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Building System  
Agrément Certificate  
**02/S030**  
Product Sheet 1

**ULTIMA BUILDING SYSTEM**

**PRODUCT SCOPE AND SUMMARY OF CERTIFICATE**

This Certificate replaces Certificate 94/S022 and relates to the Ultima Building System, which is for use as single-, two-, three-, or four-storey non-residential accommodation other than dwellings (see section 3).

**AGRÉMENT 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** — Structural testing has been used to verify the relevant aspects of the design outside the scope of the codes, including resistance of panels to racking, fastening characteristics, interaction of components and effects of thermal cycling. See section 5.

**Behaviour in relation to fire** — It can be shown by tests and assessment that the buildings will meet Building Regulations' requirements for fire rating as given in section 6, Table 3.

**Thermal insulation** — Roofs, walls and floors, and their connecting junctions, meet the limit case U value and ACD psi ( $\psi$ ) values specified for a 'notional' building. See section 7.

**Weathertightness and damp-proofing** — The steel supporting columns raise the building clear of the ground, giving the system an inherent resistance to ground moisture. See section 11.

**Durability** — The steel structure has a design life of 60 years and the design life of the external envelope and internal finishes is between 25 and 60 years. See section 14.

The BBA has awarded this Agrément Certificate to the company named above for the product described herein. This product 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: 14 November 2008

Brian Chamberlain  
Head of Approvals — Engineering

Greg Cooper  
Chief Executive

Originally certified on 30 November 1994

*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.*

# Regulations

In the opinion of the BBA, the Ultima Building System, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations:



## The Building Regulations 2000 (as amended) (England and Wales)

Requirements:	<b>A1</b>	Loading
	<b>A3</b>	Disproportionate collapse
Comment:		The buildings will have adequate strength and stability. See sections 5.1 to 5.1.1 of this Certificate.
Requirements:	<b>B2</b>	Internal fire spread (linings)
	<b>B3</b>	Internal fire spread (structure)
	<b>B4</b>	External fire spread
Comment:		The buildings will meet the relevant requirements within the limitations set out in this Certificate. See sections 6.1 to 6.4 of this Certificate.
Requirement:	<b>C2(a)(b)(c)</b>	Resistance to weather and ground moisture
Comment:		The buildings are acceptable. See sections 11.1 to 11.6 of this Certificate.
Requirement:	<b>E4</b>	Acoustic conditions in schools
Comment:		Separating and internal walls and floors incorporating the system can resist airborne and impact sound transmission. See section 10.1 of this Certificate.
Requirement:	<b>L1(a)(i)</b>	Conservation of fuel and power
Comment:		The buildings are acceptable. See sections 7.1, 7.2, 7.4 and 7.5 of this Certificate.
Requirement:	<b>Regulation 7</b>	Materials and workmanship
Comment:		The buildings are acceptable. See section 14.1 and the <i>Installation</i> part of this Certificate.



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

Regulation:	<b>8(1)(2)</b>	<b>Fitness and durability of materials and workmanship</b>
Comment:		The buildings are acceptable. See sections 13.1 to 13.6 and 14.1 and the <i>Installation</i> part of this Certificate.
Regulation:	<b>9</b>	<b>Building standards — construction</b>
Standards:	1.1(a)(b)	Structure
	1.2	Disproportionate collapse
Comment:		The buildings will have adequate strength and stability. See sections 5.1 to 5.1.1 of this Certificate, with reference to clauses 1.1.1 <sup>(1)</sup> and 1.2.1 <sup>(1)</sup> of these Standards.
Standards:	2.1	Compartmentation
	2.2	Separation
	2.3	Structural protection
	2.4	Cavities
	2.5	Internal linings
	2.6	Spread to neighbouring buildings
	2.7	Spread on external walls
	2.8	Spread from neighbouring buildings
Comment:		The buildings will meet the relevant Standards within the limitations set out in this Certificate. See sections 6.1 to 6.4 of this Certificate, with reference to clauses 2.1.1 <sup>(1)</sup> , 2.1.4 <sup>(1)</sup> , 2.1.12 <sup>(1)</sup> , 2.1.15 <sup>(1)</sup> , 2.2.1 <sup>(1)</sup> , 2.2.2 <sup>(1)</sup> , 2.2.3 <sup>(1)</sup> , 2.2.4 <sup>(1)</sup> , 2.2.7 <sup>(1)</sup> , 2.3.1 <sup>(1)</sup> , 2.3.2 <sup>(1)</sup> , 2.3.4 <sup>(1)</sup> , 2.3.5 <sup>(1)</sup> , 2.4.1 <sup>(1)</sup> to 2.4.9 <sup>(1)</sup> (inclusive), 2.5.1 <sup>(1)</sup> , 2.6.1 <sup>(1)</sup> , 2.7.1 <sup>(1)</sup> and 2.8.1 <sup>(1)</sup> of these Standards.
Standards:	3.4	Moisture from the ground
	3.10	Precipitation
	3.15	Condensation
Comment:		The buildings are acceptable. See sections 8.1 to 8.4 and 11.1 to 11.6 of this Certificate, with reference to clauses 3.4.1 <sup>(1)</sup> , 3.4.5 <sup>(1)</sup> , 3.4.6 <sup>(1)</sup> , 3.10.1 <sup>(1)</sup> , 3.10.5 <sup>(1)</sup> and 3.10.8 <sup>(1)</sup> of these Standards.
Standards:	6.1	Carbon dioxide emissions
	6.2	Building insulation envelope
Comment:		The buildings are acceptable. See sections 7.1, 7.2, 7.4 and 7.5 of this Certificate, with reference to clauses 6.1.1 <sup>(1)</sup> , 6.2.1 <sup>(1)</sup> , 6.2.4 <sup>(1)</sup> and 6.2.5 <sup>(1)</sup> of these Standards.
		(1) Technical Handbook (Non-Domestic).



## The Building Regulations (Northern Ireland) 2000 (as amended)

Regulation:	<b>B2</b>	Fitness of materials and workmanship
Comment:		The buildings are acceptable. See section 14.1 and the <i>Installation</i> part of this Certificate.
Regulation:	<b>B3(2)</b>	Suitability of certain materials
Comment:		The buildings are acceptable. See sections 13.1 to 13.6 of this Certificate.
Regulation:	<b>C4</b>	Resistance to ground moisture and weather
Comment:		The buildings are acceptable. See sections 11.1 to 11.6 of this Certificate.
Regulation:	<b>C5</b>	Condensation
Comment:		The buildings using the system are acceptable. See sections 8.1 to 8.4 of this Certificate.

