BS EN 16713-2:2016

BSI Standards Publication

Domestic swimming pools — Water systems

Part 2: Circulation systems — Requirements and test methods

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee SW/136/8, Swimming pools and aquatic equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Piscines privées à usage familial - Systèmes de distribution d'eau - Partie 2: Systèmes de circulation - Exigences et méthodes d'essai

Schwimmbäder für private Nutzung - Wassersysteme - Teil 2: Umwälzsysteme - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 5 December 2015.

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European foreword

This document (EN 16713-2:2016) has been prepared by Technical Committee CEN/TC 402 “Domestic Pools and Spas”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2016, and conflicting national standards shall be withdrawn at the latest by August 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

EN 16713, *Domestic swimming pools — Water systems*, currently comprises:

— *Part 1: Filtration systems— Requirements and test methods*;

— *Part 2: Circulation systems— Requirements and test methods*;

— *Part 3: Water treatment— Requirements*.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements and test methods for circulation systems and is applicable to equipment used in domestic swimming pools and designed for the circulation of water (introduction and/or extraction).

This standard applies for swimming pools as defined in EN 16582-1 and will be read in conjunction with it.

This standard does not apply to:

— pools for public use covered by EN 15288-1;

— spas for domestic or public use;

— paddling pools according to EN 71-8;

— pre filtration;

— natural and nature like pools.

NOTE For filtration systems see EN 16713–1 and for treatment systems EN 16713–3.

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 16582-1, *Domestic swimming pools — Part 1: General requirements including safety and test methods*

EN ISO 3386-1, *Polymeric materials, cellular flexible — Determination of stress-strain characteristic in compression — Part 1: Low-density materials (ISO 3386-1)*

EN ISO 9906:2012, *Rotodynamic pumps — Hydraulic performance acceptance tests — Grades 1, 2 and 3 (ISO 9906:2012)*

HD 60364-7-702, *Low-voltage electrical installations — Part 7-702: Requirements for special installations or locations — Swimming pools and fountains (IEC 60364-7-702)*

3 Terms and definitions

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

3.1
water operated leisure feature
feature formed as a result of water, being emitted either into, or from, a swimming pool

EXAMPLE Waves, water cannons, rain sprays, waterfalls, mushrooms and rapid rivers.

[SOURCE: EN 13451-3:2011+A2:2014, 3.12]

3.2
air and water operated leisure feature
feature formed as a result of air and water, being concurrently emitted into or from a swimming pool

EXAMPLE Hydromassages.

[SOURCE: EN 13451-3:2011+A2:2014, 3.14]

3.3
integrated swim jet system
device that incorporates suction outlets, usually include peripheral suction and an inlet, all within a single housing, that is designed to move a large volume of water at a high velocity, with or without the introduction of air

3.4
overflow channel
channel designed to collect and conduct overflowing surface water

Note 1 to entry: The water can be transported to e.g. a water balance tank.

3.5
channel drain
system fitted below within the overflow channel to collect the water from the overflow channel, when a balance tank is used

3.6
main drain
outlet device incorporated on the bottom of the basin

3.7
suction chamber
vessel between the suction outlet grille and the suction outlet piping, manufactured or field built

4 Requirements

4.1 Filtration system design

The components of the hydraulic system shall be sized or designed or be in sufficient number to meet the maximum performance requirements of the filtration unit (pump and filter).

4.2 Filtration system nominal flow rate

The filtration system nominal flow rate shall be designed according to the pool size, pool volume, shape, load and location in order to achieve sufficient water removal from the pool and distribution of water back into the pool. Where applicable, the volume of the overflow tank shall be included with the volume of the pool to give the total volume in the system. The total volume in the system is the volume used in all calculations.

The circulation system will ensure the greatest possible mixing of the water in the pool basin in order to provide a uniform distribution of chemical treatment and heat, making sure fine debris are kept in suspension as long as possible and that there are no “dead areas” where water movement is zero.

The filtration system shall have a sufficient nominal flow rate to allow the total volume of water contained in the pool to be recycled in no longer than 8 h. The filtration system nominal flow rate Q is calculated:

$$Q = \frac{V}{T_{TO}} \quad (1)$$

where

Q is the filtration system nominal flow rate in m^3/h;

V is the pool volume in m^3;

T_{TO} is the turnover time of the pool volume in h

4.3 Extraction of pool water

4.3.1 General

The majority of the pollution within a swimming pool is found in the top layer of the pool water and therefore good surface water removal during pool operation is essential for efficient filtration and treatment of the water. Other systems can also be used to help the efficiency of the removal of the complete water volume (e.g. bottom main drain, etc.).

4.3.2 Overflow channel

4.3.2.1 Dimension of overflow channel and channel drains

The cross section of the overflow channel shall be designed adequately to achieve sufficient temporary water storage. If the channel is to be used as a balance tank, it should be sufficiently sized to accommodate the effective volume required (see a) to d) in 4.3.2.3).

The dimension and numbers of channel drains shall be designed according to the expected:

a) water displaced by bathers;

b) amount of water created by waves;

c) nominal filtration system flow rate;

d) water and air based pool features.

The dimension of the channel drains shall be sufficient to allow water flow without pressure (under gravity only) and to minimize noise.

The internal surface of the overflow channel shall be easily cleaned to prevent the build of solid, bacteria biofilm, etc.

NOTE When overflow channels with a continuous slope are installed, the water can be extracted through one or more sufficiently designed channel drains at the lowest point.

4.3.2.2 Overflow channel cover

The overflow channel cover shall be designed to avoid entrapment for fingers and toes, be capable of taking the design flow of water and also be able to support the weight of the bathers. The cover shall collect the flow of water. National safety regulations shall also be considered.

The cover should be removable for maintenance and cleaning. Where the cover is not removable, an adapted cleaning system shall be provided.

4.3.2.3 Water balance tank

The size of the water balance tank should consider the:

a) amount of water displaced by bathers, or any submerged equipment;

b) amount of water created by waves;

c) losses of water due to splashing, evaporation, filter backwashing;

d) minimum water level in order to prevent air suction into the pump.

NOTE Water for filter backwashing can be also taken from the pool.

The water balance tank should have:

— access hatches to allow for cleaning and maintenance. The internal finish of the tank shall be easily cleaned so as to prevent the build-up of solids, bacteria etc.;

— venting or connection to the atmosphere;

— overflow drain;

— connection point for filling up water.

4.3.3 Skimmer

4.3.3.1 General

With a skimmer, the water will be removed of one or more positions at the pool.

The number of skimmers depends on, but is not limited to, the following:

— surface area;

— pool shape;

— skimmer opening size;

— nominal flow rate.

