BS EN 16058:2012

BSI Standards Publication

Influence of metallic materials on water intended for human consumption — Dynamic rig test for assessment of surface coatings with nickel layers — Long-term test method

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 16058:2012.

The UK participation in its preparation was entrusted to Technical Committee EH/6, Effects of materials on water quality.

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.

ISBN 978 0 580 69831 6

ICS 67.250

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2012.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16058

May 2012

ICS 67.250

English Version

Influence of metallic materials on water intended for human consumption - Dynamic rig test for assessment of surface coatings with nickel layers - Long-term test method

Influence des matériaux métalliques sur l'eau destinée à la consommation humaine - Banc d'essai dynamique pour l'évaluation des revêtements de surface ayant des couches de nickel - Méthode d'essai à long terme

Einfluss metallischer Werkstoffe auf Wasser für den menschlichen Gebrauch - Dynamischer Prüfstandversuch für die Beurteilung von Oberflächenbeschichtungen mit Nickelschichten - Langzeit-Prüfverfahren

This European Standard was approved by CEN on 13 April 2012.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, 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, Turkey and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16058:2012: E

Contents

Page

Foreword

This document (EN 16058:2012) 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 November 2012, and conflicting national standards shall be withdrawn at the latest by November 2012.

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

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.

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, 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

Contact between metallic materials and drinking water can cause metal release to the water. Metal released from product surfaces in contact with drinking water is caused by corrosion of any metal films or layers present on the products and the bulk material.

Metal release from the bulk material depends on the composition of the material. The bulk material can release metals for a long period. This long term behaviour depends on the formation of protective layers of corrosion products on the surface of the material. It is possible to test materials to assess their behaviour in releasing metals from the bulk material (EN 15664-1 and -2) so that products made of accepted materials do not have to be tested for this characteristic.

The metal release from metal layers due to coating or other production processes depends on the characteristics of those processes. Therefore products must be tested for metal release due to the presence of films or layers on the surface of products.

The test method given in this standard is designed to provide information on nickel release over time from surfaces of products having a coating containing nickel which are in contact with drinking water. This nickel coating may be added intentionally or part formed unintentionally i.e. it might appear due to electrostatic conditions in the process. For testing nickel release caused by the bulk material the test procedure according to EN 15664-1 and -2 is required.

This test is based on EN 15664-1, *Influence of metallic materials on water intended for human consumption — Dynamic rig test for assessment of metal release — Part 1: Design and operation*. It includes alternating periods of once-through flow and stagnation in a rig, simulating the conditions in a domestic distribution system.

For the commonly used chrome plating process of sanitary tap ware, preliminary research indicates that the water composition does not significantly influence the release of nickel from such surface nickel layers. The use of this method in product testing might give more information about the influence of water composition.

If this test method is used to measure the release of other metals it must be taken into account that the water composition has a strong influence on the results.

1 Scope

This European Standard specifies a procedure to determine the release of nickel from nickel layers or a coating containing nickel on inner surfaces of products which are intended to come into contact with drinking water[1)].

2 Normative references

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

EN 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 (ISO 8044:1999)*

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 the following apply.

3.1
test rig
assembly of a number of test lines and one control line

Note 1 to entry: See Clause 5 and Annex A, Figure A.1.

3.2
line
for a test rig equipped with end point device products: Continuous part between a check valve and the free outlet(s)

for a test rig equipped with in-line devices products: Continuous part between a check valve and the corresponding flow regulator

3.3
test line
line containing one product for end point devices or up to five products for in-line devices

3.4
control line
line containing a single length of pipe made on an inert material for the purposes of the test

3.5
dummy line
pipe made of an inert material for the purpose of the test used for the conditioning run of a newly built test rig

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.

3.6
product
product as manufactured with the process parameters which are used in normal production

3.7
end point device
product used to control the flow of water and releasing it to the atmosphere

EXAMPLES Taps for kitchen and wash basins.

