BRITISH STANDARD

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Influence of cementitious products on water intended for human consumption — Test methods —

Part 3: Migration of substances from factory-made cementitious products

The European Standard EN 14944-3:2007 has the status of a British Standard

ICS 13.060.20; 67.250; 91.100.10

National foreword

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Contents

Foreword

This document (EN 14944-3:2007) has been prepared by Technical Committee CEN/TC 164 “Water supply”, 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of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.

This European Standard is Part 3 of a series dealing with the influence of cementitious and associated non-cementitious products/materials on water intended for human consumption, including:

— Part 1 Influence of factory made cementitious products on organoleptic parameters;

— Part 2[1)] Influence of site-applied cementitious materials and associated non-cementitious products/materials on organoleptic parameters;

— Part 3 Migration of substances from factory made cementitious products;

— Part 4[2)] Migration of substances from site-applied cementitious materials and associated non-cementitious products/materials.

This European Standard will result in one of a series of standards that support appropriate standards.

It describes a test method to produce migration waters for the assessment of inorganic and organic substances.

Annex A, which is normative, describes additional procedures for testing factory made pipes (cement mortar lined and concrete).

Annex B, which is normative, describes additional procedures for testing factory made fittings (cement mortar lined and concrete).

Annex C, which is normative, describes additional procedures for testing factory made storage systems (cement mortar, cement mortar lined and concrete).

Annex D, which is informative, provides examples of typical test pieces and test conditions as a function of S/V ratio.

Annex E, which is informative, describes test arrangements for testing factory made cementitious products.

Annex F, which is normative, describes additional procedures for testing factory made cementitious products at elevated temperature.

Annex G, which is informative, provides a means of discriminating between porous and non-porous coatings on factory made products.

Annex H, which is informative, provides a schematic description of the test (preconditioning and migration) procedure.

Annex I, which is informative, gives recommendations for procedural tests using standard additions (positive controls).

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.

1) The work on Part 2 of EN 14944 has not yet begun.

2) The work on Part 4 of EN 14944 has not yet begun.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

With respect to any potential adverse effects of products and materials on the quality of water intended for human consumption, it should be understood that relevant national regulations remain in force until verifiable European acceptance criteria are adopted.

1 Scope

This European Standard specifies a method to determine the migration of substances from factory made cementitious products into test waters after contact with the products.

This European Standard is applicable to factory made cementitious products, e.g. cement mortar linings to metallic pipes, tanks, concrete pipes etc., intended to be used for the transport and storage of water intended for human consumption, including raw water used for the production of drinking water.

2 Normative references

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

EN 196-1, *Method of testing cement — Part 1: Determination of strength*

EN 1015-2, *Method of test for mortar for masonry — Part 2: Bulk sampling of mortars and preparation of test mortars*

EN 1015-11, *Methods of test for mortar for masonary - Part 11: Determination of flexural and compressive strength of hardened mortar*

EN 10088-1, *Stainless steels — List of stainless steels*

EN 12350-1, *Testing fresh concrete — Part 1: Sampling*

EN 12390-1, *Testing hardened concrete — Part 1: Shape, dimensions and other requirements for specimens and moulds*

EN 12390-2, *Testing hardened concrete — Part 2: Making and curing specimens for strength tests*

EN ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696:1987)*

EN ISO 7393-1, Water quality - Determination of free chlorine and total chlorine - Part 1: Titrimetric method using N, N-diethyl-1,4-phenylenediamine (ISO 7393-1:1985)

EN ISO 7393-2, *Water quality - Determination of free chlorine and total chlorine - Part 2: Colorimetric method using N, N-diethyl-1, 4-phenylenediamine, for routine control purposes (ISO 7393-2:1985)*

ISO 10523, *Water quality — Determination of pH*

3 Terms and Definitions

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

3.1
appropriate body
certification body, inspection body or test laboratory, as relevant to a particular requirement

3.2
cementitious product
factory made product containing a cementitious material supplied in the hardened state with a formed surface prior to its incorporation into the construction works

3.3
cementitious material
material that contains a hydraulic cement in sufficient proportion to act as the main binder by forming a hydrate structure that governs the performance of the material

3.4
associated non-cementitious product
product that is applied to the surface of a cementitious product, directly or indirectly, during manufacture (or construction) and that either provides a porous seal to the product or remains as a residue in contact with water
EXAMPLE Porous seal coats, formwork release agents and curing compounds.

3.5
porous seal coat
polymeric (usually organic) materials applied in a thin (25 μm to 200 μm thickness) surface layer to a cement mortar lining to restrict (but not prevent) interactions between the mortar and conveyed water (ISO 16132 [1])

3.6
proxy sample
sample of fresh mortar or fresh concrete taken from material to be used for the production of a factory made product; either spray-applied to a laboratory test plate (mortar only) or cast into a mould (mortar or concrete) of appropriate dimensions (e.g. standard cube, cylinder or prism etc.) and compacted (where appropriate), cured and hardened under conditions representative of those intended for the product

3.7
fresh concrete
concrete that is fully mixed and still in a condition capable of being compacted by the chosen method

EXAMPLE Examples of associated non-cementitious products are porous seal coats, release agents and curing compounds.

3.8
fresh mortar
cement mortar that is fully mixed and still in a condition to be applied to a substrate by the chosen method

EXAMPLE Examples of associated non-cementitious products are porous seal coats, release agents and curing compounds.

3.9
test
technical operation that consists of the determination of one or more characteristics of a given product

3.10
test procedure
specified technical method for performing a test

3.11
sample
one or more units, or a specified quantity, drawn from a batch or lot, selected at random for testing, e.g. at the factory or in a laboratory

3.12
test piece
sample or portion of a sample which is to be conditioned, treated or otherwise prepared to be tested to obtain a single test result

3.13
nominal diameter (DN/ID) or (DN/OD)
numerical designation of the size of a component, which is a whole number approximately equal to the actual dimensions in millimetres. This applies to either the internal diameter (DN/ID) or the external diameter (DN/OD)

3.14
preconditioning
succession of contact periods of a test piece with the preconditioning water (3.15) before contact with the test water

3.15
preconditioning water
water used for preconditioning prepared as described in 5.3.1

3.16
test water
water used for testing purposes prepared as described in 5.3.2 and used in accordance with 5.3.3 and 5.3.4

3.17
migration water
test water that has been in contact with a test piece under specified conditions

3.18
blank water
test water which has been kept at the same specified conditions as migration water but without contact with the test piece

3.19
disinfection treatment water
preconditioning water containing chlorine as described in 5.2.2

3.20
tap water
drinking water distributed by a public supplier

NOTE Tap water is used as a lubricant/coolant for the sawing and coring operations used to obtain test pieces generally from products of large dimensions. See normative Annex A, Annex B and Annex C.

3.21
demineralized water
water conforming to the requirements in EN ISO 3696 for Grade 3

4 Principle

Each test piece is subjected to a specified preconditioning procedure where the surface that is exposed in practice to water intended for human consumption, is brought into contact with preconditioning water during five sequential periods: three periods of 24 h, 1 period of 72 h and a final period of 24 h {with 50 mg/l Cl_2 (5.2.2) if requested to simulate chlorine disinfection treatment}.

The preconditioned test piece is then put in contact with test water, chlorinated and/or chlorine-free during three sequential migration periods. A migration period is either:

a) 72 h at (23 $\pm$ 2) °C for products intended to come into contact with chlorinated or chlorine-free cold water;

b) 24 h at a specified elevated temperature for products intended to come into contact with warm or hot chlorine-free water.

Migration rates are calculated after each contact period by determination of the content of specified substances in the corresponding migration water.

NOTE 1 The test is carried out under conditions that ensure that reliable migration rates are calculated. These conditions are not meant to simulate service conditions. Relating the results obtained from this European Standard to the service condition is carried out using a conversion procedure. This procedure will be specified in regulations.

NOTE 2 The selection of:
a) appropriate test water, chlorinated and/or chlorine-free, from those made available in this European Standard;
b) temperature of the test water;
c) need for chlorination during preconditioning;

is specified in product or system standards or in national or European regulations, as appropriate.

5 Reagents

5.1 General requirements

Use only reagents of analytical quality unless otherwise stated.

5.2 Disinfection reagents

5.2.1 Sodium hypochlorite solution, prepared from a technical or general purpose reagent grade of sodium hypochlorite (NaOCl), using test water (5.3.2) and having a known concentration of about 0,1 % by mass of free chlorine determined in accordance with either EN ISO 7393-1 or EN ISO 7393-2.

NOTE Unless tests have proved otherwise, the sodium hypochlorite solution should be considered unstable and be prepared on the day of use.

5.2.2 Disinfection treatment water, shall consist of a batch of preconditioning water (5.3.1) with a free chlorine content of (50 ± 5) mg/l as Cl_2, determined in accordance with either EN ISO 7393-1 or EN ISO 7393-2, after the addition of sodium hypochlorite solution (5.2.1).

5.3 Waters to be used for testing

5.3.1 Preconditioning water prepared by dissolving (222 ± 2) mg anhydrous calcium chloride ($CaCl_2$) and (336 ± 2) mg sodium hydrogen-carbonate ($NaHCO_3$) in one litre of demineralized water (3.21). The pH is determined in accordance with ISO 10523 and adjusted to 7,4 ± 0,1 by bubbling air and/or CO_2 into the solution.

NOTE The target total hardness is 200 mg/l as $CaCO_3$ and the target alkalinity is 244 mg/l as HCO_3^-.

5.3.2 Test water, prepared by dissolving (110 ± 1) mg anhydrous calcium chloride ($CaCl_2$), (140 ± 1) mg sodium hydrogen carbonate ($NaHCO_3$) and (48 ± 1) mg sodium silicate ($Na_2SiO_3.9H_2O$) in one litre of demineralized water.

The pH is determined in accordance with ISO 10523 and adjusted to 7,0 ± 0,1 by bubbling air and/or CO_2 into the solution.

NOTE The target total hardness is 100 mg/l as $CaCO_3$, the target alkalinity is 122 mg/l as HCO_3^- and the silica concentration is 10 mg/l as SiO_2.

5.3.3 Test water without chlorine content (chlorine-free), shall consist of a batch of test water (5.3.2) used for contact with test pieces and preparation of the blank water (3.18).

5.3.4 Test water with chlorine content (chlorinated), shall consist of test water (5.3.2) with a free chlorine content of (1,0 ± 0,2) mg/l as Cl_2, determined in accordance with either EN ISO 7393-1 or EN ISO 7393-2, after addition of sodium hypochlorite solution (5.2.1).

5.4 Cleaning liquids for apparatus

Use one of the following cleaning liquids:

— non-perfumed biodegradable detergent;

— hydrochloric acid, 2 mol/l;

— nitric acid, 10 % or 1,5 mol/l.

6 Apparatus

6.1 General

For cleaning the glassware, and appropriate apparatus, before use, the following general requirements apply:

a) Clean the glassware to be used, using detergent (5.4). Rinse the glassware in demineralized water.

b) Clean the inner surface of the glassware with hydrochloric acid (5.4) and rinse it with demineralized water. For stainless steel, clean with nitric acid (5.4) and then rinse with demineralized water.

c) Before use, rinse the glassware, and appropriate apparatus, at least three times using preconditioning water before preconditioning (8.3) or test water before the test procedure (clause 9).

6.2 Apparatus and materials for test piece preparation (see normative Annex A, B and C)

6.2.1 Stainless steel plates and cylinders

6.2.1.1 Stainless steel

Stainless steel shall be austenitic, super austenitic or duplex grades in accordance with the corresponding numerical designations, 1.4301, 1.4436, 1.4429, 1.4259 or 1.4462 in EN 10088-1 for stainless steels.

NOTE The grades above are specified for the use of stainless steel as reinforcement in concrete. Therefore they are considered to be inert when used in contact with cementitious proxy samples (see normative Annex A, Annex B and Annex C of this European Standard).

6.2.1.2 Plates

To provide a sufficient volume of migration water for assessment, the surface area of one face of a plate should be between 10 000 mm^2 and 90 000 mm^2. The length/width of the plates should be selected to be consistent with the dimensions of the test container and the volume of test water in which they will be immersed.

6.2.1.3 Cylinders

The diameter and length of a cylinder should be consistent with the dimensions of the test piece (see normative Annex A, Annex B or Annex C and informative Annex D and Annex E) and the volume of test water appropriate to the specified S/V ratio given in 7.3.