A flow rate ratio of approx. 2/3 through the skimmers and approx. 1/3 through the bottom drain(s) or additional outlets is recommended. The hazard of suction at the main drain(s) according to 4.4 shall be considered.

4.3.3.2 Installation of skimmers

When installing more than one skimmer, the skimmers shall be installed to ensure balanced flow in each skimmer.

4.3.3.3 Skimmers in outdoor pools

The positioning of skimmers should be opposite to the main wind direction.

4.3.3.4 Construction requirements

In case the skimmer lid can be walked on, the lid shall withstand the mechanical load. The skimmer lid shall be installed securely to prevent unintentional removal.

4.3.4 Main drain

The main drain shall be used in combination with surface water extraction for filtration purposes. One or more main drains can be installed in a pool. To use the main drain as pool drain it shall be installed on the deepest area of the basin.

4.4 Risk of suction entrapment

4.4.1 General

Suction devices shall be designed and installed so as to minimize the potential for entrapment of the user.

Water speed at fully submerged suction outlets should be ≤ 0,5 m/s.

Hair entrapment tests shall be performed on suction devices according to 5.3.

Safety requirements a) to c) are not applicable to:

— skimmers, because they are vented (see 4.4.3) and partly above the water level;

— integrated swim jet systems, because the users are pushed away from the outlet, as defined in 3.3 by the action of the inlet.

Additionally at least one of the following requirements shall be met:

a) multiple suction outlet system designed in such a way that:

   1) a minimum of two balanced and functioning suction outlets;

   2) the distance between the nearest points of the perimeters of the devices shall be as large as possible with respect to the size of the pool and the design of suction outlets, but with a minimum of 1 m to ensure the appropriate level of safety from entrapment;

   3) if any one of the suction outlets becomes blocked, the flow through the remaining suction outlet/s shall accommodate 100 % of the flow rate.

b) in case of suction outlet systems with only one grille, the grille shall be designed in such a way that, either,

   1) one user cannot cover more than 50 % of the opening; or

   2) raised grilles domed opposite to the flow direction, with prevalent peripheral suction. The height of the dome shall be at least 10 % of the main dimension; or

   3) single grilles with a surface of the area circumscribed to the suction openings ≥ 1 m^2 (see Figure 1); or

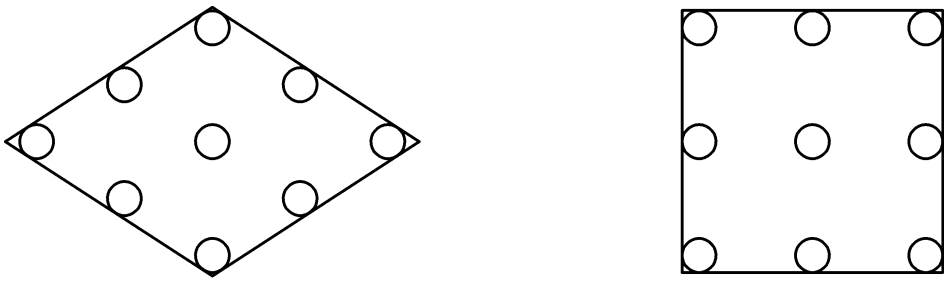


Figure 1 — Identification of the area circumscribed to the suction openings

c) any suitable designed outlet suction grille(s) that complies with the obstruction tests according to 5.4.

In addition to the requirements in a) to c), a vacuum release system may be provided.

When retrofitting existing installations that have a single suction outlet which does not comply with the requirements of this clause, then the following actions are required:

— the existing suction outlet shall be retrofitted with a grille conforming to b), or c);

— one or more additional suction outlets shall be provided as in a).

Vacuum release systems typically respond to a blockage of a single outlet by:

— releasing the vacuum by turning the pump off and introducing air;

— drawing out water present in a vent tube to allow air penetrates through this tube towards the suction system;

— mechanically operating valves to reverse flow through the suction outlet(s);

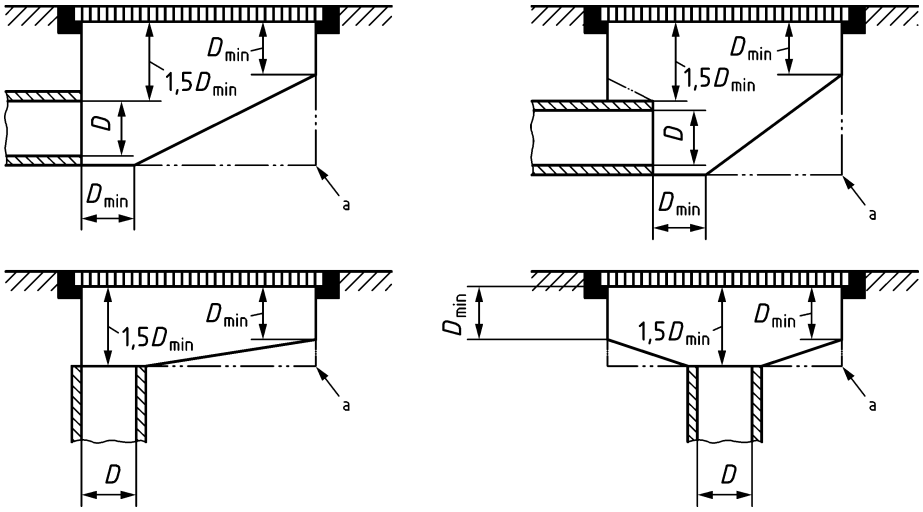
— opening a valve to atmosphere to cause a pump to lose prime.

All vacuum release systems shall be tested on outlets which meet the structural integrity and design requirements for grilles given earlier in this standard.

NOTE These devices/systems are not considered “fail safe” systems as there is no known suction vacuum release system that will completely protect against all outlet entrapment hazards. Presenting Vacuum Release Systems as “fail safe” systems would promote a false sense of security among the users of these devices/systems.

4.4.2 Suction chamber for floor and wall water outlets

Manufactured or field built floor and wall water outlets shall have a suction chamber with dimensions as shown in Figure 2.



Key

a indicates suggested suction chamber configuration

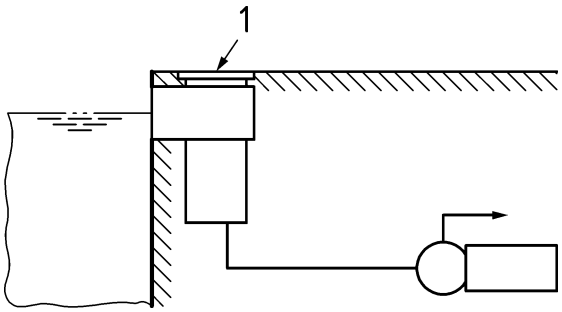
D inside diameter of the pipe

D_{min} dimension ≥ D

Figure 2 — Minimum suction chamber dimensions

4.4.3 Skimmers

Skimmers shall be effectively vented to atmosphere through openings in the lid (see Figure 3), or through a separate vent pipe.



