SLOVENSKI STANDARD
SIST EN 27490:2000

01-januar-2000

Dental gypsum-bonded casting investments for gold alloys (ISO 7490:1990)

Dental gypsum-bonded casting investments for gold alloys (ISO 7490:1990)

Gipsgebundene Einbettmassen für Goldlegierungen (ISO 7490:1990)

Revetements a couler a liant-plâtre dentaire pour les alliages d'or (ISO 7490:1990)

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Ta slovenski standard je istoveten z: **EN 27490:1991**

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ICS:

11.060.10 Zobotehniļ ni materiali Dental materials

SIST EN 27490:2000 **en**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPEENNE

EUROPÄISCHE NORM

EN 27490:1991

October 1991

UDC 615.462:616.314-089.28:620.193.6:535.6

Descriptors: Dentistry, dental materials, polymers, tests, determination, colour, stability

English version

Dental gypsum-bonded casting investments for gold alloys (ISO 7490:1990)

Revêtements à couler à liant-plâtre dentaire pour les alliages d'or (ISO 7490:1990)

Gipsgebundene Einbettmassen für Goldlegierungen (ISO 7490:1990)

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Ref. No. EN 27490:1991 E

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA ZNANOST IN TEHNOLOGIJO
Urad RS za standardizacijo in meroslovje
LJUBLJANA
SIST EN 27490 -01- 2000
PREVZET PO METODI RAZGLASITVE

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Foreword

This European Standard has been taken over by CEN/TC 55, "Dental products" from the work of the ISO/TC 106 "Dentistry" of the International Organization for Standardization (ISO).

National Standards identical to this European Standard shall be published at the latest by 92-04-02 and conflicting national standards shall be withdrawn at the latest 92-04-02.

The standard was approved and in accordance with CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard : Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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The text of the International Standard ISO 7490:1990 was approved by CEN as a European Standard without any modification.

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INTERNATIONAL STANDARD

ISO 7490

First edition
1990-06-15

Dental gypsum-bonded casting investments for gold alloys

Revêtements à couler à liant plâtre dentaire pour les alliages d'or

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SIST EN 27490:2000
https://standards.iteh.ai/catalog/standards/sist/e289ea47-3132-422d-97f0-6a538f248634/sist-en-27490-2000

Reference number
ISO 7490 : 1990 (E)

SIST EN 27490:2000

Contents

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 27490:2000
https://standards.iteh.ai/catalog/standards/sist/e289ea47-3132-422d-97f0-6a538f248634/sist-en-27490-2000

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

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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 approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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International Standard ISO 7490 was prepared by Technical Committee ISO/TC 106, *Dentistry*.

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Annexes A and B of this International Standard are for information only.

SIST EN 27490:2000

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SIST EN 27490:2000

Dental gypsum-bonded casting investments for gold alloys

1 Scope

This International Standard establishes a classification of, and specifies requirements for, gypsum-bonded casting investments together with the test methods to be used to determine compliance with these requirements.

It applies to gypsum-bonded investments suitable for casting dental gold alloy which have liquidus temperatures not higher than 1 080 °C.

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.

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ISO 1561:1975, *Dental inlay casting wax.*

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

ISO 3310-1:1982, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth.*

ISO 7500-1:1986, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tensile testing machines.*

3 Classification

For the purposes of this International Standard, gypsum-bonded investments are classified as follows:

Type 1: Thermal expansion type, for casting inlays and crowns

Type 2: Hygroscopic expansion type, for casting inlays and crowns

Type 3: For casting complete and partial denture bases

In its classification, a particular material need not be restricted to only one type.

4 Requirements

4.1 Material

The investment shall be supplied as a powder consisting essentially of a mixture of calcium sulfate hemihydrate and silica. The investment powder may also contain modifying agents. However, it shall not contain extraneous material, and shall be dry, uniform and free from lumps. If the instructions recommend the use of a mould liner (see clause 8), the recommended lining material shall be available from the manufacturer.

4.2 Particle size

The particle size distribution shall be such that, when the powder is tested as described in 7.2.2,

not more than 1 % (m/m) is retained on a 300 µm test sieve,

not more than 5 % (m/m) on a 150 µm test sieve, and

not more than 15 % (m/m) on a 75 µm test sieve.

SIST EN 27490:2000
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4.3 Unset investment

When added to water in the proportions specified by the manufacturer, and mixed as directed in 6.3, the investment shall readily form a uniform paste.