Regulations:	D1	Stability
	D2	Disproportionate collapse
Comment:	The buildings will have adequate strength and stability. See sections 5.1 to 5.1.1 of this Certificate.	
Regulation:	E3	Internal fire spread – Linings
Regulation:	E4	Internal fire spread – Structure
Regulation:	E5	External fire spread
Comment:	The buildings will meet the relevant Regulations within the limitations set out in this Certificate. See sections 6.1 to 6.4 of this Certificate.	
Regulation:	F2(a)(i)	Conversation measures
Comment:	The buildings are acceptable. See sections 7.1, 7.2, 7.4 and 7.5 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: 2 *Delivery and site handling* and 17 *Procedure* (17.1).

# Non-regulatory Information

## Zurich Building Guarantee Technical Manual 2007

In the opinion of the BBA, the Ultima Building System, when installed and used in accordance with this Certificate, satisfies the requirements of the *Zurich Building Guarantee Technical Manual*, Section 3 *Superstructure*, Sub-section *Floors*; Section 4 *Superstructure*, Sub-section *External walls – steel frame*; Section 4 *Superstructure*, Sub-section *Flat Roofs*.

# General

The standard range of building sizes and configurations covered by the scope of this Certificate have been assessed for structural stability up to three storeys and do not require any additional analysis or approval by a consultant engineer.

The Ultima Building System can be used to construct buildings with a variety of individual treatments and plan forms.

Specifiers shall 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.

This assessment does not cover staircases, windows, doorsets, fittings and raised access floors or the adequacy of the plumbing, drainage and electrical services supplied with the buildings

# Technical Specification

## 1 Description

### General

1.1 This Certificate relates only to the form of construction described below and the Ultima Building Module Technical Specification approved by the BBA, when applied to single-, two-, three- or four-storey buildings. Both parties maintain and update this specification.

1.2 The Ultima Building System is based on a module consisting of a structural steel framework and composite roof and end wall panels. The modules are used to construct single-, two-, three- or four-storey buildings incorporating walls to suit their location in the building (see Figure 1).

1.3 The modules are available in the standard range of sizes given in Table 1.

1.4 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 8.

### Structural frame

1.5 The galvanized steel frame for each module comprises four structural steel hollow-section columns, one at each corner of the module, bolted to cold-formed galvanized steel side beams at floor and roof level. Cold-formed galvanized steel floor joists span each module from side to side and are bolted to the two floor side beams. Longitudinal timber-floor runners are screwed to the steel floor joists to assist in the transportation of the module.

1.6 Each column has an integral lifting point within the top to accept a lifting eyebolt enabling the complete module to be crane handled. Upper floor modules have an integral locating socket within the bottom of the columns which is used to aid module alignment when linking them to lower modules.

Figure 1 Typical Ultima building

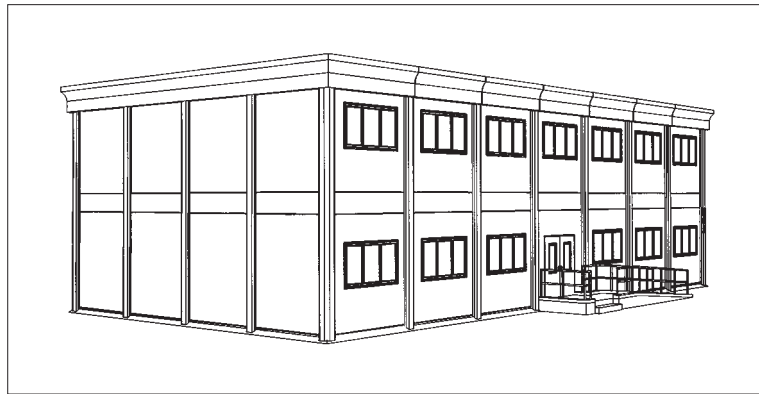
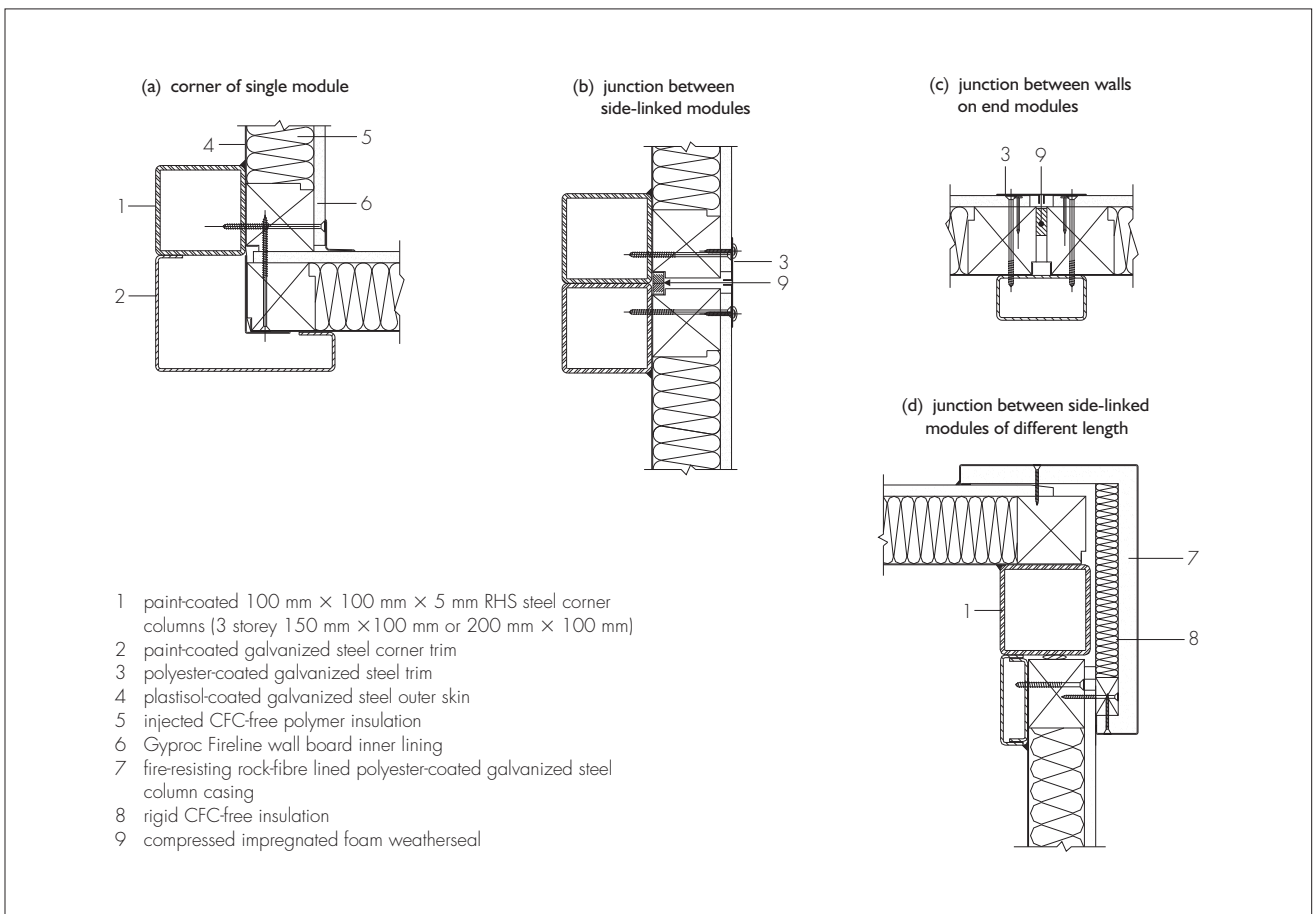


