New Zealand Standard

Solid Plastering

Part 1 – Cement Plasters for Walls, Ceilings and Soffits

Superseding NZS 4251.1:1998

NZS 4251:Part 1:2007

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COMMITTEE REPRESENTATION

This Standard was prepared under the supervision of the P 4251 Committee the Standards Council established under the Standards Act 1988.

The committee consisted of representatives of the following nominating organisations:

Building Research Association of New Zealand
Cement and Concrete Association of New Zealand
Department of Building and Housing
Claddings Institute of New Zealand Inc.
Solid Plaster Association
Stevenson Building Products

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AMENDMENTS

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NZS 4251.1:2007

New Zealand Standard

Solid Plastering

Part 1 – Cement Plasters for Walls, Ceilings and Soffits

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Referenced Documents

Reference is made in this document to the following:

New Zealand Standards

NZS 1170:- - - -	Structural design actions
Part 5:2005	Earthquake actions – New Zealand
NZS 2295:2006	Pliable, permeable building underlays
NZS 3103:1991	Specification for sands for mortars and plasters
NZS 3109:1997	Concrete construction
NZS 3111:1986	Methods for test for water and aggregate for concrete
NZS 3114:1987	Specification for concrete surface finishes
NZS 3117:1980	Specification for pigments for Portland cement and Portland cement products
NZS 3121:1986	Specification for water and aggregate for concrete
NZS 3122:1995	Specification for Portland and blended cements (General and special purpose)
NZS 3123:1974	Specification for Portland pozzolan cement (type PP cement)
NZS 3125:1991	Specification for Portland-limestone filler cement
NZS 3602:2003	Timber and wood-based products for use in building
NZS 3604:1999	Timber framed buildings
NZS 3610:1979	Specification for profiles of mouldings and joinery
NZS 3640:2003	Chemical preservation of round and sawn timber
NZS 4210:2001	Masonry construction – Materials and workmanship

Joint Australian/New Zealand Standards

AS/NZS 1170:- - - -	Structural design actions
Part 0:2002	General principles
Part 1:2002	Permanent, imposed and other actions
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AS/NZS 2269:1994	Plywood – Structural
NZS/AS 2908:- - - -	Cellulose-cement products
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AS/NZS 4200:- - - -	Pliable building membranes and underlays
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AS/NZS 4201:- - - -	Pliable building membranes and underlays – Methods of test –
Part 1:1994	Resistance to dry delamination

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AS/NZS 4534:1998	Zinc and zinc/aluminium-alloy coatings on steel wire
AS/NZS 4600:2005	Cold-formed steel structures
AS/NZS 4680:1999	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

Australian Standards

AS 1366:- - - -	Rigid cellular polystyrene
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Part 4:1989	Extruded
AS 1478:2000	Chemical admixtures for concrete
AS 1672.1:1997	Building limes
AS 2758:- - - -	Aggregates and rock for engineering purposes
Part 1:1998	Concrete aggregates
AS 3566.1:2002	Self-drilling screws for the building and construction industries – General requirements and mechanical properties
AS 3566.2:2002	Self-drilling screws for the building and construction industries – Corrosion resistance requirements
AS 3730.7:2006	Guide to the properties of paints for buildings – Latex – Exterior – Flat
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AS 3730.9:2006	Guide to the properties of paints for buildings – Latex – Exterior – Semi-gloss
AS 3730.10:2006	Guide to the properties of paints for buildings – Latex – Exterior – Gloss

British Standards

BS 1881:- - - -	Testing concrete
Part 124:1988	Methods for analysis of hardened concrete

American Standards

ASTM C631-95a	Specification for bonding compounds for interior gypsum plastering
ASTM C932-80(2005)	Specification for surface-applied bonding agents for exterior plastering

ASTM C952-91	Test method for bond strength of mortar to masonry units
ASTM C1042-99	Test method for bond strength of latex systems used with concrete by slant shear
ASTM C1116-95	Specification for fibre-reinforced concrete and shotcrete
ASTM C1152-04	Test method for acid-soluble chloride in mortar and concrete

Other Publications

Building Research Association of New Zealand, Good Stucco Practice 2004

Building Research Association of New Zealand, Weathertight Solutions Vol. 2 Stucco

Department of Building and Housing, The New Zealand Building Code

Compliance documents of the New Zealand Building Code

Foreword

The primary reason for revising the 1998 version of the Standard relates to the need to incorporate a drained and ventilated cavity for stucco construction on a rigid backing. Stucco on a non-rigid backing traditionally had a cavity and no significant changes to that section have been made.

A number of the other revisions received by Standards New Zealand since 1998 have also been included to ensure updating to 2007.

This Standard is not directed at proprietary modified plasters, which are therefore outside its scope.

The option of using expanded polystyrene as a backing to stucco has been removed since the system is more appropriate for use with proprietary modified plasters.

Review of Standards

Suggestions for improvement of this Standard will be welcomed. They should be sent to the Chief Executive, Standards New Zealand, Private Bag 2439, Wellington 6140.

NEW ZEALAND STANDARD

SOLID PLASTERING – CEMENT PLASTERS FOR WALLS, CEILINGS AND SOFFITS

1 SCOPE AND INTERPRETATION

1.1 Scope

1.1.1

This Standard sets out the requirements for solid plaster, and stucco over a drained and vented cavity with a rigid or non-rigid backing in buildings to achieve structurally sound, hard, durable and water resistant surfaces. It deals with the preparation, mixing and application of cement-based plasters to walls, ceilings and soffits of solid substrates, and exterior stucco on rigid backing and non-rigid backings. Stucco applications shall apply to buildings within the scope of 1.1.2 of NZS 3604. NZS 4251.1 applies to exterior and interior walls where impact loads are limited to soft-body impacts associated with domestic use.

C1.1.1

Special applications such as squash courts and swimming pools are outside the scope of this Standard.

1.1.2

Gypsum-based plaster and modified or proprietary modified plaster coatings are not included in this Standard.

1.2 Interpretation

1.2.1

For the purposes of this Standard the word 'shall' refers to practices which are mandatory for compliance with the Standard. The word 'should' refers to practices which are advised or recommended.

1.2.2

Clauses prefixed by '*C*' and printed in italic type are intended as comments on the corresponding mandatory clauses. They are not to be taken as the only or complete interpretation of the corresponding clause. The Standard can be complied with if the comment is ignored.

1.2.3

The term 'informative' has been used in this Standard to define the application of an appendix. An 'informative' appendix is not an integral part of a Standard but it provides information and guidance.

1.3 New Zealand Building Code

1.3.1

Cement plasters constructed in accordance with this Standard shall meet the relevant requirements of the following clauses of the New Zealand Building Code (NZBC):

(a) Clause B1 Structure

Cement plasters described in this Standard cannot be used to support any gravity loads other than their own self-weight. They will withstand earthquake, wind and impact loadings associated with domestic soft-body impacts. Their design will withstand the likely temperature variations experienced throughout New Zealand as well as the time dependent effects of shrinkage and creep.

(b) Clause B2 Durability

Cement plasters are moderately difficult to replace and therefore the Building Code's required durability is 15 years (i.e. NZBC Clause B2.3.1(b)). Cement plasters constructed in accordance with this Standard will meet this requirement.

(c) Clause E2 External Moisture

Cement plaster to exterior walls constructed in accordance with this Standard meets the NZBC's requirements for preventing the penetration of water that could cause undue dampness or damage to building elements (i.e. NZBC Clause E2.3.2).

(d) Clause E3 Internal Moisture

Cement plaster on interior surfaces that are constructed in accordance with this Standard and have a smooth trowelled (dado) finish coat will satisfy the NZBC's requirement for an 'impervious and easily cleaned' surface for solid substrates.

1.3.2

Where this Standard has provisions that are in non-specific or unquantified terms (such as where provisions are required to be appropriate, adequate, suitable, equivalent, satisfactory, acceptable, applicable or the like), then these do not form part of the means of compliance with the NZBC and shall be to the approval of the building consent authority.

1.4 Application

1.4.1 General

1.4.1.1

Solid plasters on solid substrates do not require reinforcement or applied coatings.

1.4.1.2

Stucco on rigid or non-rigid backings requires reinforcement for structural strength and applied coatings for weathertightness together with a drained and vented cavity. The requirements of the applied coating and the reinforcement for stucco are given in 2.6, 4.3 and 5.3 respectively.

1.4.2 Non-standard materials, installations or designs

This Standard does not preclude the use of new materials or innovative systems or parts of systems. Such materials or systems however are outside the scope of this Standard and full details of any such proposal would need to be submitted to the building consent authority for approval. See Appendix A for details.

C1.4.2

Traditionally certain materials, designs and techniques have been used and have become established. The materials and associated designs shown in this Standard have been proven through use. Other materials and systems are allowed but compliance with the provisions of the NZBC may need to be demonstrated to the satisfaction of the building consent authority.

1.5 Definitions

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

ADMIXTURE. Any substance added to the fundamental components of a plaster mix.

AGGREGATE. Particles of rock or mineral fragment used with various cementing materials. The term used in conjunction with plaster usually implies sand, vermiculite or perlite.

BACKGROUND. The surface to which the bond coat is applied to a solid substrate or to the steel mesh or lath in stucco construction.

BACKING. The sheet materials used on timber or steel framed walls.

BOND. The state of adhesion between a plaster coat and its background.

BONDING AGENT. An admixture used to assist the adhesion of the bond coat to the background.

BUILDING UNDERLAY. Paper, synthetic wrap or sheathing used as part of the wall cladding system to assist the control of moisture by ensuring moisture which inadvertently penetrates the wall cladding is directed back to the exterior of the building.

CAVITY. See DRAINED AND VENTED CAVITY.

CASING BEAD. uPVC or galvanised steel component designed to be fitted within the plaster thickness by the plasterer, to provide stops, trims and control joints.

CEMENT. A Portland cement or a blended Portland cement that will set and harden by chemical interaction with water.

COAT. A layer of plaster applied in a single operation. Various types, listed in the usual sequence of application, are defined as follows:

BASE COAT. Any plaster coat applied prior to application of the finish coat.

BOND COAT. The first coat of coarsely textured plaster applied to a solid substrate to provide adhesion for the second layer of plaster. It is also called SLUSH COAT.

DUBBING-OUT COAT. A coat of plaster applied to any hollow sections of a solid substrate to bring the surface to an acceptable plane for the next plaster coat.

FINISH COAT. The final coat of plaster applied over the previous coats and finished within the specified surface tolerances.

FLANKING/RENDER COAT. An intermediate levelling coat of plaster in between bond or scratch coat and finish coat.

SCRATCH COAT. A form of bond coat which provides an initial rough levelling coat on stucco and solid substrates.

CONSISTENCY. The degree of fluidity of a plaster mix.

CORNER BEAD. The casing used to form a corner and to provide reinforcement.

CURE. To provide conditions to ensure satisfactory hydration of Portland cement plaster.

DADO FINISH. The cement, lime and sand mix used as a finish coat where extreme hardness and resistance to water are required in combination with a very smooth surface.

DRAINED AND VENTED CAVITY. A cavity space, immediately behind a wall cladding that has vents at the base.

FH NAIL. Flat head nail.

FURRING. Spacers used to accurately position steel mesh or lath in the plaster coat.

LATH or MESH. An applied reinforcement for plaster.

LIGHTWEIGHT CONCRETE. Concrete containing lightweight aggregate and having a unit weight not exceeding 1850 kg/m^3.

LIGHTWEIGHT PLASTER. A plaster finish coat which contains exfoliated vermiculite, expanded perlite, polystyrene bead, or polystyrene grind.

MODIFIED PLASTER. A plaster which consists of Portland cement, sand and chemical admixtures excluding lime whose solids exceed 5 % by weight of cement.

MOIST CURING. Maintenance of a wet atmosphere around the surface of a plaster coat.

PROPRIETARY MODIFIED PLASTER. A modified plaster that has preblended ingredients for use in accordance with the manufacturer's instructions.

SELF-FURRING. Steel mesh or lath shaped in such a way that it is spaced out from the backing without the use of spacer blocks.

SLUSH COAT. See BOND COAT.

SOLID PLASTER. Portland cement based cementitious mixture of sand, aggregate, lime or other admixture and water.

SOLID SUBSTRATE. Concrete, lightweight concrete, concrete masonry, lightweight concrete masonry or brick walls and concrete ceilings and soffits.

STUCCO. Solid plaster claddings of Portland cement, sand, aggregate (often containing lime or other admixtures), applied on a background of galvanised mesh or lath over rigid or non-rigid backing fixed to light timber or steel framing.

2 GENERAL CONSIDERATIONS

2.1 General requirements of solid plastering

2.1.1 Scope

This section of the Standard specifies general requirements of solid plastering relating to work quality, reinforcement, openings and penetrations, accuracy, air temperature, control joints, and plaster finishes.

2.1.2 Work quality

All plastering work shall be performed by people with the requisite skill and experience. The work shall be carried out in accordance with this Standard.

C2.1.2

Plastering is highly skilled work and the current practice is based on tradition and site experience. A person who can demonstrate an acceptable quality of work in all respects of plastering and has successfully completed a recognised plastering trades course such as one approved by the New Zealand Qualifications Authority will satisfy this requirement.

2.1.3 Reinforcement of plaster systems

The following requirements apply:

(a) The reinforcement for stucco on rigid and non-rigid backing shall be galvanised wire mesh or expanded metal. See 4.2 and 5.3 for details and fixing of reinforcement.

In stucco construction all exterior surfaces to receive metal reinforcement shall have building underlay fixed to the background material before the reinforcement is fixed.

(b) Reinforcement is not required for solid substrates unless identified by specific design.

2.1.4 Openings and penetrations

2.1.4.1

Openings and penetrations in areas to be plastered shall be formed prior to plastering being started. Weather penetration around door and window openings in exterior claddings shall be prevented by the installation of head, sill and side flashings. Flashing systems shall be free draining to the exterior. Head and sill flashings shall extend horizontally no less than 20 mm beyond each side of the jamb facing to the opening with all flashings installed before plastering commences.

2.1.4.2

Flashing details for head, sill and jambs shall be as given in figure 1(a) and (b).

2.1.4.3

Flashings shall be constructed from type 304 or 316 stainless steel, powder coated aluminium, uPVC, hot dipped galvanised steel with a minimum coating of 400 g/m^2. The forming of the flashings shall not compromise the effectiveness of the protective coatings applied. Flashings made from other materials shall be subject to the approval of the building consent authority.

2.1.4.4 Metal components

All metal components used in solid plastering work shall be made from one of the materials listed as suitable for flashings in 2.1.4.3.

