TC 106

INTERNATIONAL STANDARD

ISO 8891

Second edition
1993-12-01

Dental casting alloys with noble metal content of 25 % up to but not including 75 %

Alliages dentaires à couler avec une teneur en métaux précieux comprise entre 25 % et 75 %

Reference number
ISO 8891:1993(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 8891 was prepared by Technical Committee ISO/TC 106, *Dentistry*, Subcommittee SC 2, *Prosthodontic materials*.

This second edition cancels and replaces the first edition (ISO 8891:1990), table 1 of which has been technically revised.

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

Introduction

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 or toxicological hazards, reference should be made to ISO/TR 7405:1984, *Biological evaluation of dental materials*, or any more recent edition.

Dental casting alloys with noble metal content of 25 % up to but not including 75 %

1 Scope

This International Standard gives the classification of, and specifies requirements and test methods for, dental casting alloys with a noble metal content of 25 % up to but not including 75 %.

It applies to casting alloys intended for making dental restorations and appliances. It does not apply to alloys intended for use as the substructure of a ceramic-to-metal restoration.

For dental casting alloys with a noble metal content of 75 % and above, see ISO 1562[1].

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was 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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

3 Classification

Dental casting alloys with a noble metal content of 25 % up to but not including 75 % shall be 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 in cross-section, e.g. saddles, bars, clasps, crowns, thimbles, unit castings and partial denture frameworks.

4 Requirements

4.1 Chemical composition

The alloys shall contain 25 % (*m/m*) up to but not including 75 % (*m/m*) of gold and/or of metals of the platinum group.

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

The percentage content 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 clause 9 c)].

If there are any hazardous constituents, their percentage shall not exceed the amount indicated on the outer packets [see clause 9 i)].

Standard analytical procedures shall be used for determining the composition.

4.2 Biocompatibility

See the Introduction for guidance on biocompatibility.

1) ISO 1562:1984, *Dental casting gold alloys.*

4.3 Corrosion resistance

The average decrease in mass of two specimens shall not be greater than 0,1 mg/cm^2.

Testing shall be carried out in accordance with 7.2.

4.4 Tarnish resistance

A comparison of the surfaces of two specimens shall not reveal any darkening or discoloration of the treated specimen.

Testing shall be carried out in accordance with 7.3.

4.5 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 7.4 and 7.5.

4.6 Melting range

The solidus and liquidus temperature shall be within ± 10 °C of the values stated on the package label or insert [see clause 9 e)].

Standard test procedures shall be used for checking this requirement.

4.7 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 clause 9 f)].

Standard test procedures shall be used for checking this requirement.

5 Sampling

The amount of test material shall be sufficient for the preparation of the following test specimens:

— corrosion and tarnish testing: four specimens;

— tensile testing:

a) six test specimens for types 1 to 3 alloys, or

b) 12 test specimens for type 4 alloys.

The method of procurement of the alloy needed for testing should be recorded in a test report.

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.

Follow the manufacturer's instructions for processing the alloy and instructions relating to necessary aids and casting equipment.

6.2 Specimens for corrosion and tarnish testing

6.2.1 For corrosion and tarnish testing, use four 1 mm thick square test specimens with dimensions of 10 mm × 10 mm.

If recommended by the manufacturer, heat-treat the specimens in accordance with the manufacturer's instructions.

6.2.2 For corrosion testing, trim the surface of two test specimens by the usual dental laboratory processes. Polish the specimens, clean off any oil or grease, thoroughly rinse the specimens in alcohol and distilled water, and dry.

6.2.3 For tarnish testing, cold-mount two test specimens and grind and polish them using standard metallographic procedures.

6.3 Specimens for tensile testing

For tensile testing, use six or 12 test specimens complying with figure 1 or 2.

A suggested casting pattern is shown in figure 3, but other spruing arrangements are just as acceptable.

After casting, carefully separate the sprues and remove any casting beads, fins, etc. Replace any test specimen with visible defects. Soften, quench and/or harden the specimens in accordance with the manufacturer's instructions.

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

7 Testing

7.1 Visual inspection

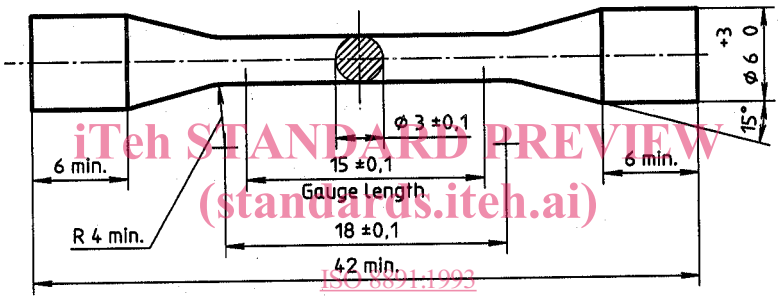
Visually inspect to check that requirements specified in clauses 8 and 9 have been met.