Key

1 vent trough lid

Figure 3 — Skimmer, vent through lid

4.5 Introduction of pool water

4.5.1 General

Water returning to the pool tank under pressure will assist the general movement of water in the pool.

The number of inlets should be sufficient to take 100 % of the nominal flow rate of filtration system.

The water speed at pool inlets shall be ≤ 15 m/s, except for vertical injection from the swimming pool floor in water depth < 700 mm, where it shall be ≤ 2 m/s.

The number and location of the inlets shall ensure an equal and efficient water distribution in order to avoid water stagnation taking into account the following:

a) effective water volume of the pool and pool size;

b) pool shape;

c) outlet location;

d) nominal flow rate of filtration system.

To verify the water distribution the dye test according to 5.1 may be applied if necessary.

4.5.2 Introduction of pool water at reduced filtration flow rate

In case of reduced filtration flow rate e.g. during night time when the pool is not used, the introduction of pool water into the pool shall still be sufficient to ensure the maximum turnover time in 4.2.

The validation at reduced flow rate may be verified according to 5.1 if necessary.

4.5.3 Air and water operated leisure feature

4.5.3.1 Introduction of water and/or air from the floor

Features incorporating the introduction of water and/or air under pressure from the swimming pool floor shall not be installed in depths of less than 700 mm unless:

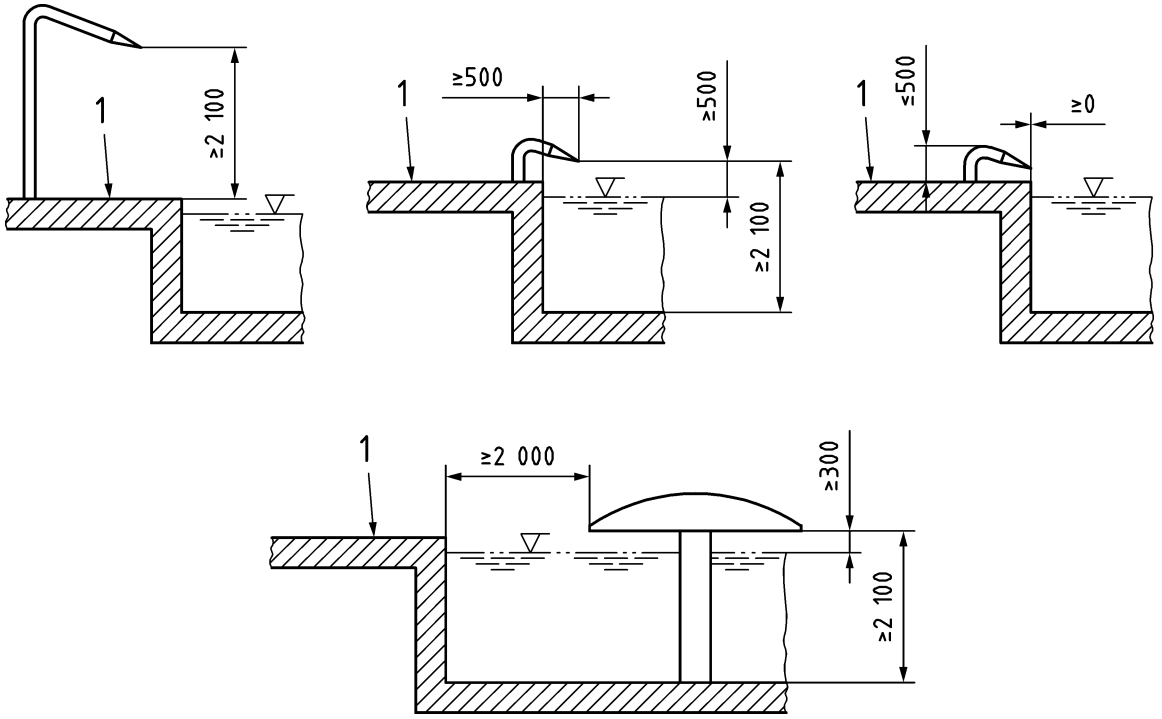
a) the vertical water speed is ≤ 2 m/s (see 4.5.1);

b) the total dynamic head in the system before the inlet is ≤ 30 kPa (≤0,3 bar) (≤3 m H_2O).

4.5.3.2 Positioning of water features

Fountains shall not be an obstruction hazard. Special attention shall be paid to interferences between the possible paths of the users in and around the pool and the design and position of the fountains. Wherever the risk of impact is foreseeable, the water effect shall not hide the fountain structure, or it shall be made obvious (see Figure 4).

Dimensions in millimetres



Key

1 walkable floor

Figure 4 — Fountains — Horizontal and vertical clearances

Generally, protruding jets should be avoided on the swimming pool wall, however in the case of overhanging counter-current or filtration units, protruding jets are allowed as long as they are part of a visible obstacle in the pool.

4.5.4 Other dangers

The manufacturer shall provide recommendations for maintenance and cleaning of the air and water operated leisure features.

4.6 Pipe work

The pipework and fittings used in any circulation system should be sized to take the nominal flow rate of filtration system and to minimize frictional head losses. The material should be non-corroding and in general terms suitable for the head pressure in the system and the water speed should not exceed 3 m/s with in the circulation pipe work at the pressure side. This is a maximum water speed at the pressure side, lower speeds are encouraged and will result in added energy savings. To avoid a potential cavitation risk it is recommended that water speed at the suction side of the pump shall be lower than the water speed at the pressure side taking into account pump suction behaviour and manufacturer's recommendations.

The maximum water speed does not apply to:

— water inlet connections;

— water based attraction connections;

— pipework and connections for water leisure features (unless specified by the manufacturer).

Pipework and fittings used in swimming pools are generally used in other fluid applications; they shall be suitable for the application and be covered by national standards.

When used underground, the pipework shall be compatible with its environment. Pipework should be installed at a certain depth below ground level depending on climatic conditions (soil freezing) and national standards/regulations. The pipes (whether rigid or flexible) shall be fully supported and shall be surrounded by non-compactable protective material to prevent any damage.

All above-ground pipe runs shall be adequately supported. It is not acceptable to rely on items of equipment for support.

All underground pipework shall be pressure tested (if applicable) for soundness before backfilling and a test report issued as proof. Annex A provides a possible pressure test procedure, which however does not supersede any national regulations. A second test shall be carried out after backfilling and before any concrete and/or finishes are installed to make sure there has been no damage to the pipework during compaction.

