

Code of practice for

Internal plastering

Committees responsible for this British Standard

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- Aggregate Concrete Block Association
- British Aggregate Construction Materials Industries
- Building Employers Confederation
- Department of the Environment (Building Research Establishment)
- Gypsum Products Development Association
- Institute of Clerks of Works of Great Britain Inc.
- Local Authority Organizations
- Mortar Producers' Association Limited
- National Federation of Plastering, Dry Lining and Partition Contractors
- Plasterers' Craft Guild
- Royal Institute of British Architects
- Royal Institution of Chartered Surveyors
- Scottish Master Plasterers' Association

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Foreword

This British Standard has been prepared under the direction of the Elements and Components (of Diverse Materials) for Buildings Standards Policy Committee. It is a revision of BS 5492:1977, which is withdrawn. The standard is designed to cover internal plaster finishes to all normal types of background.

The recommendations are framed in logical sequence, namely materials and accessories; properties of backgrounds that influence the choice of suitable plastering systems; guidance on preparation of surfaces to be plastered; choice of suitable systems; methods of application and maintenance. This edition of BS 5492 includes a section on fibrous plasterwork.

The plasters considered are: gypsum plasters; lime/gypsum plasters; premixed lightweight plasters; cement based plasters. Relevant data are summarized in a series of tables. The code also includes a table of classification of proprietary plasters.

The Technical Committee again considered mechanical methods of application of conventional plasters and concluded that the recommendations of the code are generally applicable to this technique. It was decided that it was still too early to incorporate specific recommendations for projection plasters in the main body of the text. Nevertheless, where possible reference has been made to these plasters and techniques since they are generally available for use. Guidance on the use of projection plasters and machines for their application has been included as Appendix A. These specially formulated plasters are applied in a continuous operation to the required thickness and do not require an additional finish plaster.

No recommendations for plastering over warming panels are given in this standard. The requirements for plastering over such panels vary with the type of system and advice should be obtained from the suppliers of the particular type of heating panel.

Recommendations for plastering the playing surfaces of squash courts have been omitted from this edition of BS 5492 as proprietary materials are now largely used for this application. Information regarding these materials may be obtained from the Squash Raquets Association¹⁾.

This code of practice does not deal with types of external rendering that can be used internally and for these, reference should be made to BS 5262.

Recommendations for workmanship on building sites for internal plastering are given in BS 8000-10.

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 to iv, pages 1 to 42, 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⁾ Squash Raquets Association, Francis House, Francis Street, London SW1P 1JG.

Section 1. General

1 Scope

This code of practice gives recommendations for internal plastering on all types of background for use under normal conditions. Fibrous plasterwork is included.

It covers materials, types of background, preparation of the surface to be plastered, choice of a suitable plastering system, methods of application (including renovation work) and maintenance. Guidance on the use of projection plasters, lighting for plastering, types of proprietary plaster and lead times for fibrous plasterwork is given in appendices.

Recommendations for plastering over warming panels, playing surfaces of squash courts and external rendering are not included in this standard.

NOTE The titles of the publications referred to in this standard are listed on page 42.

2 Definitions

For the purposes of this British Standard the definitions given in BS 6100-6 apply, together with the following.

fibrous plasterwork

preformed section of plasterwork made from casting plaster, hemihydrate class A, and reinforced with scrim and timber or metal lath

3 Exchange of information

Drawings and specifications, and bills of quantities where appropriate, should be prepared in sufficient detail to afford proper guidance in the preparation of estimates and the execution of the work.

An exchange of information between those responsible for the execution of the backgrounds, the internal plastering and the subsequent decoration, and with other trades whose work will affect or be affected by the plastering, should take place as soon as possible after acceptance of contract. When preparing plastering details the designer should take into account the following points.

- a) The choice of types of plaster (including plaster for specialists' work) to be used in various parts of the building depends on functional requirements and the nature of the background. The nature of the background and its plaster finish should therefore receive consideration together. Particular information should be given where blockwork or brickwork is the background to be plastered. The manufacturer and type of block or brick and its density should be specified due to the effect on suction and the need to specify the correct type or grade of plaster and whether a bonding agent is required.

- b) The type of surface finish and any other points affecting the final appearance, particularly the compatibility of the plasterwork with the proposed decorative finish and permanent lighting.

