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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Agrément Certificate
95/3132
Product Sheet 2

STO EXTERNAL WALL INSULATION SYSTEMS

STOTHERM VARIO EXTERNAL WALL INSULATION SYSTEMS

This Agrément Certificate Product Sheet(1) relates to StoTherm Vario External Wall Insulation Systems, comprising expanded polystyrene (EPS) insulation boards with glassfibre reinforcing meshes and render finishes and featuring three alternative fixing methods, for use on solid masonry and timber- or sheathed light-steel-frame constructions on new or existing domestic and non-domestic buildings.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Thermal performance — the systems can be used to improve the thermal performance of external walls and contribute to meeting the Building Regulations requirements (see section 6).

Strength and stability — the systems can adequately resist wind loads and, in certain applications, impact damage (see section 7).

Behaviour in relation to fire — The systems are suitable for use on timber-frame constructions on buildings of up to 18 m high and on solid masonry and/or sheathed light-steel framed constructions on buildings of up to and above 18 m high (see section 8).

Condensation — the systems can contribute to limiting the risk of surface and interstitial condensation (see section 10).

Durability — with appropriate care, the systems should remain effective for at least 30 years (see section 12).

The BBA has awarded this Certificate to the company named above for the systems described herein. These systems have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 25 February 2013

Sean Moriarty — Head of Approvals
Energy and Ventilation

Greg Cooper
Chief Executive

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Regulations

In the opinion of the BBA, StoTherm Vario External Wall Insulation Systems, if installed, used and maintained in accordance with this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):

The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	A1	Loading
Comment:		The insulation systems can sustain and transmit wind loads to the substrate wall. See sections 7.8 and 7.13 of this Certificate.
Requirement:	B4(1)	External fire spread
Comment:		The insulation systems can meet this Requirement. See sections 8.1 to 8.3 of this Certificate.
Requirement:	C2(b)	Resistance to moisture
Comment:		The insulation systems provide a degree of protection against rain ingress. See sections 4.10 and 9.2 to 9.4 of this Certificate.
Requirement:	C2(c)	Resistance to moisture
Comment:		The insulation systems contribute to minimising the risk of interstitial and surface condensation. See sections 10.5 and 10.7 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The insulation systems can contribute to meeting this Requirement. See sections 6.1, 6.2 and 6.4 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The systems are acceptable. See section 12.1 and the *Installation* part of this Certificate.
Regulation:	26	CO_2 emission rates for new buildings
Comment:		The insulation systems can contribute to meeting this Regulation. See sections 6.1, 6.2 and 6.4 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Fitness and durability of materials and workmanship
Comment:		The use of the systems satisfies the requirements of this Regulation. See sections 11.1 and 12.1 and the *Installation* part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1	Structure
Comment:		The systems can sustain and transmit wind loads to the substrate wall, with reference to clause 1.1.2[1][2]. See section 7.8 of this Certificate.
Standard:	2.6	Spread to neighbouring buildings
Comment:		The systems when used on timber-frame constructions incorporate materials which would not be classified as 'non-combustible'. Completed walls, therefore, should be regarded as unprotected areas as defined in this Standard, with reference to clause 2.6.4[1][2]. The systems when used on solid masonry or sheathed light-steel frame construction have been tested to BRE Report (BR 135 : 2003) *Fire Performance of External Insulation For Walls of Multi-Storey Buildings* and hence are unrestricted. Completed walls, therefore, should not be regarded as unprotected areas, with reference to clause 2.6.4[1][2]. See sections 8.1 to 8.3 of this Certificate.
Standard:	2.7	Spread on external walls
Comment:		The systems when used on timber-frame constructions incorporate materials which would not be classified as 'non-combustible' as defined in this Standard. Completed walls, therefore, should be regarded as unprotected areas, with reference to clause 2.7.1[1][2]. The systems when used on solid masonry or sheathed light-steel frame construction have been tested to BRE Report (BR 135 : 2003) and hence are unrestricted, with reference to clause 2.7.1[1][2]. See sections 8.1 to 8.3 of this Certificate.
Standard:	3.10	Precipitation
Comment:		Walls insulated with the systems will provide a degree of protection against rain ingress, with reference to clauses 3.10.1[1][2] and 3.10.2[1][2]. See sections 4.10 and 9.2 to 9.4 of this Certificate.
Standard:	3.15	Condensation
Comment:		Walls insulated with the systems will contribute to minimising the risk of interstitial and surface condensation, with reference to clauses 3.15.1[1][2], 3.15.4[1][2] and 3.15.5[1][2]. See sections 10.6 and 10.7 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Buildings insulation envelope
Comment:		The systems can contribute to satisfying these Standards, with reference to clauses 6.1.1[1], 6.1.2[1][2], 6.1.3[2], 6.1.5[2], 6.1.6[1], 6.2.1[1][2], 6.2.3[1][2], 6.2.4[2], 6.2.6[1][2], 6.2.7[1][2], 6.2.8[2], 6.2.9[1][2], 6.2.10[1][2], 6.2.11[1], 6.2.12[2], and 6.2.13[1]. See sections 6.1, 6.2 and 6.4 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The product can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6, and, therefore, will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. See sections 6.1, 6.2 and 6.4 of this Certificate.

Regulation:	12	Building standards applicable to conversions
Comment:		All comments given for these systems under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1[1][2] and Schedule 6[1][2]. (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2012

Regulation:	23(a)(b)	Fitness of materials and workmanship
Comment:		The systems are acceptable. See sections 11.1 and 12.1 and the *Installation* part of this Certificate.
Regulation:	28(a)(b)	Resistance to moisture and weather
Comment:		Walls insulated with the systems provide a degree of protection against rain ingress and contribute to satisfying this Regulation. See sections 4.10 and 9.2 to 9.4 of this Certificate.
Regulation:	29	Condensation
Comment:		Walls insulated with the systems contribute to minimising the risk of interstitial and surface condensation to satisfy this Regulation. See section 10.7 of this Certificate.
Regulation:	30(a)(b)	Stability
Comment:		The insulation systems can sustain and transmit wind loads to the substrate wall. See sections 7.8 and 7.13 of this Certificate.
Regulation:	36(a)	External fire spread
Comment:		The insulation systems have a Class '0' surface and can satisfy this Regulation. See sections 8.1 to 8.3 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide emission rate
Comment:		The insulation systems can contribute to satisfying these Regulations. See sections 6.1, 6.2 and 6.4 of this Certificate.

Construction (Design and Management) Regulations 2007

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See section: 3 *Delivery and site handling* (3.1) of this Certificate.

Additional Information

NHBC Standards 2013

NHBC accepts the use of StoTherm Vario External Wall Insulation Systems, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Part 6 *Superstructure (excluding roofs)*, Chapters 6.2 *External timber framed walls*, 6.9 *Curtain walling and cladding* and 6.10 *Light steel framed walls and floors*.

CE marking

The Certificate holder has taken the responsibility of CE marking the products in accordance with ETAG 004 : 2011.

Technical Specification

1 Description

1.1 The StoTherm Vario External Wall Insulation Systems (see Figure 1) are of three types:

- StoTherm Vario Rotofix Plus Mechanical insulation systems — tongue-and-groove expanded polystyrene (EPS) boards of size 1000 mm by 500 mm[1], thickness from 80 mm to 200 mm and minimum tensile resistance of 200 kPa, fixed to the substrate with a steel fixing incorporating a rotating spiral load-transfer plug and Fischer SXR/Hilti Rahmendübel HSF fixing pin. The fixing is embedded into the insulation and the helical shape allows for adjustment to be made to the plane of the surface of the insulation boards. There are two types of fixings, depending on the cavity width required (see Table 1). The system is used on timber-frame buildings up to 18 m in height, and on solid masonry and sheathed light-steel frame constructions on new or existing domestic and non-domestic buildings up to and above 18 m in height.

Table 1 Sto Rotofix Plus fixing and desired cavity width

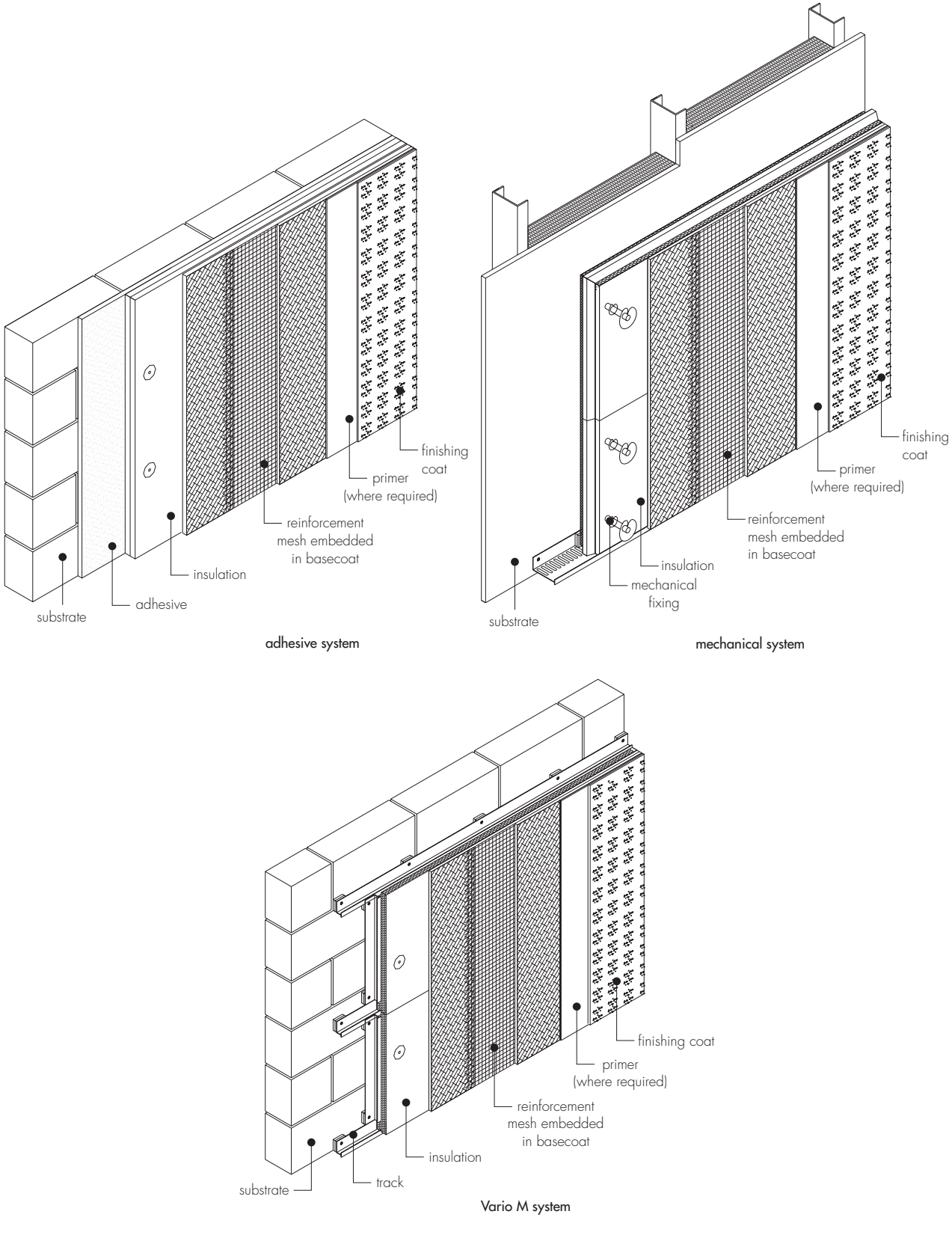
Fixing	Cavity width (mm)
Sto Rotofix Plus Green 120T/E1	10 to 30
Sto Rotofix Plus Black 160T/E100[1]	10 to 70

(1) Not suitable for use with insulation <130 mm unless the cavity width is >30 mm (see Certificate holder for details).

