BRITISH STANDARD

BS EN
14395-1:2004

Influence of organic materials on water intended for human consumption — Organoleptic assessment of water in storage systems —

Part 1: Test method

The European Standard EN 14395-1:2004 has the status of a British Standard

ICS 13.060.20; 13.060.45

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National foreword

This British Standard is the official English language version of EN 14395-1:2004.

The UK participation in its preparation was entrusted to Technical Committee EH/6, Effects of materials on water quality, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

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English version

Influence of organic materials on water intended for human consumption - Organoleptic assessment of water in storage systems - Part 1: Test method

Influence des matériaux organiques sur l'eau destinée à la consommation humaine - Evaluation organoleptique de l'eau dans les systèmes de stockage - Partie 1 : Méthode d'essai

Einfluss von organischen Werkstoffen auf Wasser für den menschlichen Gebrauch - Organoleptische Prüfung von Wasser in Speichersystemen - Teil 1: Prüfverfahren

This European Standard was approved by CEN on 8 August 2004.

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Foreword

This document (EN 14395-1:2004) 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of an identical text or by endorsement, at the latest by April 2005, and conflicting national standards shall be withdrawn at the latest by April 2005.

The material-dependent parameters and/or performance requirements are incorporated into the Product Standards, for example the System Standards for storage systems.

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

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Introduction

In respect of potential adverse effects on the quality of water intended for human consumption caused by the materials, it is recalled to mind that, while awaiting the adoption of verifiable European acceptance criteria, such as proposed in a future European Acceptance Scheme, national regulations remain in force.

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1 Scope

This document specifies a test method for determining the organoleptic properties (odour, flavour, colour and turbidity) of test waters after their contact with products made from organic materials used in storage systems (tanks, reservoirs, ancillaries and their coatings both for factory and site applied products).

Products containing cementitious materials are not covered by this document.

The test method described in this standard is applicable to products to be used under various conditions for the storage of water intended for human consumption and raw water used for the manufacture of water intended for human consumption. Coatings or protective layers on products which are not intended to be in contact with these types of waters are not covered by this method.

This document specifies the test method comprising a set of procedures with and without a disinfection pretreatment and possible temperatures for the test waters. The use of the disinfection pretreatment and the choice of the test temperature are dependant on the relevant national regulations and/or the system or product standards.

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 1622:1997, *Water analysis - Determination of the threshold odour number (TON) and threshold flavour number (TFN).*

EN ISO 7393-2:2000, *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).*

EN ISO 7887:1994, *Water quality - Examination and determination of colour (ISO 7887:1994).*

EN ISO 7027:1999, *Water quality - Determination of turbidity (ISO 7027:1999).*

3 Terms and definitions

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

3.1
odour
organoleptic attribute perceptible by olfactory organ on sniffing certain volatile substances

[ISO 5492:1992]

3.2
flavour
complex combination of the olfactory, gustatory and trigeminal sensations perceived during tasting. The flavour may be influenced by tactile, thermal, painful and/or kinaesthesic effects

[ISO 5492:1992]

NOTE The term «taste» should not be used to designate the combination of gustatory, olfactory and trigeminal sensations which are designated by the term «flavour». If, in informal language, this term is used in this sense, it should always be associated with a qualifying term, e.g. musty taste, raspberry taste, corky taste.

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3.3
threshold odour number (TON)
dilution ratio of the migration water with the reference water at the same temperature, beyond which this diluted sample does not have any perceptible odour

3.4
threshold flavour number (TFN)
dilution ratio of the migration water with the reference water at the same temperature, beyond which this sample does not have any perceptible flavour

3.5
colour
optical property that causes the changing of the spectral composition of transmitted visible light measured at three wavelengths

[EN ISO 7887:1994, Clause 3]

3.6
turbidity
reduction of transparency of a liquid caused by the presence of undissolved matter

[EN ISO 7027:1999]

3.7
reference water
water described as without any odour, flavour, colour and turbidity

3.8
test water
water used for testing purposes prepared as described in 6.3.2 and 6.3.3

3.9
migration water
test water which has been in contact with a test piece under specified conditions

3.10
blank water
test water which has been kept at the same specified conditions as migration water but without contact with the test piece

3.11
flushing water
tapwater distributed by a public supplier

3.12
disinfection treatment water
water containing chlorine prepared as described in 6.2.2

3.13
testing panel
group of people that carried out the odour /flavour assessment

