

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1561

DENTAL INLAY CASTING WAX

1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 1561, *Dental inlay casting wax*, was drawn up by Technical Committee ISO/TC 106, *Dentistry*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1561, which was circulated to all the ISO Member Bodies for enquiry in December 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Greece	Poland
Belgium	India	South Africa, Rep. of
Brazil	Israel	Spain
Canada	Korea, Rep. of	U.A.R.
Czechoslovakia	Netherlands	United Kingdom
Denmark	New Zealand	U.S.A.
France	Peru	Yugoslavia

The following Member Bodies opposed the approval of the Draft :

Sweden
Switzerland

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

DENTAL INLAY CASTING WAX

INTRODUCTION

This ISO Recommendation is technically identical with F.D.I.* Specification No. 4, the only difference being in the wording and layout to bring the text into standard ISO form. Further studies are being undertaken to provide, if necessary, for a future revision of this ISO Recommendation in the light of technological advances supported by well-documented data.

NOTE. - Throughout this ISO Recommendation the figures for SI units are approximate conversions of the technical metric units using the conversion factor 1 N = 0.102 kgf.

1. SCOPE

This ISO Recommendation gives the classification of and requirements for dental inlay casting wax, together with the test methods to be employed to determine compliance with these requirements.

2. FIELD OF APPLICATION

This ISO Recommendation is applicable to inlay casting wax used in making patterns in the production of inlays and crowns. The wax consists essentially of natural waxes, resins and hydrocarbons of the paraffin series.

3. CLASSIFICATION

The inlay wax delineated in this ISO Recommendation is of two types, namely *direct technique wax* intended primarily for intra-oral use, and *indirect technique wax* intended primarily for extra-oral use.

Each type should be classified as follows :

- **Type I :** Direct technique wax

Class 1 : Sticks

Class 2 : Cones

- **Type II :** Indirect technique wax

Class 1 : Sticks

Class 2 : Cones

4. REQUIREMENTS

4.1 Uniformity

The wax should be uniform and free from foreign materials.

4.2 Sizes

The sizes of the sticks and cones should be as specified by the purchaser.

4.3 Colour

The colour of the wax should be as specified by the purchaser.

4.4 Softening

The wax should soften when heated without becoming flaky. It should not show laminations when formed into a working mass.

4.5 Chipping

The wax should not show appreciable chipping or flaking when trimmed to a fine margin at 23 ± 2 °C.

4.6 Residue

The melted wax when vaporized at 500 °C should leave no solid residue in excess of 0.10 % of the original mass of the specimen when tested in accordance with clause 6.2.3.

4.7 Flow

The samples of the wax, when submitted to the test described in clause 6.2.1, should give flow results complying with the requirements given below for the type of wax and the different temperatures of testing.

Test temperature	30 °C	37 °C	40 °C	45 °C
Type I wax		≤ 1.0 %	≤ 20 %	≥ 70 % ≤ 90 %
Type II wax	≤ 1.0 %		≥ 50 %	≥ 70 % ≤ 90 %

4.8 Linear thermal expansion, Type I wax

4.8.1 From 25.0 to 30.0 °C the linear thermal expansion should be not more than 0.2 % when tested as detailed in clause 6.2.2.

4.8.2 From 25.0 to 37.0 °C the linear thermal expansion should be not more than 0.6 % when tested as detailed in clause 6.2.2.

4.9 Manufacturer's instructions

Instructions, including the method for softening and the working temperature, should be supplied with each package of wax. In addition, data showing the thermal expansion of the Type I wax from 25 to 30 °C and from 25 to 37 °C should accompany each package of that wax (see clause 4.8).

5. SAMPLING

The method of procurement and the amount of wax needed for testing should be the subject of agreement between the parties concerned.

6. TEST METHODS

6.1 Visual inspection

Visual inspection should be used in determining compliance with the requirements stated in clauses 4.1, 4.2, 4.3, 4.4, 4.5 and 4.9 and section 7.

6.2 Physical tests

6.2.1 Flow

6.2.1.1 APPARATUS

- (a) *Metric micrometer caliper.*
- (b) *Flow testing instrument*, (see Fig. 1), consisting of the following parts:
 - a metallic cylinder (A);
 - a shaft having a low thermal conductivity (B);
 - a brass plate (C).

The total mass, in air, of these three components should be 2 kg. The cylinder (A) should be separated a minimum distance of 76 mm from the brass plate by the shaft (B). This shaft should be of hard rubber or a similarly poor thermal conductor to reduce loss of heat from the specimen. The diameter of the brass plate should not be less than 51 mm. The thickness should not exceed 6.35 mm.

- (c) *Mould* (see Fig. 2), consisting of a stainless steel plate 6.0 mm thick, having flat parallel top and bottom surfaces, and containing four holes 10.0 mm in diameter. The axes of the holes should be perpendicular to the surfaces of the plate. The sides of the holes should be finished smooth.

