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Agrément Certificate
03/S032
Product Sheet 1

THURSTON GROUP BUILDING SYSTEMS

SURESPAN BUILDING SYSTEM

This Agrément Certificate Product Sheet(1) relates to the Surespan Building System, volumetric structural steel-framed building modules comprising, floor, wall and roof panels. The system can be used to construct buildings with single- or two-storey educational, office, institutional, residential other than dwellings and non-residential accommodation.

(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

Strength and stability — the loadbearing structure of the building system will have adequate strength and stiffness (see section 6).

Behaviour in relation to fire — elements of the building system can satisfy the relevant requirements (see section 7).

Condensation — the external building envelope can limit the risk of surface and interstitial condensation depending on external and internal exposure conditions (see section 8).

Thermal properties — the floor, wall and roof can contribute to the construction contribute to the overall thermal performance of the building system (see section 9).

Sound insulation — separating floors can adequately resist airborne and impact sound transmission (see section 12).

Weathertightness and damp-proofing — external walls, ground floors and roofs can satisfy the relevant requirements (see section 13).

Durability — the steel structure has a minimum life of 60 years and the design life of the external envelope and internal finishes between 20 and 60 years (see section 16).

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 Second issue: 14 May 2014

Brian Chamberlain
Head of Approvals — Engineering

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, Surespan Building System, 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:	A3	Disproportionate collapse
Comment:		The system will have sufficient strength and stability. See sections 6.1 to 6.9 of this Certificate.
Requirement:	B2	Internal fire spread (linings)
Requirement:	B3(1)(3)(4)	Internal fire spread (structure)
Requirement:	B4(1)(2)	External fire spread
Comment:		The system is capable of meeting the relevant Requirements within the limitations set out in this Certificate. See sections 7.1 to 7.10 of this Certificate.
Requirement:	C2(a)(b)(c)	Resistance to weather and ground moisture
Comment:		The system can satisfy this Requirement. See sections 8.1 to 8.8, 13.1 to 13.4 of this Certificate.
Requirement:	E1	Protection against sound from other parts of the building and adjoining buildings
Requirement:	E2(b)	Protection against sound within a dwelling-house etc
Requirement:	E4	Acoustic conditions in schools
Comment:		Separating floors can adequately resist airborne and impact sound transmission. See sections 12.1 to 12.2 of this Certificate.
Requirement:	H3(1)	Rainwater drainage
Comment:		The rainwater discharge from the roof is adequate. See section 13.4 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power.
Comment:		The building system can contribute to satisfying this Requirement. See sections 9.4, 9.5, 10.1 to 10.4 of this Certificate.
Regulation	7	Materials and workmanship
Comment:		The system is acceptable. See sections 16.1, 16.2 and the *Installation* part of this Certificate.
Regulation:	26	CO_2 emission rates for new buildings
Regulation:	26A	Fabric energy efficiency rates for new dwellings (in England only)
Comment:		The system is acceptable. See sections 9.1 to 9.5, 11.1 to 11.3 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Durability, workmanship and fitness of materilals
Comment:		The system can contribute to a construction satisfying this Regulation. See sections 15.1 to 15.3, 16.1 and 16.2 and the *Installation* part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1(a)(b)	Structure
Standard:	1.2	Disproportionate collapse
Comment:		The system will have adequate strength and stability with reference to clauses 1.1.1[1], 1.1.2[1], 1.1.3[1] and 1.2.1[1]. See sections 6.1 to 6.9 of this Certificate
Standard:	2.1	Compartmentation
Standard:	2.2	Separation
Standard:	2.3	Structural protection
Standard:	2.4	Cavities
Standard:	2.5	Internal linings
Standard:	2.6	Spread to neighbouring buildings
Standard:	2.7	Spread on external walls
Standard:	2.8	Spread from neighbouring buildings
Comment:		The system will satisfy the relevant requirements of these Standards within the limitations set out in this Certificate, with reference to clauses 2.1.1[1], 2.1.4[1], 2.1.12[1], 2.1.15[1], 2.2.1[1] to 2.2.4[1], 2.2.6[1], 2.2.7[1], 2.3.1[1] to 2.3.5[1], 2.4.1[1], to 2.4.9[1], 2.5.1[1], 2.6.1[1] to 2.6.7[1], 2.7.1[1] and 2.8.1[1] of these Standards. See sections 7.1 to 7.10 of this Certificate.
Standard:	3.4	Moisture from the ground
Standard:	3.6(a)	Surface water drainage
Standard:	3.10	Precipitation
Standard:	3.15	Condensation
Comment:		The system will satisfy the relevant requirements of these Standards, with reference to clause 3.4.1[1], 3.6.1[1], 3.10.1[1], 3.15.1[1], 3.15.3[1] and 3.15.7[1]. See sections 8.1 to 8.8 and 13.1 to 13.4 of this Certificate.
Standard:	6.1	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The building system can contribute to satisfying these Standards, with reference to clauses 6.1.1[1], 6.2.1[1], 6.2.4[1] and 6.2.5[1]. See sections 9.4, 9.5 and 11.1 to 11.3 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. In addition, the product can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4(1) [Aspects 1(1) and 2(1)], 7.1.6(1) [Aspects 1(1) and 2(1)] and 7.1.7(1) [Aspect 1(1)]. See sections 9.4 and 9.5 and 11.1 to 11.3 of this Certificate.

(1) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2012

Regulation:	23	Fitness of materials and workmanship
Comment:		The system is acceptable. See sections 16.1, 16.2 and the *Installation* part of this Certificate.
Regulation:	28	Resistance to moisture and weather
Comment:		The system is acceptable. See sections 13.1 to 13.4 of this Certificate.
Regulation:	29	Condensation
Comment:		The system will adequately limit the risk of surface and interstitial condensation. See sections 8.1 to 8.8 of this Certificate.
Regulation:	30	Stability
Regulation:	31	Disproportionate collapse
Comment:		The building system will have sufficient strength and stiffness. See sections 6.1 to 6.9 of this Certificate.
Regulation:	34	Internal fire spread – Linings
Regulation:	35	Internal fire spread – Structure
Regulation:	36	External fire spread
Comment:		The system is capable of meeting the relevant Regulations. See sections 7.1 to 7.10 of this Certificate.
Regulation:	39(a)(i)	Conservation measures
Regulation:	40	Target carbon dioxide Emissions Rate
Comment:		The building system can contribute to satisfying these Regulations. See sections 9.4 and 9.5, 11.1 to11.3 of this Certificate.
Regulation:	82	Rainwater drainage
Comment:		The rainwater discharge from the roof is adequate. See section 13.4 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 sections: 3 *Delivery and site handling* (3.2), 5 *Practicability of installation* and 20 *Procedure* (20.1) of this Certificate.

