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Agrément Certificate
14/5119
Product Sheet 1

AFS PERMANENT SHUTTERING SYSTEM

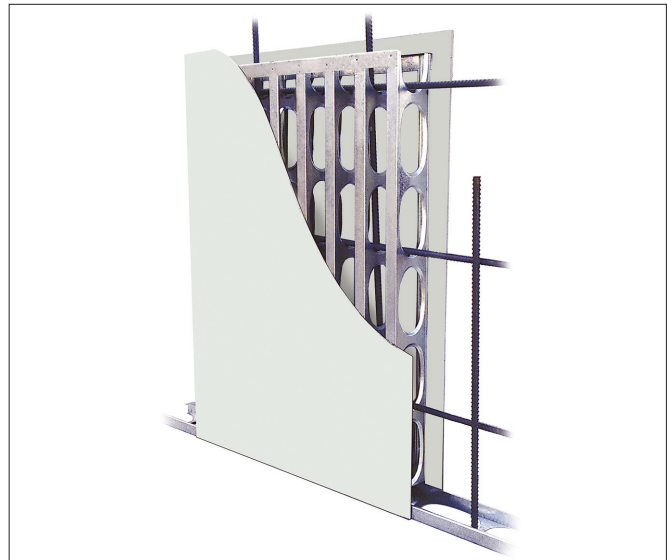
AFS LOGICWALL

This Agrément Certificate Product Sheet⁽¹⁾ relates to AFS Logicwall, a permanent formwork shuttering system comprising cement-fibre outer boards with galvanized steel core studs as permanent in-situ concrete aggregate formwork for use as loadbearing and non-loadbearing plain or reinforced concrete external, internal and separating walls in dwellings and buildings of similar occupancy.

(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 or BS 8110-2 : 1984 (see section 8).

Sound insulation — separating and internal walls formed from the system with a 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 at least 80 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: 2 May 2014

A handwritten signature in black ink that reads 'B Chamberlain'.

Brian Chamberlain
Head of Approvals — Engineering

A handwritten signature in black ink that reads 'Claire'.

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

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, the AFS Logicwall, 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
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 sections 6.1 to 6.10 of this Certificate.
Requirement:	B3(1)(2)(3)	Internal fire spread (structure)
Comment:		Walls formed from the system can meet this Requirement. See sections 8.1 to 8.5 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:	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 meet these Requirements. See sections 13.1 and 13.2 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The system is acceptable. See sections 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 meeting this Regulation. See sections 14, 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 sections 6.1 to 6.10 of this Certificate, with reference to clauses 1.1.1 ⁽¹⁾ and 1.1.2 ⁽¹⁾ 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 ⁽¹⁾⁽²⁾ and, when suitably reinforced, clause 1.2.1 ⁽¹⁾⁽²⁾ . See sections 6.1 to 6.10 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 ⁽¹⁾ of this Standard. See sections 8.1 to 8.5 of this Certificate.
Standard:	3.15	Condensation
Comment:		The system can adequately limit the risk of surface condensation and will contribute to minimising the risk of interstitial condensation, with reference to clauses 3.15.1 ⁽¹⁾ to 3.15.4 ⁽¹⁾ of this Standard. See sections 7.1 and 7.2 of this Certificate.
Standard:	5.1	Noise separation
Standard:	5.2	Noise reduction between rooms
Comment:		Separating walls formed from the system satisfy these Standards, with reference to clauses 5.1.1 ⁽¹⁾⁽²⁾ , 5.1.2 ⁽¹⁾⁽²⁾ , 5.1.4 ⁽¹⁾⁽²⁾ , 5.1.7 ⁽²⁾ , 5.1.8 ⁽¹⁾ , 5.2.1 ⁽¹⁾⁽²⁾ and 5.2.2 ⁽¹⁾⁽²⁾ . See sections 13.1 and 13.2 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The system 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. (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2012

Regulation:	23	Fitness of materials and workmanship
Comment:		The system are acceptable. See section 15, and the <i>Installation</i> part of this Certificate.
Regulation:	29	Condensation
Comment:		The panels will contribute to minimising the risk of interstitial condensation. See section 7.1 and 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 sections 6.1 to 6.10 of this Certificate.
Regulation:	31	Disproportionate collapse
Comment:		Walls incorporating the panels will have adequate strength and stiffness to satisfy this Standard with reference to clause 1.1.1 and, when suitably reinforced, clause 1.2.1. See sections 6.1 to 6.10 of this Certificate
Regulation:	35(1)(2)(3)	Internal fire spread – structure
Comment:		Walls formed from the system can meet this Regulation. See sections 8.1 to 8.5 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 meet these Regulations. See sections 13.1 and 13.2 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* (3.2) and 16 *Installation – General* (16.1) of this Certificate.

