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Agrément Certificate  
**16/5380**  
Product Sheet 1

## GREENSPAN PERMANENT SHUTTERING SYSTEMS

### SUP-R-WALL

This Agrément Certificate Product Sheet<sup>(1)</sup> relates to Sup-R-Wall, a permanent formwork system comprising fibre-cement board with specially designed styrene-butadiene copolymer spacers, for use as loadbearing and non-loadbearing reinforced and non-reinforced concrete external, internal and separating walls in domestic and commercial 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

**Structural performance** — the system has adequate strength to resist the loads associated with installation and hydrostatic pressure (see section 6).

**Behaviour in relation to fire** — the concrete walls formed from the system are non combustible and provide fire resistance when designed in accordance with BS EN 1992-1-2 : 2004 (see section 8).

**Sound insulation** — separating and internal walls formed from the system, with the minimum concrete core density stated in this Certificate, can provide sufficient sound resistance (see section 13).

**Durability** — walls constructed from the system can have a service life of 60 years (see section 15).



The BBA has awarded this Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 16 December 2016

Brian Chamberlain  
Head of Technical Excellence

Claire Curtis-Thomas  
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](http://www.bbacerts.co.uk)*

*Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.*

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# Regulations

In the opinion of the BBA, Sup-R-Wall, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying 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
Requirement:	A2	Ground movement
Requirement:	A3	Disproportionate collapse
Comment:	Walls formed from the system will have adequate strength and stiffness to satisfy these Requirements. See section 6 of this Certificate.	
Requirement:	B3(1)(2)(3)	Internal fire spread (structure)
Comment:	Walls formed from the system can satisfy this Requirement. See section 8 of this Certificate.	
Requirement:	C2(a)	Resistance to moisture
Comment:	Walls formed from the system can adequately limit the risk of moisture ingress from the ground. See section 10.1 of this Certificate.	
Requirement:	C2(c)	Resistance to moisture
Comment:	The system can contribute to minimising the risk of in-situ and surface condensation. See section 7 of this Certificate.	
Requirement:	E1	Protection against sound from other parts of the building and adjoining buildings
Requirement:	E2(a)	Protection against sound within a dwelling-house etc
Comment:	Walls formed from the system can adequately satisfy these Requirements. See section 13 of this Certificate.	
Regulation:	7	Materials and workmanship
Comment:	The system is acceptable. See section 15 and the <i>Installation</i> part of this Certificate.	



## The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:	The panels can contribute to a construction satisfying this Regulation. See section 15 and the <i>Installation</i> part of this Certificate.	
Regulation:	9	Building standards applicable to construction
Standard:	1.1(a)	Structure
Comment:	Walls incorporating the system will have sufficient strength and stiffness when designed and constructed in accordance with section 6 of this Certificate, with reference to clauses 1.1.1 <sup>(1)</sup> and 1.1.2 <sup>(1)</sup> of this Standard.	
Standard:	1.2	Disproportionate collapse
Comment:	Walls incorporating the panels will have adequate strength and stiffness to satisfy this Standard with reference to clause 1.1.1 <sup>(1)(2)</sup> and, when suitably reinforced, clause 1.2.1 <sup>(1)(2)</sup> . See section 6 of this Certificate.	
Standard:	2.1	Compartmentation
Standard:	2.6	Spread to neighbouring buildings
Comment:	This system used with an appropriate lining can achieve a period of fire resistance of 'medium' duration, with reference to clause 2.6.1 <sup>(1)</sup> of this Standard. See section 8 of this Certificate.	
Standard:	3.15	Condensation
Comment:	The system can adequately limit the risk of surface condensation and can contribute to minimising the risk of interstitial condensation, with reference to clauses 3.15.1 <sup>(1)</sup> to 3.15.4 <sup>(1)</sup> of this Standard. See section 7 of this Certificate.	
Standard:	3.4	Moisture from the ground
Comment:	Walls formed from the system can adequately limit the risk of moisture ingress from the ground. See section 10.1 of this Certificate.	
Standard:	5.1	Noise separation
Standard:	5.2	Noise reduction between rooms
Comment:	Separating walls formed from the system can satisfy these Standards, with reference to clauses 5.1.1 <sup>(1)(2)</sup> , 5.1.2 <sup>(1)(2)</sup> , 5.1.4 <sup>(1)(2)</sup> , 5.1.7 <sup>(2)</sup> , 5.1.8 <sup>(1)</sup> , 5.2.1 <sup>(1)(2)</sup> and 5.2.2 <sup>(1)(2)</sup> . See section 13 of this Certificate.	
Standard:	7.1(a)(b)	Statement of sustainability
Comment:	The system can contribute to satisfying 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. (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).	



## The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation:	23	Fitness of materials and workmanship
Comment:	The system is acceptable. See section 15 and the <i>Installation</i> part of this Certificate.	
Regulation:	28	Resistance to moisture and weather
Comment:	Walls formed from the system can adequately limit the risk of moisture ingress from the ground. See section 10.1 of this Certificate.	

Regulation:	29	Condensation
Comment:		The panels will contribute to minimising the risk of interstitial condensation. See section 7.2 of this Certificate.
Regulation:	30	Stability
Comment:		Walls constructed from the system will have sufficient strength and stiffness when designed and constructed in accordance with section 6 of this Certificate.
Regulation:	31	Disproportionate collapse
Comment:		Walls incorporating the panels will have adequate strength and stiffness to satisfy this Regulation with reference to clause 1.1.1 <sup>(1)(2)</sup> and, when suitably reinforced, clause 1.2.1 <sup>(1)(2)</sup> . See section 6 of this Certificate.
Regulation:	35(1)(2)(3)	Internal fire spread – Structure
Comment:		Walls formed from the system can satisfy this Regulation. See section 8 of this Certificate.
Regulation:	49	Protection against sound from other parts of the building and from adjoining buildings
Regulation:	50(a)(b)	Protection against sound within a dwelling or room for residential purposes
Regulation:	51	Reverberation in the common internal parts of a buildings containing flats or rooms for residential purposes
Comment:		Walls formed from the system can adequately satisfy these Regulations. See section 13 of this Certificate.

## Construction (Design and Management) Regulations 2015

## Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See sections: 3 *Delivery and site handling* (3.1 and 3.2) and 16 *Installation – General* (16.1) of this Certificate.

## Additional Information

### NHBC Standards 2016

NHBC accepts the use of Sup-R-Wall, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapter 3.1 *Concrete and its reinforcement*.

## Technical Specification

### 1 Description

1.1 Sup-R-Wall consists of an outer skin of fibre-cement board (manufactured in accordance with BS EN 12467 : 2012), adhesively fixed using polyurethane-based adhesive to specially designed styrene-butadiene copolymer spacers. The spacers incorporate shaped openings to receive single- or double-layers of reinforcement bars.

1.2 The panels are 200 mm to 1220 mm wide, and 200 mm to 3000 mm high. Their dimensions and additional characteristics are given in Table 1. The spacers come in sizes 75 mm to 200 mm, which dictate the thickness of the single or double walls (see Figure 1).