- c) Area and types of finish and thickness required together with sufficient details of the nature of the surfaces to be plastered, keyed backgrounds, the junctions with door frames, ceilings, linings etc., so that the most suitable plastering materials and methods can be selected.

- d) The nature of the background, which may suggest the need for a bonding medium or the use of a plaster having special properties, e.g. good bonding or water retentivity.

- e) The effect of the thickness of the plaster on:

- 1) the finished sizes and heights of rooms or other spaces;
- 2) the thickness of grounds;
- 3) frames which are to be flush both sides in thin walls and partitions;
- 4) the positioning of frames and other joinery relative to plaster faces;
- 5) grooves in joinery that are to receive plaster;
- 6) the positioning of heating appliances and other installations and fittings;
- 7) any other items, the specifications for which can be drawn up in detail only after the plaster thicknesses have been determined.

- f) The preparation of the different building surfaces to receive the various types of cornices, arrises, corner treatments, metal accessories (such as angles and beads), expansion joints, coves, mouldings, dado treatments and plaster enrichments. Consideration should be given to details of construction, the materials to be used and any special form of key, metal lathing, or other device to be built into, or attached to, the background as support where adhesion cannot be relied upon.

- g) The work in other trades, particularly in connection with service pipes, conduits, wiring and so forth, that are to be covered by or buried in the plaster.

- h) The suitability of materials that may be in contact with different types of plaster, as well as of any protective treatment that may be necessary.

As soon as the plastering contract has been allocated, all necessary working drawings should be provided and the site should be visited to monitor building progress. Any necessary preparatory work can then be carried out without causing delay to the work that is to follow.

A suitable system of marking the positions of fixing points and grounds and other work which may be obscured by the plaster should be followed.

A record should be maintained of all dates in connection with the construction and preparation of backgrounds and of the different operations of plastering and decoration in the various parts of the building.

Adequate lighting should be provided during all stages of the plastering work and facilities should be available for increasing the intensity of artificial lighting and suitably positioning it when working to obtain satisfactory surfaces or where it is known that the surface will be subject to shallow angle lighting. (See Appendix B.) There will be inherent limitations in appearance, and the positioning of permanent lighting should be considered in order that such limitations are not unduly emphasized, particularly where gloss or semi-gloss decorative finishes are used.

NOTE Details of the additional information required for fibrous plasterwork are given in 49.11.

4 Time schedule

In preparing a time schedule for the work involved in a building, each operation should be considered in relation to the others, due consideration being given to the most economical use of general plant and scaffolding by all trades. Attention should also be paid to ensuring that the various trades follow one another in the correct sequence and that they do not interfere unduly with each other's work.

When considering the time schedule for projection plasters, it should be remembered that mechanical methods of application can cover larger areas in shorter time periods than traditional methods and therefore more area should be made available within the time schedule to allow for this.

The time schedule for the whole building work should be planned in the initial stages before operations are begun and in consultation with those who will become responsible for carrying out the work of each of the trades concerned.

It should be borne in mind that plastering should commence only after the particular parts of the building have been made weathertight. It should be protected at all stages from the direct effects of inclement weather, e.g. due to unglazed windows, or from other hazards of construction.

The time schedule should allot times for the construction and preparation of the backgrounds to receive plaster and allow sufficient intervals for drying out and maturing, either by natural or artificial means, after the structure has been made weathertight, so that the plastering work may proceed without subsequent damage to it or its decoration. (See also BRE Digest, "*Drying-out buildings*"²⁾.)

The time schedule should also provide for the completion of all subsidiary work necessary before plastering commences. The schedule should include times for commencement of plastering work in the different parts of the building. The different phases of plastering and necessary time intervals between each should be carefully planned allowing sufficient time after completion for drying-out the plasterwork and background before the application of decoration or other finishes.

In addition, a detailed programme for the plastering and ancillary work prepared in consultation with those responsible for the work should be maintained.

Arrangements should be made and time allowed for regular site inspections to enable any defects to be located and remedied, and for the drying-out and maturing of the necessary repairs at the correct stages as the work proceeds.

