IRISH AGRÉMENT BOARD
CERTIFICATE NO. 26/0451
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Actavo Modular Building System

NSAI Agrément (Irish Agrément Board) is designated by Government to carry out European Technical Assessments.

NSAI Agrément Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2024**.

SCOPE

This Certificate relates to the Actavo Modular Building System, for the design, manufacture and installation of 3D-Volumetric buildings (MMC Category 1) either on a site-specific sub-structure or directly on the ground.

The Actavo Modular nominated Chartered Structural Engineer is responsible for the final structural design of the Actavo Modular Building System.

The Actavo Modular Building System is a factory-manufactured structural building system consisting of pre-assembled modules. These modules are delivered to site with various internal finishes, including windows, insulation, internal boarding, electrical and plumbing systems, and air conditioning where applicable. These features are outside the scope of the NSAI Agrément Certificate. The steel module frames are manufactured and fitted out with internal fixtures, fittings and finishes (outside the scope of this Certificate) relevant to their function.

The Actavo Modular Building System is certified to be used in the following purpose groups 1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b) as defined in Technical Guidance Documents (TGDs) Part B of the Building Regulations.

The maximum height of the building system depends on the external façade system used:

- For traditional brick and block outer leaf cladding, the system is certified in the stated purpose groups where the height to the upper floor surface of the top floor is not more than 15m from ground level on the lowest side of the building. Maximum building height does not exceed 20m.

- Or an NSAI Agrément approved external cladding system for LGS. Where such cladding systems are used, it is important that the maximum storey height in their NSAI Agrément certificate is complied with. Other cladding systems may be suitable but have not been considered as part of this certification. Maximum building height does not exceed 20m.

In the opinion of NSAI Agrément, the Actavo Modular Building System, as described in this Certificate, complies with the requirements of the Building Regulations 1997 to 2024, hereafter referred to as the Building Regulations in this Certificate.

RESPONSIBILITIES

Prior to the commencement of the contract, the responsibilities are determined and agreed between Actavo and the Main Contractor. This must clearly identify the responsibilities of all parties. Responsibilities for foundations design, fire stopping, cavity barriers, roof completion and other elements must be identified.

The Actavo Modular Building System is intended for use where the architectural and fire strategy drawings, where necessary in accordance with the purpose group, are available and satisfy the Building Regulations. The Architect and Engineering Design Team and the building Owner[18]/Client[62] are responsible for the architectural drawings and compliance of the building design with the applicable Building Regulations and this Certificate.

MARKETING, DESIGN AND MANUFACTURE

The product is marketed, designed and installed by:
Actavo Building Solution Ireland,
Old Milltown, Kill,
Co Kildare
Ireland, W91 XO93
www.actavo.com
+353 (0)45 886 100

The product is manufactured by:
Actavo Building Solution Ireland,
Old Milltown, Kill,
Co Kildare
Ireland, W91 XO93.

1.1 ASSESSMENT

In the opinion of NSAI Agrément, the Actavo Modular Building System if used in accordance with this Certificate can meet the requirements of the Building Regulations, as indicated in Section 1.2 of this Irish Agrément Certificate.

1.2 BUILDING REGULATIONS

REQUIREMENTS

Part D – Materials and Workmanship
D1 – Materials and Workmanship
The Actavo Modular Building System, as certified in this Certificate, meet the requirements of the Building Regulations for workmanship.

D3 – Proper Materials
The Actavo Modular Building System is comprised of 'proper materials' i.e., materials which are fit for their intended use and for the conditions in which they are to be used.

Note: Nothing in this Certificate is intended to prevent the use of materials of equivalent or superior quality, strength, fire resistance, effectiveness, durability and safety over the requirements of this Certificate.

Part A - Structure
A1 – Loading

A2 – Ground Movement

A3 – Disproportionate Collapse

Part B – Fire Safety
For purpose groups 1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b). The fire safety requirements are laid out in TGDs to Part B of the Building Regulations. Refer to maximum building height stated on the cover page of this Certificate. Distance to relevant boundary is to be reviewed by competent Fire Engineer.

B1 & B6 – Means of Escape in Case of Fire
B2 & B7 – Internal Fire Spread (Linings)
B3 & B8 – Internal Fire Spread (Structure)
B4 & B9 – External Fire Spread
B5 & B10 – Access and Facilities for the Fire Service

B12 Provision of Information

Part C – Site Preparation and Resistance to Moisture
C3 – Dangerous Substances
C4 – Resistance to Weather and Ground Moisture

Part E – Sound
E1 – Airborne Sound (Walls)
E2 & E3 –Airborne and Impact Sound (Floors)

Part F – Ventilation
F1– Means of Ventilation
F2 – Condensation in Roofs

Part J – Heat Producing Appliances
J1 – Air Supply
J3 – Protection of Building

Part L – Conservation of Fuel and Energy
L1, L4, L5, L6 – Conservation of Fuel and Energy

2.1 PRODUCT DESCRIPTION

This Certificate relates to the design, manufacture and erection of the Actavo Modular Building System.

This Certificate contains illustrations that explain the various elements of the Actavo Modular Building System – these illustrations are not intended to be used as construction drawings. Actavo Modular, in conjunction with the design team on a project, will produce a set of project specific details on a project-by-project basis. All drawings should be compliant with the relevant codes of practice and relevant standards, along with the Building Regulations.

This Certificate does not contain a full set of installation instructions, but an overview of the procedures involved. For a full list of these instructions, refer to the Certificate holder's manuals. Should a conflict arise between this Certificate and the Certificate holder's manuals, this Certificate shall take precedence.

2.1.1 Foundations & Podium Slab

The construction of the foundations and podium slab is outside the scope of this Certificate. However, the Actavo Modular Building System is designed to be constructed on any of these base structures—foundations, ground floor, or podium slab.

2.1.2 Ground Floor

A composite concrete metal deck is used for the ground floor of the lowest module. The floor is made from reinforced concrete, which is cast on a permanent metal deck, supported on a permanent steel parallel flange channel (PFC) frame (See Figure 3 and Figure 4). The ground floor module is installed on underfloor insulation or a transfer slab. The ground floor is constructed from the following:

- DPC/DPM/Radon barrier installed by others on site
- EPS insulation installed by others on site,
- Composite concrete metal deck (forming part of modular unit by Actavo)
- Floor finishes by Actavo Modular or others

The ground floor structure is supported on rising walls/foundations, as illustrated in Figure 3. The connection between the ground floor and the rising wall/foundation is achieved using anchor bolts, in accordance with the Actavo Modular Structural Engineer's specification.

Expanded Polystyrene (EPS) insulation shall be installed at ground floor level and Extruded Polystyrene (XPS) below DPC, to comply with the requirements of the Technical Guidance Documents (TGDs) to Part L of the Building Regulations, including the prevention of thermal bridging.

A radon-resistant membrane or damp-proof membrane (DPM), approved by NSAI Agrément or an equivalent authority, shall be installed beneath the EPS insulation in accordance with the TGD to Part C of the Building Regulations. This membrane must be fully sealed across the entire footprint of the building.

Where the membrane is penetrated by anchor bolts connecting the modular units to the rising walls/foundations, it shall be adequately repaired to maintain its integrity.

The hardcore bed beneath the radon/DPM membrane shall be constructed in accordance with the TGD to Part C of the Building Regulations.