The fluidity of types 1 and 2 investments shall be such that, when tested in accordance with 7.3.1, 2 min after the first contact of powder and water, the slump shall be not more than 40 mm high measured at its highest point.

The fluidity of type 3 investments shall be such that, when tested in accordance with 7.3.2, 2 min after the first contact of powder and water, the average diameter of the slump shall be not less than 60 mm.

4.4 Rate of setting

4.4.1 Working time

4.4.1.1 Low-speed mixing [1)]

When the test described in 7.3.1.2 (types 1 and 2) or 7.3.2.2 (type 3) is repeated 5 min after the first contact of powder and

1) This requirement applies to mixes prepared by hand mixing (see 6.3.1) or in mechanical devices with a rotational frequency of less than 700 r/min.

SIST EN 27490:2000

water, the mix shall still comply with the fluidity requirements specified in 4.3. No spatulation or vibration of the mix shall be permitted other than that specified in 7.3.1 (types 1 and 2) or 7.3.2 (type 3).

4.4.1.2 High-speed mixing, types 1 and 2[1)]

When the test described in 7.3.1.2 is repeated 3 min after the first contact of powder and water, the mix shall still comply with the fluidity requirements specified in 4.3. No spatulation or vibration of the mix shall be permitted other than that specified in 7.3.1.

4.4.2 Setting time

When the mixed investment is tested in accordance with 7.4, the Vicat initial set shall not vary by more than 20 % from the setting time stated by the manufacturer (see clause 8).

4.5 Compressive strength

The set investment, when tested in accordance with 7.5, shall comply with the requirements set out in table 1.

Table 1 — Compressive strength

Type	Minimum compressive strength, MPa*), at room temperature
1	2,3
2	2,3
3	5,6

*) 1 MPa = 10^6 N/m^2

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SIST EN 27490:2000
https://standards.iteh.ai/catalog/standards/sist/e289ea47-3132-422d-9740-6a538f248634/sist-en-27490-2000

4.6 Expansion

The investment, when tested in accordance with 7.6, shall have a total linear expansion (setting and thermal combined) which complies with the requirements set out in table 2. None of the thermal expansion curves produced according to 7.6.4.4 shall vary by more than ± 0,1 % expansion over the recommended casting range (see clause 8), and at least one of these curves shall agree, within 0,1 % expansion, over the recommended casting range, with the thermal expansion curve provided by the manufacturer (see clause 8).

Table 2 — Total expansion

Type	Minimum linear expansion, %
1	1,5
2	1,5
3	1,3

4.7 Behaviour during casting

The investment mould, when tested in accordance with 7.7.1 (types 1 and 2) or 7.7.2 (type 3), shall not emit offensive fumes when heated, shall not contaminate alloy cast into it, and shall not cause pitting, fins, rough surfaces or voids in the casting.

5 Sampling

The method of procurement and the amount of investment powder needed for testing shall be the subject of agreement between the interested parties. Powder from broken or damaged containers shall not be used for testing. If the powder is supplied in bulk, rather than in individual units, it shall be thoroughly mixed before testing and then stored in a moisture-proof container.

If a mould liner is recommended and is not supplied with the investment, an adequate amount of the recommended lining material shall be procured from the investment manufacturer.

6 Test conditions and preparation of test specimens

6.1 Test conditions

All mixing and testing of the investment shall be carried out in a room free from draughts and under atmospheric conditions of 23 °C ± 2 °C and (50 ± 5) % relative humidity.

6.2 Materials and apparatus

All apparatus and instruments used in mixing and testing shall be clean, dry and free from particles of gypsum. Before mixing and testing are begun, materials and apparatus shall be brought to ambient temperature. Irrespective of specimen size, all mixes shall be made with at least 100 g of powder.

6.3 Method of mixing

Carry out the mixing according to the manufacturer's instructions (see clause 8).

6.3.1 Hand mixing

6.3.1.1 Apparatus

6.3.1.1.1 Clean scratch-free flexible mixing bowl, of at least 300 ml capacity.

6.3.1.1.2 Rigid spatula, with a blade at least 20 mm wide.

6.3.1.1.3 Electric dental vibrator.

6.3.1.2 Procedure

Using the mixing bowl (6.3.1.1.1) and spatula (6.3.1.1.2), mix at least 100 g of powder with distilled water in the recommended proportions (see clause 8) according to the procedure described below.