Additional Information

NHBC Standards 2014

NHBC accepts the use of AFS Logicwall, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*.

Technical Specification

1 Description

1.1 AFS Logicwall system consists with outer skins of cement particle board, manufactured in accordance with BS EN 12467 : 2012, bonded to galvanized steel studs using adhesive. Studs are located at 146 mm centres and incorporate shaped openings within the webs to receive single or double layers of reinforcing bar.

1.2 The standard panel width is 1100 mm but can be manufactured to any width between 200 mm and 1100 mm. Panel heights are available from between 200 mm to 4200 mm. The characteristics and dimensions of the panels are given in Table 1.

Figure 1 Panel range

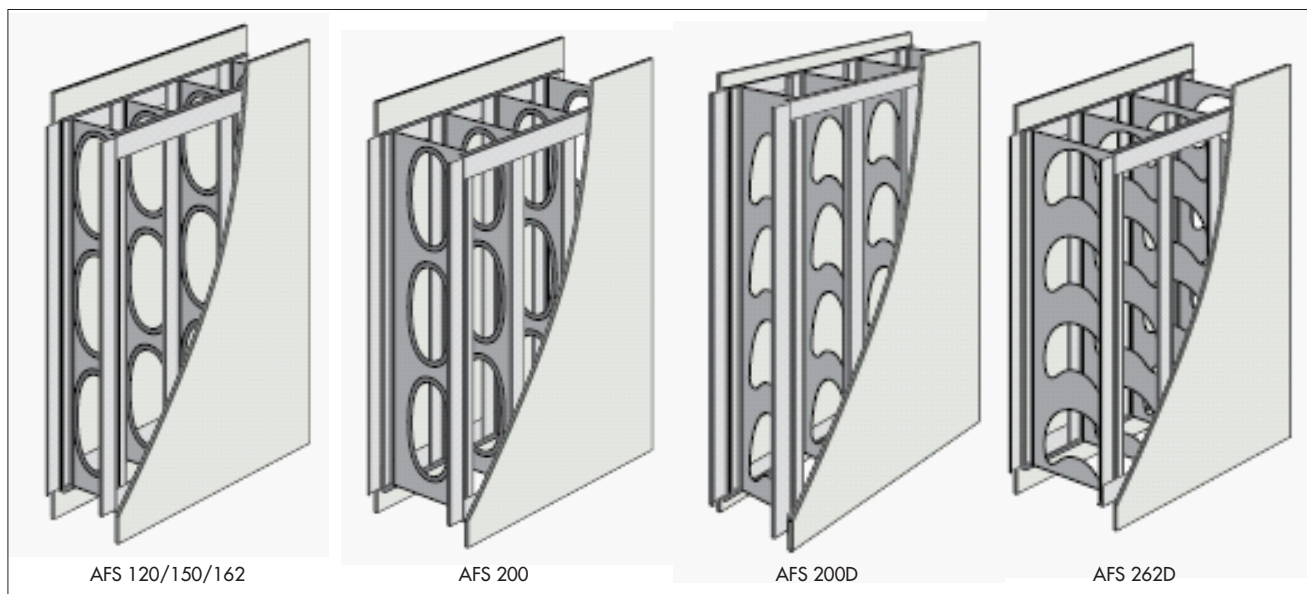


Table 1 Logicwall Range

Panel type	Particle board thickness (mm)	Stud width (mm)	Stud centres (mm)	Cavity size (mm)	Overall thickness (mm)	Filled wall mass (kg·m ²)	Unfilled wall mass (kg·m ²)	Reinforcement carrier
AFS120	6	108	146	108	120	290	26	single
AFS150	6	136	146	136	148	360	26.5	Single
AFS162	6	150	146	150	162	394	26.5	Single
AFS200	6	188	146	188	200	480	27	Single
AFS200D	6	188	146	188	200	480	27	Double
AFS262D	6	250	146	250	262	630	27.5	Double

1.3 Other components (see Figure 2) used with the standard panel as part of the system include:

- Corner panel
- Sill and lintel panel — used between standard panels to form window and door openings
- Floor track and pins— for fastening floor track to slab with pin fasteners to secure the panel to the slab or footing
- Panel end caps — to close the panel ends and finish windows and door openings
- Squints — temporary galvanised angle used for providing temporary additional support where walls change direction at angles other than 90°
- Screws — for mechanically fixing panel joints, end caps and panels to floor track
- Panel adhesive — for bonding end caps, floor track and panel joints.

