INTERNATIONAL STANDARD

ISO 8891

Third edition
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Dental casting alloys with noble metal content of at least 25 % but less than 75 %

Alliages dentaires à couler avec une teneur en métaux précieux supérieure ou égale à 25 % et strictement inférieure à 75 %

Contents

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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.

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 third edition cancels and replaces the second edition (ISO 8891:1993), of which it constitutes a technical revision.

Annexes A and B form an integral part of this International Standard. Annex C is for information only.

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 hazards, reference should be made to ISO 10993-1 and ISO 7405.

At this time it has not been possible to set requirements for corrosion and tarnish resistance. However it is recommended that the static immersion test given in annex A should be used to provide information on the type and quantity of metal ions which leach from a dental casting alloy and the sodium sulfide tarnish test given in Annex B should be used to provide information on the probability of surface alteration as a result of tarnish.

When an International Standard (e.g. ISO 10271) for corrosion and tarnish testing of dental casting alloys is published, the test procedures given in annexes A and B will be revised to conform with that International Standard, and requirements for maximum permissible corrosion and tarnish will be set. At that time, the implementation of a test on the electrochemical behaviour of dental casting alloys should also be considered.

Dental casting alloys with noble metal content of at least 25 % but less than 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 at least 25 % (mass fraction) up to but not including 75 % (mass fraction).

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

NOTE 1 For dental casting gold alloys with noble metal content of 75 % and above, see ISO 1562.

NOTE 2 For dental alloys intended as the substructure of a metal-ceramic dental restorative system, see ISO 9693.

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 3585:1998, *Borosilicate glass 3.3 — Properties.*

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

ISO 6507-1:1997, *Metallic materials — Vickers hardness test — Part 1: Test method.*

ISO 6892:1998, *Metallic materials — Tensile testing at ambient temperature.*

ISO 9693:1991, *Dental ceramic fused to metal restorative materials.*

3 Classification

For the purposes of this International Standard, dental casting 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 thin cross-section, e.g. saddles, bars, clasps, thimbles**,** unit castings and partial denture frameworks.

4 Requirements

4.1 Chemical composition

Dental casting alloys shall contain at least 25 % (mass fraction) but less than 75 % (mass fraction) of gold and platinum group metals.

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

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 9.2 c)].

The alloy shall not contain more than 0,02 % of cadmium or beryllium. If the alloy contains more than 0,1 % of nickel, the percentage shall not exceed the amount indicated on the outer package [see 9.2 j)].

Use recognized analytical procedures 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.

If such an alloy is also intended for use as the substructure of a metal-ceramic dental restorative system, it shall also meet the requirements of ISO 9693.

Table 1 — Mechanical properties

Type	Proof stress of nonproportional elongation, $R_{p0,2}$ MPa[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 MPa = 1 N/mm^2

4.4 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 9.2 g)].

Use standard test procedures to determine compliance.

4.5 Corrosion resistance

See Introduction for guidance on corrosion resistance.

4.6 Tarnish resistance

See Introduction for guidance on tarnish resistance.

4.7 Electrochemical behaviour

See Introduction for guidance on electrochemical behaviour.

5 Sampling

The sample shall be adequate to prepare the specimens as required in 6.2 and annexes A and B , 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 figure 2, cast and finished in accordance with 6.1.

Soften the specimens in accordance with the manufacturer's instructions [see 8.1 c)].

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

Dimensions in millimetres

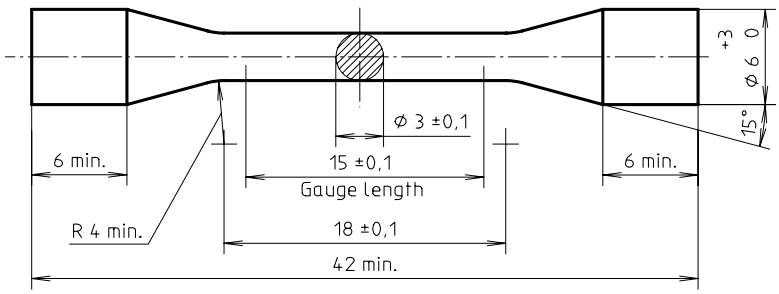

Figure 1 — Test specimen with conical shoulders

Dimensions in millimetres

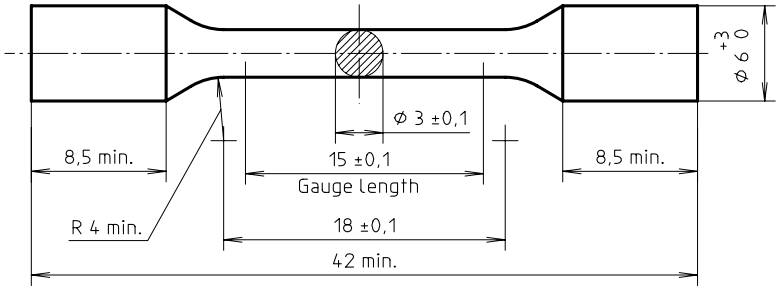

Figure 2 — Test specimen with radius shoulders

7.1 Visual inspection

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

7.2 Proof stress of nonproportional elongation

Determine the proof stress of 0,2 % nonproportional elongation in accordance with ISO 6892 with 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 force from the force/elongation diagram for 0,2 % nonproportional elongation and calculate the proof stress on the basis of the original cross-sectional area.

If four or more specimens are found to comply with 4.3, the alloy passes the test. 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 on the specimens fractured in the test according to 7.2.

If four or more of these specimens are found to comply with 4.3, the alloy passes the test. 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.

7.4 Calculation of proof stress of nonproportional elongation

Calculate the proof stress as the mean of the values for those four, five, or six specimens which comply with the requirement in table 1, and report to the nearest 5 MPa [8.1 a)].

7.5 Calculation of percentage elongation after fracture

Calculate the percentage elongation after fracture as the mean of the values for those four, five or six specimens which comply with the requirement in table 1, and report to the nearest 1 % [8.1 a)].

8 Information and instructions

8.1 Information

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

a) 0,2 % proof stress according to 7.4, elongation according to 7.5, and Vickers hardness HV5/30 according to ISO 6507-1, determined on cast specimens after heat-treatment according to 8.1 c) and 8.1 d);

b) recommended casting temperature;

c) recommended heat treatment for softening;

d) if applicable, recommended heat treatment for hardening;

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

8.2 Processing instructions

Detailed 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 % nickel, this shall be clearly stated on the package [9.2 j)], and adequately detailed instructions regarding precautions shall be given in the package or accompanying literature.

9 Marking

9.1 Alloy

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

9.2 Package

The label or insert of 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: mass fractions, in percent, of all constituents greater than 1 % in the alloy;

d) colour of the alloy;

e) type of 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 number;

i) minimum net mass, in grams;

j) if the alloy contains more than 0,1 % nickel (see 8.3), the manufacturer or supplier shall include a clearly visible warning on the package, stating that the alloy contains nickel and giving the amount present.