INTERNATIONAL STANDARD

ISO 1562

Fourth edition
2004-05-01

Dentistry — Casting gold alloys

Art dentaire — Alliages d'or à couler

Reference number
ISO 1562:2004(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO 2004

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

--`,`,`-`-`,,`,,`,`,,`---

Copyright International Organization for Standardization
Reproduced by IHS under license with ISO
No reproduction or networking permitted without license from IHS

Not for Resale

Contents

Page

Foreword ... iv

Introduction ... v

1 Scope ... 1

2 Normative references ... 1

3 Terms and definitions ... 1

4 Classification ... 2

5 Requirements ... 2
5.1 Chemical composition ... 2
5.2 Biocompatibility ... 2
5.3 Mechanical properties ... 2
5.4 Density ... 3
5.5 Corrosion resistance ... 3
5.6 Tarnish resistance ... 3
5.7 Electrochemical behaviour ... 3
5.8 Melting range ... 3

6 Sampling ... 3

7 Preparation of test specimens ... 3
7.1 General ... 3
7.2 Specimens for tensile testing ... 4

8 Testing ... 5
8.1 Visual inspection ... 5
8.2 Testing of proof strength of non-proportional extension and of percentage elongation after fracture ... 5

9 Information and instructions ... 5
9.1 Information ... 5
9.2 Processing instructions ... 6
9.3 Hazardous elements ... 6

10 Marking ... 6
10.1 Alloy ... 6
10.2 Package ... 6

Annex A (informative) Surface corrosion testing — Static immersion test ... 7

Annex B (informative) Tarnish testing — Sodium sulfide test ... 9

Annex C (informative) Electrochemical testing — Potentiodynamic test ... 11

Bibliography ... 16

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 1562 was prepared by Technical Committee ISO/TC 106, *Dentistry*, Subcommittee SC 2, *Prosthodontic materials*.

This fourth edition cancels and replaces the third edition (ISO 1562:1993), which has been technically revised, including the following changes:

a) bench-cooling replaces softening and hardening heat treatments of test specimens;

b) introduction of upper limits for beryllium and cadmium;

c) introduction of electrochemical testing (potentiodynamic test).

Introduction

Dental casting alloys with noble metal content of at least 25 % (mass fraction) but less than 75 % (mass fraction) are addressed in ISO 8891.

Dental casting alloys intended solely as the substructure of a metal-ceramic dental restorative system and also dual-purpose casting gold alloys having at least 75 % (mass fraction) noble metal content are addressed in ISO 9693.

Dentistry — Casting gold alloys

1 Scope

This International Standard gives the classification of, and specifies requirements for, dental casting gold alloys with at least 60 % mass fraction of gold and at least 75 % mass fraction of gold plus specified platinum group metals (platinum, palladium, iridium, ruthenium and rhodium). Test methods are given for providing information on corrosion resistance, tarnish resistance and electrochemical behaviour.

This International Standard is applicable to casting alloys suitable for the fabrication of dental restorations and appliances without ceramic veneer.

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.

ISO 3585, *Borosilicate glass 3.3 — Properties*

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

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature*

ISO 9693, *Metal-ceramic dental restorative systems*

ISO 10271, *Dental metallic materials — Corrosion test methods*

3 Terms and definitions

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

3.1
bench-cooling

process whereby a casting is retained in its investment with exposed metal uppermost and placed on a flat, insulating surface in freely circulating air until its temperature falls to ambient

3.2
dual-purpose casting gold alloy

casting gold alloy, in accordance with this International Standard, that is also intended for use as the substructure of a metal-ceramic dental restorative system in accordance with ISO 9693

3.3
primary pack

container that comes in direct contact with the casting gold alloy

4 Classification

For the purposes of this International Standard, dental casting gold alloys are classified, according to their mechanical properties and the application for which they are recommended, as follows:

— **Type 1:**	**low-strength**	for castings subject to very slight stress, e.g. inlays.
— **Type 2:**	**medium-strength**	for castings subject to moderate stress, e.g. inlays, onlays, and full crowns.
— **Type 3:**	**high-strength**	for castings subject to high stress, e.g. onlays, thin cast backings, pontics, crowns and saddles.
— **Type 4:**	**extra-high-strength**	for castings subject to very high stress and used in thin cross-section, e.g. saddles, bars, clasps, thimbles, unit castings and partial denture frameworks.

5 Requirements

5.1 Chemical composition

The percentage of each of the constituents in the alloy shall not deviate by more than 0,5 % (mass fraction) from the values stated on the package label or insert [see 10.2 c)].

