SLOVENSKI STANDARD
SIST EN 15664-1:2008+A1:2014

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Vpliv kovinskih materialov na pripravo pitne vode - Dinamično preskuševališče za ocenjevanje izločanja kovin - 1. del: Načrtovanje in delovanje

Influence of metallic materials on water intended for human consumption - Dynamic rig test for assessment of metal release - Part 1: Design and operation

Einfluss metallischer Werkstoffe auf Wasser für den menschlichen Gebrauch - Dynamischer Prüfstandversuch für die Beurteilung der Abgabe von Metallen - Teil 1: Auslegung und Betrieb

Influence des matériaux métalliques sur l'eau destinée à la consommation humaine - Banc d'essai dynamique pour l'évaluation du relargage de métaux - Partie 1 : Conception et fonctionnement

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13.060.20	Pitna voda	Drinking water
67.250	Materiali in predmeti v stiku z živili	Materials and articles in contact with foodstuffs

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EUROPEAN STANDARD

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English Version

Influence of metallic materials on water intended for human consumption - Dynamic rig test for assessment of metal release - Part 1: Design and operation

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This European Standard was approved by CEN on 28 October 2007 and includes Amendment 1 approved by CEN on 12 October 2013.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 15664-1:2008+A1:2013) 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of an identical text or by endorsement, at the latest by May 2014, and conflicting national standards shall be withdrawn at the latest by May 2014.

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.

This document includes Amendment 1 approved by CEN on 12 October 2013.

This document supersedes EN 15664-1:2008.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] ⟨A1⟩.

This European Standard is one of a series of test methods that supports associated product standards.

The standard has been prepared under the mandate given to CEN by the Commission of the European Communities and the European Free Trade Area [A1] *deleted text* ⟨A1⟩.

With respect to potential adverse effects on the quality of water intended for human consumption caused by metallic materials, attention is drawn to the fact that the relevant national regulations remain in force until the adoption of verifiable European acceptance criteria. Water intended for human consumption is hereafter referred to as “drinking water” and means the same as the definition given at Article 2(1) of the Council Directive 98/83/EC on the quality of water intended for human consumption.

This European Standard has been drafted in accordance with the CEN *Internal Regulations, Part 3*.

This European Standard is Part 1 of a series dealing with the test method to determine the release of metals from metallic products into drinking water comprising:

— *Part 1: Design and operation*;

[A1]

— *Part 2: Test waters*. ⟨A1⟩

Part 1 describes a test method to produce contact waters for the assessment of metal release from metallic materials.

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

Introduction

The main application of metallic materials in water supply is within the domestic installation. The test method given in this standard is designed to provide information on metal release over time from metallic materials into drinking water.

The test is based on a programme of alternating periods of once-through flow and stagnation in a rig, simulating the conditions in a domestic distribution system.

The test conditions are more relevant than conditions of continuous through-flow or sit and soak tests and are applicable to all metallic materials in distribution systems.

Internal corrosion of metallic products in water conveying systems generally leads to the build-up of layers, which might or might not be protective. The factors influencing corrosion are described in EN 12502-1. Type and rate of the production of corrosion products and the rate of metal release can depend on:

- characteristics of the metallic material;
- characteristics of the water;
- design and construction;
- pressure testing and commissioning;
- operating conditions and duration of operation.

Corrosion product layers begin to form as soon as a metallic material comes into contact with water. Their properties depend on the factors noted above and for a given water/material combination especially on the operating conditions. It is not possible to reproduce the conditions of an actual installation in tests by constant once-through flow or circulation of water. The flow regime (3.16) used in this test simulates the operating conditions in domestic drinking water installations where stagnation times of water considerably exceed the times of through-flow.

An assessment by testing is possible only if the influence of the flow regime (3.16) and the operation period (3.19) is taken into consideration. A compilation of data are needed, which has been determined under defined conditions over a prolonged period of time. In most cases, metal release decreases with operation time. For some alloying elements and impurities, however, an increase in their release can be observed.

1 Scope

This European Standard specifies a procedure to determine the release of metals from metallic materials used in construction products intended to come into contact with drinking water[1)].

The test can be used for three purposes:

a) assess a material as a reference material for a category of materials using the results of several investigations in different waters covering a broad range of water compositions;

b) assess a material for approval by way of comparative testing;

c) obtain data on the interaction of local water with a material.