Additional Information

NHBC Standards 2014

In the opinion of the BBA, the use of the Surespan Building System, in relation to this Certificate, is not subject to the requirements of these Standards.

Technical Specification

1 Description

1.1 Surespan Building System is based on volumetric modules, consisting of a structural steel frame and insulated preformed galvanized steel roof, wall and floor panels (see Figure 1). The specification approved by the BBA is described within this section when applied to single- or two-storey buildings. The modules are available in a standard range of external sizes (in metres) of:

width 2.40, 3.01 and 3.68,

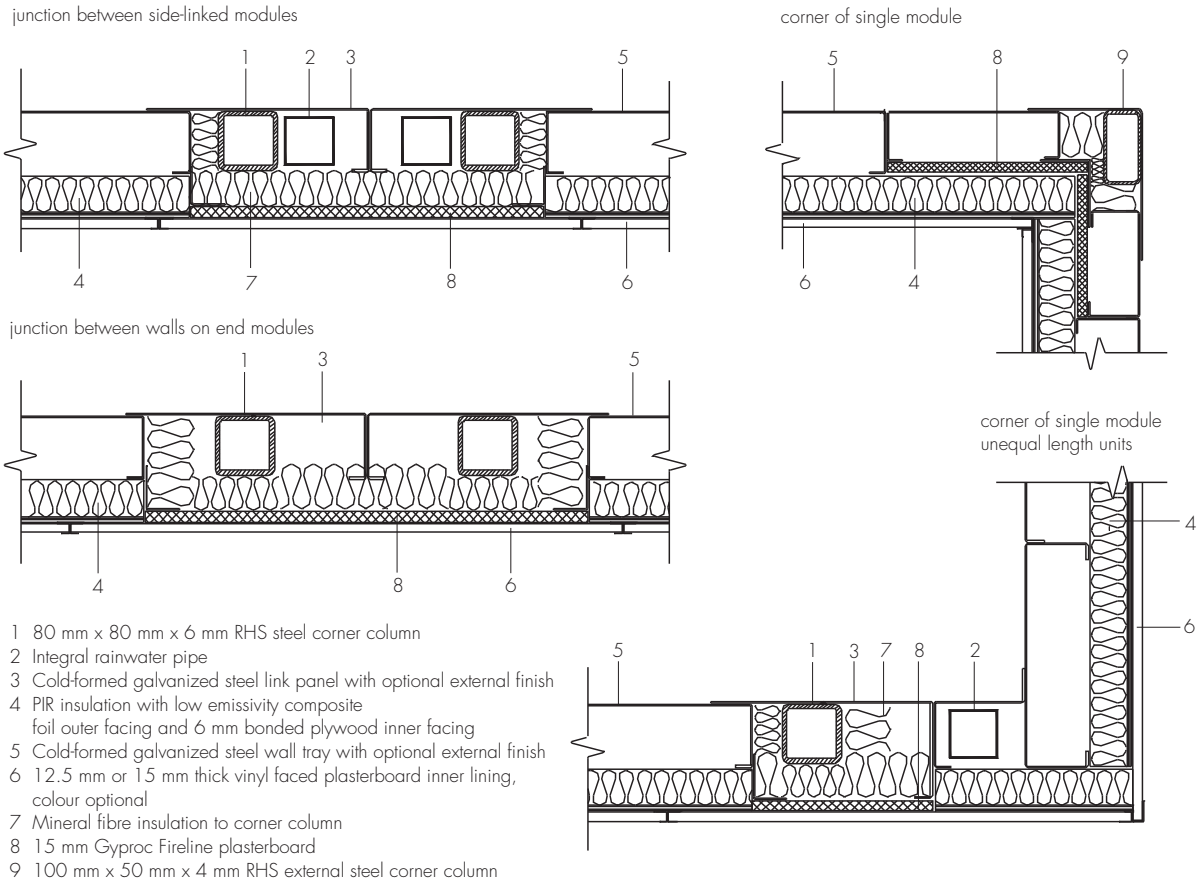
length 3.88 to 18.28

height 2.42 to 3.60.

Figure 1 Typical Surespan building

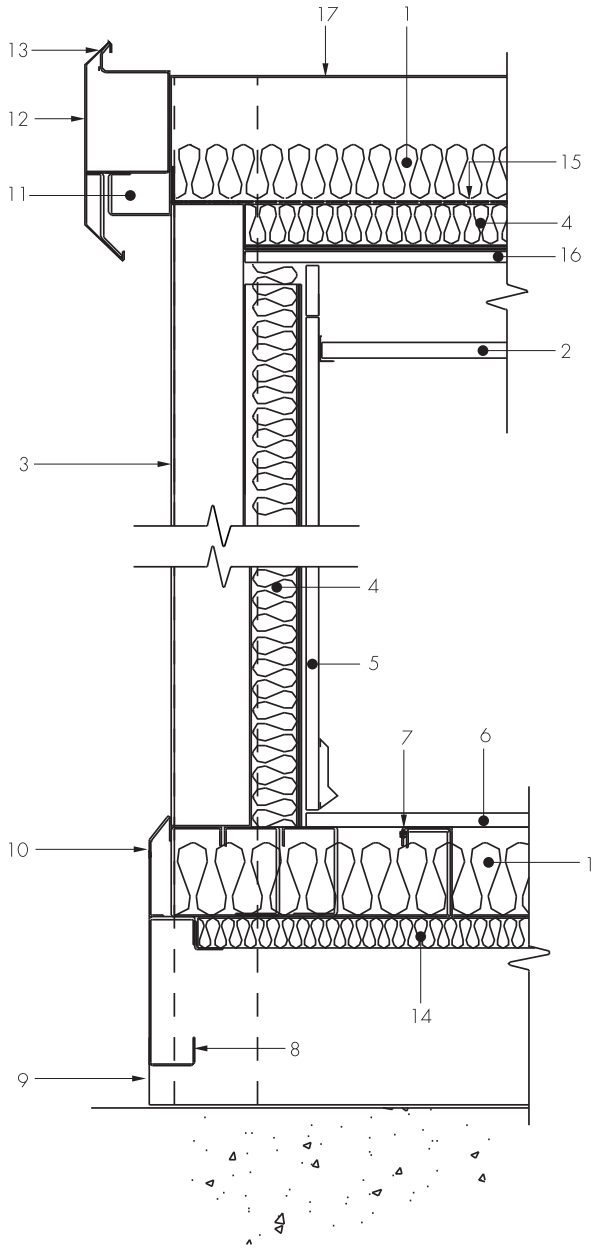
1.2 The full specification and drawings for the materials and components covered by this Certificate have been examined and are retained by the BBA. This section gives only general details of the system. Typical details are shown in Figures 2 to 5. Non-standard sizes can be accommodated to give greater flexibility of design.