3.14
storage vessels
tanks, reservoirs, cisterns and their coatings

3.15
ancillary
complete functional unit made up of one or more components (e.g. piping systems, ladders, structural supports, valves, baffles)

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3.16
storage systems
combination of storage vessels and necessary ancillaries

3.17
products
manufactured item in its finished form

3.18
sample
one or more units, or a specified quantity, drawn from a batch or lot, selected at random for inspection, e.g. in a laboratory

3.19
test piece
sample or portion which is conditioned, treated or otherwise prepared to be tested to obtain a single test result

3.20
homogeneous product
product where the water contact surface is made from the same material as the remainder of the product

3.21
non-homogeneous product
product where the water contact surface is made from a material that differs from those comprising the remainder of the product

3.22
factory made product
products made in a factory under controlled conditions as part of the manufacturing process

3.23
site applied product
product manufactured on site (e.g. sealing membranes), or products mixed, applied and cured on site (e.g. coatings, sealants and adhesives)

4 Principle

Following a defined pretreatment procedure including flushing, stagnation with or without disinfection and pre-washing, the surface of the test pieces to be tested, exposed in practice to drinking water, is brought into contact with test waters.

The migration procedure is carried out three times on the same test piece under specified conditions as follows.

Test pieces are put in contact with chlorinated and unchlorinated water for 72 h at 23 °C, or put in contact with unchlorinated water for 24 h at a specified temperature in the range 60 °C to 85 °C.

After this contact the migration water is assessed for colour and turbidity and by a test panel to determine the odour (TON) and flavour (TFN).

Additional information is given in the relevant product standard, system standard or in national regulation concerning:

— the temperature to be used in the test;

— the need for a disinfection pretreatment;

— the need to carry out a 23 °C test, using chlorinated water, for products being tested at elevated temperatures.

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5 Test environment

When testing of odour and flavour, the test environment shall conform to the requirements given in EN 1622.

6 Reagents

6.1 Sodium thiosulfate solution

Sodium thiosulfate solution, comprising a solution of 3,5 g/l of sodium thiosulfate pentahydrate ($Na_2S_2O_3 \times 5H_2O$) analytical grade, stored in the absence of light at a temperature below 10 °C, for a maximum of 4 months.

6.2 Disinfection reagents

6.2.1 Sodium hypochlorite solution

Sodium hypochlorite solution, prepared from a commercial solution of sodium hypochlorite (NaOCl) and having a known concentration of about 0,1 % by mass of free chlorine determined in accordance with EN ISO 7393-2.

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

6.2.2 Disinfection treatment water, shall consist of a batch of reference water (see 6.3.1) with a free chlorine content of (50 ± 5) mg/l as Cl2 after addition of sodium hypochlorite solution (see 6.2.1).

6.3 Waters to be used for testing

6.3.1 Reference water shall be without any perceptible odour or flavour as determined according to EN 1622, and without colour and turbidity.

When a reference water is chlorinated to 1,0 mg/l free chlorine and then dechlorinated after 72 h with sodium thiosulfate, it shall have no perceptible odour, flavour, colour and turbidity.

6.3.2 Test water without chlorine content, shall consist of a batch of reference water (see 6.3.1) used for contact with test pieces and preparation of the blank water.

6.3.3 Test water with chlorine content, shall consist of reference water (see 6.3.1) with a free chlorine content of (1 ± 0,2) mg/l as Cl2 after addition of sodium hypochlorite solution (see 6.2.1).

6.4 Cleaning liquids for apparatus

— non-perfumed biodegradable detergent;

— hydrochloric acid, 2 mol/l (analytical grade);

— nitric acid, 10 % or 1,5 mol/l (analytical grade);

— hydrogen peroxide, 3 % vol/vol (analytical grade).

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7 Apparatus

7.1 Apparatus for migration assessment

7.1.1 The following equipment shall be used:

7.1.2 Vessels, containers, connectors and stoppers, made of materials which do not affect the odour, flavour, colour and turbidity assessment under the specified test conditions such as glass, stainless steel or PTFE.

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.

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

7.2 Apparatus for odour and flavour assessment

7.2.1 The following equipment shall be used:

7.2.2 Erlenmeyer and volumetric flasks, beakers, measuring cylinders, immersion tanks, volumetric pipettes, funnels and stoppers made of glass, PTFE or stainless steel.

