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# International Standard



# 4824

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## Dentistry — Porcelain denture teeth

*Art dentaire — Dents en porcelaine*

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## Foreword

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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.

International Standard ISO 4824 was developed by Technical Committee ISO/TC 106, *Dentistry*, and was circulated to the member bodies in June 1980.

It has been approved by the member bodies of the following countries :

Australia	Ireland	Sweden
Canada	Japan	Switzerland
Egypt, Arab Rep. of	Mexico	USA
France	Netherlands	USSR
Germany, F. R.	Romania	
India	South Africa, Rep. of	

The member body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

# Dentistry — Porcelain denture teeth

## 1 Scope and field of application

This International Standard specifies the requirements and methods of test for porcelain teeth suitable for use in the fabrication of removable prostheses.

## 2 References

ISO 1567, *Denture base polymer*.

ISO 1942/2, *Dental vocabulary — List 2: Dental materials*.

## 3 Definitions

For the purposes of this International Standard the following definitions apply:

**3.1 anterior teeth (Type I):** Teeth of forms approximating those of human anterior teeth. (See ISO 1942/2.)

**3.2 diatoric teeth:** Teeth designed to be retained by anchorage slots and/or holes.

**3.3 pin teeth:** Teeth designed to be retained by headed pins.

**3.4 posterior teeth (Type II):** Teeth of forms approximating those of human posterior teeth. (See ISO 1942/2.)

**3.5 set:** A set of six anterior pin teeth or eight posterior diatoric teeth as appropriate, as received from the manufacturer.

## 4 Requirements

### 4.1 Material

The teeth shall be made of a suitable fused porcelain. The pin anchorage of pin teeth shall be made of metals that do not cause any adverse reaction with the porcelain of the tooth or with a denture base polymer complying with ISO 1567, or with saliva.

### 4.2 Shape and size

The shape and size of the teeth, when examined in accordance with 6.1 and 6.2, shall conform to the manufacturer's mould chart. A mould chart shall be available, on request, from the manufacturer which shall

- depict the shapes of the teeth;
- state the dimensions of the teeth in millimetres;
- in the case of anterior teeth (Type I), include the overall width of a set, as well as the mesio-distal width and the total inciso-cervical length of the left central incisor; and
- in the case of posterior teeth (Type II), include the overall width of a half-set (the four teeth of one side).

NOTE — Overall width is measured from the distal surfaces of canines (Type I) or second molars and mesial surfaces of first premolars (Type II), as appropriate.

### 4.3 Colour and blending of shades

Anterior teeth shall be blended and shall show no line of demarcation between incisal and gingival portions on the facial aspects of the teeth. If blending is used with posterior teeth, the same conditions shall apply. The colour, visual appearance, and blending shall correspond, within limits of professional acceptance, to the manufacturer's shade guide when inspected visually against the same background. The background shall be of a colour suitable for the purpose. The shade guide shall be available, on request, from the manufacturer.

### 4.4 Freedom from irritants

The teeth, both as supplied by the manufacturer and after processing by acceptable techniques, shall not cause damage to oral mucous membranes.

#### NOTES

- When specific toxicity tests become available it is envisaged that they will be included in this International Standard.
- It is envisaged that a future revision of this International Standard will disallow, if possible, the use of radioactive additives in the teeth.

#### 4.5 Freedom from imperfections

The teeth, when examined visually, shall be free from defects that might impair their serviceability.

#### 4.6 Surface finish

The fired teeth, when inspected visually, shall have a smooth, lustrous, non-porous surface.

When the teeth are tested in accordance with 6.3, the original finish of the teeth shall not have been impaired by the processing, and the teeth shall be capable of being ground and polished to an acceptable finish.

#### 4.7 Anchorage

##### 4.7.1 Posterior teeth

The teeth, examined in accordance with 6.4, shall provide a means of positive retention and have holes which are patent.

#### 4.8 Resistance to thermal shock

The teeth shall, when tested in accordance with 6.5, show no signs of cracking.

#### 4.9 Porosity

The teeth, when tested in accordance with 6.6, shall not show more than 16 pores of diameter greater than 30  $\mu\text{m}$  in any area of 1 mm diameter, and no more than 6 of those pores shall be between 40 and 150  $\mu\text{m}$  in diameter. There shall be no pores of diameter greater than 150  $\mu\text{m}$ .

### 5 Sampling

The sample shall comprise seven sets of teeth. They shall include five shades covering the range of shades shown by the manufacturer's shade guide. The sample shall include two pairs of sets, each pair being of the same mould and shade. The teeth shall be representative of the physical dimensions of the brand and type.

From the manufacturer's mould chart data, determine the median width of a set and the length of the central incisor for the anterior teeth and the first bicuspid for the posterior teeth. For each set of upper and lower teeth, select all those moulds that are  $\pm 1$  mm in width of a set, and  $\pm 0,5$  mm in length of central or bicuspid to the median dimensions. From the moulds that meet this specification choose the mould of a median labial-lingual or bucco-lingual thickness.

The samples shall be taken at random, for example by obtaining the sets at retail.

### 6 Inspection and methods of test

#### 6.1 Inspection

Visually examine the teeth in each set for compliance with the requirements given in 4.2, 4.3, 4.5 and 4.6.