3.8
in-line device
product used in a drinking water system that is not a tube or pipe, e.g. valve used to control the flow of water in an installation system but not dispensing to atmosphere

EXAMPLE Ball valves.

3.9
local water
drinking water from a particular supply zone

3.10
test water
water used for testing purposes

Note 1 to entry: See 7.1.

3.11
contact water
test water which has been in contact with a test line

3.12
control water
test water which has been in contact with a control line

3.13
flow regime
consecutive alternating periods of flow, at a given flow rate, and stagnation of the test water in the test rig

3.14
representative water sample
volume of water in the test line containing metals released from the product(s) to be tested

3.15
period of operation or operation period *(T)*
period of time during which the flow regime is operated for a particular test

Note 1 to entry: Time is expressed in weeks.

3.16
stagnation time (*t*)
period of time when the test water is static in the test rig

Note 1 to entry: Time is expressed in hours.

3.17
run-time curve
graphical representation of the relationship between the concentration after 4 hours of stagnation, over the period of operation (*T*)

4 Principle

Representative samples of endpoint and inline devices to be tested are installed in a test rig which is operated for 26 weeks under controlled conditions of water quality, temperature and flow regime.

Water samples are taken at specified operation periods after 4 h stagnation time throughout the whole of the test and analyzed for the nickel concentrations.

The products for testing shall be representative for the products intended to be placed on the market. If the same product might come from several manufacturing (plating) operations samples of each plant shall be tested.

5 Test rig

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

For in-line devices, a total of fifteen representative samples of the product to be tested shall be installed in a minimum of three test lines of a test rig (see Figure A.1).

For endpoint devices, five test lines each containing one representative sample of the product to be tested shall be installed in a test rig (see Figure A.2).

In addition to the test lines one control line shall be installed and operated in the same way as the test lines.

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

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

End point devices: where there are hoses or pipes for cold and hot water inlets, both shall be fed with the test water. The valves shall be set to fully open in mixed water position for the duration of the test.

In-line devices: where these are valves e.g. ball valves, they shall be set in half-open position. Other adjustable products shall be set accordingly or to a partially open position.

The product samples shall be marked so that each sample can be identified. The manufacturer shall also disclose the standard operating conditions and range of process parameters of the complete plating process.

6 Operation

6.1 General

The test rig shall be operated for 26 weeks under controlled conditions of water quality, temperature and flow regime. It 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 temperature of the test water shall be in the range from 10 °C to 25 °C. The test water supply shall be able to maintain a supply pressure of at least 1.5 bar over the whole period of the test.

The regular daily operation of the test rig shall be automatically controlled in accordance with the flow regime shown in EN 15664-1:2008, Annex B, Table B.1. The flow rate shall be (5 ± 0,5) l/min.

For a newly built test rig, conditioning (6.2) and for in-line devices fractional sampling according to EN 15664-1 shall be carried out before using it for testing.

6.2 Conditioning

A newly built rig shall be operated for a minimum of one week using free outlets for end point devices or dummy lines for in-line devices instead of product samples in order to test the proper function of the components used and to flush the system.

7 Test water

7.1 General

The test water used for testing shall be a local drinking water.

7.2 Check of test water

The test water shall be checked upstream of the test rig. The nickel concentration of the test water shall be less than 10 µg/l.

During the test period, the parameters of the test water listed in EN 15664-1:2008, Annex C, shall be measured and recorded:

- Parameters pH, conductivity, temperature and dissolved oxygen shall be measured and recorded at least four times per day, e.g. by automatic recording.

- Other parameters listed in EN 15664-1:2008, Annex C shall be measured with the frequency as defined in the table in EN 15664-1:2008, Annex C.

8 Sampling

8.1 General

Water samples shall be taken for:

– analysis of test water composition (see Clause 9 and EN 15664-1:2008);

– analysis of nickel concentration in the stagnation water (see Clause 9).

Test lines shall not be emptied as a result of sampling.

Water samples for the analysis of metals shall be acidified to a pH < 2.

