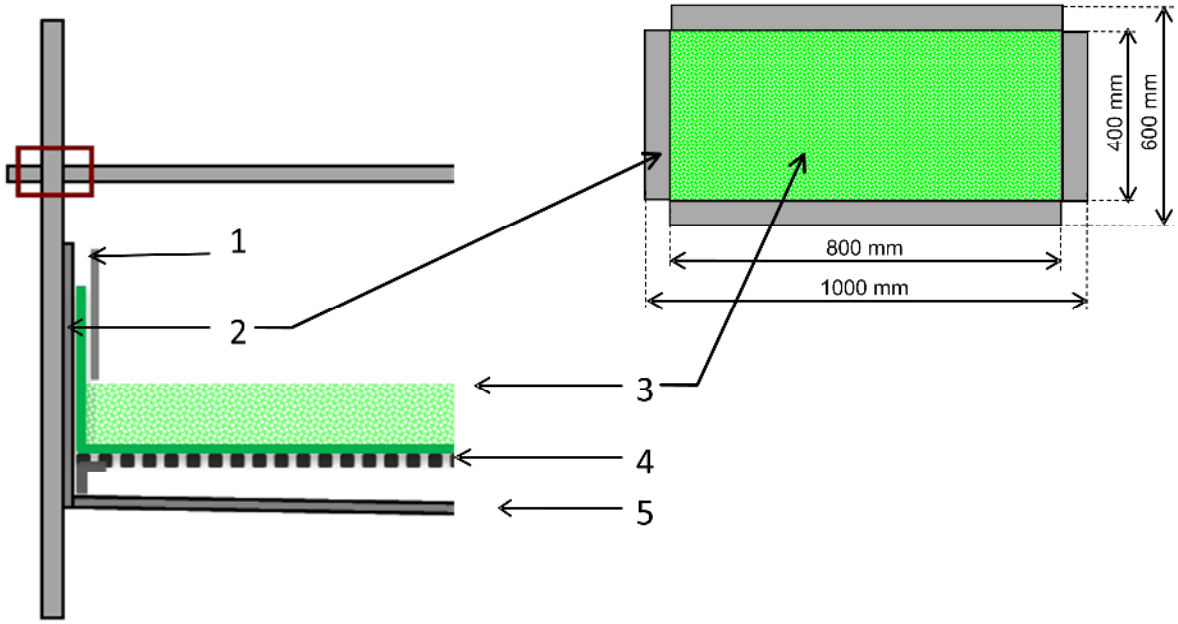


Figure B.5 – View from the top

B.5 Preparation of synthetic sport

All around a width of 10 cm, the fibres are disconnected and removed so as to bend the edge against the walls of the tank. At the corners, a square of 10 cm x 10 cm is cut to facilitate the recovery of the borders.



Key

1 stainless steel casing
2 carpet without fibers
3 fiber + carpet + granulate
4 stainless steel grid
5 stainless steel tank

Figure B.6 — Preparation

B.6 Nozzle

Inner pipe diameter : at least Ø 4,6 mm.

Angle full conical spray : typical 80°.

Feeding pressure : 1,4 bars – 1,6 bars on the nozzles.

Flow rate per nozzle at 1,5 bars = 0,15 l / min per nozzle.

Example of commercial reference :

Supplier GARDENA

Reference Micro Drip Mist Nozzle (01371-20)

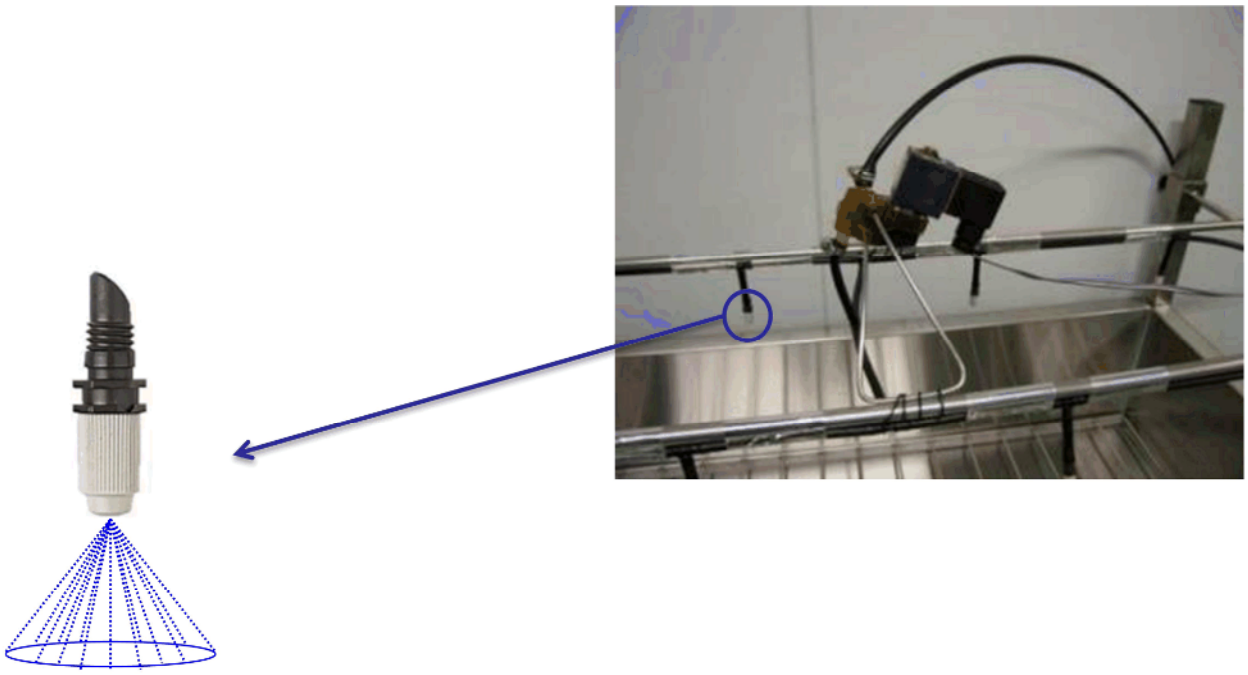


Figure B.7 — Example of nozzle

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[4] EN 15306, *Surfaces for outdoor sports areas - Exposure of synthetic turf to simulated wear*

[5] EN 15002, *Characterization of waste - Preparation of test portions from the laboratory sample*

[6] EN ISO 11885, *Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885)*

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