INTERNATIONAL STANDARD

ISO 1562

Fourth edition
2004-05-01

Dentistry — Casting gold alloys

Art dentaire — Alliages d'or à couler

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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.

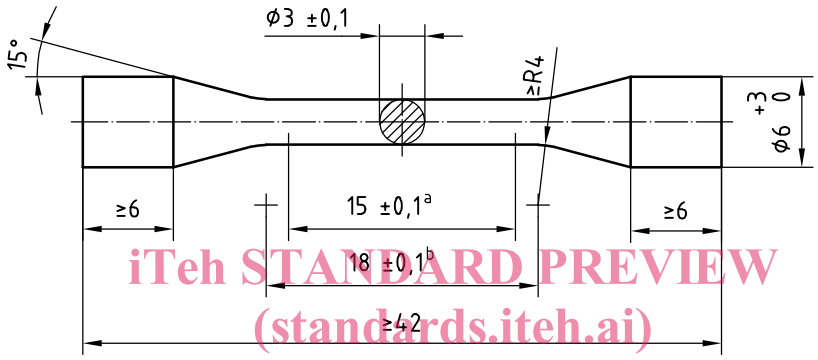
Replace any test specimens that contain visible defects.

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

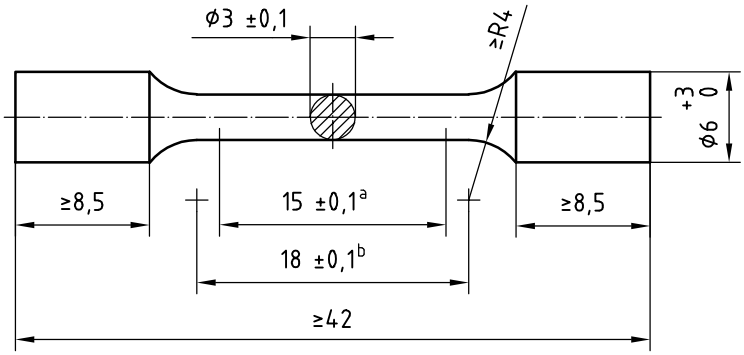


a Gauge length.

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);