The time schedule should be carefully planned to avoid the risk of serious damage to the plaster by subsequent work and to avoid any question of last minute alterations in the sequence of operations. When alterations are unavoidable permanent decoration should be postponed; if there is any doubt at the time of preparing the time schedule, such postponement should be provided for in advance so that adequate time may be allowed before decoration is commenced.

NOTE Additional recommendations for the scheduling of fibrous plasterwork are given in 49.12.

²⁾ Published by the Building Research Establishment (BRE) and available from HMSO.

Section 2. Materials and accessories

5 General

Materials and accessories should comply with British Standards where these are applicable. Clauses in this section either refer to appropriate British Standards or give recommendations for materials and accessories not covered by British Standards.

6 Plasters

6.1 Gypsum plasters

6.1.1 *Gypsum plasters, excluding premixed lightweight plasters and premixed gypsum plasters*

Gypsum plasters complying with BS 1191-1 may be divided into the following classes:

- a) *class A*. Plaster of Paris, suitable for gauging lime final coats for patching and repair work and for fibrous plasterwork;
- b) *class B*. Retarded hemihydrate plaster. Final coat plaster (finish, board finish and thin coat plasters).

Finish plasters are suitable for final coats, neat or gauged with not more than $\frac{1}{4}$ part of lime to 1 part of plaster by volume in two or three-coat work. Board finish plasters are suitable for neat work on board backgrounds.

6.1.2 *Premixed lightweight plasters*

Premixed lightweight plasters complying with BS 1191-2 consist of retarded hemihydrate plasters incorporating suitable lightweight aggregates and other additions to impart desirable properties. They may be divided into the following types:

- a) *type A*. Undercoat plasters (browning plaster, browning plaster suitable for high suction backgrounds, metal lathing plaster and bonding plaster;
- b) *type B*. Final coat plaster (finish plaster).

6.1.3 *Premixed gypsum plaster*

Premixed gypsum plasters are undercoat plasters consisting of retarded hemihydrate gypsum plasters incorporating aggregates and other additives to impart desirable properties.

6.2 Premixed lightweight cement plasters

Premixed lightweight cement plasters are proprietary plasters based on cement and lime, premixed with lightweight aggregate.

6.3 Renovation plasters

Renovation plaster systems offer increased resistance to moisture and salts, e.g. during the drying of walls after the installation of a new effective damp-proof course.

6.4 One-coat plasters

One-coat plasters are specially formulated gypsum plasters to replace separate undercoat and finish plasters.

6.5 Thin-coat plasters

Thin-coat plasters incorporate organic binders and harden by drying. They may be used for single-coat work or on appropriate undercoats. Thin-coat plasters may be applied normally or by spraying techniques.

6.6 Projection plasters

Projection plasters are specially formulated gypsum plasters suitable for direct application by special plastering machines. The projection plaster is applied and finished in a continuous operation to the required thickness. The technique may include the use of electrically-operated power floats. (See Appendix A.)

6.7 X-ray resisting plasters

X-ray protection plasters are premixed plasters incorporating barytes (barium sulphate) aggregates in undercoat and finishing grades.

6.8 Acoustic plasters

Acoustic plasters are specially formulated plasters incorporating suitable aggregates, e.g. pumice and are supplied premixed. They are normally applied only to an appropriate undercoat plaster which should be well keyed to provide a satisfactory bond. The plaster provides varying degrees of texture finish.

6.9 Proprietary plasters

A classified list of proprietary plasters is given in Appendix C, to enable users to identify the types of plaster referred to in this standard.

7 Cement

Cement should be one of the following types:

- a) Portland cement complying with BS 12;
- b) masonry cement complying with BS 5224;
- c) sulphate-resisting Portland cement complying with BS 4027;
- d) Portland-blastfurnace cement complying with BS 146;
- e) Portland pulverized-fuel ash cement complying with BS 6588.

Coloured Portland cement should comply with the physical requirements of BS 12, whilst the requirements in respect of the chemical composition should be met by the basic cement, i.e. without the added pigment.

8 Ready-mixed and retarded ready-to-use mortars

Ready-mixed mortar and retarded ready-to-use mortar should comply with BS 4721.

9 Lime

Lime should comply with BS 890.

10 Aggregates

10.1 Dense aggregates

Sand aggregates should comply with Table 1 of BS 1199:1976. Where such sands are not available, it is essential that satisfactory evidence be provided that any other sands to be used are suitable for their intended use.