6.2.2 Glass cylinders

The diameter and length of a glass cylinder should be consistent with the dimensions of the test piece (see normative Annex A, Annex B or Annex C and informative Annex D and Annex E) and the volume of test water appropriate to the specified S/V ratio given in 7.3. Glass cylinders should be provided with suitable external (opaque) shielding for use during migration procedures (test pieces and blanks), in order to minimize exposure of migration waters to ambient light.

6.2.3 Moulds for forming test pieces

Moulds for forming prisms of mortar shall conform to the requirements of EN 196-1, as specified for use in EN 1015-11, or to EN 12390-1 for forming cubes/cylinders of concrete, with modifications to materials and dimensional tolerances as specified by the appropriate normative Annex A, Annex B or Annex C of this European Standard.

Clean moulds and any filling frame used with a mould, by thoroughly washing with non-perfumed detergent (5.4) and tap water (3.20), rinsing with copious amounts of tap water, followed by a final rinse with demineralized water (3.21) and dry before use.

Where a factory made cementitious product has been formed in a process where its entire contact surface has been in contact with a release agent then where proxy samples (3.6) are used, the same release agent shall be applied to the internal surfaces of the mould, otherwise use of release agents is not permitted by this European Standard.

6.3 Apparatus and materials for preconditioning and migration procedure

6.3.1 Vessels, containers, stoppers and connectors shall consist of a material, such as glass, PTFE or stainless steel that is inert under the specified test conditions (clause 9).

NOTE The material PTFE should only be used when there is a small contact area with the test water. Thus PTFE is unsuitable for containers.

6.3.2 Equipment, capable of maintaining the test temperature within ± 2 °C for the duration of the test.

6.3.3 Where required, use only sealants that do not affect the determinations under the specified test conditions (see clause 9).

7 Samples and test pieces

7.1 Sampling, transport and storage of samples

Carry out sampling of factory made products in accordance with the relevant product standard, system standard or the national or European regulations, or the relevant normative annex to this European Standard, as appropriate.

Take care that the transport conditions do not influence the test results.

If it is necessary to store samples or test pieces before testing, ensure that they are protected from contamination taking into account any written instructions that are provided.

When appropriate, clean storage containers using the same procedures as are used for the test containers.

Ensure that the surfaces of the test pieces intended to come in contact with the test water are free from any contamination e.g. adhesive tape, labels, ink or pencil marks.

7.2 Preparation of test pieces

7.2.1 General

Prepare the test pieces in such a way that only the surface intended to come into contact with drinking water is exposed to the test water except as given in normative Annex C (see C.1.2.3.2.1) where stainless steel plates are coated with cement mortar on one face only prior to complete immersion during testing.

In the preparation of a test piece the following general principles apply:

a) ensure that test pieces are representative of the finished product;

b) during the preparation of test pieces, include any procedures that are performed in practice for curing and cleaning;

c) ensure that the minimum age of the test piece, at test, conforms to that recommended by the manufacturer for the product to be ready for use;

d) ensure that the surface area of the test piece is sufficient to fulfil the appropriate surface area to volume (S/V) ratio in accordance with the requirements of 7.3.

7.2.2 Factory made pipes, fittings and storage systems

Where possible, use the sample or test piece as the test vessel, with dimensions that provide sufficient migration water for assessment. In cases where this is not practicable (e.g. large pipes, storage systems etc.), and where alternatives are specified, use as appropriate, an alternative test piece described in the relevant normative Annex A, Annex B or Annex C of this European Standard and an appropriate test arrangement given in informative Annex E.

NOTE Where it is required to discriminate between porous and non-porous coatings already applied to factory made products, use the test procedure given in informative Annex G of this European Standard.

7.3 Surface area-to-volume ratio (S/V) for use in the test procedure

7.3.1 General

The following general principles apply for S/V ratios:

a) surface area to volume ratio (S/V) of the test piece exposed to the test water shall not be smaller than the S/V ratio of the product in the service condition;

b) where no difference in material composition and production process exists in the range of sizes produced, only the largest S/V ratio is required to be tested;

c) ratio of the surface area, *S*, of the test piece intended to come into contact with volume, *V*, of the test water is expressed per decimetre, i.e. dm^{-1}.

NOTE The unit, dm^{-1}, can also be expressed as dm^2/dm^3 or dm^2/l.

7.3.2 Pipes and fittings

The S/V ratio is calculated, in dm^{-1}, according to the formula:

$$S/V = \frac{400}{[DN/ID]} \quad (1)$$

where

[DN/ID] (3.8) is the nominal internal diameter, in mm.

Test pipes and fittings of DN/ID less than 80, at the actual S/V ratio of the pipe diameter.

Test pipes and fittings of DN/ID equal to 80 and less than 300, at an S/V ratio of (5,0 ± 0,2) dm^{-1}.

Test pipes and fittings of DN/ID 300 or greater, at an S/V ratio of (1,3 ± 0,1) dm^{-1}.

NOTE But see 7.3.1 (b) for the acceptable minimum requirement for testing pipes that are produced in a range of sizes.

7.3.3 Storage systems (cement mortar, cement mortar lined or concrete)

Test storage systems at an S/V ratio of (1,3 ± 0,1) dm^{-1}.

8 Pre-treatment of samples (curing, preconditioning and disinfection)

8.1 General

The procedures for curing cementitious products are given in 8.2.

The procedures for preconditioning and disinfection at (23 ± 2) °C are given in 8.3.

8.2 Curing

Ensure that test pieces have been subject either to the curing conditions used in manufacture of the factory made product or, in the case of test pieces formed from proxy samples (3.6), to curing conditions that are representative of those used in the manufacture of the factory made product (see the relevant normative Annex A, Annex B or Annex C of this European Standard).

8.3 Preconditioning

8.3.1 General

Precondition test pieces at the appropriate S/V ratio given in 7.3.

If disinfection treatment is required, carry out preconditioning in accordance with 8.3.3. If it is not required, follow the procedure in 8.3.2.

8.3.2 Preconditioning without disinfection treatment

Fill test pieces with, or immerse them in, or otherwise bring them into contact with (see the test arrangements in informative Annex E), preconditioning water (5.3.1) for a succession of five contact periods, without rinsing between contact periods, at a temperature of (23 ± 2)°C as follows:

— three periods of (24 ± 1) h;

— one period of (72 ± 1) h;

— one period of (24 ± 1) h.

After the fifth contact period, determine the pH of the preconditioning water in accordance with ISO 10523. If the pH exceeds 9,5 stop the testing.

NOTE 1 Where the pH exceeds 9,5 preconditioning may be repeated using new test pieces.

NOTE 2 The results of co-normative research [2] obtained using this preconditioning water indicate that where the pH exceeds 9,5 after the fifth contact period, steps should be taken to first investigate and then eliminate the cause(s) before proceeding to the test procedure (see clause 9).

8.3.3 Preconditioning with disinfection treatment

Carry out preconditioning as described in 8.3.2 but for the final 24 h contact period replace the preconditioning water by the disinfection treatment water (5.2.2).

After contact with the disinfection treatment water determine the pH in accordance with ISO 10523. If the pH exceeds 9,5 stop the testing.

If the pH is less than or equal to 9,5 rinse the test piece by filling it or immersing it in fresh preconditioning water (5.3.1) at room temperature in order to remove excess free chlorine. Carry out this rinsing operation, at least five times, continuing until the level of free chlorine detected in the rinse water reaches a constant value. The total duration of rinsing shall not exceed 1 h.

NOTE 1 See NOTE 1 in 8.3.2.

NOTE 2 See NOTE 2 in 8.3.2.

9 Test procedure

9.1 General

Where testing of products intended to come into contact with chlorinated or chlorine-free cold water is required, carry out the following procedures described in 9.2.

Where testing at elevated temperature is required carry out the procedure in accordance with normative Annex F.

9.2 Preparation of migration water for analysis of substances

NOTE The number of tests to be carried out e.g. single tests or duplicates for each water type is specified in product or system standards or in national or European regulations, as appropriate.

9.2.1 Migration procedure

Begin the first contact period immediately after preconditioning the test piece.

In all cases, (immersion, filling or other contact arrangement), ensure that the test piece or vessel/container is completely immersed or filled. Minimize headspace in order to minimize contact between the test water and air. Use a lid or cover for the vessel/container. At the end of this period, collect the migration water for analysis of migrated substances using appropriate sampling bottles.

NOTE The choice of the type of test water (chlorinated and/or chlorine-free) is specified by the product standard or system standards or in national or European regulations, as appropriate.

9.2.2 Second and third migration periods

Repeat 9.2.1 two more times using fresh test water each time, ensuring that the test pieces are put into contact with the same type of test water (e.g. chlorine-free) for the three successive periods.

9.2.3 Additional migration periods

Referring standards and/or national or European regulations may specify further sequential migration periods. Refer to Annex H for further guidance on the sequence and number of migration periods that can be specified.

9.3 Control samples (blank test)

For each contact period, carry out a blank test procedure using the same test conditions (test water, test temperature, contact periods, sealants used etc.) as described in 9.2 but omitting the test piece or replacing it by a glass container or plate, as appropriate.

Antimony can be present in cementitious products but can also migrate from glass at elevated pH. When antimony is detected in migration water in contact with the test piece but not in blank water which has a lower pH, adjust the blank to the final pH measured in the migration water and repeat the blank test in order to achieve a valid blank control.

10 Analysis

Carry out the required analysis on the migration waters using the analytical methods specified in referring documents. Determine at the end of each extraction period the concentration of the substance being measured. General guidance on analytical performance requirements such as detection limit and accuracy is contained in Guide to analytical Quality Control for water analysis, ENV ISO 13530 [3].

NOTE 1 If migration waters are not analyzed immediately, then ensure that the storage time and conditions do not adversely affect the analytical result.

NOTE 2 For some analytical methods and/or specific test procedures, recovery rates for the substances being determined need to be established using positive controls. Annex I gives further guidance.

11 Calculation of test results

11.1 Calculation of the concentration of the substances in the migration water

NOTE The migration of substances into water depends on the type of material and the migration conditions: temperature, contact time, S/V ratio and whether the water is static or flowing. For static test conditions and constant temperature, the increase in the concentration of the substance in the test water is asymptotic. However, for practical purposes the increase with time is assumed to be linear.

Calculate for each migration water the concentration of the measured substance as follows:

$$c_n^T = a_n^T - b_n^T \qquad (2)$$

where

c^T_n is the concentration of the measured substance in mg/l;

a^T_n is the concentration of the substance in mg/l measured in the migration water;

b^T_n is the concentration of the substance in mg/l measured in the blank water.

For the conditions

T is the test temperature;

n is the sequence number of the migration period.

11.2 Calculation of the migration rate of the measured substances

Calculate for each migration water the migration rate M^T_n for a migrated substance from the concentration c^T_n as follows:

$$M_n^T = \frac{c_n^T}{(S/V \,.\, t)} \qquad (3)$$

where

M^T_n is the migration rate for the n'th migration period in $mg.dm^{-2}.day^{-1}$;

t is the duration of the migration period in days i.e. three days (72 ± 1) h for (23 ± 2) °C;

S/V is the surface area-to-volume ratio in dm^{-1}.

11.3 Calculation of the mean migration rate

Calculate the arithmetic mean migration rate $\overline{M^T_n}$ for replicate values of M^T_n for each test water (5.3.3 and 5.3.4).

12 Test report

12.1 General information

The test report shall include the following information:

a) date of issue;

b) name and address of testing laboratory and location where the test was carried out when different from the address of the testing laboratory;

c) unique identification of report (such as serial number) and of each page, and total number of pages;

d) name and address of client;

e) description and identification of the sample/test piece;

f) signature and title or equivalent marking of person(s) accepting technical responsibility for the test report and date of issue;

g) statement to the effect that the test results relate only to the test piece(s) tested;

h) statement that the report shall not be reproduced except in full without the written approval of the testing laboratory.

12.2 Information on the product

The test report shall include the following information:

a) trade name or designation of the factory made/manufactured product;

b) complete identification and date of receipt of sample/test piece;

c) details of the test piece preparation;

d) name of the manufacturer for the product, the place of manufacture and date and, where relevant, the body submitting the sample and, where relevant, the body responsible for preparing the samples/test pieces;

e) description of sampling procedure, where relevant.

12.3 Information on the test procedure

The test report shall include the following information:

a) reference to this European Standard and to the referring product or system standard or national or European regulation as appropriate;

b) dates of start and completion of the test;

c) number of test pieces used together in the migration procedure;

d) volume of the test water (*V*) in litres;

e) surface area of test piece exposed to the test water, *S*, in square decimetres calculated from the actual dimensions of the test pieces;

f) actual S/V ratio used in the procedure;

g) disinfection procedure (if applicable);

h) test waters and test temperature;

i) any deviation from the test procedure specified in this standard;

j) any factors which may have affected the results, such as any incidents or any operating details not specified in this European Standard.

