SLOVENSKI STANDARD
oSIST prEN 16056:2010

01-junij-2010

Vpliv kovinskih materialov na pripravo pitne vode - Metoda za ovrednotenje pasivnega vedenja nerjavnih jekel

Influence of metallic materials on water intended for human consumption - Method to evaluate the passive behaviour of stainless steels

Einfluss metallischer Werkstoffe auf Wasser für den menschlichen Gebrauch - Verfahren zur Ermittlung des Passivverhaltens von nichtrostenden Stählen

Influence des matériaux métalliques sur l'eau destinée à la consommation humaine - Méthode d'évaluation du comportement passif des aciers inoxydables

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ICS:

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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English Version

Influence of metallic materials on water intended for human consumption - Method to evaluate the passive behaviour of stainless steels

Einfluss metallischer Werkstoffe auf Wasser für den menschlichen Gebrauch - Verfahren zur Ermittlung des Passivverhaltens von nichtrostenden Stählen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 164.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Foreword

This document (prEN 16056:2010) has been prepared by Technical Committee CEN/TC 164 “Water supply”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This European Standard is one of a series of test methods which support 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 and supports essential requirements of the relevant EU Directives.

With respect to the 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 of a series dealing with the test method to evaluate the influence of metals on drinking water:

— *Part 1: Dynamic Rig Test – Design and operation*;

— *Part 2: Dynamic Rig Test – Test waters;*

— *Part 3: Dynamic Rig Test – Guidance on interpretation of results*[1)] ;

— *Determination of residual surface lead (Pb) — Extraction method;*

— *Method to evaluate the passive behaviour of stainless steels* (this standard).

This document describes the method to evaluate the passive behaviour of stainless steels in contact with water. The passive layer is the cause for the negligible release of metal ions from stainless steels into the drinking water.

1) Not yet registered as an active project.

Introduction

The test methods in this series are designed to provide information on metal release over time from metallic materials into drinking water.

When tested in a test rig as described in EN 15664-1 stainless steels show very low metal release rates and the resulting metal concentrations in the water are in most cases below the detection limits of available analytical instruments. The reason for these small metal release rates is the formation of a passive layer on the surface of stainless steels.

It was therefore decided to test stainless steels for the properties of the passive layer and not metal release. The material under consideration is tested in an electrochemical test. For verification of the correct performance of the test protocol, the test is also performed in parallel on material 1.4404 for which the relevant data are well known.

This test is terminated when the pitting potential of the material or the break-through potential is reached.

1 Scope

This European Standard specifies a procedure to evaluate the passive behaviour of stainless steels used in construction products intended to come into contact with drinking water.

The passive state of stainless steels is the reason why no relevant amounts of metals are released from these materials into the drinking water. This test is used to verify whether the stainless steel under consideration is passive under conditions which can occur in drinking waters.

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 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 15664-1:2008, *Influence of metallic materials on water intended for human consumption — Dynamic rig test for assessment of metal release — Part 1: Design and operation*

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

EN-ISO 17475:2008, *Corrosion of metals and alloys – Electrochemical test methods — Guidelines for conducting potentiostatic and potentiodynamic polarization measurements*

3 Terms and definitions

For the purposes of this document the terms and definitions given in EN-ISO 8044:1999, EN 12502-1:2004 and EN 15664-1:2008 apply.

4 Test cell

The test equipment shall be used as described in EN-ISO 17475. The test cell shall be constructed according to EN-ISO 17475, Annex A, flushed port cell. To ensure that the salt concentration remains constant during the test, the test cell shall be modified according to the scheme shown in Figure 1. This modification allows the chloride content to remain constant despite the addition of the deionised water by adding a solution with 440 mg/l chloride with the same pumping rate. The overflow system is necessary due to the long testing time and the continuous addition of deionised water and chloride solution.

Depending on the geometry of the material and the test samples, it may be necessary to alter the geometry of the test cell base. If this is the case, it is important that a crevice-free sealing is made to ensure that only pitting corrosion is induced in this test cell.

The exposed surface of the material to be tested shall be 5 cm² to 10 cm².

The pumping rate for the deionised water and the concentrated chloride solution (440 mg/l, see Figure 1) shall be adjusted to 6 ml/h to 8 ml/h.

Test solution is in contact to air and agitated.