Short term interruption (less than three days) of the flow regime due to maintenance or problems shall be permitted without invalidating the test. Water samples, however, shall not be taken within five days following restart. Any interruption in the test shall be reported in the test report (see Clause 11) together with a justification or explanation.

8.2 Test water sampling

For the analysis of test water, samples shall be taken from the sampling point at the entry of the test rig (see Annex A, Figure A.1. and Figure A.2) after flushing.

8.3 Sampling to determine metal release

At weekly intervals, starting at the 3rd day of operation, water samples shall be taken in accordance with EN 15664-1:2008, from each test line after 4 h (± 5 min) stagnation time.

During the sampling procedure the flow rate shall be (5 ± 0,5) l/min (turbulent flow).

8.4 Sampling volumes

For end point devices the volume of the representative water sample shall be the first (500 ± 50) ml.

For in-line devices the volume of the representative water sample shall be determined according to EN 15664-1:2008, 6.3.

9 Analysis

Analyse the test water, contact water and control water using the measurement methods specified in EN 15664-1:2008, Table C.1.

NOTE General guidance on analytical performance requirements such as detection limits and accuracy is contained in ENV ISO 13530.

10 Expression of results

10.1 Nickel concentration calculation for end point devices

For each individual test line (*n*) with end point devices, at every operating time (*T*), calculate the nickel concentration as follows:

$$c_n^*(T) = \left[c_n(T) - c_{CL}(T)\right] \frac{V_{S,n}}{V_{ref}}$$

where

$c_n^*(T)$ is the nickel concentration per liter corrected by subtraction of blind value and normalized to a water sample volume of 1000 ml for line *(n)*;

$c_n(T)$ is the nickel concentration in the water sample taken from the individual test line (*n)*;

$c_{CL}(T)$ is the nickel concentration in the water sample taken from the control line *CL*;

$V_{S,n}$ is the volume of the water sample in mL taken from test line n;

V_{ref} is the reference volume of 1000 ml.

For the condition:

n: number of the test line (n=1, 2 , 3, 4 or 5)

When $\boldsymbol{c_{CL}(T)}$ is lower than the quantification limit of the analysis then:

$$c_n^*(T) = c_n(T) \frac{V_{S,n}}{V_{ref}}.$$

Any negative result shall be reported as below quantification limit.

10.2 Nickel concentration calculation for in-line devices

For each individual test line (*n*) with in-line devices, at every operating time (*T*), calculate the nickel concentration as follows:

$$c^{*}_{EP,n}(T) = \left[c_n(T) - c_{CL}(T)\right] \frac{V_{S,n}}{V_{TS}}$$

where

$c^{*}_{EP,n}(T)$ is the equivalent pipe concentration corrected by subtraction of blind value for line *(n)*;

$c_n(T)$ is the nickel concentration in the water sample taken from the individual test line (*n)*;

$c_{CL}(T)$ is the nickel concentration in the water sample taken from the control line *CL*;

$V_{S,n}$ is the volume of the water sample taken from test line *(n)* in ml;

V_{TS} is the volume of the water in the test samples installed in the test line in ml.

For the condition:

n: number of the test line (n=1, 2 , 3, …)

when

$c_{CL}(T)$ is lower than the quantification limit of the analysis then

$$c^{*}_{EP,n}(T) = c_n(T) \frac{V_{S,n}}{V_{TS}}.$$

Any negative result shall be reported as below quantification limit.

10.3 Mean concentration after a given period of operation (T)

Calculate the arithmetic mean and the standard deviation of the nickel concentrations of the different test lines.

10.4 Presentation of results

The individual values shall be tabulated.

For each test line, the nickel concentrations after 4h-stagnation according to 10.1 for end point devices or 10.2 for in-line devices shall be plotted over the period of operation (T) (see Annex B).