- StoTherm Vario Mechanical insulation systems (M) — grooved/rebated expanded polystyrene (EPS) boards of size 500 mm by 500 mm[1], thickness from 50 mm to 200 mm and minimum tensile resistance of 200 kPa, fixed to the substrate with an unplasticised polyvinyl chloride (PVC-U) or aluminium track system comprising horizontal starter tracks, intermediate tracks, vertical T-splines or intermediate tracks cut and fixed into vertical board joints and PVC packers (where required). Starter and holding tracks are fastened to substrates with Sto-approved hammer-drive or screw fixings
- StoTherm Vario Adhesive insulation systems (K) — square-edge or tongue-and-groove insulation boards of size 1000 mm by 500 mm[1], thickness from 20 mm to 200 mm and minimum tensile resistance of 200 kPa, bonded to the substrate (with supplementary mechanical fixings) using one of:
  - StoLevell Duo Plus — a polymer-based powder adhesive containing cement for mixing with clean water
  - StoLevell Uni — a polymer-based powder adhesive containing cement for mixing with clean water
  - Sto Baukleber ADH B — a powder adhesive containing cement for mixing with clean water
  - Sto dispersion adhesive — a ready-to-use organically-bound adhesive for suitable, level substrates
  - Sto Turbofix — a single-component polyurethane foam adhesive for use with tongue-and-groove EPS insulation and suitable substrates. Square-edged insulation boards may be used but greater attention must be given to the possibility of differential movement between boards before the adhesive has fully set and hardened.

(1) Other boards sizes are available from the Certificate holder.

Figure 1 StoTherm Vario External Wall Insulation Systems



1.2 The expanded polystyrene insulation boards used with the systems are available in three grades: Sto EPS Board K Square Edged, Sto EPS Board Type M (grooved and rebated) and Sto EPS Board K Tongue and Grooved. Each is available as K/M70 (white and grey with density in the range of 14 $kg \cdot m^{-3}$ to 17 $kg \cdot m^{-3}$), K90 (white and grey with density in the range of 19 $kg \cdot m^{-3}$ to 20 $kg \cdot m^{-3}$) or K200 ultra-high density [white for below damp-proof course (dpc) with a density of 30 $kg \cdot m^{-3}$]. The boards are classified as Euroclass E in accordance with BS EN 13501-1 : 2007 and are not foil-faced. Ultra-high density (UHD) boards with a density of 30 $kg \cdot m^{-3}$ for use below the damp-proof course, are outside the scope of this Certificate.

1.3 Other components of the systems include:

- StoFlexyl — for use below the damp-proof course (outside the scope of this Certificate). Further information is available from the Certificate holder
- Sto Glass Fibre Mesh — multi-stranded, alkali-resistant glassfibre with a polymer coating, marked with the Sto logo and weighing approximately 150 $g \cdot m^{-2}$, supplied in 50 m rolls in widths of 0.15 m, 0.25 m, 0.33 m and 1.1 m
- StoArmor Mesh — used in conjunction with Sto Glass Fibre Mesh, and weighing approximately 490 $g \cdot m^{-2}$
- StoArmat Novo — a ready-mixed, bagged, mineral basecoat
- Sto Armierungsputz [Sto RFP (Reinforced Fibre Polymer)] — a ready-mixed, organic basecoat
- StoLevell Duo Plus — a ready-mixed, bagged, mineral basecoat
- Stolit K (particle size 1.0 mm to 3.0 mm) — a ready-mixed, acrylic-based, textured coating
- Sto-Ispolit K— a ready-mixed, acrylic-based, textured coating
- Sto-Silkolit K— a ready-mixed, silicone-based, textured coating
- StoLevell Uni— a ready-mixed, bagged, mineral basecoat with additional redispersible synthetic-resin and aggregates
- Sto-Miral Dry Dash — receiver and aggregate
- Sto Silco K — a ready-mixed, silicone-based textured coating
- Sto Lotusan K — a ready-mixed, silicone-based, textured coating
- Sto Color Lotusan — silicone-based paint available in a range of colours
- Sto Color X Black — tinted paint
- Sto-resin brick slip — with Sto Adhesive and Pointing Mortar.

1.4 Ancillary items for use with the systems are:

- Sto aluminium starter/intermediate fixing track
- Sto PVC-U starter/intermediate fixing track
- Sto T-spline, PVC or aluminium T-profiles
- PVC packing shims of varying sizes used to ensure the level of the finished surface and maintenance of the drainage cavity
- Sto Rotofix Plus fixing
- Sto mineral fibre fire-break boards
- StoPrim Fungal
- StoPlex W sealer
- StoPrim Micro sealer
- Sto PVC Mesh Angle Bead
- Sto detail mesh
- StoArmour Angle
- Sto Expansion Joint Type E
- Sto Expansion Joint Type V
- StoSeal Tape
- Sto PU foam filler
- StoDeco Profiles — recycled mineral granulate profiles for architectural details
- StoDeco Coll Adhesive — for use with StoDeco Profiles
- SS hammer drive fixings
- Sto fixings
- deflection channels — for deflecting water around openings
- drainage profiles — to allow the drainage of water from the cavity to the external face of the wall
- insect mesh
- Sto F505 sealant.

2 Manufacture

2.1 Renders in paste form are fed by weight by the automatic control unit into the mixer itself in a controlled way. Other materials are added by hand by the mixer operator.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Sto AG has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by DGS (Certificate 003651QM).

2.4 The external wall insulation systems are manufactured by Sto AG in Germany and are imported and marketed in the UK by the Certificate holder.

3 Delivery and site handling

3.1 The insulation boards are delivered in shrink-wrapped polyethylene packs bearing the Sto logo, manufacturer's name and product identification. Each board is identified with a coloured stripe indicating the grade and fire classification.

3.2 The insulation boards must be stored on a clean, firm, level base and protected from prolonged exposure to sunlight. Open packs should be protected either by storing under cover or re-covering with opaque polythene sheeting. The boards must not come into contact with solvents or bitumen products, nor be exposed to open flame or other ignition sources. Care must be taken when handling the insulation to avoid damage.

3.3 All bagged products should be stored in dry conditions, off the ground, and protected from physical damage and moisture. All render products must be protected from excessive heat and frost.

3.4 Components are delivered in the containers and quantities listed in Table 2. Each container carries product identification.

Table 2 Component supply details

Component	Packaging and quantity/size
Standard reinforcing mesh	roll, 0.15/0.25/0.33/1.1 m by 50 m
Sto Armor mesh	roll, 1 m by 25 m
Sto TurboFix adhesive	pressurised bottle, 10.4 kg and 750 ml canister
Sto cementitious adhesive	triple-lined bag, 20–25 kg
Coatings	pail, 15 litre
Primer/cement-free basecoat/render	plastic pail, 23–25 kg
Cementitious basecoat/render	triple-lined bag, 20–25 kg

3.5 Sto Turbofix adhesive should be stored at temperatures between 15°C and 25°C.

3.6 Partially used materials remaining in bags or containers should be discarded.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on StoTherm Vario External Wall Insulation Systems.

Design Considerations

4 General

4.1 StoTherm Vario External Wall Insulation Systems are fixed to the external surface of the wall using the mechanical systems or adhesive. The Sto EPS boards are protected by a minimum 3 mm thick basecoat of StoLevell Duo Plus or a minimum 7 mm thick layer of StoArmat Novo containing a glassfibre reinforcement mesh which, when dry, is overcoated with a Sto primer plus Stolit, StoSilco or StoLotusan and other finishes detailed in section 1.3. Should a dash finish be required, application can only be made over StoSilco MP applied in a thickness of between 5 mm and 6 mm or with an additional layer of Sto Miral Dry Dash.

4.2 When mechanically-fixed insulation systems are used on steel-framed buildings incorporating vertical steel studs (minimum thickness 1.2 mm, minimum flange width 50 mm, fixed at a maximum of 600 mm centres) and sheathed with a fire-rated, exterior-grade sheathing board (see Table 3), the insulation systems are secured to the particle board creating a cavity between the sheathing and insulation. This cavity is not ventilated to the outside air to an extent that would affect the thermal performance of the insulation systems. For NHBC projects, the cavity is drained and nominally 20 mm wide.

4.3 Timber-framed buildings should be sheathed and designed in accordance with BS EN 1995-1-1 : 2004 and BS EN 1995-1-2 : 2004 (Eurocode 5). The system must incorporate an appropriate 20 mm (nominal) wide vented and drained (vented) cavity.

4.4 The minimum specification of sheathed steel-framed construction on which the insulation systems can be installed is given in Table 3.

Table 3 Sheathed steel-framed construction — minimum specification

Item	Characteristic	Standard or dimension (mm)
Steelwork	Standard Grade and coating Thickness	BS EN 10326 : 2004 Type S 320 GD +Z275 1.2
Sheathing board (fire-rated)	Type Thickness	BS EN 634-2 : 2007 12

4.5 Mechanical fixings are used with the Sto Mechanical system and supplementary mechanical fixings may be used with the adhesive insulation systems, especially during the strength development phase of the adhesive curing. Care should be taken to ensure appropriate fixing on all substrates.

4.6 The systems are applied to the outside of external walls of masonry, dense or no-fines concrete constructions, light-steel-framed and timber-framed constructions. They are suitable for use on timber-frame constructions on new or existing domestic and non-domestic buildings one metre or more (more than one metre in Scotland) from a boundary and where the floor level of any storey above the ground floor is not higher than 18 m above ground level. They are also suitable for use on solid masonry and sheathed light-steel-framed constructions on new or existing domestic and non-domestic buildings less than one metre from a boundary and where the floor level of any storey above the ground floor is up to and above 18 m in height.

4.7 The insulation systems are effective in reducing the thermal transmittance (U value) of the walls in new and existing buildings. It is essential that the detailing techniques specified in this Certificate are carried out to a high standard if the ingress of water into the insulation is to be avoided and the full thermal benefit obtained from the insulation systems.

4.8 The insulation systems will improve the weather resistance of a wall and provide a decorative finish. However, they may only be installed where other routes for moisture penetration have been dealt with separately and where there are no signs of dampness on the inner surface of the wall, other than those caused by condensation. The insulation systems can be used to overcome condensation associated with the internal wall surface.

4.9 Existing buildings subject to the Building Regulations should have wall surfaces in accordance with section 14 *Site survey and preliminary work* in the *Installation* part of this Certificate.

4.10 New walls subject to the national Building Regulations should be constructed in accordance with the relevant recommendations of:

- BS EN 1996-1-1 : 2005, BS EN 1996-1-2 : 2005, BS EN 1996-2 : 2006 and BS EN 1996-3 : 2006
- BS EN 1993-1-1 : 2005 (Eurocode 3)[1], and the relevant parts of this Certificate
- BS 8000-3 : 2001.

(1) And other parts where appropriate.

4.11 It may be necessary, depending on the method of fixing utilised, that movement joints are used through the insulation systems to ensure all substrate movement is not transferred to the insulation system and is managed in a such a way that damage to the insulation systems does not occur. Designers must ensure the sheathing boards are adequately restrained and an appropriate number of movement joints are carried through the construction where required.

4.12 Other new buildings not subject to regulatory requirements should also be built in accordance with the Standards identified in section 4.10.