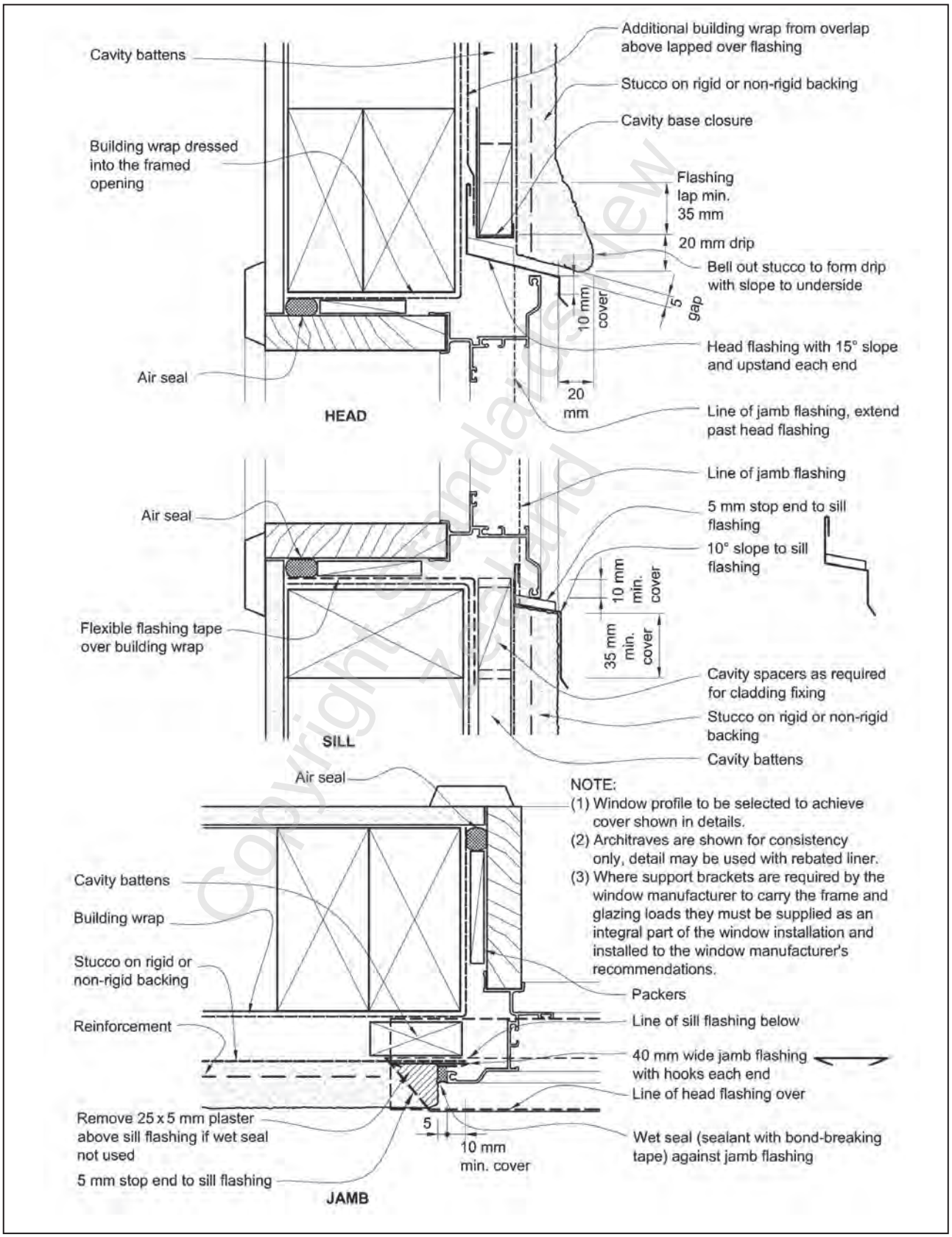


Figure 1(a) – Flashing for metal window frames

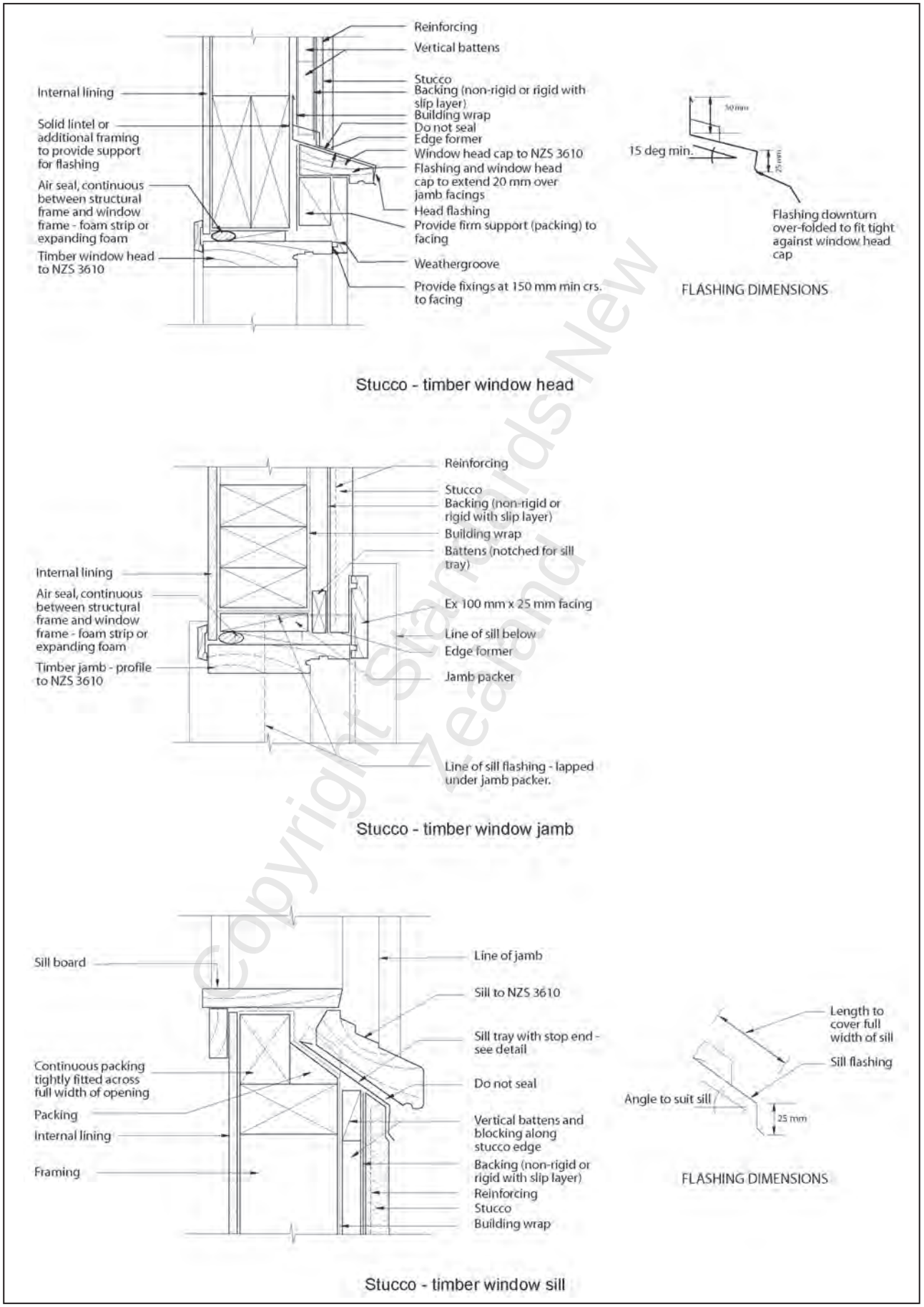


Figure 1 (b) – Flashing for timber

2.1.4.5 Service penetrations

2.1.4.5.1

All service penetrations through the plaster larger than 150 mm diameter or equivalent area (e.g. meter boxes) shall be fully flashed.

2.1.4.5.2

Small service penetrations, (up to and including 150 mm diameter or equivalent area) such as waste pipes, shall be installed so that they are supported as they pass through a framing member (dwang, nogging or similar), slope downhill to the outside and are sealed against moisture penetration. See figure 2. The hole through the framing and the sealing system itself shall allow for thermal expansion and contraction of the penetrating element and sealants shall be protected from direct sunlight which could cause deterioration of the sealant.

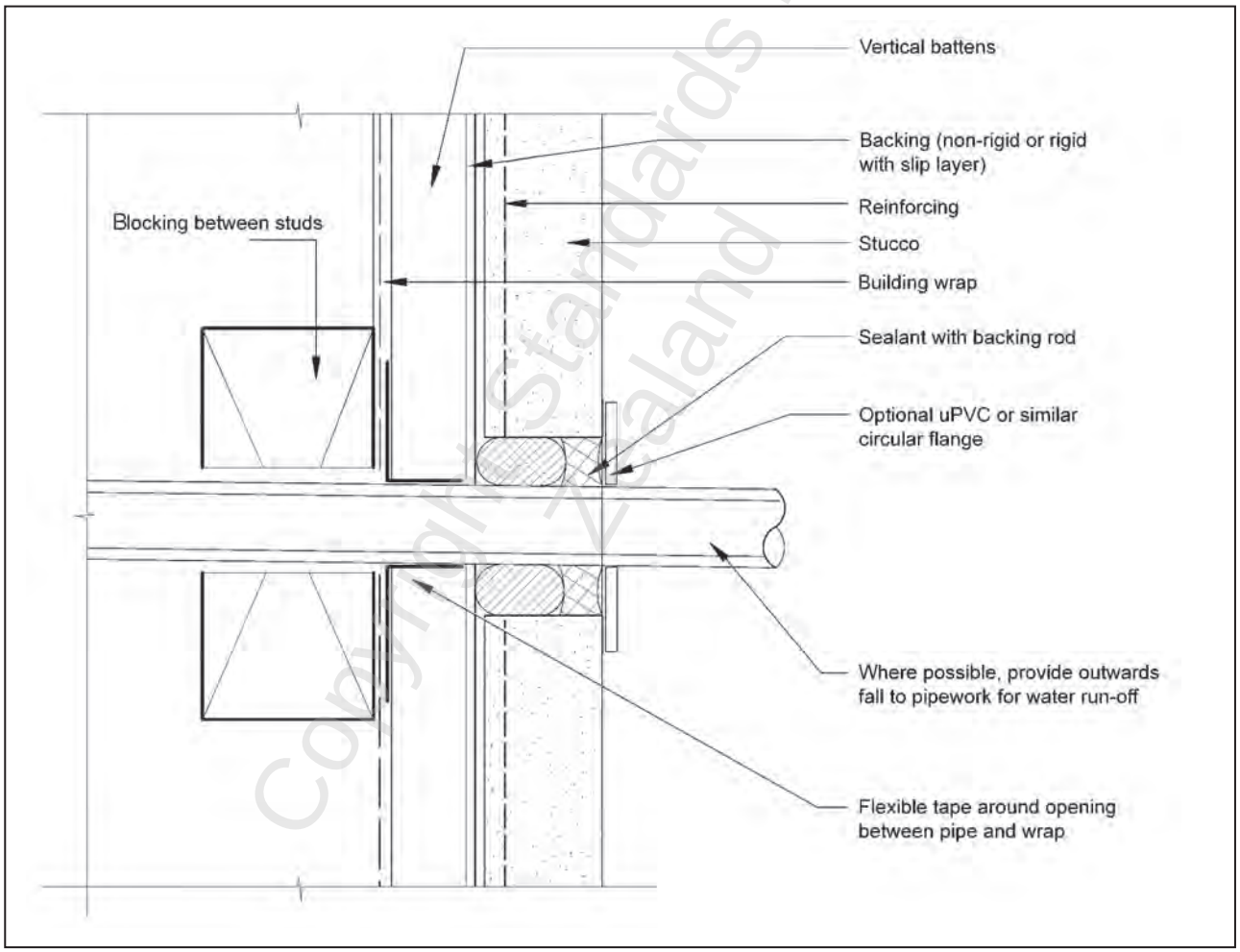


Figure 2 – Stucco pipe penetration

2.1.4.5.3

The hole for the penetration shall be at least 15 mm greater in diameter than the pipe or conduit to allow sufficient sealant thickness to accommodate movement without failure. Both the opening in the backing and in the cladding shall be sealed around the penetration. The sealant shall be forced against a backing rod, and be protected from the weather on the outside by a close-fitting flange around the pipe or conduit if necessary.

C2.1.4.5.3

When using sealants it is essential to ensure the sealant is suitable for the surfaces to which it is attached and to follow the sealant manufacturer's instructions. For contact with Portland cement plaster a neutral-curing silicone should be satisfactory. Plastic or rubber proprietary fittings or sleeves are available for waterproofing small penetrations.

2.1.5 Accuracy

2.1.5.1

All surfaces, corners, edges, angles and reveals shall be finished to lines and levels shown on the plans and specifications within the flatness tolerances specified in 2.1.5.3.

2.1.5.2

For all smooth trowelled surfaces, the background shall be brought up to line and level with vertical surfaces plumb and with horizontal surfaces level.

2.1.5.3

Tolerances applied to second coat shall:

(a) Not deviate more than ±3.0 mm as measured from a 1800 mm long shimmed straight edge;

(b) Have no abrupt deviations of surface.

2.1.6 Surface contaminants

All surfaces receiving plaster shall be free from any contaminant that will interfere with the ability of the plaster to obtain good adhesion. Contaminants include form-releasing oils, tar and bituminous emulsions, paint of any kind, dust and loose particles, soil and clay.

C2.1.6

Where concrete that forms a solid substrate has been cast against formwork, it is recommended that a chemical release agent be used to facilitate formwork removal. Surface contamination that may arise from oil-based release agents needs to be removed before plaster can be applied.

NZS 3114 specifies F2 as an appropriate concrete finish to receive plaster.

2.1.7 Air temperature

2.1.7.1 Cold conditions

No plastering shall be carried out in air temperatures below 5 °C or if the temperature is likely to drop below 5 °C in the 24-hour period following the application of plasterwork.

C2.1.7.1

At low temperatures the hydration process of the strength gain is very slow and overnight frosts may damage the plaster. Surface temperature can be significantly affected by wind speed.

2.1.7.2 Hot conditions

All necessary precautions shall be taken to protect plaster work against the effects of drying winds, direct sunlight, rain and water run-off for at least 24 hours after application.

C2.1.7.2

The restriction on plastering in hot weather is to prevent a prewetted substrate or a previous plaster coat drying more quickly than the plaster can be applied. This can lead to poor plaster adhesion and loss of moisture in the plaster mix can cause surface shrinkage cracking.

In hot sunny conditions work should be carried out on the shaded areas of a building. It is good practice to follow the sun and protect the work by shading.

2.1.8 Protection of adjacent surfaces

2.1.8.1

Plaster may have a corrosive effect on such materials as anodised aluminium, woodwork and glass. All adjacent surfaces which are not to be plastered shall be fully protected by physical barriers during the whole of the work.

2.1.8.2

Compatibility of adjacent materials shall be in accordance with tables 21 and 22 in the Acceptable Solution for NZBC Clause E2, E2/AS1.

C2.1.8

An acceptable way of creating physical barriers is to use plastic sheets and/or masking paper and tapes.

2.1.9 Control joints

2.1.9.1

Control joints shall be formed in the plaster to coincide with all locations and joints in the structure where movement is likely to occur. They shall be formed at all junctions between dissimilar substrates and at any change in wall cross section or height. Control joints shall be determined at the design stage, by the designer and included on the drawings, to allow them to be incorporated into the building design.

2.1.9.2

In stucco systems, control joint spacings (see figure 3) shall not be greater than 4 m both vertically and horizontally and be located:

(a) Vertically:

  (i) On both sides of openings 2.0 m wide or greater

  (ii) On one side of openings less than 2.0 m wide, except as specified by 2.1.9.3;

(b) Horizontally at inter-storey levels;

(c) At changes in wall cross section or height;

(d) At any point where natural flexing of a structure may occur, such as at the top plate level of a gable wall or where a cantilevered deck is attached to the building;

(e) To break up any area of wall larger than 12 m^2.

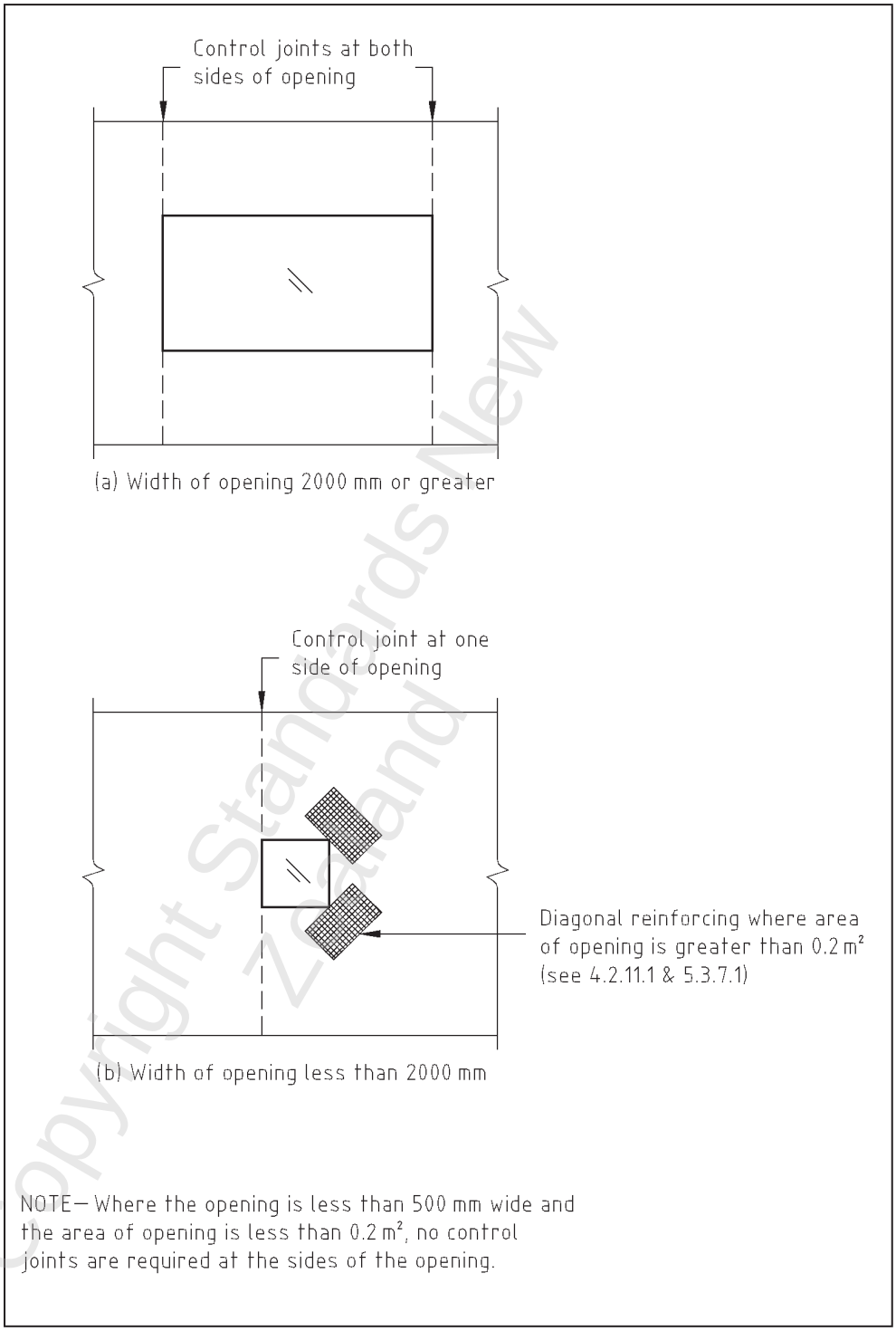


Figure 3 – Control joints at windows

2.1.9.3

Control joints are not required at the sides of openings less than 500 mm wide and less than 0.2 m^2 in area.