7.2.3 Testing vessels, comprising the following glassware (which shall be reserved for odour and flavour assessment only and cleaned separately from other items): testing bottles for odour assessment and testing glasses for flavour assessment conforming to the requirements given in EN 1622.

7.2.4 Water bath or incubator, conforming to the requirements of EN 1622.

7.3 Apparatus for colour and turbidity assessment

7.3.1 The following apparatus shall be used:

7.3.2 Apparatus for colour analysis conforming to the requirements of EN ISO 7887:1994, 6.3.1.

7.3.3 Apparatus for turbidity analysis complying with the requirements of EN ISO 7027:1999, 3.3.

8 Samples and test pieces

8.1 Homogeneous and non-homogeneous factory made and site applied products

8.1.1 Sampling of products shall be performed in accordance with the relevant product standard, system standard or the national regulations when applicable.

8.1.2 Care shall be taken that the transport conditions do not influence the test results.

8.1.3 If it is necessary to store samples before testing, they shall be protected from contamination. If the manufacturer provides written storage instructions they shall be followed.

The samples shall be stored in their original form as delivered.

Where appropriate, storage containers shall be cleaned using the same procedures as are used for the test containers.

8.1.4 If the preparation procedure for a test piece for a particular type of product has not been covered in this standard, deviation from this procedure is allowable under the following conditions:

a) the finished product and the test piece shall be produced in the same manner;

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b) the preparation of test pieces before testing shall include the procedures which are performed in practice before the system is put into operation, e.g. curing and cleaning procedures.

8.1.5 Non-homogeneous products

The test pieces shall be prepared such that only the surface intended to come into contact with drinking water is exposed to the water.

NOTE It may be necessary to seal the cut edges of test pieces.

8.1.6 Ensure that the surface of the test pieces is free from adhesive tape, labels, ink or pencil marks.

8.1.7 The minimum age of the test pieces shall conform to the relevant product standard, system standard or, if not given in such a standard, to that recommended by the manufacturer for the product to be ready for use.

8.2 Samples and test pieces of site applied products

8.2.1 The term site applied products relates to products where the surface in contact with drinking water is produced on site e.g. coatings, linings, paints, sealants and solvent cements.

8.2.2 General requirements

The manufacturer shall provide a copy of the detailed application instructions which accompany the product(s) and covering aspects such as:

— surface preparation;

— mix ratios and method of mixing;

— method of application;

— minimum cure temperature, time and conditions;

— product film thickness;

— associated products, e.g. primers and undercoats.

8.2.3 Test samples shall be prepared by the test laboratory, or under the supervision of the test laboratory by the manufacturer or contractor, in accordance with the manufacturer's written instructions. Where it is found necessary to deviate from these instructions, this shall only be done with the prior agreement of the test laboratory and manufacturer or contractor.

The test laboratory shall keep a detailed written record of sample production and curing conditions.

8.2.4 If specialized equipment is required for site application of a material, then the test samples shall be prepared by a competent contractor under site conditions, e.g. wet surfaces.

8.2.5 Start the test procedure as soon as the curing period specified by the manufacturer is completed.

8.3 Surface-area-to-volume ratio (S/V)

The surface area of the test pieces exposed to the test water shall relate to realistic conditions and are expressed in Tables 1 and 2.

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Table 1 — S/V test ratio for factory made products

Item	**Surface Area/Volume Test Ratio** (dm-1)
Storage vessels	1
Ancillaries	0,4
Adhesives, elastomeric seals	0,2

Table 2 — S/V test ratio for site applied products

Item	**Surface Area/Volume test Ratio** (dm-1)
Reservoir floors, walls and baffles: Paints, linings	0,5
Adhesives and repair systems, primers and sealants	0,2
Water stops, resin anchors, solvent cements, water tightness products	0,1

The surface-area-to-volume ratio, S/V, shall be expressed per decimeter, i.e. dm^{-1} (which is dm^2/dm^3 or dm^2/l);

where

S is the surface area of the test piece in contact with the test water, in square decimeters;

V is the volume of test water in contact with the test piece, in litres.

9 Preparation of reagents and apparatus

9.1 Reference water

9.1.1 Determine that the water conforms to 6.3.1 for odour, flavour, colour and turbidity using the procedure referred to in 12 for odour and flavour and in 13 for colour and turbidity.