Table 1 Size range<sup>(1)</sup>

Type	Internal length (m)	Internal width (m)	Internal height (m)
7	7.049	2.9, 3.3	2.4, 2.6, 2.8, 3.2
9	9.451	2.9, 3.3	2.4, 2.6, 2.8, 3.2
12	11.853	2.9, 3.3	2.4, 2.6, 2.8, 3.2
14	14.255	2.9, 3.3	2.4, 2.6, 2.8, 3.2

(1) Longer and wider modules are available but are not covered by this Certificate.

Figure 2 Details in plan



## Floors

1.7 Floors comprise 18 mm thick, moisture-resistant structural particle board type P5 to to BS EN 312 : 2003 fixed to the galvanized steel joists with adhesive and zinc-plated screws. The floor is completely underdrawn and insulated with rigid, HCFC-free, urethane foam boards with foil facings on both sides.

Figure 3 Long wall section

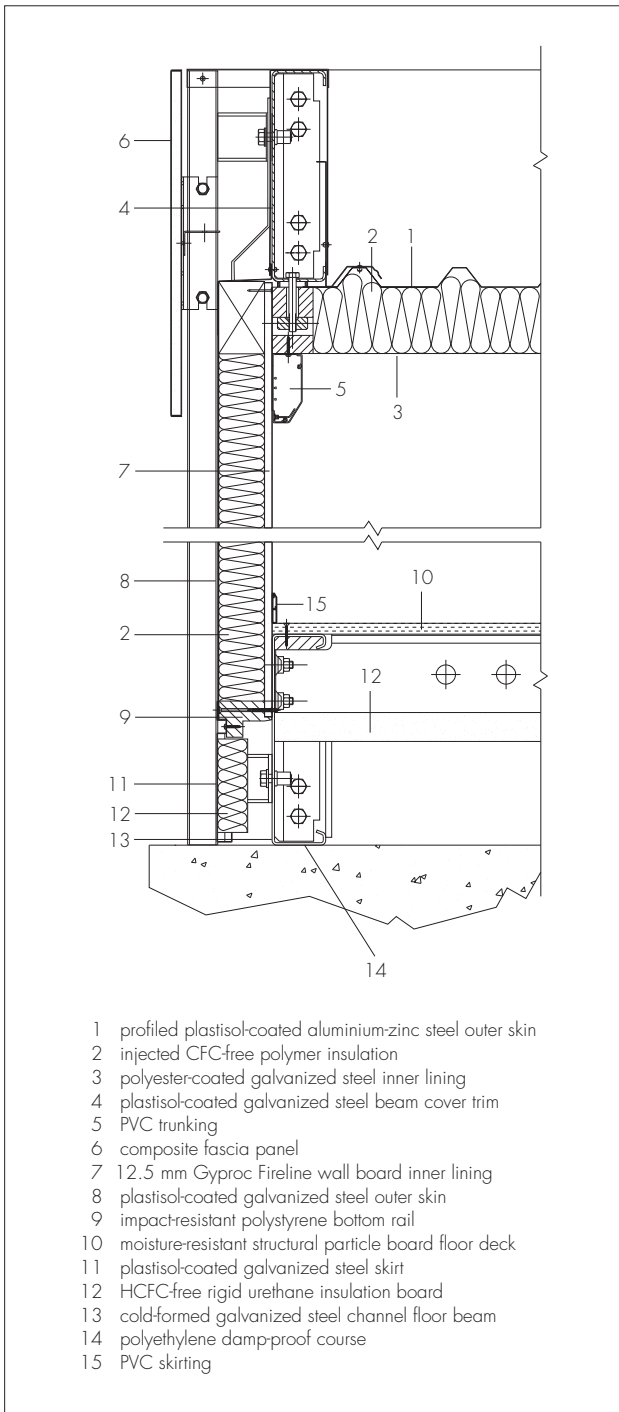
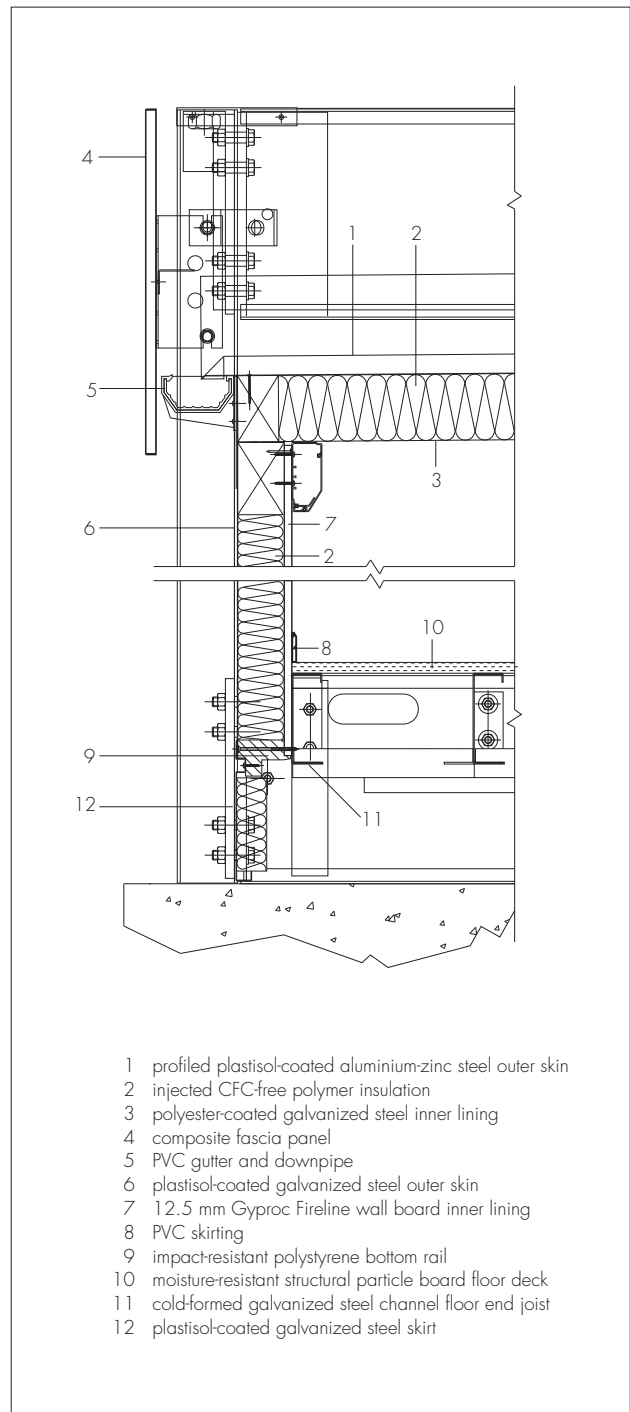