The pressure tests shall be carried out for all swimming pools during construction and/or renovation of the hydraulic system or fittings (inlet/outlet). Where pipes are split into branches, in particular with multiple skimmer outlets and returns, the branch pipes shall be sized so that they can take the full proportion of their part of the flow.

Valves shall be fitted within the circulation pipe design to isolate various items of equipment within the system so that they can easily be removed for maintenance or repair. Moreover some valves can be fitted for changing the direction of water flow (e.g. multiport valves).

They shall be suitable for their application and be in accordance with national standards.

4.7 Pumps

4.7.1 Principle

This section contains requirements for pumps intended for filtration and/or circulation and/or water leisure features in domestic swimming pools. Pumps are elements subjected to CE marking, therefore this section shall be read and interpreted in conjunction with the current regulation.

4.7.2 General

The design of the filtration system will depend significantly on the correct selection of the filter pump, see Annex B. Its size and performance should be matched or determined under the consideration of the following:

a) flow rate;

b) head loss of filter;

c) head loss of pipe and pipefittings;

d) head loss of sanitation and heating equipment;

e) etc.

If appropriate, a balancing valve on the immediate pressure side of the pump should be fitted so that the correct flow rate can be achieved either by using the in-line flow meter or the pump performance curve.

Filtration system should be fitted with a means of preventing objects from fouling the impeller.

Parts of the pump that needs further operation or servicing shall be easily accessible. Whenever the strainer is not an integral part of the pump, the qualification and characterization of the product shall include it as far as it is sold together with the pump.

If required, pumps should have at least a drain hole with a plug or equivalent means to drain the housing for servicing and/or winterizing, without disconnecting the pump from the pipe work. Whenever the strainer is not an integral part of the pump, it should also have a drain hole with a plug or equivalent means.

4.7.3 Hydrostatic pressure test

The pump and parts of it that contain water under pressure shall be capable of withstanding a hydrostatic pressure test at 150 % of the maximum gauge pressure by the pump.

Whenever the strainer is not an integral part of the pump, the requisites for the hydrostatic pressure test will also apply.

Hydrostatic pressure test shall be performed according to 5.5.4.

4.7.4 Resistance of materials

The pump materials used shall be suitable for the chemical and mechanical influence within swimming pool water treatment.

Any pump materials affected by corrosion shall meet the requirement stated in the corrosion resistance clause in EN 16582-1.

4.7.5 Performance characterization

4.7.5.1 Head vs. flow rate curve

For each pump and model, the manufacturer shall provide, on demand, the differential dynamic head vs. flow rate curves. The testing procedure shall be conducted as specified in EN ISO 9906:2012, Annex A, considering monobloc pumps with a nominal power rate less than 10 kW. If not otherwise agreed upon between the manufacturer and purchaser, the tolerance factors shall be the following:

— rate of flow τQ = ± 10 %;

— pump total head τH = ± 8 %.

4.7.5.2 Power drawn vs. flow rate curve

For each pump and model, the manufacturer shall provide, on demand, the active power drawn from the electrical supply for its operation during the whole working range as defined in its head-flow curve. This data shall be presented drawing active power against flow rate.

Testing procedure and representation shall be carried out according to EN ISO 9906:2012, 4.2.

4.7.5.3 Total efficiency vs. flow rate curve

For each pump and model, the manufacturer shall provide, on demand, the total efficiency (hydraulic power discharged by the pump vs. electrical power) during the whole working range as defined in its head-flow curve. This data shall be presented drawing total efficiency against flow rate.

Testing procedures and representation shall be carried out according to EN ISO 9906:2012, 4.4.2.

4.7.6 Self-priming performance

A pump designated as self-priming shall be capable to re-prime itself during its normal operation. Whenever a self-priming performance is claimed, self-priming performance shall be verified in accordance to 5.5.3.

4.7.7 Endurance running test

Pump and parts of it shall withstand a continuous running test according to 5.5.5.

4.7.8 Cyclical endurance test

Pump and parts of it shall withstand a cyclical test according to 5.5.6.

4.7.9 Installation requirements

4.7.9.1 General

The installation of the pump shall be done according to the manufacturer's instructions provided in, either the installation manual or user's manual.

Pumps can cause vibrations and/or shock waves during stopping and starting phases. If required pumps may be connected with flexible joints to the pipework at suction and pressure side in order to minimize the mechanical stress.

It is recommended to mount pumps on an anti-vibration plinth to avoid sound transmission. Where practical, the pumps should be installed below water level.

4.7.9.2 Electrical Installation

Implemented in accordance with the manufacturer's instructions, the electrical installation of the pump or any electrical circulation devices related to the pool, shall comply with the requirements of HD 60364-7-702 (excluding mobile equipment) or valid national requirements.

These devices shall also comply with electrical product standards or valid national requirements.

4.8 Information to the user and to the installer

The manufacturer shall provide with each pump a manual. The manual shall include written information and at least one drawing for the proper installation, use and safety of the product.

Instructions for the consumer shall contain information, including, but not limited to, the following:

— Mind all the safety requirements and recommendations described in the manual;

— In case of doubt on the pump or any circulation devices, contact a qualified installer, or the manufacturer/importer/distributor;

— The water circulation installation shall comply with the European as well as national/local regulations, especially when dealing with electrical issues;

— In case a massage hose can be connected to the water inlet, the manufacturer shall warn the consumer of the potential danger of the jet when aimed at somebody above water level. He shall especially mention the risk for injury to the eyes;

— Any change of valve position, pump size, grille size can cause a change of the flow and the suction velocity can be increased;

— the address or telephone number where the consumer/installer can obtain additional information during the installation in the event of problems.

5 Test methods

5.1 Dye test

When using Eriochrome-black-T indicator for metal-titration -$C_{20}H_{12}N_3NaO_7S$ use the following procedure:

a) Prepare Eriochrome-black-T with a dosage of 10 g per 50 m^3 pool water. If it is a pool with a chargeback tank add 60 % of the usable capacity of the tank to your calculation;

b) Take into account the possible absorption by filtration media which would affect the colouring (filter sand, Hydro-Anthracite, active carbon…). In any event the test shall be carried out with the same head loss as when the filter is in use;

c) Reduce the concentration of chlorine down to zero (e.g. a Sodium thiosulphate pentahydrate could be used);

d) Prepare an Eriochrome-black-T solution of 1 % (10 g pigment in 1 l water) in water, which is free of Chlorine. Use 1 l of this solution per 50 m^3 water as written in a);

e) Introduce the solution into the circulation system via one of the following options:

   1) into the chargeback tank or in a drain of the overflow gutter;

   2) into a skimmer;

   3) through a dosing pump and an injector into the piping of the water treatment system.

f) The insertion shall be done so that there is a continuous flow of pigmented water into the pool for not less than 30 min;

g) The progress of the change in the colouration shall be documented with video or photographs. The time from the first introduction of the coloured solution until the water is constantly coloured also shall be documented;

h) The first part of the dye test is passed when the water is uniformly coloured in 30 min maximum;

i) Now wait till the colouration is completely stabilized;

j) Insert chlorine in a dosage of 5 mg/l at the same point with the same procedure as the solution in e) was introduced;

k) The progress of the change in the colouration shall be documented with video or photographs. The time from the first introduction of chlorine until the water is completely clear shall also be documented;

l) The second part of the colouration test is passed when the water is completely clear in 30 min or less.