4.13 When using the system, consideration must be given to the overall design to minimise the risk of condensation and the recommendations of BS 5250 : 2011 should be followed.

4.14 The fixing of rainwater goods, satellite dishes, clothes lines, hanging baskets and similar items is outside the scope of this Certificate.

4.15 The effect of the installation of the insulation systems on the acoustic performance of a construction is also outside the scope of this Certificate.

4.16 It is essential that the insulation systems are installed and maintained in accordance with the conditions set out in this Certificate.

5 Practicability of installation

The systems should only be installed by installers who have been trained and approved by the Certificate holder (see section 13).

6 Thermal performance

6.1 Calculations of the thermal transmittance (U value) should be carried out in accordance with BS EN ISO 6946 : 2007, BRE Digest (BR 443 : 2006) *Conventions for U-value calculations*, and, where required, BRE Report (BR 465 : 2002) *U-values for light steel-frame construction*, using the declared thermal conductivity ($\lambda_{90/90}$ *value*) ($W \cdot m^{-1} \cdot K^{-1}$) of:

- Sto EPS Board K70 0.038
- Sto EPS Board K90 T&G 0.034
- Sto Grey EPS 0.030.

6.2 For the Sto resin brick slip applications, the following corrected thermal conductivity values ($\lambda_{90/90}$ *value*) ($W \cdot m^{-1} \cdot K^{-1}$) should be used:

- Sto EPS Board K70 0.039
- Sto EPS Board K90 T&G 0.035
- Sto Grey EPS 0.031.

6.3 The U value of a wall construction will depend on the selected insulation thickness, the fixing method and the insulating value of the substrate masonry and its internal finish. Example U values are given in Tables 4 to 6.

Table 4 Insulation thickness required to achieve some typical design values(1)

U value ($W \cdot m^{-2} \cdot K^{-1}$)	Insulation type	Thickness of insulation (mm)		
		Adhesive bonded(2)(3)	Anchor fixings (2)(4)(5)	Profile fixings(2)(6)
0.19	K70	200	—	190
	K90	190	—	180
	Grey EPS 90	—	—	—
0.26	K70	150	160	140
	K90	130	160	130
	Grey EPS 90	—	—	—
0.28	K70	150	160	130
	K90	120	150	120
	Grey EPS 90	—	—	—
0.30	K70	130	150	120
	K90	120	150	110
	Grey EPS 90	—	—	—

(1) Wall construction: 200 mm dense concrete block (λ = 1.75 $W \cdot m^{-1} \cdot K^{-1}$) with 12 mm dense plaster finish.
(2) Based upon incremental insulation thickness of 10 mm.
(3) Δ_{Uf} based on n_f = 2 m^2, λ_{steel} = 50 $W \cdot m^{-1} \cdot K^{-1}$, diameter of fixing = 5.5 mm (assumes that the fixing penetrates the whole insulation layer).
(4) Δ_{Uf} based on n_f = 9 m^2, λ_{steel} = 50 $W \cdot m^{-1} \cdot K^{-1}$, diameter of fixing = 5.5 mm (assumes that the fixing penetrates the whole insulation layer).
(5) The point thermal transmittance of the Rotofix Plus fixing can be taken generally as 0.004 $W \cdot m^{-2} \cdot K^{-1}$. For specific cases, the advice of the Certificate holder should be sought.
(6) Includes one non-combustible fixing per m^2, Δ_{Uf} < 3% of U.

Table 5 Steel frame — approximate wall U values(1)(2)(3)

Insulation thickness (mm)	Rail fix U value ($W \cdot m^{-2} \cdot K^{-1}$)	Rotofix U value ($W \cdot m^{-2} \cdot K^{-1}$)
100	0.37	0.35
200	0.19	0.19

(1) Wall construction:
- 150 mm steel C-sections with 50 mm flanges (λ = 50 $W \cdot m^{-1} \cdot K^{-1}$)
- 12 mm cement particle board (λ = 1 $W \cdot m^{-1} \cdot K^{-1}$)
- 20 mm cavity spacer (λ = 0.17 $W \cdot m^{-1} \cdot K^{-1}$)
- drainage cavity (BS EN ISO 6946 : 2007)
- PVC fixing rail (λ = 0.17 $W \cdot m^{-1} \cdot K^{-1}$)
- 5 mm diameter steel anchor (λ = 50 $W \cdot m^{-1} \cdot K^{-1}$)
- EPS insulation (λ = 0.038 $W \cdot m^{-1} \cdot K^{-1}$)
- 8 mm render (λ = 1 $W \cdot m^{-1} \cdot K^{-1}$)
- one 8 mm diameter stainless steel fixing (λ = 17 $W \cdot m^{-1} \cdot K^{-1}$).

(2) Plain wall U values only.
(3) Based on calculationss in accordance with BS EN ISO 6946 : 2007 and three-dimensional computer modelling in accordance with BS EN ISO 10211 : 2007.

Table 6 Timber frame with fixing rail — approximate wall U values[1][2][3]

Insulation thickness (mm)	Rail fix U value ($W \cdot m^{-2} \cdot K^{-1}$)	Rotofix U value ($W \cdot m^{-2} \cdot K^{-1}$)
100	0.31	0.31
200	0.17	0.18

(1) Wall construction:
- 90 mm timber frame with bridging percentage of 15% (λ = 0.13 $W \cdot m^{-1} \cdot K^{-1}$)
- 12 mm cement particle board (λ = 0.23 $W \cdot m^{-1} \cdot K^{-1}$)
- 20 mm cavity spacer (λ = 0.17 $W \cdot m^{-1} \cdot K^{-1}$)
- drainage cavity (BS EN ISO 6946 : 2007)
- PVC fixing rail (λ = 0.17 $W \cdot m^{-1} \cdot K^{-1}$)
- 5 mm diameter steel anchor (λ = 50 $W \cdot m^{-1} \cdot K^{-1}$)
- K70 insulation (λ = 0.038 $W \cdot m^{-1} \cdot K^{-1}$)
- 8 mm render (λ = 1 $W \cdot m^{-1} \cdot K^{-1}$)
- one 8 mm diameter stainless steel fixing (λ = 17 $W \cdot m^{-1} \cdot K^{-1}$).

(2) Plain wall U values only.

(3) Based on calculationss in accordance with BS EN ISO 6946 : 2007 and three-dimensional computer modelling in accordance with BS EN ISO 10211 : 2007.

6.4 The systems can maintain, or contribute to maintaining, continuity of thermal insulation. Care must be taken to ensure an appropriate thickness of insulation is used, particularly at points such as junctions between floors and walls and at window and door reveals, to avoid thermal bridging and reduce the risk of condensation forming at these points. Items such as windows and doors should be selected taking into account the thickness of insulation required at the reveals to help prevent condensation forming at these junctions. Detailed guidance for junctions and on limiting heat loss by air infiltration can be found in:

England and Wales — Approved Documents to Part L and, for new thermal elements to existing buildings, Accredited Construction Details (version 1.0). For new-build, see also SAP 2009, Appendix K, and the *iSBEM User Manual*

Scotland — Accredited Construction Details (Scotland)

Northern Ireland — Accredited Construction Details (version 1.0).

7 Strength and stability

General

7.1 The resistance to wind loads will depend upon the insulation system used. The systems can be designed to provide adequate resistance to design loads applicable in the UK.

7.2 Provided the substrate is suitable, the fixings will effectively transfer the self-weight of the render insulation systems to the substrate.

7.3 The self-weight of the insulation systems including the render and the insulation is transferred to the substrate via the relevant fixing method. The number and the span between rail fixings, the number and span between Sto Rotofix Plus fixings or the suitability of adhesive should be determined by the building designer.

7.4 Where either of the mechanical fixing systems is used, the condition of the surface to receive the product is not a consideration provided the fastenings are anchored into a substrate capable of supporting the loads imposed by the external insulation plus the forces acting upon it. Trial tests shall be conducted on the walls of the building (see section 7.11).

7.5 Where the adhesive insulation system is used, trial tests shall be conducted on the walls of the building to determine the adequacy of the adhesive to withstand the expected wind loading (derived from calculations using the relevant wind speed data for the site) and a safety factor of 5.7. Details of the use of the systems without supplementary fixings can be obtained from the Certificate holder.

7.6 Negative wind pressure (suction) is resisted by the bond between the render and the insulation boards, the flexural strength of the render and insulation and, depending upon the chosen fixing method, one of:

- Sto Rotofix Plus Mechanical insulation systems — the resistance to pull-over of the fixing from the insulation, the strength of the Rotofix Plus fixing and the resistance to pull-out between the fixing and substrate wall
- Sto Mechanical insulation systems — the resistance to pull-over of the rail from the insulation, the strength of the rail, the resistance to pull-over of the rail from the rail fixing and the resistance to pull-out between the fixing rail and substrate wall
- Sto Adhesive insulation systems with supplementary fixings — the adhesive bond strength between the insulation and the adhesive and the adhesive bond strength between the adhesive and substrate.

7.7 Positive wind load (pressure) is transferred to the substrate wall directly via compression and bending of the render and insulation and, depending upon the chosen fixing method, one of:

- Sto Rotofix Plus Mechanical insulation systems — the bearing of the insulation onto the substrate or the flexural strength of the render and insulation through the fixings and into the substrate wall

- Sto Mechanical insulation systems — the bearing of the insulation onto the substrate or the flexural strength of the render and insulation through the fixing rails and packers where used and into the substrate wall
- Sto Adhesive insulation systems — the bearing of the insulation through the adhesive into the substrate.

7.8 The wind loads on the walls should be calculated in accordance with BS EN 1991-1-4 : 2005 or BS 6399-2 : 1997, BS EN 1993-1-1 : 2005, BS EN 1993 -1-3 : 2006 and BS EN 1995-1-2 : 2004. Special consideration should be given to locations with high wind-load pressure coefficients (additional fixings or adhesive coverage may be necessary). In accordance with BS EN 1990 : 2002, it is recommended that a load factor of 1.5 is used to determine the ultimate wind load to be resisted by the insulation systems.

7.9 Assessment of structural performance for individual buildings should be carried out by a suitably qualified and experienced person.

7.10 The resistance to wind loads depends upon the fixing system used (see Table 7):

- Sto Rotofix Plus Mechanical insulation systems — tests carried out on an installation with tongue-and-groove insulation boards with a minimum of four and a maximum of six fixings per square metre indicated that the systems can resist wind loads of 3800 Pa and 5053 Pa respectively
- Sto Rail insulation systems — tests carried out on an installation with horizontal rails fixed at a maximum of 300 mm centres with fixings passing into the studs at a maximum of 600 centres indicated that the system can resist a wind load of 1100 Pa
- Sto Adhesive insulation systems — where the surface bond of the substrate is in question, an appropriate number of site-specific bond strength tests should be conducted on the substrate of the building to determine the minimum resistance to failure of the adhesive. The design bond strength is the average of the five smallest measured values at the ultimate load divided by a factor of safety of 9. Supplementary fixings are used where required. It is essential that the appropriate movement joints and expansion joints are used through the insulation systems to ensure all substrate movement is managed in such a way that damage to the insulation systems does not occur.