The alloy shall not contain more than 0,02 % (mass fraction) of cadmium or beryllium. If the alloy contains more than 0,1 % (mass fraction) of nickel, the percentage shall not exceed the amount indicated on the outer package [see 10.2 j)].

Determine the composition, using analytical procedures with sensitivities appropriate to the concentration of each element, and its permitted deviation from the stated value or permitted limit.

5.2 Biocompatibility

Specific qualitative and quantitative requirements for freedom from biological hazard are not included in this International Standard, but it is recommended that, in assessing possible biological hazards, reference be made to ISO 10993-1 and ISO 7405.

5.3 Mechanical properties

The mechanical properties of the alloy, depending on its Type classification, shall comply with the requirements specified in Table 1.

Testing shall be carried out in accordance with 8.2 on specimens prepared according to 7.1 and 7.2.

Table 1 — Mechanical properties

Alloy	**Minimum proof strength of non-proportional extension** $R_{p0,2}$ MPa	**Minimum percentage elongation after fracture** %
Type 1	80	18
Type 2	180	10
Type 3	270	5
Type 4	360	3

5.4 Density

The density of the alloy as delivered shall not deviate by more than 0,5 g/cm^3 from the value stated on the package label or insert [see 10.2 g)].

Use test procedures with an accuracy appropriate to determine compliance.

5.5 Corrosion resistance

At this time it has not been possible to set requirements for corrosion. However it is recommended that the static immersion test given in Annex A be used to provide information on the type and quantity of metal ions which leach from a dental casting alloy.

The test procedure in Annex A is in accordance with ISO 10271.

5.6 Tarnish resistance

At this time it has not been possible to set requirements for tarnish resistance. However it is recommended that the sodium sulfide tarnish test given in Annex B be used to provide information on the probability of surface alteration as a result of tarnish.

The test procedure in Annex B is in accordance with ISO 10271.

5.7 Electrochemical behaviour

Either as an alternative or in addition to the static immersion test, the potentiodynamic test given in Annex C should be used in evaluating the electrochemical behaviour of dental casting gold alloys.

The test procedure in Annex C is in accordance with ISO 10271.

5.8 Melting range

Solidus and liquidus temperatures of the alloy shall not deviate by more than ± 20 °C from the values stated on the package label or insert [see 10.2 f)].

Determine solidus and liquidus temperatures by the cooling curve method or other procedures with an accuracy of ± 10 °C.

6 Sampling

The sample shall be adequate to prepare the specimens as required in 7.2 and Annexes A, B and C (if used), and shall be from one batch (lot). Further samples and packaging materials shall be made available for inspection in accordance with 8.1.

7 Preparation of test specimens

7.1 General

Prepare the test specimens by the lost wax process of investment casting generally employed in a dental laboratory, following the manufacturer's instructions for use (investing, melting and casting).

Unless the manufacturer recommends otherwise, bench-cool the casting, divest and carefully separate the sprues and remove any casting beads, fins, etc.

If a manufacturer recommends a heat treatment for hardening [see 9.1 d)] for all castings, apply this heat treatment to all test specimens.

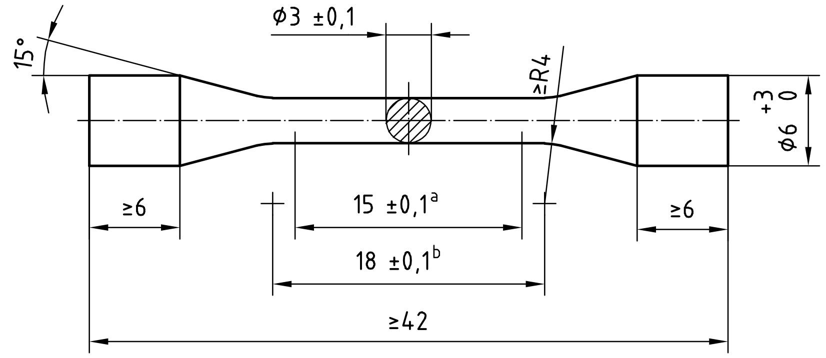
Replace any test specimens that contain visible defects.

7.2 Specimens for tensile testing

For tensile testing in accordance with Clause 8, prepare specimens, which comply with Figure 1 or Figure 2, cast and finished in accordance with 7.1.

NOTE Test specimens normally require no further finishing after the treatment described above.