2.1.9.4

Lath or wire mesh reinforcement shall not be continuous across control joints.

2.1.9.5

Control joints shall be formed by plastering up to a corrosion resistant jointing bead or flashing or a temporary batten. Alternatively, a neat straight V-groove shall be cut through the bond and flanking coats before they harden. After the flanking coat is cured and dried, this groove shall be filled with a polyurethane, polysulphide or neutral cure silicon type sealant prior to the overall application of the finish coat (see figure 4(a)).

C2.1.9.5

Alternative joint formers may be used provided they follow the principles of permitting movement and maintain weathertightness of the joint as required by 2.1.9.5.

2.1.9.6

See figure 4 (a) – (d) for details of horizontal and vertical control joints.

C2.1.9

If possible, control joints should be located in a pattern which contributes to the appearance of the structure.

During the development of this Standard, an evaluation of random cracking arising from shrinkage showed that the risk of such cracking was greatly increased by having continuous reinforcement through a control joint. Hence the requirements of NZS 4251.1 for non-continuous reinforcement.

Section 3.8 of the BRANZ 'Good Stucco Practice' (2004) and Weathertight Solutions Vol 2 Stucco give more details of control joints which comply with the principles illustrated in figure 4.

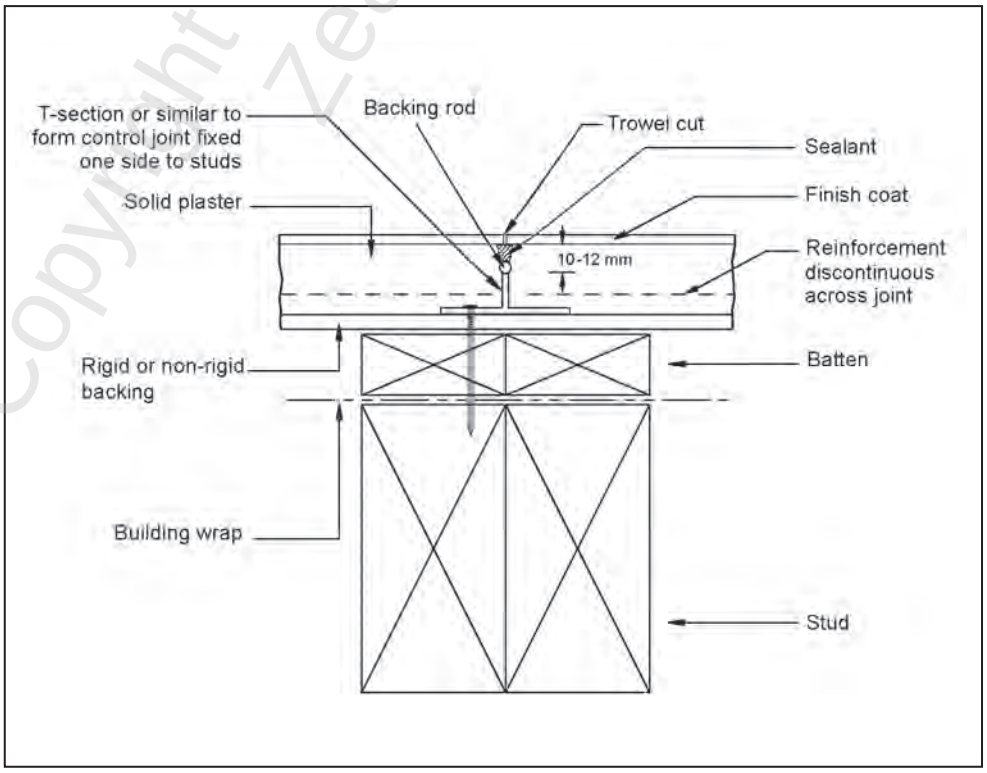
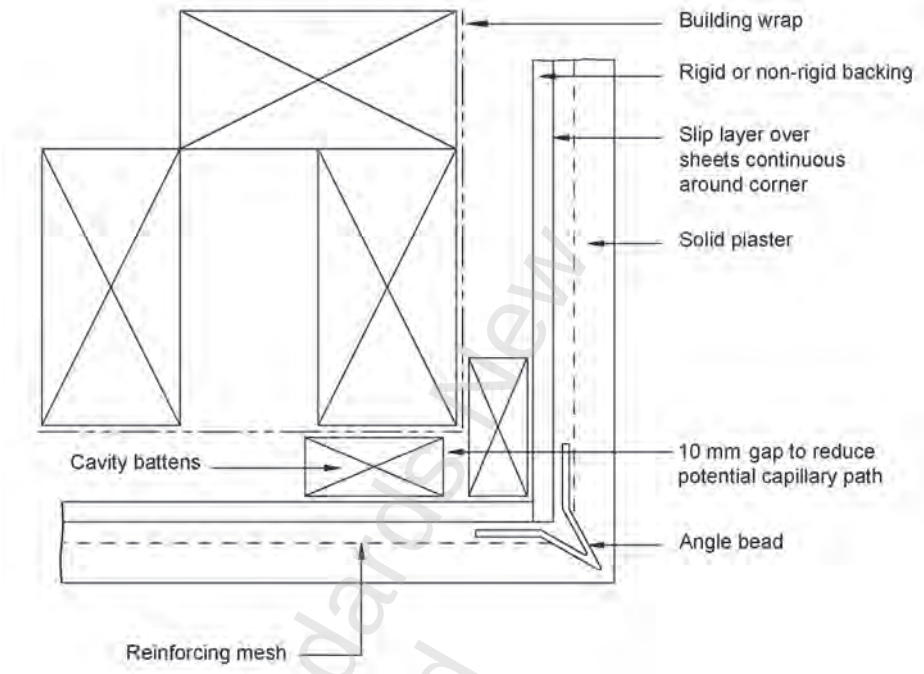


Figure 4(a) – Stucco control joint – Vertical T-section



NOTE – Vertical control joints are required within 2 m of all external corners.

Figure 4(b) – Stucco control joint – External corner

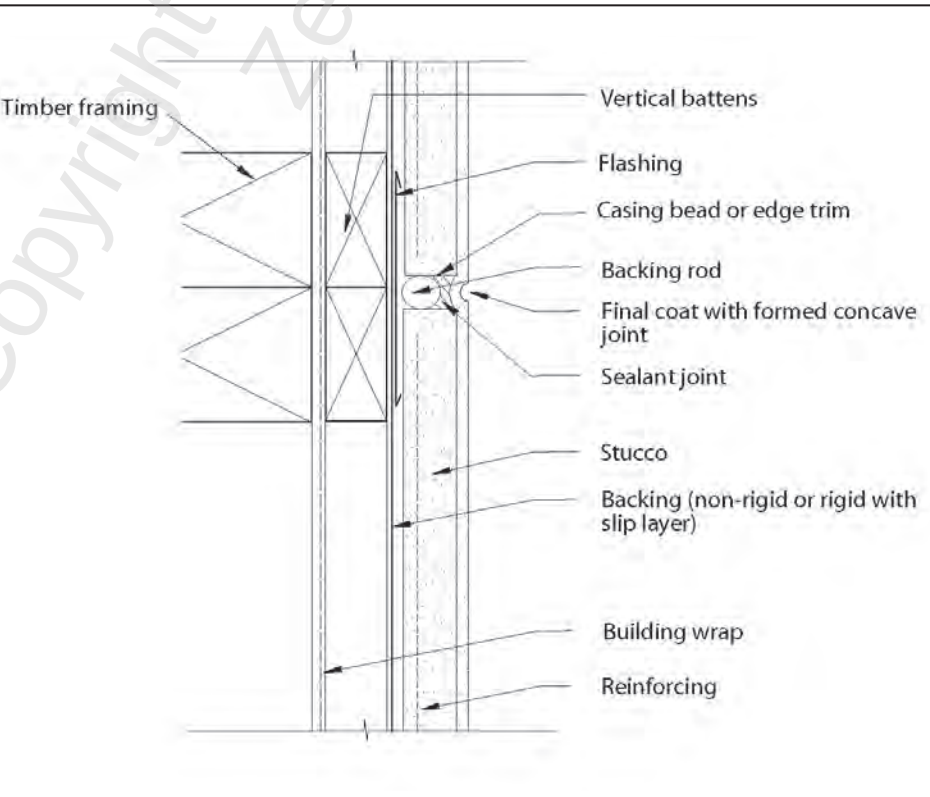


Figure 4(c) – Stucco control joint – Vertical sealant

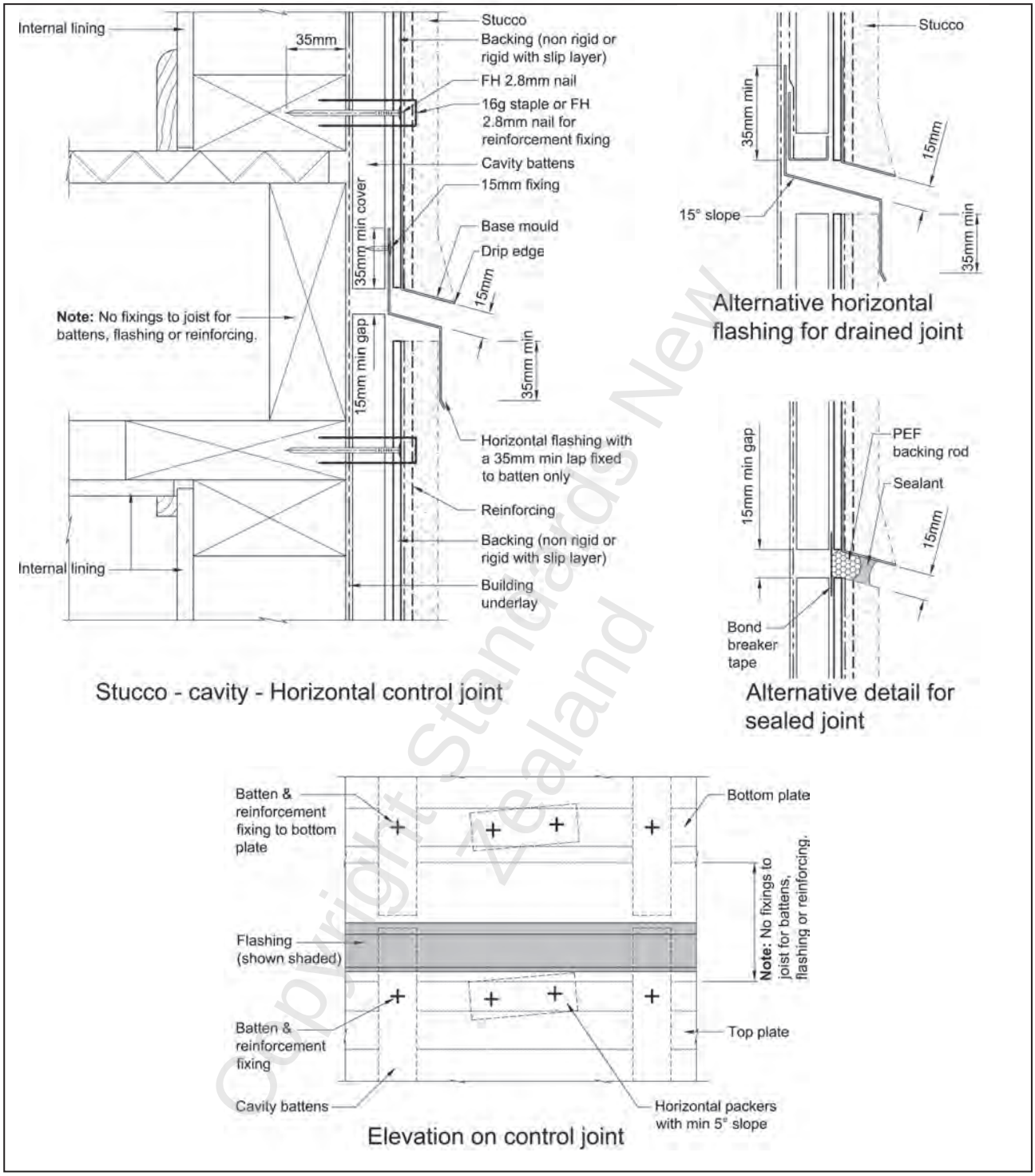


Figure 4(d) – Stucco control joint – Horizontal

2.1.10 Plaster finishes

2.1.10.1 Types of finishing coats

2.1.10.1.1

Plaster finish coats shall be smooth trowelled, medium textured or heavily textured as described in 2.5.7.

C2.1.10.1.1

Texture, as a description of surface appearance, is identified generally with the method and tools used to achieve the finish. Texture can be varied by the size and shape of the aggregate used and the tools employed. See Appendix B for types of finishing coats commonly used.

2.1.10.1.2

For thicknesses of plaster coats see table 5, table 7 and table 8.

2.1.10.2 Angle arrises

2.1.10.2.1

Where no external corner reinforcement or corner bead is specified, arrises shall be removed to form a 45° angle or other desired shape.

2.1.10.2.2

Square arrises shall be softened down by lightly rubbing over with a wet trowel when finishing.

2.1.10.2.3

Plaster thicknesses as specified in table 5, table 7 and table 8 shall be maintained at the arrises.

2.1.10.3 Drip edge

At the bottom of exterior wall panels, a drip edge shall be provided to deflect water run off (see figure 5 and figure 6).

2.2 Materials for solid cement plasters

2.2.1 Scope

This clause covers the selection of materials for solid plasters.

C2.2.1

Cement-based plaster systems need to satisfy important workability requirements during application. These are dependent on the correct mix proportions and the materials used, especially the sand. The finished plaster work needs to be structurally sound, well adhered, free of cracking and water resistant. The quality of the finished work is influenced by several factors including the correct plaster mix applied in a consistent manner to a properly prepared substrate by a competent tradesperson (see 2.1.2).

2.2.2 Materials and source

2.2.2.1

The materials used in the plaster mixes shall be of consistent quality suitable for the intended use, satisfying the grading and compliance requirements of this Standard.

2.2.2.2

The source of materials shall not be changed during the course of the work unless it can be shown that alternative materials can continue to meet the requirement of the Standard. ➤

C2.2.2.2

For uniformity of surface colour, it is essential to ensure that the continuity of the supply of all materials is maintained from the original sources.

2.2.2.3 Cement

Cement shall meet the requirement of one of the following:

(a) Type GP, GB, HE or SR Portland or Blended cement complying with NZS 3122;

(b) Portland pozzolan cement complying with NZS 3123; or

(c) Portland-limestone filler cement complying with NZS 3125.

White cement shall comply with the performance requirements of NZS 3122.

C2.2.2.3

The cement production Standard NZS 3122 has adopted a coding system to suit eventual integration with overseas Standards.

Within the plastering industry, three types of standard production cement from NZS 3122 are likely to be used:

GP General Purpose Portland Cement which was Ordinary Portland Cement (OPC).

GB General Purpose Blended Cement which was not covered by an earlier edition of NZS 3122. Cements are made up of a mixture of GP cement and other materials such as blast furnace slag and flyash.