2.1.3 Compartment Floor

The Actavo Modular Building System provides a non-combustible steel and concrete composite deck where the structure of the compartment floor consists of metal deck profile and concrete. The compartment floor can be designed to provide 30/60/90min fire resistance from the underside. The following is the structure/configuration of this floor (See Figure 5 and Figure 6).

- Soft floor covering.
- Steel / Concrete composite deck sitting into the bottom flange of a perimeter PFC channel.
- Typically 20mm deflection gap.
- Weatherproofing membrane.
- OSB board.
- Steel joist.
- Air tightness membrane.
- 12.5mm plasterboard.

The compartment floor is constructed from non-combustible materials, with an additional membrane and OSB layer required, and is suitable for use in buildings of any purpose group up to the maximum height allowed in this Certificate.

2.1.4 Fire Resistance of Steel/Concrete Composite Deck

The fire resistance of the composite deck is provided from the underside of the deck. The composite deck can provide up to 90 minutes load bearing fire resistance from a combination of the

reinforcement steel bars within the trough of the decking and adequate concrete cover to the reinforcement steel bars.

All electrical and ventilation services are installed to the underside of the deck. The fire stopping of holes in the composite deck floor slab to accommodate pipes passing through a compartment floor (unless the pipe is in a protected shaft) should comply with Section 3.4 of the TGD B Volume 1, and 3.5 of TGD B Volume 2 of the Building Regulations for all purpose groups to which this Certificate relates.

2.1.5 Services in Compartment Floors

Electrical installations and recessed lights may not be accommodated within any of the compartment floor build ups. All electrical installations must be accommodated by creating a separate service void under the compartment floor. All services are installed with reference to Section 3.5.7 and 3.4 of TGD B Volume 1 for all purpose groups to which this certificate applies. Penetrations through compartment floors should be minimised. Mechanical ventilation extraction ducts are allowed to pass vertically through the floor but must be appropriately fire sealed where they enter and exit and comply with the recommendations contained within the TGD's B of the Building Regulations.

2.1.6 Loadbearing Walls

The loadbearing wall consists of SHS/RHS as the primary structure within each module. Light Gauge Steel (LGS) is then utilised as non-load bearing infill panels between the structural SHS/RHS members. This system can be used in buildings not more than 20m in height.

All mild steel sections are fully welded all round or connected through a bolted fin plate. Any SHS/RHS structural members used as part of the Actavo Building System must be fabricated in accordance with I.S. EN 1090-1[10] and in accordance with execution class EXC2.

The wall panels systems are filled with stone mineral wool between the studs to meet the fire resistance requirements and for additional thermal insulation and acoustic properties. The wall panels are then boarded with the required thickness and grade of plasterboard as per Table 2 of this Certificate, depending on their location within the module and the building, to meet fire requirements, acoustic requirements and/or weathering requirements.

2.1.7 External Walls

The external walls in the context of this Certificate refer an outer wall of a building (which is not a separating wall), taken from the innermost surface to outermost external surface, including all building components integral to the construction of the wall.

The external leaf of the Actavo Modular Building System is constructed on site, of either a traditional brick/block masonry to I.S. EN 1996-1-1[13] or an NSAI Agrément approved external cladding system for LGS. Where such cladding systems are used, it is important the maximum storey height in their NSAI Agrément certificate is complied with. Other cladding systems may be suitable but have not been considered as part of this certification. Maximum building height does not exceed 20m.

2.1.8 Internal Walls

Internal walls within the modules vary in design, depending on the project specific design of the overall building and on the service requirements which each wall is required to meet. Therefore, different types of internal walls exist within the modules, including load-bearing walls, non-load bearing walls and walls designed for lateral wind load resistance.

Non-load bearing internal walls are those which serve no structural function during the service life of the building. The non-load bearing partitions are generally fitted within modules to divide the internal area of a particular module. These walls can be required to serve a structural purpose during the transportation, lifting and installation of the modules. Non-load bearing walls may be required to provide fire resistance to comply with fire strategy for the building.

Where an internal wall is loadbearing it may be fully constructed of SHS/RHS or it may be comprised of corner posts with LGS non-load bearing studs and plasterboard for finishing.

2.1.9 Module Ceiling

The module ceilings are constructed from steel joist spanning the width of the module at a maximum 600mm centres. The trusses are typically a minimum 150mm deep but may be deeper to accommodate service runs.

A service zone is achieved in the centre of the truss allowing space for the module services. All service connections between the modules are connected from within the modules allowing the roof of the module to act as a permanent roof during construction. The services are accommodated within the ceiling below the concrete floor or accommodated in service ducts.

2.1.10 Roof Structure

The Actavo Modular Building System offers a flat roof system comprising a concrete composite deck. The flat roofing solution chosen for a particular building is both client and project

specific and must be assessed and signed off by a nominated Actavo Modular Chartered Structural Engineer.

A parapet may be provided on the roof to provide edge protection. This is achieved by installing HRS posts to the top module roof PFC at designated centres with an infill wall between. On the roof structure, stubs from certain modules will protrude through the roof membrane. These stubs will support a structural SHS grillage to accommodate any plant loading requirements for the structure. The vertical loads are transferred via the grillage into the stub then columns and down through the building.

The general ceilings of the intermediate modules are formed using LGS joist spanning the width of the module @ 600mm c/c. The top of the steel joist are sheathed with a OSB board to form a working platform which is covered by a watertight membrane to protect the module. The underside of the Steel joist are sheeted with 1No. layer of plasterboard.

2.1.11 Internal Linings and Finishes

Linings to walls and ceilings are of plasterboard of Type F, manufactured to I.S. EN 520[14]. They are attached by means of self-drill/self-tap screws into steel members. In areas prone to high levels of humidity, moisture resistant plasterboard should be used. Joints in plasterboard can be taped and filled in accordance with the plasterboard manufacturer's instructions. Alternatively skim coat plaster can be applied.

Reaction to fire classification of surface linings of walls and ceilings should meet the fire classification as per TGDs to Part B of the Building Regulations.

2.1.12 Services

Services are outside the scope of this Certificate. Electrical installation should be designed and installed in accordance with I.S. 10101[15]. Heating and plumbing services must be designed and installed by competent professional engineers to Part J and H of the Building Regulations.

Care shall be taken to avoid dissimilar metals coming into contact to avoid risk of galvanic corrosion. Local earth connection to the steel frame shall be avoided. The structural frame should be earthed in accordance with the current regulations I.S. 10101[15].

Where services are required on a separating wall, they can be accommodated by creating a service cavity to the separating wall with timber battens or metal top hat sections and plasterboard.

2.2 GENERAL BUILDING STRUCTURE

2.2.1 Foundations

Foundations are outside the scope of this Certificate. Based on finalised layouts, the nominated Actavo Modular Structural Engineer can carry out load takedown calculations and provide the Client appointed Structural Engineer with accurate line loads which they can accommodate into their foundation design.

2.2.2 Concrete Podium Slab (Transfer Slab)

The Actavo Modular Building System can be constructed off a concrete podium slab. Responsibility for construction, tolerances and structural details shall be clearly defined before construction begins. See section 2.1.1 of this Certificate.

2.2.3 Lateral load resistance

The Actavo Modular Building System is intended to provide overall structural stability on its own. Structural stability can be achieved through complementary systems, such as a concrete core and/or a separate braced structure using hot-rolled steel members, typically located in stair and lift cores or at the end gables. These elements are integral to the overall building design and are required to ensure compliance with structural regulations. Responsibility for construction, tolerances and structural details of this braced structure shall be clearly defined before construction begins.