Dimensions in millimetres

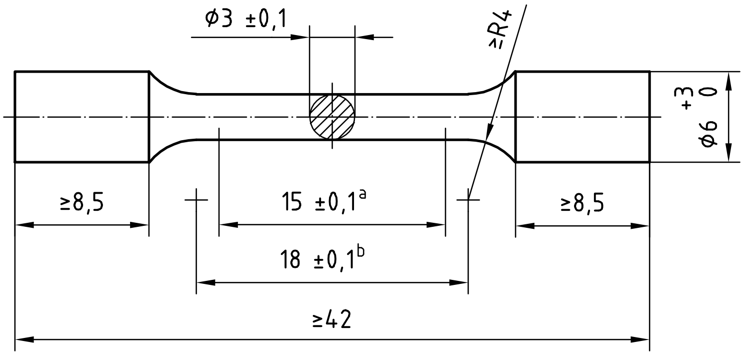


a Gauge length.

b Parallel section of test specimen.

Figure 1 — Test specimen with conical shoulders

Dimensions in millimetres



a Gauge length.

b Parallel section of test specimen.

Figure 2 — Test specimen with radius shoulders

8 Testing

8.1 Visual inspection

Visually inspect to check that requirements specified in Clauses 9 and 10 have been met.

8.2 Testing of proof strength of non-proportional extension and of percentage elongation after fracture

8.2.1 Tensile testing

Determine the proof strength of 0,2 % non-proportional extension and the percentage elongation after fracture in accordance with ISO 6892 on six test specimens cast and finished in accordance with Clause 7. Load the test specimens in tension in a universal tensile testing machine at a cross-head speed of (1,5 ± 0,5) mm/min up to the fracture point of the specimens.

Determine the force from the force/elongation recording for 0,2 % non-proportional extension and calculate the 0,2 % proof strength on the basis of the original cross-sectional area.

Determine the percentage elongation after fracture on the same specimens fractured in the test.

8.2.2 Evaluation of the results of tensile testing

Check the result of each specimen for compliance with the requirements given in 5.3, Table 1, for the type claimed for the alloy in 10.2 e). A specimen complies with 5.3 only if the limits on both 0,2 % proof strength and percentage elongation are met.

If four, five or six specimens are found to comply with 5.3, the alloy passes the test.

If fewer than three specimens are found to comply with 5.3, the alloy does not pass the test.

If three specimens are found to comply with the requirements specified in 5.3, repeat the test with a second set of six specimens. If in this second test, five or six specimens are found to comply with 5.3, the alloy passes the test.

8.2.3 Calculation of proof strength of 0,2 % non-proportional extension and of percentage elongation after fracture

Calculate the proof strength of 0,2 % non-proportional extension as the mean of the values for those four, five or six specimens of the first test, or if applicable, of those three specimens of the first test plus those five or six specimens of the second test which are found to comply with the requirements in Table 1, and report to the nearest 5 MPa [9.1 a)].

Calculate the percentage elongation after fracture as the mean of the values for those four, five or six specimens of the first test, or if applicable, of those three specimens of the first test plus those five or six specimens of the second test which are found to comply with the requirements in Table 1, and report to the nearest 1 % [9.1 a)].

9 Information and instructions

9.1 Information

The following information shall be included in the package or accompanying literature:

a) 0,2 % proof strength and elongation obtained according to 8.2.3, and Vickers hardness HV5/30 obtained according to ISO 6507-1, determined on cast specimens after bench-cooling and, if applicable, after heat-treatment according to 9.1 c) and 9.1 d);

b) recommended casting temperature;

c) if applicable, recommended heat treatment for softening;

d) if applicable, recommended heat treatment for hardening;

e) if applicable, recommendations for brazing, welding or other joining techniques;

f) recommended application.

9.2 Processing instructions

Detailed instructions for use shall be made available to the purchaser by the distributor and/or manufacturer.

9.3 Hazardous elements

If the alloy contains more than 0,1 % (mass fraction) of nickel, this shall be clearly stated on the package [10.2 j)], and adequately detailed instructions regarding precautions shall be given in the package or accompanying literature.

10 Marking

10.1 Alloy

The ingots, or the primary pack of any other form in which the alloy is supplied, shall be clearly marked to identify the manufacturer or supplier of the alloy.

10.2 Package

The label or insert of the package shall be marked at least with the following information:

a) manufacturer's or distributor's name or trademark, and postal address;

b) designation or trade name of the alloy;

c) composition: Name (or chemical symbol) and mass fractions, in percent, of each constituent present in at least 1 % (mass fraction) in the alloy. Name (or chemical symbol) of each constituent present in at least 0,1 % (mass fraction) but less than 1 % (mass fraction) in the alloy;

d) colour of the alloy;

e) alloy Type, in accordance with the classification given in Clause 4;

f) melting range: solidus and liquidus temperatures of the alloy, in degrees Celsius;

g) density of the alloy, in grams per cubic centimetre;

h) lot number;

i) minimum net mass, in grams;

j) if the alloy contains more than 0,1 % (mass fraction) of nickel (see 9.3), the manufacturer or supplier shall include a clearly visible warning on the package, stating that the alloy contains nickel and giving the amount present.