Sufficient attention is not always paid to the suitability of the sands used for plastering. The strength of sanded undercoats depends, to a large extent, on the quality and grading of the sand (which comprises at least two-thirds of the mass of the undercoat). The working properties of mixes, their water demand, setting times and the behaviour of the finished product may all be affected by the choice of sand.

Sands that are naturally slightly coarse may often be made to comply with British Standards by screening through a suitably sized sieve. Final coat sands may often be obtained from undercoat sands in a similar manner. The required grading for either undercoat or final coat sands can often be obtained by blending together suitable proportions of sands which are by themselves of unsuitable grading.

Barytes aggregates provide a protection value against electromagnetic radiation and may be used with a binder of either Portland cement or gypsum plaster. Premixed gypsum plasters incorporating controlled quantities of barytes aggregates are available. The addition of any other aggregates, cement or filler will impair the protection level afforded by the plasterwork. Because of the danger to health of occupants if errors are allowed to occur in the application of the protection, it is essential that the utmost precautions be taken to ensure complete compliance with the designer's specification. The designer's specification should be drawn up in consultation with the hospital physicist or the National Radiological Protection Board³⁾.

10.2 Lightweight aggregates

These should comply with BS 3797. Lightweight aggregates used in plastering comprise expanded perlite and exfoliated vermiculite.

11 Water

Water should be clean, free from harmful amounts of deleterious matter and from any unusual proportion of dissolved salts; in case of doubt an analysis should be made. Sea water, tidal estuary or brackish water should not be used. Water fit for drinking is suitable.

12 Admixtures

Organic workability aids (plasticizers or air entraining agents) should, where applicable, comply with BS 4887-1 and should be used in accordance with manufacturer's instructions. Other admixtures such as water retentivity aids should be used in accordance with the particular plastering specification.

Only clean water should be added to premixed gypsum and cement plasters.

13 Bonding agents

Polyvinyl acetate (PVAc) emulsion bonding agents should comply with BS 5270-1. Other materials such as emulsions of other polymers, styrene-butadiene rubber (SBR) and bituminous solutions and emulsions are available as proprietary products and should be used in accordance with the manufacturer's instructions.

Emulsions of polymers and styrene-butadiene rubber can be used on soffits or walls and, in addition to their use as bonding agents, they are also used to reduce suction on high suction backgrounds.

Bituminous solutions and emulsions should not be used on soffits but are intended to provide some resistance to damp penetration when used as a vertical damp proof course on walls.

14 Synthetic fibres

Suitable synthetic fibres that are clean, dry and free from oil may be used.

³⁾ National Radiological Protection Board, Harwell, Didcot, Oxfordshire OX11 0RQ.

15 Jointing materials

15.1 Joint reinforcement

Joint reinforcement should be of corrosion-resistant metal, hessian or suitable glass or synthetic fibre, with a mesh just coarse enough to allow easy passage of plastering materials. It should be used to reinforce joints to minimize cracking, e.g. between boards or slabs used as a base for plastering or over surfaces subject to local stresses. The material should have an acceptable minimum strength to prevent it being severed by the edge of the trowel, particularly on internal angle applications.

15.2 Paper jointing tape

Paper jointing tape should be suitable for the jointing of gypsum plasterboard.

16 Metal beads

Galvanized steel beads should comply with BS 6452-1. Stainless steel beads should comply with the dimensional requirements of BS 6452-1, except that the gauge may be reduced to a minimum of 0.4 mm, and should be of stainless steel to Grade 304/S15 of BS 1449-2.

Various types of metal beads are available in the following categories:

- a) *angle beads*: these provide an arris for plaster on external corners;
- b) *plaster stop beads — feature beads*: these provide a line where plasters finish at openings, abutments or to each side of movement joints;
- c) *movements beads* (not included in BS 6452-1): these provide a movement joint to relieve shrinkage stresses in the plaster.

Care should be taken to ensure that metal beads are kept dry and distortion is prevented during storage and handling. Care should also be taken to prevent damage to the galvanized coating.