HE High Early Strength Cement which was earlier designated Rapid Hardening (RH).

There will be colour differences between the different cement types, including NZS 3122 Portland and blended cements and NZS 3125 Portland-limestone filler cement.

2.2.2.4 Sand

2.2.2.4.1

Sand shall be to correct grading and as defined in 2.2.2.4.4 which shall replace the flow time requirement given in 8.1 of NZS 3103. In other respects the sand shall comply with the requirements of NZS 3103.

2.2.2.4.2

Sands for use in any external stucco plaster shall not have a chloride content in excess of 0.05 % by mass of sand.

C2.2.2.4.2

Sand is the major component of a plaster mix and has a significant effect on its workability and long term performance. Variations in sand, cleanliness, grading or moisture content affect the strength, density and working properties of the plaster, while variations in colour or moisture content also affect the uniformity of colour of the hardened plaster.

Unwashed beach sand may not comply with 2.2.2.4.2, as the chloride content can be in the order of 0.03 % to 0.09 % by weight of dry sand.

Current test certificates obtained from the supplier for grading and for chloride content are methods of demonstrating compliance.

The corrosion protection of reinforcement by encapsulation in the plaster is significantly affected by the amount of chloride that is contained in the plaster. Accordingly, it is necessary to place chloride limits on the basic materials making up the plaster. The use of chloride-based accelerator admixtures has been restricted in 2.2.3.3 in external stucco applications and some restrictions have been placed on the maximum chloride content of the sand. The 0.05 % of mass has been permitted as this Standard specifically requires the plaster surface to be sealed by painting and to be maintained over the life of the system. Where plaster is unprotected, then the chloride limit would be set at a lower level, i.e. 0.03 %.

There are several test methods for chloride content. Two common wet chemical methods are quoted but XRF (X-Ray Fluoroscopy) methods could be used provided an equivalency of performance to the wet chemical methods can be demonstrated.

2.2.2.4.3

Sand sampling shall be carried out in accordance with NZS 3111 section 5 and tested for chloride content in accordance with BS 1881:Part 124 or ASTM C1152.

2.2.2.4.4 *Grading*

Grading for plaster sand for use in all coats except the finishing coat, showing percentage passing shall be as in table 1. See table 2 for the grading of finishing sand. ➤

Table 1 – Grading of sand

Sieve size (mm)	**4.75**	**2.36**	**1.18**	**0.6**	**0.3**	**0.15**	**0.075**	**Pan**
Min. (ASTM)	100	90	60	35	10	0	0	0
Max. (ASTM)	100	100	90	70	30	5	3	0

Table 2 – Grading of finishing sand

Sieve size (mm)	**2.36**	**1.18**	**0.6**	**0.3**	**0.15**	**0.075**	**Pan**
Min. (ASTM)	100	70	55	5	0	0	0
Max. (ASTM)	100	100	95	75	20	5	0

Sands that do not fully comply with table 1 may still be used, given that local usage has shown that the sand has suitable workability and a history of satisfactory performance which has been proved by independent technical assessment to be suitable as plastering sand. (See Appendix C for the method of assessment of sand.)

C2.2.2.4.4

Sand grading is based upon achieving a structural and weather resistant plaster coating. In areas of New Zealand where manufactured angular sands are used it will be preferable to use lime as an admixture to assist in producing fine particle lubrication of the mix. Generally this grading and particle size will not produce a fine smooth finish.

2.2.3 Admixtures

2.2.3.1 General

Admixtures used in plaster mixes to improve workability, bond, control setting times, and as an aid to curing shall comply with 2.2.3.3 to 2.2.3.5.

C2.2.3.1

Admixtures are a recognised component of plaster systems used to a greater or lesser degree by most tradespeople. Some admixtures are well known and their use may be specified (see below).

2.2.3.2 Lime

2.2.3.2.1

Hydrated lime shall comply with AS 1672.1 and be included in the plaster mix in accordance with table 3.

2.2.3.2.2

Hydrated lime can be added direct in powder form at the time of mixing or as a lime putty. Lime putty is prepared by soaking appropriate batch volumes (see table 3) of powdered lime in water for approximately 24 hours, draining off any excess water and then adding the creamy putty material to the plaster mix.

C2.2.3.2

Hydrated lime has very fine plate-like particles that help to 'lubricate' the plaster mix improving the workability. This is particularly important when using manufactured angular sands.

Lime putty is generally used in thin finishing plaster coats to overcome the early stiffening of the mix associated with adding powdered hydrated lime directly into a plaster mix.

2.2.3.3 Chemical admixtures

2.2.3.3.1

Chemical admixtures, such as water reducing admixtures, retarding admixtures, accelerating admixtures and air entraining admixtures shall comply with AS 1478.

2.2.3.3.2

Dosage rates detailed by the manufacturer shall be accurately determined for the particular plaster mix and volume of plaster mixed to ensure performance requirements set out in AS 1478 are achieved.

2.2.3.3.3

The admixture dosage shall be accurately measured and dispensed into the plaster mix.

C2.2.3.3

Addition of lime is not recommended with chemical admixtures.

When dosage rates are such as to create a modified plaster the subsequent operations of such a plaster need to follow the manufacturer's instructions. Such applications are not covered in this Standard at present.

2.2.3.3.4

Combinations of admixtures shall be used only if the manufacturers can provide performance results showing that the combinations of the proposed admixtures for a specified plaster mix are compatible and their use in the plaster mix will produce plaster of a quality equal to or greater than a fully cured plaster with no admixtures.

2.2.3.3.5

Calcium chloride based accelerators shall not be used in any external plaster systems containing metal reinforcement, unless it can be shown that in combination with the sand the chloride levels in the plaster do not exceed 0.04 % by mass of plaster.

2.2.3.4 Bonding agents

2.2.3.4.1

Bonding agents for exterior and interior work shall be specially formulated water-based emulsions such as:

(a) Styrene butadiene rubber (SBR) emulsions; or

(b) Acrylic emulsions.

2.2.3.4.2

Bonding agents formulated with polyvinyl acetate (PVA) shall only be used in an interior, moisture-free environment.

2.2.3.4.3

The bonding agent emulsions shall be considered as a part replacement for mixing water and dosed as required by the manufacturer's instructions to ensure increased bond in accordance with the testing requirements of ASTM C631, C932, C952 and C1042 as appropriate.

C2.2.3.4

Emulsions become effective by coalescing which happens only when the mixture dries out. Uncoalesced emulsions can be leached out of the mix by water. Mixes containing an emulsion should therefore be cured by maintaining moist conditions but not by applying free water. They should then be allowed to dry out completely before being exposed to wet service conditions.

Undiluted polymer emulsions should be used on their own with great caution because they may form a plastic skin that will act as a debonding agent. Because PVA is unstable in continuous moist conditions it should be used only for plaster work that will be permanently dry in service.

2.2.3.5 Oxides/pigments

2.2.3.5.1 *Coloured admixtures*

Where stucco and plaster finishes are not required to be painted to meet the requirements of Clause E2 of the NZBC, coloured oxide and pigments may be used and shall comply with NZS 3117.

C2.2.3.5.1

It is recommended that sufficient mix is made to complete the total wall or a discrete section.

Rate of curing can alter colour finish.

Pre-coloured cement-based plasters may not provide a uniform coloured finish.

Exterior coloured plaster surfaces will be subject to water staining and a potential for colour fade. Some efflorescence due to the leeching of soluble salts to the surface is also possible, particularly when plaster is applied in winter conditions.

Water staining and efflorescence effects can be reduced with the application of a cement compatible exterior grade clear sealer coat which will also greatly improve the waterproofing of the plaster system. (See 2.6 for suitable coating systems.)

2.2.3.5.2 *Dosage rates*

Dosages of mineral oxide shall not exceed 3 % by weight of cement unless it can be shown that greater concentrations do not have a detrimental effect on the plaster. Dosages in excess of 6 % by weight of cement shall not be used.

C2.2.3.5.2

Oxides and pigment dosage rates based on the cement content of the plaster mix should also not exceed the maximum rate stated by the manufacturer, within the guidelines of NZS 3117.

The colour saturation point for most oxides and pigments based on the cement content is generally between 5 % and 8 % by weight. A good depth of colour can be achieved by 3 % to 4 %.

Addition of oxides at the 15 % level has been shown to produce a significant (90 %) loss in strength of the plaster coat.

2.2.3.6 Synthetic fibres

2.2.3.6.1

Synthetic fibre type and size shall comply with ASTM C1116, be compatible with cement-based plasters, and able to be evenly distributed into the plaster mix.

2.2.3.6.2

Fibres shall be permitted in the plaster coat containing the metal lath reinforcing only if that coat is manually applied.

2.2.3.6.3

The fibres shall be clean, dry, and free of any coating that will adversely affect the plaster bond to the fibres.

2.2.3.6.4

The quantities of fibres in the plaster mix shall be as required by the synthetic fibre manufacturer to ensure compliance with ASTM C1116.

C2.2.3.6

The addition of synthetic fibres such as polypropylene or fibreglass to a plaster mix helps to control stresses and reduce the potential for cracking through providing initial additional strengthening as the plaster mix cures. The fibres are not a replacement for the specified metal reinforcement. E-type fibreglass fibres are acceptable, even though their long-term durability will not equal that of AR-type (alkali resistant) fibreglass or polypropylene fibres.

The addition of synthetic fibres reduces the risk of surface plaster cracks in hot, dry conditions.

Fibres should not be used in the first coat of plaster if it is pneumatically applied, as the fibres are likely to prevent the plaster mix from penetrating the openings in the reinforcing. This can result in an inadequate coat thickness and a failure to enclose the reinforcing in plaster.

Fibres are not usually used in the final plaster coat of a system as the fibres would protrude from the surface and produce an unsatisfactory finish.

It is not practicable to give a general specification for weight of fibres per mix as fibre density varies for different types and batching is normally measured by volume. However, the approximate measure of 0.5 litre of fibres to a normal 30-litre mix appears to work satisfactorily.

2.2.3.7 Lightweight aggregates

2.2.3.7.1

Expanded perlite and exfoliated vermiculite shall have no dimension greater than 4 mm and shall comply with the relevant sections of AS 2758.1.

2.2.3.7.2

Polystyrene bead or grind shall comply with AS 1366.4.

2.2.4 Stone

Stones used in roughcast finished coats shall meet the durability requirements specified in NZS 3121 and shall have no dimension greater than 14 mm.

2.2.5 Water

Water shall comply with NZS 3121. Drinkable water supplied by the local authority for domestic use is suitable.

2.2.6 Storage

Materials shall be stored in dry conditions off the floor or ground on timber battens or dunnage ensuring protection from contamination and degradation.

2.3 Plaster mixes

2.3.1 Scope

This clause gives mix proportions for plastering systems covered in the Standard.

2.3.2 Mixes for plastering

Plaster mixes, by volume, shall be as detailed in table 3. Plaster on porous solid substrates, as determined from 3.3, requires a scratch coat rather than bond coat.

C2.3.2

The finishes are described in Appendix B.

As a general rule, each coat of plaster should be weaker than the preceding one, except that a slightly stronger mix may be used in a thin finish coat.

Table 3 – Mixes for plastering (by volume)

Background	Finish	Bond coat or scratch coat	Flanking coat	Finishing coat
Concrete	Dado finish	CS 1:1½	CLS 1:1:6	CLS 1:1:1
	Sponge finish	CS 1:1½	CLS 1:1:6	See Note 6
	Lightweight plaster	CS 1:1½	CV 1:4	CV 1:4
	Tyrolean	CS 1:1½	CLS 1:1:6	CS 1:3
	Textured & scraped	CS 1:1½	CLS 1:1:6	CLS 1:½:4
	Combed	CS 1:1½	CLS 1:1:6	CLS 1:½:4
	Rough cast	CS 1:1½	CLS 1:1:6	CLSA 1:1:½:3
	Dry dash	CS 1:1½	CLS 1:1:4	Dry dash Note 7
Brick & blockwork (unit masonry)	Dado finish	CS 1:1½ – 2	CLS 1:1:6	CLS 1:1:1
	Sponge finish	CS 1:1½ – 2	CLS 1:1:6	See Note 6
	Lightweight plaster	CS 1:1	CV 1:4	CV 1:4
	Tyrolean	CS 1:1½ – 2	CLS 1:1:6	CS 1:3
	Textured & scraped	CS 1:1½	CLS 1:1:6	CLS 1:½:4
	Combed	CS 1:1½	CLS 1:1:6	CLS 1:½:4
	Rough cast	CS 1:1½ – 2	CLS 1:1:6	CLSA 1:1:½:3
	Dry dash	CS 1:1½ – 2	CLS 1:1:4	Dry dash Note 7

Table 3 – Mixes for plastering (by volume) (continued)

Background	Finish	Bond coat or scratch coat	Flanking coat	Finishing coat
Lightweight concrete & blocks	Dado finish	CS 1:2	CLS 1:1:6	CLS 1:1:1
	Sponge finish	CS 1:2	CLS 1:1:6	See Note 6
	Lightweight plaster	CS 1:2	CV 1:4	CV 1:4
	Tyrolean	CS 1:2	CLS 1:1:6	CS 1:3
	Textured & scraped	CS 1:1½	CLS 1:1:6	CLS 1:½:4
	Combed	CS 1:1½	CLS 1:1:6	CLS 1:½:4
	Rough cast	CS 1:2	CLS 1:1:6	CLSA 1:1:½:3
	Dry dash	CS 1:2	CLS 1:1:4	Dry dash Note 7
Stucco Rigid backing & non-rigid backing	Dado finish	CLS 1:1:6	CLS 1:1:6	CLS 1:1:1
	Sponge finish	CLS 1:1:6	CLS 1:1:6	CLS 1:2:9
	Lightweight plaster	CS 1:3	CV 1:4	CV 1:4
	Tyrolean	CLS 1:1:6	CLS 1:1:6	CS 1:3
	Textured & scraped	CLS 1:1:6	CLS 1:1:6	CLS 1:½:4
	Combed	CLS 1:1:6	CLS 1:1:6	CLS 1:½:4
	Rough cast	CLS 1:1:6	CLS 1:1:6	CLSA 1:1:½:3
	Dry dash	CLS 1:1:6	CLS 1:1:4	Dry dash Note 7

Key to table

C Portland cement
L Lime or lime putty (see 2.2.3.2)
S Sand
V Exfoliated vermiculite or expanded perlite or polystyrene bead or polystyrene grind
A Stone

NOTE –
(1) Where admixtures are used instead of lime refer to the manufacturer's recommendations.
(2) See also 2.2.3.3.
(3) Surface porosity of the substrate (see 3.3.2) will determine whether a bond coat or scratch coat is used.
(4) Smooth trowel finishes are not recommended because of the potential to highlight fine cracks and minor surface irregularities.
(5) Flanking coat is also known as render coat (see definitions in 1.5).
(6) For sponge finish on solid substrates, a satisfactory finished surface of the flanking coat can be achieved i.e. 2 coats.
(7) To ensure full covering of the surface a second application of dry dash may be required.

2.4 Batching and mixing

2.4.1 Scope

This clause covers batching and mixing of cement plasters by machine or by hand.

2.4.2 Batching

2.4.2.1

The plaster ingredients, water and liquid admixtures shall be batched by volume using accurate gauge boxes or other suitable containers.

2.4.2.2

Pigments and liquid or solid admixtures shall be batched according to the manufacturer's recommendations.

C2.4.2

A shovel is not an adequate or accurate measure.

2.4.3 Mixing

2.4.3.1 General

2.4.3.1.1

Portland cement plasters shall be thoroughly mixed to provide a uniform consistency throughout the mix.

2.4.3.1.2

Machine mixing shall be used where practicable.

C2.4.3.1

In order to ensure proper intermixing of all materials machine mixing is highly desirable, since the performance of the plaster is influenced by the consistency of the plaster production. Careful hand mixing is possible where small quantities of plaster may be required.

2.4.3.2 Machine batching and mixing

2.4.3.2.1

Three quarters of the required water shall be measured and placed in the mixer, followed by the addition of measured quantities of other ingredients.

2.4.3.2.2

The remaining water shall be progressively added if necessary to ensure that the mixing produces a mixture which is uniform in colour and consistency.

C2.4.3.2

When mixing the plaster the aim is to get uniform consistency using identical proportions of ingredients in each batch.

2.4.3.3 Mixing time

For each mix, the mixing time taken shall be established by preparing a trial batch and accurately recording the time taken to produce the required consistency, as described in 2.4.3.2. That mixing time shall be used for all subsequent batches with the same components and mix proportions.