Annex A
(informative)

Surface corrosion testing — Static immersion test

A.1 Preparation of test specimens

For corrosion testing, prepare two specimens with dimensions of approximately 34 mm × 13 mm × 1,5 mm, by casting and finishing in accordance with 7.1.

If recommended by the manufacturer [see 9.1 c) and d)], heat-treat the specimens in accordance with the manufacturer's instructions.

Remove at least 0,1 mm from all surfaces of the specimens using standard metallographic procedures, ending with ASTM 600 or FEPA P 1200 wet silicon carbide paper. Do not use the same grinding paper for the preparation of specimens of different alloys.

A.2 Corrosion testing

A.2.1 Reagents

The following reagents are required, in accordance with ISO 10271.

A.2.1.1 **Lactic acid** (approx. 90 % $C_3H_6O_3$), chemically pure is acceptable.

A.2.1.2 **Sodium chloride** (NaCl), analytical grade.

A.2.1.3 **Water**, of grade 2 in accordance with ISO 3696:1987.

A.2.1.4 **Ethanol** (C_2H_5OH), analytical grade.

A.2.1.5 **Corrosion solution**.

Prepare an aqueous corrosion solution of 0,1 mol/l lactic acid and 0,1 mol/l sodium chloride immediately before use. Dissolve (10,0 ± 0,1) g lactic acid (A.2.1.1) in approximately 300 ml water (A.2.1.3), add (5,85 ± 0,05) g sodium chloride (A.2.1.2) and dilute to (1 000 ± 3) ml with water (A.2.1.3). Measure the pH of the solution. If the pH value is not in the range of 2,2 to 2,4, the solution shall be discarded and the reagents checked.

A.2.2 Apparatus

The following apparatus is required, in accordance with ISO 10271.

A.2.2.1 **Borosilicate glass container**, in accordance with ISO 3585.

A.2.2.2 **pH-meter**.

A.2.3 Procedure

Determine the surface area of each test specimen to the nearest 0,1 cm^2. Clean the specimens ultrasonically in ethanol (A.2.1.4) for 2 min, rinse them with water (A.2.1.3), dry with oil- and water-free compressed air. Place each specimen in a separate glass container of diameter 16 mm and length 160 mm.

Record the pH of the corrosion solution (A.2.1.5). Add sufficient corrosion solution (A.2.1.5) to each container to cover the specimens (approximately 10 ml); record these volumes to the nearest 0,1 ml. Close the containers to prevent evaporation. Hold at (37 ± 1) °C for (7 ± 0,1) d. Then remove the specimens. Record the pH of the residual solution.

A.2.4 Analysis

By using an instrumental analytical method of adequate sensitivity (e.g. AAS or ICP), analyze each residual solution quantitatively for constituents of the alloy [see 10.2 c)] and for nickel, cadmium and beryllium.

A.3 Test report

In a test report, record the analytical method used (A.2.4), and give the detection limits for all observed elements.

Record also the pH values (A.2.3) and any deviations from specimen preparation (see A.1), or test procedure (see A.2). For each element found in each residual corrosion solution, record separately the analyzed values in micrograms per square centimetre per seven days.

Annex B
(informative)

Tarnish testing — Sodium sulfide test

B.1 Preparation of test specimens

For tarnish testing, prepare two specimens of approximately 10 mm diameter and at least 0,5 mm thickness, by casting and finishing in accordance with 7.1.

If recommended by the manufacturer [see 9.1 c) and d)], heat-treat the specimens in accordance with the manufacturer's instructions.

Cold-mount the specimens in epoxy resin, grind and polish them using standard metallographic procedures, finishing with water-based polishing paste of 1 µm particle size. Do not use the same grinding paper and polishing materials for the preparation of specimens of different alloys.

Clean surfaces ultrasonically for 2 min in ethanol (B.2.1.3), rinse with water (B.2.1.2), and dry with oil- and water-free compressed air.

NOTE Epoxy resin specifically is necessary, because other resins can be dissolved by ethanol.

B.2 Tarnish testing

B.2.1 Reagents

The following reagents are required, in accordance with ISO 10271.