2 Normative references

〈A1〉 The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. 〈A1〉

EN 1484, *Water analysis — Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC)*

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

EN 12502-1:2004, *Protection of metallic materials against corrosion — Guidance on the assessment of corrosion likelihood in water distribution and storage systems — Part 1: General*

EN 25813, *Water quality - Determination of dissolved oxygen — Iodometric method (ISO 5813:1983)*

EN 25814, *Water quality — Determination of dissolved oxygen — Electrotechnical probe method (ISO 5814:1990)*

EN 27888, *Water quality — Determination of electrical conductivity (ISO 7888:1985)*

EN ISO 6878, *Water quality — Determination of phosphorus — Ammonium molybdate spectrometric method (ISO 6878:2004)*

EN ISO 8044:1999, *Corrosion of metals and alloys — Basic terms and definitions (ISO 8044:1999)*

〈A1〉 EN ISO 9963 (all parts), *Water quality — Determination of alkalinity (ISO 9963, all parts)* 〈A1〉

EN ISO 10304-1, *Water quality — Determination of dissolved fluoride, chloride, nitrite, orthophosphate, bromide, nitrate and sulphate ions, using liquid chromatography of ions — Part 1: Method for water with low contamination (ISO 10304-1:1992)*

EN ISO 11885, *Water quality — Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy (ISO 11885:1996)*

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1) Water intended for human consumption is referred to as "drinking water" and means the same as the definition given at Article 2(1) of the Council Directive 98/83/EC on the quality of water intended for human consumption. Luxembourg, Office for Official Publications of the European Communities. 3 November 1998.

EN ISO 14911, *Water quality — Determination of dissolved Li+, Na+, NH4+, K+, Mn2+, Ca2+, Mg2+, Sr2+ and Ba2+ using ion chromatography — Method for water and waste water (ISO 14911:1998)*

EN ISO 15586, *Water quality — Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003)*

〉A1〈 EN ISO 17294 (all parts), *Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) (ISO 17294, all parts)* 〉A1〈

ISO 6058, *Water quality — Determination of calcium content — EDTA titrimetric method*

ISO 6059, *Water quality — Determination of the sum of calcium and magnesium — EDTA titrimetric method*

ISO 9297, *Water quality — Determination of chloride — Silver nitrate titration with chromate indicator (Mohr's method)*

ISO 9964-3, *Water quality — Determination of sodium and potassium — Part 3: Determination of sodium and potassium by flame emission spectrometry*

ISO 10523, *Water quality — Determination of pH*

3 Terms and definitions

For the purposes of this 〉A1〈 document 〉A1〈 the terms and definitions given in EN ISO 8044:1999, EN 12502-1:2004 and the following apply.

3.1
test rig
assembly of test lines, control lines and where necessary reference lines together with test water inlet and discharge arrangements, see Annex A, Figure A.1

3.2
line
continuous part between a check valve and the corresponding flow regulator

3.3
control line
line containing a single length of pipe made of an inert material for the purposes of the test

3.4
test line
line containing test pieces or a test pipe

3.5
reference line
line containing test pieces each made of the same reference material or line containing a single length of pipe made of a reference material

3.6
dummy lines
pipes made of an inert material for the purposes of the test used for the conditioning run of a newly built test rig

3.7
test pipe
specimen that is representative of a construction product in the form of a pipe for use with drinking water in terms of material composition and surface characteristics

3.8
test piece
specimen that is representative of a construction product, which is not a pipe, for use with drinking water in terms of material composition, see Annex A, Clause A.2

3.9
category
group of materials with the same metal release characteristics in respect of their application in products and behaviour in contact with drinking water

3.10
reference material
metallic material of a tightly defined composition for which the characteristics of metal release into drinking water are known and reproducible, and are accepted for a category

3.11
surface characteristics
aspects of the surface of a product exposed to the water, which are derived from the production process

3.12
local water
water from a particular supply zone

3.13
test water
water used for testing purposes

3.14
contact water
test water which has been in contact with a test line

3.15
control water
test water which has been in contact with the control line

3.16
flow regime
consecutive alternating periods of flow, at a given flow rate, and stagnation of the test water in the test rig

3.17
representative water sample
continuous column of water in the test line containing released corrosion products from the test pieces or test pipe uninfluenced by the remainder of the test rig

3.18
fractional sampling
method used to check the proper hydraulic function of the rig and to determine the representative volume of the water samples

3.19
period of operation or operation period
T
period of time, expressed in weeks, during which the flow regime is operated for a particular test

3.20
stagnation time
t
period of time, expressed in hours, when the test water is static in the test rig

3.21
run-time curve
graphical representation of the relationship between the mean of the metal concentration arising from the sampling plan, *MEP(T)*, or of the concentration after 4 hours of stagnation, over the period of operation (*T*)

3.22
stagnation curve
graphical representation of the relationship between the measured metal concentration and the length of the stagnation time (*t*) at a given period of operation (*T*)

4 Principle

Test pieces or test pipes of a material of defined geometry and given surface characteristics are installed in a test rig which is operated for a period of time under controlled conditions of water quality, temperature and flow regime.

