INTERNATIONAL STANDARD 1561

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION •МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Dental inlay casting wax

Cires à inlays dentaires

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

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.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 106 has reviewed ISO Recommendation R 1561 and found it technically suitable for transformation. International Standard ISO 1561 therefore replaces ISO Recommendation R 1561-1970 to which it is technically identical.

ISO Recommendation R 1531 was approved by the Member Bodies of the following countries :

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

The Member Bodies of the following countries expressed disapproval of the Recommendation on technical grounds :

Sweden
Switzerland*

No Member Body disapproved the transformation of ISO/R 1561 into an International Standard.

* Subsequently, this Member Body approved the Recommendation.

Printed in Switzerland

Dental inlay casting wax

1 SCOPE

This International Standard specifies the classification of, and requirements for, dental inlay casting wax, together with the test methods to be employed to determine compliance with these requirements.

NOTE — Throughout this International Standard the figures for SI units are approximate conversions of the technical metric units using the conversion factor 1 N = 0,102 kgf.

2 FIELD OF APPLICATION

This International Standard 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 covered by this International Standard 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 shall 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 shall be uniform and free from foreign materials.

4.2 Sizes

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

4.3 Colour

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

4.4 Softening

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

4.5 Chipping

The wax shall 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 shall leave no solid residue in excess of 0,10 % of the original mass of the specimen when tested in accordance with 6.2.3.

4.7 Flow

The samples of the wax, when submitted to the test specified in 6.2.1, shall give flow results complying with the requirements given in the table for the type of wax and the different temperatures of testing.

TABLE — **Flow test temperatures**

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 shall be not more than 0,2 % when tested as specified in 6.2.2.

4.8.2 From 25,0 to 37,0 °C the linear thermal expansion shall be not more than 0,6 % when tested as specified in 6.2.2.

4.9 Manufacturer's instructions

Instructions, including the method for softening and the working temperature, shall 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 shall accompany each package of that wax (see 4.8).

5 SAMPLING

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

6 TEST METHODS

6.1 Visual inspection

Use visual inspection in determining compliance with the requirements stated in 4.1, 4.2, 4.3, 4.4, 4.5 and 4.9 and clause 7.

6.2 Physical tests

6.2.1 *Flow*

6.2.1.1 Apparatus

a) **Metric micrometer caliper.**

b) **Flow testing instrument** (see figure 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 shall be 2 kg. The cylinder (A) shall be separated a minimum distance of 76 mm from the brass plate by the shaft (B). This shaft shall be of hard rubber or a similarly poor thermal conductor to reduce loss of heat from the specimen. The diameter of the brass plate shall be not less than 51 mm and the thickness not greater than 6,35 mm.

c) **Mould** (see figure 2), consisting of a stainless steel plate 6 mm thick, having flat parallel top and bottom surfaces, and containing four holes 10 mm in diameter. The axes of the holes shall be perpendicular to the surfaces of the plate. The sides of the holes shall be finished smooth.

d) **Metal pouring pan** (see figure 3).

6.2.1.2 Preparation of test specimens

Break a quantity of wax into pieces and place in the metal pouring pan. Place the pan on a surface which is 130 mm below a 250 W infra-red lamp. Heat the wax, and stir as it melts, until a temperature of 75 ± 5 °C is reached. Maintain at this temperature until the sample is melted throughout. Use a thermometer to measure the temperature.

Pour the melted wax into the mould placed on a smooth glass slab 152 mm long, 76 mm wide and 19 mm thick, both preheated to 55 ± 5 °C. Lubricate the mould with a silicone grease whose melting point is higher than 75 ± 5 °C. As the wax solidifies and a shrinkage void appears, add liquid wax.

When the wax has lost its mirror-like surface, place a smooth, flat tin-foil or aluminium-foil covered glass plate, preheated to 55 ± 5 °C, on top of the mould. Apply a load of 90 N (9 kgf) to the top of the foil-covered glass plate for 30 min. Remove the load and the glass plate and trim the excess wax away by drawing a straight-edged metal scraper across the mould, thereby finishing the specimen flush with the surface.