9.1.2 If 9.1.1 shows that the water has a perceptible odour, flavour, colour and turbidity then reject this batch of water and use another batch or source of water and check it in accordance with 9.1.1.

9.2 Water with chlorine content

Add a sufficient quantity of sodium hypochlorite solution (see 6.2.1) to the reference water (see 3.7) to give a final free residual chlorine concentration of (1,0 ± 0,2) mg/l as Cl2 when analysed in accordance with EN ISO 7393-2.

9.3 Disinfection treatment water

Add a sufficient quantity of sodium hypochlorite solution (see 6.2.1) to the reference water (see 3.7) to give a final residual chlorine concentration of (50 ± 5) mg/l as Cl2, when analysed in accordance with EN ISO 7393-2.

9.4 Cleaning of the glassware

9.4.1 Clean the glassware to be used, using detergent (see 6.4). Rinse the glassware in reference water (see 3.7) and then clean the inner surface (see 9.4.2).

9.4.2 Clean the inner surface of the glassware with hydrochloric acid (see 6.4) and rinse it in reference water (see 3.7).

NOTE For cleaning stainless steel plates, nitric acid should be used instead of hydrochloric acid.

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If further cleaning of the inner surface is necessary, repeat the cleaning using hydrogen peroxide (see 6.4) followed by rinsing with reference water (see 3.7).

9.4.3 Before use, rinse the glassware at least three times, using reference water (see 3.7).

10 23 °C test procedure

10.1 General

10.1.1 Test pieces may be either factory made products (see 8) or site applied products (see 9).

10.1.2 The following procedures shall be performed at (23 ± 2) °C. for tests at elevated temperature (see Clause 11).

10.1.3 Carry out the procedures in the following sequence: flushing (10.2), stagnation (10.3), pre-washing (10.4), migration (10.5) and finally odour, flavour, colour and turbidity assessment of the migration water (see Clauses 12 and 13 and A.1).

Ensure that surfaces which are not intended to be in contact with drinking water shall not come into contact with the test water during the test.

If it is not possible for laboratory time constraint reasons to carry out the test procedures without a break, the break shall be during the pretreatment procedures. However, the migration periods shall be consecutive and without a break.

10.2 Flushing

Place the test pieces in an appropriate vessel (e.g. a bucket) for (60 ± 5) min, having a water through flow (see 3.11) from the bottom upwards.

NOTE The calculated speed of the water flow with regard to the upper open surface of the vessel needs to be approximately 1 to 3 m/min.

10.3 Stagnation

10.3.1

If disinfection treatment is required, carry out stagnation in accordance with 10.3.2. If not then follow 10.3.3.

10.3.2 Stagnation with disinfection water

10.3.2.1 Immerse the test pieces (from 10.2) using disinfection treatment water (see 3.12) and allow to stand at (23 ± 2) °C for (24 ± 1) h.

10.3.2.2 After this period, discard the disinfection treatment water and carry out pre-washing in accordance with 10.4.

10.3.3 Stagnation without disinfection water

10.3.3.1 Immerse the test pieces (from 10.2) using reference water (see 3.7) and allow to stand at (23 ± 2) °C for (24 ± 1) h.

10.3.3.2 After this period, discard the reference water and carry out pre-washing in accordance with 10.4.

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10.4 Pre-washing

10.4.1 General

Pre-washing shall be carried out in two stages, flushing (see 10.4.2) and rinsing (see 10.4.3).

10.4.2 Flushing

Carry out in accordance with 10.2.

10.4.3 Rinsing

Rinse the test pieces by immersing them three times in reference water (see 3.7). Immediately after completion of the rinsing procedure perform migration procedure in accordance with 10.5.

10.5 Migration

10.5.1 Carry out the following procedure using test water without chlorine (see 6.3.2) and test water with chlorine (see 6.3.3).

10.5.2 Immerse the test pieces using the test waters and allow to stand for (72 ± 1) h at (23 ± 2) °C. At the end of this period, collect the migration waters and immediately assess them for TON, TFN, colour and turbidity in accordance with Clauses 12 and 13.

10.5.3 Repeat 10.5.1 two more times using fresh test waters, ensuring that the test pieces are put in contact with the same type of test water (e.g. without chlorine) for all the three periods.

10.5.4 Carry out the blank test in parallel (see 10.5.2 and 10.5.3), using the same test conditions in order to obtain the blank water (see 3.10).