Table 1 *Sup-R-Wall range*

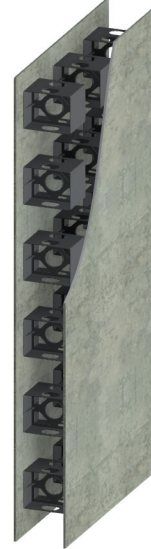
Panel type maximum dimensions (mm)	Fibre-cement board thickness (mm)	Spacer size (mm)	Cavity size (mm)	Overall thickness of wall (mm)	Filled wall mass (kg·m <sup>-2</sup> )	Unfilled wall mass (kg·m <sup>-2</sup> )	Reinforcement carrier
1200 x 3000	6	75	75	87	200.33	17.90	Single
		100	100	112	260.58	18.15	Single
		125	125	137	320.83	18.40	Single
		150	150	162	381.21/382.56	18.80	Single/double
		200	200	212	505.52	20.65	Double



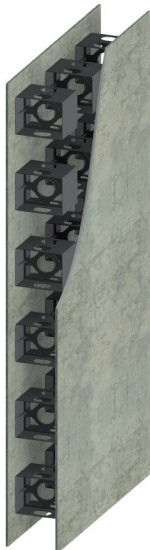
87 mm  
single



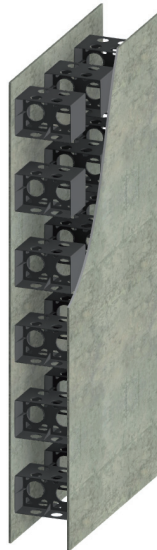
112 mm  
single



137 mm  
single



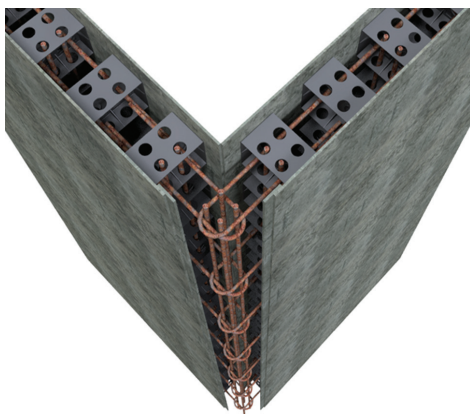
162 mm  
single



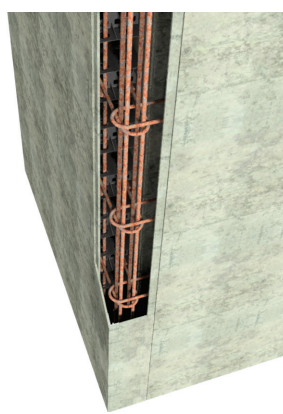
162 mm  
double



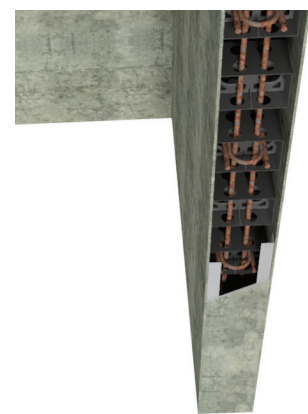
212 mm  
double



corner steel



corner fillet



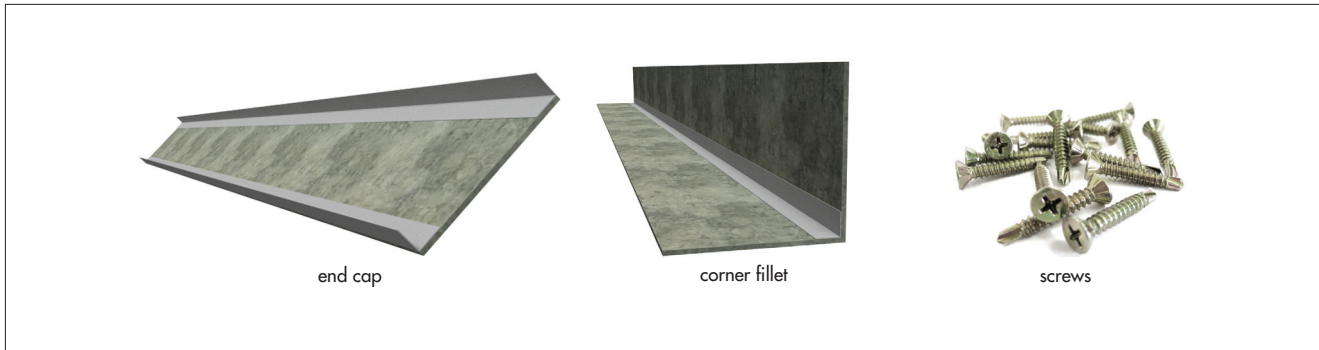
end cap



### 1.3 Ancillary components used as part of the system:

- corner fillet — to form wall corners
- panel end caps — to close the panel ends and finish openings
- sill and lintel panels — used between standard panels to form windows and doors openings
- screws — for mechanically-fixed panel joints and end caps
- panel adhesive — polyurethane-based adhesive for bonding end caps and panel joints
- jointing compound and mesh tape.

Figure 2 Ancillary components used with the standard panels as part of the system



### 1.4 Ancillary items used with the system but outside the scope of this Certificate include:

- concrete — used as the core of the wall and sourced from a QSRMC(1) registered or BSI Kite-marked batching plant or supplier and, typically, be of strength class C25/30 to C35/45 (specified to BS EN 206 : 2013) with a recommended maximum aggregate size of 10 mm. Admixtures should comply with BS EN 934-2 : 2009 or BS EN 480-1 : 2014. Specific concrete mixes are dependent on individual requirements
- steel reinforcement (where required) — should comply with BS 4449 : 2005 and be sourced from a CARES(2) registered supplier. The maximum reinforcing bar size is 16 mm vertically and 20 mm horizontally.

(1) Quality Scheme for Ready Mixed Concrete.

(2) UK Certification Authority for Reinforcing Steel.

### 1.5 Other non-specified components for use with the wall construction, but outside the scope of this Certificate, include:

- foundations — agreed by specifier
- panel lifter — for installation of the Sup-R-Wall panels
- temporary bracing system (push and pull props) — placed as specified by the Certificate holder
- brace screws — for temporary fixing of wall braces to the Sup-R-Wall panels
- masonry bolts — for temporary fixing of wall braces to floor slab
- door frames — fire-rated door frames manufactured with profiles to suit panels
- fire barriers
- external masonry — brickwork or stonework fixed in accordance with BS EN 1996-1-1 : 2005 or BS 8298-2 : 2010 respectively
- external render — in accordance with BS EN 13914-1 : 2016 and suitable for use with the system
- acrylic render — in accordance with BS EN 13914-1 : 2016
- brickwork/stonework ties — to BS EN 845-1 : 2003
- plasterboard internal linings — to BS EN 520 : 2004 and BS 8212 : 1995
- internal taping and jointing — to BS EN 520 : 2004
- external insulation systems in accordance with ETAG 004 : 2013.

## 2 Manufacture

2.1 The panels are manufactured using traditional manufacturing techniques under controlled factory conditions.

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.