Remove the mould from the glass by gently tapping the side of the mould and the specimens of wax from the mould by chilling in water at 10 °C. Store the specimens at 23 ± 2 °C for 24 h before testing.

6.2.1.3 Procedure

Determine the initial length of the specimen, prepared in accordance with 6.2.1.2, at 23 ± 2 °C using the metric micrometer caliper. Take four measurements around the circumference and one measurement in the centre of the specimen. Average the measurements and record to the nearest 0,005 mm.

Place the specimen and flow testing instrument in a water bath and hold at the testing temperature (see table in 4.7) for 20 min prior to testing. Maintain the temperature of the bath to within 0,1 °C of the required temperature (using a calibrated thermometer to determine the temperature). Agitate the water bath by means of a mechanical stirrer. Place a thin sheet of regenerated cellulose film between the instrument and each end of the specimen with the bottom of the specimen 51 mm below the surface of the water in the bath.

Apply a constant axial load of 19,6 N (2 kgf) to the specimen for 10 min, then remove the specimen from the water bath and cool in air to 23 ± 2 °C. Strip off the waterproof film and determine the final length in the same manner as the original length.

6.2.1.4 Expression of results

Report the flow, as evidenced by the change in length, as a percentage of the initial length.

Report the value for flow at any temperature as the average value, to the nearest 0,1 %, for two specimens.

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 figure 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 figure 5) with openings for viewing the reference marks for linear measurements. These openings shall be located 6,35 m from each end of the holder and shall 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 25,4 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

Melt the wax as specified in 6.2.1.2 and pour into the brass mould, preheated to 55 ± 5 °C and lubricated with a silicone grease whose melting point is higher than 80 °C, until the mould is overfilled. As the wax solidifies and shrinkage occurs, add liquid wax. When the wax has lost its mirror-like surface, place a lubricated brass plate, preheated to 55 ± 5 °C, on top of the overfilled mould. Apply a load of 90 N (9 kgf) to the top of the brass plate. After 30 min remove the load and brass plate and trim the excess wax 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 suitable for use with a micrometer microscope comparator.

Remove the specimen from the mould and embed in its surface, near each end, small metal pins with cross-marks to serve as reference marks for subsequent linear measurements. After the test specimen has been prepared, store it at 37 °C for 24 h before testing.

6.2.2.3 PROCEDURE

Place the specimen, prepared in accordance with 6.2.2.2, in the holder (6.2.2.1 c)), heat to the three different specified temperatures and measure the distance between the reference marks at each temperature with the micrometer microscope comparator (6.2.2.1 a)). Make the initial measurement in water after 30 min at 25,0 ± 0,1 °C, then raise the temperature of the water bath to 30,0 ± 0,1 °C. Allow the specimen to remain for 20 min at that temperature before determining the distance between the marks. Carry out the same procedure at 37,0 ± 0,1 °C. Make a repeat test on the same specimen starting at 25,0 ± 0,1 °C.

6.2.2.4 EXPRESSION OF RESULTS

Using the measurement at 25,0 ± 0,1 °C as zero, report the value for linear thermal expansion as the average value to the nearest 0,05 % of the two determinations at each temperature.

6.2.3 *Determination of non-volatile residue*

6.2.3.1 PROCEDURE

Place approximately 1 g of wax in a crucible previously conditioned to constant mass by repeated heating to 500 °C and cooling to 23 ± 2 °C. Place the conditioned, tared and loaded crucible in a furnace at 23 ± 2 °C. Increase the temperature of the furnace to 500 °C and maintain at this temperature for 1 h.

After 1 h remove the crucible from the furnace, place in a desiccator, allow to cool to 23 ± 2 °C and then weigh.

6.2.3.2 EXPRESSION OF RESULTS

Report the value for residue as the average value, to the nearest 0,02 %, of two determinations.