B.2.1.1 **Sodium sulfide hydrate** ($Na_2S \cdot xH_2O$, approx. 35 % Na_2S), analytical grade.

B.2.1.2 **Water**, grade 2 according to ISO 3696:1987.

B.2.1.3 **Ethanol** (C_2H_5OH), analytical grade.

B.2.1.4 **Tarnishing solution**.

Prepare an aqueous solution of 0,1 mol/l sodium sulfide immediately before use. Dissolve (22,3 ± 0,1) g sodium sulfide hydrate (B.2.1.1) in water (B.2.1.2), and dilute to (1 000 ± 3) ml with water (B.2.1.2).

B.2.2 Apparatus

The following apparatus is required, in accordance with ISO 10271.

B.2.2.1 **Dipping device**, which dips the test specimen into the tarnishing solution for 10 s to 15 s every minute at (23 ± 2) °C.

B.2.3 Procedure

Take one of the specimens, prepared for tarnish testing in accordance with B.1, and fix it in the dipping device (B.2.2.1). Run the test for (72 ± 1) h. Replace the tarnishing solution after (24 ± 1) h and after (48 ± 1) h. After

(72 ± 1) h, remove the test specimen from the dipping device, rinse it thoroughly with water (B.2.1.2), dip it in ethanol (B.2.1.3), and then dry with oil- and water-free compressed air.

CAUTION — Tests should be carried out in a properly operating exhaust hood.

B.2.4 Inspection

Examine and compare the surfaces of the treated and the untreated specimens visually without magnification for any surface deterioration.

Persons making the inspection shall have nominally normal trichromatic vision. Corrective (non-magnifying) untinted lenses may be worn. The inspection shall be carried out at a light intensity at the specimens of at least 1 000 lx and at a distance not exceeding 25 cm from the specimens.

B.2.5 Test report

In a test report, record any deviations from sample preparation (Clause B.1), or test procedure (Clause B.2). Record also any visible differences with regard to colour and reflectivity (see B.2.4).

Annex C
(informative)

Electrochemical testing — Potentiodynamic test

C.1 Preparation of test specimens

For the electrochemical testing, prepare at least four samples with a surface area not less than 0,1 cm^2 by casting and finishing in accordance with 7.1. The samples may be cut from one cast rod. Blast the surfaces with pure alumina of particle size 125 µm to remove investment. If recommended by the manufacturer [see 9.1 c) and d)], heat-treat the specimens in accordance with the manufacturer's instructions.

Samples shall be prepared with one flat surface exposed. A suitable contact shall be provided for the connection to the electrochemical apparatus.

The working electrode shall be prepared in a way that ensures the absence of crevices. The recommended procedure is that of embedding the sample in epoxy resin. (Instead of embedding, a sample holder may be used if the absence of crevices is confirmed by sample examination before and after the test.)

Remove at least 0,1 mm from the free surface. Use a measuring instrument, such as a micrometer, to measure the change in thickness. Use fresh abrasive paper for each alloy. Finish using standard metallurgical procedures with wet silicon carbide papers, ending with diamond paste of particle size 1 µm.

Examine with a light microscope at × 50 for cracks or crevices at the sample/resin interface. Replace the sample if any cracks or crevices are found. Determine the exposed area of the sample to an accuracy of 0,01 cm^2. Clean the surfaces ultrasonically for 2 min in ethanol (C.2.1.6) and rinse with water (C.2.1.4). Store in water (C.2.1.4) until transfer to test cell.

NOTE Epoxy resin specifically is necessary, because other resins can be dissolved during immersion, thereby causing a loss in electrical insulation.

C.2 Electrochemical testing

C.2.1 Reagents

The following reagents are required, in accordance with ISO 10271.

C.2.1.1 **Lactic acid** (approx. 90 % $C_3H_6O_3$), chemically pure is acceptable.

C.2.1.2 **Sodium chloride** (NaCl), analytical grade.

C.2.1.3 **Sodium hydroxide** (NaOH), analytical grade.

C.2.1.4 **Water**, grade 2 according to ISO 3696:1987.

C.2.1.5 **Argon or nitrogen gas**, with oxygen content $\leqslant 5 \times 10^{-6}$.

C.2.1.6 **Ethanol** (C_2H_5OH), analytical grade.

C.2.1.7 **Electrolyte solution**.

Dissolve 9,0 g sodium chloride (C.2.1.2) in approximately 950 ml water (C.2.1.4). Adjust to pH of (7,4 ± 0,1) using aqueous solutions of 1 % lactic acid (C.2.1.1) or 4 % sodium hydroxide (C.2.1.3), respectively. Dilute with water (C.2.1.4) to 1000 ml.