11 Test report

The test report shall contain:

a) name and address of the test institute;

b) name(s), function(s) and signature(s) or equivalent identification of person(s) authorising the test report;

c) registration mark or number of the test report;

d) name and address of the customer and/or producer of the tested material;

e) name and address of the manufacturer and the plating plant;

f) number of this standard and year of its publication;

g) description of products under test;

   1) cross sectional and dimensional drawing of the tested products;

   2) detailed description of the process and the parameters of the plating process;

   3) production date and specific storing conditions;

h) dates of starting and finishing rig testing;

i) relevant testing conditions;

   1) water source;

   2) test water analysis during the testing period (see EN 15664-1:2008, Annex C);

   3) graphs of the following test water parameters against the operating period, *T*, for the whole testing period:

      i) temperature;

      ii) conductivity;

      iii) alkalinity;

      iv) pH-value;

      v) oxygen;

      vi) TOC;

   4) graph of room temperature against the operating period, *T*, for the whole testing period;

j) description of any deviations from the specified procedure;

k) specification of the analytical devices used and their detection limits;

l) test results according to Clause 10;

m) date of report and signature.

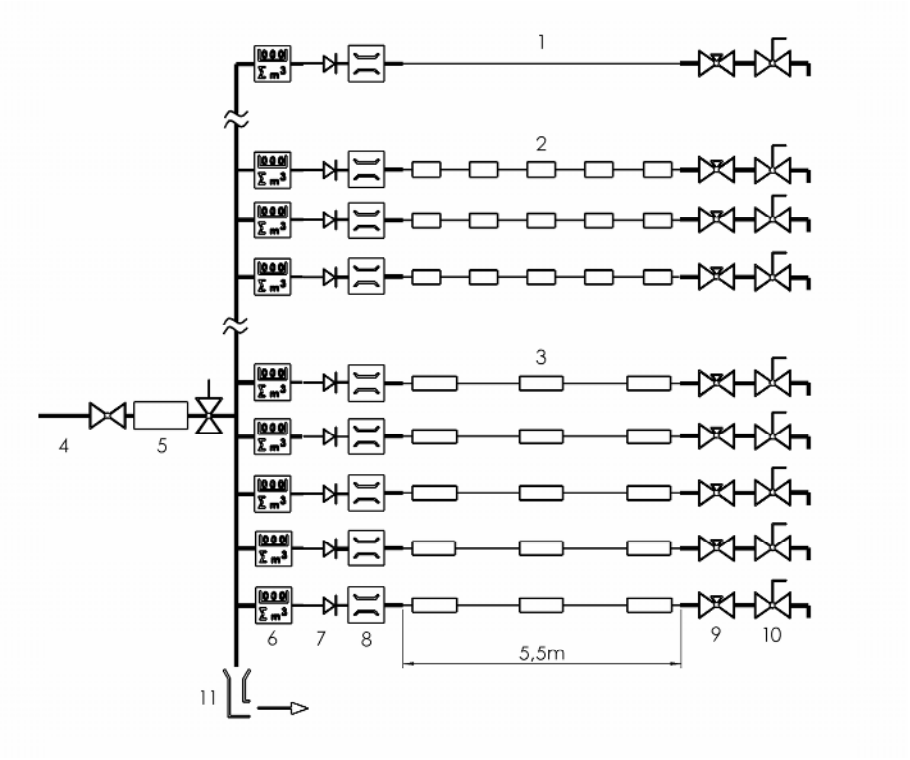
Annex A
(normative)

Test rig components and assembly — Test rig

The test rig shall be set up as shown in Figure A.1 for in-line devices and Figure A.2 for end point devices. Check valves shall be provided in order to prevent interferences between test and control lines and vice versa.

The shut-off time of the outlet valves shall be in the range of 50 ms to 100 ms.