7 PACKAGING AND MARKING

7.1 Packaging

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

7.2 Marking

7.2.1 *Lot numbers*

Each container shall 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*

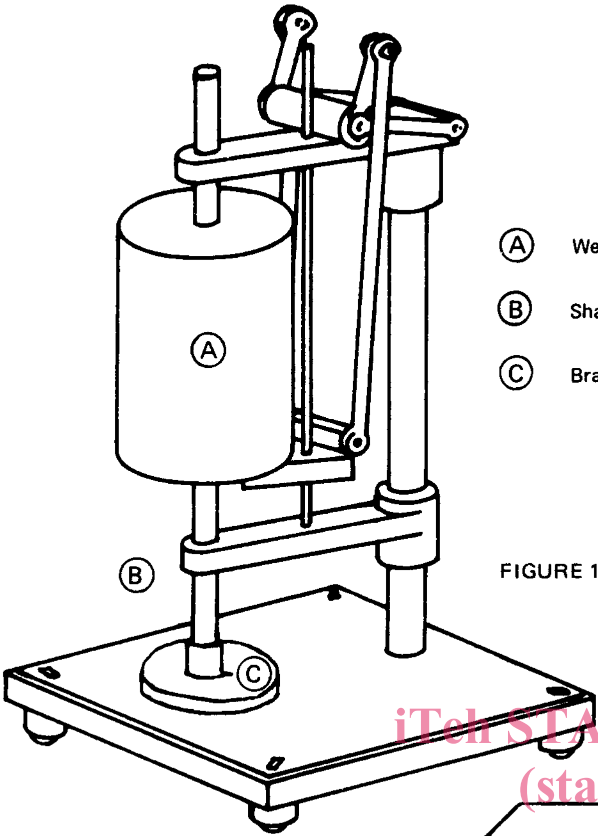
The date of manufacture (year and month) shall be given on the container either as a separate item or as part of the lot number.

7.2.3 *Net mass*

The minimum net mass, in grams, of the contents shall be indicated on all containers.

7.2.4 *Type*

The type and class of wax, as designated in clause 3, shall be indicated on all containers.