6.2.1.2 PREPARATION OF TEST SPECIMENS. A quantity of wax should be broken into pieces and placed in a metal pouring pan (see Fig. 3). The pan should be placed on a surface which is 130 mm below a 250 W infra-red lamp. The wax, while being stirred, should be allowed to reach a temperature of 75 ± 5 °C and be maintained at this temperature until the sample is melted throughout. A thermometer should be used to measure the temperature. The melted wax should then be poured into a mould that has been lubricated with a silicone grease whose melting point is higher than 75 ± 5 °C.

The mould should be preheated to 55 ± 5 °C and placed on a smooth glass slab 152 mm long, 76 mm wide and 19 mm thick, preheated to the same temperature. As the wax solidifies and a shrinkage void appears, liquid wax should be added. When the wax has lost its mirror-like surface, a smooth flat tin foil or aluminium-foil covered glass plate, preheated to 55 ± 5 °C, should be placed on top of the mould. A load of 90 N (9 kgf) should be applied to the top of the foil covered glass plate for 30 minutes. The load and the glass plate should then be removed and the excess wax trimmed away by drawing a straight-edged metal scraper across the mould thereby trimming the specimen flush with the surface. The mould should be removed from the glass by gently tapping the side of the mould. The specimens of wax should be removed from the mould by chilling in water at 10 °C and then should be stored at 23 ± 2 °C for 24 hours before testing.

6.2.1.3 PROCEDURE. The initial length of the specimen prepared in accordance with clause 6.2.1.2 should be determined at 23 ± 2 °C using a metric micrometer caliper.

Four measurements should be made around the circumference and one measurement should be made in the centre of the specimen. The measurements should be averaged and recorded to the nearest 0.005 mm. The specimen and flow testing instrument (6.2.1.1 (b)) should be placed in a water bath and held at the testing temperature for 20 minutes prior to testing. The temperature of the bath should be controlled to within 0.1 °C of the required temperature. (A calibrated thermometer should be used for determining the temperature.) Agitation should be provided in the water bath by means of a mechanical stirrer. A thin sheet of regenerated cellulose film should be placed between the instrument and each end of the specimen. The bottom of the specimen should be 51 mm below the surface of the water in the bath. A constant axial load of 19.6 N (2 kgf) should then be applied to the specimen for 10 minutes, after which the specimen should be removed and cooled in air to 23 ± 2 °C. The waterproof film should be stripped off and the final length determined in the same manner as the original length.

- 6.2.1.4 **EXPRESSION OF RESULTS.** The flow, as evidenced by the change in length, should be reported as a percentage of the initial length.

The value for flow at any temperature should be the average value for two specimens and should be reported to the nearest 0.1 %.

6.2.2 *Linear thermal expansion*

6.2.2.1 **APPARATUS**

- (a) *Micrometer microscope comparator*, or an equivalent instrument of equal accuracy.
- (b) *Brass mould* (see Fig. 4), 305 mm in length, having an opening of 6.35 mm × 6.35 mm running its full length, with spacers, 19 mm in length, at each end.
- (c) *Suitable holder* (see Fig. 5) with openings for viewing the reference marks for linear measurements. These openings should be located 6.35 mm from each end of the holder and should be 9.52 mm × 12.8 mm in size. The holder is so constructed that the wax specimen rides against only two narrowed sections, having 7.94 mm × 7.94 mm openings, located 25.40 mm from each end, to enable alignment with a minimum of restraint to the expansion during heating.

- 6.2.2.2 **PREPARATION OF TEST SPECIMENS.** The wax should be melted as described in clause 6.2.1.2 and poured into the brass mould, lubricated with a silicone grease whose melting point is higher than 80 °C, until the mould is overfilled. The mould should be preheated to 55 ± 5 °C. As the wax solidifies and shrinkage occurs, liquid wax should be added. When the wax has lost its mirror-like surface, a lubricated brass plate, preheated to 55 ± 5 °C, should be placed on top of the overfilled mould. A load of 90 N (9 kgf) should be applied to the top of the brass plate for 30 minutes. The weight and the brass plate should then be removed and the excess wax trimmed away until the specimen is flush with the top of the mould. The size of the specimen thus prepared will be approximately 267 mm × 6.35 mm × 6.35 mm and is suitable for use with a micrometer microscope comparator. The specimen should be removed from the mould and should have embedded in its surface, near each end, small metal pins having cross marks which should serve as reference marks for subsequent linear measurements. After the test specimen has been prepared it should be stored at 37 °C for 24 hours before testing.

- 6.2.2.3 **PROCEDURE.** The specimen prepared in accordance with clause 6.2.2.2 should be heated to three different temperatures and the distance between the reference marks should be measured at each temperature with the micrometer microscope comparator (6.2.2.1 (a)). The specimen should be placed under a suitable holder with openings for viewing the reference marks (see clause 6.2.2.1 (c)). An initial measurement should be made in water after 20 minutes at 25.0 ± 0.1 °C. The temperature of the water bath should then be raised to 30.0 ± 0.1 °C. The specimen should remain for 20 minutes at that temperature before the distance between the marks is determined. The same procedure should be carried out at 37.0 ± 0.1 °C. A repeat test starting at 25.0 ± 0.1 °C should be made on the same specimen.