2.3 DESIGN AND MANUFACTURE

The Actavo Modular Building System must be designed in accordance I.S. EN 1993-1-1**Error! Reference source not found.**, and manufactured in accordance with I.S. EN 1090-1[10].

2.3.1 Plasterboard Installation

The proper application of plasterboard to the steel frame members (LGS or SHS/RHS) is critical for both fire and sound performance. Attention shall be given to proper and practical detailing on the part of the designer and a high standard of workmanship on behalf of Actavo. Plasterboard, in addition to all cavity barriers and fire stops on all structural walls and floors and separating walls, must be fully checked on site and signed off in accordance with project specific details by the appropriate personnel, as detailed in section 2.7 and 3.2.5.1 of this Certificate. All boarding that provides fire resistance must conform to the specification given in Table .

If alternative boarding is proposed, then an independent fire test report, from an Accredited Laboratory, must be provided and assessed by a competent Fire Engineer.

2.4 STRUCTURAL PRINCIPLES

2.4.1 Steel Frame Structure

The primary load bearing elements of the modular system consist of mild steel SHS/RHS corner and intermediate studs fixed to top and bottom parallel flanged channels (PFC). LGS is then utilised as non-load bearing infill panels between the mild steel carcass as described in Section 2.1.6 of this Certificate. Table 1 shows the typical section sizes used in the Actavo Modular system.

2.4.2 Protective Coatings

The LGS members are all coated with a protective zinc-rich metal coating. The LGS members are manufactured from galvanized coil steel to I.S. EN 10346[19] (min. yield stress 350 N/mm2) with 275g/m2 zinc protection.

The paint system in accordance with I.S. EN ISO 12944-5[55] is used on the hot or cold rolled primary structure. The paint system for the primary structure is designed to achieve high durability and C2 corrosivity category for all elements except the ground floor structure. For ground floor structure:

- Structural steel elements above 150mm above external ground level, the paint system is designed to achieve C2 corrosivity category and high durability. The paint system is in accordance with I.S. EN ISO 12944-5[55].

- Structural steel elements below 150mm above ground floor are characterised by C3 corrosivity category and are hot dip galvanised to I.S. EN ISO 1461[56] and I.S. EN ISO 14713-2[57]. Minimum coating thickness (nominal dry film thickness)/ weight equals to 710gms/m2.

Where the protective coating on steelwork is damaged during the installation, it shall be adequately repaired to meet the protective coatings requirements stated in this Section.

In addition to the steel members in the system being protected by zinc rich protective coatings, further protection against corrosion and therefore longer design life is given to the steel by providing the following:

- Where a void is introduced beneath the concrete modular floor for project-specific design purposes, a minimum of a 150mm ventilation void is provided to the Ground Floor Modules. The U/S of the ventilation void shall be above the external finished ground level to avoid a sump affect occurring beneath the building.
- The bottom channel on all ground floor modules is additionally protected by a 100mm wide DPC from the floor slab,
- The insulation on the outside of the external walls keeps the steel in a "warmframe" environment, which in conjunction with the external membrane, prevents the formation of condensation within the wall structure,
- All fasteners have been assessed and tested for use with the system, to ensure they meet the minimum design life of the system and are manufactured in accordance with ISO 9223[42].

2.4.3 Fasteners and Connection Joints

There is no welding of joints within the LGS elements of the system.

Actavo Modular provide a full specification of all fasteners, where they are to be used and how they are to be installed. Only fasteners approved or supplied by Actavo Modular may be used with the system.

Actavo Modular specify corrosion protection of fasteners with consideration to the environment in which they are to be used, with additional coatings applied on site where required.

2.4.4 Racking

The overall stability of the structure is provided by means of LGS flat strap bracing fixed to infill LGS wall panels and located at regular centres. The system is not limited to this lateral stability solution and can be integrated with cold rolled SHS steel bracing and/or a traditional reinforced concrete core.

2.4.5 Holding Down

Modules are connected to the concrete core and transfer slab to provide lateral resistance and resistance to uplift.

Connections in between the modules are installed on site. Connections on site include the following:

- Holding down bolts to foundations/substructure
- Vertical connections between the modules
- Horizontal connections between the Modules

Requirement for vertical and horizontal connections depends on the consequence class in accordance with NA+A1+AC2 to I.S. EN 1991-1-7:2006-2015 **Error! Reference source not found.**.

The consequence class determination considers building type/occupancy and building height.

Holding down connections are installed (where necessary) to provide adequate loading transfer to foundations.

The type of fixing used to hold down the modules of the system will be dependent on what substrate the anchor is being fixed to. Typically cast in reinforcement or chemical anchors are used. Anchors design and installation shall be in accordance with HSA: Code of Practice for the Design and Installation of Anchors [46].

Vertical connections between the modules are installed (where necessary) using custom fabricated tying plates.

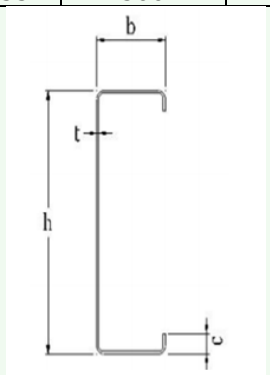
All connections shall be designed on a project specific basis by Actavo Structural Engineer in accordance with the design guidance set out in I.S. EN 1992-4[47] and I.S. EN 1993-1-8[23] and installed by competent personnel in accordance with Actavo Modular Manuals [50] [51]. The positions of the fixings are project specific and are determined by the Actavo Modular Structural Engineer.

2.5 COMPARTMENTATION

2.5.1 Separating Wall

Separating walls are constructed using two independent framed leaves (studs at 600mm centres max.), two layers of gypsum plasterboard internal lining on each side with an additional two boards in the cavity between frames.

The studs are fully filled with stone mineral wool batts of a minimum density 22kg/m^3. The cavity at the junction of the separating wall and external wall is closed as illustrated in Figure 7. This detail seals air gaps and minimises flanking sound transmission.

Table 1: Typical Sizes of Elements in the Steel Frame System						
Component Type		Grade of Steel	Typical Section Dimensions			
			Depth (h) (mm)	Width (b) (mm)	Lip (c) (mm)	Thickness (t) (mm)
Wall Stud	LGS C Stud	S450gd +z275	120	75		2mm
Wall Stud (Base)	LGS C Stud	S450gd +z275	124	40	N/A	2mm
Wall Stud (Head)	LGS C Stud	S450gd +z275	124	70	N/A	2mm
Wall Stud	RHS/SHS	S355	90	90	N/A	variable
Floor Perimeter	PFC	S355	300	100	N/A	variable
Roof Perimeter	PFC	S355	300	100	N/A	variable
						
1. The range of thickness of cold formed sections available = 0.8, 1.0, 1.2, 1.5 mm. 2. These profiles are typical variations. Alternative profiles are available on request as all steel sizes are project specific.						

The head of the separating wall must be fire-stopped, and the cavity closed as specified by the Actavo construction details. Where services are required in a separating wall, they can be accommodated by additional dry lining to the separating wall with battens and plasterboard.
No services are allowed to pass through a separating wall. All battens used in the Actavo building system are treated in accordance with BS 8417[17]. This detail, along with all other critical fire stopping details, must be inspected and signed off on every building by the Actavo Site Quality Manager, or an appointed Actavo representative.
Design must comply with the requirements of sections 3.5 of TGD's B Volume 1 and 3.5 Volume 2 of the Building Regulations.