Figure 2 Ancillary components



1.4 Ancillary items specified for use the system but outside the scope of this Certificate include:

- Concrete — used as the core of the wall and sourced from QSRMC⁽¹⁾ registered or a BSI Kite-marked batching plant or supplier. Typically the strength class C25/30 to C35/45 specified to BS EN 206-1 : 2000 with a recommended aggregate size 10 mm. Admixtures should comply with BS EN 934-2 : 2001 or BS EN 480-1 : 2006. Specific concrete mixes are dependent on individual requirements.
- Steel reinforcement — where required, should comply with BS 4449 : 2005 and sourced from a CARES (UK Certification Authority for Reinforcing Steel) registered supplier

(1) Quality Scheme for Ready Mixed Concrete

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

- Foundations — agreed by specifier
- Panel lifter — for installation of AFS Logicwall panels
- Temporary bracing system — as specified by the Certificate holder
- Brace screws — for temporary fixing of wall braces to AFS Logicwall panels
- Excalibur bolts — for temporary fixing of wall braces to floor slab
- Door frames — fire rated door frames manufactured with profile to suit panels
- Fire barriers
- External masonry — brickwork or stonework fixed in accordance with the provisions of BS EN 1996-1-2 : 2005 or the appropriate part of BS 8298 : 2010 respectively
- External render — in accordance with BS EN 13914-1 : 2005 and suitable for use with the system
- Acrylic render — suitable acrylic render products, in accordance with BS EN 13914-1 : 2005 for use with the system
- Brickwork/stonework ties — to BS EN 845-1 : 2003
- Plasterboard internal linings — to BS EN 520 : 2004 and BS 8212 : 1995.

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 these panels and the sites involved.

3.2 Good site practice should be observed to prevent damage to the panels during construction. The panels can withstand the normal loads associated with site handling and installation.

3.3 Panels are stacked in sequence according to schedules prepared from the construction drawings and each panel is shop drawn and coded for identification on site. Panels should be stacked flat unless agreed by the Certificate holder.

3.4 Panels should be moved to location 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 also be thick enough to allow insertion by crane onto the floor slab ready for placement.

3.5 Limited exposure to weather will not affect the panels, however, where storage for any period in excess of two weeks is required, the panels must be protected from the weather.

3.6 All ancillary items should be stored undercover 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 AFS Logicwall.

Design Considerations

4 Use

4.1 The AFS Logicwall System is used 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 structures is subject to design limitations in accordance with British or European 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 subject to the national Building Regulations incorporating the system should be designed to the relevant sections of BS 8007 : 1987, BS 8102 : 2009, BS 8110-1 : 1997 or BS EN 1991-1-4 : 2005, BS EN 1992-1-1 : 2004 and BS EN 1992-1-2 : 2004 and approved by a suitably qualified and experienced individual.

6.3 Other buildings not subject to any of the Regulations defined in section 6.2 should also be built in accordance with these same Standards.

6.4 After installation, the concrete is not readily examined after casting, therefore, care must be taken to ensure full compaction is achieved as specified in BS 8110-1 : 1997, Section 2, or BS EN 1992-1-1 : 2004, Sections 4 and 8.

6.5 Walls using the system are normally constructed in continuous lift one storey in height (see section 1.8). Particular care is necessary to maintain alignment during concrete filling, and checking between lifts. 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 cement particle 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 or finishes, 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 (plain) concrete or reinforced concrete walls. Particular attention should be made to the type of concrete mix used to ensure segregation does not occur and the wet concrete is allowed to flow freely around the panel studs, 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 described in BS 8500-1 : 2006, Table A.1 and BS EN 206-1 : 2000, Table 1.

6.10 To achieve a structurally stable formwork during the construction process, the formwork must be braced sufficiently to resist the loads imparted on the system by the wet concrete and other construction loads. A typical 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.