Table 1 — Mechanical properties

Type	Proof stress of non-proportional elongation, $R_{p0,2}$ N/mm² 1) State			Percentage elongation after fracture % 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/mm² = 1 MPa

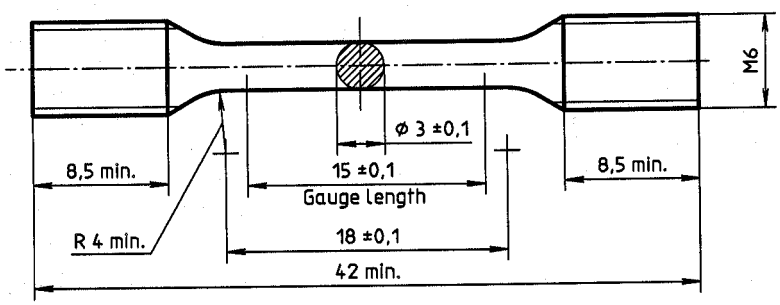
Dimensions in millimetres



NOTE — The cylindrical end length is given for guidance.

Figure 1 — Test specimen with cylindrical ends

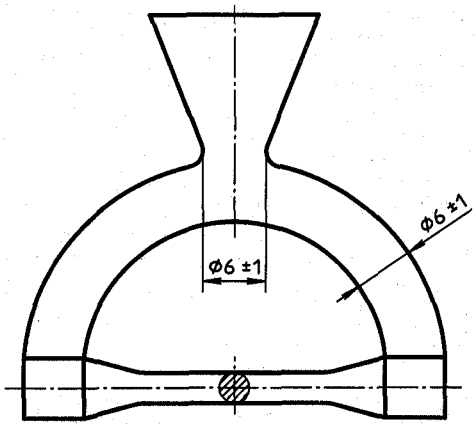
Dimensions in millimetres



NOTE — The threaded end length is given for guidance.

Figure 2 — Test specimen with threaded ends

Dimensions in millimetres



NOTE — The sprues may have the shape of a bow or a triangle or a "U".

Figure 3 — Test specimen with suggested sprues and sprue button

7.2 Corrosion resistance

7.2.1 Reagents

Lactic acid	$C_3H_6O_3$
Sodium chloride	NaCl
Ammonia solution	NH_4OH
Alcohol	C_2H_5OH

7.2.2 Procedure

Take two test specimens, prepared for corrosion testing in accordance with 6.2, weigh to an accuracy of ± 0,1 mg, and determine the surface area of both specimens.

Suspend the two specimens in a continuously aerated solution of 0,1 mol/l lactic acid (analytical grade) and 0,1 mol/l sodium chloride (analytical grade) at (37 ± 1) °C for 7 days.

Subsequently wash the specimens, clean them in ammonia solution, thoroughly rinse them in alcohol and distilled water, dry, and finally weigh them again.

Calculate the change in mass of the two specimens, and divide by the surface area, which is nominally 4,8 cm^2.

NOTE 2 When an International Standard for corrosion testing becomes available, the test solutions and procedures given above will be revised in conformity with that International Standard.

7.3 Tarnish resistance

7.3.1 Reagents

Sodium sulfide	Na_2S
Alcohol	C_2H_5OH

7.3.2 Procedure

Take one of the mountings, prepared for tarnish testing in accordance with 6.2, and fix it in a device which dips the specimens into a freshly made aqueous solution of 0,1 mol/l sodium sulfide (analytical grade) at (23 ± 2) °C for a period of 10 s to 15 s every minute.

After 72 h, rinse the specimen thoroughly in alcohol and distilled water, and dry.

Examine and compare the surfaces of the treated and untreated specimens visually without magnification.

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

7.4 Proof stress of non-proportional elongation

Determine the proof stress of non-proportional elongation in accordance with ISO 6892 on the cast and conditioned test specimens in accordance with 6.3. Load the test specimens in a tensile tester at a cross-head speed of 1,5 mm/min ± 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.

Calculate the value for proof stress as the mean of the values from those four, five or six specimens which are found to comply with 4.5. If fewer than four specimens comply with the requirements specified in 4.5, the alloy shall be rejected.

Report the mean value for the proof stress of non-proportional elongation to the nearest 5 N/mm^2.

7.5 Percentage elongation after fracture

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

Calculate the value for elongation as the mean of the values from those four, five or six specimens which are found to comply with 4.5. If fewer than four specimens comply with the requirements specified in 4.5, the alloy shall be rejected.

Report the mean value for the percentage elongation after fracture to the nearest 1 %.

8 Information and instructions

The information and instructions specified in 8.1 to 8.3 shall be provided as a minimum.

8.1 Information

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

a) mechanical properties;

b) recommended casting temperature;

c) recommended heat treatment for softening;

d) in the case of type 4 alloys, recommended heat treatment for hardening;

e) recommendations for soldering.

8.2 Processing instructions

Exact instructions for processing shall be made available to the purchaser by the distributor.

8.3 Hazardous constituents

If the alloy contains more than 0,02 % nickel, cadmium or beryllium each, this shall be clearly stated on the packets and adequately detailed instructions regarding precautions shall be given in the packets or accompanying literature.

9 Marking

The ingots shall be clearly marked to identify the manufacturer or supplier and the alloy.

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

a) manufacturer's name and/or trademark;

b) designation or tradename of the alloy;

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

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

e) melting range — solidus and liquidus temperatures of the alloy, in degrees Celsius;

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

g) 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);

h) minimum net mass, in grams;

i) hazardous constituents — if an alloy contains more than 0,02 % nickel, cadmium or beryllium each, the manufacturer or supplier shall include a clearly visible warning on the packet, identifying by name the constituent(s) concerned and the amount(s) used.