Figure 4 Short wall section



## External walls

1.8 External walls are of composite construction having an external skin of plastisol-coated galvanized steel sheet (the subject of a BBA Certificate), timber top and end posts, rigid polymer intermediate studs, impact-resistant polystyrene bottom rail and an internal lining of 12.5 mm thick gypsum wallboard to BS 1230-1 : 1985, type 5 (improved fire protection performance) vapour check board. The void between the external skin and internal lining is filled with injected, CFC-free polymer insulation.

1.9 All walls are fixed to the perimeter of the galvanized steel floor frame with zinc-plated steel screws and, in addition, short walls are also fixed to the steel columns with zinc-plated steel screws. The wall-to-wall corner joints and the wall-to-roof joints are fixed with zinc-plated steel screws.

## External roof ceiling panel

1.10 The external roof is of composite construction having an upper profilled (trapezoidal) skin of aluminium/zinc alloy coated sheet steel to BS EN 10327 : 2004, rigid polymer/plywood composite inserts, timber peripheral frame and a ceiling lining of polyester-coated galvanized steel. The void between the upper skin and ceiling lining is filled with injected, CFC-free polymer insulation.

1.11 The external roof is bolted to, and supported by, the two steel roof side beams, so that it has a 1:127 fall along the length of the module.

Figure 5 Section through junction — two modules joined end to end

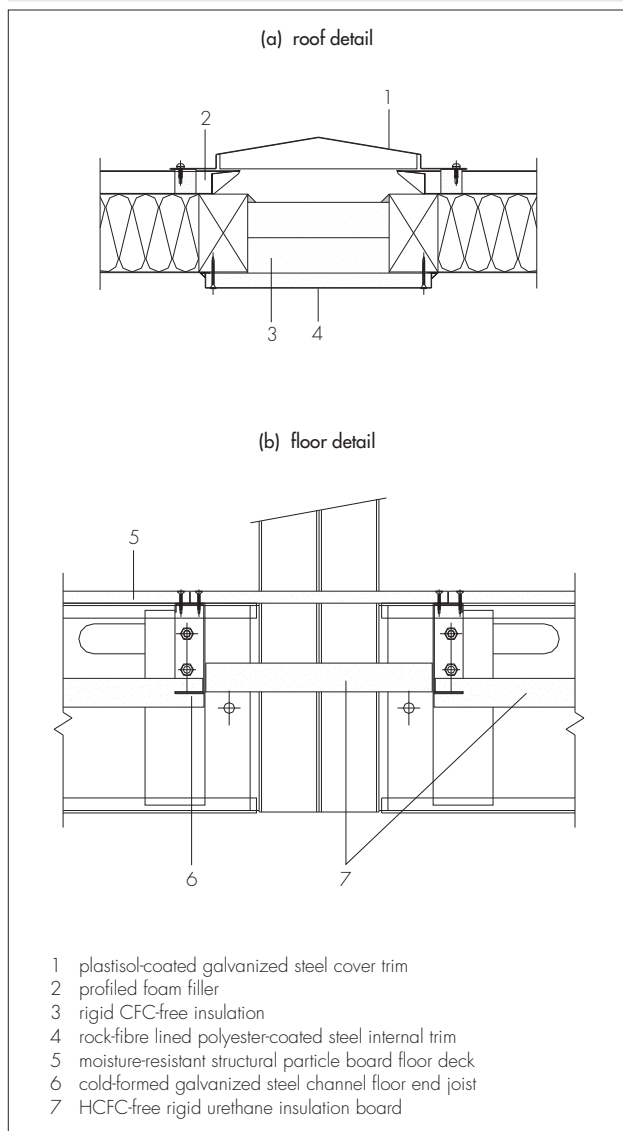
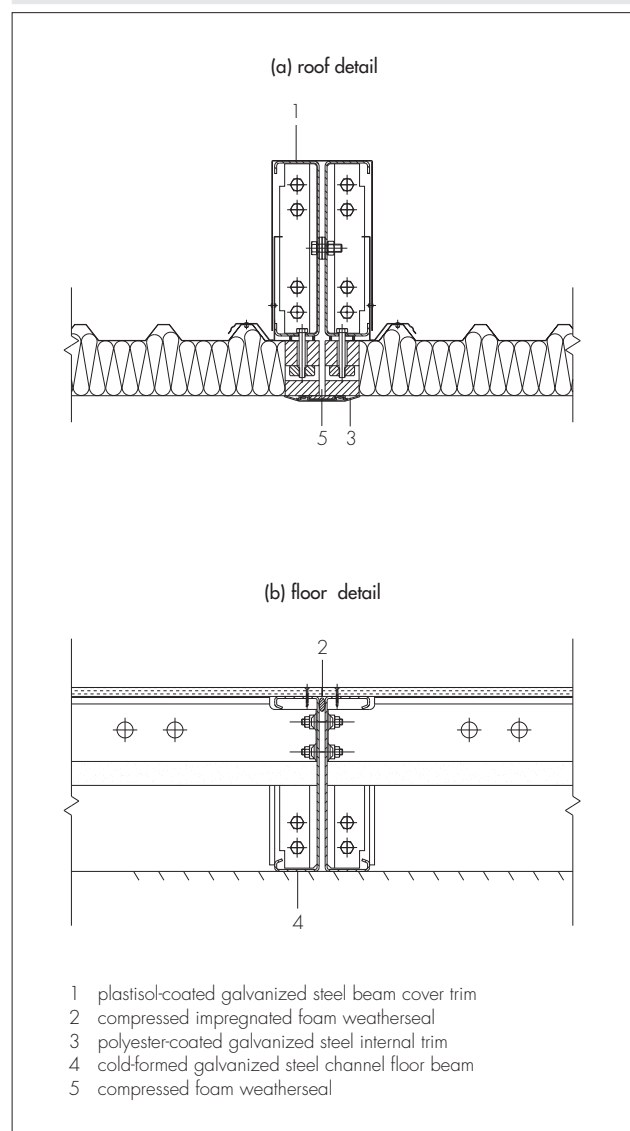


Figure 6 Section through junction — two modules joined side to side



### Intermediate ceiling panels for two, three or four storeys

1.12 The ceiling panel is a composite construction having an upper plywood deck, timber peripheral frame and ceiling lining of polyester-coated galvanized steel. The void between the upper deck and ceiling lining is filled with injected, CFC-free polymer insulation.

