INTERNATIONAL STANDARD

ISO 1562

Third edition
1993-12-01

Dental casting gold alloys

Alliages d'or dentaires à couler

Reference number
ISO 1562:1993(E)

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.

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.

International Standard ISO 1562 was prepared by Technical Committee ISO/TC 106, *Dentistry*, Sub-Committee SC 2, *Prosthodontic materials*.

This third edition cancels and replaces the second edition (ISO 1562:1984), of which it constitutes a technical revision.

Annex A forms an integral part of this International Standard.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland
Printed in Switzerland

Introduction

Specific quantitative and qualitative requirements for freedom from biological hazard are not included in this International Standard but it is recommended that, in assessing possible biological or toxicological hazards, reference should be made to ISO/TR 7405:1984, *Biological evaluation of dental materials*, or any more recent edition.

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Dental casting gold alloys

1 Scope

This International Standard gives the classification of, and specifies requirements and test methods for gold-based dental casting alloys with a content of at least 75 % (*m/m*) of gold and platinum group metals.

It applies to casting alloys suitable for the fabrication of dental restorations and appliances.

It does not apply to alloys intended for use as the substructure of a metallo-ceramic restoration, which is covered by ISO 9693; nor does it apply to dental casting alloys with noble metal content of 25 % up to but not including 75 %, which are covered by ISO 8891.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 6892:1984, *Metallic materials — Tensile testing.*

3 Classification

For the purposes of this International Standard, dental casting gold alloys are classified, according to their physical 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 and onlays;

Type 3: high-strength — for castings subject to high stress, e.g. onlays, thin cast backings, pontics, full crowns and saddles;

Type 4: extra-high-strength — for castings subject to very high stress and thin cross-section, e.g. saddles, bars, clasps, thimbles, unit casings and partial denture frameworks.

4 Requirements

4.1 Chemical composition

Dental casting gold alloys shall contain at least 65 % (*m/m*) of gold, and at least 75 % (*m/m*) of gold and platinum group metals.

NOTE 1 Suitable platinum group metals are platinum, palladium, iridium, ruthenium and rhodium.

The percentage of each of the constituents in the alloy shall be within 0,5 % (*m/m*) of the values stated on the package label or insert [see 9.2 c)].

If there are any hazardous constituents, their percentage shall not exceed the amount indicated on the outer package [see 9.2 j)].

Standard analytical procedures shall be used for determining the composition.

4.2 Biocompatibility

See the Introduction for guidance on biocompatibility.

4.3 Mechanical properties

The mechanical properties of the different types of alloys shall comply with the requirements specified in table 1.

Testing shall be carried out in accordance with 7.2 and 7.3.

4.4 Density

The density of the alloy as delivered shall be within 0,5 g/cm^3 of the value stated on the package label or insert [see 9.2 g)].

Standard test procedures shall be used for checking this requirement.

5 Sampling

The sample shall be adequate to prepare the specimens as required in 6.2 and annex A, and shall be from one batch. Further samples and packaging materials shall be made available for inspection in accordance with 7.1.

6 Preparation of test specimens

6.1 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.

After casting, carefully separate the sprues and remove any casting beads, fins, etc.

Replace any test specimens with visible defects.

6.2 Specimens for tensile testing

For tensile testing in accordance with 7.2 and 7.3, prepare six specimens which comply with figure 1 or 2, cast and finished in accordance with 6.1.

Soften the specimens in accordance with the manufacturer's instructions.

If the alloy is hardenable, prepare a further six specimens and harden these in accordance with the manufacturer's instructions [see 8.1 d)].

NOTE 2 Test specimens normally require no further finishing after the treatment described above.

7 Testing

7.1 Visual inspection

Visually inspect to check that requirements specified in clauses 8 and 9 have been met.

7.2 Proof stress of non-proportional elongation

Determine the 0,2 % proof stress of non-proportional elongation in accordance with ISO 6892 on the test specimens cast and conditioned in accordance with 6.1 and 6.2. Load the test specimens in tension in a universal mechanical testing instrument at a cross-head speed of (1,5 ± 0,5) mm/min up to the fracture point of the specimens.

Determine the values from the resultant stress-strain curves at the 0,2 % offset level and calculate the proof stress on the basis of the original cross-sectional area.

Table 1 — Mechanical properties

Type	Proof stress of non-proportional elongation, $R_{po,2}$ N/mm^2 [1]			Percentage elongation after fracture %	
	State			State	
	softened		hardened	softened	hardened
	min.	max.	min.	min.	min.
1	80	180	—	18	—
2	180	240	—	12	—
3	240	—	—	12	—
4	300	—	450	10	3

1) 1 N/mm^2 = 1 MPa

If four or more specimens are found to comply with 4.3, calculate the proof stress as the mean of the values of those specimens, and report to the nearest 5 MPa.

If fewer than four specimens comply with the requirements specified in 4.3, repeat the test.

If again fewer than four specimens comply with the requirements specified in 4.3, the alloy does not pass the test.

7.3 Percentage elongation after fracture

Determine the percentage elongation after fracture in accordance with ISO 6892.

If four or more specimens are found to comply with 4.3, calculate the elongation as the mean of the values of those specimens, and report to the nearest 1 %.