Table 7 Sto external wall insulation systems — example wind loading calculations[1]

Characteristic	StoTherm Classic Rotofix Plus Mechanical insulation systems (4 fixings)	StoTherm Classic Rotofix Plus Mechanical insulation systems (6 fixings)	StoTherm Classic Mechanical insulation systems (M)	StoTherm Classic Adhesive insulation systems (K)
Resistance to wind loads (Pa)[1]	2800	5053	3300	—
Material factor[2]	1.5	1.5	3	—
Design resistance to wind loads (Pa)	2533	3369	1100	—
Characteristic anchor pull-out resistance per anchor or adhesive bond strength (N)[3]	1000	1000	650	20000
Factor of safety	2	2	2	5.7
Design pull-out resistance or design adhesive bond strength (N)	500	500	325	3509
Design pull-out resistance multiplied by the number of fixings (N)	2000	3000	1950	—
Limiting resistance (Pa)[4]	2000	3000	1100	3509

(1) From test results (see section 7.10).

(2) Based upon the EPS used and the manufacturing controls in place.

(3) From site tests (see section 7.11).

(4) The lesser of the board design pull-out resistance and the resistance to wind loads for the system. This value must be higher than the value calculated from section 7.8 (see section 7.12).

7.11 An appropriate number of site-specific pull-out tests shall be conducted on the substrate of the building (masonry, concrete or plain sheathing board) to determine the minimum resistance to failure of the fixings. The characteristic pull-out resistance should be determined in accordance with the guidance given in ETAG 014 : 2002, Annex D, using 60% of the mean value of the five smallest measured values at the ultimate load. The design pull-out resistance per square metre is the mean pull-out resistance multiplied by the number of fixings (minimum of either 4 or 6) and divided by a factor of safety of 2. This value must be higher than the resistances given in section 7.10.

7.12 The designer should ensure that firebreaks used with the insulation systems are fixed adequately to resist the anticipated wind loading.

7.13 The mechanical insulation systems are not affected by the maximum deflections permitted in the design of steel-frame structures to BS EN 1993-1-1 : 2005 and BS EN 1993-1-3 : 2006, ie span/300. Mid-span deflections should not be greater than span/300. Deflection should be limited where possible to minimise damage to the insulation systems.

Impact loading

7.14 The systems are suitable for use at zones liable to impacts from thrown or kicked objects, but in public locations where the height of the system will limit the size of the impact; or at lower levels where access to the building is

primarily to those with some incentive to exercise care in accordance with ETAG 004 : 2000, use category II. For areas likely to be prone to greater impacts, the advice of the Certificate holder should be sought.

8 Behaviour in relation to fire

General

8.1 The surface spread of flame classification of the external surface of the system is given in Table 8.

Table 8 Surface spread of flame performance[1]

Maximum declared organic content of the rendering system[2]	Minimum declared flame retardant of the rendering system[2]	Euroclass according to BS EN 13501-1 : 2007
Reinforcement coat: 16% Finishing coat: 14.75%	Reinforcement coat: 20% Finishing coats: 7.5%	B-s2, d0 B-s2, d0

(1) The effects of primer and paint need to be taken into account by the building designer.

(2) Percentage relative to the initial weight after drying.

8.2 The insulation material is combustible and, therefore, its use in the system on timber-frame constructions is restricted to buildings of up to 18 m in height only.

8.3 The systems on solid masonry and/or sheathed light-steel-framed constructions have been assessed in accordance with BS 8414 -1 : 2002 and BS 8414 -2 : 2005. Hence, they are suitable for use on buildings of up to and above 18 m high.

8.4 Fire stopping or fire barriers (see Figure 2) should be incorporated into a construction at each floor level above the first floor. Guidance is given in:

England and Wales — Approved Document B, Volume 1, Sections 8 and 9, and Volume 2, Sections 12 and 13

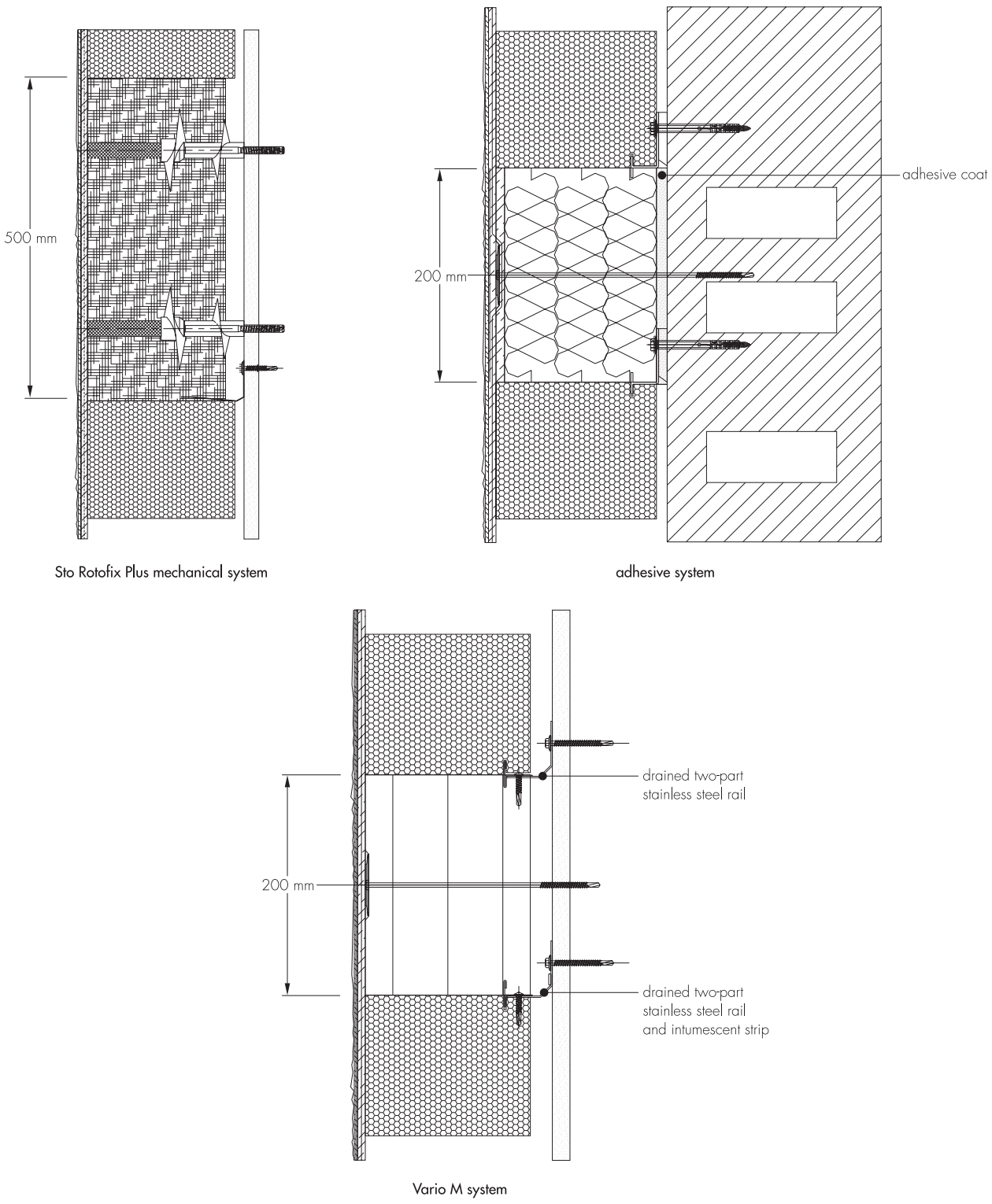
Scotland — Mandatory Standard 2.2, clause 2.4.1[1][2]

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

Northern Ireland — Technical Booklet E, Section 5.

Figure 2 Fire barriers



9 Rain penetration

9.1 Guidance in BRE Report (BR 262 : 2002) *Thermal insulation: avoiding risks* should be followed in that the designer should select a construction appropriate to the local wind-driven rain index, paying due regard to the design detailing, workmanship and materials to be used. Additional guidance can be found in:

England and Wales — Approved Document C, Section 5

Scotland — Mandatory Standard 3.10, clauses 3.10.2[1][2], 3.10.3[1][2] and 3.10.5[1][2]

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

Northern Ireland – Technical Booklet C, Section 2.

9.2 In all cases, care should be taken to ensure that walls are weathertight prior to application of the insulation systems. The insulation systems should only be installed where there are no signs of dampness on the inner surface of the substrate other than those caused solely by condensation.

9.3 Where used, the sheathing board substrate must be of a suitable exterior grade with appropriately sealed joints, sealed penetrations and vapour control layers where required. Examples of relevant detailing for external wall insulation systems with a drainage cavity can be seen in SCI Publication P343 *Insulated Render Systems Used With Light Steel Framing* (Steel Construction Institute, 2006).

9.4 The designer should check that windows, doorsets, flashings, and other similar items have been specifically designed for this use. Particular attention should be paid to the prevention of water ingress. For example, at junctions between the insulation systems and windows, openings and penetration details should be designed to deflect water away from the insulation and onto the external face of the wall.

9.5 At the tops of walls, the insulation systems should be protected by an adequate overhang or other detail designed for use with this type of insulation systems (see Figure 7).

10 Condensation

10.1 When using the systems, consideration must be given to the overall design to minimise the risk of condensation, and the recommendations given in BS 5250 : 2011 should be followed.

10.2 Dynamic condensation modelling in accordance with BS EN 15026 : 2007 can be carried out for light-steel or timber-framed constructions to help establish the likelihood of moisture accumulating within the construction over the design life of the building.

10.3 The water vapour resistivity for the basecoat with the render finishes is not more than 2000 $MN \cdot s \cdot g^{-1} \cdot m^{-1}$.

10.4 The resistivity of the EPS insulation boards can be taken as 300 $MN \cdot s \cdot g^{-1} \cdot m^{-1}$.

Surface condensation

10.5 Walls will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 0.7 $W \cdot m^{-2} \cdot K^{-1}$ at any point, and the junctions with other elements and openings comply with the requirements given in section 9.4.

10.6 Walls and ceilings will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed 1.2 $W \cdot m^{-2} \cdot K^{-1}$ at any point. Guidance may be obtained from BS 5250 : 2011, Annex G, and BRE Report (BR 262 : 2002).

Interstitial condensation

10.7 Weathertight walls incorporating the insulation systems will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2011, Annexes D and G, and BS EN ISO 10456 : 2007.

11 Maintenance and repair

11.1 Regular checks should be made on the installed insulation systems, particularly at joints with other elements, to ensure that ingress of water does not occur. This should verify that architectural details for shedding water clear of the building are present and functioning, and that external plumbing fitments are in good condition. Maintenance schedules should include the replacement and resealing of joints, for example between the insulation systems and window and door frames. The interval between inspections should be considered for each building allowing for such factors as the building location and height. Necessary repairs should be effected immediately and the sealant at joints at window and door frames replaced at regular intervals.

11.2 The designer should ensure suitable access is available to enable maintenance inspections to take place safely.

11.3 Damaged areas must be repaired using the appropriate Sto components and the procedures detailed in the Certificate holder's technical literature. The Certificate holder should be consulted on the appropriate measures for a particular installation.

11.4 The finishes may become soiled in time, the rate depending on the product chosen, initial colour, the degree of exposure, level of atmospheric pollution and the design and detailing of the wall. The appearance may be restored by a powerwash at 30 bar maximum pressure and 30°C maximum temperature with the nozzle no closer than 500 mm from the finish coating or, if required, overcoating by the application of a further finish of paint, but great care must be taken not to adversely affect the water vapour transmission characteristics of the insulation systems.

12 Durability

12.1 The system should remain effective for at least 30 years, provided any damage to the surface finish is repaired immediately, and regular maintenance is undertaken (see section 11).