11 Elevated temperature test procedure

11.1 General

11.1.1 Test pieces may be either factory made products or site applied products (see Clause 8).

Ensure that surfaces which are not intended to be in contact with drinking water shall not come into contact with the test water during the test.

11.1.2 Carry out the procedures in the following sequence: flushing (see 11.2), stagnation (see 11.3), flushing (see 11.4), elevated temperature stagnation (see 11.5), rinsing (see 11.6) and migration (see 11.7) and finally odour, flavour, colour and turbidity assessment of the migration water (see A.2).

11.1.3 Carry out the procedure described in 11.5 (elevated temperature stagnation), in 11.6 (rinsing) and in 11.7 (migration) at the test temperature specified either in national regulations or in referring standards. If this information is not available, perform these steps at 60 °C or 85 °C.

Carry out all other procedures at (23 ± 2) °C.

11.2 Flushing

Carry out in accordance with 10.2.

11.3 Stagnation

Carry out in accordance with 10.3.

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11.4 Flushing

Carry out in accordance with 10.2.

After completion perform the elevated temperature stagnation, in accordance with 11.5.

11.5 Elevated temperature stagnation

11.5.1 Immerse the test pieces using reference water (see 3.7) at the test temperature and allow to stand at the test temperature (see 11.1.3) for (8 ± 0,5) h.

11.5.2 Discard the water and replace with fresh reference water at the test temperature (see 6.3.1) and allow to stand for (16 ± 0,5) h at the test temperature.

11.5.3 Discard the water and perform rinsing in accordance with 11.6.

11.6 Elevated temperature rinsing

Rinse the test pieces (from 11.5) by immersing them three times in reference water (see 6.3.1) at the test temperature. Immediately after completion of the rinsing procedure perform migration procedure in accordance with 11.7.2

11.7 Elevated temperature migration

11.7.1 Carry out the following procedure only using test water without chlorine (see 6.3.2) detailed in 11.1.3.

11.7.2 Immerse the test pieces using the test water (see 6.3.2) at the test temperature and allow to stand for (24 ± 1) h at the test temperature. At the end of this period, collect the migration water and blank water and allow to cool them to 25 °C for TON, TFN, and to the temperature required for colour and turbidity in accordance with Clauses 12 and 13.

11.7.3 Repeat 11.7.2 two more times.

11.7.4 Carry out the blank test in parallel (see 11.7.1 and 11.7.2) using the same test conditions in order to obtain the blank water (see 3.8).

12 Determination of TON and TFN

12.1 If the test has been performed with chlorinated test water, dechlorinate the migration and blank waters with sodium thiosulfate solution (see 6.3.1). 13.2 determine the TON and TFN of each water sample (blank and migration waters) in accordance with EN 1622.

12.2 At the end of the migration period, the blank water may have a slight perceptible odour and/or flavour. If the odour or flavour is found to be abnormal, consider the test invalid and repeat the entire procedure using new test pieces.

13 Determination of colour and turbidity

Determine colour and turbidity of each water sample (blank and migration waters) after each migration period in accordance with Clause 3 of EN ISO 7887:1994 for colour and 3.3 of EN ISO 7027:1999 for turbidity.

14 Expression of results

The results for each migration period shall be expressed:

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— as a threshold odour number and a threshold flavour number as described in EN 1622;

— as a spectral absorption coefficient at three wavelengths for colour according to Clause 3 of EN ISO 7887:1994;

— as FNU for turbidity according to 6.3 of EN ISO 7027:1999.

15 Test report

15.1

The dated test report shall include the following information:

15.2 General information

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

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

— name and address of client;

— description and identification of the test item;

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

— a statement to the effect that the test results relate only to the items tested;

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

15.3 Information on the product

The information on the product shall at least include:

— trade name or designation of manufactured product;

— complete identification; date of receipt of test item;

— details of the test piece preparation;

— the name of the manufacturer of the product, the production place and date and, where relevant, the organisation submitting the sample and, where relevant, the organisation responsible for preparing the samples;

— description of sampling procedure, where relevant.

15.4 Information on the test procedure

The information on the procedure shall include:

— reference to this standard and to the referring standard or national regulation (if applicable);

— dates of start and completion of the test;

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— number of test pieces used together in a migration;

— volume of the test liquid (V) in litres;

— surface area of test piece exposed to the test liquid (S) in square decimetres calculated from the actual dimensions of the test pieces;

— actual S/V ratio;

— disinfection procedure (if applicable);

— source of reference water and details of preparation (if applicable);

— test waters and test temperature;

— any deviation from the test procedure specified in this document;

— any factors which may have affected the results, such as any incidents or any operating details not specified in this document.