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 1.1, 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 Where the system is used as part of a cavity wall construction; to limit the risk of fire spread between floors in buildings subject to the national Building Regulations, 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 wall, separating wall junctions and wall, floor junctions 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 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 8110-2 : 1984, Table 4.6. Fire resistance values for various reinforced concrete wall thicknesses formed using the elements are given in this table. Fire resistance values achievable using the systems are given in Tables 2 and 3. Alternatively, if reinforced concrete walls are designed in accordance with BS EN 1992-1-1 : 2004, fire resistance values for various concrete wall thicknesses set out in BS EN 1992-1-2 : 2004, Table 5.4 can be used, 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 (in minutes) for minimum concrete core thickness for walls (Firewall elements only) with vertical reinforcement (BS 8110-2 : 1984 only)⁽¹⁾

Reinforcement and concrete specification	Concrete thickness (mm) ⁽²⁾				
	30	60	90	180	240
Walls with 0.4% to 1% steel reinforcement made from dense aggregate with 25 mm cover to reinforcement	140	140	140	200	—
Walls with over 1% steel reinforcement made from dense aggregate with 25 mm cover to reinforcement	140	140	140	200	200
Walls less than 4% steel reinforcement made from dense aggregate	—	—	200	—	—

(1) Concrete walls constructed from the formwork system have been assessed in accordance with BS 8110-2 : 1985, Table 4.6 (note: actual element core widths stated in Table 4).

(2) Excluding any combustible finish for a fire resistance (loadbearing capacity, integrity and insulation).

Table 3 Minimum concrete core thickness for loadbearing reinforced concrete walls (Firewall elements only) as per BS EN 1992-1-2 : 2004, Table 5.4

Standard fire resistance	Minimum dimensions (mm) Wall thickness/axis distance ⁽¹⁾ for:			
	$\mu_{fi}^{(2)} = 0.35$		$\mu_{fi}^{(2)} = 0.27$	
	Wall exposed on one side	Wall exposed on two sides	Wall exposed on one side	Wall exposed on two sides
REI 30	100/10 ⁽³⁾	120/10 ⁽³⁾	120/10 ⁽³⁾	120/10 ⁽³⁾
REI 60	110/10 ⁽³⁾	120/10 ⁽³⁾	130/10 ⁽³⁾	140/10 ⁽³⁾
REI 90	120/20 ⁽³⁾	140/10 ⁽³⁾	140/25 ⁽³⁾	170/25

(1) Centre of reinforcement to nearest exposed surface.

(2) The definition μ_{fi} of is given in BS EN 1992-1-1 : 2004, Section 5.3.2(3).

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

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 AFS Logicwall must comply with good practices and relevant codes, national Standards and Building Regulations and the 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(1), and 3.19, clause 3.19.4⁽¹⁾

Northern Ireland – Technical Booklet L.

(1) Technical Handbook (Domestic).

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 air permeability in accordance with the requirements of Mandatory Standards 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 Standards 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⁽¹⁾ 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).

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 will have a service life of not less than 80 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 (constituting a 'mild' exposure environment) and these are adequately maintained.

Installation

16 General

16.1 Installation of the AFS Logicwall is carried out in accordance with the Certificate holder's installation instructions, by trained, approved or supervised 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 or BS 8119-1 : 1997.

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, smooth finished, cleaned off and within an accuracy tolerance of $\pm 10 \text{ mm}$ over a 3.0 metre distance in any direction. Any out-of-tolerances adjustments must be made prior to placement of formwork.

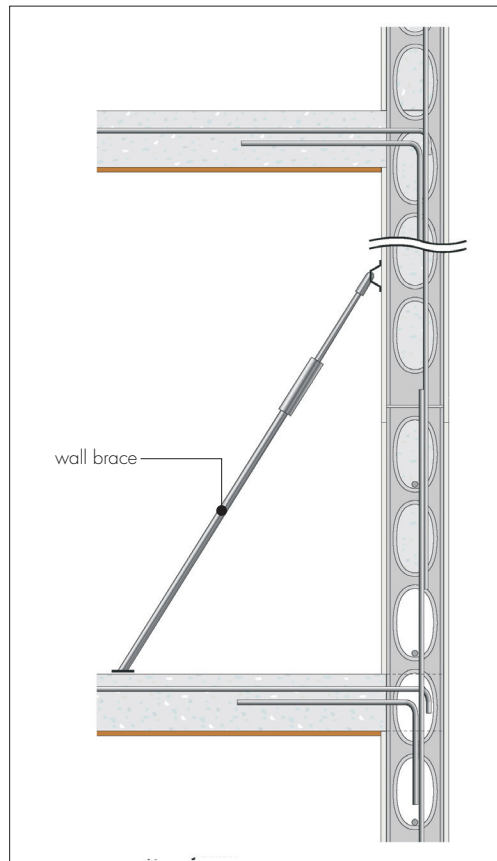
18 Procedure

Wall assembly

18.1 Prior to AFS Logicwall panels being placed, the steel floor track is laid fixed with pins and sealed using panel adhesive following the designers construction drawings.