### 3 Delivery and site handling

- 3.1 The panels are delivered on vehicles suitable for the panels and the sites involved. The Certificate holder can supply a metal pallet-lifter frame which can be placed around each pallet to allow for easier off-loading and placement by the crane.
- 3.2 Good site practices should be observed to prevent damage to the panels during construction. Depending on the size of the panels, three to four people will be needed to remove the panels from the pallets and to transport them to the fixing location. The panels are ready to install once removed from the pallets.
- 3.3 Panels are stacked in sequence according to schedules prepared from the construction drawings; each panel has a numbering or barcode system and are coded for ease-of-identification on site to facilitate both construction and reinforcement bar installation where appropriate. Panels should be stacked flat.
- 3.4 Panels should be moved (still on their pallets) to their destination (for storage/build) and placed off the ground on timber bearers. Where packs are stacked on top of each other, bearers must be kept in line and should be thick enough to allow ease-of-access for the crane for placement.
- 3.5 Once the panels are delivered to site they should be protected from the elements prior to installation. If the panels are to be left on site for long periods, they should be stored under cover and protected from rain and sunlight.
- 3.6 All ancillary items should be stored under cover and in dry conditions until required for use.

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Sup-R-Wall.

### Design Considerations

#### 4 Use


- 4.1 The Sup-R-Wall system is satisfactory for use as permanent formwork in loadbearing and non-loadbearing reinforced and unreinforced concrete external, internal and separating walls in domestic and commercial buildings, subject to design limitations regarding height, load and fire risk. Use in any structure is subject to design limitations in accordance with national Building Standards.
- 4.2 The system has not been assessed for use below ground (such as basement construction), where a watertight construction and resistance to hydrostatic pressure from ground water or other liquids is required. Use in this situation is therefore outside the scope of this Certificate.
- 4.3 Foundations are outside the scope of this Certificate but must be adequate to support the intended loads.

#### 5 Practicability of installation

The system is designed to be installed by builders who have been trained and approved by the Certificate holder.

#### 6 Structural performance

##### General

-  6.1 The system is satisfactory for use in loadbearing and non-loadbearing wall as permanent formwork for in-situ dense aggregate concrete.
- 6.2 Structures incorporating the system which are subject to the national Building Regulations must be designed in accordance with the relevant sections of BS EN 1992-3 : 2006, BS 8102 : 2009, BS EN 1992-1-1 : 2004, BS EN 1991-1-4 : 2005 and BS EN 1992-1-2 : 2004, and be approved by a suitably-qualified and experienced individual.
- 6.3 Other walls not subject to national Building Regulations should also be built in accordance with the Standards listed in 6.2.
- 6.4 After installation, the concrete is not readily examined after casting. Care, therefore, must be taken to ensure full compaction is achieved, as specified in BS EN 1992-1-1 : 2004.
- 6.5 Permanent formwork is normally constructed in a continuous lift of one storey (see section 1.8). Particular care is necessary to maintain alignment during concrete filling, and checking between each lifts is necessary. A suitable propping system (see section 6.10) must be used in conjunction with the formwork. The supports are checked prior to, and during, the concrete pour to ensure stability and alignment is maintained.
- 6.6 Generally, facing brickwork or stonework should be attached using suitable wall ties that are fixed through the fibre cement board and into the concrete core with suitable fixings (see section 1.5), to the depth recommended by the wall tie manufacturer.
- 6.7 Heavy attachments (eg, balcony, staircase), fixed either internally or externally, must be attached via support systems designed to take account of the applied load, using suitable fixings or cast into the concrete core.

## Strength and stability



6.8 Walls constructed using the formwork may be treated as conventional unreinforced or reinforced concrete walls. Particular attention should be made to the type of concrete mix used to ensure segregation does not occur and that wet concrete is allowed to flow freely around the panel spacers, formed openings and congested areas of reinforcement.

6.9 The nominal concrete cover to reinforcement should be that appropriate to exposure classes X0 and XC1 as described in BS 8500-1 : 2015 and BS EN 206 : 2013.

6.10 To achieve a structurally stable formwork during the construction process, the formwork must be braced sufficiently to resist the loads placed on the system by the wet concrete and other construction loads. A system of temporary bracing should be designed to give lateral support during the pouring of the concrete and curing stage. The Certificate holder recommends that propping is provided at maximum 1.1 metre centres, or less when openings are formed in the wall. All soffits to openings should be fully supported until the concrete has attained the minimum required strength. Concrete should be poured in layers, as described in section 18.11.

## 7 Risk of condensation

### Surface condensation



7.1 External walls will adequately limit the risk of surface condensation. Openings in walls and junctions with other elements, designed in accordance with the relevant guidance given in section 11, will also be acceptable.

### Interstitial condensation



7.2 Subject to the construction used and amount of vapour being produced, the risk of interstitial condensation will be minimal. Any vapour build-up will be low and will dissipate during the summer months.

## 8 Behaviour in relation to fire



8.1 The formwork elements are non combustible. For buildings in Scotland, completed walls with appropriate finishes can satisfy the required durations of fire resistance and, therefore, may be used in separating walls.

Where combustible materials are incorporated in external walls and are one metre or less from a relevant boundary, the construction should comply with the relevant exceptions on the use of combustible materials permitted by the guidance supporting the Building Regulations in Scotland.

8.2 The risk of fire spread over the internal wall surface will depend on the finishes that are used, and the relevant requirements of the national Building Regulations should be observed.

8.3 To limit the risk of fire spread between floors in buildings where the system is used as part of a cavity wall construction, fire barriers should be installed at each floor level above the first floor (ie, starting at the second storey). Fire barriers should completely seal any cavity.

8.4 Care should be taken to ensure that all detailing at junctions (including external walls, separating walls and walls/floors) adequately maintain the required period of fire resistance. Any cavities formed in the completed walls or service entry points must be appropriately fire-stopped, and detailing around any openings must provide sufficient protection to the formwork. The formwork on the interior face must be discontinuous across wall and floor junctions.

8.5 Reinforced concrete walls constructed from the system can be assessed in accordance with BS EN 1992-1-1 : 2004, Table 5.4 (where fire resistance values for various reinforced concrete wall thicknesses formed using the elements are shown). Fire resistance values achievable using the system are given in Tables 2 and 3 of this Certificate, subject to cover and design load considerations. The tabulated values do not take account of any additional protection provided by the internal and external finishes.

*Table 2 Fire-resistant values for minimum concrete core wall thicknesses (partitions only)<sup>(1)</sup>*

Standard fire resistance (minutes)	Minimum wall thickness (mm)
30	60
60	80
90	100
120	120

(1) As per BS EN 1992-1-2 : 2004, Table 5.3.

Table 3 Minimum concrete core thickness for loadbearing reinforced concrete walls (Firewall elements only)<sup>(1)</sup>

Standard fire resistance	Minimum dimensions (mm)			
	Wall thickness/axis distance <sup>(2)</sup> for:			
	$\mu_{fi}^{(3)} = 0.35$		$\mu_{fi}^{(3)} = 0.27$	
	Wall exposed on one side	Wall exposed on two sides	Wall exposed on one side	Wall exposed on two sides
30	100/10 <sup>(4)</sup>	120/10 <sup>(4)</sup>	120/10 <sup>(4)</sup>	120/10 <sup>(4)</sup>
60	110/10 <sup>(4)</sup>	120/10 <sup>(4)</sup>	130/10 <sup>(4)</sup>	140/10 <sup>(4)</sup>
90	120/20 <sup>(4)</sup>	140/10 <sup>(4)</sup>	140/25	170/25
120	150/25	160/25	160/35	220/35
180	180/40	200/45	210/50	370/55
240	230/55	250/55	270/60	350/60

(1) As per BS EN 1992-1-2 : 2004, Table 5.4.

(2) Centre of reinforcement to nearest exposed surface.