1.13 The ceiling panel is bolted to, and supported by, the two steel roof side beams in a horizontal plane.

### Protection of steelwork against corrosion

1.14 Floor side beams are produced from 2.5 mm, 3 mm or 4 mm thick galvanized steel sheet to BS EN 10326 : 2004, S350GD + Z450-N-A-C. Roof beams are produced from 2.5 mm, 3 mm, 4 mm, 5 mm and 6 mm thick galvanized steel sheet to BS EN 10326 : 2004, S350GD + Z275-N-A-C or better.

1.15 The floor joists are produced from galvanized steel sheet to BS EN 10147 : 2000, with a Z275 coating.

1.16 The structural steel columns are shot-blasted and coated with two coats of anti-corrosive primer and finished in grey paint.

1.17 The external skin of the building is protected by a 200 µm coating of PVC plastisol (the subject of a BBA Certificate) applied over a Z275 zinc coating to BS EN 10326 : 2004.

### Finishes

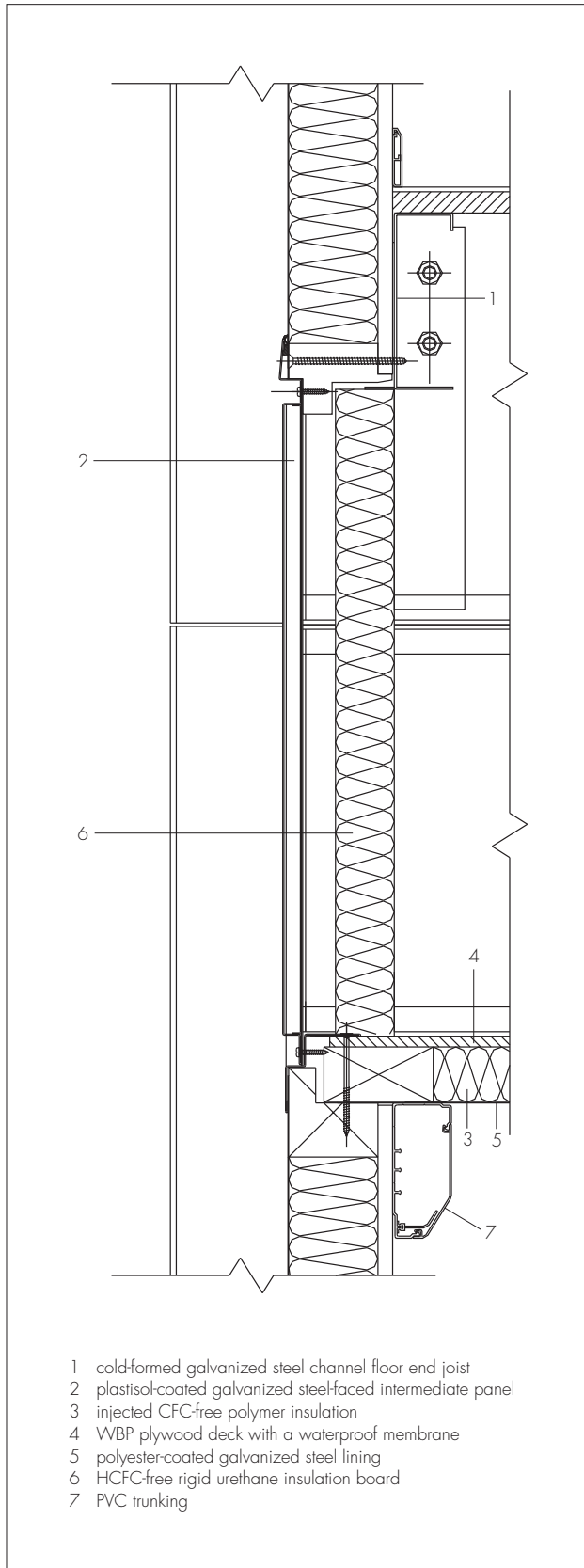
1.18 The external faces of wall panels, wall trims and fascias have a goosewing-grey coloured plastisol coating (the subject of a BBA Certificate), with a leathergrain finish.

1.19 The external face of the roof panel has a white plastisol coating with an aluminium/zinc alloy coated finish.

1.20 Internal walls have a textured white vinyl covering.

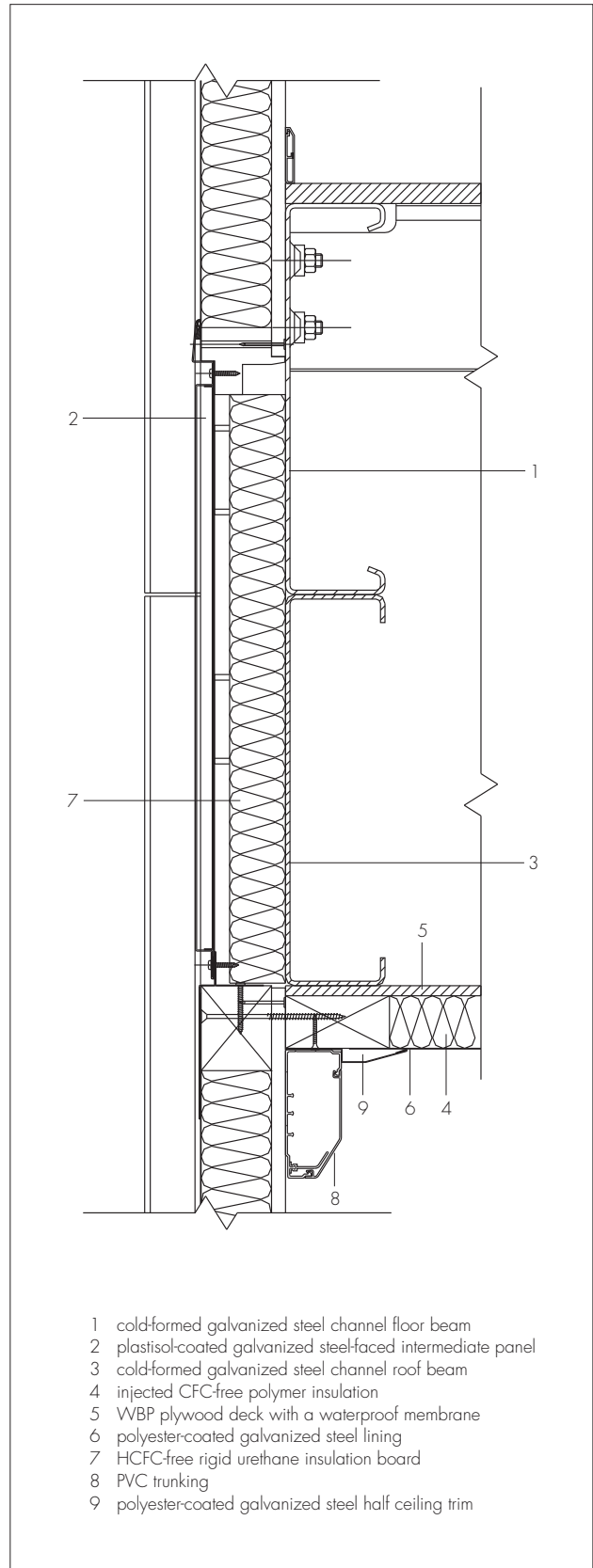
1.21 The ceiling has a silk white polyester finish.