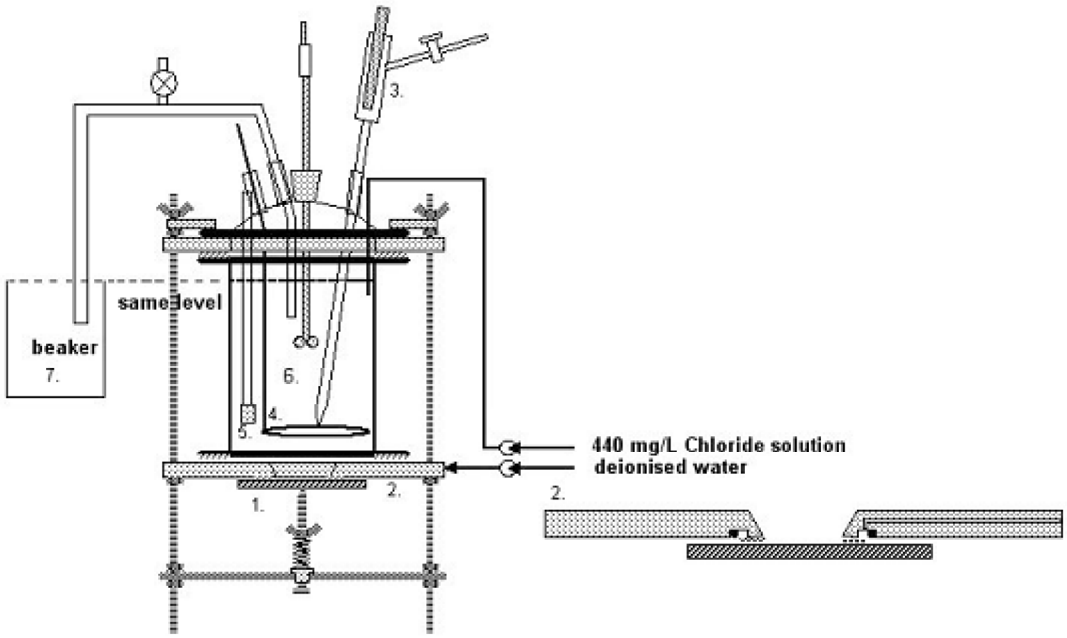

Figure 1 — Scheme of test set-up for slow polarisation test

1- Test specimen

2- Flush-port plate

3- Reference electrode

4- Counter electrode

5- Gas supply

6- Stirrer

7- Breaker for overflow

5 Test water

Prepare the test water by dissolving sodium chloride p.a. in deionised water (conductivity < 1 mS × m^{-1}) to give a chloride concentration of 220 mg/l.

6 Sample Preparation

The test samples shall, if available, be taken from sheet or plate material and have dimensions of about 50 mm × 50 mm corresponding to the size of the sample holder of the electrochemical cell used. Any other material shape may be used if the appropriate size of sample can be machined.

Test samples shall be marked for identification on the rear surface of each.

Mount the test pieces, using double-sided adhesive tape, on a sample holder and grind under flowing water using successively finer SiC paper starting grade 80 and finishing grade 320. Rinse the test pieces under flowing water and turn 90 degrees when changing to the next finer grade of SiC paper in accordance with

standard grinding procedures.

After grinding, degrease and clean the test pieces as follows. Immerse the test pieces for 10 minutes in an alkaline detergent (e.g. RBS detergent) in an ultrasonic bath at (50±5) °C, rinse with deionised water (conductivity < 1 mS × m^{-1}) and then with ethanol. Finally dry with pressurized grease-free air.

If the above preparation procedure results in exposure of sensitive areas (e.g. cut areas which will not be in contact with drinking water during service but may contain precipitations which influence the corrosion behaviour) in the material that are irrelevant to practical use, an adapted preparation method may be applied, provided the requirements for grinding and cleaning are fulfilled.

NOTE Such an adaptation may be needed for odd geometries like rods or cast products.

Start the test immediately after the surface preparation.

7 Test procedure

The tests shall be performed at (25 ± 2) °C.

Measure the free corrosion potential at the beginning of the test. Time for stabilisation is 60 min.

Start slow polarisation with a potential of U_H = 250 mV. Slow polarisation shall proceed in the anodic direction, either with a stepwise increase of the potential 25 mV/1,5 h or with a constant polarisation rate in the range between 17 mV/h and 36 mV/h.

Continuously record the potential and current.

Terminate the test when the current density remains stable above 30 µA/cm² and the material does not repassivate.

Examine the sample after demounting. If the sample suffered from crevice corrosion (see EN-ISO 8044), the test results shall be rejected.

Check the chloride content of the test water after the test. If it is not in the range (220 ± 25) mg/l the results of the test must be rejected and the test repeated.

Perform the test in triplicate for material 1.4404 and for the material under consideration.

8 Evaluation of test results

The results of the tests shall be provided as current density versus potential curves for all single tests (as shown in Figure 2 and 3).

From these curves the pitting potential (or the break-through potential if the material does not suffer from pitting corrosion) shall be evaluated. For the purpose of this standard the pitting potential is defined as the potential at which the current density exceeds 10 µA/cm².

The pitting potentials with reference to the standard hydrogen electrode (U_{SHE}) shall be reported as single values and in form of arithmetic average for material 1.4404 and the material under consideration.