Figure 2 Details in plan

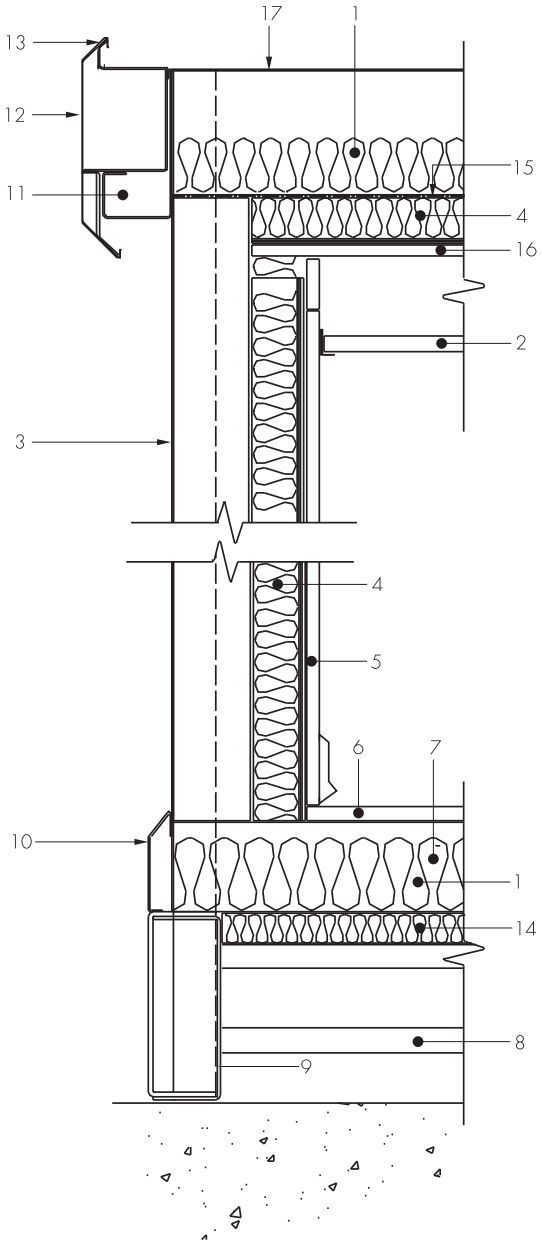


1 80 mm x 80 mm x 6 mm RHS steel corner column
2 Integral rainwater pipe
3 Cold-formed galvanized steel link panel with optional external finish
4 PIR insulation with low emissivity composite foil outer facing and 6 mm bonded plywood inner facing
5 Cold-formed galvanized steel wall tray with optional external finish
6 12.5 mm or 15 mm thick vinyl faced plasterboard inner lining, colour optional
7 Mineral fibre insulation to corner column
8 15 mm Gyproc Fireline plasterboard
9 100 mm x 50 mm x 4 mm RHS external steel corner column