12.2 The standard reinforcing mesh has adequate resistance to accidental damage where used in situations where walls are exposed but have some protection, eg walls of private dwellings and walls of communal dwellings above ground-floor level. In other situations, eg walls of public buildings at ground-floor level, the combined heavy-duty and standard reinforcing meshes are required to increase the resistance to impact. Guidance may be obtained from

BRE Current Paper CP 6 : 81 : 1981 *Assessment of external walls: hard body impact resistance*, ETAG 004 : 2000 and the Certificate holder.

Installation

13 General

Application of the StoTherm Vario External Wall Insulation Systems, within the context of this Certificate, should be carried out by registered installers as recommended by the Certificate holder. A Certificate-holder registered installer is a company which:

- employs operatives who have been trained and approved by the Certificate holder to install the insulation systems and who, upon completion of their training, have been issued with an appropriate identification card or certificate by the Certificate holder
- has undertaken to comply with the Certificate holder's application procedure, including the requirement for each application team to include at least one member with an identification card or training Certificate
- is subject to audits by the Certificate holder, including site inspections.

14 Site survey and preliminary work

14.1 It is essential that the substrate is weathertight before the installation of the insulation systems. A pre-installation survey of the property is carried out to determine whether repairs are required to the building structure, sheathing board, steel or timber frame. The survey should include tests and an assessment and recommendation on the type and number of fastenings required in respect of the building's expected wind loading. A specification is prepared for each project covering each elevation of the building, and with details indicating:

- position of tracks
- number and fixing pattern for Sto Rotofix Plus fixings
- position of starter profile or starter mesh (for adhesively fixed insulation systems)
- reinforcing mesh(es)
- detailing around windows, doors and at eaves
- dpc level
- exact position of expansion joints, if required
- areas where exterior grade sealants must be used
- location and type of weather seals to be used
- location of water deflection channels (see Figure 4)
- alterations required to external plumbing
- position of fire barriers.

14.2 The suitability of the construction for the installation of the insulation systems is determined as part of the pre-installation survey.

14.3 All necessary repairs to the building structure are completed before installation of the insulation systems commences.

14.4 Surfaces should be sound, clean, and free from loose material. The flatness of surfaces must be checked against the tolerances of the proposed insulation systems; this may be achieved by using a straight-edge spanning the storey height. Any excessive irregularities, ie greater than 10 mm, must be made good prior to installation to ensure that the insulation boards are installed with a smooth, in-plane finished surface.

14.5 Where surfaces are covered with an existing rendering it is essential that the bond between the background and the render is adequate. All loose areas should be hacked off and reinstated. An alternative fixing method should be used if the adhesive bond strength is not sufficient.

14.6 On existing buildings, purpose-made sills must be fitted to extend beyond the finished face of the insulation systems. New buildings should incorporate suitably deep sills.

14.7 Where appropriate, external plumbing should be removed and alterations made to underground drainage to accommodate its repositioning on the finished face of the insulation systems.

14.8 Internal wet work, eg screeding or plastering, must be completed and allowed to dry prior to the application of the insulation systems.

15 Procedure

General

15.1 Application of the StoTherm Vario External Wall Insulation Systems is carried out in accordance with the Certificate holder's technical literature.

15.2 Application of coating materials must not be carried out on damp substrates, if rain is expected, at temperatures below 5°C or above 30°C, or if exposure to frost is likely. The coating must be protected from rapid drying. Weather conditions, therefore, should be monitored to ensure correct curing conditions.

15.3 All rendering should be in accordance with the relevant recommendations of BS EN 13914-1 : 2005.

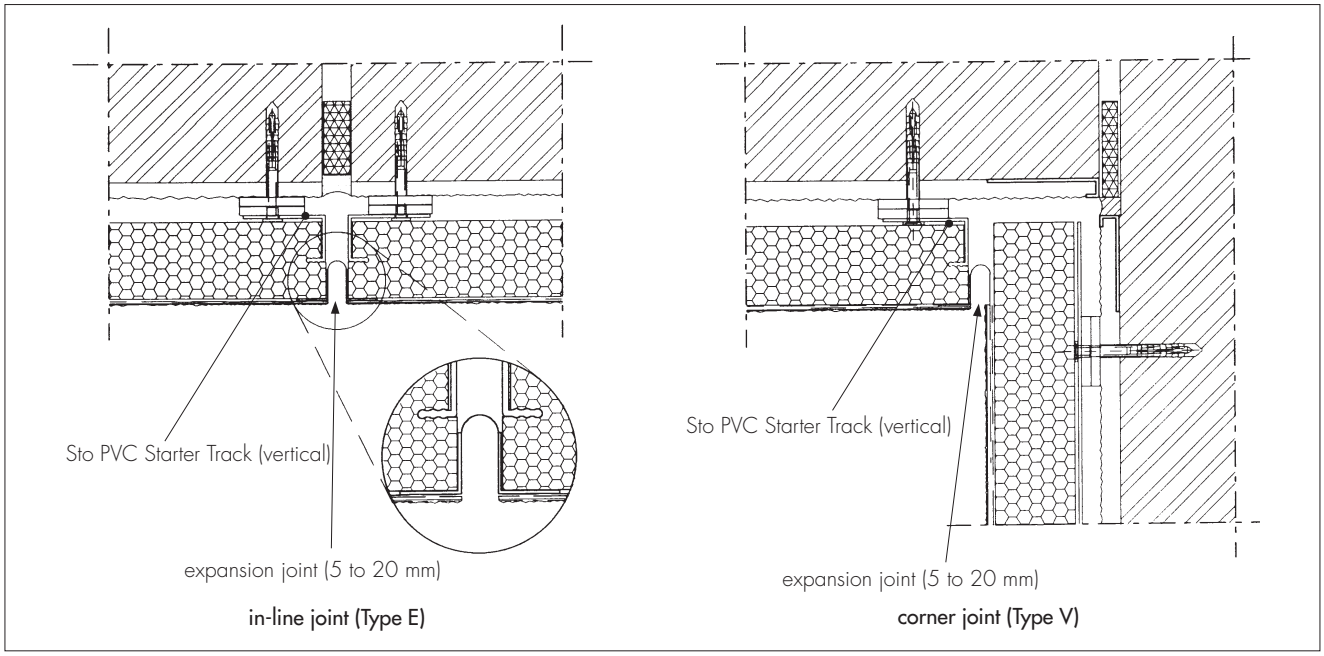
Movement joints

15.4 Movement joints should be included where required. For example, if an expansion joint is incorporated in the substrate, a movement joint must be provided in the insulation systems.

15.5 Movement joints extend through the full insulation systems and are made using Sto profiles E or V (see Figure 3), or sealed with an expansion joint sealant against a backer rod(1).

(1) Sealant and backer rod to be approved by the Certificate holder.

Figure 3 Sto vertical expansion joint types E and V



15.6 Where necessary, expansion beads are fixed vertically in predetermined positions across the building depending on the individual requirements of each job.

15.7 The movement joint sealant must not come into direct contact with the insulation board. Therefore, it is essential to ensure that the reinforcement mesh and the basecoat are taken around the complete edge of the insulation board.

Mechanical systems

15.8 For installations beginning at the base of the wall, the Sto aluminium starter track is used to mount the first row of boards. For installations commencing at first-floor level, either the Sto aluminium or Sto PVC-U Starter Tracks may be used. Both profiles are fixed to the substrate with Sto hammer-drive fixings or screws at a maximum of 300 mm centres (see Figure 4). Care must be taken not to overdrive the fixings.

15.9 For installations onto masonry walls where the render insulation systems will be returned to the wall, a strip of mesh is partially adhered so that 200 mm (plus the thickness of the insulation) is hanging from the starting line. The Sto reinforcement coating is subsequently used to wrap the overhanging mesh around the profile (including any PU foam filling between shims) and adhere it to the first course of insulation boards. All exposed insulation board edges are protected in this manner (see Figure 5). For installation onto timber-framed buildings, a ventilation bead profile should be used to maintain the drainage vent for the system.

15.10 For installations onto masonry walls where the render insulation systems will not be returned to the wall, the Sto Starter Track is fixed along the starting line using shims to overcome any undulations (gap is subsequently filled with PU filler foam or a suitable flexible sealant), normally at or just above dpc level. When a drained starter track is required for a timber-frame or some steel-frame substrates (as required by NHBC), a perforated track 20 mm wider than the insulation is used and an insect mesh is used inside the track; the track is directly fixed to substrate, without shims.

Figure 4 Typical section at base level

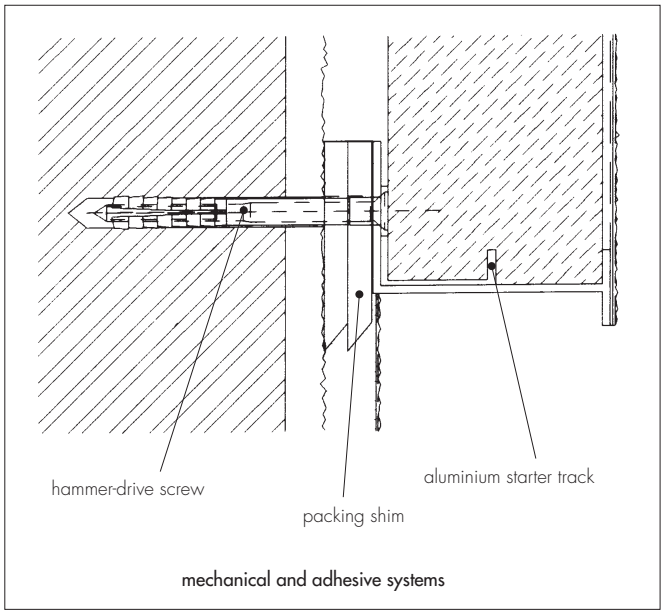
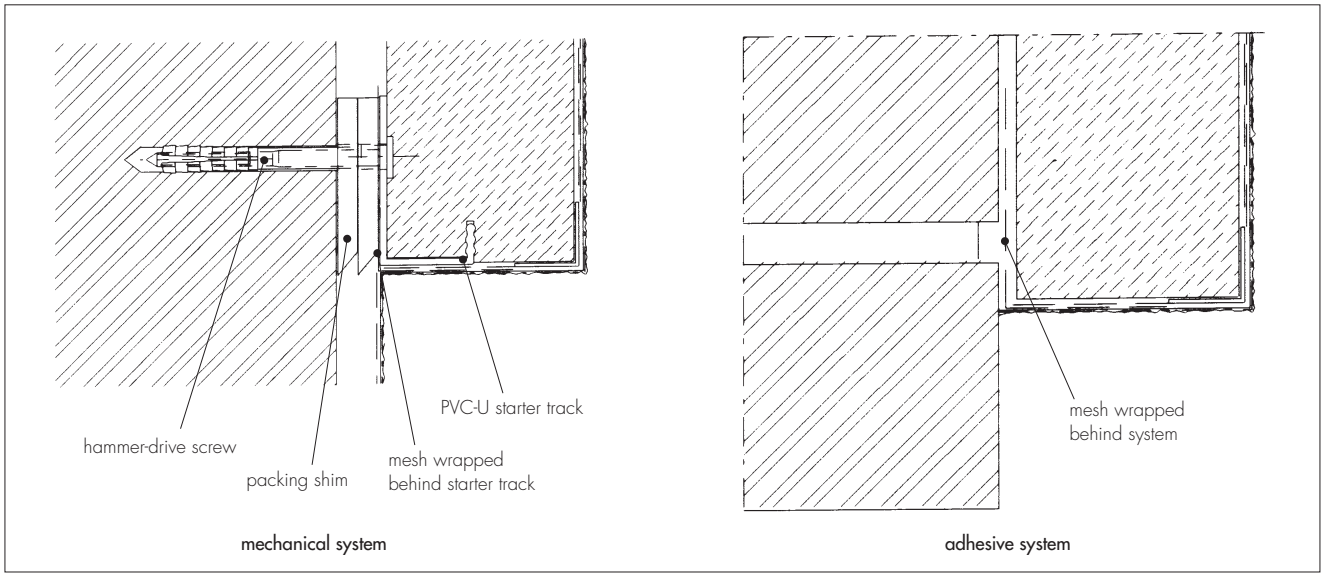


Figure 5 Typical sections at first floor level



15.11 After positioning the first row of boards, the horizontal intermediate tracks are installed into the grooves at the top edges. The intermediate tracks are fastened to the substrate with SS hammer-drive fixings or screws at maximum 300 mm centres. Subsequent rows of boards are installed using the same procedure.