(3) The  $\mu_{fi}$  is the reduction factor for the load level in a fire situation in accordance with BS EN 1992-1-2 : 2004, Section 5.3.2<sup>(3)</sup>.

(4) Normally, the cover specified in BS EN 1992-1-1 : 2004 will control this distance.

The minimum thickness for normal weight concrete should not be less than:


- 200 mm for unreinforced wall
- 140 mm for reinforced load-bearing wall
- 120 mm for reinforced non-loadbearing wall

and the axis distance of the load-bearing wall should be not less than 25 mm.

## 9 Weathertightness

Resistance to rain ingress is provided by the external finishes and has not been assessed by the BBA. The design and construction of external wall finishes used with Sup-R-Wall must comply with good practices and the relevant codes, national Standards, Building Regulations and Certificate holder's instructions.

## 10 Damp-proofing and waterproofing

 10.1 The formwork elements will not transmit moisture by capillary action. The concrete wall formed with the system should be constructed using the specified concrete recommended by the Certificate holder (see section 1.4).

10.2 Window and door openings and penetrations of the concrete (such as pipe entries of formwork ties) must also be securely sealed to maintain watertightness. The advice of the Certificate holder should be sought on suitable details.

## 11 Proximity of flues and appliances

When installing the system in close proximity to certain flue pipes and/or heat-producing appliances, the following provisions to the national Building Regulations are acceptable:

**England and Wales** — Approved Document J3

**Scotland** — Mandatory Standards 3.18, clause 3.18.5<sup>(1)</sup>, and 3.19, clause 3.19.4<sup>(1)</sup>

(1) Technical Handbook (Domestic).

**Northern Ireland** — Technical Booklet L.

## 12 Airtightness

12.1 Buildings can achieve adequate resistance to heat loss by air infiltration provided there is effective sealing around junctions between units during site assembly.


12.2 In England, Wales and Northern Ireland, completed buildings are subject to pre-completion testing for airtightness in accordance with the requirements of:

**England and Wales** — Approved Document L1A (section 43) L2A (section 20B)

**Northern Ireland** — Technical Booklet F1 (Sections 2.59 to 2.69) and F2 (Sections 2.72 to 2.77).

12.3 In Scotland, completed dwellings are subject to testing of air permeability in accordance with the requirements of mandatory Standard 6.2 (clause 6.2.5). Alternatively, where a default design value of  $15 \text{ m}^3 \cdot \text{h}^{-1} \cdot \text{m}^{-2}$  at 50 Pa is stated in demonstrating compliance under mandatory Standard 6.1, testing is not required.

## 13 Sound insulation

 13.1 In England and Wales, separating walls are subject to pre-completion testing in accordance with Approved Document E, Section 1. A similar approach is described in the Scottish Building Standards, section 5.1.2<sup>(1)(2)</sup>, and the Building Regulations (Northern Ireland), Document G.

13.2 Internal walls and walls flanking separating walls in new dwellings and rooms for residential purposes should have a minimum mass per unit area, excluding finishes, in excess of  $120 \text{ kg} \cdot \text{m}^{-2}$ .

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).



## 14 Maintenance and repair

Minor repairs to the formwork can be carried out prior to concrete pouring using expanded foam, to reduce leakage of wet concrete and maintain the integrity of the system.

## 15 Durability



Concrete walls constructed with the system can have a service life of 60 years provided they are designed in accordance with section 6. The formwork system will have a similar service life provided it is protected from damage by the external and internal finishes of the wall construction (ie, a 'mild' exposure environment) and the finishes are adequately maintained.

## Installation

### 16 General

16.1 Installation of the Sup-R-Wall is carried out in accordance with the Certificate holder's installation instructions, by trained and approved operatives and the requirements of BS 5975 : 2008 and BS 8000-2.1 : 1990. Supervision during placing and compacting of the concrete must be provided.

16.2 Concrete must be compacted in accordance with the requirements of BS EN 1992-1-1 : 2004.

16.3 The temperature of the concrete being placed must be between 5°C and 30°C. In air temperatures below 5°C or above 25°C, the top of the formwork should be protected to aid curing after completion of concreting.

### 17 Preparation

17.1 The preparation, installation and temporary support of the formwork system must be in accordance with the Certificate holder's installation instructions.

17.2 The foundation must be level and within an accuracy tolerance of  $\pm 10$  mm in any direction. Any out-of-tolerances adjustments must be made prior to placement of formwork.

### 18 Procedure

#### Wall assembly

18.1 Prior to Sup-R-Wall panels being placed, timber supports are fixed (before standing the panels upright — see Figure 3). The bottom timber support (kicker assembly — see Figure 3) needs to run along the bottom edge of the Sup-R-Wall panels to a minimum height of 150 mm. Timber supports must be fixed firmly to the ground using concrete screw bolts (as recommended by the Certificate holder). The panels must be properly supported to protect them against lifting. If the panel is being erected at the slab edge, refer to Figure 4.