5.2 Entrapment test

Any accessible circulation equipment shall fulfil the general entrapment requirements in accordance with EN 16582-1.

5.3 Hair entrapment test

5.3.1 Application

Hair entrapment tests may be used as a test under installed conditions “on site” or as a design test in a laboratory.

5.3.2 Test equipment

A hair probe made of 50 g of natural or of a good quality synthetic, both medium to fine, straight, 400 mm in free length. The hair probe shall be in good condition, tangle free and the end of single strand may not be jagged.

One side of the hair probe shall be attached to a rod of 25 mm to 30 mm diameter. The length of the rod shall be suited to the test situation ≥ 300 mm.

A dynamometer with an accuracy of 0,5 N to determine the traction force against the entanglement shall be used.

For design tests on specimen, the following additional requirements shall be fulfilled:

— a container of sufficient depth to provide a minimum of 300 mm of water above the uppermost portion of the device; as well as

— a pump capable of producing a flow rate of at least 25 % greater than the pool device manufacturer's recommended flow rate.

5.3.3 General

5.3.3.1 Test method

5.3.3.1.1 On site test

For the on-site test, the pool shall be in full operation. Testing may be carried out from the basin edge, water surface or by diving or robotic equipment. If the pool device to be tested is located:

a) < 500 mm below water surface, the test shall be carried out with suitable equipment;

b) 500 mm to 2 000 mm below water surface, the test shall be carried out considering clear visibility, under certain circumstances granted by suitable equipment;

c) > 2 000 mm below water surface, the test shall be carried out with diving or robotic equipment.

Saturate the hair for at least 2 min in pool water. After being saturated, place the free end of the hair approximately 300 mm in front of the device and above the uppermost surface of the face of the device (see Figure 5).

Slowly move the hair ends closer to the device and feed the highest possible quantity of hair ends into the device itself in the direction of the intake flow. Continue to slowly feed the hair by moving the rod from side to side while shortening each pass for at least 1 min until ideally at least 50 % of the length has been sucked in. In any case, a length suitable to detect the presence of turbulence behind the grille shall be fed in. Then lay the rest of the hair against the device, in such a way that the hair remains in contact with it for at least 30 s.

The surface of the device shall be divided in areas of about 50 cm x 50 cm. In the centre of each area and additionally above the pipe, where the highest water speeds occurs, one test shall be carried out. If the hair does not get sucked into the main drain the test is passed. With the pump still operating, test the pulling force necessary to free the hair from the device. Measure the force to free from the entanglement.

Repeat the test 3 times for single area as defined before. For devices with perforated plates, grille e.g. with larger surface, move the free end of the hair over and against the whole surface. Detect if the hair probe gets sucked. Unless suctions provide unavoidable slits between grille and floor or wall or between the grille and frame, which cannot be sealed, see 5.3.4.

If one device serves more than one attraction, the test shall be carried out at the maximum of the possible flow rate.

Brush hair periodically, to keep tangle free.

If slits related to suction points are present, see 5.3.4.

5.3.3.1.2 Laboratory test

Test a group of 10 specimens of the device. Install the device to be tested into the wall of the container and connect it to the pump following the manufacturer's recommendations. Fill the tank to a water level of 300 mm above the uppermost portion of the device. Actuate the pump and regulate the flow to the manufacturer's recommended flow rate.

Saturate the hair for a minimum of 2 min in test water. After being saturated, place the free end of the hair approximately 300 mm in front of the device and above the uppermost surface of the face of the device [see Figure 5b)].

Slowly move the hair ends closer to the device and feed the ends of the hair into the device in the direction of the intake flow. Continue to slowly feed the hair by moving the rod from side to side while shortening each pass of the rod for at least 2 min. Then, lay the hair against the device for at least 30 s [see Figure 5c)].

The surface of the device shall be divided in areas of about 50 cm × 50 cm. In the centre of each area and additionally above the pipe, where the highest water speeds occurs, one test shall be carried out. If the hair does not get sucked into the main drain the test will be passed. With the pump still operating, test the pulling force necessary to free the hair from the device. Measure the force to free from the entanglement.

Repeat the test 3 times for a single area as defined before. For devices with perforated plates, grilles e.g. with larger surface, move the free end of the hair over and against the whole surface. Detect if the hair probe gets sucked.

Brush the hair periodically, to keep tangle free.

5.3.3.2 Evaluation

Measuring results of all items which define the test result shall be recorded.

EXAMPLE

— Each single test;

— adjustments of pumps;

— pump size;

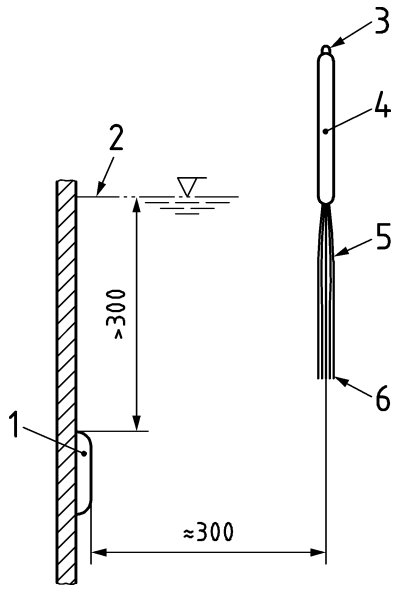
— pipe devices.

Taking into account the weight of the saturated test probe, the device passes the test when on all the tests the traction force is < 15 N.

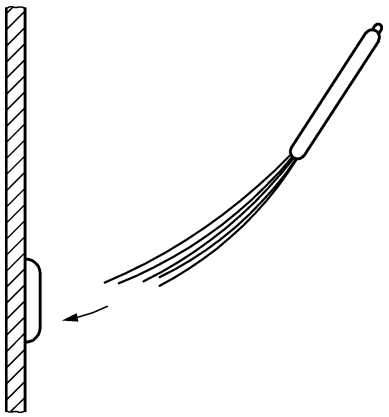
Taking into account the weight of the saturated test probe, the device fails the test, when on any one of the tests the traction force is ≥ 15 N.

NOTE If a device has a design approval, an additional on-site test is not required. Because pool installation and operation conditions may differ from test conditions, a final on site test is advised.