18.2 Corner panels are installed first and hand lifted in place over the steel floor track into position. Standard panels are subsequently installed in sequence ensuring adequate temporary bracing using props (at maximum 1.1 metre centres) are provided along the wall length to give lateral support during the concrete pour and cure stage.

Figure 3 Bracing detail at wall junction



18.3 Where necessary, horizontal and vertical steel reinforcement steel and electrical services are placed in the walls.

18.4 Once the construction is complete, all panel openings and ends are closed with end caps.

18.5 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. Reinforcement should be checked for correct cover distance and rigidity. Where reinforcement is only provided above openings, the individual bars should extend at least 500 mm beyond the opening span.

Concrete placement

18.6 Concrete should be placed by a line or boom pump preferably with a hose diameter of 65 mm, but not exceeding 100 mm.

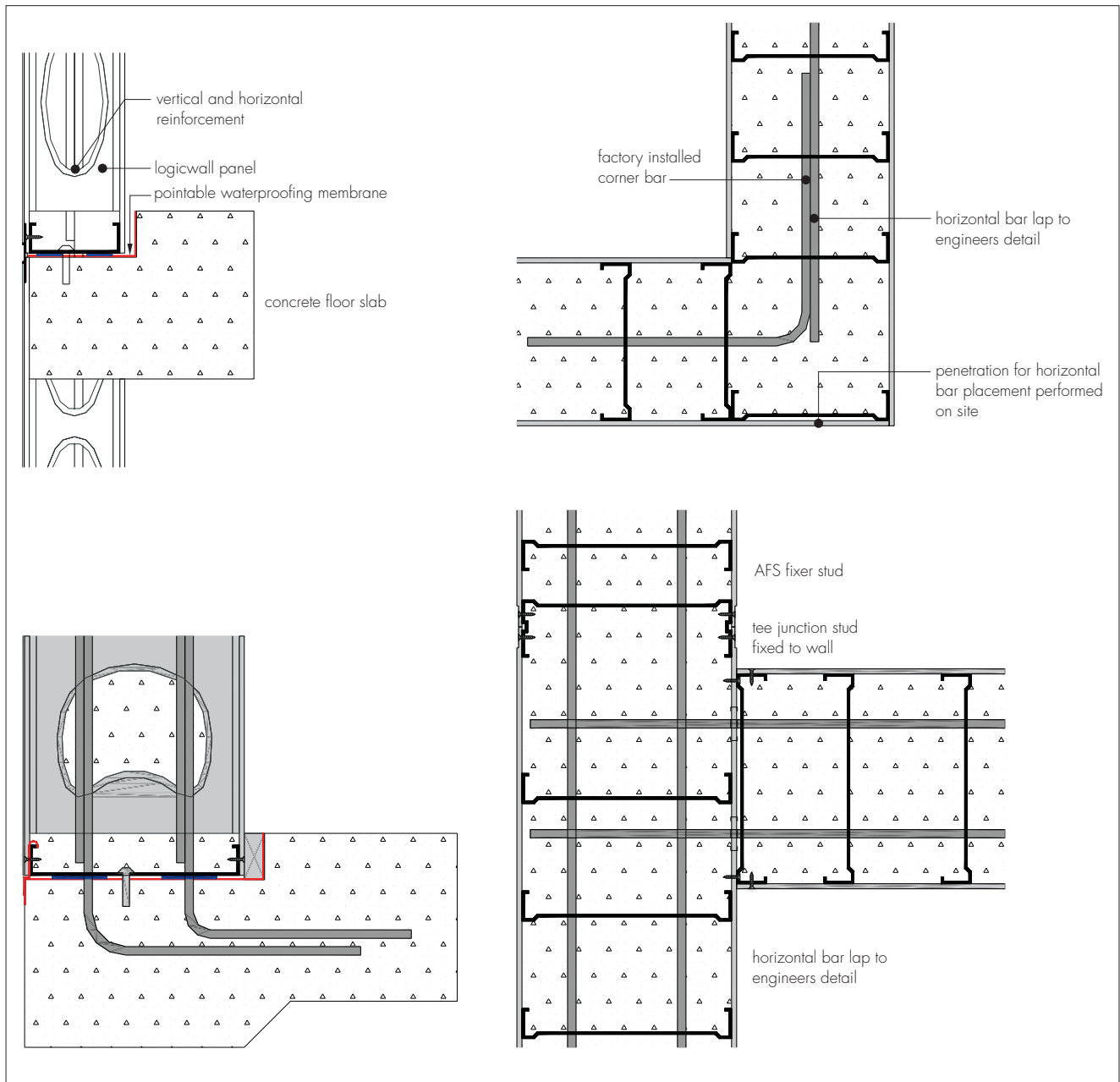
18.7 The concrete pumping rate should be such that excessive pressure is not allowed to occur, both for the safety of the site operative and to avoid damage to the panels. The flow of the concrete should be aimed directly down the inside face of the panels and not on the reinforcement to prevent buildup of concrete at the top of the panels.