2.5.2 Single Frame Compartment Walls

A compartment wall within the Actavo building system can be constructed of a single frame wall and must be designed and specified to meet the acoustic, fire and structural requirements of the Building Regulations. This compartment wall must not be used where a wall is common to two or more buildings (separating wall) or where a compartment wall is used to separate dwellings from each other within a building.

Services can pass through a compartment wall when they are appropriately protected with reference to Section 3.5.7 and 3.7 of TGD B Volume 1 and 3.5 and 3.7 of Volume 2 of the Building Regulations. Services passing through compartment walls should be kept to a minimum and avoided where possible.

2.5.3 Cavity Barriers and Fire Stops

If an element is intended to provide fire separation (i.e. it has a requirement for fire resistance in terms of insulation and integrity), then every joint or opening to allow services to pass through the element should be adequately protected by sealing of fire-stopping so that the fire resistance of the element is not impaired.

Cavity barriers and fire stopping shall be in accordance with sections 3.6 and 3.7 of TGD B Volume 1, and Section 3.6 and 3.7 of TGD B Volume 2 of the Building Regulations.

Figure 5, Figure 6, Figure 7, **Figure 9** and Figure 10 show typical details on the installation of cavity barriers and fire stops in the Actavo Modular Building System.

The Actavo Modular installation team will inspect all cavity barriers and fire stops prior to the closing

up of the cavities and ceilings and this is recorded in the quality control file for that site. The fire stopping must be installed correctly before Actavo Modular will issue the certificate for the building.

2.6 DELIVERY, STORAGE AND SITE HANDLING

2.6.1 Delivery of Modules

The modules leave the factory as weather proofed sealed units. A crane with a specifically designed lifting frame lifts the modules into place directly from the delivery transport. All lifting shall be carried out by competent personnel in accordance with the Actavo Modular Manuals [50] [51] and site-specific safety statement along with the site-specific lifting plan. Modules are lifted from the delivery transport in a sequential manner. Figure 1 and Figure 2 illustrate a module covered with a waterproof membrane being lifted into place on site.

2.6.2 Traceability

Each module is labelled with a unique numbering system or QR Code. This number/code is taken from the "Project Numbering Register" and records the project number, reference to the building, floor, where the module is to be placed, and individual module number. This ensures modules are delivered to site in the correct order and subsequently placed in the correct sequence.

Figure 1: Module being lifted into position using a lifting frame.

Figure 2: Module installation in progress on site.

2.6.3 Typical Material List Supplied to Site

A comprehensive bill of materials is supplied on a project basis. The bill of materials within Actavo Modular's scope of works gives a detailed list of all components delivered to site to complete the installed modular units.

2.6.4 Main Contractor Responsibilities

The Main Contractor is generally responsible for the construction of all facade claddings, roof claddings and the installation of fire stopping and cavity barriers where it is impractical for Actavo Modular to install prior to these claddings being applied. All other fire stopping, and cavity barriers are the responsibility of Actavo Modular.

2.7 INSTALLATION

2.7.1 General

Site installation must only be carried out by approved licensed installers employed by Actavo or by a specialist sub-contractor under the supervision of Actavo Modular and in accordance with the Actavo Modular manuals [50] [51].

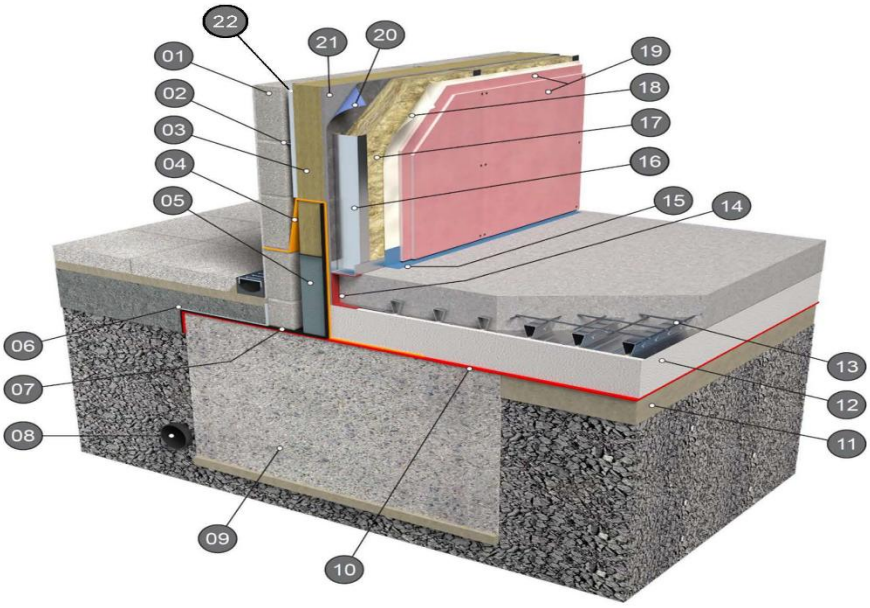
Installers are approved once they have undergone on-site training, understand the fundamental structural principals of the system, fire stopping requirements, tolerances, importance of weathering, storage and handling of the modules and all other relevant information. Installers should have installed modules under the guidance of a qualified installer.

All off-loading and erection should be in accordance with the Actavo Modular's method statement and erection procedures and the lifting plan. Care must be taken to avoid any damage to the steel frame components during lifting and connection brackets during transportation and installation.

An Actavo Modular Chartered Structural Engineer or Actavo Modular nominated Consulting Chartered Structural Engineer must assess the adequacy of the design of the proposed superstructure of the building system in accordance with the Actavo Modular Inspection Plan and the DHLGH Code of Practice for Inspecting and Certifying Buildings and Works[18].