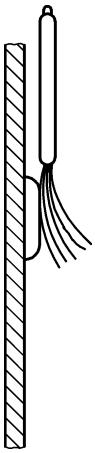
Dimensions in millimetres



a) Starting position



b) Direction of hair feed — Attempt to feed hair ends into intake openings



c) Final position — Hold against device

Key

1 suction device
2 water level
3 attachment of dynamometer
4 rod
5 hair sample
6 hair ends

Figure 5 — Stages for hair entrapment test

5.3.4 Hair entrapment in slits

5.3.4.1 Test method

Saturate the hair for a minimum of 2 min in test water. After being saturated, move the free end of the hair over and against the slit protection. Repeat this test 3 times.

In case of slits related to suction points, cover or enclose the main opening to increase the suction effect at the slit.

Test for the amount of pull necessary to free the hair from the entanglement. Measure the force required to free the test probe from the entanglement by pulling the dynamometer and rod vertically. Brush hair periodically to keep tangle free.

5.3.4.2 Evaluation

Taking into account the weight of the saturated test probe, the protection passes the test when on all the 3 tests the required traction force is < 15 N.

Taking into account the weight of the saturated test probe, the protection fails the test when on anyone of the 3 tests the required traction force is ≥ 15 N.

5.4 Obstruction test for outlet suction grilles

5.4.1 General

All the water outlets should be tested when installed horizontally.

5.4.2 Test device

A test device composed of a slab of expanded elastomeric closed cell foam with the following characteristics:

— mechanical strength (60 ± 20) kPa at 50 % — relative distortion under compression in accordance with EN ISO 3386-1;

NOTE 1 The manufacturers of flexible cellular materials refers usually to NF R99-211 which refers to EN ISO 3386-1.

— density (80 ± 20) kg/m^3;

— thickness 45^{+2}_{0} mm;

— oval shape, made by overlapping two disks of radius 95 mm with their centres one radius apart and connecting them by their common tangents (see Figure 6);

Dimensions in millimetres

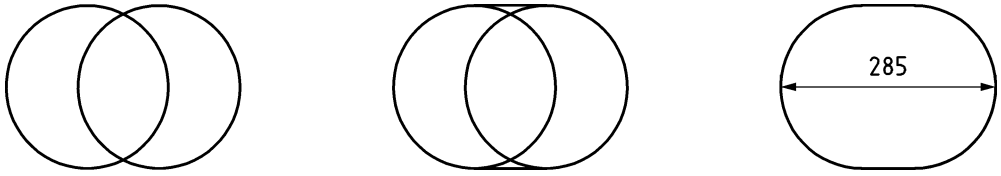
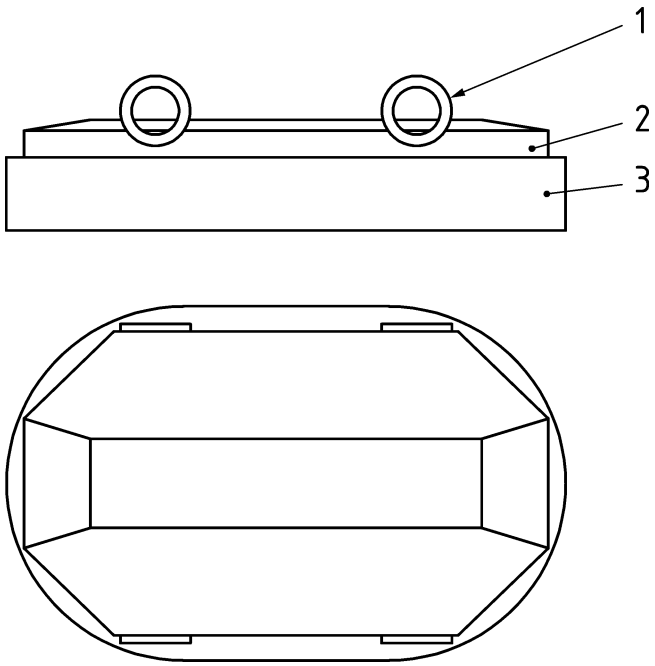


Figure 6 — Shape of the test device

— the mass of the test device shall be (2,8 ± 0,1) kg; the mass of the steel plate bellow should be adjusted to the mass of the foam slab in order to comply with the total mass value;

— a steel plate of the same shape as the slab, with a thickness of about 10 mm; the purpose of this plate is to stiffen the test device and raise its average density to above 1 so that when the test device is submerged in water it exerts a downward vertical traction force of less than 5 N. The steel plate should be fitted with four eyebolts.



Key

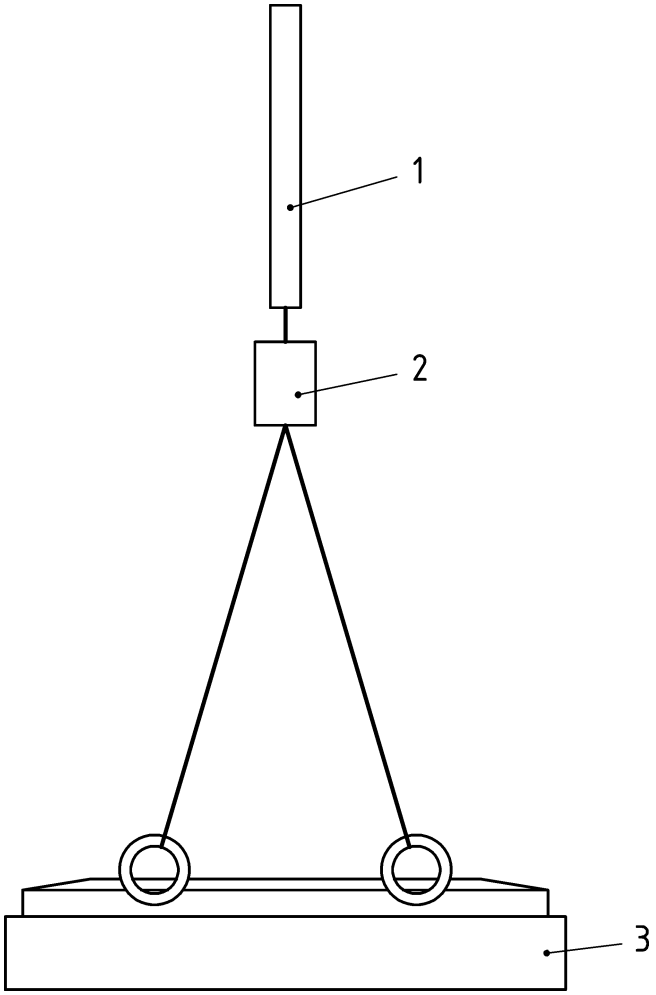
1 rings
2 steel plate
3 foam slab

Figure 7 — Test device assembly

NOTE 2 A child of 8 years of age is used as a reference for the test assembly in 5.4, as this group proved to be statistically one of the more exposed to suction risk.