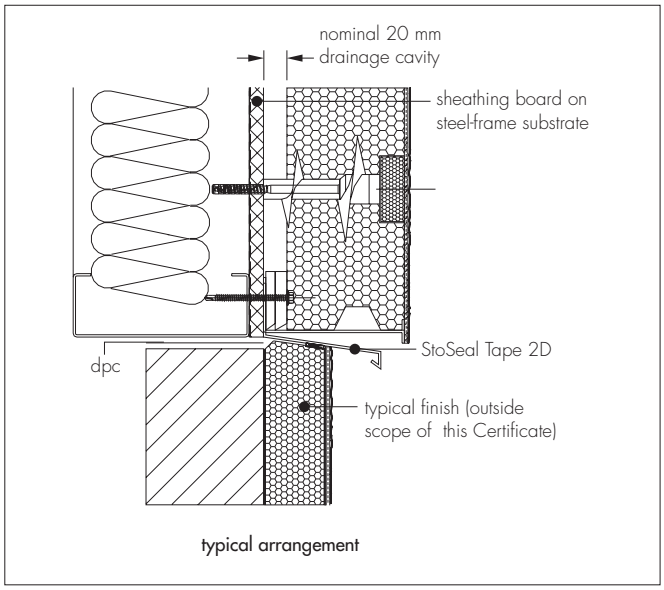
15.12 The boards must be butted tightly together with the vertical joints staggered and any open joints in the insulation systems filled with slivers of insulation board or Sto PU foam. High spots or irregularities should be removed by lightly planing with a rasping board. The entire surface is rasped to provide a mechanical key for the render basecoat.

Sto Rotofix Plus Mechanical systems

15.13 For Sto Rotofix Plus mechanical system installations beginning at the base of the wall, the Sto aluminium horizontal starter track is used to mount the first row of boards. For installations commencing at first-floor level, either the Sto aluminium starter track or a temporary timber batten may be used. The aluminium profiles are fixed to the substrate with Sto hammer-drive fixings or screws at maximum of 300 mm centres (see Figure 3). Care must be taken not to overdrive the fixings. The insulation boards are installed with the tongue edges of the insulation boards aligned to the top and left of the board.

15.14 If a temporary timber batten is to be used, a strip of mesh is partially adhered to the wall so that 200 mm (plus the thickness of the insulation) is hanging from the starting line of the insulation. The cavity must be filled using PU foam at the base to fill the gap. The Sto reinforcement render is used to wrap the overhanging mesh around the lower edge and adhere it to the first row of insulation boards. All exposed edges of the insulation boards are protected in this manner (see Figure 6). If the installation requires drainage (eg in timber-frame construction), a perforated starter track is required to maintain the drainage for the system in preference to the back wrap detail.

Figure 6 Typical section at base level and Rotofix detail



15.15 Once a row of insulation boards has been positioned, the spiral load transfer plug is installed into the insulation using the appropriate tools. Holes are drilled through the plugs into the substrate and steel fixing pins fitted, fixing the boards to the substrate. Circular recesses are cut into insulation boards (boards greater than 100 mm thickness) before the spiral load transfer plug is inserted.

15.16 After the insulation boards have been secured to the substrate, the spiral load transfer plug can be rotated to adjust the line of the surface of the wall. An EPS blank or PU foam must be used in the recess when the fixing has been installed and the wall adjusted.

15.17 The boards must be butted tightly together with the vertical joints staggered and open joints in the insulation systems filled with slivers of insulation board or Sto PU foam. High spots or irregularities should be removed by lightly planing with a rasp over the entire surface.

15.18 Packing shims are used at fixing points behind the starter and holding tracks where it is necessary to overcome surface irregularities.

Adhesive systems

15.19 StoLevell Uni/Sto Levell Duo Plus adhesive is prepared by mixing with the correct quantity of clean water with every 25 kg bag.

15.20 Installation begins at the base of the wall above the dpc. A firm, horizontal support of either the Sto aluminium profile or a temporary timber batten, is used to mount the first row of boards. The aluminium profile is installed as previously described (see Figure 5).

15.21 If a temporary timber batten is to be used, a strip of mesh is partially adhered to the wall so that 200 mm (plus the thickness of the insulation) of it is hanging from the starting line of the installation. The Sto reinforcement render is subsequently used to wrap the overhanging mesh around the lower edge and adhere it to the first row of insulation boards. All exposed edges of the insulation boards are protected in this manner (see Figure 6).

15.22 The adhesive is applied over the entire face of the insulation board, using a notched trowel, or in a continuous line around the perimeter of the board with six additional dabs of adhesive distributed over the remaining surface (minimum 40% coverage or 20% where augmented with a minimum of eight fixings per m^2).

15.23 The boards must be pressed firmly against the wall and butted tightly together with the vertical joints staggered. Open joints in the insulation systems should be filled with slivers of insulation board or Sto PU foam and high spots or irregularities removed by lightly rasping over the whole surface.

15.24 With substrates of no-fines concrete or low loadbearing capacity, Sto Thermo expanding dowels are used as supplementary mechanical fixings at the specified minimum frequency of eight per square metre (additional fixings should be used where required). As with all installations using mechanical fixings pull-out testing should be used to verify the dowel performance in these substrates.

15.25 For fixing Sto-TurboFix adhesive systems, the substrate must be level, loadbearing, clean and free from efflorescence and separating agents. The air and substrate temperature should not be less than + 5°C nor more than + 30°C. Substrate unevenness of up to approximately 20 mm may be equalised using Sto-Turbofix and supplementary mechanical fixings where required. Unevenness greater than 20 mm will require a different fixing method.

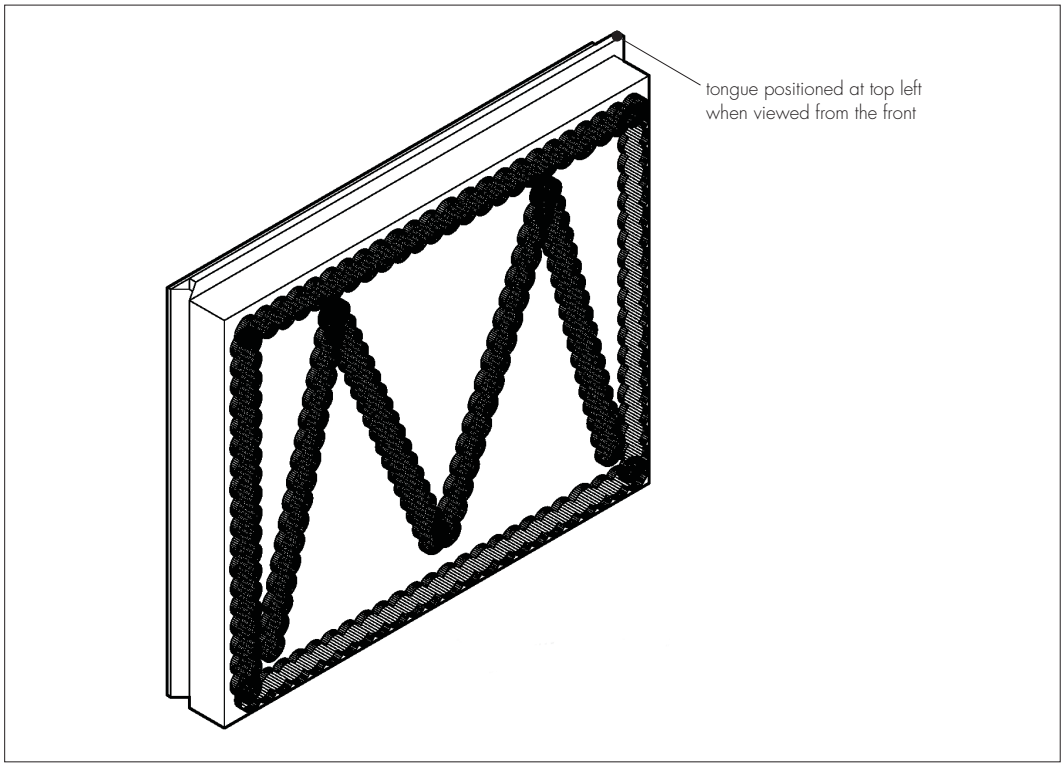
15.26 The bottle containing the adhesive foam should be shaken thoroughly 20 to 30 times at the beginning of works, and again after each successive 1 to 2 hours. The material should be protected against direct sunlight and temperatures above 50°C.

15.27 Installation begins at the base of the wall above the dpc. A firm, horizontal support of either the Sto aluminium profile or a temporary timber batten, is used to mount the first row of boards. The aluminium profile is installed as previously described (see Figure 4).

15.28 If a temporary timber batten is to be used, a strip of mesh is partially adhered to the wall so that 200 mm (plus the thickness of the insulation) is hanging from the starting line of the installation. The Sto reinforcement render is subsequently used to wrap the overhanging mesh around the lower edge and adhere it to the first row of insulation boards. All exposed edges of the insulation boards are protected in this manner (see Figure 6).

15.29 The Sto-TurboFix foam adhesive is applied to the face of the insulation board in a continuous line around the perimeter of the board with additional lines of adhesive in an enclosed M or W shape over the remaining surface (see Figure 7). The adhesive pattern must ensure an even adhesive covering of greater than 40%.

Figure 7 Typical pattern for application of Sto-TurboFix



15.30 The insulation board coated with Sto-Turbofix must be applied to the wall immediately after application of the adhesive foam.

15.31 The boards must be pressed gently in place against the wall and butted tightly together, working from bottom to top, with the vertical joints staggered. The insulation boards must not be knocked onto the wall. The position of the board can be adjusted within 10 minutes of application. Open joints in the insulation systems should be filled with slivers of insulation board or Sto PU foam and high spots or irregularities removed by lightly rasping over the whole surface.

15.32 With substrates of no-fines concrete or low loadbearing capacity, Sto Thermo expanding dowels are used as supplementary mechanical fixings at the specified minimum frequency of eight per square metre.

Basecoat

15.33 Prior to the application of the basecoat, seals are applied where required and a bead of sealant is applied to window and door frames, overhanging eaves, gas and electric meter boxes, wall vents or where the render abuts any other building material or surface. StoSeal sealing tape is installed as the insulation boards are placed in position and cannot be applied after installation of the insulation.