Figure 7 Floor/ceiling assembly — short wall section



- 1 cold-formed galvanized steel channel floor end joist
- 2 plastisol-coated galvanized steel-faced intermediate panel
- 3 injected CFC-free polymer insulation
- 4 WBP plywood deck with a waterproof membrane
- 5 polyester-coated galvanized steel lining
- 6 HCFC-free rigid urethane insulation board
- 7 PVC trunking

Figure 8 Floor/ceiling assembly — long wall section



- 1 cold-formed galvanized steel channel floor beam
- 2 plastisol-coated galvanized steel-faced intermediate panel
- 3 cold-formed galvanized steel channel roof beam
- 4 injected CFC-free polymer insulation
- 5 WBP plywood deck with a waterproof membrane
- 6 polyester-coated galvanized steel lining
- 7 HCFC-free rigid urethane insulation board
- 8 PVC trunking
- 9 polyester-coated galvanized steel half ceiling trim

1.22 Fascias, roof flashings and wall trims fabricated from plastisol-coated steel (the subject of a BBA Certificate) are fitted to the external corners, the perimeter of the roof, the lower perimeter of all modules, the upper perimeter of modules to be used at ground floor in two-, three- or four-storey buildings and the horizontal junction between modules in two-, three- or four-storey buildings. Fascias are factory fitted. Intermediate panels are fitted after site assembly of the modules.

1.23 In applications where water will be present, vinyl floor covering is provided with welded joints, and sealed upstands at all floor/wall interfaces. The vinyl floor covering is specified to BS EN 649 : 1997 and is classified as 23, 24 and 35 in accordance with BS EN 685 : 2005 and G5ws in accordance with MOAT No 36 : 1987.

## Manufacture

1.24 Bought-in materials and components are to agreed specifications or in accordance with British Standards or Agrément Certificates.

1.25 Steel-framed components of the system are fabricated using conventional metalworking techniques.

1.26 Quality checks are made on the sub-assemblies, such as wall and roof panels and the steel frame, and on the final assembly of the modules. Quality control carried out during manufacture includes checks on dimensions, squareness and welding.

## 2 Delivery and site handling

2.1 The modules are transported to site on a flat-bed lorry or trailer long enough to fully support the module.

2.2 The modules are unloaded by crane.

2.3 The open sides of the modules are weatherproofed during transit.

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

# Assessment and Technical Investigations

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

## Design Considerations

### 3 Use

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

### 4 Practicability of installation

The Certificate holder is responsible for delivery and installation.

### 5 Strength and stability



5.1 With certain exceptions described in this section, the design of the Ultima Building System is in accordance with:

- BS 5268-6.1 : 1996
- BS 5268-2 : 2002
- BS 5950-1 : 2000
- BS 5950-5 : 1998.

5.2 The system is designed to support loads in accordance with:

- BS 6399-1 : 1996
- BS 6399-2 : 1997
- BS 6399-3 : 1988.

5.3 Where required, structural testing has been used to verify the relevant aspects of the design outside the scope of the codes, including resistance of panels to racking, fastening characteristics, interaction of components and effects of thermal cycling.

5.4 The limitations on the number of modules that can be used is detailed in Table 2.

5.5 Two- and three-storey buildings covered by this assessment must be constructed from modules of similar length placed one above the other.

5.6 Four-storey buildings are available and are assessed individually by the Certificate holder. The structural assessment of these buildings is not covered by this Certificate.

5.7 A multi-span layout, within the scope of this Certificate, is limited to four modules only.

5.8 In certain building configurations, the racking resistance of the building is supplemented by internal walls designed generally in accordance with BS 5268-6.1 : 1996. All changes to these internal walls must be agreed by the Certificate holder.

5.9 The roof is designed to support a uniformly-distributed imposed load of 0.75 kNm<sup>-2</sup> or a concentrated load of 0.9 kN, in accordance with BS 6399-3 : 1988, and, therefore, is acceptable where access is not provided, other than that necessary for cleaning or repair.

5.10 The floor is designed to support a uniformly distributed imposed load of 3 kNm<sup>-2</sup> or a concentrated load of 4.5 kN in accordance with BS 6399-1 : 1996 and, therefore, is acceptable, for example, in classrooms and offices for general use. Floors designed to support greater loads are available but are not covered within the scope of this

Certificate. Raised access floors have not been assessed and, therefore, are not covered within the scope of this Certificate.

5.11 Most building configurations 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.

5.12 Foundations must be designed in accordance with BS 8004 : 1986.

**Table 2** Standard range of building sizes and configurations

Module	Span <sup>(1)</sup>	No of storeys <sup>(2)</sup>	Basic wind speed <sup>(3)</sup> (ms <sup>-1</sup> )	Min size of building <sup>(4)</sup> (No of bays)
7	single	1	24	1
7	double	1	24	2
7	single	2	24	3
7	double	2	24	4
7	single	3	24	4
7	double	3	24	7
9	single	1	24	1
9	double	1	24	2
9	single	2	24	3
9	double	2	24	5
9	single	3	24	5
9	double	3	24	9
12	single	1	24	1
12	double	1	24	2
12	single	2	24	5
12	double	2	24	6
12	single	3	24	6
12	double	3	24	10
14	single	1	24	2
14	double	1	24	2
14	single	2	24	4
14	double	2	24	7
14	single	3	24	7
14	double	3	24	11

- (1) Where triple or quadruple module spans are required, reference should be made to the Certificate holder.
- (2) Where four-storey buildings are required, reference should be made to the Certificate holder.
- (3) As defined in BS 6399-2 : 1997. Single- and two-storey buildings sited in country more than 10 km from sea. Three-storey buildings sited in towns more than 10 km from sea.
- (4) Maximum building size can be determined on a project basis by the inclusion of deflection limiting walls.