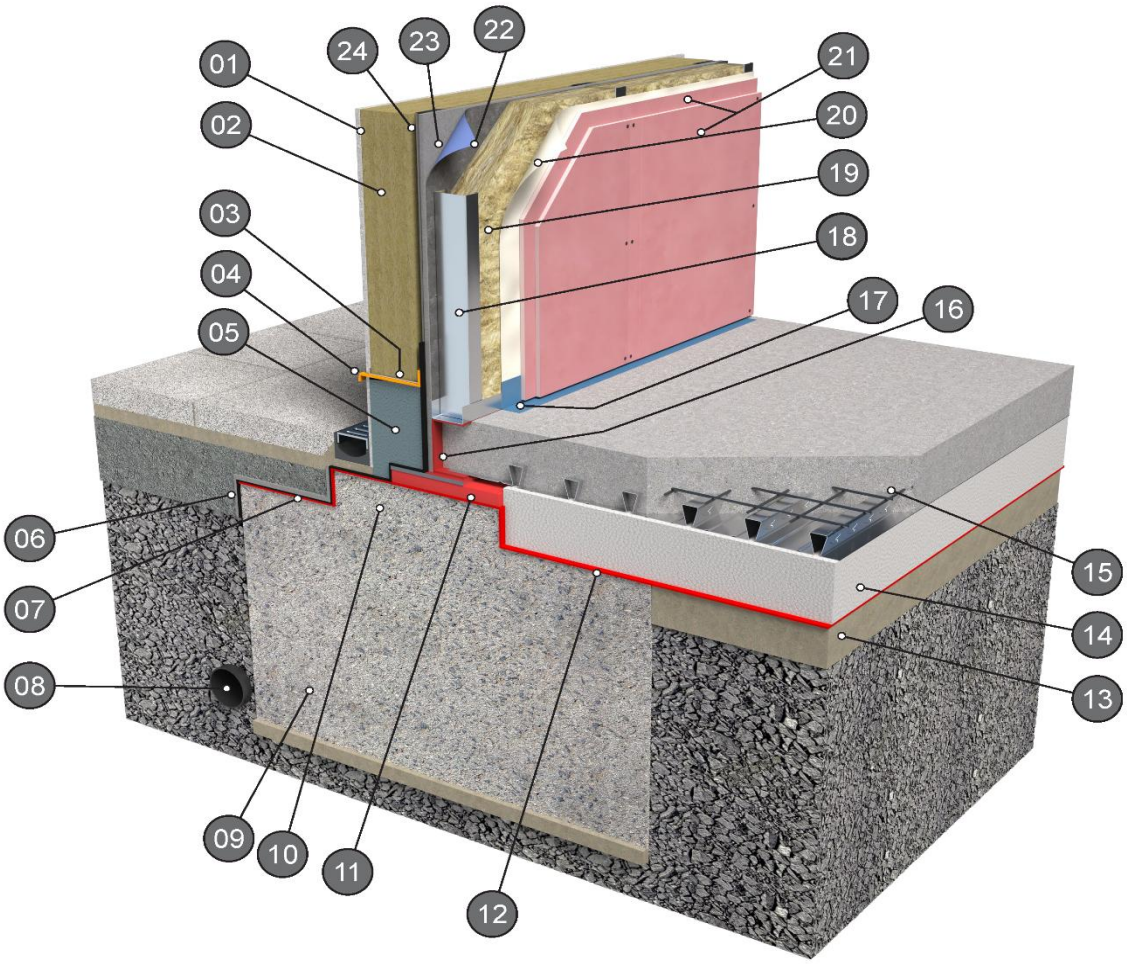
2.7.2 Site Supervision

Each project will have a specific site inspection plan to comply with the BC(A)R 2014 (S.I. 9, 2014) requirements. Actavo Modular Install team will take responsibility for carrying out inspections in accordance with the site inspection plan and maintaining appropriate records.



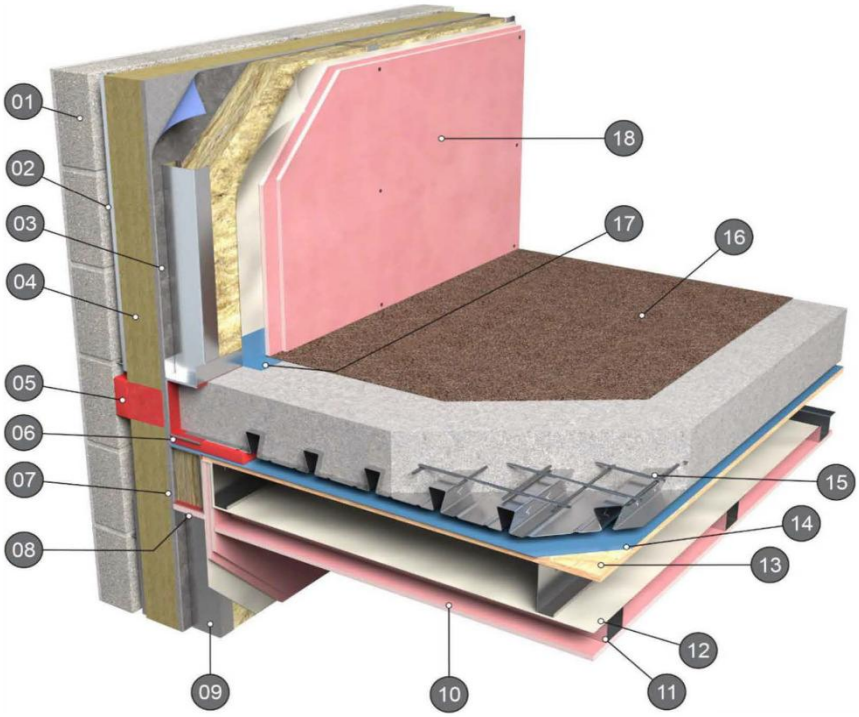
1. Masonry Outer Leaf Design to Designers requirements
2. External Masonry/brick restraint system fixed back to metal studs in module wall
3. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
4. Stepped DPC min. 150mm above ground level. DPC to lap with DPC underframe
5. 50mm Plinththerm XPS Insulation board below DPC fixed with propriety fixing to engineers specification and detail
6. Protection Board Applied externally for protection prior to backfilling with suitably drained backfill
7. Continuous tanking membrane to be brought down face of module and below block for full width. Fully bonded to radon barrier for full width of block
8. Land Drain
9. Structural Foundation Type and Specification to Structural engineer's design requirements
10. Radon barrier fully bonded to tanking membrane for full width of block.
11. 100mm Sand Binding on well compacted hardcore
12. Ground floor Insulation type & thickness as per Designers U-Value Calculations
13. 140mm Comflor to Structural engineer's design requirements
14. PFC Structural Beam to Structural engineer's design requirements
15. VPC Taped to concrete slab
16. LGS at 600mm C/C. Base track fixed with Stainless steel Anchor bolt to Engineers detail and specification
17. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
18. Airtightness Membrane
19. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
20. Breather Membrane
21. Cement Board
22. 40mm Unventilated Cavity, drained via weepholes in Masonry installed above DPC

Figure 3: External Wall with Masonry Outer Leaf and Cavity to Ground Floor Detail



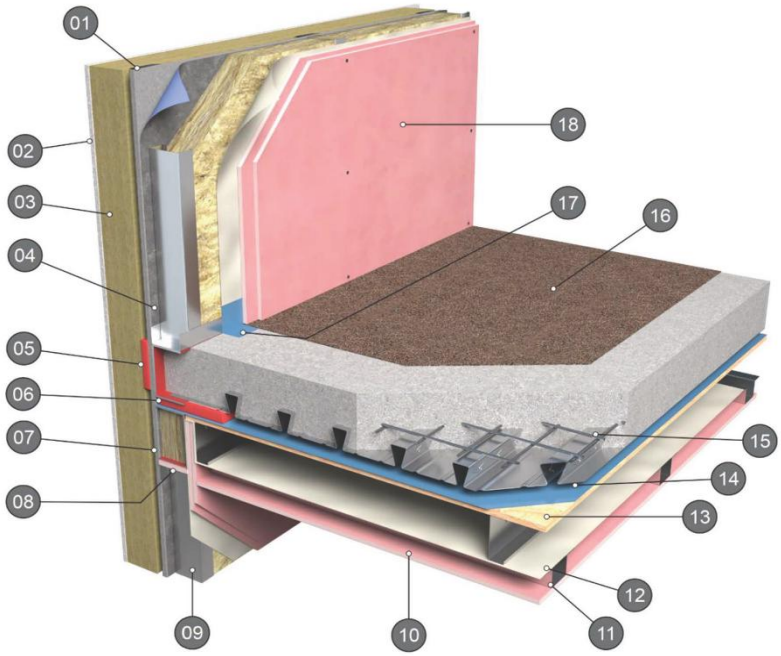
1. 6-8mm Silicone Render applied uniformly on rasped EWI Board
2. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height
   Min. thickness 100mm with a minimum density of 22kg/m3.
3. Perforated drainage stainless steel base rail
4. Plinth Capping on stepped DPC, Minimum 150mm above ground level
5. 50mm Plinththerm XPS Insulation board below DPC fixed with propriety fixing to engineers specification and detail.
6. Protection Board Applied externally for protection prior to backfilling with suitably drained backfill
7. Continuous tanking membrane to be brought down face of module and below block for full width. Fully bonded to radon barrier for full width of block
8. Land Drain
9. Structural Foundation Type and Specification to Structural engineer's design requirements
10. 450mm x 450mm concrete stub column to structural engineers specification
11. Thermal Break
12. Radon barrier fully bonded to tanking
13. 100mm Sand Binding on well compacted hardcore
14. Ground floor Insulation type & thickness as per Designers U-Value Calculations
15. 140mm Comflor to Structural engineer's design requirements
16. PFC Structural Beam to Structural engineer's design requirements
17. VPC Taped to concrete slab
18. LGS at 600mm C/C. Base track fixed with Stainless steel Anchor bolt to Engineers detail and specification
19. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
20. Airtightness Membrane
21. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
22. Breather Membrane
23. Cement Board
24. 25mm Ventilated Cavity, drained via Perforated Drainage Stainless Steel Base rail