Figure 3 Kicker assembly

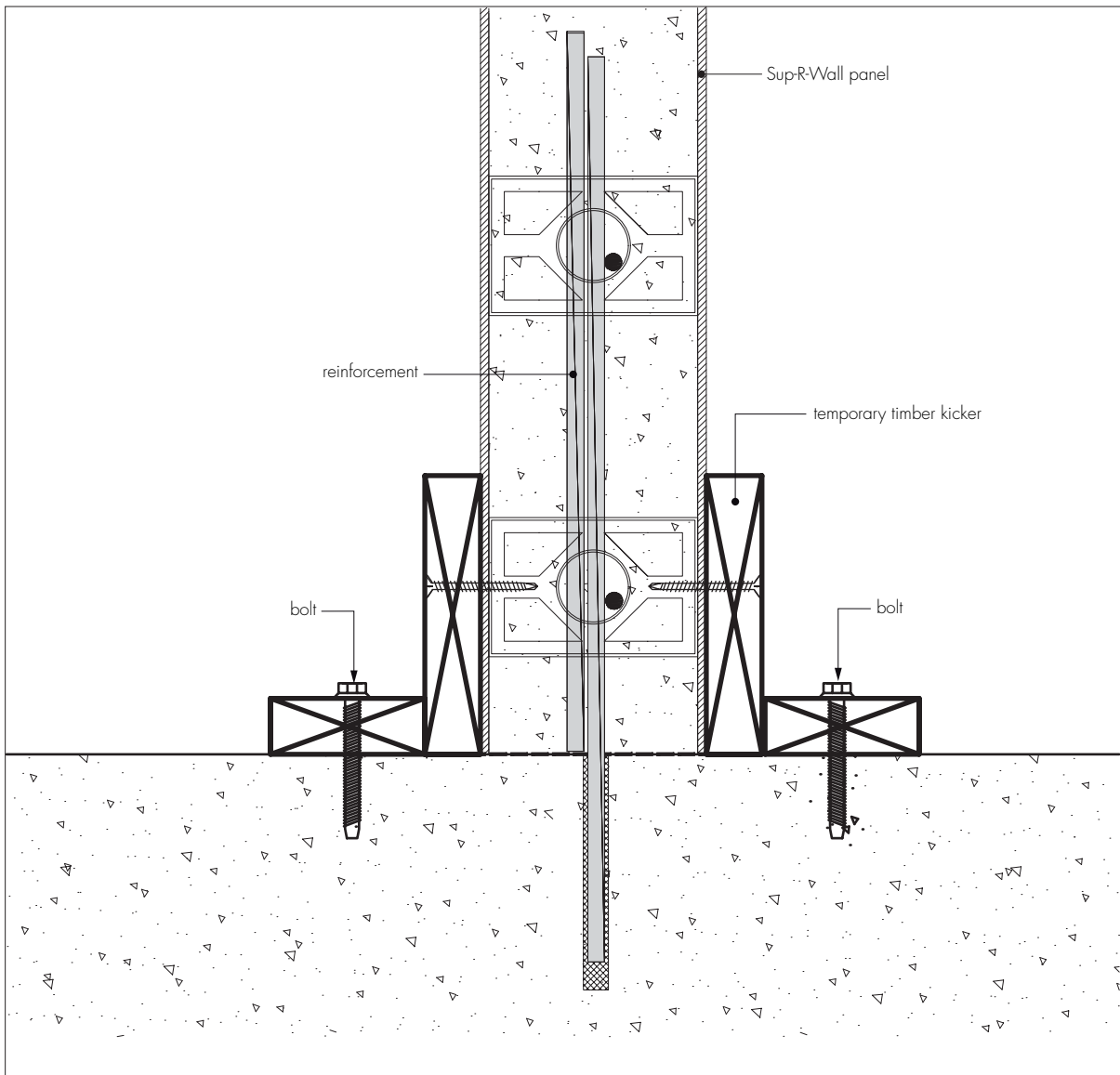
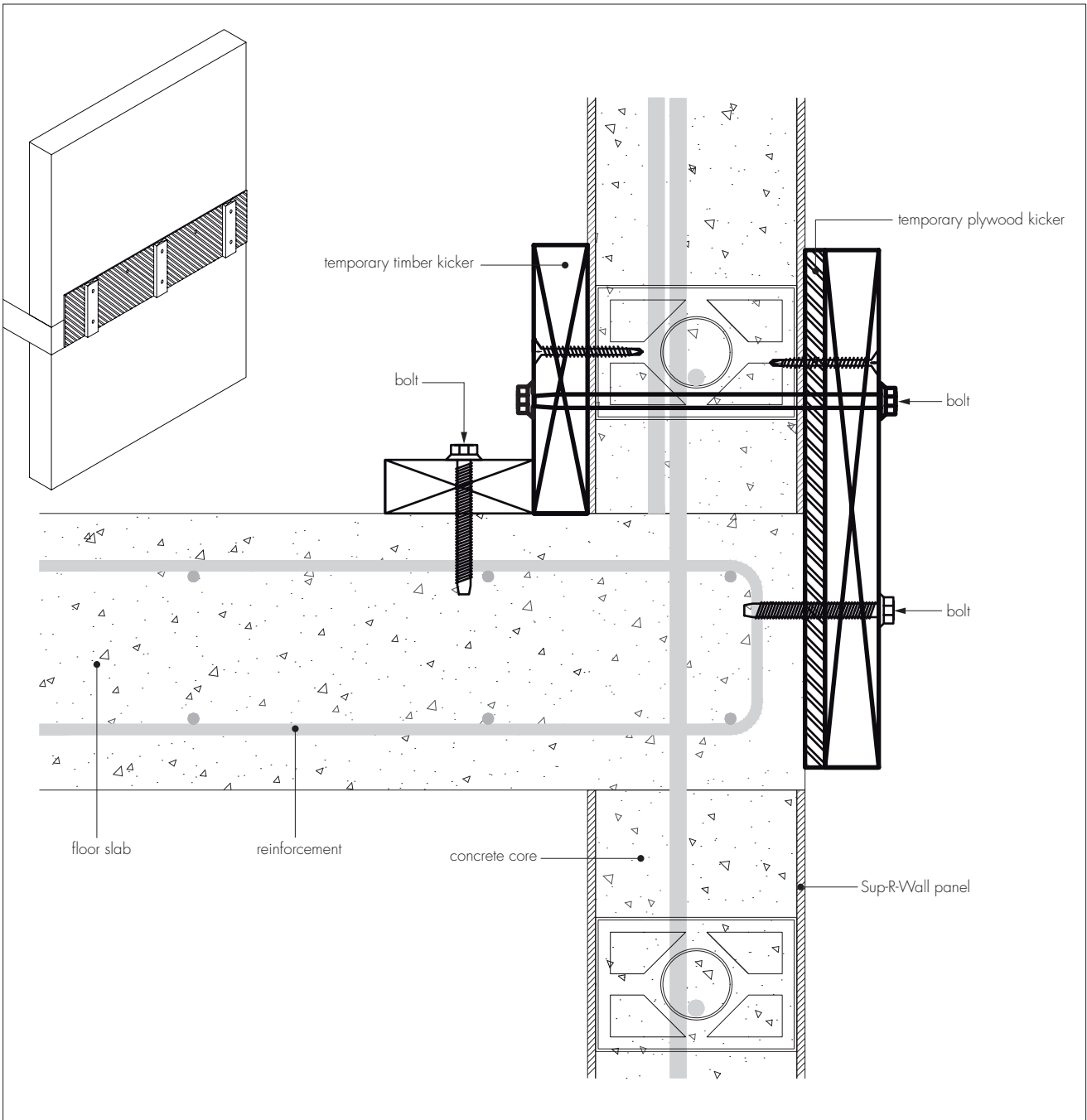
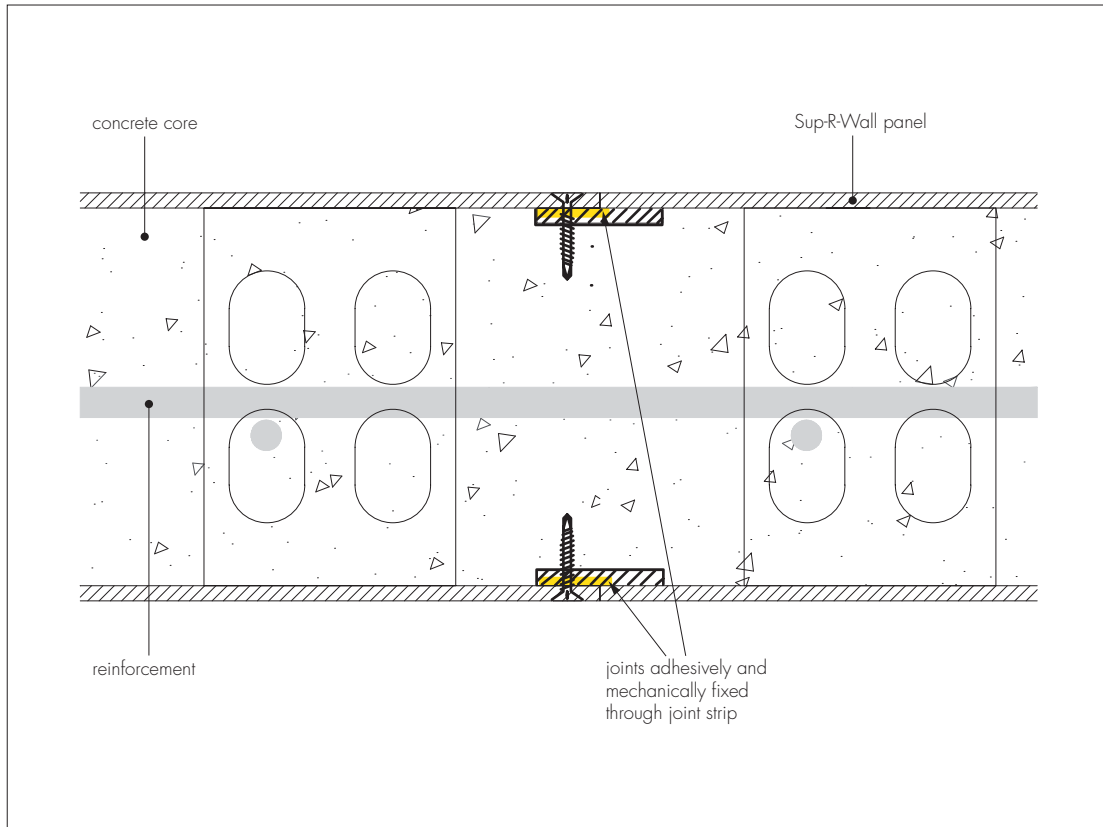