Figure 3 Long and short wall sections



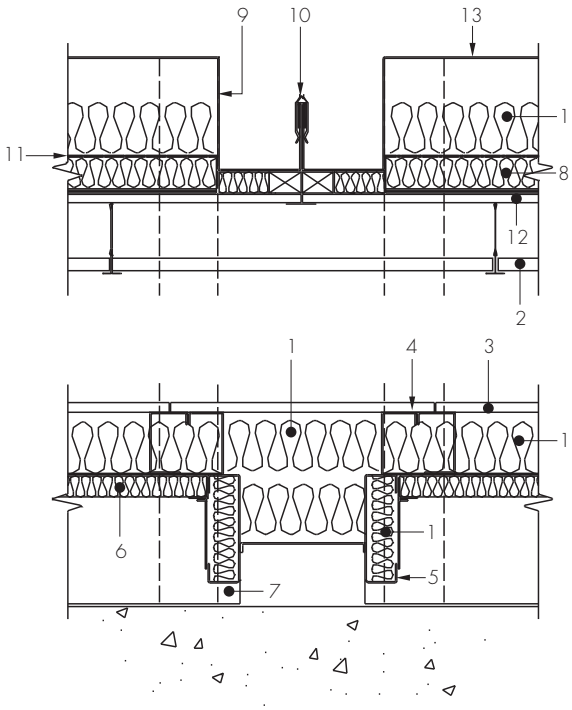
long wall



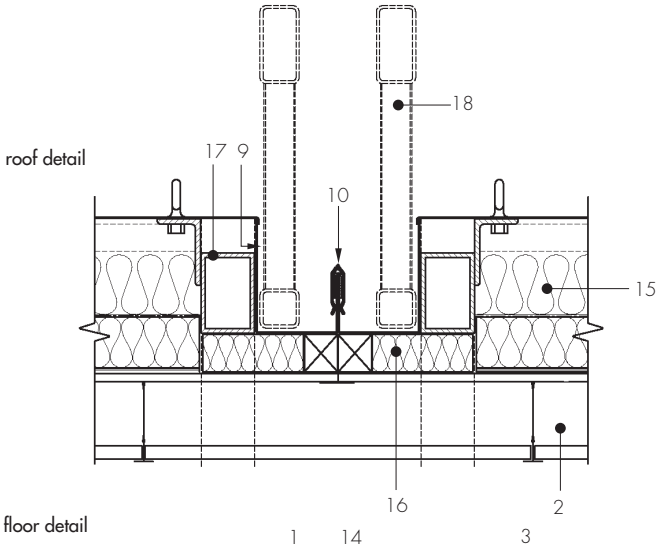
short wall

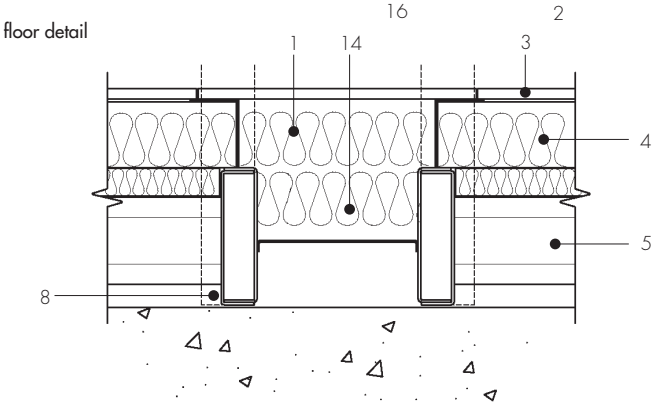
1 Mineral fibre insulation
2 Suspended ceiling
3 Cold-formed galvanized steel wall tray with optional external finish
4 PIR insulation with low emissivity composite foil outer facing and 6 mm bonded plywood inner facing
5 12.5 mm or 15 mm thick vinyl faced plasterboard inner lining, colour optional
6 15 mm moisture resistant structural board floor deck fixed to steel floor trays
7 Cold-formed galvanized and insulated steel floor tray and sub-floor
8 Cold-formed galvanized steel cross bearer
9 Cold-formed galvanized steel floor beam
10 Cold-formed galvanized base perimeter
11 Cold-formed galvanized perimeter gutter
12 Cold-formed galvanized perimeter fascia
13 Cold-formed galvanized fascia bracket
14 PIR insulation with low emissivity composite foil facing on both sides
15 Polythene vapour barrier
16 Plasterboard inner lining
17 Cold-formed galvanized steel roof tray

Figure 4 Section through junction — two modules joined end to end and side to side



module joint – end to end

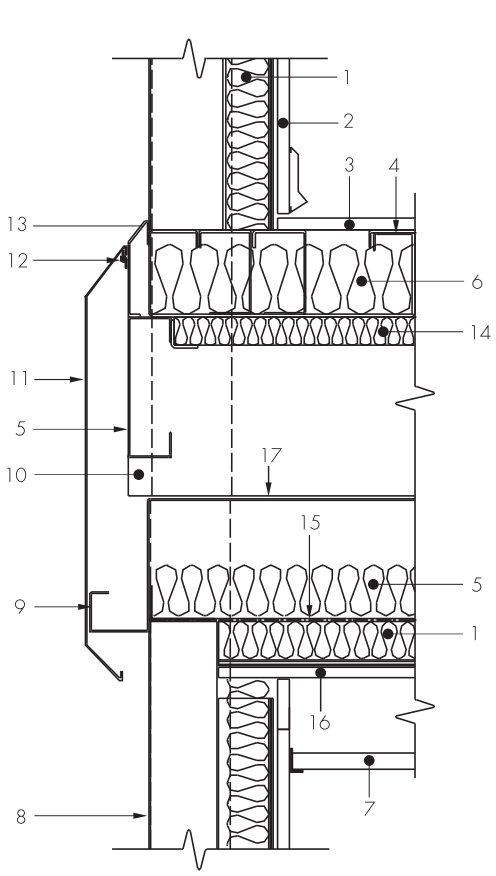




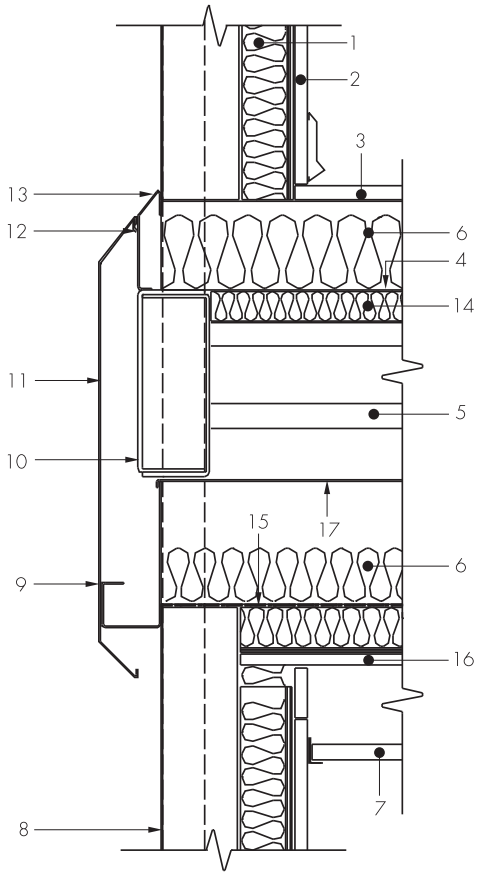
module joint – side to side

1 Mineral fibre insulation
2 Suspended ceiling
3 15 mm moisture resistant structural board floor deck fixed to steel floor trays
4 Cold-formed galvanized and insulated steel floor tray and sub-floor
5 Cold-formed galvanized steel cross bearer
6 PIR insulation with low emissivity composite foil facing on both sides
7 Cold-formed galvanized steel floor beam
8 PIR insulation with low emissivity composite foil outer facing and 6 mm bonded plywood inner facing
9 Cold-formed galvanized valley gutter
10 Cold-formed galvanized steel gutter capping
11 Polythene vapour barrier
12 Plasterboard inner lining
13 Cold-formed galvanized steel roof tray
14 Additional insulation to link joints
15 Mineral fibre insulation to roof tray complete with polyurethane insulation with bonded plywood over polythene vapour barrier
16 Polyurethane insulation with foil vapour barrier
17 Roof support beam subject to roof span and load
18 Lattice beam

Figure 5 Floor/ceiling assembly — short and long wall section



short wall section



long wall section

1 PIR insulation with low emissivity composite foil outer facing and 6 mm bonded plywood inner facing
2 12.5 mm or 15 mm thick vinyl faced plasterboard inner lining, colour optional
3 15mm moisture resistant structural board floor deck fixed to insulated steel floor trays
4 Cold-formed galvanized steel floor tray
5 Cold-formed galvanized steel cross bearer
6 Mineral fibre insulation
7 Suspended ceiling
8 Cold-formed galvanized steel wall tray with optional external finish
9 Cold-formed galvanized perimeter gutter
10 Cold-formed galvanized steel floor beam
11 Cold-formed galvanized perimeter fascia
12 Cold-formed galvanized fascia clip
13 Cold-formed galvanized base perimeter
14 PIR insulation with low emissivity composite foil facing on both sides
15 Polythene vapour barrier
16 Plasterboard inner lining
17 Cold-formed galvanized steel roof tray

1.3 The galvanized steel frame for each module comprises:

Hot-rolled structural hollow sections

- corner columns
- intermediate posts (as applicable)
- roof chords (lattice beams)
- ceiling wide beams.

Cold-formed galvanized steel

- floor side beams
- floor cross beams
- pitched roof frames and floor
- ceiling, floor and wall trays
- structural members, as applicable.