## 6 Behaviour in relation to fire



6.1 Buildings subject to Building Regulations in England and Wales, Scotland or Northern Ireland must not be erected within one metre of a boundary. Due regard must be taken of all 'unprotected areas'.

6.2 It can be shown by tests and assessment that the buildings will meet Building Regulations' requirements for fire rating as given in Table 3.

**Table 3** Fire rating

Component	Duration
External walls (from inside)	60 minutes — Integrity
Combined ceiling and floor assembly (from underside)	one hour <sup>(1)</sup>
Steel column casing	one hour <sup>(1)</sup>

(1) 'medium duration' in Scotland.

6.3 The various exposed surfaces of the building element are assessed as having the following surface spread of flame ratings<sup>(1)</sup>:

- Class 0 ('low risk' in Scotland)
  - plastisol coated steel (external wall and roof surfaces)
  - Gypsum fire enhanced vapour check wallboard (internal wall surface)
  - polyester ceiling surfaces

— mineral fibre tiles (suspended ceiling surface)

- Class 1 ('medium risk' in Scotland)

— ground-floor insulation underdrawing.

(1) As defined in the national Building Regulations thus:

**England and Wales** — Approved Document B, Appendix A, paragraph 13

**Scotland** — Technical Handbook (Non-Domestic), Annex 2.E.

**Northern Ireland** — Technical Booklet E, paragraph 4.3 (see also Diagram 4.1).

6.4 The roof is designated AA in accordance with the national Building Regulations:

**England and Wales** — Approved Document B, Section 10.4

**Scotland** — Technical Handbook (Non-Domestic), Annex 2.F

**Northern Ireland** — Technical Booklet E, Section 4.19.

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

6.6 The regulations dealing with *Fire Spread* (England and Wales) and *Structural Fire Precautions* (Scotland and Northern Ireland) contain 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 the Ultima Building System.

6.7 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.

6.8 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.

## 7 Thermal insulation



7.1 For the purpose of calculations, the element U values and their connecting junction psi ( $\psi$ ) values, may be taken from Table 4.

Table 4 Element U values ( $Wm^{-2}K^{-1}$ )

Element	U value
Ground floor	0.25 <sup>(1)</sup>
External wall	0.34
Flat roof	0.25

(1) For a typical floor p/a of approximately 0.7.

7.2 The building fabric's 'conductive' heat losses (see Table 4) do not exceed those specified for a 'notional' building (with metal cladding) in the Simplified Building Energy Model (SBEM) or the fabric performance limits specified in the relevant documents supporting the national Building Regulations.

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



7.4 Tests to CIBSE TM 23 : 2000 *Testing buildings for air leakage*, on a single-storey building with a floor area of 190 m<sup>2</sup> resulted in an air leakage of less than 10 m<sup>3</sup>h<sup>-1</sup>m<sup>-2</sup> at an applied pressure difference of 50 Pa.

### Special considerations



7.5 Temporary buildings with a planned use of less than two years (less than and including two years in England and Wales) are exempt from the national Building Regulation requirements for energy efficiency.

7.6 Where more than 70% of the external envelope is created from sub-assemblies (or disassembly of existing buildings) manufactured before the following dates, compliance with the guidance in *Energy Performance Standards for Modular and Portable Buildings* (MPBA) 2006, would demonstrate reasonable provision for energy efficiency:

England and Wales 6 April 2006

Scotland 1 May 2007

Northern Ireland 30 November 2006.

## 8 Condensation



8.1 The buildings are not suitable for use where the internal relative humidity is expected to exceed 70% for any significant length of time since condensation may occur. Assuming normal internal conditions of temperature and humidity, and appropriate ventilation (see section 9.1), it is considered that the amount and duration of any condensation will be insufficient to significantly affect the structural or thermal properties of the building.

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.

8.3 Equipment producing large quantities of water vapour, for example flueless heaters, must not be used.

8.4 Adequate underfloor ventilation is provided to ensure that any condensation on the steelwork or insulation is effectively dispersed (see section 9.2).

## 9 Ventilation

9.1 The design of the windows should allow adequate ventilation and is an important factor in reducing the incidence of surface condensation. The windows should be designed so that the amount of openable window ventilation is a minimum of 5% of the floor area or provision of mechanical ventilation considered. The Certificate holder should be consulted with regard to the requirements for background ventilation which can be facilitated by the standard window system.

9.2 The void beneath the ground floor must have at least 600 mm<sup>2</sup> of open ventilation area per metre run of external wall.

## 10 Sound insulation



10.1 When the modules are used as school buildings, the designer must address the requirements of Building Bulletin 93.

10.2 Tests and assessments in accordance with BS 2750-3 : 1980 show that the weighted sound reduction index ( $R_w$ ) of an external wall, with and without a window, was estimated to be 29 dB, and measured to be 31 dB, respectively.

10.3 When tested in accordance with BS 2750-4 : 1980, the mean standardized Level Difference ( $D_{nT,w}$ ) of four floor/ceiling assemblies was measured to be 47 dB. Flanking transmission varies with the layout of the building and will affect this value.

10.4 Impact sound transmission will depend on the resilience of the floor coverings used in the buildings.

## 11 Weathertightness and damp-proofing



11.1 The steel supporting columns raise the building clear of the ground, giving it an inherent resistance to ground moisture. A damp-proof course (dpc) to protect the galvanizing is provided where the galvanized steel structure contacts the foundations.

11.2 The ground beneath the building, as a minimum, should be effectively cleared of turf and other vegetable matter at least to a depth sufficient to prevent later growth.

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

11.4 The roof and external wall surfaces provide adequate weather resistance. The final weathertightness of the building is dependent upon correct positioning and sealing of the roof beam casings, and the sealing of the horizontal and vertical joint between modules.

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

11.6 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.

## 12 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.

## 13 Maintenance



13.1 The external wall skin of plastisol coating requires an occasional washing down with water containing a mild detergent. Where a high aesthetic standard is required, maintenance painting may be required after a period from 10 to 30 years, depending on colour and environmental conditions, using a paint recommended by the Certificate holder.

13.2 The ceiling and internal surfaces can be cleaned using water containing a mild detergent. These surfaces can be decorated using a paint recommended by the Certificate holder.

13.3 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 to the original.

13.4 The exposed columns should be repainted in accordance with BS EN ISO 12944-2 : 1998.

13.5 In the event of impact or other damage to an external wall, a replacement plastisol-coated steel panel can be fitted over the original panel by the Certificate holder. If necessary, damage to the foam core of the wall can be made good before fitting the replacement panel. This will restore the appearance and ensure that the weathertightness and insulation are unaffected.