C2.4.3.3

Excessive mixing time when using polymer-based plasticisers causes excessive air entrainment which results in reduced strength, loss of bond and increased shrinkage. (A laboratory study where mixing time was increased from 2 minutes to 15 minutes gave a strength reduction of 50 % and a shrinkage increase of 35 %.)

Mixing times are longer if a concrete mixer is used rather than the more efficient paddle mixer. A simple time switch on the mixer is a reliable way of ensuring correct mixing time.

2.4.3.4 Hand mixing

Hand mixing shall be done on a smooth non-porous surface. The sand shall be spread out in a 100 mm thick layer. The cement and lime shall then be spread uniformly over the sand. Mix the ingredients thoroughly, until the colour is uniform. Then gradually add the water while mixing until the uniform consistency is achieved.

2.4.3.5 Re-mixing

2.4.3.5.1

Re tempering or re-mixing after the plaster has stiffened shall not be permitted.

C2.4.3.5.1

Freshly mixed plaster has two stages of losing workability. The first stage is due to evaporation of water from the plaster mix and therefore is very dependent on wind and temperature conditions as well as the covering protection of the wet mix. In this stage the plaster may receive limited addition of water to restore the original workability by remixing. The second stage relates to the stiffening of plaster mix due to the hydration process set off by a chemical reaction between water and cement. No tempering of plaster mix is permitted in this stage.

2.4.3.5.2

General and blended Portland cement-based plaster which remains unused after 90 minutes, measured from the time of mixing, shall not be used unless a retarding admixture was used at the time of mixing to extend the setting time.

2.4.3.6 Premix

All premixed materials shall be delivered to the site in sealed packaging, bearing the trade names of the materials, the manufacturers' details and mixing instructions.

2.4.3.7 Cleaning

Frequent washing of all mixing equipment and tools shall be undertaken, especially if latex emulsion admixtures are used in the gauging liquid.

C2.4.3.7
Frequent washing means a minimum of 3 times a day for sand cement mixes and at 45-minute intervals for mixes with latex admixtures.

2.5 Application and curing of plaster coats

2.5.1 Scope

This clause includes application and curing of various types of plaster coats such as bond coats, scratch coats, flanking coats and finish coats.

2.5.2 General

2.5.2.1
Each coat of plaster shall be cured to provide moisture for cement hydration while ensuring a controlled rate of drying to resist cracking which could lead to structural failure or water penetration. No plaster coat shall be applied over a preceding coat of plaster until the base plaster has been correctly cured.

2.5.2.2
Mixes containing admixtures shall be cured under conditions recommended by the manufacturer.

2.5.3 Dubbing-out

2.5.3.1
All dubbing-out which is necessary to provide a plane background for plasterwork shall be completed at least 48 hours before the application of base coats to allow the dubbing-out to dry. If the dubbing-out thickness needed is greater than 15 mm it shall be built up in 2 or more coats, each not more than 15 mm thick. The mix for dubbing-out shall not be weaker than the flanking coat.

2.5.3.2
Where dubbing-out exceeds 30 mm specific design is necessary, which is outside the scope of this Standard.

2.5.4 Bond coat

2.5.4.1
Bond coats are required on non-porous solid substrates as determined from 3.3. Bond coat plaster mix shall be applied to the substrate prepared in accordance with 3.2 and 3.3.

2.5.4.2
The bond coat shall be applied by throwing the plaster with force onto the substrate using a scoop or a suitable trowel. The resulting bond coat shall comprise a close rough textured layer of plaster up to 4 mm thick. No attempt shall be made to smooth off, level, or pat into place this plaster coat.

C2.5.4.1 and C2.5.4.2
A machine pump designed for the purpose of applying cement-based plaster may also be suitable for applying the bond coat.

2.5.4.3 Curing of bond coat

The bond coat shall be cured in accordance with one of the following procedures:

(a) Moist-curing shall be provided for 48 hours and then left to dry for 24 hours or until the surface hardness is suitable for the application of the flanking coat.

(b) Where an acrylic bonding agent has been used in the plaster mix, moist-curing shall be dispensed with and the plaster coat shall be protected from direct sun and drying wind for at least 16 hours after application. After this curing, the bond coat shall be left to dry for 24 hours or until the surface hardness is suitable for the application of the flanking coat.

(c) Where the flanking coat is to be applied within 24 hours of the application of the bond coat, moist-curing required in (a) or protection in (b) shall be provided for 12 hours and the coat shall be allowed to dry until the surface hardness is suitable for the application of the flanking coat. See C2.5.4.3.

The flanking coat shall then be immediately applied.

If for any reason the follow-up of placing the flanking coat does not take place, then the curing regimes of 2.5.4.3 (a) and (b) shall be reintroduced and the appropriate periods of curing and delay times shall apply.

See 2.5.8 for the practical scratch test for determining a suitable hardness and hence strength gain.

C2.5.4.3

In method 2.5.4.3 (c) continuity of curing of the bond coat is achieved by the application of the flanking coat which effectively prevents moisture loss from the bond coat.

Method 2.5.4.3 (c) is not applicable to scratch coats used on stucco construction.

2.5.5 Scratch coat

2.5.5.1

A scratch coat as a base coat shall be the base coat for stucco systems or on solid substrates of brickwork or similar absorbent surfaces. The plaster shall be applied to the substrate to the required thickness by trowel application or mechanical means, with sufficient pressure to ensure continuous contact with the solid substrate or stucco background. The finished surface of the scratch coat shall be scratched with a suitable tool to leave grooves approximately 5 mm deep spaced at 15 mm to 20 mm intervals.

C2.5.5.1

The grooves are required to provide key for the flanking coat and also promote closely spaced cracks due to the plaster shrinking during the drying period.

There are different scratch coat thicknesses for solid substrates and stucco construction (see 3.5, 4.4 and 5.5 on thickness).

2.5.5.2 Curing of scratch coat

The scratch coat shall be cured in accordance with the following:

(a) On solid substrates the procedures shall be the same as required for a bond coat in 2.5.4.3.

(b) On stucco construction moist curing shall be provided for 48 hours and then left to dry for 24 hours or until the surface hardness is suitable for the application of the flanking coat.

See 2.5.8 for the practical scratch test for determining a suitable hardness and hence strength gain.

2.5.6 Flanking/Render coat

2.5.6.1

A flanking coat shall be applied to:

(a) A solid substrate that has received either a bond (including a dubbing-out coat where required) or a scratch coat; and

(b) Scratch coats on rigid and non-rigid backings.

2.5.6.2

Before the application of the flanking coat the surfaces of the bond or the scratch coat shall be thoroughly brushed to remove all loose material and shall be dampened with water to promote good adhesion. There shall be no free water on the surface at the time of application of the flanking coat.

See 2.5.8 for the practical scratch test for determining a suitable hardness and hence strength gain.

2.5.6.3

The plaster shall be applied to the substrate 2 mm or 3 mm greater than the required thickness by trowel application or mechanical means, with sufficient pressure to ensure continuous contact with the substrate.

2.5.6.4

The excess plaster shall be struck off with a suitable screed or rule to within ±3 mm over 1800 mm of the required line and level. Ridges in the plaster's surface shall be floated out and any hollows filled in with more plaster and then struck off or ruled out flush with the surrounding plaster.

2.5.6.5

The surface of the flanking coat shall be finished to provide a flat compacted surface with an open grained finish such as that achieved with a wooden float.

C2.5.6

Excessive steel floating should be avoided as such floating tends to bring the cement and fine sand to the surface.

2.5.6.6 Curing of flanking coat

2.5.6.6.1

The flanking coat shall be moist-cured for a minimum of 48 hours and then allowed to dry slowly for at least a further 72 hours.

2.5.6.6.2

If a bonding agent has been used in the plaster mix, moist-curing shall be dispensed with and the coat shall be protected from direct sun and drying winds for at least 16 hours after application. After curing this coat shall be allowed to dry for at least a further 72 hours. (See Appendix D.)

2.5.7 Finishing coats

2.5.7.1

A finishing coat shall be applied only to a flanking coat which has been prepared in accordance with 2.5.6 of this Standard. The finishing coats shall be smooth trowelled or medium or heavily textured as described in 2.5.7.3, 2.5.7.4 and 2.5.7.5.

2.5.7.2

For a 2-coat system on solid substrates as described in 3.5 and table 5, a flanking coat shall be applied directly to a scratch coat to form the final coat. The flanking coat sand shall not be changed to a finer particle grading nor additional cement used.

C2.5.7.2

In the 2-coat system on solid substrates, the flanking coat contains sand particles that are larger than those used in standard finish coats. Hence smooth compact surface finishes are not possible with this system. Reducing particle size has consequential effects of increased shrinkage and cracking.

2.5.7.3 Smooth trowelled finishing coats

Smooth trowelled finishing coats shall be 2 mm to 3 mm thick.

C2.5.7.3

Examples of finishes in this category are smooth trowelled (dado) and sponge (see Appendix B).

2.5.7.4 Medium textured finishing coats

Medium textured finishing coats shall not be greater than 6 mm thick.

C2.5.7.4

Examples of finishes in this category are Tyrolean, textured and scraped or combed finish (see Appendix B).

2.5.7.5 Heavily textured finishing coats

Heavily textured finishing coats shall not be greater than 14 mm thick.

C2.5.7.5

Examples of finishes in this category are hand-thrown rough cast and dry-dash. (See Appendix B.) A typical pebble dash finish may have a 6 mm coat plus a stone protrusion of 8 mm to give a total finish thickness of 14 mm.

2.5.7.6 Curing of finish coats

2.5.7.6.1

The finish coat shall be kept continuously moist for at least 72 hours after application and shall then be allowed to dry.

2.5.7.6.2

If hot or windy conditions prevail during the next 72 hours of drying, the surface shall be occasionally dampened by spraying with water.

2.5.7.6.3

Where a bonding agent has been used in the plaster mix, moist curing shall be dispensed with but the surface shall be protected from direct sun and drying wind for at least 16 hours after application and shall then be allowed to dry (see Appendix D).

C2.5.7.6

Curing of the finish coat is necessary to prevent plastic cracking due to rapid water loss caused by the usually thin (2 mm to 3 mm) coat. Correct curing also aids the development of strength where a hard abrasion-resistant surface is required.

In order to prevent shrinkage crazing, it is essential that the finish coat is dried slowly.

2.5.8 Surface hardness or scratch test

Using a metal coin or nail, scratch the surface of the plaster coat. If the plaster surface powders or crumbles, then the plaster has not reached a suitable strength, prior to proceeding with subsequent plaster coats or surface coatings.

2.6 Surface coatings

2.6.1

Exterior stucco and plaster on solid substrates shall be waterproofed by the application of a surface coating if required to meet Clause E2 of the NZBC.

C2.6.1

In some situations the surface does not need waterproofing e.g. garden features/walls. Specialist surface coatings such as for some interior finishes are not covered by this Standard.

2.6.2

An alkali resistant water based dispersion coating system having a minimum dry film thickness of 80 μm (micro metres) and complying with any of Parts 7, 8, 9 or 10 of AS 3730 is deemed to comply with this requirement.

2.6.3

This shall be achieved by at least 2 or 3 coats, depending on the product used and the texture of the plaster surface.

2.6.4

The surface coating shall not be applied until:

(a) The surface complies with 2.5.8; and

(b) The painting contractor has determined that the moisture content is at a level suitable for paint application.

C2.6

Uncoated cement plaster systems cannot be assumed to be completely waterproof as the drying process is likely to produce voids and fine shrinkage cracks which, although often not readily visible, permit the entry of water in driving rain conditions. Integral waterproof proprietary admixtures used in flanking and finish coats will assist in reducing water penetration.

Moisture should be controlled first by trying to eliminate its entry and secondly by allowing it to dissipate without causing damage to building elements. Plaster which has been proportioned, mixed, applied and cured in accordance with this Standard will provide a high level of resistance to water penetration, but for stucco systems, it is essential to provide a coating.

An acrylic system is called up as the coating needs to prevent the entry of liquid water yet allow the ready transmission of water vapour.

Light coloured finishes are preferable to dark ones as dark colours absorb more heat and increase the likelihood of cracking with changes in temperature.

High build coatings can be an effective surface finish on plaster and stucco. High build systems generally have better crack bridging ability but should not be regarded as a cure for poorly mixed, poorly cured or poorly detailed plaster. Information on the suitability of high build coatings for specific uses can be obtained from specific manufacturers.

A plaster system may require 14 days of drying after the conclusion of curing before the plaster is likely to meet the provisions of 2.6.4 (b). Clearly, if there are periods of wet weather, then the time to reach a satisfactory moisture level will be extended, delaying the paint application.

2.7 Maintenance

The completed plaster system shall be regularly maintained to ensure continued resistance to water entry. Maintenance shall include the removal of dirt, mould and other organic deposits, the repair of cracks or other defects, and repainting as necessary to preserve the waterproof finish.

C2.7

Organic deposits, if not removed, can release organic acids which attack cement plaster.

Where a clear coating system is used, as over an oxide coloured plaster (see C2.2.3.5.1) the durability is likely to be less than for a coloured coating system and repainting will need to be performed more frequently.

Cracks in the plaster, which have ceased to move, can be repaired by raking out the crack, removing any loose material and applying fresh plaster. Cracks which are subject to movement (sometimes on a seasonal basis) may be filled with an elastomeric sealant. In such cases it is essential to follow the advice of the sealant manufacturer regarding selection and application of the product.

Very fine cracks can be repaired by applying a very high build paint (coating thickness greater than 300 µm thick) over the crack.

All repair work should be cleaned and coated with a paint system complying with 2.6.

3 SOLID SUBSTRATES

3.1 Scope

3.1.1

This section is applicable to solid substrates and covers surface preparation, assessment of porosity and surface dampening, plaster systems and plaster thickness.

3.1.2

The structural design and construction of all solid substrates including expanded polystyrene block walls are outside the scope of this Standard. These shall comply with all relevant requirements of the NZBC including Clauses B1, B2, E2 and E3 and the New Zealand Standards NZS 4210 and NZS 3109.

3.2 Surface preparation

3.2.1 General

Good bond between the plaster and the background shall be achieved over the total surface area. Surfaces shall be prepared thoroughly as described in 3.2.2.

3.2.2 Preparation of solid substrate

The following requirements shall apply:

(a) All projections and fins that exceed 4 mm in projection or are of a soft friable nature, shall be hacked off;

(b) All other loosely attached material including possible surface contaminants shall be removed;

C3.2.2(b)

Typical surface contaminants which could interfere with bond are, for example, paints, oils, greases, adhesives, form release agents, residues of curing compounds, lichen and moss, laitance and lime efflorescence. Various cleaning materials may be used to remove some of these materials, but care needs to be taken to ensure that no corrosive or bond-inhibiting residues are left on the surface.

(c) The surface shall be inspected for possible material that may subsequently detach from the substrate and such material shall be removed;

C3.2.2(c)

Typical examples of this could be previously plastered surfaces.

(d) The surface shall be roughened to provide an adequate mechanical key. If the plaster system to be applied is less than 15 mm thick the surface shall be roughened to 'coarse sandpaper' texture i.e. 1.0 mm amplitude (the height difference between peaks and troughs). For plaster systems 15 mm or more thick the surface shall be roughened to an amplitude of 3 mm;

C3.2.2(d)
Surface roughening for in situ concrete can be achieved by using surface retarders on formwork during casting or by hand or mechanical scabling, grit blasting or high pressure water jetting.

(e) Where the substrate is concrete masonry, the surface shall be clean and free of dust prior to using a bond coat as per 2.5.4;

(f) Where the substrate consists of old brickwork, rake out all the soft joints to a depth of not less than 10 mm and refill;

(g) Final cleaning shall remove all dust and other debris.

C3.2.2(g)
This operation is critically important since residual layers of loose material will interfere with the plaster bond and substantially negate the effectiveness of surface roughening. Air jetting and wet hosing are the preferred cleaning methods. Brushing is inadequate unless performed with extreme thoroughness.

3.3 Assessment of porosity and surface dampening

3.3.1 Scope

This clause describes how to determine if a substrate is porous or non-porous and gives the requirement for surface dampening.

3.3.2 Porosity

3.3.2.1
Solid substrates are defined as non-porous and porous, and shall be assessed by determining the ability of the prepared surface to repel or absorb water.

3.3.2.2
The degree of absorption shall be assessed by applying water by a brush or a cup to the solid substrate and observing what happens.