1.4 Floors, external walls and ceilings incorporate butted galvanized interlocking steel trays welded or riveted to each other and to the floor and ceiling side beams. Cross beams provide additional support for the floor trays and transport. In roofs, the trays are inverted and the base forms a flat roof deck.

1.5 Pitched roof assemblies comprise galvanized steel spars, trusses, ladder frames and sections assembled and anchored with appropriate fixings.

External walls

1.6 External walls comprise polyisocyanurate (PIR) foam insulation boards with a 6 mm thick bonded plywood inner facing and a low emissivity composite foil outer facing, fixed to the galvanized steel wall tray lips. A 12.5 mm or 15 mm thick vinyl faced plasterboard is applied as the internal lining. The external skin[1] comprises traditional brick outer leaf and cavity or optional textured panels, brick slips, render systems or a proprietary cladding system can be applied.

(1) These finishes are outside the scope of this Certificate.

Ground floors

1.7 Ground floors comprise PIR foam insulation boards with a low emissivity composite foil facing on both sides and mineral fibre insulated galvanized steel floor trays with a depth of 100 mm and overlaid with 15 mm thick, grade F20 plywood to BS EN 636 : 2003.

Roof/ceiling

1.8 The ceiling comprises 150 mm thick mineral fibre insulation within the galvanized steel roof trays with 50 mm thick PIR foam insulation boards with a 6 mm thick bonded plywood inner facing and a low-emissivity composite foil outer facing, fixed to the underside of the inverted roof trays, and a 12.5 mm or 15 mm thick internal plasterboard lining. A polythene vapour barrier layer is laid over the PIR insulation boards. A proprietary suspended ceiling system may be applied.

Separating intermediate floors

1.9 Separating intermediate floors are assembled from ground floor and roof/ceiling elements of individual modules positioned on top of each other (see Figure 5).

Flat roof

1.10 The base of the roof trays forms a flat deck with integral gutter sections spanning the module width, and welded gutter sections spanning the length of the module. The flat roof deck provides a permanent watertight barrier immediately after the bays are positioned on site and also provides structural support for an aesthetic pitched roof alternative.

Pitched roof

1.11 Once the modules have been positioned and joined with gutter cappings, the pitched roof frame can be assembled and fixed directly to the flat roof of the upper modules. Steel roof joists at centres not exceeding 1200 mm are attached to the eaves and ridge members with a minimum slope of 15°. They are also supported at maximum 3010 mm centres along their length by a factory-welded ladder frame. Fixings are accomplished either with fillet welds or brackets and self-tapping screws without penetration through the flat roof deck. Conventional slate or tile weatherproofing is applied in accordance with BS 5534 : 2003.

Corrosion protection

1.12 The structural steel columns, roof side beams, intermediate posts and roof beam chords are coated in galvanizing paint where accessible.

1.13 All cold-formed components are produced from galvanized steel sheet to BS EN 10346 : 2009, with a Z140 and Z275 coating for internal and external application respectively.

Finishes

1.14 Internal plasterboard surfaces are capable of receiving a range of conventionally-applied finishes. In applications where water will be present, eg kitchens or toilets, a suitable resilient floor covering with welded joints and cove skirting is used.

2 Manufacture

2.1 Steel-framed components of the system are fabricated using conventional metalworking techniques. The modules are assembled into the planned configuration and completed as far as is possible in the factory, including all fittings, services and finishes. Services connected and tested, where possible, before being disassembled and made weatherproof and ready for transport to site.

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 non conformities
- 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 modules are transported to site on a flat-bed lorry or trailer, long enough to fully support the module. The open sides of the modules are weatherproofed during transit.

3.2 The roof deck of each module has four or six threaded lifting eyes allowing the complete module to be lifted and positioned by crane. Second storey modules are positioned directly over the ground-floor modules.

3.3 The modules are normally positioned on the day of delivery, therefore, site storage is not required.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the Surespan Building System.

Design Considerations

4 General

4.1 The Surespan Building System is for use as a single- or two-storey educational, office, institutional, residential other than dwellings and non-residential accommodation.

4.2 The system can be used to construct buildings with a variety of individual treatments and plan forms. Specifiers must ensure plan form, internal subdivision, siting of the buildings, access for the disabled, access for fire services, and means of escape in case of fire, comply with the relevant Building Regulations' requirements. The Certificate holder offers adaptations to the system for the construction of buildings in excess of two storeys, subject to specific engineer's reports.

5 Practicability of installation

The system must be installed by the Certificate holder or by operatives trained and approved by the Certificate holder.

6 Strength and stability

6.1 The design of buildings is carried out only by a suitably qualified and experienced individual in accordance with:

BS EN 1991-1-1: 2002 or BS 648 : 1964
BS EN 1991-1-1: 2002 or BS 6399-1 : 1996
BS EN 1991-1-3: 2003 or BS 6399-3 : 1988
BS EN 1991-1-4: 2005 or BS 6399-2 : 1997
BS EN 1993-1-3 : 2006 or BS 5950-5 : 1998
BS EN 1993-1-5 : 2006 or BS 5950-1 : 2000
BS EN 1996-1-1 : 2005 or BS 5628-2 : 2005
BS EN 1996-1-1: 2005 or BS 5628-3 : 2005.

6.2 Where required, structural testing has been used to verify the relevant aspects of the design outside the scope of the codes.

6.3 It is also the responsibility of a suitably qualified and experienced individual to:

- carry out stability analysis of the structure including the necessary measures to brace it
- prepare a schedule of reaction loads to aid the nominated geotechnical contractor to design the necessary foundations
- prepare a schedule of roof loads to enable the roof to be designed
- allow for the weights of building services in the design calculations
- ensure that the building is designed to incorporate adequate ties to preclude disproportionate collapse.

6.4 The system is designed to support wind loads in accordance with BS EN 1991-1-4 : 2005 or BS 6399-2 : 1997.

6.5 The roof is designed to support imposed uniformly distributed loads and concentrated loads in accordance with BS EN 1991-1-3 : 2003 or BS 6399-3 : 1988, and dead loads including the self-weight and any necessary plant.

6.6 The floor is designed to support a uniformly distributed imposed load of 4 $kN \cdot m^{-2}$ or a concentrated load of 4.5 kN, in accordance with BS EN 1991-1-1 : 2002 or BS 6399-1 : 1996 and, therefore, is acceptable in, for example, offices and classrooms.

6.7 Most building configurations do not require the modules to be bolted to foundations. Stability calculations are available from the Certificate holder justifying any requirements for bolting modules to the foundation.