12.4 Test results

The test report shall include the following information:

a) number of tests carried out;

b) test results and calculated values reported in tabular form (see example below);

c) European Standard for the analytical method used to produce the test results;

d) general performance of the analytical method in the European Standard e.g. limit of detection, precision estimates, statement of uncertainty etc.

Table 1- Example of Test Result presentation

		Sequence number of migration period (n)			
		1	2	3	X[1)]
a^T_n	1				
	2[2)]				
b^T_n					
c^T_n	1				
	2[2)]				
M^T_n	1				
	2[2)]				
$\overline{M^T_n}$					

[1)] Additional migration periods where specified.

[2)] Duplicates where specified.

Annex A
(normative)

Additional procedures for testing factory made pipes (cement mortar lined and concrete)

A.1 Sampling, test piece preparation and storage

A.1.1 Sampling

See also 7.1 and 7.2.

Sample factory made cement mortar lined pipes and concrete pipes at the point of release of the factory as finished products, for preparation as test pieces.

Where specified, pipes may be sampled indirectly as proxy samples (**3.6**) of the fresh mortar or concrete used in their manufacture, for preparation as test pieces.

A.1.2 Test piece preparation and storage

A.1.2.1 General

Test pieces prepared from factory made cement mortar lined pipes or concrete pipes shall:

a) be one of the following:

1) complete pipes;

2) cylindrical sections of pipe sawn from complete pipes using tap-water-cooled/lubricated (3.20) sawing procedures;

3) blocks or cores sawn or cored from complete pipes using tap-water-cooled/lubricated (3.20) sawing or coring procedures;

4) proxy test pieces, where specified, prepared by the manufacturer from samples of fresh mortar or concrete (3.6) used in the manufacture of pipes, in accordance with either A.1.2.3 for mortar or A.1.2.4 for concrete, in order to provide hardened surfaces representative of the contact surface of the finished product;

b) be of sufficient surface area to fulfil the appropriate surface area to volume (S/V) ratio for the migration procedure, in accordance with the requirements of 7.3;

c) be of suitable general dimensions (see informative Annex D) e.g. length, surface area, diameter etc. to provide sufficient migration water for assessment;

d) have their surface area to volume (S/V) ratios (as required in the migration procedure; see 7.3), calculated using their nominal internal diameters (DN/ID) where cylindrical in section;

e) be suitably documented and identified and be free from any surface contamination e.g. adhesive tape, labels, ink or pencil marks;

f) be protected from contamination and mechanical damage in the factory using unused food grade packaging materials when it is necessary to store them prior to dispatch to the test laboratory;

g) be subject to comparable conditions for storage in the test laboratory as for storage in the factory;

h) be taken at the point of release, or in the case of proxy samples (3.6), be of a minimum age recommended by the manufacturer for the product to be ready for use, before any testing shall begin.

A.1.2.2 Pipes sampled as finished products

See A.1.2.1 a) for test piece preparation.

Figure E.1 and Figure E. 2 in informative Annex E give examples of suitable test arrangements for use in the migration procedure. Examples of dimensions for S/V ratios of 1,3 dm^{-1} and 5,0 dm^{-1} are given in Annex D, Table D.1.

A.1.2.3 Pipes sampled as fresh mortar

A.1.2.3.1 General

Test pieces shall be prepared from proxy samples of the fresh mortar (3.8) used to line factory made pipes and be either spray-applied to stainless steel plates in accordance with A.1.2.3.2.1 or be cast as prisms in accordance with A.1.2.3.2.2.

Hardened test pieces shall be monolithic, undamaged and representative in structure, composition and homogeneity of the fresh mortar from which they were prepared.

Test arrangements, for using the test pieces in the migration procedure, shall be as given in A.1.2.3.2.3.

A.1.2.3.2 Test pieces (fresh mortar)

A.1.2.3.2.1 Coated plates

Where test plates are specified, they shall be made by coating one face of a stainless steel plate (6.2.1.1) with the fresh mortar used in the manufacture of the pipe using the same process of application used in the factory. In addition:

a) coated plate shall not be marked for identification purposes but shall be identified in an alternative traceable manner e.g. by mechanical marking on the rear of the test plate;

b) coated plate shall be placed in the vicinity of the pipe that it represents and shall undergo the same curing regime as that applied to the pipe;

c) after curing, the undamaged coated plate shall be stored under the same environmental conditions that apply to the finished pipe during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the pipe;

d) following the curing/storage period, the coated plate shall be placed in an unused food grade plastics bag and sealed. A damaged plate shall be discarded.

A.1.2.3.2.2 Prisms

a) Where test prisms are specified, they shall be prepared from the fresh mortar used in the manufacture of the pipe, sampled in accordance with EN 1015-2, and formed as prisms of dimensions 1,6 dm x 0,4 dm x 0,4 dm, in accordance with EN 196-1, as specified in EN 1015-11, with the following modifications:

1) tolerances given in EN 1015-11 for shape and dimensions are for guidance only;

2) joints of moulds shall not be coated with any wax, oil or grease to achieve water tightness;

3) where the factory made cementitious product has been formed in a process where its entire contact surface has been in contact with a release agent, the same release agent shall be applied to the internal surfaces of the mould, otherwise use of release agents is not permitted by this European Standard.

NOTE Where release agents are not permitted, moulds of steel or cast iron may not be suitable for forming test pieces for use in the migration procedure.

b) Prisms shall be made and cured in accordance with EN 1015-11 with the following modifications:

1) irrespective of the type of material from which a mould is made, the mould, together with any filling frame, shall be thoroughly washed with non-perfumed detergent (5.4) and water, rinsed with copious amounts of tap water, given a final rinse with demineralized water (3.21) and then dried before use;

2) prism shall not be marked for identification purposes but shall be identified in an alternative traceable manner;

3) moulds shall be covered and be placed in the vicinity of the pipe that it represents and the prism shall undergo the same curing regime as that applied to the pipe. Covers to moulds shall be made of an impermeable material that does not react with cement;

4) on removal from the mould after curing, the undamaged prism shall be stored under the same environmental conditions that apply to the finished pipe during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the pipe;

5) following the curing/storage period, the prism shall be placed in an unused food grade plastics bag and sealed. A damaged prism shall be discarded.

A.1.2.3.2.3 Test arrangements (fresh mortar)

The test arrangements for test pieces prepared from the fresh mortar used to line pipes should be either:

a) as given in Figure E.6 in informative Annex E, for test plates, or;

b) as given in Figure E.7 in informative Annex E, for test prisms.

In Figure E.7, the test vessel and mesh support shall be made of inert material that does not affect the analytical results. The test vessel shall have a cover in order to minimise contact with the air. The mesh support shall allow direct contact with test water on all sides of a test piece but shall not significantly affect the surface area of a test piece exposed to the test water.

A.1.2.4 Pipes sampled as fresh concrete

A.1.2.4.1 General

Where required, test pieces shall be prepared from samples of the fresh concrete (**3.7**) used to make pipes and be cast, compacted and cured in accordance with A.1.2.4.2.

Hardened test pieces shall be monolithic, undamaged and representative in structure, composition and homogeneity of the fresh concrete from which they were prepared.

Test arrangements, for using the test pieces in the migration procedure, shall be as given in A.1.2.4.3.

A.1.2.4.2 Test pieces (fresh concrete)

a) Test pieces shall be prepared from the fresh concrete used to manufacture the pipe, sampled in accordance with EN 12350-1, and formed as either cubes or cylinders, in accordance with EN 12390-1 for shape and dimensions, with the following modifications:

1) tolerances given in EN 12390-1 for shape and dimensions are for guidance only;

2) joints of moulds shall not be coated with any wax, oil or grease to achieve water tightness;

3) where the factory made cementitious product has been formed in a process where its entire contact surface has been in contact with a release agent, the same release agent shall be applied to the internal surfaces of the mould, otherwise the use of release agents is not permitted by this European Standard.

NOTE Where release agents are not permitted, moulds of steel or cast iron may not be suitable for forming test pieces for use in the migration procedure.

b) Cubes or cylinders shall be made and cured in accordance with EN 12390-2, with the following modifications:

1) irrespective of the type of material from which a mould is made, the mould, together with any filling frame, shall be thoroughly washed with non-perfumed detergent (5.4) and water, rinsed with copious amounts of tap water, given a final rinse with demineralized water (3.21) and then dried before use;

2) cube or cylinder shall not be marked for identification purposes but shall be identified in an alternative traceable manner;

3) moulds shall be covered and be placed in the vicinity of the pipe that it represents and shall undergo the same curing regime as that applied to the pipe. Covers to moulds shall be made of an impermeable material that does not react with cement;

4) upon removal from the mould after curing, the undamaged cube or cylinder shall be stored under the same environmental conditions that apply to the finished pipe during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the pipe;

5) following the curing/storage period, the cube or cylinder shall be placed in an unused food grade plastics bag and sealed. A damaged cube or cylinder shall be discarded.

A.1.2.4.3 Test arrangements - Cubes/cylinders

A.1.2.4.3.1 Testing one face only

The test arrangement should be as given in Figure E.5 in informative Annex E, where a cylindrical test container of stainless steel (6.2.1.2) or glass (6.2.2) is attached and sealed with sealing compound (6.3.3) to a cast surface of the cube or cylinder.

A.1.2.4.3.2 Testing fully immersed

The test arrangement should be as given in Figure E.7 in informative Annex E where the cube (or cylinder) is tested fully immersed in test water during the migration procedure.

In Figure E.7 the test vessel and mesh support shall be made of inert material that does not affect the analytical results. The test vessel shall be provided with a cover in order to minimise contact with the air. The mesh support shall allow direct contact with test water on all sides of a test piece but shall not significantly affect the surface area of a test piece exposed to the test water.

A.2 Surface area to volume (S/V) ratio

The S/V ratio for pipes to be used in the migration procedure shall be as given in 7.3.2.

NOTE See 7.3.1 (b) for a testing policy option where pipes of nominally identical composition and production process are produced in a range of sizes.

A.3 Pretreatment of test pieces (preconditioning and disinfection)

Preconditioning and any disinfection pretreatment shall be carried out in accordance with either 8.3.2 or 8.3.3, as appropriate.

A.4 Test procedure

A.4.1 Migration procedure at 23 °C

Where testing of factory made pipes at 23 °C is required, the migration procedure shall be carried out in accordance with clause 9.

NOTE Where specified, hardened test pieces made from fresh mortar or concrete, used in the manufacture of pipes may represent the finished product in the migration procedure, see A.1.2.3 and A.1.2.4.

A.4.2 Migration procedure at elevated temperature

Where testing of factory made pipes at elevated temperature is required, the test pieces and test arrangements to be used in the migration procedure are as given in this annex and the migration procedure is as given in normative Annex F.

NOTE See note to A.4.1.

A.5 Expression of results

Express results in accordance with clause 11.

A.6 Reporting

Report results in accordance with clause 12.

Annex B
(normative)

Additional procedures for testing factory made fittings (cement mortar lined and concrete)

B.1 Sampling, test piece preparation and storage

B.1.1 Sampling of Factory made fittings

See also 7.1 and 7.2.

Sample factory made cement mortar lined fittings and concrete fittings at the point of release of the factory as finished products, for preparation as test pieces.

Alternatively, fittings may be produced in the factory in the form of equivalent-pipes (see B.1.2.2.1 for cement mortar and B.1.2.2.2 for concrete) under the same manufacturing conditions, composition and nominal diameter as the fitting and be sampled at the point of release of the factory, in place of a finished fitting, for preparation as test pieces.

Where specified, fittings may be sampled indirectly as proxy samples (3.6) of the fresh mortar or concrete used in their manufacture, for preparation as test pieces.