3.3.2.3
The surface shall be defined into 2 categories:

(a) If little or no water is absorbed, it is defined as a non-porous surface;

(b) All other surfaces are defined as porous.

Category (a) surfaces shall be prewetted by brushing or fog spraying with water and then allowing the wet shine to go off before applying a bond coat.

Category (b) surfaces shall be wetted thoroughly and then allowed to become just surface dry before plastering starts.

C3.3.2

The degree of porosity will vary for different surfaces.

On very porous substrates such as lightweight concrete blocks, the partial sealing of the surface to control the aggressive suction can be achieved using one part of water to one part of bonding agent mix plus cement, applied to the surface and allowed to dry before application of the first plaster coat. Another alternative is to apply a bond coat that includes a bonding agent in proportions recommended by the bonding agent manufacturer.

3.3.3 Surface dampening

The background surface shall be dampened and allowed to dry back to a surface-dry condition.

C3.3.3

The purpose of dampening the substrate for cement plaster is to reduce excessive suction and to provide a reservoir of moisture for curing the plaster. For low-porosity surfaces a water spray shortly before plastering is acceptable. However, the surface needs to return to a surface-dry condition before plastering, as the complete absence of suction or the presence of free water on the surface will significantly impair the achievement of bond. For high-porosity surfaces, several water spray applications may be necessary to achieve a satisfactory surface condition prior to applying plaster.

3.4 Plaster systems for solid substrates

The plaster system applied to all solid substrates shall consist of 2 or more separate coats as detailed in table 4. ➤

Table 4 – Plaster systems for solid substrates

(a)	**Non-porous dependent on finish**	3-coat system	1 – Bond 2 – Flanking 3 – Finishing
	Sponge	2-coat	See note 4 to table 5
(b)	**Porous dependent on finish required:** **Textured finish only**	2-coat system	1 – Scratch 2 – Finishing
	Any other finish **(Smooth trowelled or dado)**	3-coat system	1 – Scratch 2 – Flanking 3 – Finishing
	Sponge	2-coat	See note 4 to table 5

C3.4
In addition it may be necessary to use dubbing-out coats to provide a level plane for plasterwork.

3.5 Plaster thickness for solid substrates

3.5.1 Scope

This clause gives acceptable thickness of plaster coats for porous and non-porous solid substrates.

3.5.2 Thickness of plaster

Plaster thickness shall be measured from the face of the solid substrate. The thickness of individual plaster coats shall be as given in table 5.

Table 5 – Thickness of plaster coats for solid substrates

Non-porous substrate	**Bond coat**	**Flanking coat**	**Finishing coat** [See note (2)]	**Total thickness**
Concrete – walls	3 to 4 mm	9 to 15 mm	2 to 3 mm	14 to 22 mm
– ceilings	3 to 4 mm	3 to 7 mm	2 to 3 mm	8 to 14 mm
Porous substrate	**Scratch coat**	**Flanking coat**	**Finishing coat** [See note (2)]	**Total thickness**
Bricks Concrete blocks Lightweight concrete Lightweight concrete blocks	3 to 4 mm	9 to 15 mm	2 to 3 mm	14 to 22 mm

	Scratch coat	**Textured finish coat**	**Total thickness**
Porous substrate (2-coat textured finish)	5 to 8 mm	10 to 14 mm	15 to 22 mm

NOTE –

(1) Bond coat shall be used for non-porous concrete wall or ceilings and scratch or bond coat can be used for porous substrates.

(2) See 2.5.7.4 and 2.5.7.5 for medium and heavily textured finishes and appropriate thicknesses.

(3) Where dubbing-out is necessary to provide a level plane for plasterwork, it shall be executed at least 48 hours prior to the application of bond coats. If the thickness needed is greater than 15 mm it shall be built up in 2 or more coats, each not more than 15 mm thick. The mix for dubbing-out shall not be weaker than the flanking coat.

(4) Flanking coat is also known as render coat (see definitions in 1.5). For sponge finishes, the finishing coat may be omitted provided the minimum plaster thickness is achieved.

C3.5.2
Smooth trowelled finishes are not recommended because of the potential to highlight fine cracks and minor surface irregularities (see Appendix B).

4 STUCCO ON RIGID BACKINGS

4.1 Scope and general considerations

4.1.1 Scope

This clause covers stucco on rigid backings with a drained and vented cavity fixed to light framed construction of timber or steel. It deals with materials and fixing, metal reinforcement, plaster systems and plaster thicknesses applicable to rigid backing.

4.1.2 General considerations

4.1.2.1

The scratch coat for stucco on rigid backing shall be reinforced with galvanised wire mesh or expanded metal conforming to 4.2.

4.1.2.2

The timber framing supporting the rigid backing shall comply with the provisions of NZS 3604 and the NZBC Clause E2/AS1.

4.1.2.3

Where steel framed buildings are to be clad with plaster, the building shall come within the scope of 1.1.2 of NZS 3604, with steel framing substituted for timber framing. Steel wall framing shall be the subject of specific design in accordance with AS/NZS 1170 and AS/NZS 4600. Steel framed wall deflections shall not exceed the suggested serviceability limits for brittle claddings of AS/NZS 1170. The maximum stud and dwang spacing shall be as for timber framing.

4.2 Materials and fixing

4.2.1 General

A drained and vented cavity shall be provided between the building underlay on the timber frame and the rigid backing of the stucco.

4.2.2 Building underlay

Building underlay shall be fixed to the exterior face of the framing and shall be in accordance with the requirements of the NZBC Clause E2/AS1.

4.2.3 Drained and vented cavities

4.2.3.1 General

The following requirements shall be met:

(a) Cavity battens need only be temporarily fixed to the wall framing;

(b) Rigid backing shall be fixed through the cavity battens into the wall framing as required by 4.2.4 with the stucco reinforcing fixed to the battens and framing as required by 4.2.9.

C4.2.3.1(a)

The battens will need to be temporarily fixed to the stud through the building underlay. They become finally secured by the rigid backing fixings which need to penetrate 35 mm minimum into the timber stud or 10 mm through a steel stud.

4.2.3.2 Requirements

The cavity shall:

(a) Be formed using vertical cavity battens of 18 to 25 mm thickness, of equal width to the stud, complying with NZS 3602 and be treated to H3.1 of NZS 3640;

(b) Incorporate packers at heads and sills of openings and at eaves level to support the edges of cladding. The horizontal packer shall be laid approximately 5° off horizontal and 50 mm short of any vertical batten to promote ventilation and prevent water being trapped by the batten;

(c) Not be vented at the top;

(d) Be constructed to restrict air movement between the drained and vented cavity and the wall and roof framing, attic roof space and subfloor space;

(e) Be drained and vented to the exterior at the bottom edges with a cavity closer with 1000 mm^2 of opening per lineal metre of wall. Individual openings in the cavity closer shall be no greater than 5 mm to provide vermin proofing and no less than 3 mm.

4.2.4 Backing materials and fixing to timber framing

4.2.4.1 General

Rigid backings shall comprise the following materials:

(a) Plywood; and/or

(b) Fibre-cement sheet

complying with 4.2.4.2 to 4.2.4.3.

C4.2.4.1

The rigid backings specified ensure that the backing deflection is limited to a maximum of 6 mm when the plaster is applied. Rigid backings will be durable for not less than 15 years therefore meeting the NZBC's durability requirement B2 Clause 2.3.1(b).

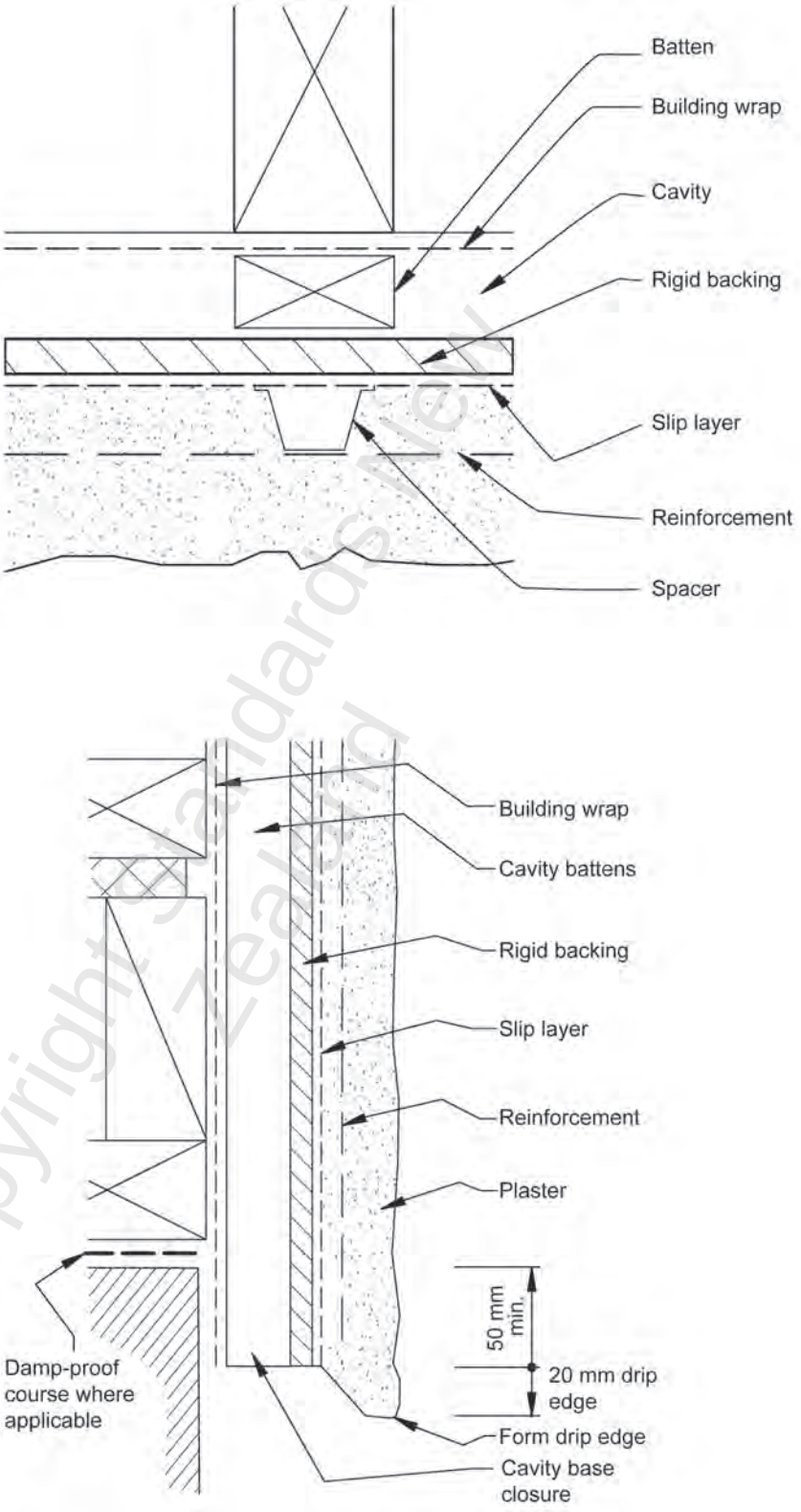
Cement plaster systems cannot be assumed to be completely weatherproof and it is necessary to ensure that any moisture entry does not penetrate to the structural framing.

4.2.4.2 Slip layer

Rigid backings shall be overlaid with building underlay to provide a slip layer which permits the independent movement of plaster and backing (see figure 5).

4.2.4.3 Sheet distorsion

Sheets that become distorted and are more than ±3.0 mm out of plane at the time of plastering as a result of excessive exposure to the weather shall be replaced.



NOTE – Cavity base closure shall contain a minimum ventilation opening of 1000 mm^2/m at the base.

Figure 5 – Rigid backing detail

4.2.4.4 Plywood backings

4.2.4.4.1 *Specification and thickness*

Plywood backings shall comply with AS/NZS 2269 and be treated to H3.1 Group B of NZS 3640. The sheet thickness shall comply with table 6.

C4.2.4.4.1

Vertically fixed sheets need to be thicker as sheet stiffness is lower where the face veneers are parallel to the studs.

Table 6 – Plywood sheet thickness

Plywood sheet thickness (mm)					
Sheets vertical			**Sheets horizontal**		
Stud spacing (mm)			**Stud spacing** (mm)		
400	480	600	400	480	600
12	12	15	9	9	12

4.2.4.4.2 *Fixing to timber framing*

Joints between sheets shall have gaps of 3 mm.

All edges of sheets shall be supported and fixings shall be 10 mm from sheet edges except as required by horizontal joint. See figure 4(d).

Sheets shall be nailed at 150 mm centres around the perimeter and at 300 mm centres within the body of the sheet.

FH nails shall be hot dipped galvanised, 2.8 mm minimum in diameter and shall penetrate the framing by a minimum of 35 mm.

C4.2.4.4.2

The minimum FH nail length will be the sum of the sheet thickness + cavity depth + 35 mm.

Where the sheet joints are not supported by studs then dwangs or nogs of sufficient width need to be added to allow adequate fixing.

4.2.4.5 Fibre cement sheet backings

4.2.4.5.1 *Specification and thickness*

Fibre cement sheet shall comply with NZS/AS 2908.2. It shall have a thickness of no less than 4.5 mm and span no more than 600 mm between stud centres or cavity battens.

C4.2.4.5.1
See Appendix A for information on alternatives.

4.2.4.5.2 *Fixing to timber framing*

Joints between sheets shall have a minimum gap of 2 mm.

All edges of sheets shall be supported and fixings shall be a minimum of 10 mm from sheet edges except as required by horizontal joint in figure 4(c).

Sheets shall be nailed at 200 mm centres around the perimeter and at all intermediate framing.

Dwangs shall be provided at a maximum space of 800 mm.

FH nails shall be hot dipped galvanised, a minimum of 2.8 mm in diameter and shall penetrate the framing by a minimum of 35 mm. Nailing shall be started 50 mm from the corners of sheets.

C4.2.4.5.2
The minimum FH nail length will be the sum of the sheet thickness + cavity depth + 35 mm.

Where the sheet joints are not supported by studs then dwangs or nogs of sufficient width need to be added to allow adequate fixing.

4.2.5 Fixing rigid backing to steel framing

4.2.5.1
Rigid backings shall be fixed to steel framing in the manner described for timber framing in 4.2.4.4.2 but FH nails shall be substituted with screws which penetrate no less than 10 mm through the steel studs and are located at the same spacings as specified for FH nails in timber framing.

4.2.5.2
Screws shall be self-embedding complying with AS 3566.1 and .2. Screws shall be no less than No. 8 gauge (approximately 3 mm in diameter excluding the raised thread) and be hot-dipped galvanised to meet the following durability classes:

(a) Class 4 for use in sea spray zone as defined in NZS 3604;

(b) Class 3 for all other zones as defined in NZS 3604.

C4.2.5
The minimum screw length will be the sheet thickness + cavity depth + 10 mm. See Appendix A for information on alternatives.

4.2.6 Slip layer

4.2.6.1
Any building underlay complying with the requirements of the Acceptable Solution for NZBC Clause E2, E2/AS1, shall be applied over the rigid backing as a slip layer.

4.2.6.2

The building underlay shall be free from holes, breaks and other defects. The rolls of building underlay shall be run horizontally and lapped not less than 75 mm at joints with the direction of the lap ensuring that water is shed to the outside of the underlay with the upper sheet lapped over the lower sheet.

4.2.7 Metal reinforcement and flashings

4.2.7.1 Scope

This clause covers metal reinforcement fixed over the slip layer and its installation, accessories and flashings.

4.2.7.2 General

Metal reinforcement shall be used over rigid backing on timber stud or metal stud construction.

C4.2.7.2

Reinforcement is used to resist shrinkage stresses, to hold the plaster together and to fix to the framing. For the reinforcement to perform these functions it is essential that it is spaced out from the backing and embedded in the plaster.

4.2.8 Types of reinforcement

Metal reinforcement for exterior plastering shall be either:

(a) Wire mesh with a mesh size of 15 mm to 50 mm, a minimum wire diameter after galvanising of 0.9 mm and hot-dipped galvanised in accordance with AS/NZS 4534 W20Z; or

(b) Expanded metal reinforcing manufactured from steel sheet no less than 0.45 mm thick and hot-dipped galvanised in accordance with AS/NZS 4680.

C4.2.8

The specific requirements of AS/NZS 4680 for the thickness of ferrous metals used for lath give an average galvanised coating of 320 gms/m^2 each side of a sheet.

4.2.8.1

Metal reinforcement shall be stretched taut and spaced (furred) out from the backing slip layer not less than 6 mm nor more than 9 mm.