Figure 4 Kicker assembly at floor slab edge



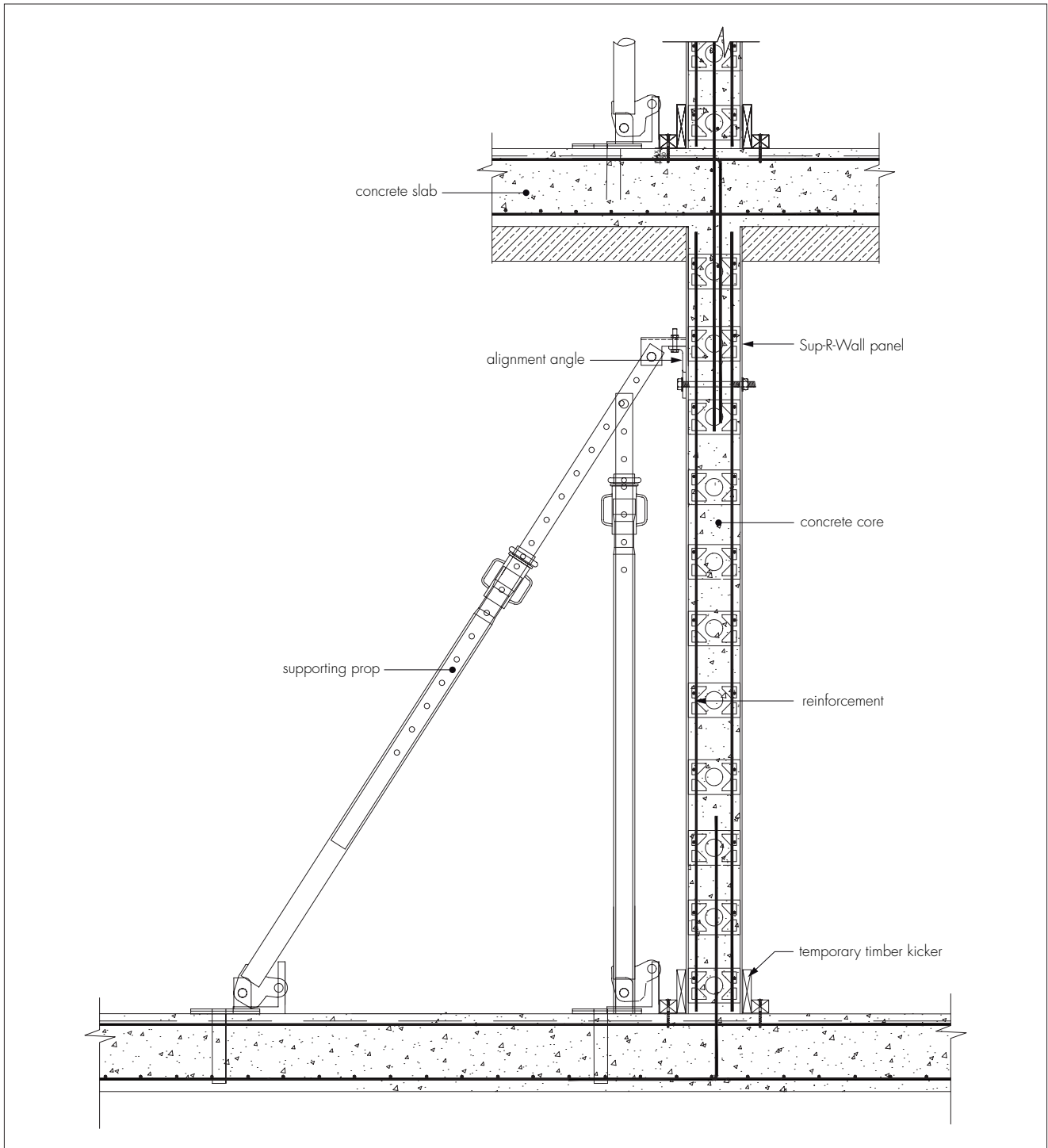
18.2 Once the Sup-R-Wall panels are erected and placed into the kicker assembly to fix them together, one panel must be slid into the other so that joints are fully closed. The vertical joint areas on the panels must overlap each other so that no more than a 1 to 2 mm gap (maximum) is left between the panels once they are joined together. Prior to joining panels, a bead of glue must be placed along all joints. Each panel is screwed together at the joints with the specified screws at the recommended spacing of 200 mm maximum — see Figure 5.

Figure 5 Panel joint



18.3 Where necessary, panels can be propped with push and pull props, first fixed to the floor and then fixed to the panel or onto the bracing timber (see Figure 6). Extra bracing must be provided at corner sections and T-junctions or wherever a weakness may occur. Panels requiring extra bracing will be identified with a red mark. It is important to ensure the additional bracing is not limited to the areas with a red mark and that the whole panel is properly braced.

Figure 6 Bracing detail



18.4 At the panel openings for windows, the bottom section wall of the window opening is positioned first, similar to how the large panels were placed. The joints are glued and screwed. The top header section is positioned in the same manner. A full panel is then placed alongside to complete the window opening.

18.5 All corner openings must be left open. This allows for the placement of the reinforcement bar. Once the reinforcement bar has been placed, all corner openings must be closed. Special corner closures and gap closures are provided with the wall panels. Window and door heads and jambs need to be closed prior to pouring. The bottom wall section of the window panels must remain open during the pour. This allows the concrete to come fully up to the window bottom sill. Closing openings can be done with the pre-formed closers supplied.