If fewer than four specimens comply with the requirements specified in 4.3, repeat the test.

If again fewer than four specimens comply with the requirements specified in 4.3, the alloy does not pass the test.

8 Information and instructions

8.1 Information

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

a) 0,2 % proof stress and elongation according to 4.3, and Vickers hardness HV5/30;

b) recommended casting temperature;

c) recommended heat treatment for softening;

d) if applicable, recommended heat treatment for hardening;

e) recommendations for brazing.

8.2 Processing instructions

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

8.3 Hazardous elements

If the alloy contains more than 0,1 % of nickel, or more than 0,02 % of cadmium or beryllium or any other hazardous elements, this shall be clearly stated on the package and adequately detailed instructions regarding precautions shall be given in the package or accompanying literature.

9 Marking

9.1 Alloy

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

9.2 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 address;

b) designation or trade name of the alloy;

c) composition — percentages by mass of all constituents greater than 1 % (*m/m*) in the alloy;

d) colour of the alloy;

e) type of the alloy, in accordance with the classification given in clause 3 ;

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 or batch number — a serial number or combination of letters and numbers which refer to the manufacturer's records for that particular lot or batch of the alloy;

i) minimum net mass, in grams;

j) if the alloy contains hazardous elements (see 8.3), the manufacturer or supplier shall include a clearly visible warning on the package, identifying by name the constituents concerned and the amounts used.

Dimensions in millimetres

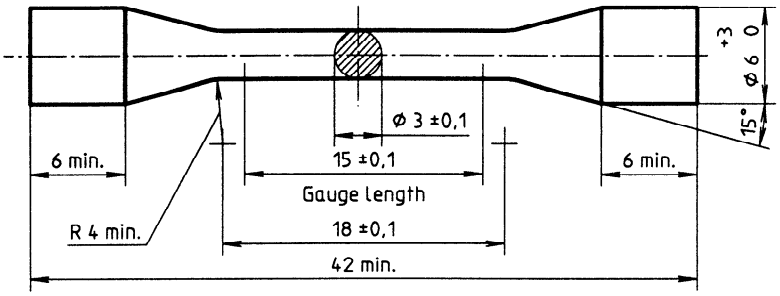

Figure 1 — Test specimen with conical shoulders

Dimensions in millimetres

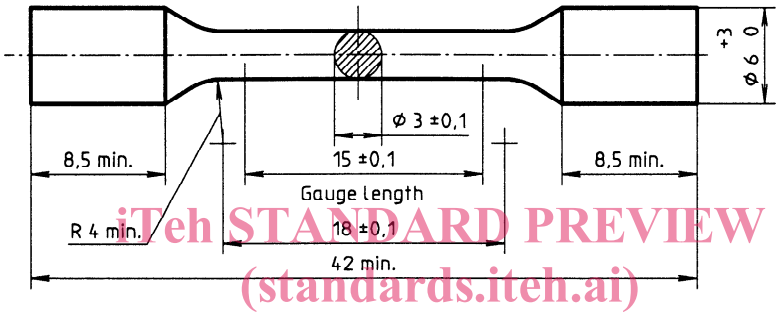

Figure 2 — Test specimen with radius shoulders

Annex A
(normative)

Corrosion test — Static immersion test

A.1 Specimens for corrosion-testing

For corrosion-testing, prepare six specimens cast and finished in accordance with 6.1, with dimensions of 32 mm × 10 mm × 1,5 mm. If recommended by the manufacturer [see 8.1 d)], heat-treat the specimens in accordance with the manufacturer's instructions.

Grit-blast the surfaces of the specimens and wet-grind using standard metallographic procedures to ASTM 600 or FEPA P 1200 silicon carbide paper. Remove at least 0,1 mm from all sides.

A.2 Testing

A.2.1 Reagents

Lactic acid	$C_3H_6O_3$	(analytical grade)
Sodium chloride	NaCl	(analytical grade)
Water	grade 2	(according to ISO 3696)

A.2.2 Procedure

Determine to the nearest 0,1 cm^2 the surface area of the test specimens prepared in accordance with A.1. Subsequently clean off any abrasive, oil or grease. Rinse the specimens in ethanol and dry.

Make two sets of three specimens, each set having a total surface area of approximately 20 cm^2.

Prepare an aqueous solution comprising 0,1 mol/l lactic acid and 0,1 mol/l sodium chloride.

Containers should be selected so that the volume of solution will be approximately 1,3 ml per cm^2 of test specimen surface area.

Suspend each set of specimens in a separate container for seven days at (37 ± 1) °C in a manner such that all specimens are completely covered by the solution and do not come into contact with each other or the wall or the bottom of the container. The container shall be tightly sealed to prevent evaporation.

Analyse each test solution separately for elements stated by the manufacturer in accordance with clauses 8 and 9, using an adequately sensitive, quantitative analytical method, e.g. AAS (atomic absorption spectrometry) or OES (optical emission spectrometry).

For all elements found in each solution, report single values of each of the two tests, in µg/cm^2.

NOTE 3 When an International Standard for corrosion testing becomes available, the test solution and procedures given above will be revised in conformity with that International Standard.