The foam slab and the steel plate are bonded permanently together (see Figure 7).

This test device is connected to the dynamometer by four non-elastic 500 mm long ties, and dynamometer is connected to the traction device (see Figure 8).



Key

1 traction device
2 effort sensor
3 test device

Figure 8 — Test rig

5.4.3 Water flow

The bench should be carried out in the conditions (flow rate) specified by the manufacturer through the suction device being tested and a pressure drop of at least 90 kPa when the device is obstructed.

The test should be carried out in the conditions (flow rate) specified by the manufacturer.

5.4.4 Procedure

Install the system in the test pool in normal conditions of use, including the flow rate specified by the manufacturer. The suction system should be submerged at a water depth of 75 mm measured vertically upwards from the installation surface of the suction device; position the test device on the suction device with the pump switched off. Switch on the pump; and after 5 s exert progressively an upward vertical force up to a maximum value of 300 N and hold it for 5 s.

5.4.5 Evaluation

The test is passed when under the required load the test device can be detached from the suction system.

5.5 Evaluation of pumps intended for pool water filtration and/or pool water circulation purposes

5.5.1 Principle

The test conditions specified in 5.5 are not intended to represent actual swimming pool field conditions, and serves the purpose of characterization and evaluation of the pumps designed for filtration and/or circulation of pool water and/or water leisure features.

Newly designed pump models shall be tested according to 5.5.

If there are changes in construction and/or design of existing pump models, the tests according to 5.5 shall be repeated.

It is recommended that a pump is periodically taken off the production line and tested according to 5.5 (random sample survey).

5.5.2 General comments on apparatus and test conditions

All the apparatus and devices used in the measurement chain shall meet the accuracy and repetition required by the tests defined. The apparatus shall be subjected to periodical calibration and traceability.

For the repetition of the tests described, the water temperature and turbidity shall be recorded and kept during the test in the range:

— Water Temperature: 20°C ± 6°C;

— Water Turbidity < 15 FNU.

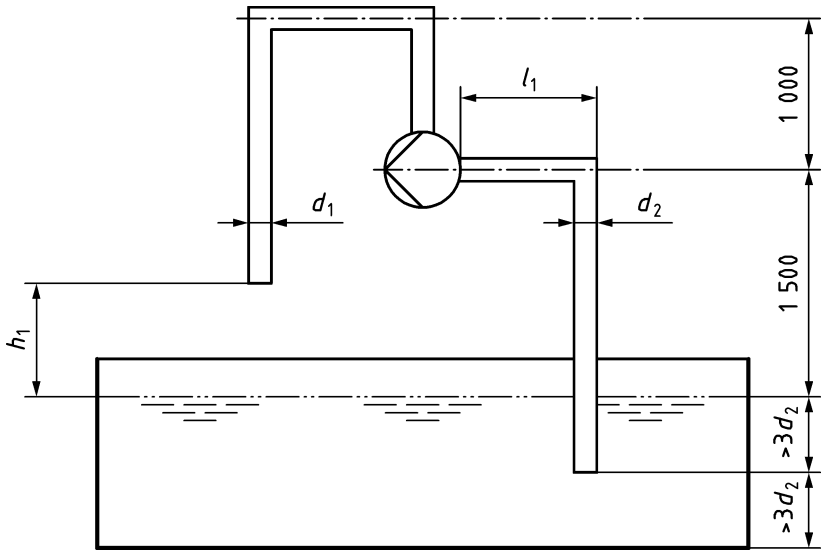
NOTE The reason for the definition of the water test conditions is to ensure that the physical properties of the water do not significantly change during the test and among different test rounds.

5.5.3 Self-priming performance

Self-priming performance shall be verified in accordance to the following test: The pumps delivered without strainer shall be tested without strainer, unless the manufacturer recommends the use of a specific model of strainer. In this case, the pump shall be tested with the recommended strainer.

a) The pump shall be installed according to Figure 9. If tested with the pump the basket of the strainer shall be perfectly clean.

Dimensions in millimetres



Key

d_1 inside diameter of the pressure pipe

d_2 inside diameter of the suction pipe

l_1 horizontal length of the suction pipe, shall be minimum $10d_2$

h_1 height between the end of the pressure pipe and the water level, shall be between 100 mm and 250 mm

Figure 9 — Apparatus for self-priming capability test

b) The pump shall be filled with water before the first start.

c) The pump shall be turned on and the timer started.

d) The time to achieve full flow shall be recorded. This is the priming time (PT).

e) The pump shall be shut off and all pipes drained of water.

f) Steps c) to e) shall be repeated at least twice (no additional water shall be added to the pump).

g) A pump can be designated as self-priming, if the priming time (PT) for each run does not exceed 12 min or the manufacturer's recommended time, whichever is smaller.

5.5.4 Hydrostatic pressure test

Pump and parts of it that contain water under pressure shall be capable of withstanding a hydrostatic pressure test at 150 % of the maximum pressure deployed by the pump (pressure at flow = 0).

Test notes:

a) The pump shall be filled with test water and all air removed from the system;

b) Increasing pressure shall be applied in a uniform manner to obtain 1,5 times the maximum pressure deployed by the pump (at Q = 0) in a period of 60 s to 70 s;

c) The pressure shall be held for 3 min. The pump housing shall be examined for leakage during the test period;

d) After the test there shall be no evidence of rupture, leakage, burst or permanent deformation on any part of the pump.

5.5.5 Endurance running test

Pumps (and parts of them) shall withstand a continuous running test of at least 3 000 h.

Test notes:

a) Whenever the strainer is not an integral part of the pump, the requirements for the endurance running test will also apply;

b) The pump shall be connected, turned on and the timer started;

c) The pump shall run at the maximum performance point for 3 000 h without any malfunction, which could compromise either the expected application or the safety of use.

5.5.6 Cyclical endurance test

Pump (and parts of it) shall withstand a cyclical test for at least 10 000 cycles of operation.

Test notes:

a) Whenever the strainer is not an integral part of the pump, the requirements for the cyclical endurance test will also apply;

b) The pump shall be connected to the test bed with a valve installed at the outlet port regulated so that the obtained head is 95 % of the total head delivered at zero flow.

c) The pump shall be turned on and off in intervals of a maximum of 3 min for a total of at least 10 000 uninterrupted cycles;

d) After the test there shall be no evidence of rupture, leakage, burst or permanent deformation on any part of the pump and strainer, if any, or any mechanical or electrical failure.