6.8 Updated wind and roof snow loading maps for Scotland can be found in:

- *Wind loading on traditional dwellings: Amendments of simplified design guidance for the Scottish Office Small Building Guide* (BRE, 1999)
- *Proposed revision of the simplified roof snow load map for Scotland* (BRE, 2003).

6.9 Foundations must be designed in accordance with BS EN 1997-1-2 : 2004 or BS 8004 : 1986.

7 Behaviour in relation to fire

7.1 Buildings subject to national Building Regulations must not be erected within one metre of a boundary. Due regard must be taken of all 'unprotected areas'.

7.2 Tests and assessment show that the buildings will meet national Building Regulations requirements for fire rating as given in Table 1.

Table 1 Fire rating

Component	Duration (hours)
External walls	<1[1] (from inside)
Combined ceiling and floor assembly	<1[1] (from underside)
Steel column protection	1[1] (faces exposed on the inside)

(1) 'Medium duration' in Scotland.

7.3 In respect of the Building Regulations the external claddings are assessed as having surface spread of flame characteristics of:

brickwork	Class 0[1]
Colorcoat HP200	Class 0[1]

(1) 'Low risk' in Scotland.

7.4 The internal surfaces of walls and ceiling are assessed as having surface spread of flame characteristics of:

plasterboard	Class 0[1]
vinyl-faced plasterboard	Class 0[1]
mineral fibre tiles (suspended ceilings)	Class 0[1]

(1) 'Low risk' in Scotland.

7.5 The tiled pitched roof and the metal flat roof are designated AA in accordance with the Building Regulations for:

England and Wales — Approved Document B, Appendix A,
Northern Ireland — Technical Booklet E.

7.6 The designation of the roof in Scotland must be determined in accordance with the deemed-to-satisfy provisions to Annex 2.F for compliance with the Building (Scotland) Regulations.

7.7 Adequate provision must be made for escape in case of fire.

7.8 The building system must comply to the regulations with regard *Fire Spread* (England and Wales) and *Structural Fire Precautions* (Scotland and Northern Ireland) and meet limits to the size of compartments in buildings according to the use and in some cases height. The BBA and the Certificate holder have agreed a list of these limits as they apply to Surespan.

7.9 Where it is necessary for fittings, services or ducts to penetrate part of the fire-resisting construction, the detailing must ensure that the relevant fire resistance is not impaired, particularly in relation to the integrity requirements.

7.10 The behaviour in relation to fire of any intermediate walls or cavity barriers between modules; in either the roof and floor voids (other than where these occur at the perimeter of a module), or windows and doors, or internal stairwells, have not been assessed and therefore are outside the scope of this Certificate.

8 Condensation

General

8.1 Consideration must be given to the overall design to minimise the risk of condensation and the recommendations of BS 5250 : 2011 should be followed. For the purposes of calculation of condensation risk, vapour diffusion factors may be taken from those given in BS 5250 : 2011.

8.2 If the floor is penetrated by services, eg soil pipes, the joints between the services and the floor deck and floor insulation must be adequately sealed to prevent the ingress of water and water vapour.

Interstitial condensation

8.3 Calculation shows that the amount and duration of any condensation will be insufficient to significantly affect the structural or thermal properties of the building assuming appropriate ventilation where the expected relative humidity at an internal temperature of 20°C is less than 50%.

8.4 Where the expected relative humidity at an internal temperature of 20°C ranges from 51% to 70% in the building, depending on external and internal exposure conditions, calculations to BS 5250 : 2011 have to be carried out to verify that condensation does not occur within the structure; such condensation could adversely affect its structural or thermal performance. Where necessary, the external envelopes should be used in conjunction with a suitably installed

vapour control layer. Attention should be paid to lower temperatures on metal surfaces within the external envelopes at thermal bridges, in particular for floor trays, where possible local condensation may have an adverse effect on structural performance.

Surface condensation and risk of mould growth

8.5 The risk of condensation forming on an internal surface of the building in line with the repeating thermal bridges created by the structural steel is dependent on its temperature and the temperature and humidity of the adjacent air. The risk will be minimal when the minimum surface temperature factor exceeds that shown in Table 2, for the relevant expected relative humidity in the building.

Table 2 Minimum temperature factors[1] to minimise the risk of surface condensation on non-absorbent surfaces

Humidity Class	Expected relative humidity in the building at 20°C internal temperature (%)	Temperature factors for 20°C internal temperature
1	< 35 (eg storage areas)	0.30
2	35–50 (eg offices, shops)	0.50
3	50–60 (eg residential building with low occupancy)	0.68
4	60–70 (eg residential building with high occupancy)	0.80

(1) The ratio of temperature drop between the internal surface and the external environment and the total temperature drop between internal and external environments.

8.6 To avoid mould growth on absorbent surfaces in residential and educational buildings, a minimum temperature factor of 0.75 should be met.

8.7 In all cases, the risk of surface condensation can be reduced by limiting activities which produce large amounts of moisture and providing means for adequate ventilation (including underfloor ventilation); ventilators can alleviate localised surface condensation. Equipment producing large quantities of water vapour, for example, flueless heaters must not be used.

8.8 Where required, mechanical ventilation should be designed in such a way that the relative humidity is kept below the critical level in the building to prevent surface condensation and mould growth.

9 Thermal properties

9.1 The overall U value will depend on the construction adopted. Examples of thermal transmittance values for different wall, floor and roof constructions are listed in Table 3.

Table 3 Examples of achievable Element U values

Construction type	Description	U value ($W \cdot m^{-2} \cdot K^{-1}$)[1]
Roof	106 mm TR31[2] (100 + 6) or 100 mm K8 and 6 mm ply with 150 mm rock fibre roll ($\lambda_{90/90}$ *value* 0.044 $W \cdot m^{-1} \cdot K^{-1}$ or better) in cavity	0.15
	96 mm TR31[3] (90 + 6) or 90 mm K8 and 6 mm ply with 150 mm HP rock fibre ($\lambda_{90/90}$ *value* 0.034 $W \cdot m^{-1} \cdot K^{-1}$ or better) in the cavity	0.15
Wall	76 mm TR31[3] (70 + 6) with 65 mm HP rock fibre ($\lambda_{90/90}$ *value* 0.034 $W \cdot m^{-1} \cdot K^{-1}$ or better) and 25 mm drained spacer in the cavity	0.20
	61 mm TR31[3] (55 + 6) with 65 mm HP rock fibre and 25 mm drained spacer in the cavity	0.25
	61 mm TR31[3] (55 + 6) or 55 mm K8 and 6 mm ply with clear cavity	0.32
Floor[3]	80 mm rock fibre ($\lambda_{90/90}$ *value* 0.035 $W \cdot m^{-1} \cdot K^{-1}$ or better) in the cavity underdrawn with 35 mm Kingspan	0.20
	80 mm rock fibre roll ($\lambda_{90/90}$ *value* 0.044 $W \cdot m^{-1} \cdot K^{-1}$ or better) in the cavity underdrawn with 35 mm Kingspan	0.21