15.5 Test results

The test results shall at least include for odour and flavour, the threshold odour number (TON) and the threshold flavour number (TFN) and colour and turbidity for the three migration periods for the chlorinated and unchlorinated migration waters and blank water.

Information relative to the results obtained from EN 1622 including the particular method chosen and the number of test panellists will be given.

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Annex A
(informative)

Schematic presentation of the test method

Figures A.1 and A.2 of this annex show schematically the relation between the different procedures described in this document.

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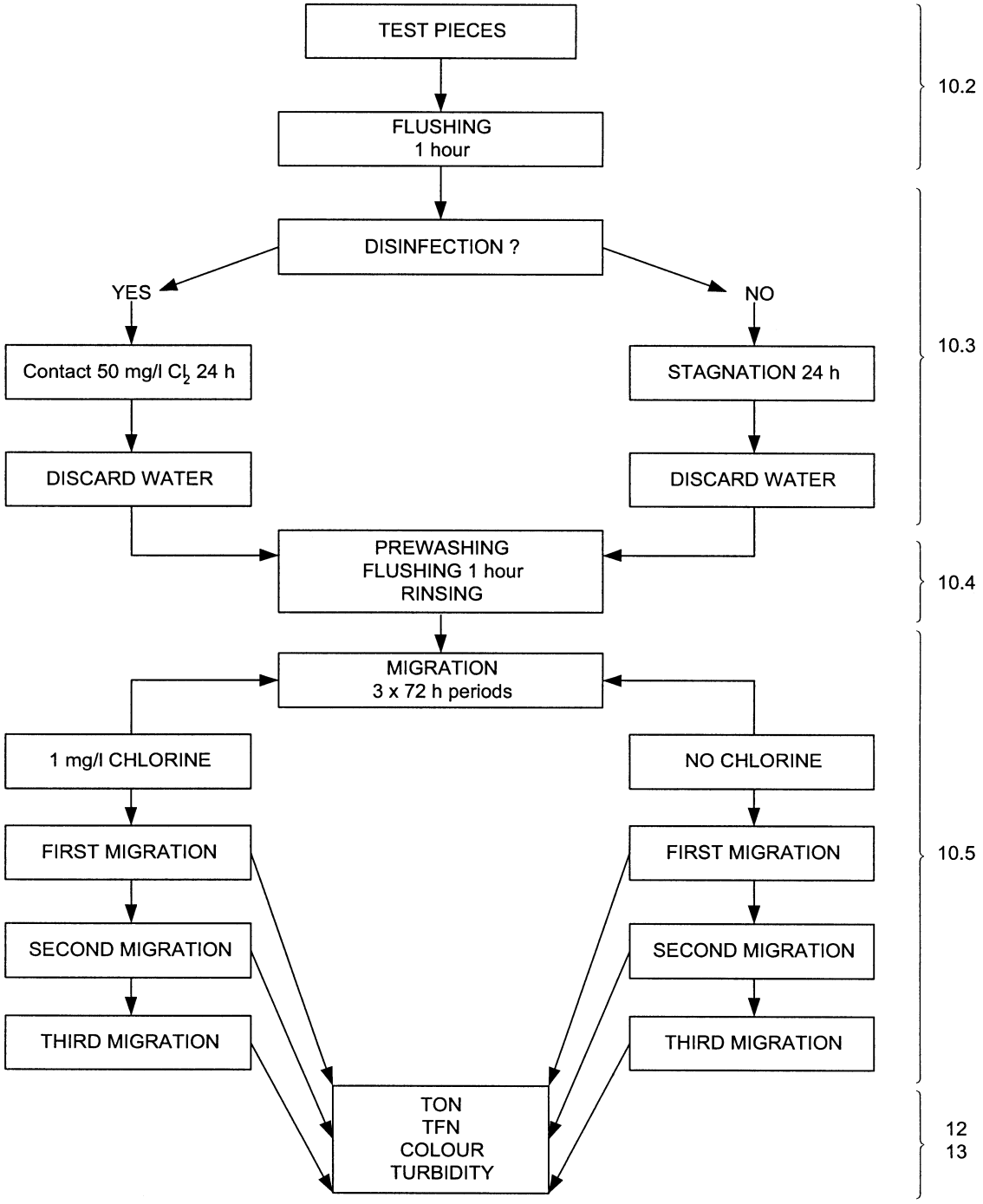