18.6 Openings cut out on-site are outside the scope of the Certificate.

### Reinforcement bar placing

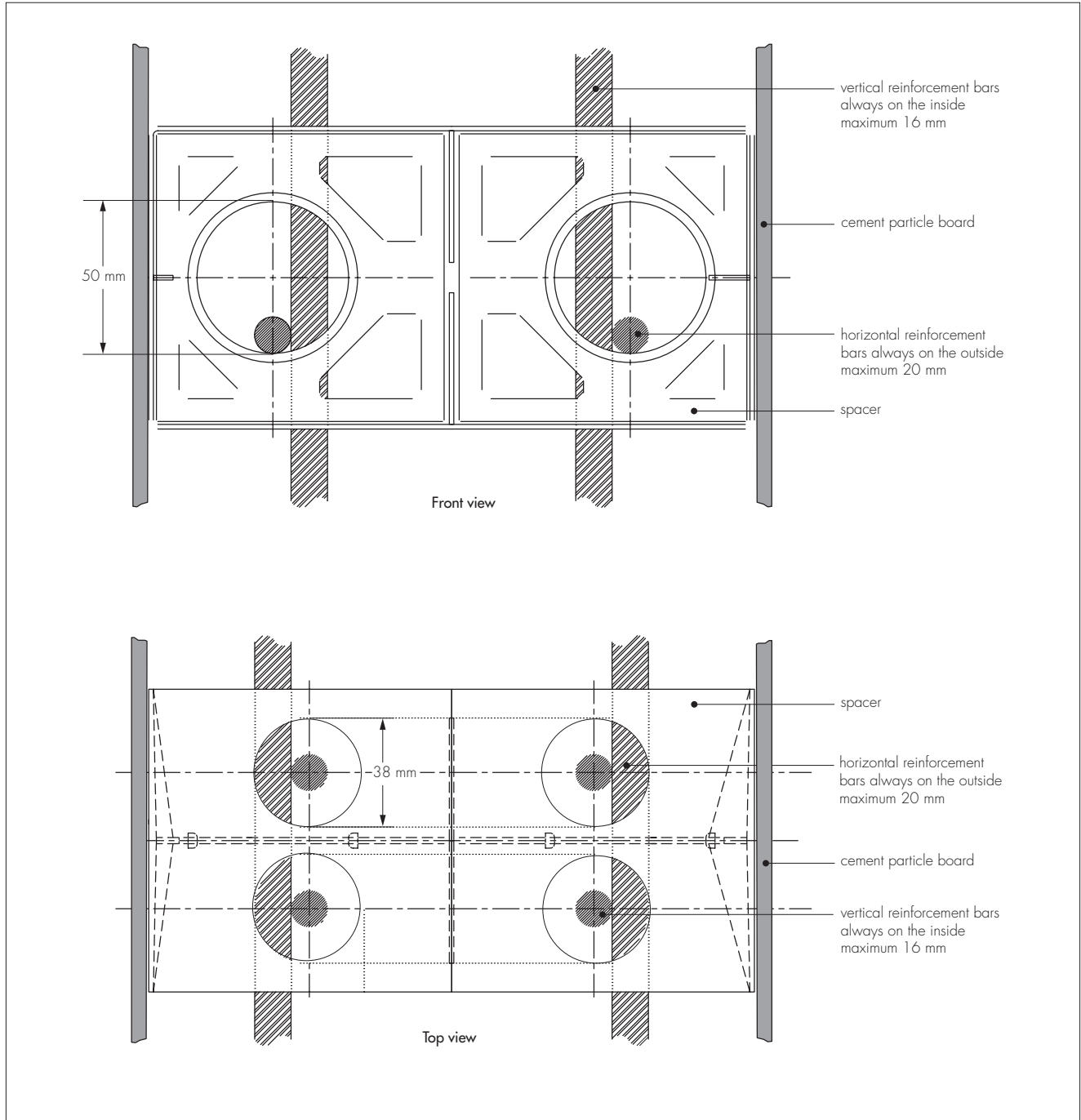
18.7 Once the required number of panels are standing, it must be ensured that the wall is straight and plumb. The horizontal reinforcement bar needs to be placed first into the styrene-butadiene copolymer spacers within the wall panels to the specification required, followed by the vertical reinforcement bar and U-bars, etc.



18.8 The spacers are designed with holes to accommodate the vertical reinforcement bar and ensure its proper placing within the wall panel and to keep position during the pour (see Figure 7 and 8). This allows for the correct level of concrete cover without the need for tying-in the reinforcement bar. Always ensuring that the horizontal reinforcement bar is aligned to the outside face of the wall in relation to the vertical bar.

18.9 The holes in the spacer's holes are adequate to accommodate a wide range of reinforcement designs but it will be limited by the spacer's holes' diameters. It is recommended the reinforcement bar is installed at 200 mm or 400 mm centres (spacers are installed at 200 mm centres within the panel) both vertically and horizontally. The maximum reinforcement bar size is 16 mm in diameter vertically and 20 mm in diameter horizontally.

Figure 7 Placement of reinforcement bars into the spacers



### Preparations before pouring the concrete

18.10 Once the construction is complete, all Sup-R-Wall panel openings and ends are closed. Prior to concrete pouring, a check is carried out on the system to ensure conformity to design and layout, correct alignment and plumb, and that bracings and props are secured. All joints must be checked, making sure they have been properly glued and screwed. Where reinforcement is only provided above openings, the individual bars should extend at least 500 mm beyond the opening span.

## Concrete placement

18.11 When pouring using a concrete pump, the preferred method is via a nozzle with a diameter of 65 mm, but not exceeding 100 mm.

18.12 The concrete pumping rate should be such that excessive pressure does not occur. The weight of concrete created from the drop (fall) of pumping needs to be reduced by the following:

- concrete needs to be a loose pump mix with a 10 mm aggregate maximum (6 to 10 mm recommended and 125 to 175 mm slump)
- concrete mix should have a plasticizer to increase slump and flow to minimise vibration required
- self-compacting concrete recommended to reduce vibration required
- concrete strength to be specified by structural engineer
- the hose should not be held directly over the wall, and instead held a distance from the wall and brought across the end of the hose on a right angle to the wall. This reduces the pressure from the concrete and takes the power out of the drop.

18.13 Concrete core filling is undertaken in passes, not exceeding 800 mm in height for the first pass, a further 800 mm for the second pass and another 800 mm maximum for subsequent passes. However, this may vary depending on temperature, workability of the concrete being poured and the thickness of the wall being core filled. Concrete should be allowed to achieve its initial set before commencing the placement of the next layer of concrete. Particular care should be taken when core-filling corners, lintels and sills.

18.14 Typical completed construction details are shown in Figure 8 and 9.

## 19 Finishing

### Fixings

19.1 Suitably durable and mechanically-adequate fixings, reinforcing starter bars or support brackets must be used for all structural elements (eg, floors and roofs) and must be post-drilled or cast into the concrete core.

### Electrical and plumbing

19.2 Electrical and plumbing services can be placed within the formwork. All electrical services should be ducted. Any services introduced should conform to Building Regulation and Health and Safety requirements. Further details on fixing methods can be obtained from the Certificate holder.

### Wall penetrations

19.3 Sleeves for ducts or service penetrations may be positioned within the formwork prior to concrete pouring. Service entry points to basement walls should be avoided. All service entry points should be sealed to prevent ingress of water, dampness or vermin.

### Internal wall finishes

19.4 A range of internal finishes can be applied or fixed directly to the system, subject to fire restrictions. Where conventional dry lining systems are used, they should be fixed into the concrete core.

### External wall finishes

19.5 External cladding must be supported by means of a system compatible with the specified cladding and the wall's construction. Masonry systems may be supported by wall ties cast into the concrete core of the wall; timber or panel claddings may be supported by batten and rail systems pinned back to the concrete core.