(1) Takes into account repeating thermal bridges due to steel trays.
(2) TR31 – Kingspan Thermafloor ($\lambda_{90/90}$ *value* 0.022 $W \cdot m^{-1} \cdot K^{-1}$).
(3) The value given is the Uf[4] value. The final U value for the ground floor should be calculated in accordance with BS EN ISO 13370 : 2007.
(4) Thermal transmittance of suspended part of floor, in $W \cdot m^{-2} \cdot K^{-1}$

9.2 The building fabric ψ values for linear thermal bridges can be taken as the default values for metal-cladding construction in accordance with IP 01/06, Table 4. The Certificate holder should be contacted for specific details not included in IP 01/06, Table 4, relating to the system.

9.3 Designers must select services, envelope airtightness and window/door specifications that will achieve a carbon emissions reduction of from 23.5% to 28% for the complete proposed building when compared to the 'notional' building.

9.4 A wall, floor or roof constructed with the system can meet or satisfy the requirements of the national Building Regulations:

England and Wales — Approved Document L1A, Table 2

Scotland — Mandatory Standard 6.2, clause 6.2.1[1], Table *Maximum U-values for building elements of the insulation envelope*

Northern Ireland — Technical Booklet F1, Table 2.2.

(1) Technical Handbook (Domestic).

9.5 Junctions with other elements should be designed to limit heat loss. Detailed guidance in this respect and on limiting heat loss by air infiltration can be found in:

England and Wales — Approved Documents to Part L (see also SAP 2009, Appendix K, and the *iSBEM User Manual*)

Scotland — Accredited Construction Details (Scotland)

Northern Ireland — Accredited Construction Details (version 1.0).

10 Air permeability

10.1 To minimise air leakage, the external envelope must be installed and sealed in accordance with the Certificate holder's recommendations at all joints, junctions and penetrations.

10.2 In England, Wales and Northern Ireland, completed buildings are subject to pre-completion testing for airtightness in accordance with the requirements of Approved Document L2B (section 20A), and Technical Booklet F2 (sections 2.72 to 2.77) respectively.

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

10.4 From tests to the Air Tightness Testing and Measurement Association's (ATTMA) Technical Standard 1 : 2007 *Measuring Air Permeability of Building Envelopes*, it is shown that an air leakage rate of less than 10 $m^3 \cdot h^{-1} \cdot m^{-2}$ at an applied pressure difference of 50 Pa can be achieved (see Table 4).

Table 4 Airtightness test results

Envelope area of the building tested (m^2)	Air permeability rate at 50 Pa ($m^3 \cdot h^{-1} \cdot m^{-2}$)
1776	4.49
365	3.66
198	7.49

11 Ventilation

11.1 Ventilation of the buildings should be provided in accordance with:

England and Wales — Approved Document F, Section 2

Scotland — Mandatory Standard 3.14

Northern Ireland — Technical Booklet K.

11.2 The void beneath the ground floor must have an area of at least 600 mm^2 of open ventilation per metre run of external wall.

11.3 Cold roof spaces must include provision for ventilation in accordance with BS 5250 : 2011.

12 Sound insulation

12.1 Completed floors separating rooms for residential purposes are subject to pre-completion testing for airborne and impact sound insulation in accordance with Approved Document E, Section 1 (see Table 5).

Table 5 Performance standards for purpose-built rooms for residential purposes

Construction	Airborne sound insulation $D_{nT,w}+C_{tr}$ (dB)	Impact sound insulation $L'_{nT,w}$ (dB)
Separating floor	≥ 45	≤ 62

12.2 When the modules are used as school buildings, the designer must address the requirements given in Building Bulletin 93.

12.3 Field measurements to BS EN ISO 140-4 : 1998 and BS EN ISO 140-7 : 1998 show that the separating floors are able to meet the airborne and impact sound insulation requirements shown in Table 5.

13 Weathertightness and damp-proofing

13.1 The steel supporting columns raise the building clear of the ground, giving it an inherent resistance to ground moisture.

13.2 In preparing the site for erection of the building, adequate drainage must be provided to prevent water collecting beneath or against the building structure. For example, flower beds should not be positioned so that loose soil can become banked against the building perimeter.

13.3 The roof and external wall surfaces can provide adequate weather resistance. The final weathertightness of the building is dependent upon correct positioning and sealing of all horizontal and vertical joints between modules.

13.4 The buildings are provided with suitable rainwater gutters and downpipes.

13.5 The performance of windows and doors is not covered by this Certificate. However, the perimeter joints between windows and doors and the wall panels have been assessed and are adequate to ensure that water penetration will not occur at these positions.

14 Services

Electrical and plumbing services are outside the scope of this Certificate. However, in designing and installing these services, precautions must be taken to avoid the possible risk of long-term damage to the structure or the services by, for example, the ingress of water, water vapour or condensate from cold water service pipes.

15 Maintenance

15.1 The Certificate holder provides an Operation and Maintenance Manual containing information on required actions to extend the service life of the building.

15.2 The external roof surface and gutters must be examined on an annual basis to ensure that the galvanized coating shows no signs of breakdown that could lead to the formation of corrosion to the underlying metal. In areas of high exposure or in close proximity to tree growth, this would be recommended on a more regular basis. Where required, cleaning and over painting should be undertaken to extend service life of the roof.

15.3 External cladding panels may require occasional maintenance.

15.4 In the event of impact or other damage to an external wall, repairs must be carried out in accordance with the Certificate holder's Operations and Maintenance Manual.

15.5 Should it be necessary to replace or repair the vinyl floor covering, all joints must be welded. Any replacement vinyl floor covering must be to an equivalent specification as the original.

15.6 Trims or skirt panels can also be readily replaced if necessary.

16 Durability

16.1 The main structural framework is assessed as capable of achieving a design life of 60 years. Other elements can achieve a design life of between 20 years and 60 years depending on the materials, construction and degree of maintenance. Reference may be made to BS 7543 : 2003 in this respect.