18.8 Concrete core filling is undertaken in passes not exceeding 1.2 m in height for the first pass at the base of the wall and 1.5 m for subsequent passes, however, this will 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.

18.9 Concrete pokers should be used for vibration of the reinforcement steel and for light vibration of the concrete and a 25 mm needle vibrator should be used for the top 500 mm of the wall.

18.10 Typical completed construction details are shown in Figure 4

Figure 4 Typical construction detail



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, based on gypsum plasterboard are used they should be screw-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 walls construction. Masonry systems may be supported by wall ties cast into the concrete core of the wall; curtain wall, timber or panel claddings may be supported by batten and rail systems pinned back to the concrete core.

Technical Investigations

20 Investigations

20.1 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.

20.2 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.

Bibliography

- BS 4449 : 2005 *Steel for the reinforcement of concrete — Weldable reinforcing steel — Bar, coil and decoiled product — Specification*
- BS 5628-1 : 2005 *Code of practice for the use of masonry — Structural use of unreinforced masonry*
- BS 5628-3 : 2005 *Code of practice for the use of masonry — Materials and components, design and workmanship*
- BS 5975 : 2008 *Code of practice for temporary works procedures and the permissible stress design of falsework*
- BS 8000-2.1 : 1990 *Workmanship on building sites — Code of practice for concrete work — Mixing and transporting concrete*
- BS 8004 : 1986 *Code of practice for foundations*
- BS 8007 : 1987 *Code of practice for design of concrete structures for retaining aqueous liquids*
- BS 8102 : 2009 *Code of practice for protection of below ground structures against water from the ground*
- BS 8110-1 : 1997 *Structural use of concrete — Code of practice for design and construction*
- BS 8110-2 : 1985 *Structural use of concrete — Code of practice for special circumstances*
- BS 8298 : 1994 *Code of practice for design and installation of natural stone cladding and lining*
- BS 8500-1 : 2006 *Concrete — Complementary British Standard to BS EN 206-1 — Method of specifying and guidance for the specifier QUERY*
- BS EN 206-1 : 2000 *Concrete — Specification, performance, production and conformity*
- BS EN 480-1 : 2006 *Admixtures for concrete, mortar and grout — Test methods — Reference concrete and reference mortar for testing*
- BS EN 520 : 2004 *Gypsum plasterboards — Definitions, requirements and test methods*
- BS EN 845-1 : 2003 *Specification for ancillary components for masonry — Ties, tension straps, hangers and brackets*
- BS EN 934-2 : 2001 *Admixtures for concrete, mortar and grout — Concrete admixtures — Definitions and requirements, conformity, marking and labelling*
- BS EN 1991-1-4 : 2005 *Eurocode 1 : Actions on structures — General actions — Wind actions*
- BS EN 1992-1-1 : 2004 *Eurocode 2 : Design of concrete structures — General rules and rules for buildings*
- BS EN 1992-1-2 : 2004 *Eurocode 2 : Design of concrete structures — General rules — Structural fire design*
- BS EN 12350-2 : 2000 *Testing fresh concrete — Slump-test*
- BS EN 12524 : 2000 *Building materials and products — Hygrothermal properties — Tabulated design values*
- BS EN 13163 : 2008 *Thermal insulation products for buildings — Factory made products of expanded polystyrene (EPS) — Specification*
- BS EN 13914-1 : 2005 *Design, preparation and application of external rendering and internal plastering — External rendering*
- BS EN ISO 6946 : 1997 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*
- ETAG 009 : 2002 *Guideline for European Technical Approval of non-loadbearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete*

Conditions of Certification

21.1 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.

21.2 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.

21.3 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.

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

21.5 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.

21.6 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.