B.1.2 Test piece preparation and storage

B.1.2.1 General

Test pieces prepared from factory made cement mortar lined fittings or concrete fittings shall:

a) be either of the following:

1) blocks or cores sawn or cored from complete fittings (generally of large diameter) using tap-water-cooled/lubricated (3.20) sawing or coring procedures;

2) complete equivalent-pipes prepared by the manufacturer in accordance with B.1.2.2.1 in the case of mortar lined fittings or B.1.2.2.2 for concrete fittings;

3) cylindrical sections of equivalent-pipe sawn using tap-water-cooled/lubricated (3.20) sawing procedures;

4) proxy test pieces, where specified, prepared by the manufacturer from samples of fresh mortar or concrete (3.6) used in the manufacture of fittings, in accordance with either B.1.2.4 in the case of mortar or B.1.2.5 for concrete, to provide hardened surfaces representative of the contact surface of the finished product;

b) be of sufficient surface area to fulfil the appropriate surface area to volume (S/V) ratio for the migration procedure, in accordance with the requirements of 7.3;

c) be of suitable general dimensions (see informative Annex D) e.g. length, surface area, diameter etc. to provide sufficient migration water for assessment;

d) have their surface area to volume (S/V) ratios (as required in the migration procedure; see 7.3), calculated using their nominal internal diameters (DN/ID) where cylindrical in section;

e) be suitably documented and identified and be free from any surface contamination e.g. adhesive tape, labels, ink or pencil marks;

f) be protected from contamination and mechanical damage in the factory using unused food grade packaging materials when it is necessary to store them prior to dispatch to the test laboratory;

g) be subject to comparable conditions for storage in the test laboratory as for storage in the factory;

h) be taken at the point of release, or in the case of proxy samples, be of a minimum age recommended by the manufacturer for the product to be ready for use, before any testing shall begin.

B.1.2.2 Production of equivalent-pipes

B.1.2.2.1 Cement mortar lined

Factory produced batches of fresh cement mortar (3.8) for manufacturing cement mortar lined ferrous metal fittings, shall be applied to the internal surface of a straight length of ferrous metal pipe of appropriate internal diameter in order to produce an equivalent-pipe of nominal internal diameter (DN/ID) equal to that intended for the finished cement mortar lined fitting.

B.1.2.2.2 Concrete

Factory produced batches of fresh concrete (3.7) for manufacturing concrete fittings, shall be formed (e.g. spun, sprayed, vibro-cast etc.) into a concrete pipe of suitable length in order to produce an equivalent-pipe of nominal internal diameter (DN/ID) equal to that of the finished concrete fitting.

B.1.2.3 Equivalent pipes sampled as finished products

See B.1.2.1 a) for test piece preparation.

Figure E.1 and Figure E.2 in informative Annex E give examples of suitable test arrangements for use in the migration procedure. Examples of dimensions for S/V ratios of 1,3 dm^{-1} and 5,0 dm^{-1} are given in Annex D, Table D.1.

B.1.2.4 Fittings sampled as fresh mortar

B.1.2.4.1 General

Test pieces shall be prepared from samples of the fresh mortar (3.8) used to line factory made fittings and be either spray-applied to stainless steel plates in accordance with B.1.2.4.2.1 or be cast as prisms in accordance with B.1.2.4.2.2.

Hardened test pieces shall be monolithic, undamaged and representative in structure, composition and homogeneity of the fresh mortar from which they were prepared.

Test arrangements, for using the test pieces in the migration procedure, shall be as given in B.1.2.4.2.3.

B.1.2.4.2 Test pieces (fresh mortar)

B.1.2.4.2.1 Coated plates

Where test plates are specified, they shall be made by coating one face of a stainless steel plate (6.2.1.1) with the fresh mortar used in the manufacture of the fitting using the same process of application used in the factory. In addition:

a) coated plate shall not be marked for identification purposes but shall be identified in an alternative traceable manner e.g. by mechanical marking on the rear of the test plate;

b) coated plate shall be placed in the vicinity of the fitting that it represents and shall undergo the same curing regime as that applied to the fitting;

c) after curing, the undamaged coated plate shall be stored under the same environmental conditions that apply to the finished fitting during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the fitting;

d) following the curing/storage period, the coated plate shall be placed in an unused food grade plastics bag and sealed. A damaged plate shall be discarded.

B.1.2.4.2.2 Prisms

a) Where test prisms are specified, they shall be prepared from the fresh mortar used in the manufacture of the fitting, sampled in accordance with EN 1015-2, and formed as prisms of dimensions 1,6 dm x 0,4 dm x 0,4 dm, in accordance with EN 196-1, as specified in EN 1015-11, with the following modifications:

1) tolerances given in EN 1015-11 for shape and dimensions are for guidance only;

2) joints of moulds shall not be coated with any wax, oil or grease to achieve water tightness;

3) where the factory made cementitious product has been formed in a process where its entire contact surface has been in contact with a release agent, the same release agent shall be applied to the internal surfaces of the mould, otherwise the use of release agents is not permitted by this European Standard.

NOTE Where release agents are not permitted, moulds of steel or cast iron may not be suitable for forming test pieces for use in the migration procedure.

b) Prisms shall be made and cured in accordance with EN 1015-11 with the following modifications:

1) irrespective of the type of material from which a mould is made, the mould, together with any filling frame, shall be thoroughly washed with non-perfumed detergent (5.4) and water, rinsed with copious amounts of tap water, given a final rinse with demineralized water (3.21) and then dried before use;

2) prism shall not be marked for identification purposes but shall be identified in an alternative traceable manner;

3) mould shall be covered and be placed in the vicinity of the fitting that it represents and the prism shall undergo the same curing regime as that applied to the fitting. Covers to moulds shall be made of an impermeable material that does not react with cement;

4) on removal from the mould after curing, the undamaged prism shall be stored under the same environmental conditions that apply to the finished fitting during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the fitting;

5) following the curing/storage period, the prism shall be placed in an unused food grade plastics bag and sealed. A damaged prism shall be discarded.

B.1.2.4.2.3 Test arrangements (fresh mortar)

Test arrangements for test pieces prepared from the fresh mortar used to line fittings should be either:

a) as given in Figure E.6 in informative Annex E, for test plates, or;

b) as given in Figure E.7 in informative Annex E, for test prisms.

In Figure E.7, the test vessel and mesh support shall be made of inert material that does not affect the analytical results. The test vessel shall be provided with a cover in order to minimise contact with the air. The mesh support shall allow direct contact with test water on all sides of a test piece but shall not significantly affect the surface area of a test piece exposed to the test water.

B.1.2.5 Fittings sampled as fresh concrete

B.1.2.5.1 General

Where required, test pieces shall be prepared from samples of the fresh concrete (3.7) used to make fittings and be cast, compacted and cured in accordance with B.1.2.5.2.

Hardened test pieces shall be monolithic, undamaged and representative in structure, composition and homogeneity of the fresh concrete from which they were prepared.

Test arrangements, for using the test pieces in the migration procedure, shall be as given in B.1.2.5.3.

B.1.2.5.2 Test pieces (fresh concrete)

a) Test pieces shall be prepared from the fresh concrete (3.7) used to manufacture the fitting, sampled in accordance with EN 12350-1, and formed as either cubes or cylinders, in accordance with EN 12390-1 for shape and dimensions, with the following modifications:

1) tolerances given in EN 12390-1 for shape and dimensions are for guidance only;

2) joints of moulds shall not be coated with any wax, oil or grease to achieve water tightness;

3) where the factory made cementitious product has been formed in a process where its entire contact surface has been in contact with a release agent, the same release agent shall be applied to the internal surfaces of the mould, otherwise the use of release agents is not permitted by this European Standard.

NOTE Where release agents are not permitted, moulds of steel or cast iron may not be suitable for forming test pieces for use in the migration procedure.

b) Cubes or cylinders shall be made and cured in accordance with EN 12390-2, with the following modifications:

1) irrespective of the type of material from which a mould is made, the mould, together with any filling frame, shall be thoroughly washed with non-perfumed detergent (5.4) and water, rinsed with copious amounts of tap water, given a final rinse with demineralized water (3.21) and then dried before use;

2) cube or cylinder shall not be marked for identification purposes but shall be identified in an alternative traceable manner;

3) moulds shall be covered and be placed in the vicinity of the fitting that it represents and shall undergo the same curing regime as that applied to the concrete fitting. Covers to moulds shall be made of an impermeable material that does not react with cement;

4) on removal from the mould after curing, the undamaged cube or cylinder shall be stored under the same environmental conditions that apply to the finished concrete fitting during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the fitting;

5) following the curing/storage period, cube or cylinder shall be placed in an unused food grade plastics bag and sealed.

B.1.2.5.3 Test arrangements (cubes/cylinders)

B.1.2.5.3.1 Testing one face only

The test arrangement should be as given in Figure E.5 in informative Annex E where a cylindrical test container of stainless steel (6.2.1.2) or glass (6.2.2) is attached and sealed with sealing compound (6.3.3) to a cast surface of the cube or cylinder.

B.1.2.5.3.2 Testing fully immersed

The test arrangement should be as given in Figure E.7 in informative Annex E where the cube (or cylinder) is tested fully immersed in test water during the migration procedure.

In Figure E.7, the test vessel and mesh support shall be made of inert material that does not affect the analytical results. The test vessel shall be provided with a cover to minimise contact with the air. The mesh support shall allow direct contact with test water on all sides of a test piece, but shall not significantly affect the surface area of a test piece exposed to the test water.

B.2 Surface area to volume (S/V) ratio

The S/V ratio for fittings to be used in the migration procedure shall be as given in 7.3.2.

NOTE See 7.3.1 (b) for a testing policy option where fittings of nominally identical composition and production process are produced in a range of sizes.

B.3 Pre-treatment of test pieces (preconditioning and disinfection)

Preconditioning and any disinfection pre-treatment shall be carried out in accordance with either 8.3.2 or 8.3.3, as appropriate.

B.4 Test procedure

B.4.1 Migration procedure at 23 C

Where testing of factory made fittings in the form of equivalent-pipes, or in any other test piece geometry, at 23 °C is required, the migration procedure shall be carried out in accordance with clause 9.

NOTE Where specified, test pieces made from fresh mortar or concrete, used in the manufacture of fittings may represent the finished product in the migration procedure, see B.1.2.4 and B.1.2.5.

B.4.2 Migration procedure at elevated temperature

Where testing of factory made fittings at elevated temperature is required, the test pieces and test arrangements to be used in the migration procedure are as given in this Annex B and the migration procedure is as given in normative Annex F.

NOTE See note to B.4.1.

B.5 Expression of results

Express results in accordance with clause 11.

B.6 Reporting

Report results in accordance with clause 12.

Annex C
(normative)

Additional procedures for testing factory made storage systems (cement mortar, cement mortar lined and concrete)

C.1 Sampling, test piece preparation and storage

C.1.1 Sampling

See also 7.1 and 7.2.

Sample factory made storage systems at the point of release of the factory as finished products, for preparation as test pieces.

Alternatively where specified, storage systems may be sampled indirectly as proxy samples (3.6) of the fresh mortar or concrete used in their manufacture, for preparation as test pieces.

C.1.2 Test piece preparation and storage

C.1.2.1 General

Test pieces prepared from factory made storage systems manufactured from mortar or concrete or lined with mortar shall:

a) be either:

1) blocks or cores sawn or cored from storage systems using tap-water-cooled/lubricated (3.20) sawing or coring procedures;

or

2) or proxy test pieces, where specified, prepared by the manufacturer from samples of fresh mortar or concrete (3.6) used in the manufacture of storage systems, in accordance with either C.1.2.3 in the case of mortar or C.1.2.4 for concrete, in order to provide hardened surfaces representative of the contact surface of the finished product.

b) be of sufficient surface area to fulfil the appropriate surface area to volume (S/V) ratio for the migration procedure, in accordance with the requirements of 7.3;

c) be of suitable general dimensions (see informative Annex D) e.g. length, surface area, diameter etc. to provide sufficient migration water for assessment;

d) be suitably documented and identified and be free from any surface contamination e.g. adhesive tape, labels, ink or pencil marks;

e) be protected from contamination and mechanical damage in the factory using unused food grade packaging materials when it is necessary to store them prior to dispatch to the test laboratory;

f) be subject to comparable conditions for storage in the test laboratory as for storage in the factory;

g) be taken at the point of release, or in the case of proxy samples, be of a minimum age recommended by the manufacturer for the storage system to be ready for use, before any testing shall begin.

C.1.2.2 Storage systems sampled as finished products

See C.1.2.1 a) for test piece preparation.

Informative Annex E gives examples of suitable test arrangements for use in the migration procedure.

C.1.2.3 Storage systems sampled as fresh mortar

C.1.2.3.1 General

Test pieces shall be prepared from samples of the fresh mortar (3.8) used to make or line factory made storage systems and be either spray-applied to stainless steel plates in accordance with C.1.2.3.2.1 or be cast as prisms in accordance with C.1.2.3.2.2.

Hardened test pieces shall be monolithic, undamaged and representative in structure, composition and homogeneity of the fresh mortar from which they were prepared.

Test arrangements, for using the test pieces in the migration procedure, shall be as given in C.1.2.3.2.3.