Figure 4: External Wall with Insulated Render System to Ground Floor Detail



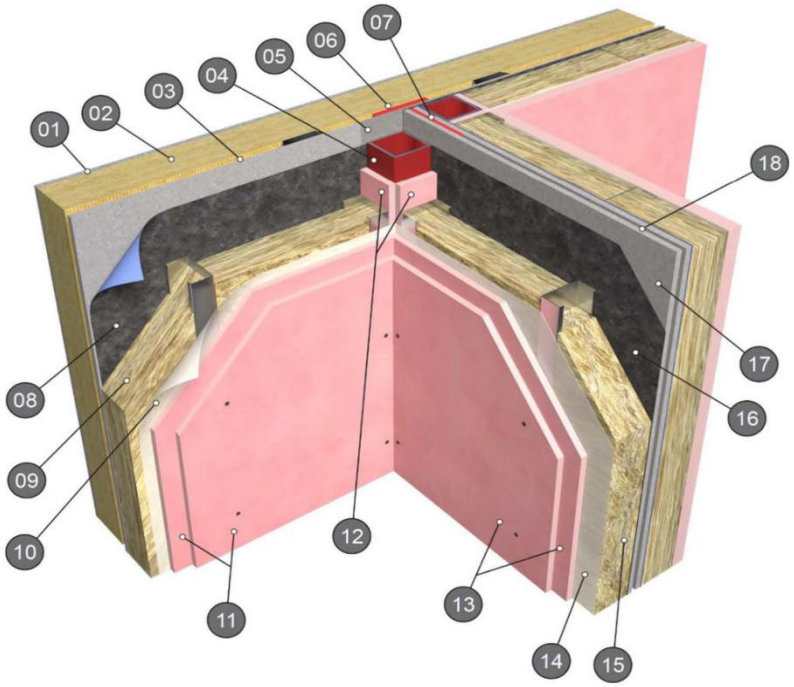
1. 6-Smm Silicone Render on Masonry Outer Leaf Designed to Designers requirements with 40mm Cavity
2. External masonry/brick restraint system fixed back to metal studs in module wall
3. Breather membrane to be lapped down over module below and sealed
4. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
5. Proprietary fire barrier to full width of cavity of floor junction
6. Proprietary fire barrier to full width of cavity of floor junction
7. 12mm Cement board fitted over joint to make continuous wall build up
8. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
9. LGS at 600mm C/C infilled with Mineral wool insulation - type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3. Airtightness Membrane applied to internal side finished with 2no. 15mm sheets of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
10. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
11. 50 mm MF Top Hat Channel for service cavity
12. Airtightness membrane with joints lapped and taped
13. 12mm OSB 3 board
14. Protective membrane to roof of module when in transport/storage
15. 140mm Comflor to Structural engineer's design requirements
16. Acoustic Resilient Layer
17. VCL taped to concrete slab - Continuous membrane tape along perimeter of module fl floor to wall junction
18. LGS at 600mm C/C infilled with Mineral wool insulation - type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3. Airtightness Membrane applied to internal side finished with 2no. 15mm sheets of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate

Figure 5: External wall with Masonry Outer Leaf and Cavity and Compartment Floor Junction



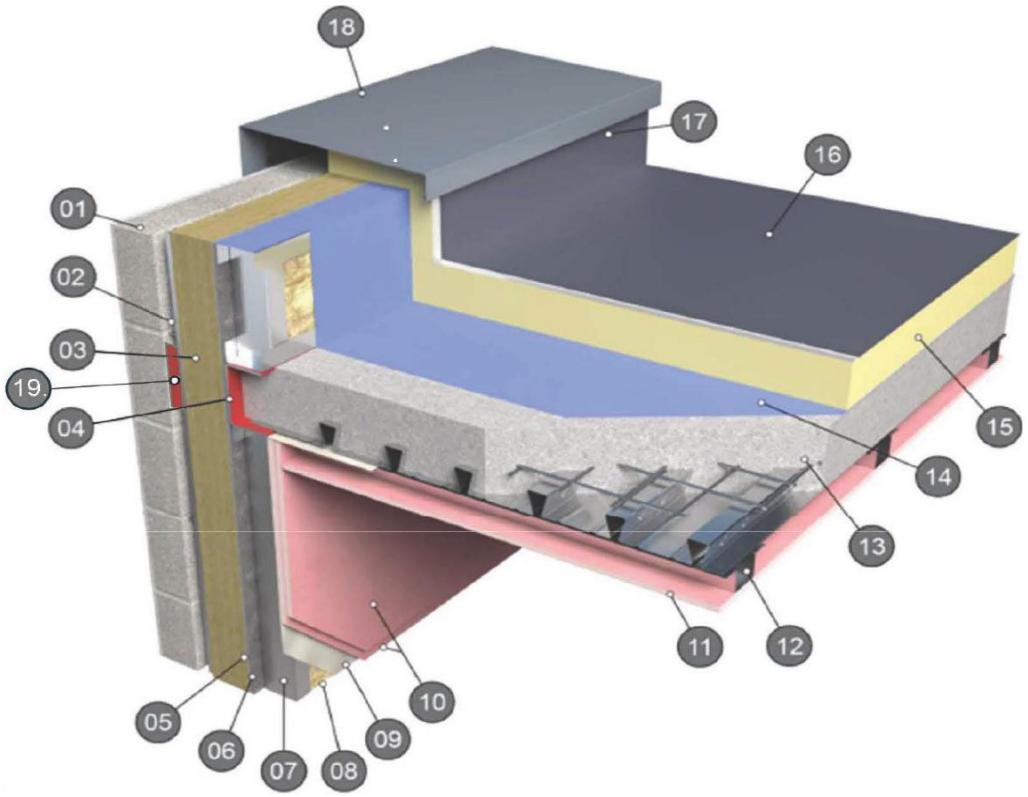
1. 25mm Unventilated Cavity
2. 6-8mm Silicone Render applied uniformly on rasped EWI Board
3. Mineral Wool insulation type & thickness as per Designers Li-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
4. Breather membrane to be lapped down over module below and sealed
5. Proprietary fire barrier to full width of cavity of floor junction
6. Proprietary fire barrier to full width of cavity of floor junction
7. 12mm Tepepan Cement fitted over joint to make continuous wall build up
8. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate fitted to perimeter of PFC
9. LGS at 600mm C/C infilled with Mineral wool insulation - type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3 . Airtightness Membrane applied to internal side finished with 2no. 15mm sheets of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
10. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
11. 50 mm MF Top Hat Channel for service cavity
12. Airtightness membrane with joints lapped and taped
13. 12mm OSB 3 board to underside of membrane
14. Protective membrane to roof of module when in transport/storage
15. 140mm Comfier to Structural engineer's design requirements
16. Acoustic Resilient Layer
17. VCL taped to concrete slab - Continuous membrane tape along perimeter of module floor to wall junction
18. LGS at 600mm C/C infilled with Mineral wool insulation - type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3 . Airtightness Membrane applied to internal side finished with 2no. 15mm sheets of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate

Figure 6: External wall with Insulated Render System and Compartment Floor Junction



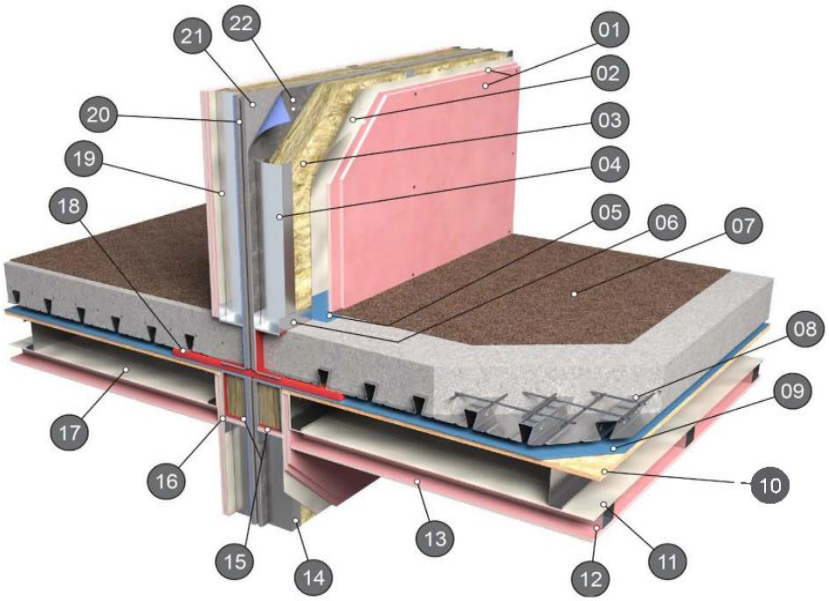
1. 6-8mm Silicone Render applied uniformly on rasped EWI Board
2. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
3. 25mm unventilated Cavity
4. SHS Column to Engineers specification & Detail
5. 12mm Tepepan Cement fitted over joint to make continuous wall build up
6. Proprietary fire barrier to extend across full width of adjoining modules
7. Fire Barrier
8. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2.
9. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
10. Airtightness membrane with joints lapped and taped
11. 2no. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
12. Fireline boards to each side of column
13. 2no. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
14. Airtightness membrane with joints lapped and taped
15. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
16. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2.
17. 1no. Layer of Fibre Cement Board to each module
18. 10mm Tolerance

Figure 7: External wall with Insulated Render System and Compartment Wall Junction



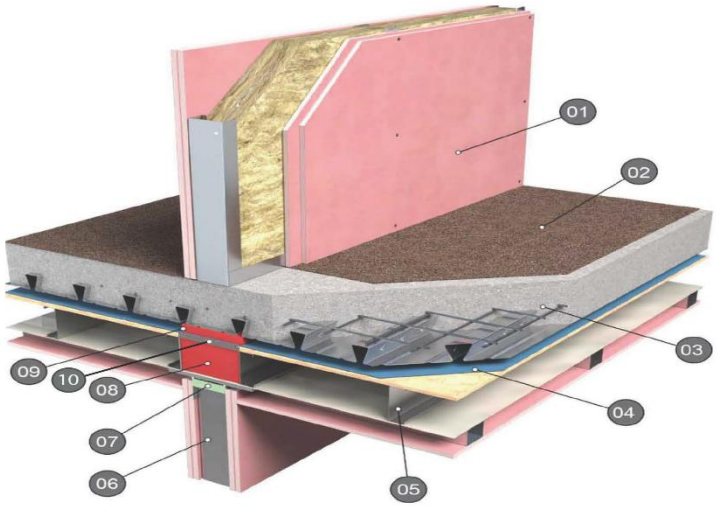
1. Masonry Outer Leaf Design to Designers requirements
2. External masonry/brick restraint system fixed back to metal studs in module wall
3. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3 as per fire test
4. PFC Structural Beam to Structural engineer's design requirements
5. 12mm Cement Board fitted over joint to make continuous wall build up
6. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2.
7. LGS at 600mm C/C
8. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
9. Airtightness membrane with joints lapped and taped
10. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
11. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
12. 50 mm MF Top Hat channel for service cavity
13. 140mm Comflor to Structural engineer's design requirements
14. VCL as per designers' specification & detail
15 Roof insulation Type & thickness per designers u-value calculations and height of buildings
16. Flat roof finish as per designers' specification & detail
17. Roof covering to lap up over parapet upstand
18. Capping to top of parapet wall per designers' requirements
19. Approved Cavity Closer

Figure 8: External Wall with Masonry Outer Leaf and Cavity and Flat Roof Eaves Detail



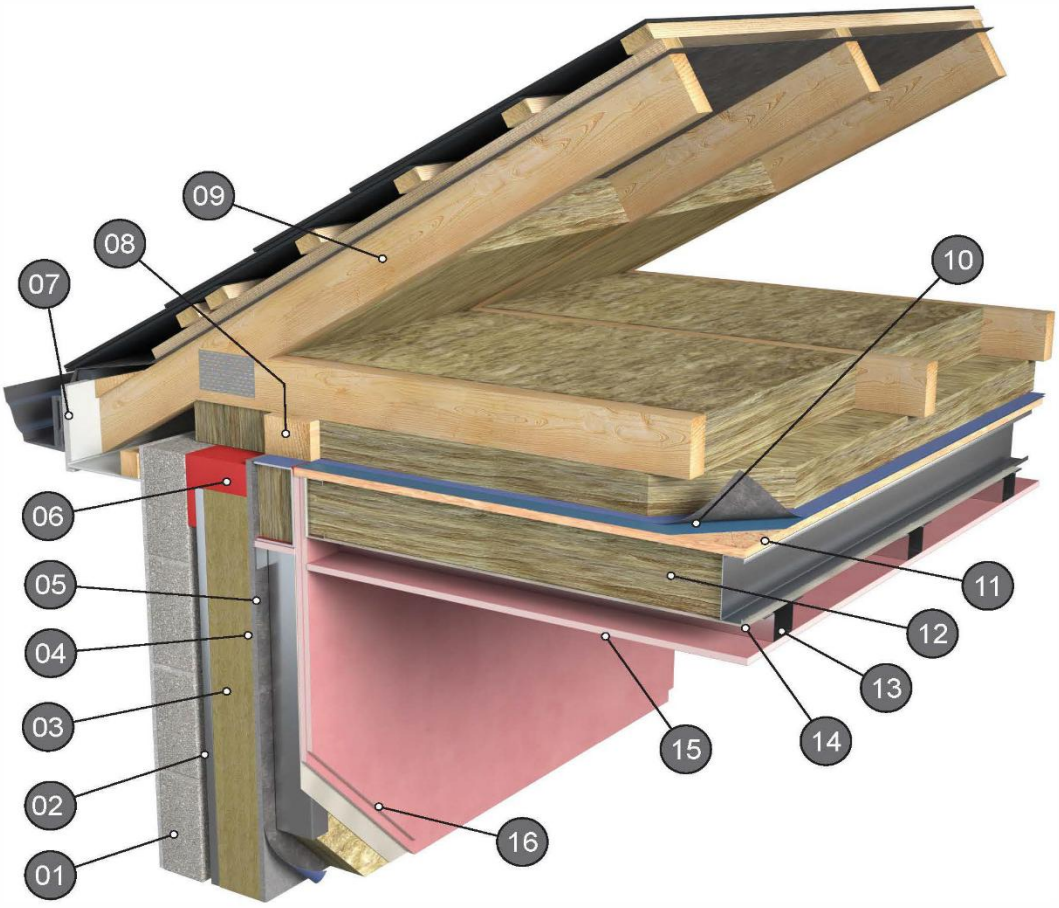
1. 2no. 15mm Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
2. Airtightness membrane with joints lapped and taped
3. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
4. 100mm LGS with studs at 600mm C/C.
5. VCL with minimum water vapour resistance of at least 250 MNs/g, taped to Concrete Slab
6. 100mm LGS Base track fixed with Stainless steel Anchor bolt to Engineers detail and specification
7. Acoustic resilient layer with minimum density of 600 kg/m3 and minimum thickness of 3mm
8. 140mm Comflor to Structural engineer's design requirements
9. Protective membrane to roof of module when in transport/storage
10. 15mm OSB 3 Board
11. Airtightness membrane with joints lapped and taped
12. 50 mm MF Top Hat channel for service cavity
13. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
14. LGS at 600mm C/C infilled with Mineral wool insulation – type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3). Airtightness Membrane applied to internal side finished with 2no. 15mm Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
15. PFC Structural Beam to Structural engineer's design requirements
16. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
17. Typical Module floor detail consisting of 1 no. layer plasterboard (Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate), mechanically fixed to underside of 50 mm MF Top Hat Channel. Airtightness membrane fixed to underside of purlin as per engineers' specification with 12.5mm OSB mechanically fixed above. 140 mm Comflor to Structural engineer's design requirements with acoustic resilient layer above
18. Firestopping to match the fire resistance of the Wall/Floor
19. LGS at 600mm C/C infilled with Mineral wool insulation – type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3). Airtightness Membrane applied to internal side finished with 2no. 15mm Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
20. 10mm Tolerance
21. 9mm Fibre cement board
22. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2