Figure A.1 — Products to be tested at (23 ± 2) °C

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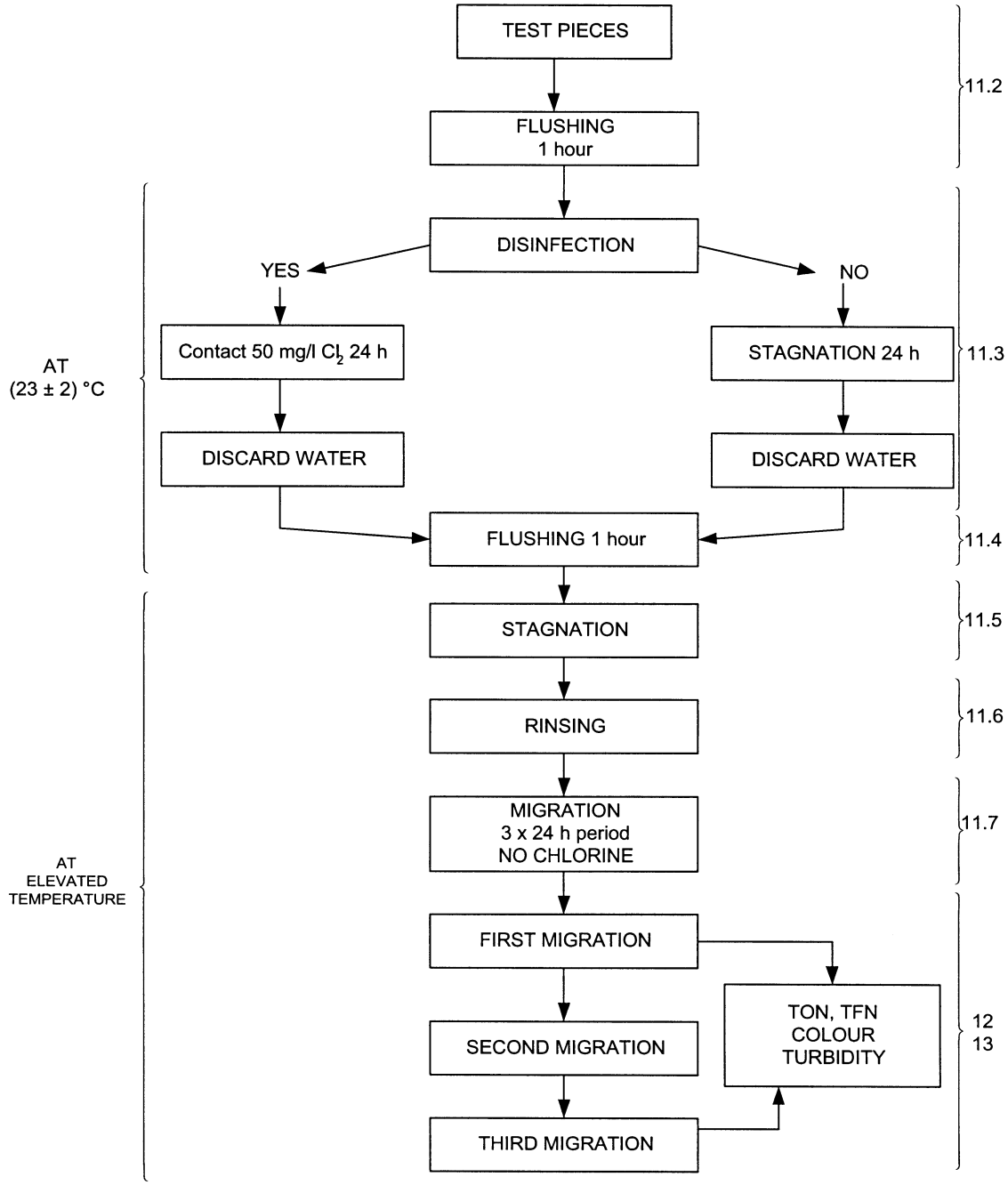

Figure A.2 — Products to be tested at elevated temperatures

Bibliography

[1] ISO 5492:1992, *Sensory analysis - Vocabulary.*

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