17 Gypsum plasterboard

Gypsum plasterboard when used as a background to plastering systems should comply with BS 1230. Nails for fixing gypsum plasterboard backgrounds should be galvanized, sherardized or zinc electroplated. Minimum nail dimensions for shank and head should be 2.5 mm and 7 mm respectively.

18 Metal laths

Metal laths used as a background for plastering should comply BS 1369-1. Fixings should be compatible with the laths used (see clause 26).

19 Non-metal laths

Laths of corrugated bitumen impregnated fibre or dimpled plastics provides a barrier to damp penetration. It is pre-formed to provide a mechanical key for plaster. The manufacturer should be consulted as to its suitability for any particular application and its method of use.

20 Galvanized wire netting

Where required to provide a mechanical key, 0.71 mm galvanized wire netting of mesh not greater than 50 mm and complying with BS 1485 should be used. Fixings should be galvanized, sherardized or zinc electroplated.

Section 3. Design

21 Factors influencing the selection of a plastering system

The primary function of a plaster finish is to mitigate unevenness in the background and provide a reasonably smooth surface which is compatible with the required decorative finish and resistant to damage under the conditions to which it is likely to be subjected. Other functions that a plaster finish may be required to perform are to improve the fire resistance of a structural element or the acoustic or thermal properties of a surface or partition.

In selecting a plastering system for any particular purpose, consideration should first be given to the relative importance of these various functions.

Consideration should be given to the use of a cement-based final coat in some locations, i.e. walls to be tiled or walls in public areas liable to damage. The background to which the plaster is to be applied should then be considered in relation to its strength, suction, bonding properties, liability to shrinkage or thermal movement, and probable content of water and soluble salts. The need for bonding treatment should be considered. It may be necessary to consult the blockwork manufacturer's recommendations.

Other factors are the availability of suitable sand, the weather conditions that are likely to prevail during the process of plastering and subsequent drying before decoration, and the length of time available for these processes.

The characteristics of plaster undercoats and final coats are described in Table 1 and Table 2.

Recommendations for suitable plastering systems are given in section 4.

Where non-traditional detailing, e.g. no architraves, is proposed, careful consideration should be given as to how this should be achieved.

Grounds should always be specified to ensure that plaster does not come into contact with the floor slab or screed.

Large areas of walls and ceiling, e.g. those found in school halls, should preferably be sub-divided into smaller areas by the use of design joints.

22 Suitable combinations of undercoats and final coats and characteristics of plastering mixes

22.1 General

Undercoats and final coats should be reasonably related to one another and to the structural background as regards density and strength and liability to expansion or contraction during setting or drying, or subsequently. The most common defect is bond failure between successive coats or between the first coat and the background : bond failure may be caused by:

- a) defects of background or undercoat, e.g. lack of adequate key, weakness, contamination with dirt or grease, or by the use of water contaminated by cleaning tools for the control of suction;
- b) films of unset plaster produced by premature drying;
- c) salt formation at the interface;
- d) structural movement, moisture movement or thermal movement;
- e) inadequate suction control;
- f) any combination of these causes.

22.2 Essential characteristics and general properties of normal plastering mixes

22.2.1 General

For the purposes of obtaining an understanding of the characteristics and properties of plastering mixes necessary for a reasoned choice of materials and for their proper use, the plastering mixes have been considered in five groups:

- a) mixes based on cement, or cement and lime (see **22.2.2**);
- b) lightweight cement plasters (see **22.2.3**);
- c) premixed gypsum plasters (see **22.2.4**);
- d) premixed lightweight gypsum plasters (see **22.2.5**);
- e) mixes based on gypsum plasters gauged with lime (see **22.2.6**).

22.2.2 *Mixes based on cement, or cement and lime*

Plastering mixes containing cement, lime and sand are characterized by high workability and marked ease of application; these properties become less pronounced as the proportion of lime decreases or when an unsoaked hydrated lime is used. These mixes have a reasonably long working time, a fairly slow rate of strength development (increasing with the amount of cement added) and adequate early strength to withstand modern building conditions. They need moisture to complete the setting process and, for this reason, rapid drying in the early stages should be avoided. Shrinkage, partly irreversible, occurs on drying, causing stresses to be set up both in the applied coat and in the undercoat or background. In order to avoid breakdown of adhesion between successive coats and cracking of the final coat, it is essential that the drying shrinkage of the first coat be materially complete before a subsequent coat is applied. Each undercoat should therefore be allowed to harden and dry thoroughly.