#### 6.2 Shape and size

Measure (on the basis given in the manufacturer's mould chart) the dimensions of the teeth in each set for conformity with the values given in the mould chart. In measuring,

- a) the teeth should be held in a manner that permits an accurate measurement to be taken;
- b) a vernier micrometer fitted with parallel steel face pieces should be used;
- c) the tooth width should be recorded as the maximum dimension obtainable by a mesial/distal measurement of the tooth at right angles to its long axis.

In the case of the overall width, the teeth comply if the measured value does not differ by more than 7 % from the value given in the chart. In the cases of the mesio-distal width and inciso-cervical length, measured along the inciso-cervical axis, of the left central incisor of a set of anterior teeth, the teeth comply if the measured values do not differ by more than 7 % from the values given in the chart.

#### 6.3 Surface finish

##### 6.3.1 Effect of processing

###### 6.3.1.1 Preparation of specimens

Process a set (six or eight teeth) to a denture-base polymer complying with ISO 1567, using the customary denture compression packing technique, following the manufacturer's instructions, and using a modelling wax and gypsum product of suitable quality.

###### 6.3.1.2 Procedure

After deflasking, using dental laboratory tools and techniques, remove any surplus denture base material from those surfaces of the teeth which are normally exposed. Polish the denture base material by acceptable polishing techniques, taking care to keep the polishing tools wet where appropriate.

After polishing, examine the teeth visually for evidence of any damage suffered in processing, excluding accidental damage by tools used in processing.

##### 6.3.2 Effect of grinding

###### 6.3.2.1 Preparation of specimens

Using a wet, fine grit silicon carbide lathe wheel of diameter  $63 \pm 3$  mm and thickness  $4,7 \pm 0,3$  mm carefully grind the

occlusal surfaces or the incisal edges of the processed teeth, removing a layer of porcelain approximately 1 mm thick. The wheel shall be rotated at a speed of  $1\,700 \pm 300$  r/min.

#### 6.3.2.2 Procedure

After using acceptable dental procedures to re-polish the ground surface, note the quality, as compared to the original finish.

### 6.4 Anchorage

#### 6.4.1 Posterior diatoric teeth

##### 6.4.1.1 Procedure

By visually examining each tooth of two sets (sixteen teeth) ascertain whether the anchorage slots and/or holes provide positive retention for the denture base material.

By probing with a stiff wire (for example high tensile stainless steel) demonstrate the patency of the holes.

### 6.5 Resistance to thermal shock

#### 6.5.1 Apparatus

Electric oven, controlled at  $100 \pm 2$  °C.

#### 6.5.2 Preparation of specimens

Using a suitable cleanser (for example 10 g/l household detergent), thoroughly clean two sets (twelve or sixteen teeth) of the same mould and shade, removing all traces of adherent wax.

#### 6.5.3 Procedure

Place the teeth in a perforated metal container and transfer the container to the oven. After 20 min, remove the container from the oven and immediately immerse it in a shallow dish of ice water at  $1 \pm 1$  °C. The volume of the water shall be sufficient to cover the sample completely and to maintain its temperature at  $1 \pm 1$  °C and the sample shall remain immersed for not less than 30 s. Then return the sample to the oven and dry for a further 15 min at 100 °C. Remove the container from the oven and examine each tooth by high intensity transillumination, using X 10 magnification. A bright fibre optic system would be one such appropriate source of illumination.

### 6.6 Porosity

#### 6.6.1 Apparatus

Optical microscope, with photographic equipment.

Equipment for the preparation of polished sections.

#### 6.6.2 Preparation of specimens

Cut two teeth of a set in their long axis, using a wet diamond wheel. Embed the four halves [for example in autopolymerizing polymethyl methacrylate (PMMA)]. Smooth each half-tooth using wet silicon carbide papers of grits 240, 400, and 600 (new 220, 500, and 800), and polish using diamond paste (medium grain size 3 µm) on felt.

#### 6.6.3 Procedure

View the four specimens under the microscope. Count in the most porous area, but not in the region of the core, the pores having a diameter between 30 and 40 µm, and those with a diameter of 40 to 150 µm in an area of 1 mm diameter. For counting, a photomicrograph with a final enlargement of about 100 is suitable, as it is possible to mark the counted pores. The size determination is facilitated if a gauge is included in the photograph.

#### 6.6.4 Calculation and expression of results

If the specimens do not comply with the requirements of 4.9, repeat the test using four fresh specimens. If the fresh specimens comply with the requirements of 4.9, the teeth shall be considered to have passed the test. If the fresh specimens do not comply with the requirements of 4.9, the teeth shall be considered to have failed the test.

## 7 Packaging, marking and labelling

### 7.1 Packaging

The teeth shall be supplied in suitably mounted sets in containers that are strong enough to protect the contents against damage during normal transport, storage and handling.

### 7.2 Marking, labelling

#### 7.2.1 Marking on mounts

The following information shall be clearly marked on each mount:

- a) manufacturer's name or brand name;
- b) mould designation;
- c) shade designation;
- d) the country of origin.

#### 7.2.2 Marking on containers

The manufacturer's name or brand name shall appear, in clear and indelible markings, on each container or on a label securely attached to each container.

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