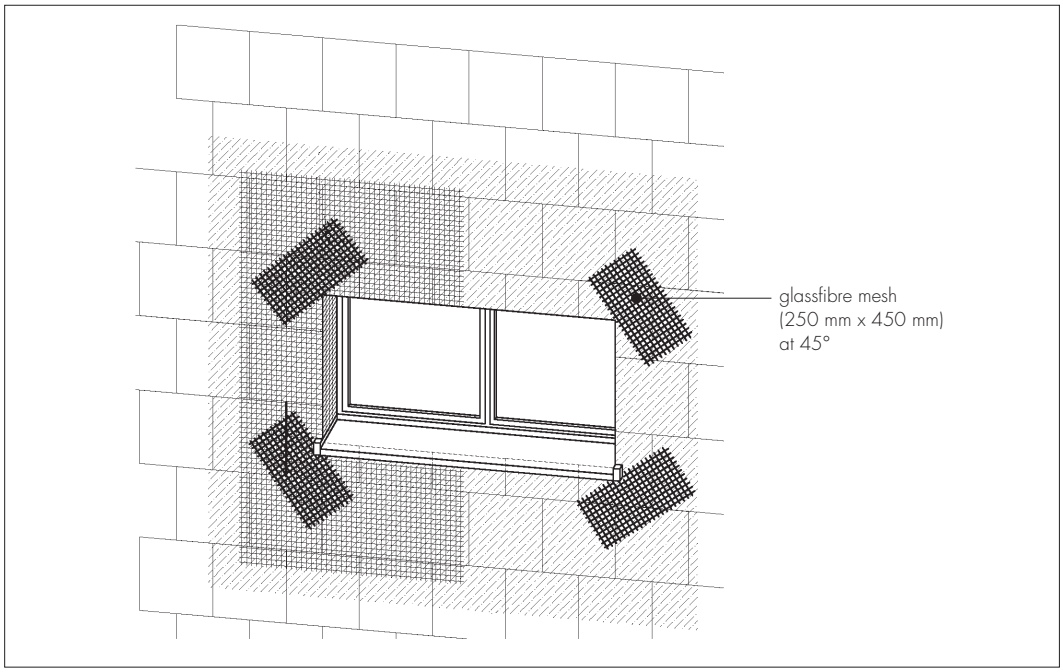
15.34 The prepared basecoat is applied to a minimum thickness of 3 mm over the insulation boards (for StoLevell Duo Plus or StoLevel-Uni), using spray equipment or a stainless steel trowel. The basecoat is applied progressively, working in 1.2 m sections in a vertical or horizontal direction.

Reinforcing

15.35 The Sto reinforcement mesh is immediately embedded into the wet basecoat, overlapping at all mesh joints by not less than 100 mm. Corner details are reinforced using Sto PVC Mesh Angle Beads for external corners and StoArmour Angle in internal corners.

15.36 Additional pieces of reinforcing mesh (450 mm by 250 mm) are used diagonally at the corners of openings (see Figure 8).

Figure 8 Additional reinforcement at openings



15.37 The mesh should be free of wrinkles and fully embedded in the basecoat with the mesh pattern just visible on the finished surface. The Sto logo should not be visible on the cured insulation systems.

15.38 The basecoat should be left to dry thoroughly before application of a primer and the decorative finish. Depending on conditions, the drying time will be between 24 hours and 48 hours.

Finishing

15.39 The render finishes are prepared in accordance with the Certificate holder's Technical Datasheets and project method statement and are trowel-applied using a stainless steel trowel or spray-applied, in thicknesses from 1.5 mm to 6 mm, depending on the product used and the aggregate grain size.

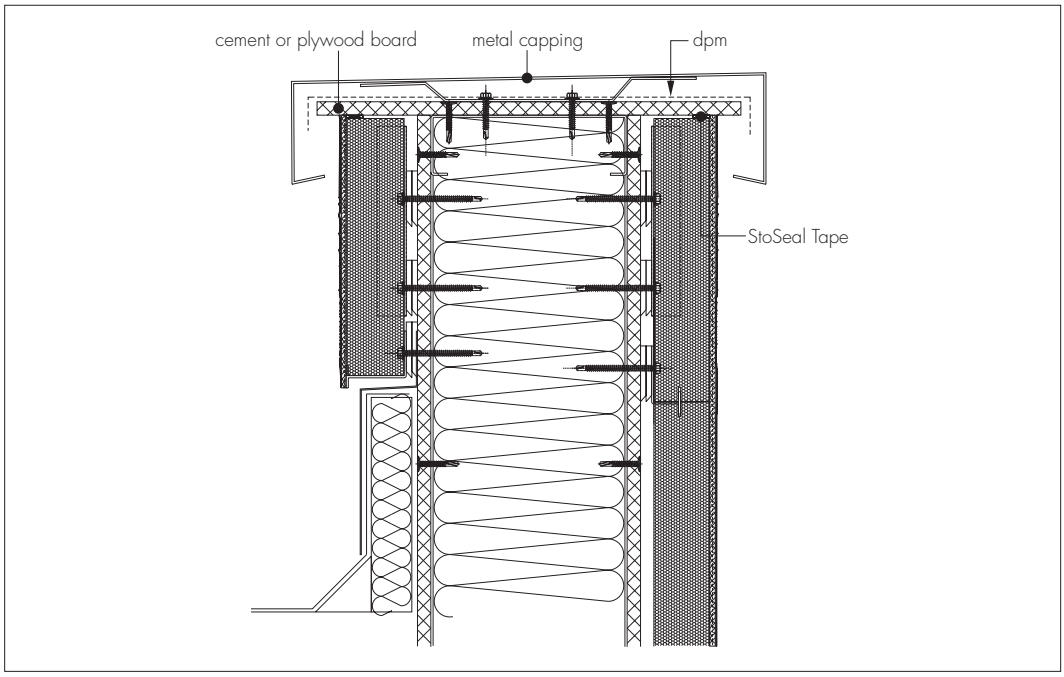
15.40 A dash finish may be applied to StoMiral Dry Dash Receiver. The coating must be at least 6 mm thick, with the 6 mm to 8 mm aggregate applied immediately after application, while the coating is still soft. On completion, the surface must be checked to ensure an even coverage of spar dash has been achieved. Where necessary, the aggregate should be lightly tamped to ensure a good bond.

15.41 The finish coats should be allowed to dry thoroughly before any of the paint coatings covered by this Certificate are applied to any features.

15.42 Continuous surfaces must be completed without a break, so the coatings must always be applied to a wet edge.

15.43 At the top of the wall the insulation boards must be protected by fitting under capping or coping stones or similar projection and be sealed using StoSeal Tape or appropriate StoSeal beads (see Figure 9).

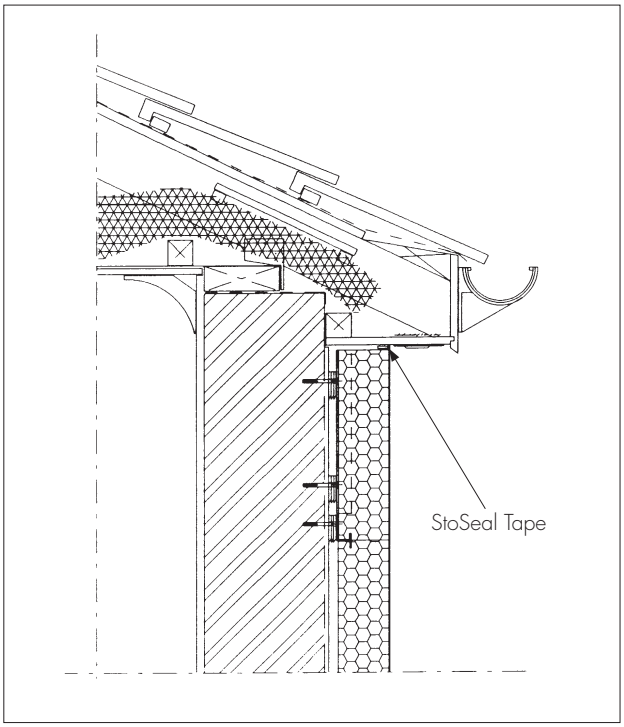
Figure 9 Typical wall top/parapet detail



15.44 Wallheads are formed by returning the reinforcing coat and reinforcement on to the horizontal surface. For an overhanging soffit, a seal is installed between the insulant and the underside of the soffit.

15.45 Care should be taken in the detailing of the insulation systems around openings and projections (see Figure 10).

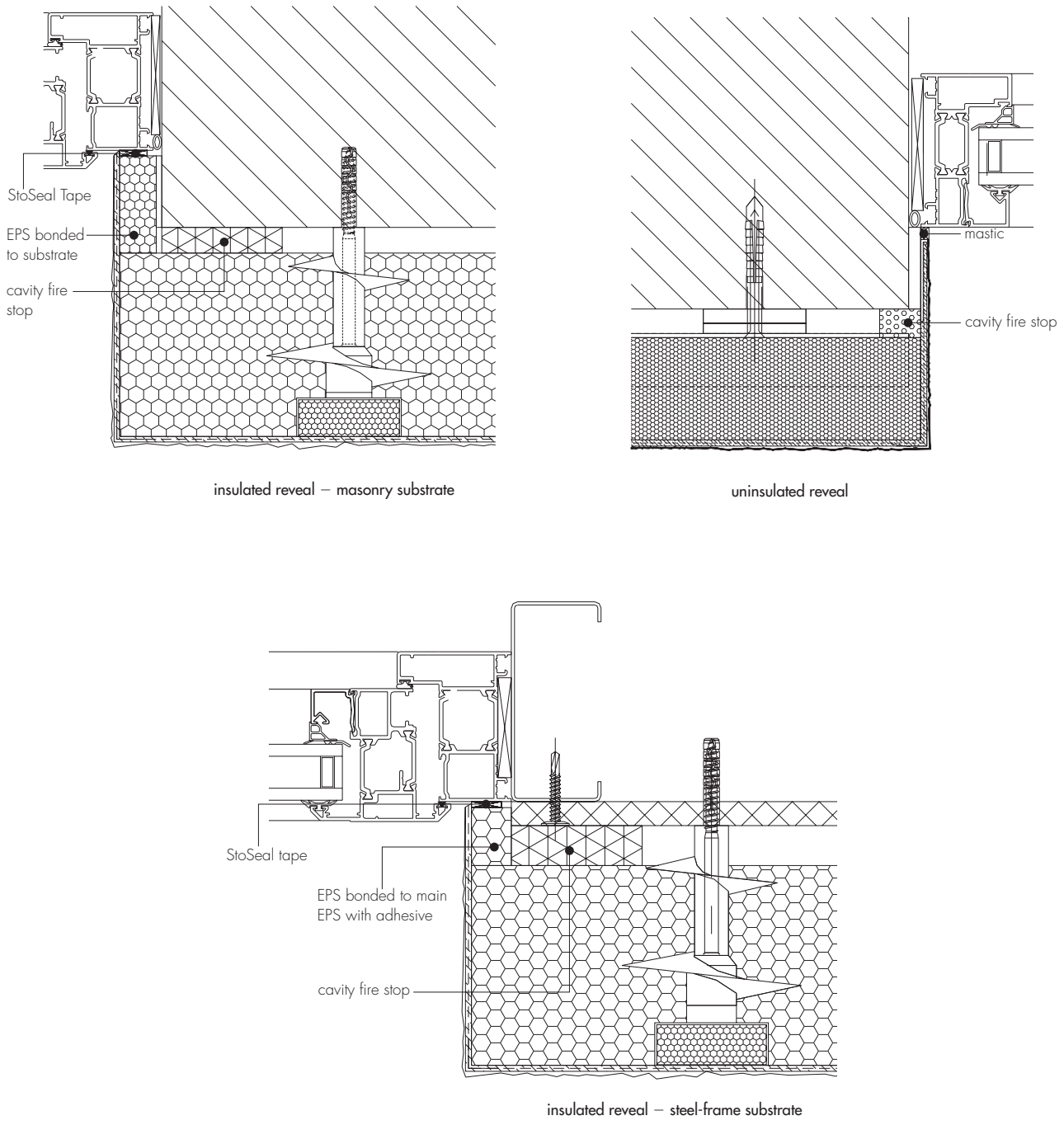
Figure10 Eaves detail on pitched roofs



15.46 At windows and doors the insulation should be continued around the reveals where there is sufficient clearance. New buildings should be built to allow this. Where there is insufficient clearance, the basecoat, reinforcement mesh and render decorative finish should be continued into the reveal (otherwise the reveal should be insulated using alternative means).