5.6 Test report

The results of the indicated test in 4.7.3, 4.7.6, 4.7.7 and 4.7.8 shall be recorded in a test report. All failure of any nature shall be also mentioned in this test report.

Annex A
(informative)

Pressure test procedure

A.1 Principle

The pipework pressure test can be carried out by an external organization or by the swimming pool builder himself.

The pipe pressure test should be carried out using a pressure source (water or air under pressure) at a minimum of 250 kPa (2,5 bar), according to the following procedure. Any other test protocol allowing pressure to be generated in the pipework is also accepted.

Some precautions shall be brought for the use of fluid under pressure (especially violent projections…)

A.2 Procedure

When the part of hydraulic system is isolated (with a specific valve), the test device is hermetically applied on the relevant fitting.

The test device is then linked to the pressure source where pressure is beforehand measured (minimum 250 kPa ± 3 % (2,5bar)).

Gradually apply the test pressure in the pipework to test, until a minimum pressure of 250 kPa (2,5bar) (see the manometer of the test device). Close the pressure source (with a specific valve of test device) and maintain the pipework under pressure. The notified pressure by the manometer shall not decrease during a minimum period of 3 min.

A leak on the pipework will generate a pressure loss. Re-test the relevant pipework following the procedure in the case where a leak is repaired.

At the end of the test, discharge progressively pipework under pressure.

These results of the pipework pressure test should be recorded in a contractual document, by the stakeholders.

A.3 Acceptance criteria

When subjected to the pressure test as defined in A.2, the pipework shall not exhibit any sign of leakage.

Annex B
(informative)

Pump selection principle

Selection of Q (m^3/h), nominal flowrate of circulation system,
according to EN 16713–2:2016, 4.2

↓

Calculation of the total headloss $\Delta\rho$ generated by the hydraulic circuit of the pool water circulation at Q.
For this calculation, the hydraulic circuit shall be considered with all its equipment and with clean filter media.

↓

Choice of pump delivering Q at $\Delta\rho$
referring to the pump performance curve taking into account the hydraulic efficiency

Annex C
(informative)

Environmental aspects

Every product has an impact on the environment during all stages of its life-cycle, e.g. extraction of resources, acquisition of raw materials, production, testing, distribution, use (application), reuse, end-of-life treatment, including final disposal. These impacts range from slight to significant; they can be short-term or long-term; and they occur at global, regional or local level. Provisions in product standards have an influence on environmental impacts of products.

The need to reduce the potential adverse impacts on the environment of a product that can occur during all stages of its life is recognized around the world. The potential environmental impacts of products can be reduced by taking into account environmental issues in product standards.

During the life-cycle of a given product, different environmental aspects can be determined. The aim is to promote a reduction of potential adverse environmental impacts caused by products.

NOTE For information, an environmental checklist is given in Table C.1. The purpose of the environmental checklist is to explain whether the standard covers relevant product environmental aspects and, if so, how they are dealt with in the standard.

By no means shall these environmental aspects interfere with the basic health and safety requirements in this standard. In any case the requirement of this standard prevails any environmental aspect that might be related to this product.

The following environmental aspects should be considered.

a) Materials should be selected to optimize product durability and lifetime and consideration should be made to avoiding the selection of rare or hazardous materials;

b) Consideration should be made to using recycled or reused materials, and to the selection of materials which can then be subsequently recycled;

c) The possibility of marking components to aid to their sorting for disposal/recycling at end of life should also be reviewed;

d) Packaging design should consider using recycled materials, and materials that need little energy for their manufacture, and should minimize waste;

e) Packaging design should consider subsequent reuse and recycling;

f) The size and weight of packaging should be minimized while protecting the products to minimize waste through damage. Packaging should be designed to optimize capacity of transportation vehicles while facilitating safe loading and unloading;

g) Test materials should be used and disposed of properly, according to the manufacturer's instructions and to the enforced law in respect of environmental protection;

h) Test facility, test equipment and tools s be designed to minimize the risk of leak into the environment;

i) Maximum use should be made of high efficiency motors, lighting and displays;

j) The design should facilitate the manufacturing of the product and packaging using tools which minimize the generation of noise and vibration;

k) In case of treatment with chlorine or bromine, the use of sodium thiosulfate, as specified in EN 16399, can be used to remove the excess chlorine to reduce the environmental impacts (where applicable).

Table C.1 — Environmental Checklist

Environmental Issue	Stages of the life cycle										All stages
	Acquisition		Production		Use			End-of-Life			
	Raw materials and energy	Pre-manufactured materials and components	Production	Packaging	Use	Maintenance and repair	Use of additional products	Reuse/ Material and Energy Recovery	Incineration without energy recovery	Final disposal	Transportation
Inputs											
Materials											
Water											
Energy											
Land											
Outputs											
Emissions to air											
Discharges to water											
Discharges to soil											
Waste											
Noise, vibration, radiation, heat											
Other relevant aspects											
Risk to the environment from accidents or unintended use											
Customer information											
Comments:											
NOTE 1 The stage of packaging refers to the primary packaging of the manufactured product. Secondary or tertiary packaging for transportation, occurring at some or all stages of the life cycle, is included in the stage of transportation. NOTE 2 Transportation can be dealt with as being a part of all stages (see checklist) or as separate sub-stage. To accommodate specific issues relating to product transportation and packaging, new columns can be included and/or comments can be added.											

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[1] 97/23/EC, *Pressure Equipment Directive*

[2] EN 15288 (all parts), *Swimming pools*

[3] EN 13451-3:2011+A2:2014, *Swimming pool equipment — Part 3: Additional specific safety requirements and test methods for inlets and outlets and water/air based water leisure features*

[4] EN 16399, *Chemicals used for treatment of swimming pool water — Sodium thiosulfate*

[5] EN 16582-2, *Domestic swimming pools — Part 2: Specific requirements including safety and test methods for inground pools*

[6] EN 16582-3, *Domestic swimming pools — Part 3: Specific requirements including safety and test methods for aboveground pools*

[7] EN 71-8, *Safety of toys — Part 8: Activity toys for domestic use*

[8] AC P90-321, *Private swimming pools for family use — General rules for dimensional and appearance tolerances on pools and swimming pool copings*

[9] AC P90-322, *Private swimming pools for family use — Earthworks*

[10] AC P90-324, *Private swimming pools for family use — Filtration unit*

[11] AC P90-325, *Private swimming pools for family use — Water network*

[12] AC P90-326, *Private swimming pools for family use — Pool fittings*

[13] EN 16713–1, *Domestic swimming pools — Water systems — Part 1: Filtration systems — Requirements and test methods*

[14] EN 16713–3, *Domestic swimming pools — Water systems — Part 3: Treatment — Requirements*

[15] NF R99-211, *Flexible cellular materials — Classification — Symbolization — Characteristics*

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