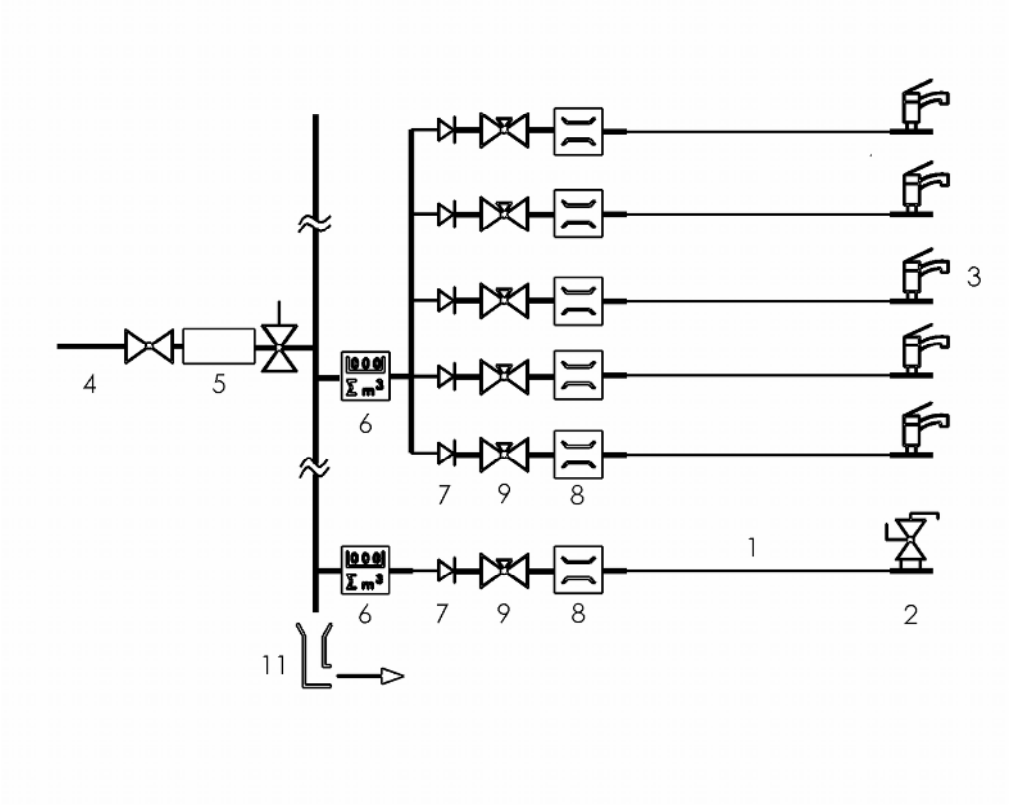
For in-line devices the flow regulator shall be at the outlet of the test lines and for end point devices the flow regulator shall be at the inlet connection of the test line.



Key

1	control line	7	check valve
2	3 test lines with 5 samples	8	flow meter (optional)
3	alternatively: 5 test lines with 3 samples	9	flow regulator
4	test water inlet	10	outlet valve
5	filter	11	inlet test water sampling point
6	water meter		