15.47 The insulation systems must be sealed around window frames and sills to give an elastic joint using StoSeal Tape or, in uninsulated reveals, StoSeal F 505 sealant (see Figure 11). Additional insulation should be fitted around openings, if required, to maintain the continuity of the insulation.

Figure 11 Typical details at reveals



15.48 Window sills must be designed to shed water away from the joints between the render and opening detail by, for example, fitting with stooled ends. Stoseal tape is installed between the vertical flange and the window frame and beneath the sill and around the stooled ends.

15.49 Window/door reveals and heads are sealed using the Sto Stopseal Bead (a PVC bead incorporating integral Stoseal 15/2-6) and a polythene masking strip to help protect other finishes. Where the bead cannot be installed, Stoseal 15/2-6 may be used.

15.50 When the insulation systems are used onto steel frames (NHBC) and timber-framed structures incorporating a drainage cavity, a PVC channel is fitted within the drainage cavity above openings such as windows and doors, at an angle of not less than 10° from the horizontal and 150 mm beyond each side of the opening. The drainage channel will deflect any water present in the cavity away from the sheathing board. This channel is screw-fixed to the substrate at 300 mm centres (see Figures 12 and 13). Where the cavity width is greater than the depth of the drainage channel, the channel should be packed from the substrate so that it sits against the rear face of the insulation, with the resultant gap being filled with a suitable sealant tooled at the top edge to ensure water cannot be trapped.

15.51 Mineral fibre lamella (class A1) fire break boards are adhesively fixed to the substrate at the appropriate position using Sto Levell Uni.

15.52 Where a drainage cavity is required for the mechanical rail system, the firebreak boards are installed between two stainless steel fire-break rails placed at the top and bottom of the fire-break detail and are fastened to the substrate with Sto-approved fixings at maximum 300 mm centres. Sto Intumescent Strip is installed on the back flange of the lower rail. The fire-break rails are pre-drilled to allow free drainage and are designed to deflect moisture away from the façade board. The rail is manufactured in two parts to allow adjustment. For insulation systems using the Sto Rotofix Plus insulation systems installed onto a drained substrate, only a single part stainless steel fire break rail is required in conjunction with a 500 mm high mineral fibre board firebreak. The drainage holes are limited to remove the requirement for the intumescent strip on this profile. The mineral fibre firebreak board is fixed using the Sto Rotofix plus fixings.

15.53 On completion, external fittings should be re-fixed to the substrate using a suitable method. Further information is available from the Certificate holder.

16 Site practice

It is essential that appropriate site surveillance is in place to ensure detailing is carried out to the correct level. Additionally, the installation of the insulation systems should be checked by the person supervising the works at the end of each relevant stage. Further information is available from the Certificate holder.

Figure 12 Layout of deflection channels around openings such as windows

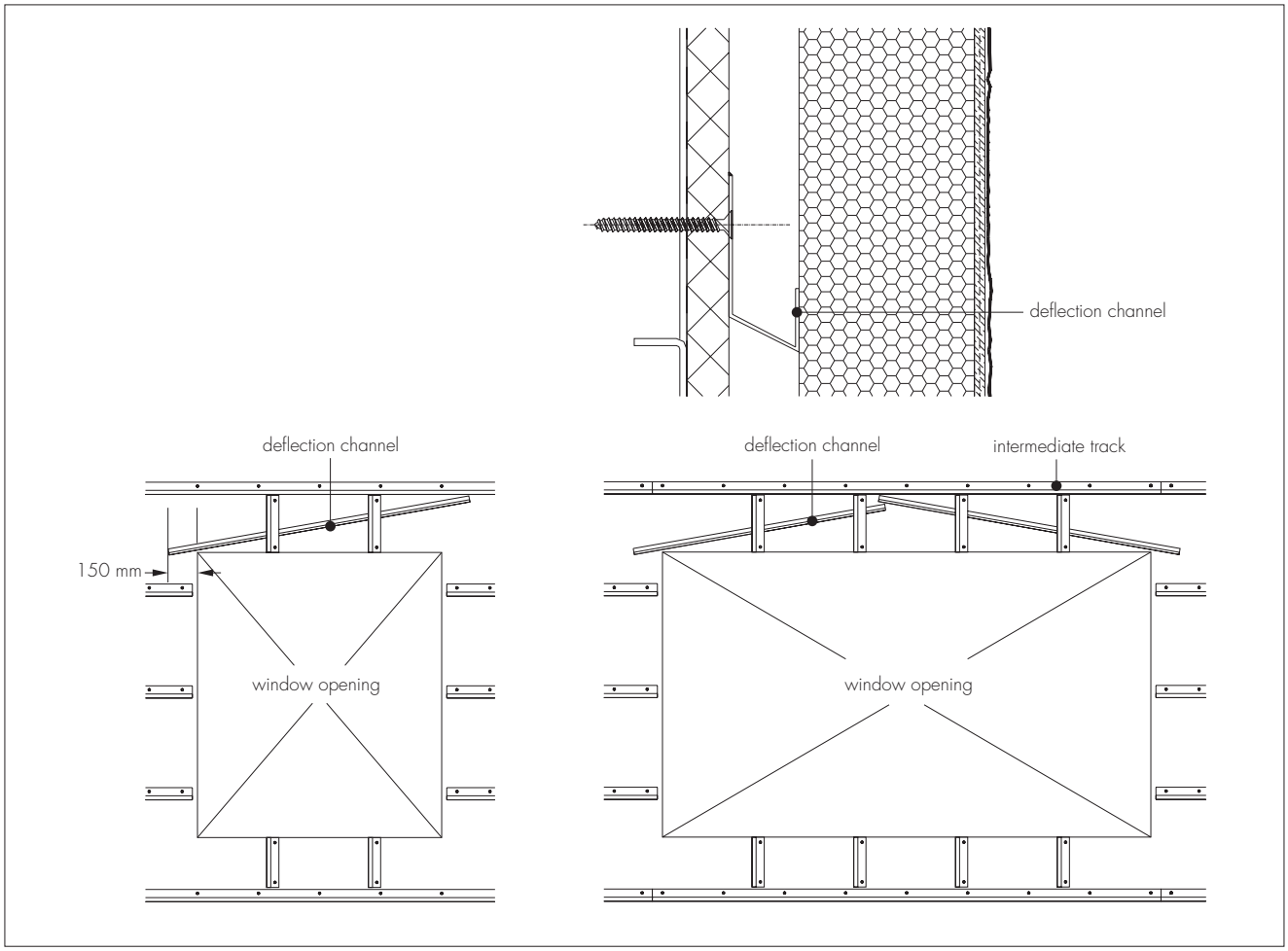
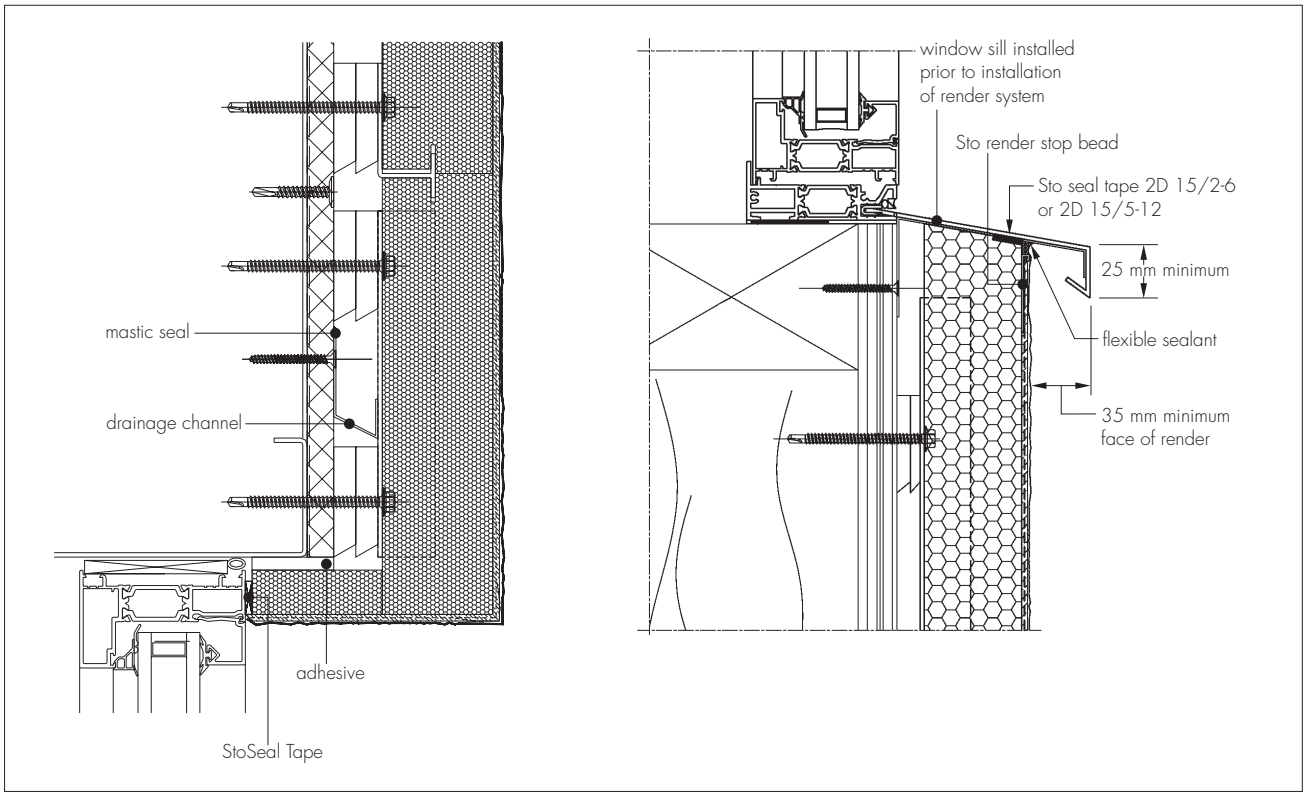


Figure 13 Window head detail



Technical Investigations

17 Investigations

17.1 An examination was made of test data relating to:

- test reports
- adequacy of fixing systems
- durability of finish
- fire
- fire barrier suitability
- pull-out strength of the systems
- thermal conductivity
- component characterisation
- heat/spray cycling
- resistance to freeze/thaw
- impact resistance
- water vapour permeability.

17.2 Calculations and reports were assessed in connection with the structural performance of the insulation systems.

17.3 The practicability of installation and the effectiveness of detailing techniques were examined.

17.4 The manufacturing process, the methods adopted for quality control of manufacture and bought-in components, and details of the quality and composition of the materials used were examined.

17.5 An assessment of the risk of interstitial condensation was undertaken.

17.6 Data generated from the assessment resulting in the issue of BBA Certificates 90/2433/C and 90/2460/C were used in support of this approval.

Bibliography

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ETAG 004 : 2000 *Guideline for European Technical Approval of External Thermal Insulation Composite Systems with Rendering*

ETAG 014 : 2002 *Guideline for European Technical Approval of Plastic Anchors for fixing of External Thermal Insulation Composite Systems with Rendering*

18 Conditions

18.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page — no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
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- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

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