C.2.2 Apparatus

The following apparatus is required, in accordance with ISO 10271.

C.2.2.1 Temperature-controlled borosilicate glass test cell, in accordance with ISO 3585 [a double-walled cell is unnecessary if the test is carried out at (23 ± 2) °C].

C.2.2.2 Scanning potentiostat, potential range ± 1600 mV, current output range 10^{-9} A to 10^{-1} A.

C.2.2.3 Potential measuring instrument, with input impedance $> 10^{11}\ \Omega$ and sensitivity/accuracy able to detect a change of 1 mV over a potential change of ± 1600 mV.

C.2.2.4 Current-measuring instrument, capable of measuring a current to within 1 % of the absolute value over a current range between 10^{-9} A and 10^{-1} A.

C.2.2.5 Working electrode (sample holder).

C.2.2.6 Counter-electrode(s), composed of high purity vitreous carbon or platinum.

C.2.2.7 Reference electrode, either saturated calomel electrode (SCE) or Ag/AgCl electrode (saturated silver chloride electrode [SSE]).

C.2.2.8 pH meter, with an accuracy of ± 0,1 pH units.

C.2.3 Procedure

C.2.3.1 Set-up

An example of an electrochemical measuring circuit is shown in Figure C.1; an example of an electrolytic cell is shown in Figure C.2.

Fill the test cell with electrolyte solution (C.2.1.7).

Test at room temperature (23 ± 2) °C.

Place counter-electrode(s) in the test cell, followed by the reference electrode. Then place the working electrode in the test cell without immersion in the electrolyte solution. Activate the magnetic stirrer. Bubble oxygen-free nitrogen or argon at a rate of about 100 $\text{cm}^3 \cdot \text{min}^{-1}$ through the electrolyte for at least 30 min. Immerse the working electrode in the electrolyte solution. Adjust the reference electrode. Adjust the gas flowrate to give a slight bubbling. Begin the measurement procedure.

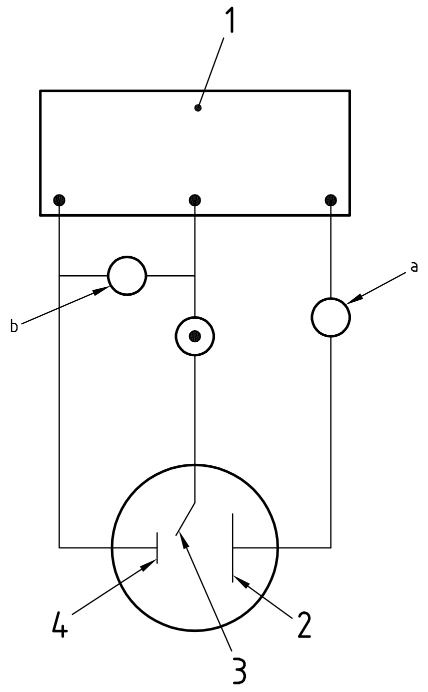
C.2.3.2 Open-circuit potential measurement

Record the curve of open-circuit potential vs time for 2 h. Determine the open-circuit potential (E_{ocp}) in millivolts (SCE) after immersion for 2 h ± 6 min. An example of a potential vs time curve is shown in Figure C.3.

C.2.3.3 Potentiodynamic measurements (anodic polarization)

Start the potentiodynamic scan, 5 min after finishing the open-circuit potential measurement, at E_{ocp} minus 150 mV.

The potentiodynamic sweep rate should be 1 mV s^{-1} up to a current density of $10^{-3}\ \text{A} \cdot \text{cm}^{-2}$ or a potential of + 1000 mV (SCE) or to a potential 300 mV above the breakdown potential E_{p}. Record the curve of potential vs logarithm of current density. A reverse scan back to the original potential may be used to obtain information on pitting corrosion. An example of a curve of potential vs log current density is shown in Figure C.4.



Key

1 potentiostat

2 counter-electrode

3 reference electrode

4 working electrode

[a] Current measurement.

[b] Potential measurement.