Figure A.1 — Schematic of test rig for testing in-line devices



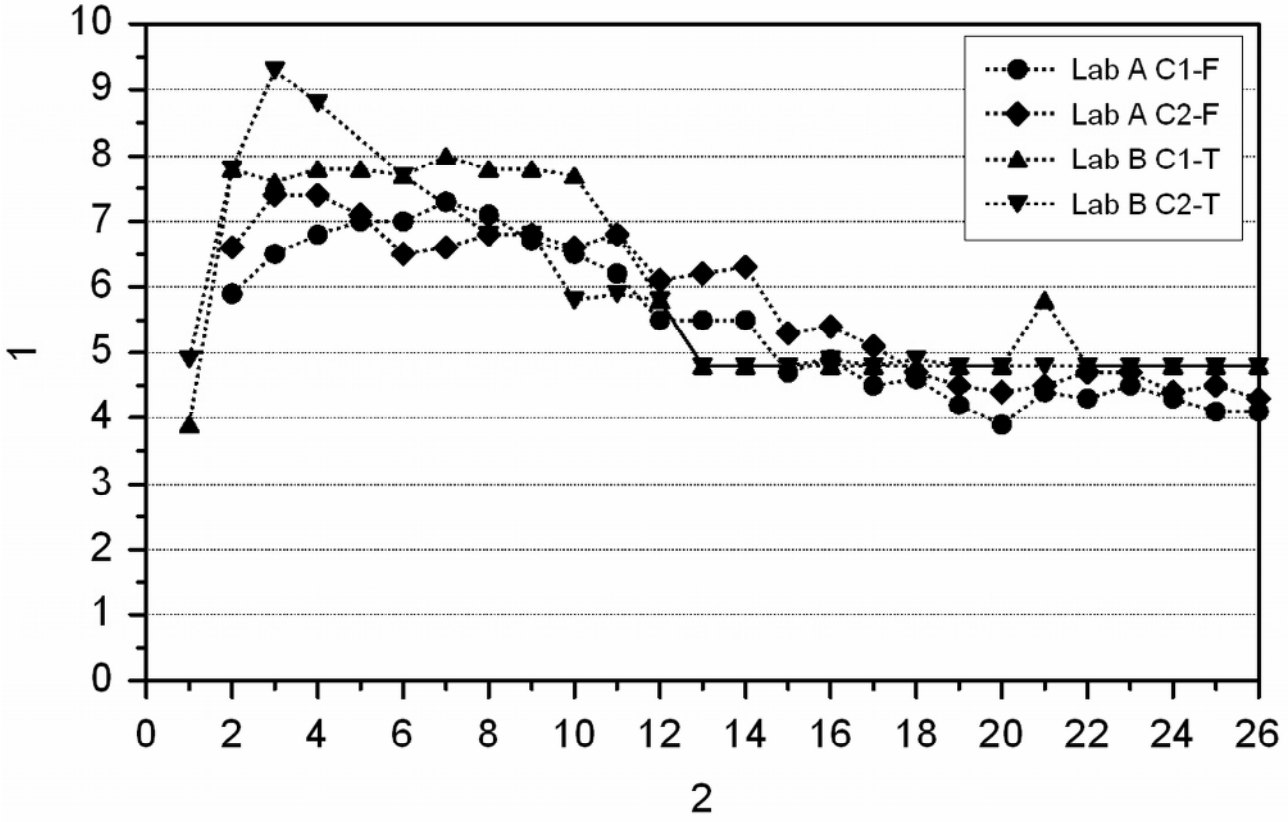
Key

1	control line	6	water meter
2	outlet valve	7	check valve
3	test line with sample	8	flow meter (optional)
4	test water inlet	9	flow regulator
5	filter	11	inlet test water sampling point

Figure A.2 — Schematic of a test rig for testing end point devices

Annex B
(informative)