13.6 Trims or skirt panels can be readily replaced if necessary.

## 14 Durability



14.1 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 25 and 60 years depending on the materials, construction and degree of maintenance. Reference may be made to BS 7543 : 2003, or relevant Agrément Certificate in this respect.

14.2 Particular care is required in arrangement for dpcs, integrity of vapour control layers and weathertightness of the building envelope.

14.3 Foot traffic over the roof should be restricted to the purpose of maintenance and suitable precautions taken to avoid the risk of damaging the plastisol coating.

14.4 The ceiling covering will remain effective for this period.

14.5 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 of the tiles.

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

14.7 The sealants used in the construction of the modules in the factory and the seal between modules on site are concealed and are not subject to excessive movement. They should not normally require replacement during the building's envisaged life.

## 15 General

15.1 Buildings must be erected with due regard to any boundary (see sections 6.1 and 6.2).

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

## 16 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 Ultima Building System modules are delivered to site:

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

## 17 Procedure

17.1 The modules are placed by crane by Portakabin Ltd 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.

17.2 Temporary weatherproofing at joints between modules and the open ends of incomplete buildings is provided by Portakabin Ltd to suit the construction sequence.

17.3 Where specified, the building modules must be bolted to the foundations.

17.4 Building modules of the same length can be multi-stacked. The modules are bolted together at the four steel column points and along the longitudinal beams.

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

## 18 Supervision

For the benefit of clients who may wish to carry out their own checks during installation, the following, in addition to those carried out routinely, can be made:

- Before each ground-floor module is positioned:
  - location of dpc's
  - positioning of sealing strip between adjacent modules.
- During positioning of ground-floor modules:
  - damage is not caused to the steelwork protective systems.
- After each ground-floor module is positioned:
  - fixings between modules.
- Before each first-, second- and third-floor module is positioned:
  - positions of sealing strip between adjacent modules.
- After each first-, second- and third-floor module is positioned:
  - fixings between modules.
- Completion of roof weatherproofing at junction between modules.
- Satisfactory extension of finishings over joints between modules.
- Fixing of casings to columns to ensure continuity of fire protective systems.
- Satisfactory fixing of ground-floor skirt panels to provide ventilation.

### 19 Investigations

An analysis was made of data to determine:

- structural adequacy
- behaviour in fire
- airtightness
- effect of thermal bridging
- roof and wall U values to BS EN ISO 6946 : 2007
- floor U values to BS EN ISO 13370 : 1998 and BS EN ISO 10211-1 : 2001.

### 20 Other investigations

20.1 An examination was made of existing data to assess:

- structural strength and stability
- behaviour in fire
- impact resistance of floor and wall panels
- load capacity of roof and floor
- physical characteristics of injected, CFC-free polymer insulation
- resistance to sound transmission
- weathertightness
- durability
- maintenance requirements
- acoustic performance
- suitability of three-storey applications.

20.2 Calculations were undertaken and examined in conjunction with the results of the tests referred to in sections 18 and 19, to establish the structural strength and stability.

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

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

## Additional information

The management systems of Portakabin Ltd have been assessed and registered as meeting the requirements of BS EN ISO 9001 : 1994 by SGS Yarsley International Certification Services Ltd (Certificate No Q/444).

The Certificate holder's environmental management system for the offices and manufacturing plant have been assessed and registered as meeting the requirements of BS EN 14001 : 2004 by the BSI (Certificate No EMS 515280).

Portakabin Ltd holds LABC<sup>(1)</sup> approval for the Ultima Building System (Certificate No 180-3-84).

(1) Local Authority Building Control (national type approval).

## Bibliography

- BS 1230-1 : 1985 *Gypsum plasterboard — Specification for plasterboard excluding materials submitted to secondary operations*
- BS 2750-3 : 1980 *Measurement of sound insulation in buildings and of building elements — Laboratory measurements of airborne sound insulation of building elements*
- BS 2750-4 : 1980 *Measurement of sound insulation in buildings and of building elements — Field measurements of airborne sound insulation between rooms*
- BS 5268-2 : 2002 *Structural use of timber — Code of practice for permissible stress design, materials and workmanship*
- BS 5268-6.1 : 1996 *Structural use of timber — Code of practice for timber frame walls — Dwellings not exceeding four storeys*
- BS 5950-1 : 2000 *Structural use of steelwork in building — Code of practice for design — Rolled and welded sections*
- BS 5950-5 : 1998 *Structural use of steelwork in building — Code of practice for design of cold formed thin gauge sections*
- 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 : 1992 *Guide to durability of buildings and building elements, products and components*
- BS 8004 : 1986 *Code of practice for foundations*
- BS EN 312 : 2003 *Particleboards — Specifications*
- BS EN 649 : 1997 *Resilient floor coverings — Homogeneous and heterogeneous polyvinyl chloride floor coverings — Specification*
- BS EN 685 : 2005 *Resilient, textile and laminate floor coverings — Classification*
- BS EN 10147 : 2000 *Continuously hot-dip zinc coated structural steels strip and sheet — Technical delivery conditions*
- BS EN 10326 : 2004 *Continuously hot-dip coated strip and sheet of structural steels — Technical delivery conditions*
- BS EN 10327 : 2004 *Continuously hot-dip coated strip and sheet of low carbon steels for cold forming — Technical delivery conditions*
- BS EN ISO 6946 : 2007 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*
- BS EN ISO 9001 : 1994 *Quality systems — Model for quality assurance in design, development, production, installation and servicing*
- BS EN ISO 10211-1 : 2001 *Thermal bridges in building construction — Heat flows and surface temperatures — General calculation methods*
- BS EN ISO 12944-2 : 1998 *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Classification of environments*
- BS EN ISO 13370 : 1998 *Thermal performance of buildings — Heat transfer via the ground — Calculation methods*
- MOAT No 36 : 1987 *UEAtc Directives for the Assessment of Manufactured Plastic Floorings*

## 21 Conditions

21.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is granted only to the company, firm or person named on the front page — no other company, firm or person may hold or claim any entitlement to this Certificate
- 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 References in this Certificate to any Act of Parliament, Statutory Instrument, Directive or Regulation of the European Union, British, European or International Standard, Code of Practice, manufacturers' instructions or similar publication, are references to such publication in the form in which it was current at the date of this Certificate.

21.3 This Certificate will remain valid for an unlimited period provided that the product/system and the manufacture and/or fabrication including all related and relevant 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 In granting this Certificate, the BBA is not responsible for:

- 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
- individual installations of the product/system, including the nature, design, methods and workmanship of or related to the installation
- the actual works in which the product/system is installed, used and maintained, including the nature, design, methods and workmanship of such works.

21.5 Any information relating to the manufacture, supply, installation, use and maintenance 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 and maintained. It does not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date 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. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the manufacture, supply, installation, use and maintenance of this product/system.