Figure C.1 — Schematic diagram of measuring circuit

C.3 Test report

The test report shall contain the following information:

a) identity of the test alloy;

b) details of heat-treatment, if applicable;

c) test temperature (23 ± 2) °C;

d) description of any deviations from sample preparation (C.1) or test procedure (C.2);

e) open-circuit potential E_{ocp} in millivolts (SCE);

f) potential vs log current density curve or potential vs current density curve;

g) zero current potential E_{z} in millivolts (SCE);

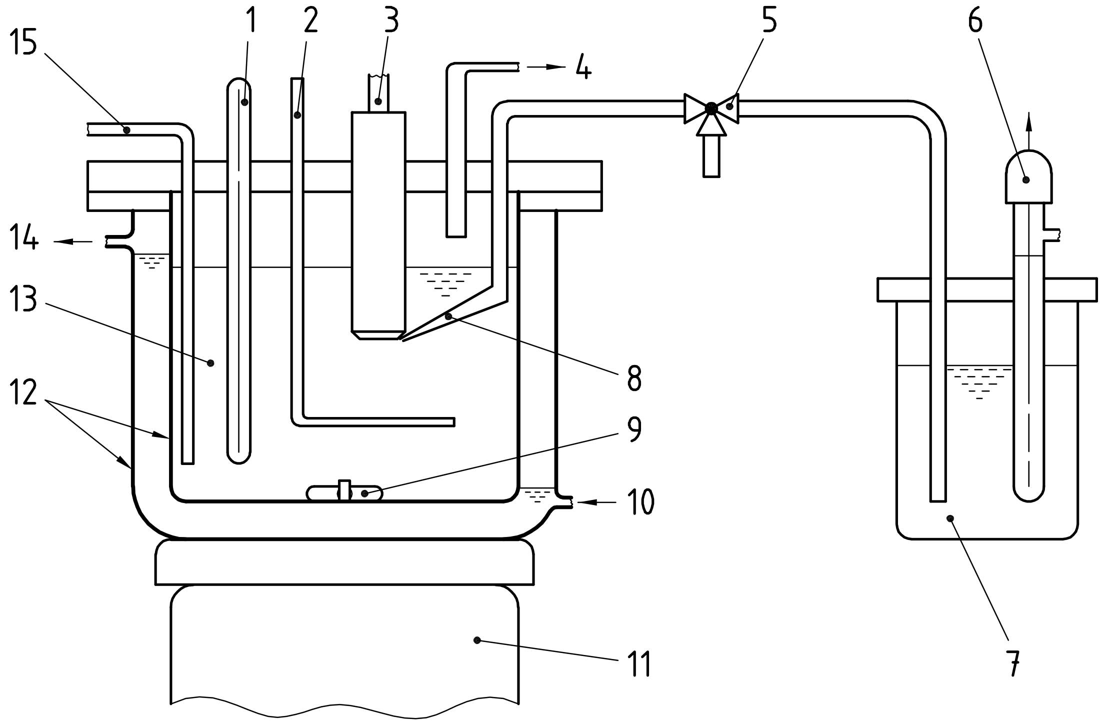
h) breakdown potential E_{p} in millivolts (SCE), with the corresponding current density I_{p} in amperes per square centimetre;

i) active peak potential E_{c} in millivolts (SCE) between E_{z} and E_{p} with the corresponding current density I_{c} in amperes per square centimetre;

j) current density I_{300} in amperes per square centimetre at potential of E_z plus 300 mV (SCE);

k) description of any significant changes of the electrolyte or the alloys surface.

If a reference electrode other than a saturated calomel electrode (SCE) is used, the reported potential values shall be converted to mV (SCE).



Key

1	thermometer
2	counter electrode
3	working electrode
4	gas outlet
5	electrolytic bridge
6	reference electrode (saturated calomel electrode) [SCE]
7	saturated solution of KCl
8	Luggin capillary
9	magnetic stirrer (PTFE-coated)
10	water inlet
11	magnetic agitator motor
12	double-walled vessel
13	electrolyte solution
14	water outlet
15	bubbler (using nitrogen)