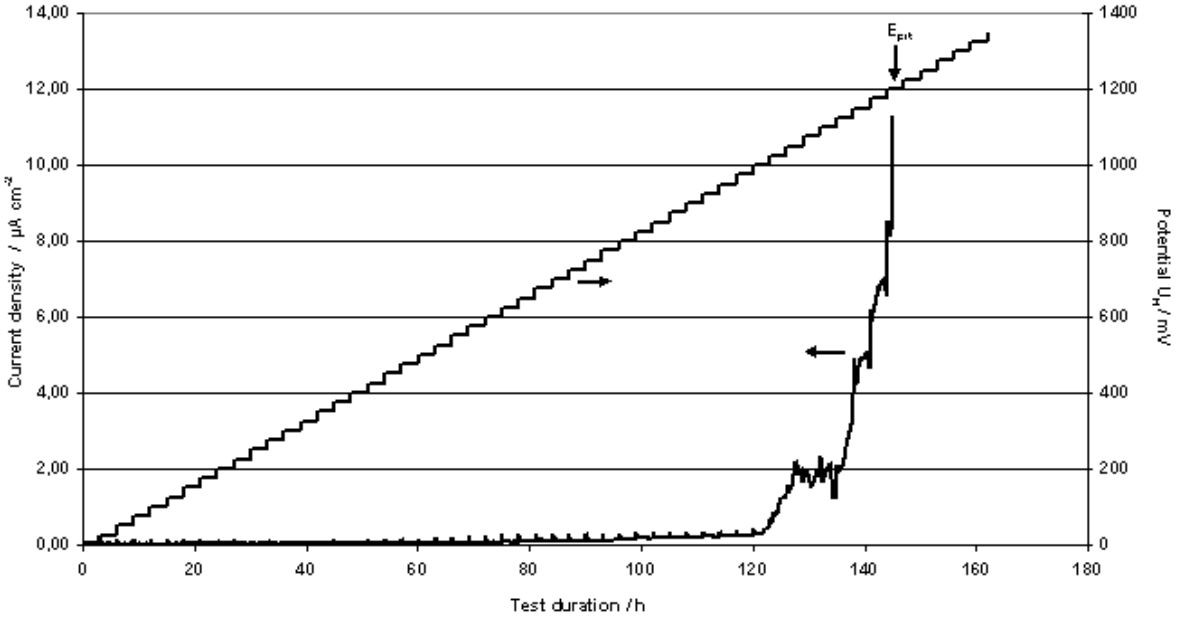

Figure 2 — Scheme of a current density versus potential curve (stepwise increase of potential)

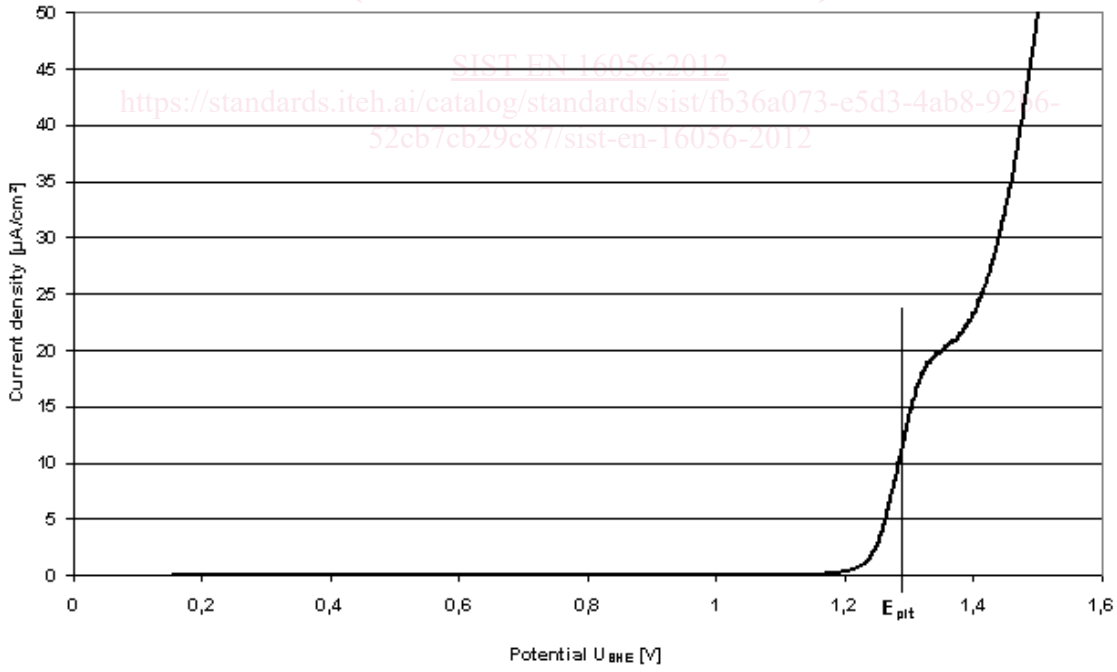

Figure 3 — Scheme of a current density vs. potential curve (constant polarisation rate)