C.1.2.3.2 Test pieces (fresh mortar)

C.1.2.3.2.1 Coated plates

Where test plates are specified, they shall be made by coating one face of a stainless steel plate (6.2.1.1) with the fresh mortar used in the manufacture of the storage system using the same process of application used in the factory. In addition:

a) coated plate shall not be marked for identification purposes but shall be identified in an alternative traceable manner e.g. by mechanical marking on the rear of the test plates;

b) coated plate shall be placed in the vicinity of the storage system that it represents and shall undergo the same curing regime as that applied to the storage system;

c) after curing, the undamaged coated plate shall be stored under the same environmental conditions that apply to the finished storage system during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the storage system;

d) following the curing/storage period, the coated plate shall be placed in an unused food grade plastics bag and sealed. A damaged plate shall be discarded.

C.1.2.3.2.2 Prisms

a) Where test prisms are specified, they shall be prepared from the fresh mortar used in the manufacture of the storage system, sampled in accordance with EN 1015-2, and formed as prisms of dimensions 1,6 dm $\times$ 0,4 dm $\times$ 0,4 dm, in accordance with EN 196-1, as specified in EN 1015-11, with the following modifications:

1) tolerances given in EN 1015-11 for shape and dimensions are for guidance only;

2) joints of moulds shall not be coated with any wax, oil or grease to achieve water tightness;

3) where the factory made cementitious product has been formed in a process where its entire contact surface has been in contact with a release agent, the same release agent shall be applied to the internal surfaces of the mould, otherwise the use of release agents is not permitted by this European Standard.

NOTE Where release agents are not permitted, moulds of steel or cast iron may not be suitable for forming test pieces for use in the migration procedure.

b) Prisms shall be made and cured in accordance with EN 1015-11 with the following modifications:

1) irrespective of the type of material from which a mould is made, the mould, together with any filling frame, shall be thoroughly washed with non-perfumed detergent (5.4) and water, rinsed with copious amounts of tap water, given a final rinse with demineralized water (3.21) and then dried before use;

2) prism shall not be marked for identification purposes but shall be identified in an alternative traceable manner;

3) mould shall be covered and be placed in the vicinity of the storage system that it represents and the prism shall undergo the same curing regime as that applied to the storage system. Covers to moulds shall be made of an impermeable material that does not react with cement;

4) on removal from the mould after curing, the undamaged prism shall be stored under the same environmental conditions that apply to the finished storage system during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the storage system;

5) following the curing/storage period, the prism shall be placed in an unused food grade plastics bag and sealed. A damaged prism shall be discarded.

C.1.2.3.2.3 Test arrangements (fresh mortar)

The test arrangements for test pieces prepared from the fresh mortar used to make or line storage systems should be either:

a) as given in Figure E.6 in informative Annex E, for test plates; or

b) as given in Figure E.7 in informative Annex E, for test prisms.

In Figure E.7, the test vessel and mesh support shall be made of inert material that does not affect the analytical results. The test vessel shall have a cover to minimise contact with the air. The mesh support shall allow direct contact with test water on all sides of a test piece but shall not significantly affect the surface area of a test piece exposed to the test water.

C.1.2.4 Storage systems sampled as fresh concrete

C.1.2.4.1 General

Test pieces shall be prepared from samples of the fresh concrete (3.7) used to make factory made storage systems and be cast, compacted and cured in accordance with or C.1.2.4.2.

Hardened test pieces shall be monolithic, undamaged and representative in structure, composition and homogeneity of the fresh concrete from which they were prepared.

Test arrangements, for using the test pieces in the migration procedure, shall be as given in C.1.2.4.3.

C.1.2.4.2 Test pieces (fresh concrete)

a) Test pieces shall be prepared from the fresh concrete (3.7) used to manufacture the storage system, sampled in accordance with EN 12350-1, and formed as either cubes or cylinders, in accordance with EN 12390-1 for shape and dimensions, with the following modifications:

1) tolerances given in EN 12390-1 for shape and dimensions are for guidance only;

2) joints of moulds shall not be coated with any wax, oil or grease to achieve water tightness;

3) where the factory made cementitious product has been formed in a process where its entire contact surface has been in contact with a release agent, the same release agent shall be applied to the internal surfaces of the mould, otherwise the use of release agents is not permitted by this European Standard.

NOTE Where release agents are not permitted, moulds of steel or cast iron may not be suitable for forming test pieces for use in the migration procedure.

b) Cubes and cylinders shall be made and cured in accordance with EN 12390-2 with the following modifications:

1) irrespective of the type of material from which a mould is made, the mould, together with any filling frame, shall be thoroughly washed with non-perfumed detergent (5.4) and water, rinsed with copious amounts of tap water, given a final rinse with demineralized water (3.21) and then dried before use;

2) cube or cylinder shall not be marked for identification purposes but shall be identified in an alternative traceable manner;

3) mould shall be covered and be placed in the vicinity of the storage system that it represents and the cube or cylinder shall undergo the same curing regime as that applied to the storage system. Covers to moulds shall be made of an impermeable material that does not react with cement;

4) on removal from the mould after curing, the undamaged cube or cylinder shall be stored under the same environmental conditions that apply to the finished storage system during storage at the factory until it reaches the minimum age recommended by the manufacturer for use of the storage system;

5) following the curing/storage period, the cube or cylinder shall be placed in an unused food grade plastics bag and sealed. A damaged test piece shall be discarded.

C.1.2.4.3 Test arrangements (fresh concrete)

The test arrangements for cubes or cylinders prepared from the fresh concrete used to make the storage system should be either:

a) as given in Figure E.5 in informative Annex E where a cylindrical test container of stainless steel (6.2.1.2) or glass (6.2.2) is attached and sealed with sealing compound (6.3.3) to a cast surface of the cube or cylinder, or;

b) as given in Figure E.7 in informative Annex E where the cube (or cylinder) is tested fully immersed in test water.

In Figure E.7 the test vessel and mesh support shall be made of inert material that does not affect the analytical results. The test vessel shall be provided with a cover in order to minimise contact with the air. The mesh support shall allow direct contact with test water on all sides of a test piece but shall not significantly affect the surface area of a test piece exposed to the test water.

C.2 Surface area to volume (S/V) ratio

The S/V ratio for factory made storage systems to be used in the migration procedure shall be as given in 7.3.3.

C.3 Pretreatment of test pieces (preconditioning and disinfection)

Preconditioning and any disinfection pretreatment shall be carried out in accordance with either 8.3.2 or 8.3.3, as appropriate.

C.4 Test procedure

C.4.1 Migration procedure at 23 °C

Where testing of factory made storage systems at 23 ^{o}C is required, the migration procedure shall be carried out in accordance with clause 9.

NOTE Where specified, test pieces made from fresh mortar or concrete used in the manufacture of storage systems may represent the finished product in the migration procedure, see C.1.2.3 and C.1.2.4.

C.4.2 Migration procedure at elevated temperature

Where testing of factory made storage systems at elevated temperature is required, the test pieces and test arrangements to be used in the migration procedure are as given in this annex and the migration procedure is as given in normative Annex F.

NOTE See NOTE in C.4.1.

C.5 Expression of results

Express results in accordance with clause 11.

C.6 Reporting

Report results in accordance with clause 12.

Annex D
(informative)

Examples of typical test pieces and test conditions as a function of S/V ratio

D.1 General

The selection of the appropriate type of, or geometry for, a test piece will either be specified by the product standard or system standard or in national or European regulations.

Tabulated dimensions, in millimetres, are given in Table D.1 to Table D.4 for:

- pipes and fittings (as equivalent-pipes representing those fittings) of cylindrical section;
- test pieces to which a cylinder of stainless steel or glass is to be attached as the test container;
- square test plates coated on one face with mortar and to be tested completely immersed;
- standard specimens moulded from proxy samples i.e. prisms (mortar), cubes (concrete) and cylinders (concrete) where all faces are to be exposed to test water.

The implications of the values given in the tables for the selection of, and dimensions of, appropriate test pieces vary as a function of S/V ratio.

NOTE 1 Shaded areas in tables give the range of test piece dimensions or volumes of test water that are likely to be impracticable for use in laboratory conditions. In particular, 15 l is likely to be the limiting volume for test water.

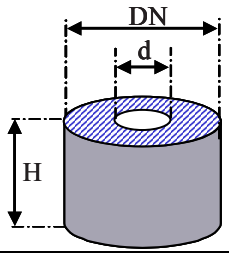
NOTE 2 In general, the tabulated values for dimensions (l) and (d) have been rounded to the nearest 5 mm and volumes of test water have been rounded to the nearest 5 mm.

NOTE 3 In the case of migration testing, it should be noted that the minimum volume depends on required parameters (between one to 5 l of migration water needed to carry out the determinations).

D.2 Pipes and fittings

Where cylindrical sections of pipes or fittings represented by equivalent-pipes are appropriate as test pieces, the tabulated values (H) in Table D.1 give the length of section, as a function of S/V ratio, required to provide a number of fixed volumes of migration water.

Table D.1 — Pipe or fitting of cylindrical section (internal surface exposed) with internal glass or stainless steel cylinder



Internal surface $S = \pi.DN.H$
Volume of water = $\pi.(DN^2-d^2).H/4$

criteria :
H > 100 mm
H < 300 mm preferred

DN/ID (mm)		600	300	150	100	80
S/V (dm^{-1}) (required)		1,3 ± 0,1	1,3 ± 0,1	5,0 ± 0,2	5,0 ± 0,2	5,0 ± 0,2
d[1)] (mm)		425	0	100	45	0
H (mm) for :	V = 2 L	15	30	210	320	400
	V = 5 L	35	70	530	795	995
	V = 10 L	70	140	--	--	--

[1)] d is the external diameter of the internal glass or stainless steel cylinder.

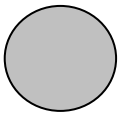
NOTE This test arrangement is not suitable for DN/ID greater than 600.

D.3 Test pieces to which a cylinder of stainless steel or glass is to be attached

In the case of test pieces, such as a face of a concrete cube or cylinder, sawn block or core, to which a cylinder of stainless steel (6.2.1.2) or glass (6.2.2) is to be attached in a water-tight manner, the values (d) in Table D.2 are the diameters of the cylinder. Therefore to make use of the values in the table, given the practical problems of attaching a cylinder of stainless steel or glass to a concrete surface, cylinders to the diameters in the table should be attached to surfaces of larger diameter.

NOTE To minimise any errors due to the curvature of the surface of a test piece e.g. a concrete core sampled from a pipe, the ratio of pipe diameter DN/ID to cylinder diameter should be greater than 3. As a consequence, sawn or cored test pieces from pipes of DN < 555 mm (3 x 185) can not be tested with this test arrangement.

Table D.2 — Circular surface exposed to test water (e.g. cylinder attached to surface of a concrete cube, cylinder, sawn block or core*)*

 Circular surface $S = \pi.d^2/4$				criteria : d > 100 mm d < 300 mm preferred		
S/V = 1,3 ± 0,1 dm^{-1}						
V (litre)	2	3	4	5	10	15
d (mm)	185	225	260	290	410	505
NOTE 1 The height of water in the attached cylinder is 75 mm.						
NOTE 2 This arrangement can not be used practically for S/V = 5,0 dm^{-1}.						

D.4 Square test plates coated with mortar

Where test pieces are square test plates coated with mortar, the values in Table D.3 are the limiting dimensions of a coated plate that is to be tested completely immersed.

Table D.3 — Square surface exposed to test water (e.g. test plate)

 Square surface $S = a^2$			criteria : a > 100 mm a < 300 mm preferred	
S/V = 1,3 ± 0,1 dm^{-1}				
V (litre)	2	5	10	15
a (mm)	165	260	365	445
NOTE This arrangement can not be used practically for S/V = 5,0 dm^{-1}.				

D.5 Moulded test pieces where all faces are exposed to test water

Where test pieces are to be formed in moulds from fresh mortar or concrete and then exposed with all faces in contact with test water, the values in Table D.4 identify the types of test piece and the limiting dimensions to be considered, i.e.:

— mortar prisms;

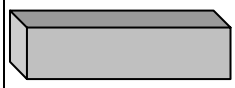
— concrete cubes;

— concrete cylinders.

NOTE Two or more test pieces can be used in the same vessel where necessary to obtain a sufficient volume of water.