Figure C.2 — Schematic diagram of electrolytic cell

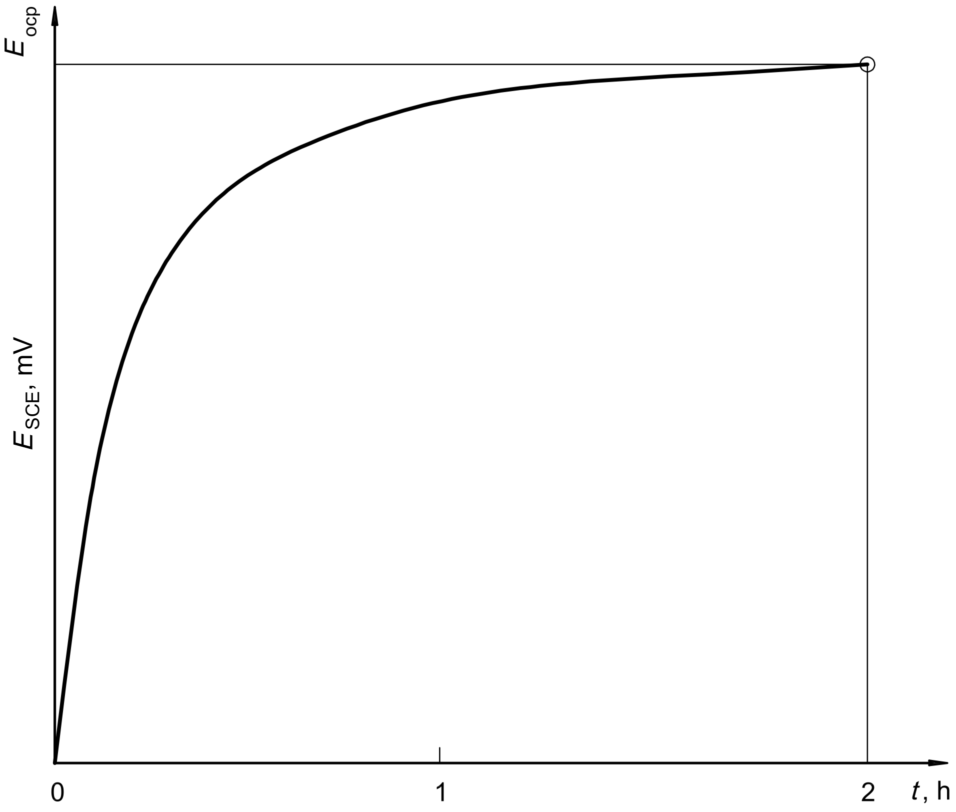


Figure C.3 — Open-circuit potential versus time

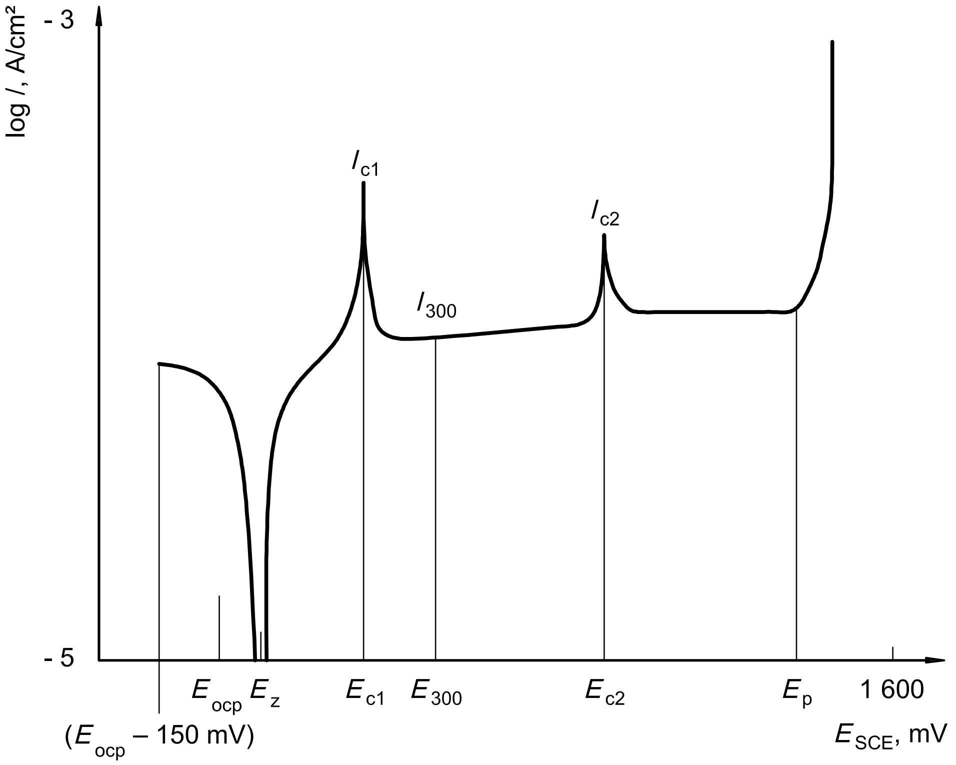


Figure C.4 — Logarithm of current density versus potential

Bibliography

[1] ISO 8891, *Dental casting alloys with noble metal content of at least 25 % but less than 75 %*

[2] ISO 7405, *Dentistry — Preclinical evaluation of biocompatibility of medical devices used in dentistry — Test methods for dental materials*

[3] ISO 10993-1, *Biological evaluation of medical devices — Part 1: Evaluation and testing*

ICS 11.060.10

Price based on 16 pages