A Weight

B Shaft

C Brass plate

FIGURE 1 — **Flow testing instrument**

Dimensions in millimetres

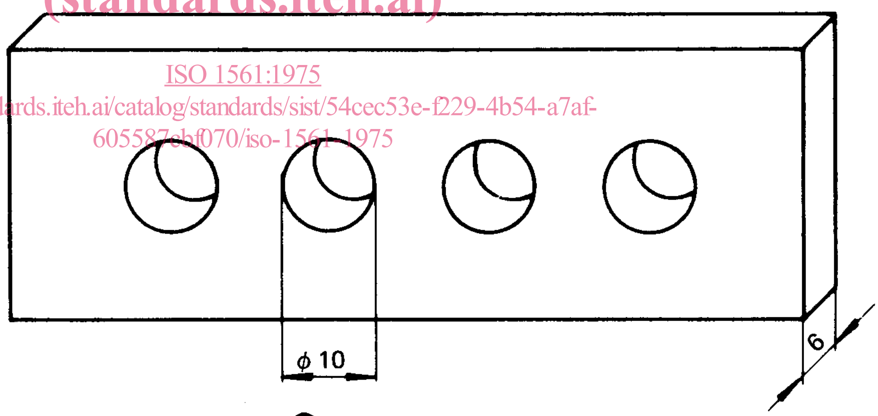


FIGURE 2 — **Mould for forming flow specimens**

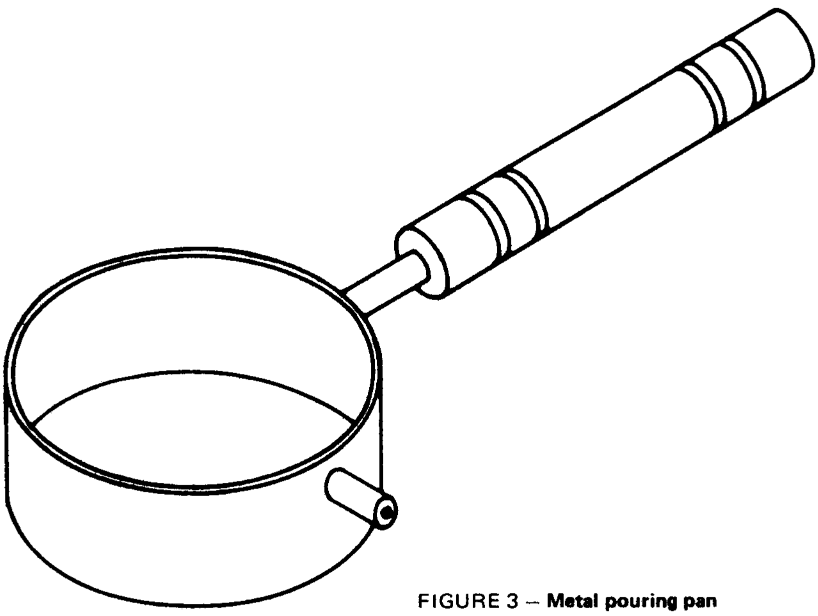


FIGURE 3 — **Metal pouring pan**

Dimensions in millimetres

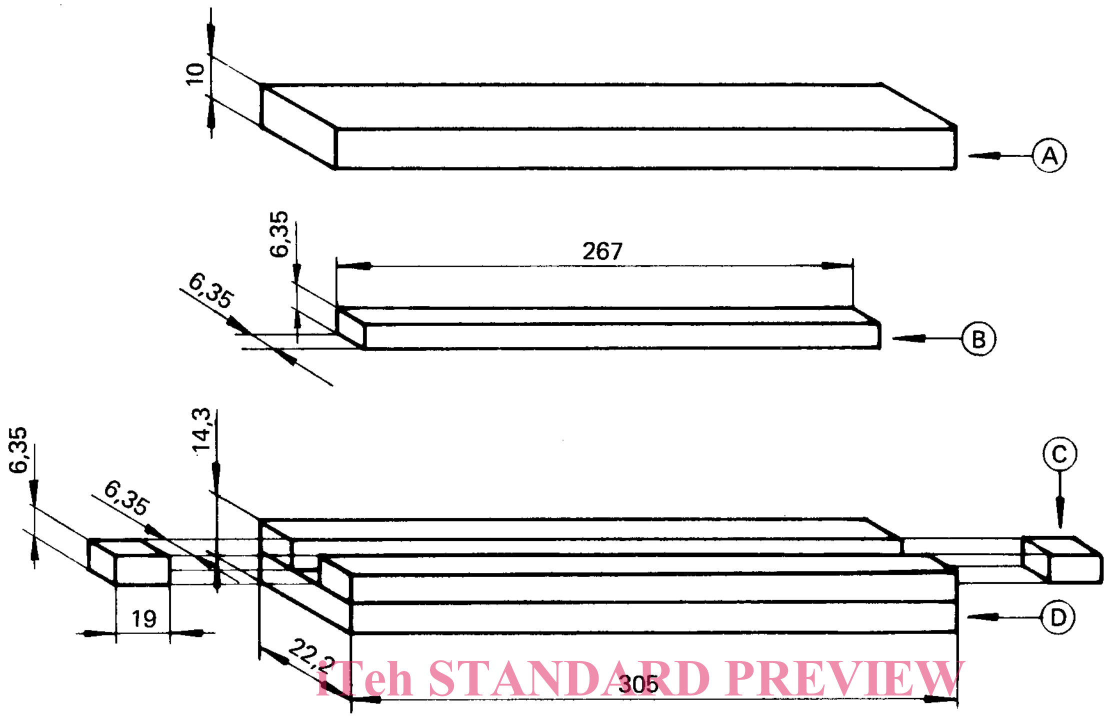


FIGURE 4 – **Mould for forming thermal expansion specimen**

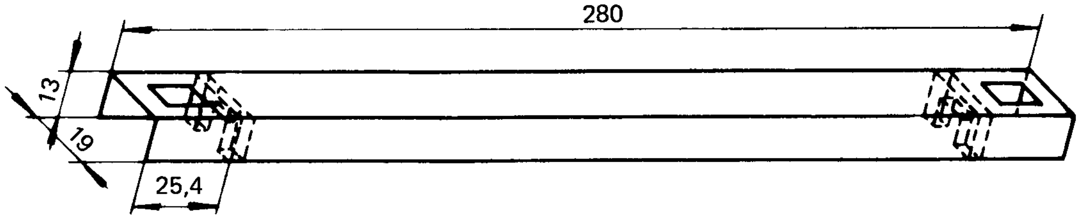


FIGURE 5 – **Holder for thermal expansion specimen**