Table D.4 — Typical standard moulded test pieces and volumes of test water as a function of S/V ratio where all faces are exposed to test water

Mortar prism A



Dimensions :

40 mm x 40 mm x 160 mm

(S=2,88 dm^2)

S/V (dm^{-1})	**1,3 ± 0,1**	**5,0 ± 0,2**
V (L)	2,15	0,58

Mortar prism B

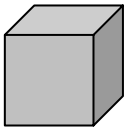
Dimensions :

20 mm x 20 mm x 160 mm

(S=1,36 dm^2)

S/V (dm^{-1})	**1,3 ± 0,1**	**5,0 ± 0,2**
V (L)	1,00	0,27

Concrete cube A



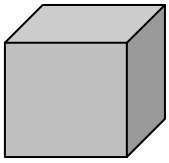
Dimensions

100 mm x 100 mm x 100 mm:

(S=6,0 dm^2)

S/V (dm^{-1})	**1,3 ± 0,1**	**5,0 ± 0,2**
V (L)	4,50	1,20

Concrete cube B



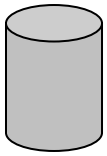
Dimensions :

150 mm x 150 mm x 150 mm

(S=13,5 dm^2)

S/V (dm^{-1})	**1,3 ± 0,1**	**5,0 ± 0,2**
V (L)	10,15	2,70

Concrete cylinder A



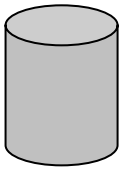
Dimensions :

ϕ= 100 mm, L = 200 mm

(S =7,85 dm^2)

S/V (dm^{-1})	**1,3 ± 0,1**	**5,0 ± 0,2**
V (L)	5,90	1,57

Concrete cylinder B



Dimensions :

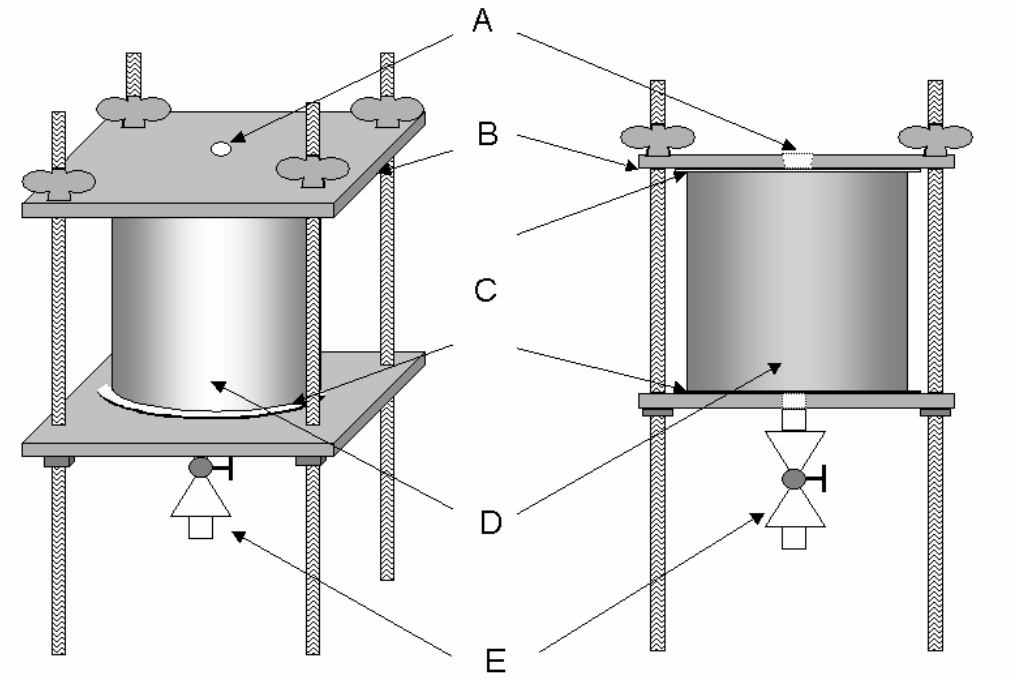
ϕ= 113 mm, L = 226 mm

(S= 10,03 dm^2)

S/V (dm^{-1})	**1,3 ± 0,1**	**5,0 ± 0,2**
V (L)	7,50	2,01

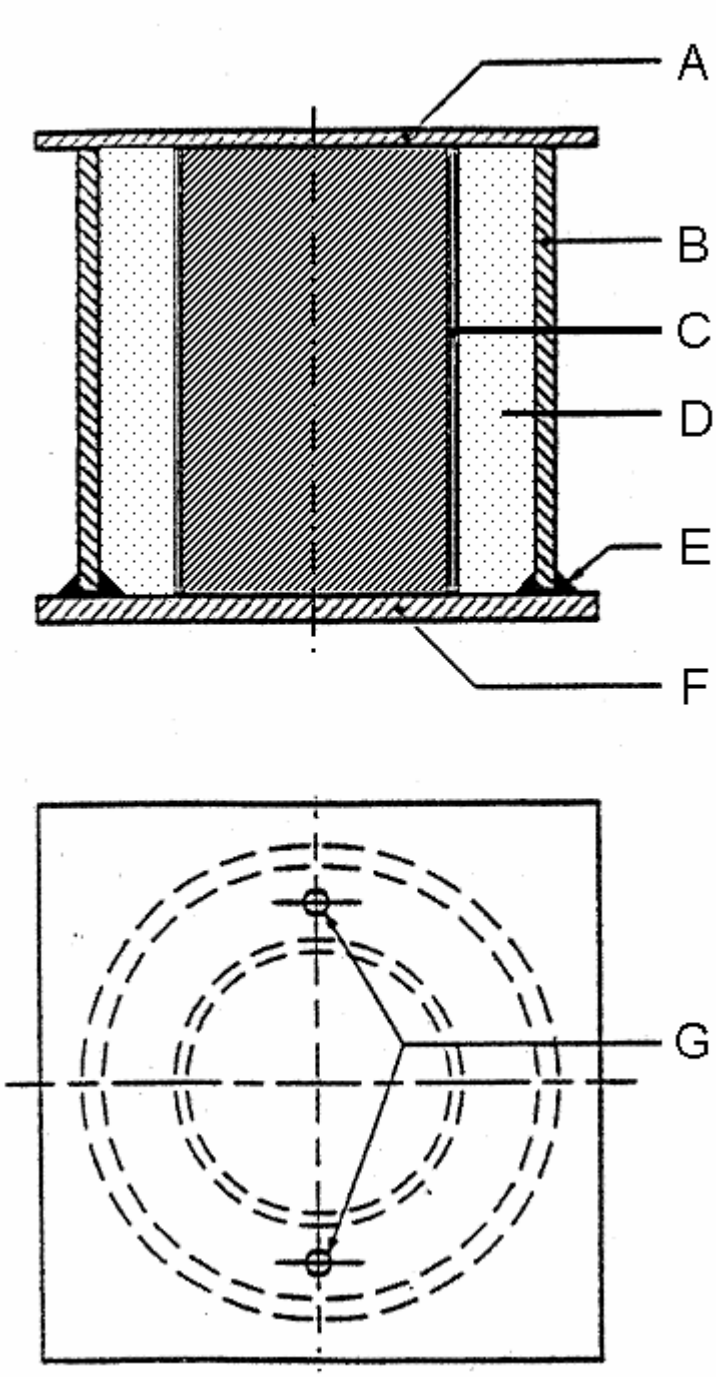
Annex E
(informative)

Test arrangements for testing factory made cementitious products



Key
A Filling hole
B Stainless steel plates
C PTFE gasket
D Test piece
E Emptying/sampling valve

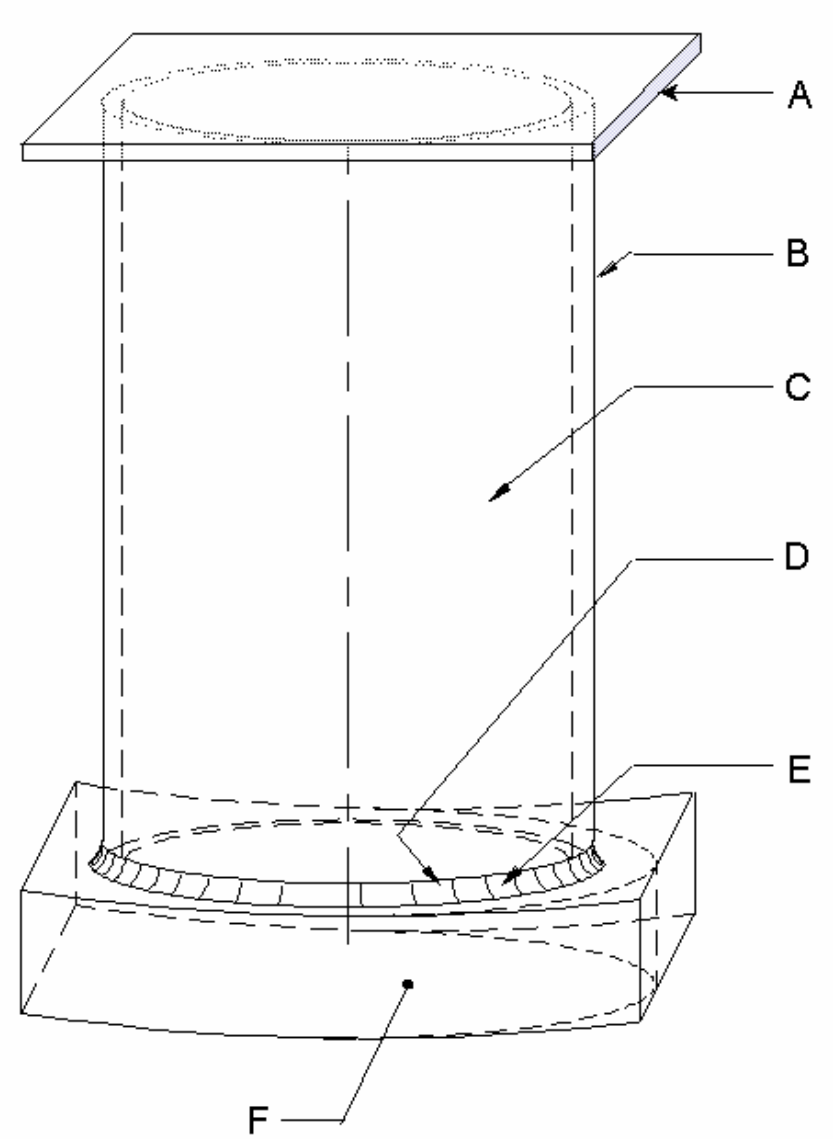
Figure E.1 — Typical test arrangement for pipes and equivalent-pipes (representing fittings) of small diameter



Key

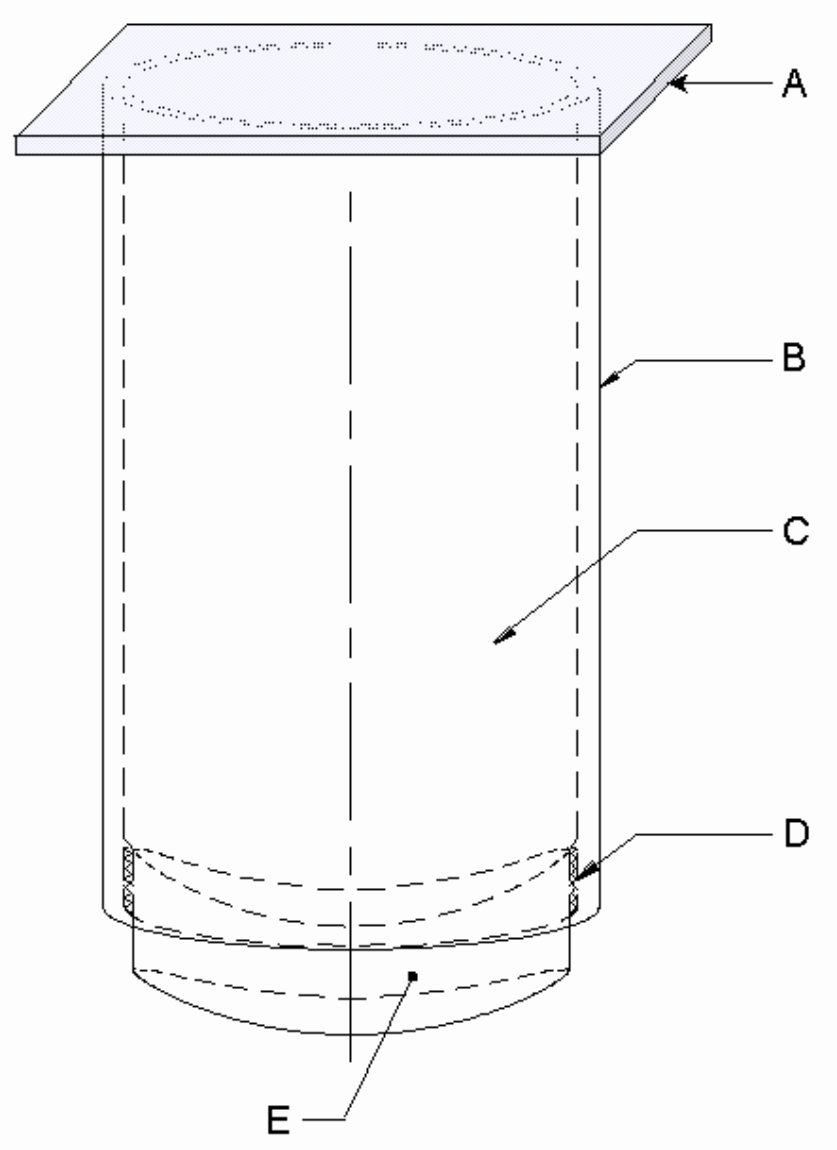
A Top plate of glass or stainless steel
B Pipe wall
C Cylinder of glass or stainless steel
D Test water (test piece completely filled)
E Seal between pipe section and plate, if necessary
F Bottom plate of glass or stainless steel
G Hole in top plate for filling with test water and release of air (sealed with stoppers)