16.2 The galvanizing will be effective for the building's service life subject to the maintenance requirements set out in section 15.2.

16.3 Foot traffic over the roof weatherproofing finish should be restricted to the purpose of maintenance and suitable precautions taken to avoid the risk of damage. Particular care is required in arrangement for damp-proof courses, integrity of vapour control layers and weathertightness of the building envelope.

16.4 The ceiling and wall lining will remain effective for the building's service life. If a suspended ceiling is used, the mineral fibre tiles will be effective for the building's envisaged life, but may require occasional painting. Care must be taken to ensure that any paint coating maintains the Class 0 surface spread of flame characteristics of the tiles.

16.5 The vinyl floor covering may require replacement during the building's envisaged life, depending on the use.

16.6 The sealants used in the construction of the modules in the factory and to seal between bays on site are concealed and are not subject to excessive movement. Normally, they should not require replacement during the building's service life.

17 Re-use and recyclability

The main structural components can be recycled.

Installation

18 General

18.1 Any installation work of Surespan Building System should follow the details and information contained in the construction drawings, as prepared by the Certificate holder or approved designers. All buildings must be erected with due regard to any boundary (see sections 7.1 and 7.2).

18.2 Erection is carried out by the Certificate holder or authorised contractors. The arrangements for erection have been assessed and found to be satisfactory.

18.3 All necessary health and safety procedures must be observed and strictly adhered to.

19 Supervision

In addition to the checks carried out routinely by the Certificate holder, clients may wish to carry out their own checks during installation. These procedures include:

- before each ground-floor module is positioned: foundation plates/bolts (if required) placement
- during positioning of ground-floor bays: damage is not caused to the steelwork protective systems
- after each ground-floor module is positioned: fixings between modules
- before each first-floor module is positioned: fixings between modules
- after each first-floor module is positioned: fixings between modules
- application of sealant in junctions between modules
- completion of roof weatherproofing at junction between modules
- satisfactory extension of finishings over joints between modules.

20 Preparation

Clients are normally responsible for provision of suitable foundations and services and, therefore, the following aspects should be subject to supervision and should be checked before the modules are delivered to site:

- setting out and level of foundations
- setting out of service connections.

21 Procedure

21.1 The modules are placed by crane by the Certificate holder or authorised contractor on prepared foundations using purpose-designed lifting points incorporated in the steel frame. Access to the site is required for the crane and this requirement will be agreed with the client.

21.2 The ground beneath the building, as a minimum, should be effectively cleared of turf and other vegetation matter to at least a depth sufficient to prevent later growth. The covering of the ground under the suspended floor should be at least 100 mm thick concrete laid on a compacted hardcore bed, or 50 mm thick concrete laid on a 0.30 mm polyethylene sheet, or a 100 mm thick hardcore bed covered with a damp-proof membrane in accordance with BS 8102 : 2009. Any filling should be of hard, inert material, with the top surface not below that of the adjacent ground.

21.3 Where specified, the modules must be bolted to the foundations.

21.4 Modules can be bolted together along the longitudinal side beams.

21.5 Temporary weatherproofing at joints between bays and the open ends of incomplete buildings is provided as required by the Certificate holder to suit the construction sequence.

21.6 The completion of external cladding and internal finishes and trims is carried out on site. Service connections are made and internal subdivisions and finishes completed at joints between modules.

Technical Investigations

22 Investigations

22.1 An analysis was made of data to determine:

- structural adequacy
- behaviour in relation to fire
- element U values
- effect of thermal bridging
- condensation
- airtightness
- acoustic performance
- resistance to ground moisture
- weathertightness
- maintenance requirements
- durability.

22.2 Calculations were undertaken and examined in conjunction with the results of the tests referred to in this section to establish the structural strength and stability.

22.3 Calculations were made and computer simulations carried out to determine the effectiveness of the insulation arrangements and the risk of condensation.

Bibliography

BS 648 : 1964 *Schedule of weights of building materials*

BS 5250 : 2011 *Code of practice for control of condensation in buildings*

BS 5534 : 2003 *Code of practice for slating and tiling (including shingles)*

BS 5628-2 : 2005 *Code of practice for the use of masonry — Structural use of reinforced and pre-stressed masonry*

BS 5628-3 : 2005 *Code of practice for the use of masonry — Materials and components, design and workmanship*

BS 5950-1 : 2000 *Structural use of steelwork in building — Code of practice for design — Rolled and welded sections*

BS 5950-4 : 1994 *Structural use of steelwork in building — Code of practice for design of composite slabs with profiled steel sheeting*

BS 6399-1 : 1996 *Loading for buildings — Code of practice for dead and imposed loads*

BS 6399-2 : 1997 *Loading for buildings — Code of practice for wind loads*

BS 6399-3 : 1988 *Loading for buildings — Code of practice for imposed roof loads*

BS 7543 : 2003 *Guide to durability of buildings and building elements, products and components*

BS 8004 : 1986 *Code of practice for foundations*

BS 8102 : 2009 *Code of practice for protection of below ground structures against water from the ground*

BS EN 636 : 2003 *Plywood — Specifications*

BS EN 1991-1-1 : 2002 *Eurocode 1 — Actions on structures General actions*

BS EN 1991-1-3 : 2003 *Eurocode 1 — Actions on structures General actions*

BS EN 1991-1-4 : 2005 +A1 : 2010 *Eurocode 1 — Actions on structures General actions*

BS EN 1993-1-3 : 2006 *Eurocode 3 — Design of steel structures — General rules — Supplementary rules for cold formed members and sheeting*

BS EN 1993-1-5 : 2006 *Eurocode 3 — Design of steel structures — Plated structural elements*

BS EN 1996-1-1 : 2005 *Eurocode 6 — Design of masonry structures — General rules for reinforced and unreinforced masonry structures*

BS EN 1997-1 : 2004 *Eurocode 7 — Geotechnical design General rules*

BS EN 10346 : 2009 *Continuously hot-dip coated steel flat products — Technical delivery conditions*

BS EN ISO 140-4 : 1998 *Acoustics — Measurement of sound insulation in buildings and of building elements — Field measurements of airborne sound insulation between rooms*

BS EN ISO 140-7 : 1998 *Acoustics — Measurement of sound insulation in buildings and of building elements — Field measurements of impact sound insulation of floors*

BS EN ISO 13370 : 2007 *Thermal performance of buildings — Heat transfer via the ground — Calculation methods*

23 Conditions

23.1 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.

23.2 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.

23.3 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.

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

23.5 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.

23.6 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.

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