The rate of drying will vary widely with conditions of temperature, humidity and ventilation. The time allowed for drying of the undercoats also serves to reduce the risk both of efflorescent salts finding their way to the final plaster and of map-cracking of the finishing plaster by the drying and maturing shrinkage of the undercoats.

Table 1 — Characteristics of plaster undercoats

Plasters	Shrinkage or expansion	Strength and hardness	Remarks
Lime : sand 1 : 2 to 3	All shrink on drying. Too much clay or fine material or sands of uniform particle size make for high shrinkage. Contents of clay or fine material should not exceed 5 %. Strong mixes tend to develop a few large cracks; weaker mixes develop finer and distributed cracks	Weak and soft	Takes a long time to harden and is not recommended for present day practice
Cement-based undercoats Cement : sand 1 : 3 to 4		Strong and hard	Hardens progressively. Undercoats should be allowed to dry and shrink before applying the next coat. A workability aid or the addition of one-quarter to one-third volume of lime helps application
Aerated cement : sand 1 : 5 to 6 1 : 7 to 8 Cement : lime : sand 1 : 1 : 5 to 6 1 : 2 : 8 to 9 Masonry cement : sand 1 : 4 to 5 1 : 5½ to 6½		Sufficiently strong and hard for most purposes, although neither the 1 : 8 aerated cement : sand, the 1 : 2 : 9 cement : lime : sand nor the 1 : 6 masonry cement : sand mixes are sufficiently strong to receive neat gypsum plaster finishes	Hardens progressively. Undercoats should be allowed to dry and shrink before applying the next coat. The aerated mixes do not develop high suction on drying, and they are more effective barriers to the passage of moisture and efflorescent salts
Premixed lightweight cement undercoat including renovating	Shrinks on drying	Sufficiently strong and hard for most purposes but the manufacturers should be consulted as to its suitability for use with particular gypsum final coats	Hardens progressively. Undercoats should be allowed to dry and shrink before applying the next coat. They are more effective barriers to the passage of moisture and efflorescent salts
Premixed lightweight gypsum undercoats	Their relatively small movement is easily restrained by the backings	Varies with the type of undercoat. Although they are more liable to indentation than cement-based mixes, their resilience tends to prevent more serious damage	Sets quickly. It is essential to use the undercoat appropriate to the background. On high suction backgrounds high suction browning grade will assist application
Projection plasters		Sufficiently strong and hard for most purposes	Offers the advantages of an equivalent two-coat plaster system on suitable substrates
One-coat plasters			
Premixed gypsum plasters and gypsum renovation plaster			Sets quickly. Strength continues to develop over several days

Table 2 — Characteristics of final coats

Plasters	Shrinkage or expansion	Strength and hardness	Remarks
Lime plasters Neat or sanded (Mix proportions by volume 1 : 0 to 1)	Shrinks on drying. The addition of well graded fine clean sand progressively reduces this shrinkage	Weak and soft, easily damaged	Takes a long time to harden and is initially suitable only for a permeable decorative finish that is not affected by alkali
Gypsum plasters Class B ^a	Expands as it sets although this expansion is extremely small. Subsequent movements are small. Too rapid drying may lead to delayed expansion	Hard	Requires a strong undercoat. Predetermined setting time
Thin-coat plasters	Similar to class B	Slightly lower than class B	Requires a strong undercoat. Gradual setting characteristics. Quick drying. Suitable to receive most types of decoration
Premixed lightweight plasters		Surface hardness similar to neat class B gypsum plaster. Liability to indentation varies with the type of lightweight undercoat used, but the resilience of these tends to prevent serious damage	Requires a strong undercoat. Setting and drying characteristics as for neat class B gypsum plaster
Final coat		Hard	Requires a strong undercoat. Gradual setting characteristics. Normal drying. Suitable to receive most types of decoration
Projection plasters			
One-coat plasters			
Renovation finish plasters			Requires a strong undercoat. Setting and drying characteristics as for neat class B gypsum plaster

^a A small proportion of lime, not exceeding $\frac{1}{4}$ part by volume, may be added to certain class B plasters.