Figure E.2 — Typical test arrangement for pipes and equivalent-pipes (representing fittings) of DN/ID greater than 800



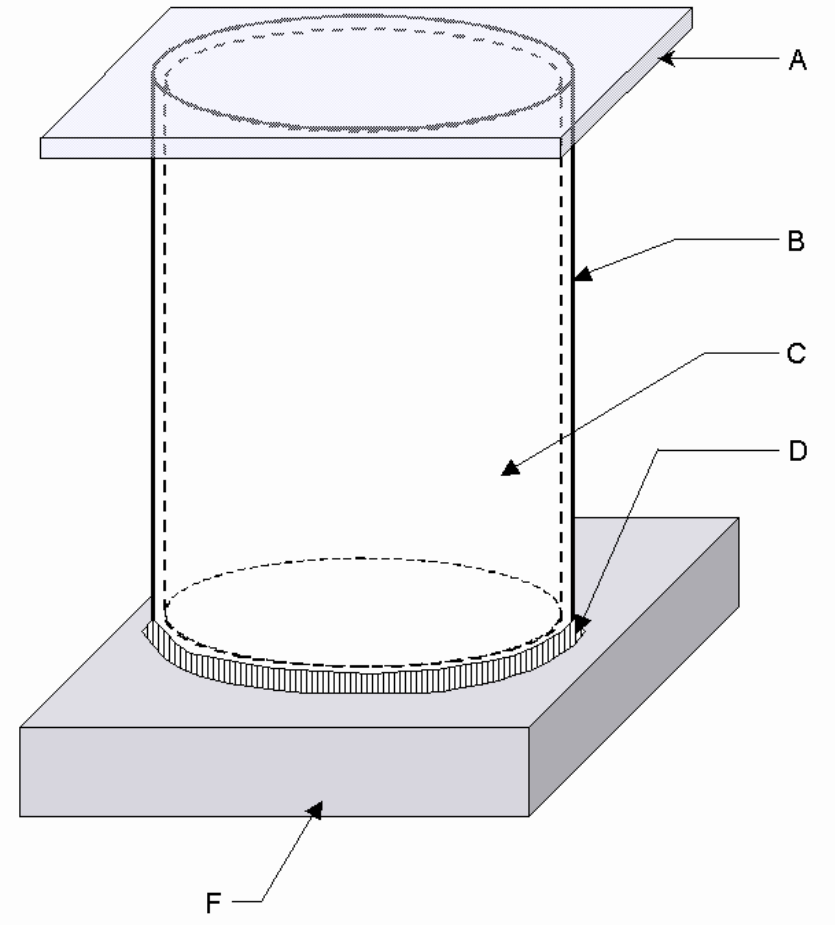
Key
A Cover
B Glass or stainless steel cylinder
C Test water
D Shaped extremity (to fit the sample curvature)
E Sealant
F Sawed concrete sample (taken from pipe wall)

Figure E.3 — Typical test arrangement for blocks sawn from: pipes, fittings or storage systems (sawn option)



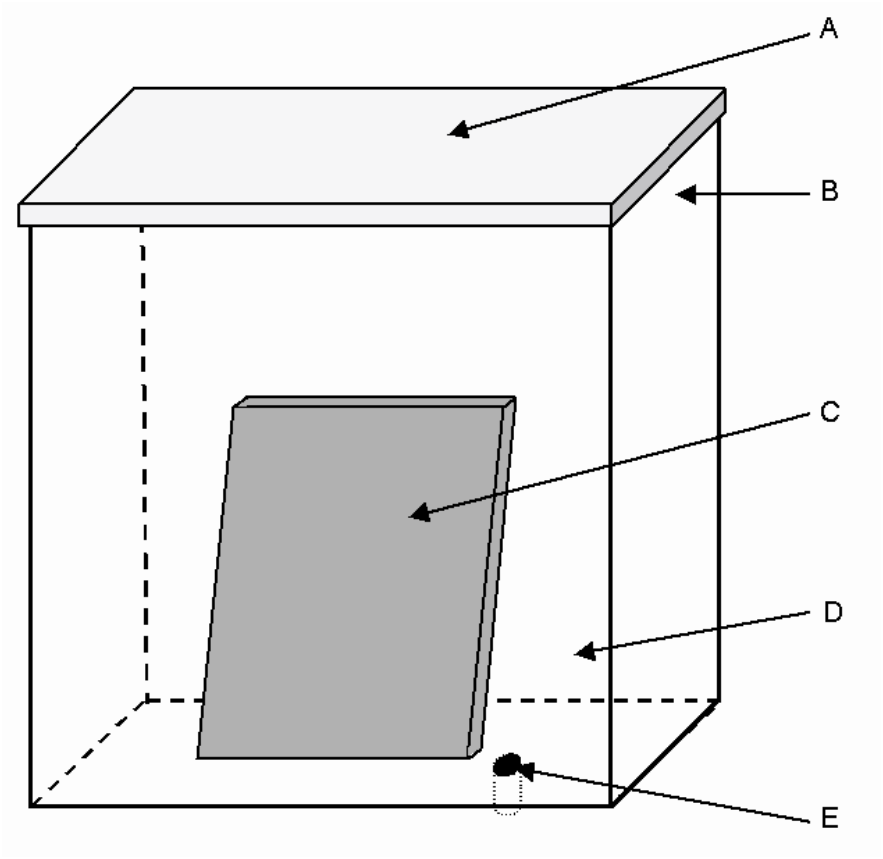
Key
A Cover
B Glass or stainless steel cylinder
C Test water
D Sealant
E Cored concrete sample (taken from pipe wall)

Figure E.4 — Typical test arrangement for blocks cored from: pipes, fittings or storage systems (cored option)



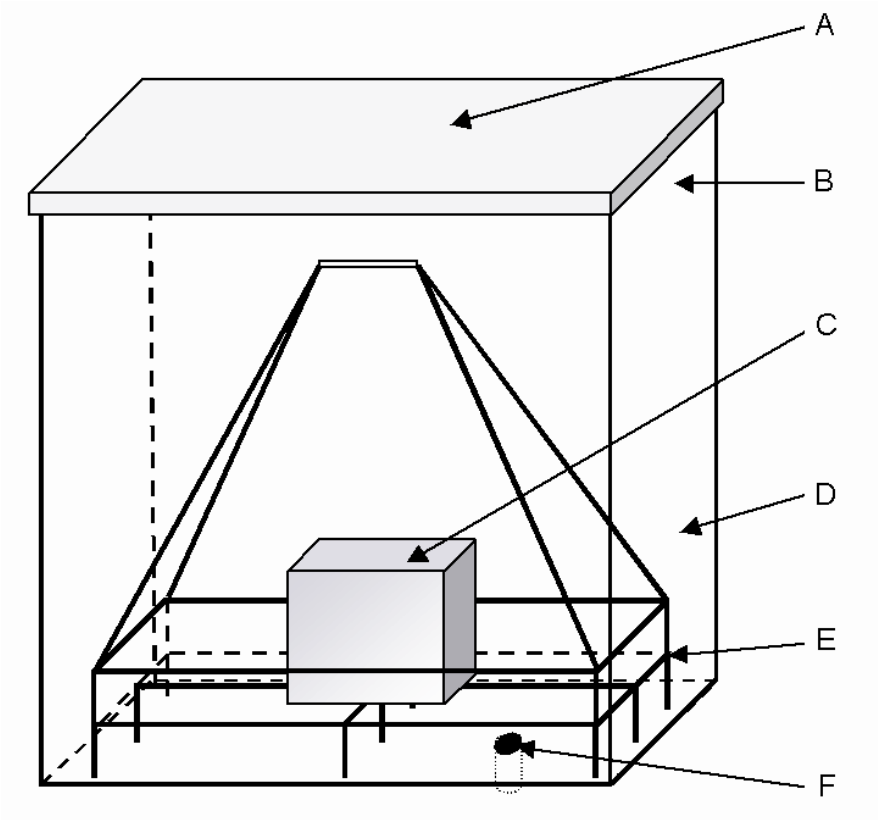
Key
A Cover
B Glass or stainless steel cylinder
C Test water
D Sealant
F Test piece (cube or cylinder)

Figure E.5 — Typical test arrangement for testing, on one face only, cubes or cylinders made from fresh concrete



Key
A Cover
B Container
C Test piece (mortar-coated stainless steel plate)
D Test water
E Drain/stopcock

Figure E.6 — Typical test arrangement for stainless steel test plates coated with fresh mortar



Key
A Cover
B Container
C Test piece
D Test water
E Mesh support
F Drain/stopcock

Figure E.7 — Typical test arrangement for testing, fully immersed, cubes or cylinders prepared from fresh concrete or prisms prepared from fresh mortar

Annex F
(normative)

Additional procedures for testing factory made cementitious products at elevated temperature

F.1 General

Sampling, test piece preparation, storage, test arrangements, surface to volume (S/V) ratio and pre-treatment of test pieces (preconditioning and disinfection) shall be carried out in accordance with either normative Annex, A, Annex B or Annex C, of this European Standard, as appropriate to product type.

F.2 Test procedure at elevated temperature

F.2.1 General

The elevated temperature to be used for testing will either be specified by the product standard or system standard or in national or European regulations.

Carry out the following procedures at the specified test temperature controlled to ± 2 °C.

F.2.2 Preparation of migration water for the assessment of migration of substances

Begin the first contact period immediately after preconditioning the test piece in accordance with either 8.3.2 or 8.3.3, as appropriate.

Immerse in, or fill with, or otherwise bring the test piece (see normative Annex A, Annex B or Annex C) into appropriate contact with test water (5.3.2) and allow to stand for (24 ± 1) h at the test temperature controlled to ± 2 °C. In all cases (immersion, filling or other contact arrangement), ensure that the test piece or vessel/container is completely immersed or filled. Use a cover for the vessel/container in order to minimize:

— evaporation of test water;

— loss of any volatile components;

— headspace and contact between the test piece and air.

At the end of this period, collect the migration water and allow to cool in a covered vessel to (23 ± 2) °C. Following cooling, and without delay, determine the migration of substances, in accordance with clause 9.

Repeat F.2.2 two more times using fresh test water (5.3.2) each time.

F.3 Control samples (blank test)

For each contact period, carry out a blank test procedure using the same test conditions (test water, test temperature, contact periods, sealants used etc.) as described in F.2 but omitting the test piece or replacing it by a glass container or plate, as appropriate.

F.4 Expression of results

Express the results in accordance with clause 11.

F.5 Reporting

Report results in accordance with clause 12.

Annex G
(informative)

Discrimination between porous and non-porous coatings on factory made products

G.1 Principle

The coating used in the factory to coat a factory made cementitious product is applied in the laboratory to a stainless steel plate to produce a laboratory blank. The coated surface of the factory made product and the coated surface of the blank are brought, independently, into contact with demineralized water for 24 h each. At the end of the contact period the pH is determined on the water in contact with the blank and the water in contact with the coated product, and the results compared. On the basis of the difference in pH between the waters, the coating on the product is classified as either porous or non-porous.

A classification of porous indicates that the coated product exhibits cementitious behaviour and should be tested for migration of substances in accordance with this European Standard. Whereas a classification of non-porous indicates that the product exhibits non-cementitious behaviour and should be tested in accordance with methods designed to test non-metallic and non-cementitious products.