4.2.8.2

Spacers for furring the reinforcement shall comprise 50 mm to 60 mm squares of fibre cement sheet or H3 treated plywood. Alternative spacers such as purpose made plastic or galvanised steel spacers are acceptable subject to the approval of the building consent authority.

4.2.8.3

Self-furring reinforcement that meets the requirements of 4.2.8 may be used.

C4.2.8.3

If the reinforcement is not spaced out from the backing it cannot be embedded in the plaster and hence it becomes ineffective. Further the spacing ensures that the reinforcing is covered to a depth that allows scratching of the bond coat.

Self-furring reinforcement systems with ribs are suitable for use over rigid backings.

Materials for use as spacers for reinforcement mesh need to be compatible with wet plaster, larger than the mesh size, durable and unaffected by moisture.

4.2.9 Fixing of reinforcement

4.2.9.1

The reinforcement shall be fixed with 2.8 mm minimum diameter hot-dipped galvanised FH nails or 16 g galvanised steel or type 304 or 316 stainless steel staples at no more than 150 mm spacing on all vertical and horizontal supports except where steel framing has been used (see 4.2.9.4). Laps shall be either lashed with galvanised tie wire not less than 1.2 mm in diameter or connected by galvanised clips spaced at not more than 150 mm centres.

4.2.9.2

Where mesh or lath is provided with a predominant feature or strength in one direction, this direction shall be laid across the primary supports.

4.2.9.3

The minimum depth of penetration of fixings into the timber batten and framing shall be not less than 35 mm for FH nails 2.8 mm minimum in diameter, and where staples are used, the minimum depth of penetration shall be 30 mm for 16 g staples. Where plywood backing is used, the penetration requirements of 35/30 mm may include the plywood thickness. Where cement based rigid backing is used, no sheet thickness allowance shall be permitted.

4.2.9.4

For fixing into steel framing, nails/staples shall be replaced by hot dipped galvanised steel screws complying with 4.2.5 which penetrate not less than 35 mm combined embedment into the batten with the steel frame.

C4.2.9

See Appendix A5 for information on alternatives.

4.2.10 Continuity of reinforcement

The following requirements apply:

(a) Continuity of reinforcement shall be maintained by lapping the galvanised wire mesh or expanded metal reinforcement by 100 mm at sides and 150 mm at the ends. Laps at ends of sheets shall be staggered.

(b) Continuity of reinforcement at angles (corners) shall be maintained either by wrapping furred out wire mesh around the angle or by the use of casing bead that shall be lapped in accordance with (a) with adjoining reinforcement.

C4.2.10

See Appendix A5 for information on alternatives.

4.2.11 Openings

4.2.11.1
Where galvanised wire mesh or expanded metal is used as reinforcement over rigid backings on timber or metal framing, the corners of openings which exceed 0.2 m^2 in area shall be provided with additional reinforcing strips of mesh or expanded metal of at least 450 mm x 300 mm fixed diagonally (longer dimension at an angle of 45°) across the corners.

4.2.11.2
Where control joints as required by 2.1.9.5 occur at the sides of an opening, diagonal reinforcing strips as required in 4.2.11.1 across the corners shall be omitted to ensure that there is a break in the reinforcing at the control joints (see figure 3).

4.2.12 Accessories

4.2.12.1
All plaster accessories such as angle beads, screed beads and plaster stops shall be rigidly attached to the supporting frames and shall be true to line and level.

4.2.12.2
These accessories shall be compatible with and satisfy the durability requirements of the stucco system as a whole.

C4.2.12
Accessories may be attached by galvanised wire tying, nailing or stapling through expanded wings or through holes provided in the accessory.

The use of angle beads produced from ferrous materials is not recommended as surface treatments utilised in the protection of ferrous material are easily damaged during plastering.

4.2.13 Flashings

4.2.13.1
Flashings shall meet the requirements of 2.1.4.

4.2.13.2
All flashings shall be in place before fixing the metal reinforcement which shall extend over that part of the flashing covered by the plaster.

4.3 Plaster systems for stucco on rigid backings

4.3.1 Scope
This clause applies only to stucco on rigid backings.

4.3.2 Plastering systems

The plaster system applied to metal reinforcing over a rigid backing shall be a 3-coat work comprising the following:

1 – Scratch coat;

2 – Flanking coat; and

3 – Finish coat.

Methods of application and curing of these coats are covered in section 2.

4.4 Plaster thickness for stucco on rigid backings

4.4.1 Scope

This clause gives acceptable thickness of plaster coats for stucco on rigid backings.

4.4.2 Thickness of plaster

Plaster thickness shall be measured from the exterior face of the backing at a stud position. The thickness of the individual plaster coats for stucco on rigid backings shall be as given in table 7.

C4.4.2

Smooth trowelled finishes are not recommended because of the potential to highlight fine cracks and minor surface irregularities (see Appendix B).

Table 7 – Thickness of plaster coats for rigid backing

Scratch coat	Flanking coat [1]	Finish coat [2]	Minimum thickness	Maximum thickness [2]
9 to 12 mm	6 to 9 mm	2 to 3 mm	21 mm	26 mm

NOTE –

(1) Flanking coat is also known as render coat (see definitions in 1.5).

(2) Medium and heavily textured surfaces may exceed 2 to 3 mm total thickness for a finished plaster coat to achieve the desired finish specified for the size of the aggregate used. See 2.5.7.4 and 2.5.7.5 for appropriate thicknesses.

5 STUCCO ON NON-RIGID BACKINGS

5.1 Scope and general considerations

5.1.1 Scope

This clause covers stucco on non-rigid backings with a drained and vented cavity fixed to light-framed construction of timber or steel. It deals with materials and fixing, metal reinforcement, plaster systems and plaster thicknesses applicable to non-rigid backing.

5.1.2 General considerations

5.1.2.1

The timber framing supporting the non-rigid backing shall comply with the provisions of NZS 3604. Walls, however, shall be limited to 2.4 m high and studs spaced at 400 mm centres with 3 rows of dwangs evenly spaced, with the top dwang just below eaves level.

5.1.2.2

Stud spacing may be increased to 600 mm where self furring hot dipped galvanised expanded metal with stiffening ribs is used, provided it can be demonstrated to the approval of the Building consent authority that its deflection, under normal plaster application, would be no more than 6 mm.

5.1.2.3

Where steel-framed buildings are to be clad with plaster, the building shall come within the scope of 1.1.2 of NZS 3604, with steel framing substituted for timber framing. Steel wall framing shall be the subject of specific design in accordance with AS/NZS 1170 and AS/NZS 4600. Steel-framed wall deflections shall not exceed the suggested serviceability limits for brittle claddings of AS/NZS 1170. The maximum stud and dwang spacing shall be as for timber framing.

C5.1.2

The 2.4 m high timber stud restriction may be waived for specific designed timber stud walls which are outside of the scope of this Standard.

5.2 Materials and fixing

5.2.1 General

A drained and vented cavity shall be provided between the building underlay on the face of the stud and the non-rigid backing (building underlay) to the plaster.

5.2.2 Building underlay

Building underlay shall be fixed to the exterior face of the framing and shall be in accordance with the requirements of the Acceptable Solution for NZBC Clause E2, E2/AS1.

5.2.3 Drained and vented cavities

5.2.3.1 General

Cavity battens shall be attached to the framing by either:

(a) Temporarily tacking the battens in place and then securing them to the framing with the fixings that attach the reinforcement; or

(b) Fixing the cavity batten directly to the framing with minimum 2.8 mm diameter hot dipped galvanised FH nails, minimum 60 mm long at maximum of 300 mm centres, ensuring a penetration into framing of at least 35 mm.

C5.2.3.1

The battens in (a) will need to be temporarily fixed to the stud through the building underlay. They become finally secured by the reinforcement fixings which need to penetrate 35 mm into the timber stud or 10 mm through a steel stud.

5.2.3.2 Requirements

The cavity shall:

(a) Be formed using vertical cavity battens of 18 to 25 mm thickness, of equal width to the stud, complying with NZS 3602 and be treated to H3.1 of NZS 3640;

(b) Incorporate packers at heads and sills of openings and at eaves level to support edges of cladding. The horizontal packer shall be laid approximately 5° off horizontal and 50 mm short of any vertical batten to promote ventilation and prevent water being trapped by the batten;

(c) Not be vented at the top;

(d) Be constructed to restrict air movement between the drained and vented cavity and the wall and roof framing, attic roof space and subfloor space;

(e) Be drained and vented to the exterior at the bottom edges with a cavity closer with 1000 mm^2 of opening per lineal metre of wall. Individual openings in the cavity closer shall be no greater than 5 mm to provide vermin proofing and no less than 3 mm.

5.2.4 Backing materials and fixing

5.2.4.1 Backing deflection

Non-rigid backings shall be fixed to the framing in a manner which limits the backing deflection to a maximum of 6 mm when the plaster is applied.

5.2.4.2 Backing specification

Non-rigid backing shall be any building underlay complying with the requirements of the Acceptable Solution for NZBC Clause E2, E2/AS1.

5.2.4.3 Fixing of non-rigid backing to cavity battens

Non-rigid backing (building underlay) shall be installed in the following manner:

(a) The non-rigid backing (building underlay) shall be provided with support to keep it taut to limit its deflection to no more than 6 mm. This shall be achieved by the use of 75 mm galvanised wire mesh, or by plastic tape or wire at 150 mm centres run over the battens;

(b) Fix the non-rigid backing (building underlay) over the outside of the battens on top of a support system in (a) before fixing the reinforcement;

(c) Building underlay for the non-rigid backing shall be fixed with sufficient staples to maintain position until reinforcement is fixed.

5.2.5 Fixing cavity battens to steel stud framing

5.2.5.1

Cavity battens shall be fixed to steel stud framing in the manner described in 5.2.3.1 but FH nails shall be substituted with screws which penetrate no less than 10 mm through the steel studs. The screws shall be located at maximum 300 mm centres.

5.2.5.2

Screws shall be self-embedding complying with AS 3566.1 and 2. Screws shall be no less than No. 8 gauge (approximately 3 mm in diameter excluding the raised thread) and be hot-dipped galvanised to meet the following durability classes:

(a) Class 4 for use in sea spray zone as defined in NZS 3604;

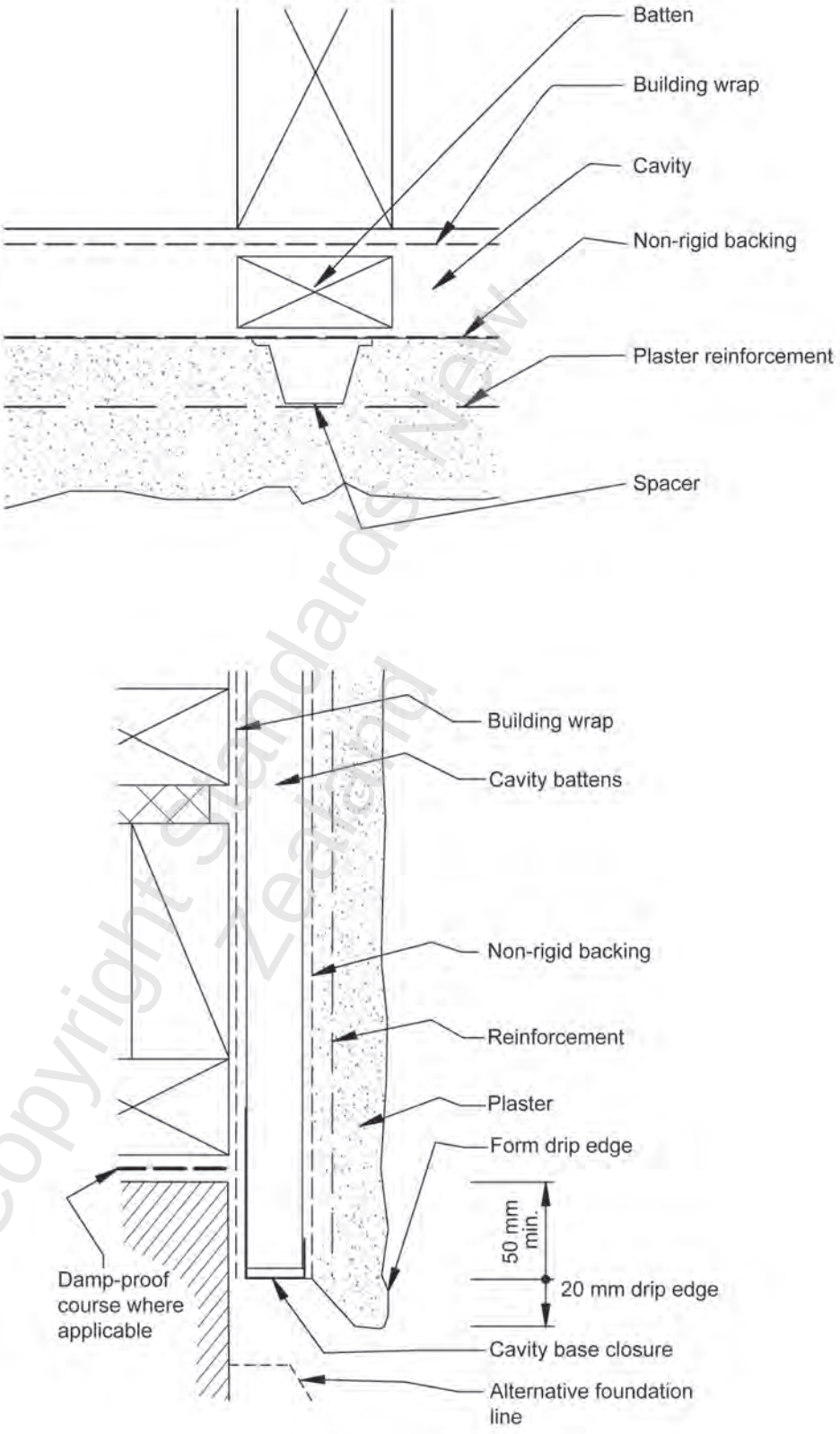
(b) Class 3 for all other zones as defined in NZS 3604.

C5.2.5.2

See Appendix A5 for information on alternatives.

5.2.6 Cavity drainage

Where non-rigid backing is used the cavity between the backing and the building underlay shall be ventilated to the outside air with bottom openings of 1000 mm^2/m which shall serve to drain moisture to the outside (see figure 6). The bottom of the cavity shall be vermin proofed.



NOTE – Cavity closure shall contain a minimum opening of 1000 mm^2/m at the base.

Figure 6 – Non-rigid backing detail

5.3 Metal reinforcement and flashings

5.3.1 Scope

This clause covers metal reinforcement fixed to the outer face of non-rigid backing and its installation, accessories and flashings.

5.3.2 General

Metal reinforcement shall be used over non-rigid backing for stucco on timber stud or metal stud construction.

C5.3.2

Reinforcement is used to resist shrinkage stresses, to hold the plaster together and to fix to the framing. For the reinforcement to perform these functions it is essential that it is spaced out from the backing and embedded in the plaster.

5.3.3 Types of reinforcement

Metal reinforcement for exterior plastering shall be either:

(a) Wire mesh with a mesh size of 15 mm to 50 mm, a minimum wire diameter after galvanising of 0.9 mm and hot-dipped galvanised in accordance with AS/NZS 4534 W20Z; or

(b) Expanded metal reinforcing manufactured from steel sheet no less than 0.45 mm thick and hot dipped galvanised in accordance with AS/NZS 4680.

C5.3.3

The specific requirements of AS/NZS 4680 for the thickness of ferrous metals used for lath give an average galvanised coating of 320 gms/m^2 each side of a sheet.

5.3.4 Spacing or furring of reinforcement

5.3.4.1

Metal reinforcement shall be stretched taut and spaced (furred) out from the backing building underlay not less than 6 mm nor more than 9 mm.

5.3.4.2

Spacers for furring the reinforcement shall comprise 50 mm to 60 mm squares of fibre cement sheet or H3 treated plywood. Alternative spacers such as purpose-made plastic or galvanised steel spacers are acceptable.

5.3.4.3

Self-furring reinforcement materials that meet the requirements of 5.3.3 may be used.

C5.3.4

If the reinforcement is not spaced out from the backing it cannot be embedded in the plaster and hence it becomes ineffective. Further the spacing ensures that the reinforcing is covered to a depth that allows scratching of the bond coat.

Self-furring reinforcement systems with ribs are suitable for use over non-rigid backings.

Materials for use as spacers for reinforcement mesh need to be compatible with wet plaster, larger than the mesh size, durable and unaffected by moisture.

