

Specification for

Dental casting investments —

Part 3: Ethyl silicate-bonded
investment materials

UDC 616.314 – 089.27:661.718.5

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

Co-operating organizations

The Dental Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- Association of Dental Hospitals of Great Britain and Northern Ireland*
- British Dental Association*
- British Dental Trade Association*
- British Plastics Federation
- Dental Education Advisory Council
- Department of Health and Social Security*
- Department of Industry — Laboratory of the Government Chemist*
- Department of Industry — National Engineering Laboratory
- Ministry of Defence*
- Royal Society of Medicine
- Scottish Home and Health Department

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- British Institute of Surgical Technicians
- Dental Laboratories Association
- Institute of Dental Surgery
- London Dental Study Club
- Individual expert

This British Standard, having been approved by the Dental Industry Standards Committee, was published under the authority of the Executive Board on 27 March 1975

© BSI 12-1999

The following BSI references relate to the work on this standard:
Committee reference DNMH/4/3
Draft for comment 73/60911

ISBN 0 580 08901 0

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

	Page
Co-operating organizations	Inside front cover
Foreword	ii
1 Scope	1
2 Reference	1
3 Requirements	1
4 Sampling	1
5 Test methods	1
6 Marking	4
Appendix A Conversion table	5
Figure 1 — Diagram of thermal expansion equipment	6
Figure 2 — Mould and former used in thermal expansion test	7
Figure 3 — Transverse strength test apparatus	7
Figure 4 — Diagram of furnace and lever system suitable for high temperature transverse strength tests	8
Publication referred to	Inside back cover

Foreword

This British Standard forms one of a series on dental equipment and materials, prepared under the authority of the Dental Industry Standards Committee.

The technique employed in mixing and using dental casting investments is almost as critical as their chemical composition in governing their behaviour and properties under normal laboratory conditions. This fact is known, appreciated and made use of both by those people handling dental investments and by those responsible for their manufacture. It does, however, make the specification of a standardized mixing technique and consistency for use in preparation of the test specimen quite impossible, and reference has therefore been made to the manufacturer's instructions. To safeguard the interests of the consumer in this respect, special attention has been paid to the subject of information on mixing techniques and expansion, with a requirement that ample data on these items be included in every package of material.

Ethyl silicate investment materials have a number of characteristics which set them apart from other dental casting materials. Firstly, there is the critical importance of the particle size distribution in the setting reaction and thermal expansion unless the manufacturer uses a suitable mixture of particle sizes the material will not set and the expansion will be unsatisfactory. As such a deficiency will automatically preclude an investment from even being considered for compliance with the terms of a specification, the committee responsible for this standard decided that the inclusion of the usual sieving test, which features in Parts 1 and 2, was unnecessary. Another characteristic is the prolonged gelling type of reaction which takes place during setting. This presents a number of problems in definition and determination of what could be described as a set condition, and in this instance also it was considered that with the safeguard provided by the other requirements for physical properties, there was no immediate need for inclusion of a special test just to determine an arbitrary set for these materials. Lastly, it will be noticed that the requirement for high temperature transverse strength in this specification is slightly lower than that set for gypsum and phosphate investment materials. This is because, due to practical difficulties in actual testing, the strength of ethyl silicate materials is determined at a temperature significantly below that used in actual casting when the maximum strength will be obtained.

In preparing this British Standard the opportunity has been taken to use, where applicable, SI metric units. Recognizing that some of these units may be unfamiliar, a conversion table is included in Appendix A¹⁾ which should provide a sufficient range of equivalent values for the interpretation of the relevant clauses.

Certification. Attention is drawn to the certification facilities described on the inside back cover of this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ Information on the international (SI) system of Units is given in BS 3763 "The International System of units (SI)" and PD 5686 "The use of SI units". Tables of conversions are given in BS 350 "Conversion factors and tables", Part 1 "Basis of tables. Conversion factors".

1 Scope

This British Standard specifies requirements for ethyl silicate-bonded investment materials supplied as two or more components for use in dental casting procedures.

2 Reference

The title of the British Standard referred to in this standard is given on the inside back cover.

3 Requirements

3.1 Components. The manufacturer or supplier of the investment powder shall also supply the ethyl silicate component and give full information on all other components required (see 3.5).

3.2 Powder. The investment powder shall be free from undesirable extraneous material and lumps. Colouring matter shall not be regarded as extraneous material.

3.3 Expansion. The mixed investment, when tested not less than 24 h after the first contact of investment and binder liquid as described in 5.2, shall exhibit a total expansion (covering air setting and thermal behaviour) of not less than 1.5 %. (See also further reference to expansion in 3.5.)

3.4 Transverse strength

3.4.1 Low temperature (green strength). The transverse strength of the set investment test pieces 24 h after the commencement of mixing, determined at a temperature of $23 \pm 2^\circ\text{C}$ and in the manner described in 5.3, shall be not less than 0.4 MN/m^2 .

3.4.2 High temperature. The transverse strength of the set investment test pieces, determined at $1\,000^\circ\text{C}$ and in the manner described in 5.3, shall be not less than 0.4 MN/m^2 .

3.5 Information to be provided by the manufacturer. Adequate instructions and information on the items listed in a) to f) shall accompany each container. This information shall also be readily available to a prospective purchaser on demand.

- a) Full details of the proportioning and mixing technique, including the powder, binder liquid, additives, mixing apparatus and information on variables intended to affect the physical properties of the mixed investment for specific purposes.
- b) Relevant information on the timing of the mixing-setting-firing sequence.

c) Full details of the firing cycle, including preheating of the mould, the temperature of the furnace during the firing period, the minimum time recommended for ensuring complete burn out of a wax pattern and a temperature range within which a mould may be used for casting.

d) A clear warning regarding the risk of explosion if these materials are heated in an unvented furnace.

e) Full details of the following expansion characteristics of the material:

- 1) thermal expansion at the recommended firing temperature;
- 2) casting range (for definition see 5.2.4).

The figures quoted for these characteristics shall be to the accuracy specified under the conditions of test in clause 5.

f) A reference to the short shelf life of mixed binder liquid.

The details given for items a) to c) shall be sufficiently precise for use in preparing test specimens.

4 Sampling

The method of sampling shall be agreed between the parties concerned. The interval of time between sampling and testing shall be kept as short as possible.

5 Test methods

5.1 Mixing, general

5.1.1 Temperature and humidity. All mixing of investment shall, unless stated otherwise, be carried out at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

5.1.2 Apparatus. The following apparatus shall be used for mixing the investment in all test procedures. All apparatus and instruments listed shall be clean, dry and free from particles of set investment. Mixing apparatus and instruments which have been used previously for other types of investment shall not be used. Before starting mixing all materials and apparatus shall be brought to a temperature of $23 \pm 2^\circ\text{C}$.

5.1.2.1 A flexible bowl of suitable material (such as rubber) and size.

5.1.2.2 A dental "plaster" spatula with a curved stainless steel blade of approximately $110 \text{ mm} \times 25 \text{ mm} \times 2 \text{ mm}$.