G.2 Apparatus

G.2.1 stainless steel plates, square plates of dimensions between 10 000 mm^2 and 25 000 mm^2 are suitable.

G.2.2 cylinders, of stainless steel or glass with the approximate dimensions 125 mm x 90 mm in diameter.

G.2.3 pH meter, capable of measuring to an accuracy of 0,1 pH units.

G.3 Materials and reagents

G.3.1 sealing compound/sealant, conforming to 6.3.3.

G.3.2 demineralized water, conforming to the requirements given in EN ISO 3696, grade 3.

G.4 Test procedure

G.4.1 General

The laboratory blank (see G.4.2) and the coated product (see G.4.3) are tested at the same S/V ratio but with varying volumes of demineralized test water.

G.4.2 Laboratory blank

Carry out the following procedures in the laboratory in accordance with the manufacturer's instructions for application and curing.

Apply the coating to one face of a stainless steel test plate (G.2.1) to the same thickness as the coating applied in the factory to the product in order to produce a laboratory blank. Allow to cure.

Immediately after the coating has cured, attach a cylinder (G.2.2) to the coated face of the laboratory blank using a sealing compound (6.3.3) to give a water-tight seal between the base circumference of the cylinder and the coated face (see Figure E.3 in informative Annex E for a similar test arrangement). Allow the sealing compound to cure.

Determine the volume of demineralized water (3.21) to be used for testing the laboratory blank, as follows:

a) in the case where the coated product is a complete pipe, equivalent pipe or a cylindrical section of pipe, use the volume of demineralized water for the blank test given in Table G.1 appropriate to the diameter DN/ID of the product. Interpolation between values is permitted.

b) in the case where the coated product is a sawn block or core taken from a pipe, equivalent pipe, section of pipe or from a storage system, use a fixed volume of demineralized water of approximately one half litre for testing the laboratory blank.

Table G.1 — Typical volumes of demineralized water required in the blank test (pipe/equivalent pipe or cylindrical pipe-section of DN/ID ≤ 300)

Pipe diameter DN/ID	**60**	**80**	**100**	**150**	**250**	**300**
S/V (dm^{-1})	6,67	5,0	4,0	2,67	1,6	1,33
Volume of water (dm^3)	0,1	0,13	0,16	0,24	0,40	0,48
Depth of water in cylinder (mm)	15	20	25	37	63	75
NOTE Tabulated values assume that the test pieces are vertical when tested.						

Pour the appropriate volume of demineralized water into the cylinder (**G.2.2**) and cover the open end using a plate of stainless steel or glass. Allow to stand in the laboratory for approximately 24 h.

G.4.3 Coated product

Bring only the coated surface of the factory coated product into contact with demineralized water (3.21) as follows:

a) in the case where the coated product is a complete pipe, equivalent pipe or cylindrical section of pipe, seal (see 6.3.3) one end of the product against a stainless steel or glass plate and test the product held vertically by partially filling with one litre of demineralized water. Cover the test arrangement with a plate of stainless steel or glass and allow to stand in contact with the water for 24 h.

b) in the case where the coated product is a sawn block or core, attach a cylinder (G.2.2) to the coated face in the same way as given in G.4.2 for attaching a cylinder to a laboratory blank. Pour approximately 0,5 l of demineralized water into the cylinder and cover the open end using a plate of stainless steel or glass. Allow to stand for approximately 24 h.

G.5 Determination of pH

Immediately following the 24 h migration period, determine the pH of each water using the pH meter (G.2.3).

G.6 Expression of results

Express the results, to the nearest 0,1 pH unit, as pH_{coat} for the factory coated product and as pH_{blank} for the laboratory blank.

G.7 Classification criteria

Where the pH difference:

— $pH_{coat} - pH_{blank} \geq + 1,0$ pH unit, classify the coating as porous.

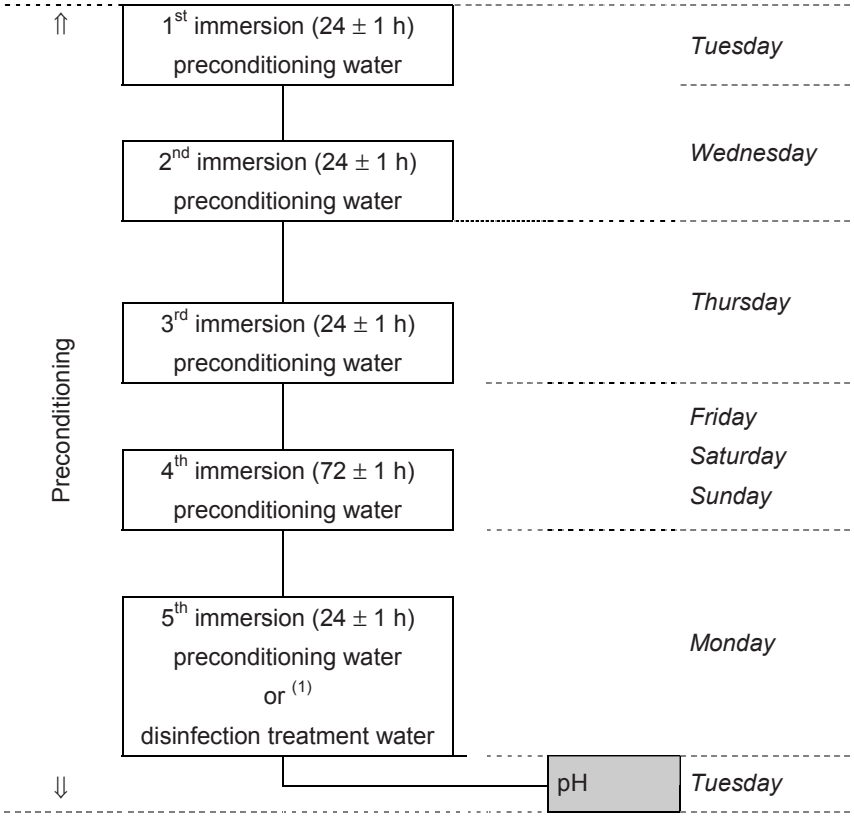
— $|pH_{coat} - pH_{blank}| < 1,0$ pH unit, classify the coating as non-porous.

Annex H
(informative)

Schematic description of the test procedure

H.1 Preconditioning

A schematic description of the preconditioning is given in Figure H.1.



Key

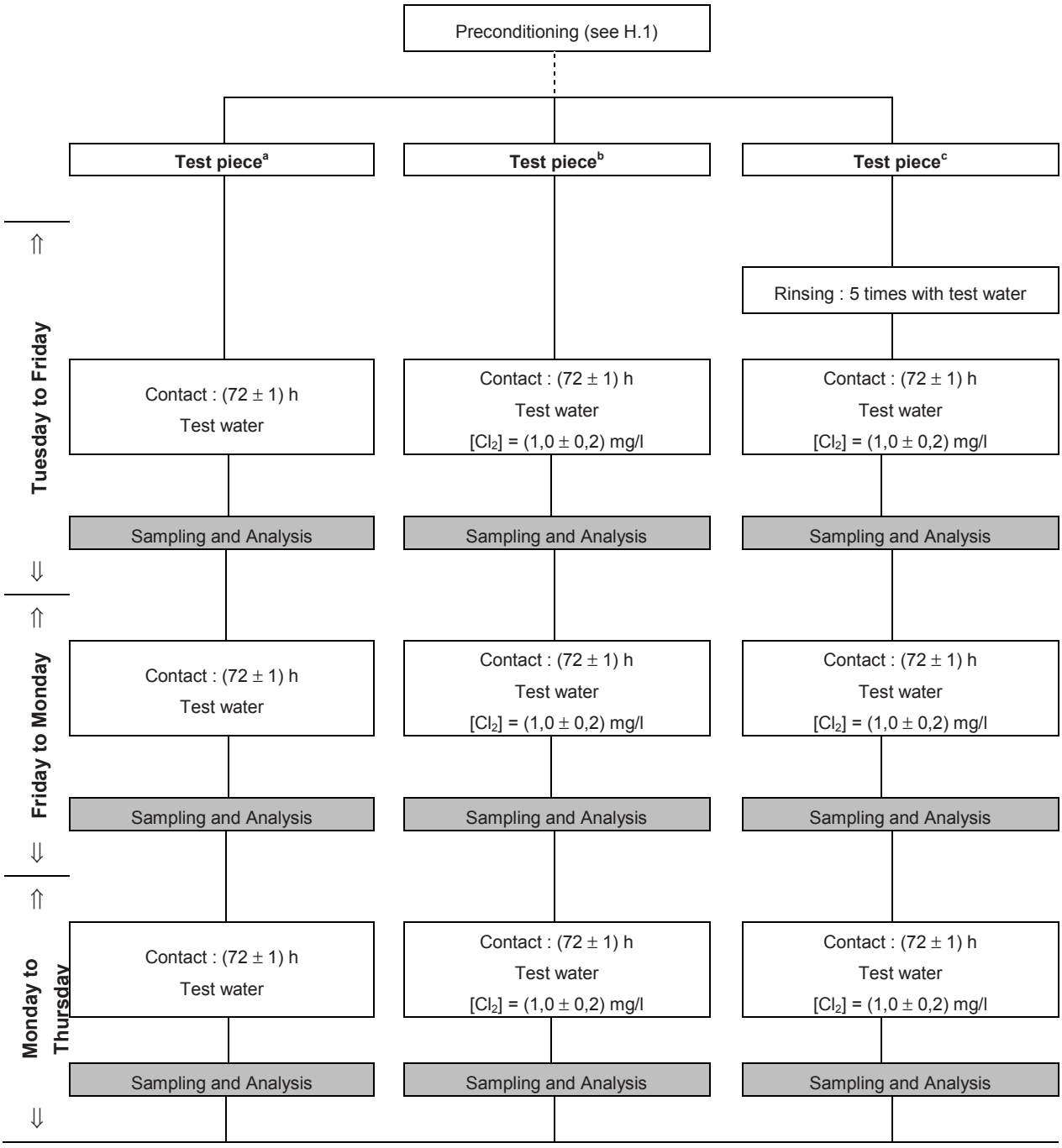
(1) If disinfection treatment is required, replace the preconditioning water (5.3.1) for the fifth contact period, by disinfection treatment water (5.2.2).

NOTE The days of the week are for guidance only.

Figure H.1 — Schematic description of the preconditioning

H.2 Production of migration water at 23 C

A schematic description of the procedure is given in Figure H.2.



Key

a This scheme should be used where neither the preconditioning stage (see H.1) nor the migration procedure (see 9.2) involves the use of chlorinated waters.

b This scheme should be used where only the test water (see 5.3.3) used in the migration procedure is chlorinated.

c This scheme should be used where chlorinated disinfection water (5.2.2) has been used in the preconditioning stage (see H.1) and chlorinated test water (5.4.3) is to be used in the migration procedure.

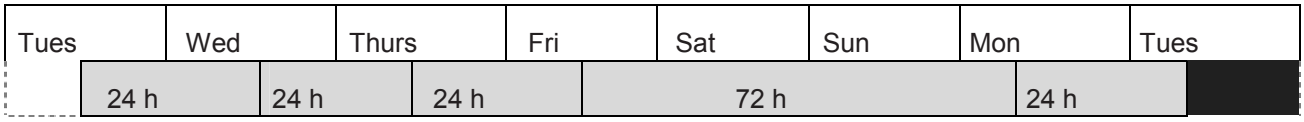
NOTE The days of the week are for guidance only.

Figure H.2 — Schematic description of the test

H.3 Typical Schedule

H.3.1 Preconditioning

The following diagram shows a typical schedule of the preconditioning.



H.3.2 Production of migration waters

The following diagram shows a typical schedule of the production of migration waters.

Annex I
(informative)

Procedural tests using standard additions (positive controls)

Periodically establishing recovery levels of substances determined from analytical methods and specific test procedures is good laboratory practice. Any requirements for particular products will be specified in the referring standards or by the appropriate national regulatory authorities.

a) Positive control should be included, where appropriate, to ensure that there are no significant losses of the measured substance migrating from the test piece, during the migration periods or during sampling for analysis (e.g. by evaporation, absorption on test vessels, etc.).

b) Solution of known concentration of the substance to be determined should be prepared using the test water and further treated as described in 9.3 [control samples (blank tests)].

c) If the recovery of the substances does not meet the requirement specified in either the referring standard or by the national regulatory authorities, then the whole test procedure should be checked, and if necessary repeated, until the required performance is obtained.

Bibliography

[1] ISO 16132, Ductile iron pipes and fittings - Seal coats for cement mortar linings

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