1) This requirement applies only to mixes prepared in mechanical devices with a rotational frequency of 1 400 r/min or higher. These devices include provision for vacuum investing as well as mixing, and are suitable only for use with small casting rings (types 1 and 2 investments only).

SIST EN 27490:2000

Measure the mass of the powder and the mass or volume of the distilled water with an accuracy of ± 1 %.

Pour the water into the mixing bowl. Begin timing from the moment at which investment powder and water first make contact. Shake or sift the investment into the water over a period of 15 s, in such a way that entrapment of air is minimized.

During the next 15 s, jar or vibrate the bowl. In this period ensure that the powder is completely wetted, using limited movements of the spatula if necessary, but avoiding any stirring movements.

Then spatulate the powder and water for 30 s, using a circular stirring motion at a rate of approximately 3 r/s. Minimize the incorporation of air into the mix. During spatulation subject the bowl to appropriate vibration by means of an electric dental vibrator (6.3.1.1.3). Complete the mixing procedure in 60 s ± 2 s.

Transfer the mixed investment immediately to the moulds or testing apparatus.

6.3.2 Mechanical mixing

6.3.2.1 Apparatus

Mechanical mixing apparatus complying with the details specified by the investment manufacturer [see item d) in clause 8].

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6.3.2.2 Procedure

SIST EN 27490:2000
https://standards.iteh.ai/catalog/standards/sist/e289ea47-3132-422d-97f0-6a538f248634/sist-en-27490-2000

Using the mechanical mixing apparatus (6.3.2.1), mix at least 100 g of powder with distilled water in the recommended proportion, for the time recommended by the investment manufacturer [see item d) in clause 8].

Transfer the mixed investment immediately to the moulds or testing apparatus.

7 Test methods

7.1 Visual inspection

Visual inspection shall be used in determining compliance with requirements of 4.1 and clauses 9 and 10.

7.2 Particle size distribution

7.2.1 Apparatus

7.2.1.1 Test sieves, round, of diameter 200 mm and of the following nominal aperture sizes: 300 µm, 150 µm, and 75 µm, complying with the requirements of ISO 3310-1.

7.2.1.2 Oven or **drying cabinet,** maintained at 40 °C ± 2 °C.

7.2.2 Procedure

Add 25 g of investment powder to 100 ml of 2-propanol (isopropyl alcohol 95 %) in a 250 ml conical flask. Stopper the flask and shake for 2 min. Transfer the suspension to the 300 µm sieve (7.2.1.1) nested on the 150 µm sieve which is in turn nested on the 75 µm sieve, and wash with 2-propanol until the washings are clear. When the washings from the 300 µm and the 150 µm sieves are clear, the sieves may be separated to facilitate washing the residues on the 75 µm sieve.

Dry the residues on the sieves at 40 °C ± 2 °C. Remove and weigh the residues, and report the mass of each residue as a percentage of the mass of the original sample.

CAUTION — When using 2-propanol keep away from flame, provide good ventilation and avoid excessive inhalation of vapour.

7.3 Fluidity of the unset mix

7.3.1 Types 1 and 2 investments

7.3.1.1 Apparatus

7.3.1.1.1 Mould, as shown in figure 1.

7.3.1.1.2 Flat smooth glass or glazed plate, at least 80 mm square.

7.3.1.1.3 Electric dental vibrator.

7.3.1.2 Procedure

Make a mix of investment, following the appropriate method described in 6.3 and timing the test from the moment of first contact between powder and water. Stand the mould (7.3.1.1.1) in the centre of the plate (7.3.1.1.2) and fill it with the mix, applying sufficient vibration to the plate so that the mould fills rapidly. The vibration shall cease not later than 110 s from the start of mixing.

Place the plate and the filled mould on a vibration-free surface. After 2 min ± 1 s from the start of mixing, lift the mould vertically away from the plate at a rate of approximately 10 mm/s and allow the mix to slump on the plate.

When the investment has set sufficiently, measure the height of the slump at its highest point.

If in the first test the investment fails to meet the requirement specified in 4.3, repeat the test two more times and report the average of the three results as the height of the slump.

7.3.2 Type 3 investments

7.3.2.1 Apparatus

7.3.2.1.1 Electric vibrator with a substantially flat platform, to which is screwed or bolted a flat smooth glass or