5.3.5 Fixing of reinforcement

5.3.5.1

The reinforcement shall be fixed with 2.8 mm minimum diameter hot-dipped galvanised FH nails or 16 g galvanised steel or type 304 or 316 stainless steel staples at no more than 150 mm spacing on all vertical and horizontal supports except where steel framing has been used (see 5.3.5.4). Laps shall be either lashed with galvanised tie wire not less than 1.2 mm in diameter or connected by galvanised clips spaced at not more than 150 mm centres.

5.3.5.2

Where mesh or lath is provided with a predominant feature or strength in one direction, this direction shall be laid across the primary supports.

5.3.5.3

The depth of penetration for reinforcement fixings shall be:

(a) Where the cavity batten has been fixed directly to the framing (as described in 5.2.3.1(b)), minimum 35 mm into the cavity batten and framing for FH nails, minimum 30 mm for staples;

(b) Where the reinforcement fixings are used to attach the batten (as described in 5.2.3.1(a)), minimum 35 mm into framing. Stapling shall not be used in this operation.

5.3.5.4

For fixing into steel framing FH nails/staples shall be replaced with hot-dipped galvanised steel screws complying with 4.2.5 which penetrate no less than 35 mm combined embedment into the batten with steel frame.

C5.3.5

These fixings are important as they support the total weight of the plaster.

See Appendix A5 for information on alternatives.

5.3.6 Continuity of reinforcement

The following requirements apply:

(a) Continuity of reinforcement shall be maintained by lapping the galvanised wire mesh or expanded metal reinforcement by 100 mm at sides and 150 mm at the ends. Laps at the ends of sheets shall be staggered;

(b) Continuity of reinforcement at angles (corners) shall be maintained either by wrapping furred-out wire mesh around the angle or by the use of casing bead that shall be lapped in accordance with (a) with adjoining reinforcement.

C5.3.6

See Appendix A5 for information on alternatives.

5.3.7 Openings

5.3.7.1
Where galvanised wire mesh or expanded metal is used as reinforcement over non-rigid backings on timber or metal framing, the corners of openings which exceed 0.2 m^2 in area shall be provided with additional reinforcing strips of mesh or expanded metal of at least 450 mm x 300 mm fixed diagonally (longer dimension at an angle of 45°) across the corners.

5.3.7.2
Where control joints occur at the sides of an opening, diagonal reinforcing strips as required by 5.3.7.1 across the corners shall be omitted to ensure that there is a break in the reinforcing at the control joints as required by 2.1.9.

5.3.8 Accessories

5.3.8.1
All plaster accessories such as angle beads, screed beads and plaster stops shall be rigidly attached to the supporting frames and shall be true to line and level.

5.3.8.2
These accessories shall be compatible with, and satisfy the durability requirements of the stucco system as a whole.

C5.3.8
Accessories may be attached by galvanised wire tying, nailing or stapling through expanded wings or through holes provided in the accessory.

The use of angle beads produced from ferrous materials is not recommended as surface treatments utilised in the protection of ferrous material are easily damaged during plastering.

5.3.9 Flashings

5.3.9.1
Flashings shall meet the requirements of 2.1.4.

5.3.9.2
All flashings shall be in place before fixing the metal reinforcement which shall extend over that part of the flashing covered by the plaster.

5.4 Plaster systems for stucco on non-rigid backings

5.4.1 Scope
This clause applies only to plaster on stucco on non-rigid backings.

5.4.2 Plastering systems

The plaster system applied to a background of galvanised mesh or lath over a non-rigid backing shall be a 3-coat work comprising:

1 – Scratch coat

2 – Flanking coat, and

3 – Finish coat.

Methods of application and curing of these coats are covered in section 2.5.

5.5 Plaster thickness for stucco on non-rigid backings

5.5.1 Scope

This clause gives acceptable thickness of plaster coats for stucco on non-rigid backing.

5.5.2 Thickness of plaster

Plaster thickness shall be measured from the face of the backing at a stud position. The thickness of the individual plaster coats for stucco on non-rigid backings shall be as given in table 8.

Table 8 – Thickness of plaster coats for non-rigid backing

Scratch coat	Flanking coat [1]	Finish coat [2]	Thickness	
			Minimum	Maximum [2]
9 to 12 mm	6 to 9 mm	2 to 3 mm	21 mm	26 mm

NOTE –

(1) Flanking coat is also known as render coat (see definitions in 1.5).

(2) Medium and heavily textured surfaces may exceed 2 to 3 mm total thickness for a finished plaster coat to achieve the desired finish specified for the size of the aggregate used. See 2.5.7.4 and 2.5.7.5 for appropriate thicknesses.

APPENDIX A –
MATTERS OUTSIDE THE SCOPE OF THIS STANDARD

(Informative)

This Appendix provides information on matters which are outside the scope of this Standard but nevertheless are of relevance to cement plasters. Where cement plaster designs are based on information contained in this Appendix then full details of what is proposed need to be submitted to and approved by the building consent authority.

A1 Sample areas

When required by the specifier, samples of the plaster system or the plaster finish are to be prepared by the plasterer, prior to the work commencing.

CA1

Sample size should be at least 1 m^2 and finished to a standard that can be replicated over the total work area.

A2 Proprietary plasters

All premixed materials should be delivered to the site in sealed packaging, bearing the trade names of the materials, the manufacturers' details and mixing instructions. Such instructions should be adhered to.

A3 Curing compounds

Cement-based finishing coats with or without a bonding agent may be cured by the application to the surface of a clear acrylic emulsion sealer according to the manufacturer's recommendations.

A4 Moulded work

Features to be moulded into plaster, either *in situ* or precast and subsequently fixed to plaster need to be fully specified, giving patterns, sizes, compositions, fixing details etc.

These should be fixed either mechanically or by using epoxy adhesives according to manufacturer's specification.

A5 Alternatives to those specified in the Standard

A5.1

Alternatives to this Standard include any one or more of the following:

(a) Different number or thickness of plaster coats;

(b) Different preparation, placement, curing and weathering;

(c) Different thickness of the backings (rigid or non-rigid) materials specified;

(d) Different backing materials;

(e) Different reinforcement materials or fixing details;

(f) Different support conditions or spans for the plaster.

Such designs are outside the scope of this Standard and where the alternatives are proposed full details shall be forwarded to the building consent authority for approval prior to construction.

A5.2

In all cases it is essential that the manufacturers' instructions be followed.

A5.3

Products or plaster systems that have been independently appraised by suitably qualified people or organisations should be favoured over systems that do not have appraisals. Products or plaster systems that have been appraised and then certified by the Department of Building and Housing shall automatically be accepted by building consent authorities as complying with those clauses of the NZBC claimed in the appraisal. In all cases where appraisals are involved the products or systems shall be used in strict accordance with the conditions and limitations of the appraisal and as per the manufacturers' specifications.

APPENDIX B –
TYPES OF FINISHING COAT

(Informative)

B1 The plaster finish coats are to be one of the following finishes.

B2 Smooth trowelled (dado) finish

Cement based plaster is laid on with a trowel, skimmed with a float and trowelled down. The surface is trowelled to a smooth, dense finish as the plaster stiffens. No water is applied during trowelling.

B3 Lightweight plaster finish

Lightweight plaster finish which contains exfoliated vermiculite or expanded perlite is applied with a trowel or sprayed on by pump to achieve either a fine or medium textured finish.

B4 Sponge finish

The plaster is laid on thinly with a trowel, floated up with a wood float and lightly finished with a close cellular sponge.

B5 Textured and scraped finish

The plaster is applied to a uniform thickness with a laying trowel. As soon as the coat has set, but before it has hardened excessively, the aggregate is exposed by scraping the surface with a straight-edged trowel or joint rule.

B6 Combed finish

The plaster is applied to a uniform thickness and when it has set but not excessively hard, a comb is used to scratch the desired effect which may be in a shadow pattern, wavy, circular, or just a vertical effect.

B7 Hand-thrown rough cast finish

The plastic finish mix is thrown onto the surface with a scoop or trowel. No retouching is done.

B8 Machine applied (Tyrolean) finish

The plaster finish mix is machine-applied with either a hand operated 'TYROL' machine or is sprayed on using a compressed air hopper gun with variable pressure to achieve either a fine or coarse finish. The 'Tyrolean' effect can be pigmented to various pastel colours.

B9 Dry-dash/Pebble-dash finish

The washed, dried aggregate is thrown onto the surface while the flanking coat is still soft.

CB1

Heavily textured and rough cast finishes have two pronounced advantages compared with the smoother finishes:

(a) They shed water more readily because of the large number of drip points formed on the surface.

(b) They are less prone to crazing and colour variation because of the absence of a cement-rich surface skin.

Smooth finishes are not recommended on the exterior because of the potential to highlight fine cracks and minor surface irregularities.

APPENDIX C – SAND ASSESSMENT METHOD

(Informative)

C1 The requirements for sand are set out in 2.2.2.4. The information in this Appendix provides guidelines for determining the suitability of sands that do not fully comply with 2.2.2.4.

C2 Sand may be assessed for suitability by:

(a) Comparing grading and maximum particle size and if necessary, the clay content as set out in C2(c);

(b) Making a mix to assess water requirements and workability:

(i) Weigh out the following amounts of material:

1 kg of cement

5 kg of dry sand

200 g (ml) of water

300 g (ml) of water

1000 g (ml) of water

(ii) Mix the cement and sand to a uniform colour on a non-absorbent surface

(iii) Mix, in 3 stages, each of the amounts of water (200 ml, 300 ml and 1000 ml) until the mixes reach a consistency suitable for plaster

If 1000 ml of water is enough the sand is of good quality

If 1000 + 200 ml is enough the sand is of average quality

If 1000 + 200 + 300 ml is enough, the quality of the sand is poor, and

If more water than that is required, the quality is very poor

'Good' and 'Average' sands are suitable for use in all plasterwork. 'Poor' sands may be used for interior plaster. 'Very poor' sands should not be used

(iv) Assess the workability of the mix (at plastering consistency) by forming a flattened heap about 100 mm high and 200 mm in diameter on a non-absorbent surface. Place a plasterer's trowel face down on top of the heap and try to push the trowel down.

A workable plaster will squeeze out from under the trowel and it will be possible to push the trowel to within a few millimetres of the underlying surface. An unworkable mix will 'lock up' once the trowel has moved 3 mm to 5 mm and prevent further downward movement of the trowel.

If the mix appears to be workable, pick up some of the plaster on a trowel then tilt the trowel. The plaster should slide off easily. If it clings to the trowel, the mix is too 'fatty', an indication of excessive clay content of the sand; ➤

(c) Only a small proportion of clay can be tolerated in a plaster sand. Sands with a suspected high content shall be tested prior to use.

Sands with high clay content may generally be recognised as follows:

(i) The fraction that passes a 0.075 mm sieve can, after being moistened, be rolled into a thread about 3 mm or less in diameter

(ii) Plaster mixes made with such sands are very 'fatty', tend to cling to a trowel and have a high water requirement.

Specialist advice should be sought if there is any doubt about the content and type of clay in a sand.

NOTE – Test sieves are expensive and normally found only in laboratories. For a field test a nylon stocking is an effective substitute. Place a few handfuls of dry sand in the foot of a nylon stocking and tie closed. Shake the sand and collect the dust in a bowl then perform the test above.

C3 Bottle test

An alternative simple test is to take a glass jar with parallel sides, fill to approximately three quarters with sand, add clean water with a teaspoonful of salt to fill the bottle. Seal the top and shake vigorously and allow to stand for 3 hours undisturbed.

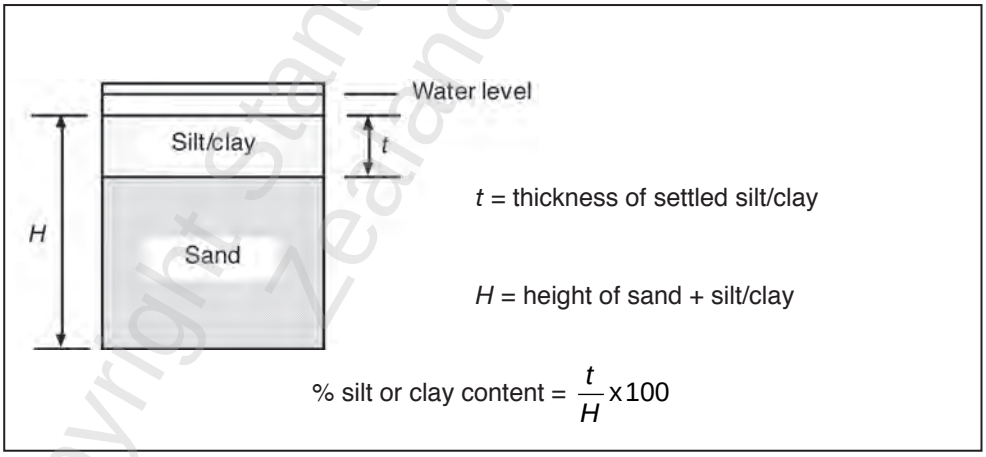


Figure C1 – Bottle test

The following determine the suitability of the sand:

(a) Clay/silt particles will have settled out on the top surface of the sand. If the percentage change is over 5 % the sand should not be used unless more detailed performance tests can confirm its suitability;

(b) If the water remaining is discoloured then there are also organic impurities. These impurities can give significant reduction in strength and extend setting times. If the discolouration is significant the sample should not be used unless more detailed performance tests can confirm its suitability.

APPENDIX D – PLASTER ON CURING

(Informative)

D1 A sand-cement plaster can achieve satisfactory strength and bond to the substrate only if it is thoroughly cured, i.e. if adequate water is retained in the plaster long enough to ensure advanced hydration of the cement. Conventional methods of curing therefore involve the prevention or substantial retardation of moisture evaporation from the surface and are normally continued for several days after application of the plaster. Curing is particularly important during periods of low humidity and drying winds and in situations exposed to direct sunlight.

Extended curing should be applied if the ambient temperature is low, since the reaction between cement and water is retarded by low temperatures.

D2 Tensile stresses in the plaster, and shear stresses at the plaster-substrate interface, begin to develop only when the plaster is allowed to dry. The maximum shear stress is proportional to the plaster thickness. If it overcomes the adhesion of the plaster, debonding occurs. To minimise this possibility, each coat in a multi-coat plaster system is usually cured and dried individually. This procedure ensures that any cracks caused by excessive tensile stress are very fine, they are not associated with bond failure, and they do not affect the integrity of subsequent coats.

D3 The use of acrylic emulsions in plasters offers a means of eliminating the requirements for extended periods of moist curing. As compared with plain plasters, those containing acrylic emulsions in appropriate quantity have lesser potential drying shrinkage, reduced modulus of elasticity (higher extensibility) and enhanced strength development even in the absence of moist curing. Other advantages associated with the use of acrylic emulsions are a slower rate of water loss in drying conditions, which improves the potential for stress relief by creep, and a considerable improvement in bond to substrates. The combined influence of all these factors is to restrict the magnitudes of tensile stresses in the plaster and shear stresses at interfaces, and so minimise the risk of tensile cracking or bond failure.

In consequence of these features, the normally recommended curing procedures may be altered when dealing with the application of acrylic-modified plasters to any substrate. Acrylic-modified plasters are required only to be protected from direct sun and drying winds for at least 16 hours after application. As a means of ensuring this protection, plaster in exposed situations should not be applied when strong drying winds are anticipated. Nor should it be applied in direct sunlight or to surfaces which will be heated by the sun later in the day. Plastering should be scheduled to start on the shady side of the building and continue round following the sun.

D4 The circumstances prevailing on site will determine the method of curing plaster coats. A plaster coat can lose water by migration into the background or previous coat and by evaporation from its surface. Sufficient water for cement hydration can be maintained by the provision of a wet atmosphere around the surface of the plaster coat. This can be achieved by covering the work with hessian which is kept continually wet. Plastic sheeting can be used to reduce air circulation in the vicinity of newly applied plaster, in which case the plaster coat should be wetted when it has gained sufficient strength to permit this.

D5 In areas where high summer temperatures occur, curing may be assisted by hanging scrim or shade cloth over the plaster to give shade, reduce the effect of drying winds and to retain moisture.

D6 Proprietary sprinkler systems with programmed timers are very useful, especially over weekends when sites may not be attended.

D7 If during the specified curing period, the plaster has changed colour and gone white, it has obviously been allowed to dry prematurely and will fail to reach its required strength. No amount of subsequent wetting will correct the situation and the risk of cracking is high.

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