- 6.2.2.4 **EXPRESSION OF RESULTS.** Using the measurement at 25.0 ± 0.1 °C as zero, the value for linear thermal expansion should be the average value of the two determinations at each temperature and should be reported to the nearest 0.05 %.

6.2.3 *Determination of non-volatile residue*

- 6.2.3.1 **PROCEDURE.** Approximately 1 g of wax should be placed in a crucible previously conditioned to constant mass by repeated heating to 500 °C and cooling to 23 ± 2 °C. The conditioned, tared and loaded crucible should be placed in a furnace at 23 ± 2 °C. The temperature of the furnace should be increased to 500 °C and maintained at this temperature for 1 hour. The crucible should be removed from the furnace, placed in a desiccator, allowed to cool to 23 ± 2 °C and then weighed.

- 6.2.3.2 **EXPRESSION OF RESULTS.** The value for residue should be the average value of two determinations and should be reported to the nearest 0.02 %.

7. PACKAGING AND MARKING

7.1 Packaging

The material should be packaged in accordance with accepted commercial practice.

7.2 Marking

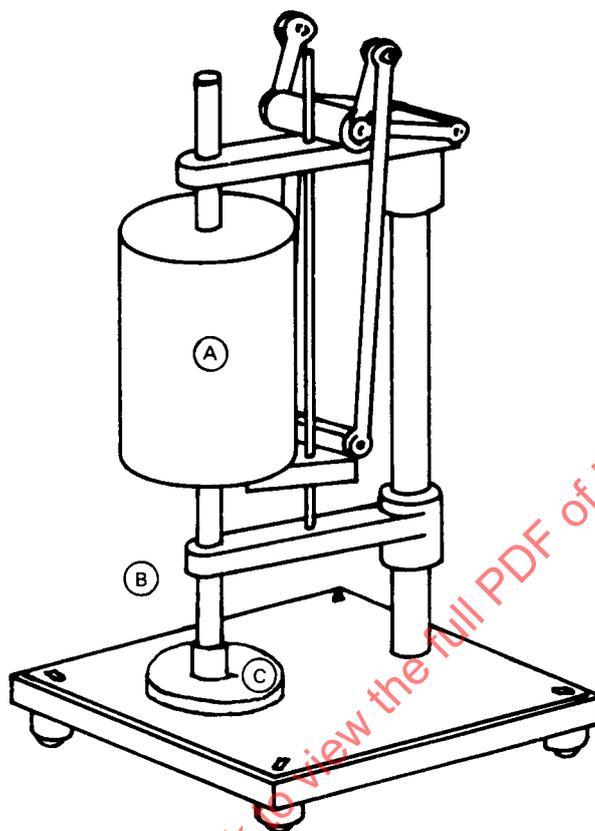
7.2.1 *Lot numbers.* Each container should be marked with a serial number or a combination of letters and numbers which refers to the manufacturer's records for the particular lot or batch of wax.

7.2.2 *Date of manufacture.* The date of manufacture (year and month) should be given on the container either as a separate item or as part of the lot number.

7.2.3 *Net mass.* The minimum net mass, in grammes, of the contents should be indicated on all containers.

7.2.4 *Type.* The type and class of wax, as designated in section 3, should be indicated on all containers.

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- (A) Weight
- (B) Shaft
- (C) Brass plate

FIG. 1 - Flow testing instrument

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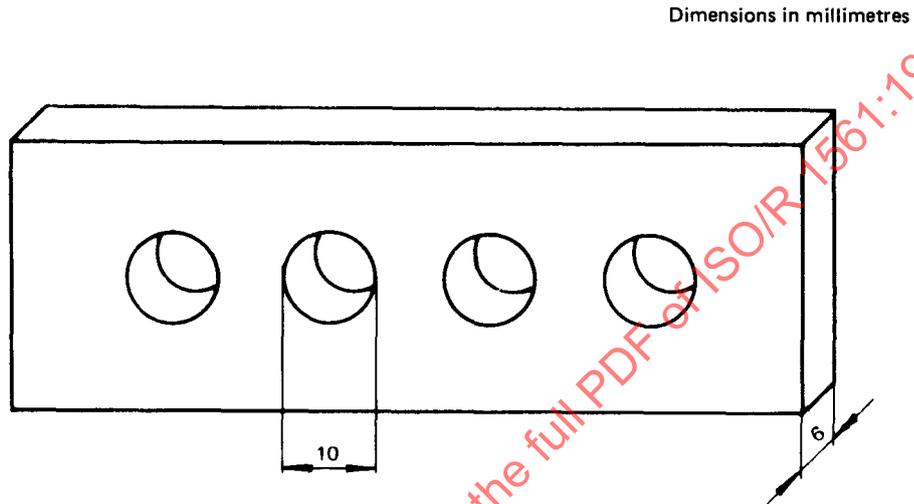


FIG. 2 - Mould for forming flow specimens

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