Example of graphs for expression of results

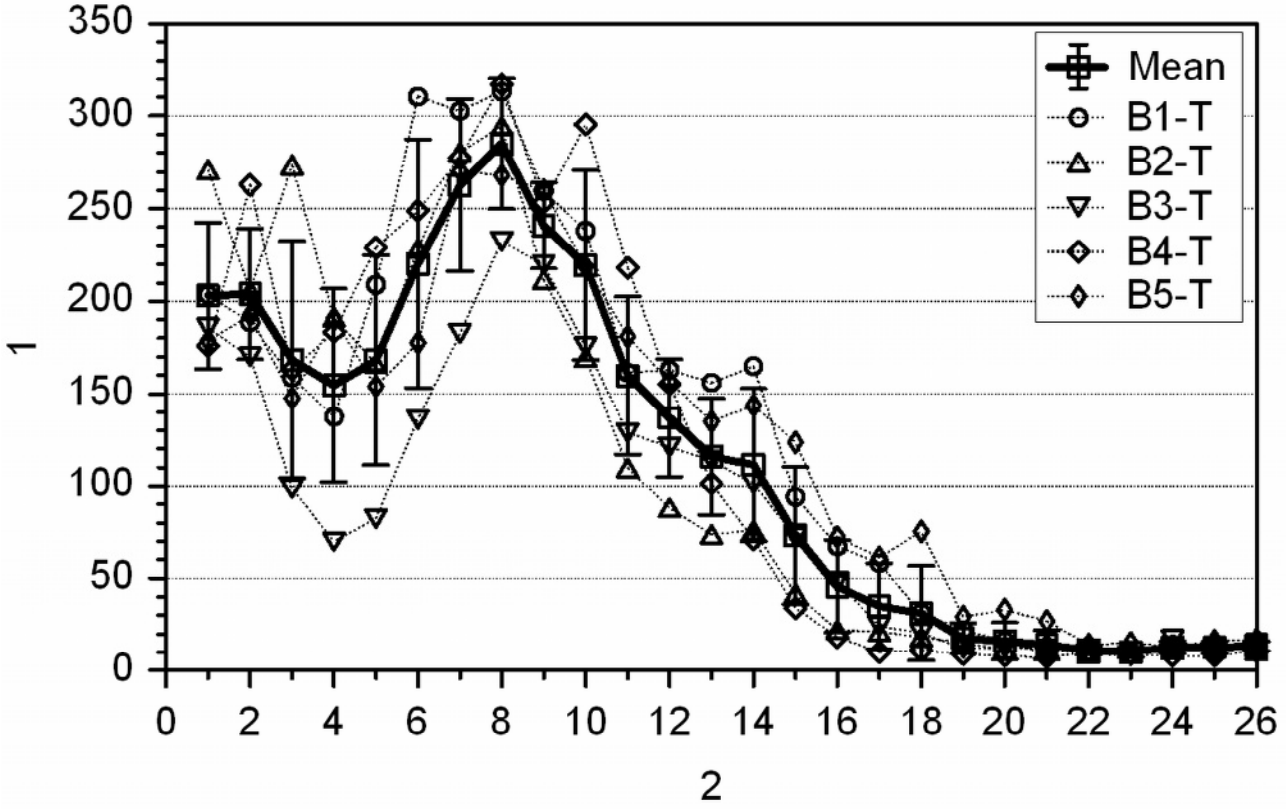


Key

1 nickel concentration in µg/l

2 operation time in weeks

Figure B.1 — Example of a run-time curve for the 4h stagnation samples



Key

1 concentration (µg/l)

2 operation period (weeks)

Figure B.2 — Example of a run-time curve for the 4h stagnation samples

Bibliography

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

[2] EN 15664-2, *Influence of metallic materials on water intended for human consumption — Dynamic rig test for assessment of metal release — Part 2 Test waters*

[3] EN 25813, *Water quality — Determination of dissolved oxygen — Iodometric method (ISO 5813)*

[4] EN 25814, *Water quality — Determination of dissolved oxygen — Electrotechnical probe method (ISO 5814)*

[5] EN 27888, *Water quality — Determination of electrical conductivity (ISO 7888)*

[6] EN ISO 6878, *Water quality — Determination of phosphorus — Ammonium molybdate spectrometric method (ISO 6878)*

[7] EN ISO 9963-1, *Water quality — Determination of alkalinity — Part 1: Determination of total and composite alkalinity (ISO 9963-1)*

[8] EN ISO 10304-1, *Water quality — Determination of dissolved anions by liquid chromatography of ions — Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (ISO 10304-1)*

[9] EN ISO 11885, *Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885)*

[10] EN ISO 14911, *Water quality — Determination of dissolved Li^+, Na^+, NH_4^+, K^+, Mn^{2+}, Ca^{2+}, Mg^{2+}, Sr^{2+} and Ba^{2+} using ion chromatography — Method for water and waste water (ISO 14911)*

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

[12] EN ISO 17294-2, *Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) — Part 2: Determination of 62 elements (ISO 17294-2)*

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

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

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

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

[17] ISO 10523, *Water quality — Determination of pH*

[18] 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

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™