Figure 8 Typical construction detailing

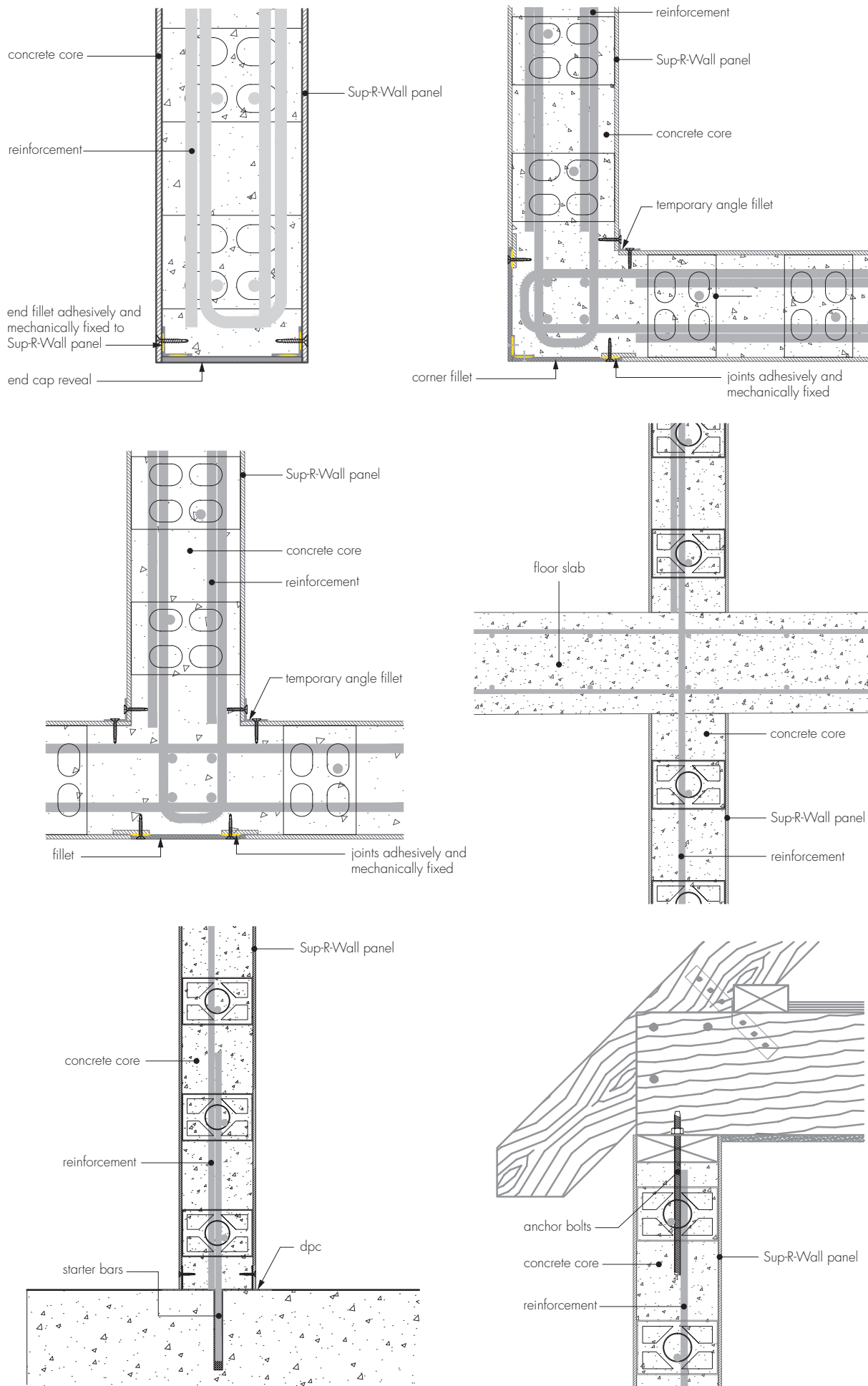
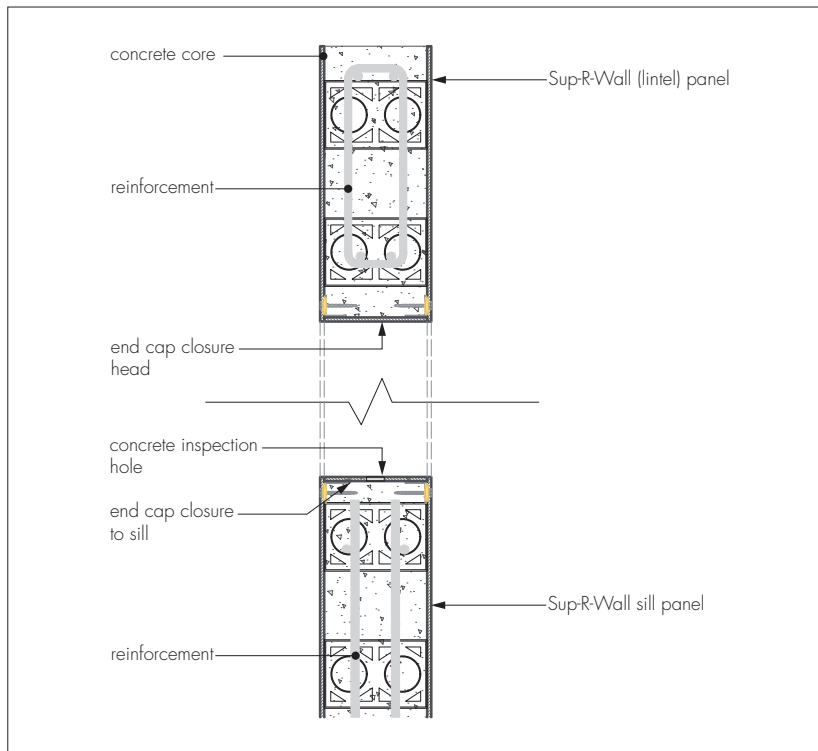


Figure 9 Typical opening detailing



## Technical Investigations

### 20 Tests

20.1 Tests were conducted and the results assessed to determine:

- determination of tensile strength of spacer/fibre cement board
- determination of density of spacer.

20.2 An assessment was made of data relating to:

- component characterisation (panels/spacers)
- density of fibre cement board
- resistance to freeze/thaw of the fibre cement board
- soak -dry test strength of the fibre cement board
- warm water test of the fibre cement board
- water impermeability of the fibre cement board
- density of the fibre cement board
- surface spread of flame tests to BS 476-4 : 1970, BS 476-6 : 1989 and BS 476-7 : 1997.

### 21 Investigations

21.1 A site visit was carried out to witness the installation process, including construction of formwork, placement of reinforcement and pouring of concrete and overall performance of the formwork.

21.2 An assessment was made on technical data relating to:

- Strength performance of panel to hydrostatic pressure for wet concrete
- Strength characteristics of adhesive to resist hydrostatic pressure.

21.3 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained on the quality and composition of materials used.

## Bibliography

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- BS 476-6 : 1989 + A1 : 2009 *Fire tests on building materials and structures — Method of test for fire propagation for products*
- BS 476-7 : 1997 *Fire tests on building materials and structures — Method of test to determine the classification of the surface spread of flame of products*
- BS 4449 : 2005 + A3 : 2016 *Steel for the reinforcement of concrete — Weldable reinforcing steel — bar, coil and de-coiled product — Specification*
- BS 5975 : 2008 + A1 : 2011 *Code of practice for temporary works procedures and the permissible stress design of falsework*
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- ETAG 004 : 2013 *Guideline for European Technical Approval of External Thermal Insulation Composite Systems (ETICS) with Rendering*



## 22 Conditions

22.1 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
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

22.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

22.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- 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.

22.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

22.5 In issuing this Certificate, the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

22.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.