Water samples are taken at specified operation periods after specified stagnation times throughout the whole of the test and analysed for the concentrations of relevant metals.

5 Test rig

5.1 General

The test rig shall be constructed in accordance with Annex A in addition to the requirements given in this clause.

A test rig shall have: one line for control purposes (5.3); three identical test lines for each material submitted for testing as set out in 5.4; and three identical reference lines (see 5.5) for comparative testing.

With the exception of the materials under test, all materials used in the test rig that come into contact with the test water shall be inert for the purposes of the test.

Precautions shall be taken to ensure there is no transformation or contamination of the surface of test pieces or pipes during preparation for installation or during the installation itself.

The materials for testing shall be in the form of pipes or test pieces. Where the material used for testing is intended to be used for pipes and other applications, it shall be tested as a pipe.

5.2 Test rig arrangement

The test rig shall be arranged in the following way for the relevant purpose:

- Assess a material as a reference material for a category of materials the test rig shall comprise three test lines made up of the material under examination and a control line. The rig shall be operated in several different waters covering a broad range of water compositions (see Part 2 of this standard).

- For comparative testing of materials the test rig shall comprise three test lines containing the material under examination, three reference lines containing the reference material for the category of the material under test and a control line. The rig shall be operated with one test water defined in Part 2 of this standard.

- Obtain data on the interaction of local water with a material the rig shall comprise three test lines made up of the material under examination and a control line. The rig shall be operated with the local water in question. This would include, for example, the effect of water treatment on the metals under examination.

5.3 Control line

The line for control purposes shall contain a single length of pipe made of stainless steel conforming to EN 10088-1, material no. 1.4401. The pipe shall have an inner diameter of (13 ± 1) mm.

5.4 Test lines

5.4.1 General

A test rig shall have three identical test lines for each material.

5.4.2 Materials in the form of pipes

Each line shall include a single length of test pipe as shown in Annex A, Figure A.3. Pipes shall have an inner diameter of (13 ± 1) mm. Where this diameter is not available then the next larger commercially available size shall be used.

The test pipes shall be marked with the name of the manufacturer, identification of the material and the date of manufacture.

When testing pipes by comparative testing, the inner pipe diameter shall be the same for both the candidate material and the reference material.

5.4.3 Materials in the form of test pieces

Each test line shall consist of five test pieces connected by pipes as shown in Annex A, Figure A.2. All five test pieces in one test line shall be representative of one material. The internal surface which is exposed to the test water shall have a length of (100 ± 1) mm and a diameter of (17 ± 0,3) mm. The sections of pipe and the pipe connections between the individual test pieces shall be of stainless steel, conforming to EN 10088-1, material no. 1.4401. Pipes shall have an inner diameter (13 ± 1) mm. Connecting pieces shall be in the form defined in Annex A. The test pieces and the pipe sections shall be equi-potentially bonded.

The test pieces shall be marked with the name of the manufacturer, identification of the material and the date of manufacture.

5.5 Reference lines for comparative testing

When the test rig is used for comparative testing it shall contain reference lines in addition to the test lines (see 5.4.2 and 5.4.3):

- three reference lines when testing materials in the form of pipes;
- three reference lines each containing five test pieces made of the reference material, when testing materials for other forms.

6 Operating conditions

6.1 General

The test rig shall be operated at a room temperature of (20 ± 5) °C and shall not be thermally insulated. Temporary deviations of the temperature shall be recorded. The water supply shall be able to maintain a supply pressure of at least 3 bar over the whole period of the test. The test water shall have a pressure between 3 bar and 5 bar upon entering the test rig.

For a newly built test rig, conditioning (6.2) and fractional sampling (6.3) shall be carried out before using it for testing. After changes of the test rig, which may influence its hydraulic properties, repeat fractional sampling.