Figure 9: Compartment Wall to Floor detail



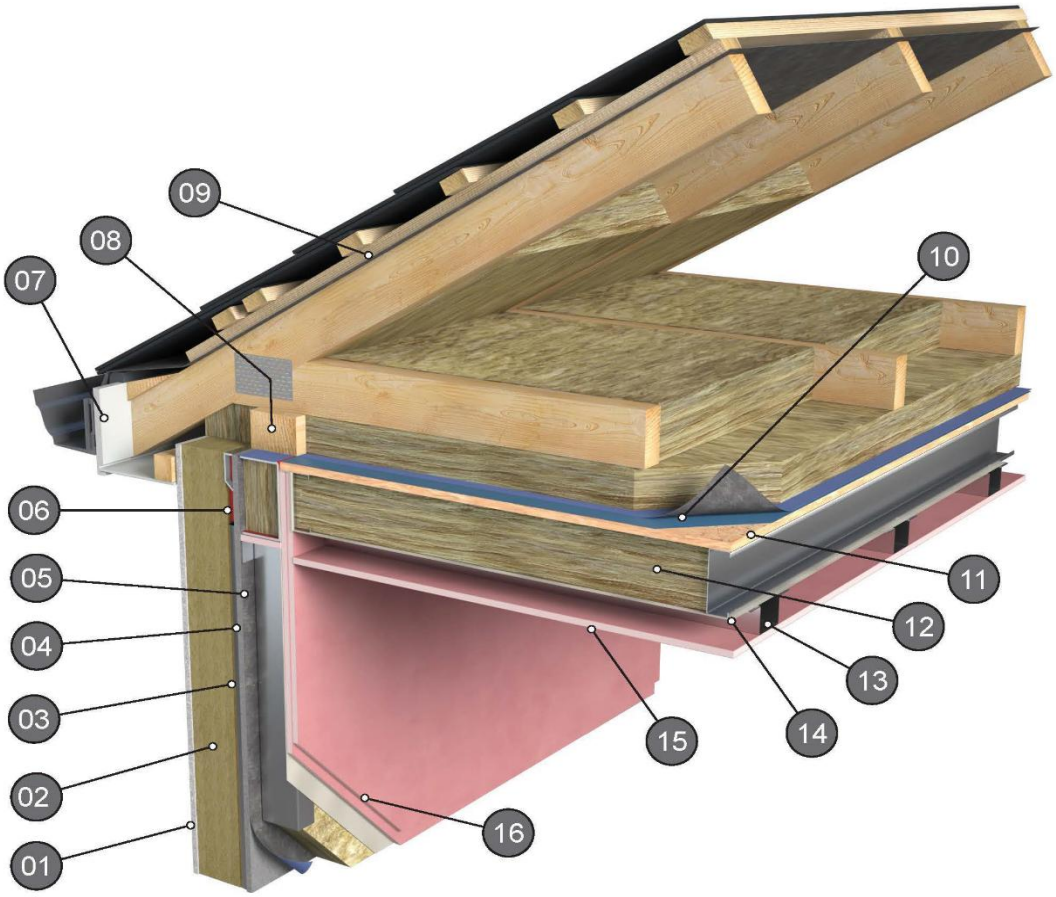
1. Internal 60min stud wall consisting of 2no. 15mm Layers of Type F plasterboard lining(s)(installed in accordance with 3 2.5.1 and Table 2 of this Certificate) on LGS Stud wall system with 600mm C/C, infilled with Mineral wool insulation - type & thickness as per Designers U-Value Calculations (Min thickness 100mm with a minimum density of 22kg/m3) Finished with 2no. 15mm Layers of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate on the opposite face
2. Acoustic Resilient Layer with minimum density of 600 kg/m^3 and a minimum thickness of 3mm
3. 140mm Comflor to Structural engineer's design requirements
4. Protective membrane to roof of module when in transport/storage
5. Typical Module Compartment floor detail consisting of 1no. layer of plasterboard mechanically fixed to underside of 50 mm MF Top Hat Channel. Airtightness membrane fixed to underside of purlin as per engineers' specification with 12.5mm OSB3 mechanically fixed above. 140mm Comflor to Structural engineer's design requirements with acoustic resilient layer above
6. Internal 60min stud wall consisting of 2no. 15mm Layers of Type F plasterboard lining(s) (installed in accordance with 3.2.5.1 and Table 2 of this Certificate) on LGS Stud wall system with 600mm C/C, infilled with Mineral wool insulation - type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3) Finished with 2no. 15mm Layers of Type F plasterboard lining(s), installed in accordance with 3. 2.5.1 andTable 2 of this Certificate on the opposite face
7. Firestrip - self-adhesive butyl extruded intumescent gap sealer
8. Firestopping to be fitted for full depth of ceiling above fire rated partitions with Linear Firestop with minimum density of 110 Kg/m3 fitted as rectangular pieces, tightly butt jointed and com pressed by at least 5% in thickness
9. Firestopping installed between top of lower module and underside of upper module at fire rated partitions with Linear Firestop with minimum density of 110 Kg/m3 fitted as rectangular pieces, tightly butt jointed and compressed by at least 5% in thickness
10. Cement Based Board with a min. Thickness of 12 mm

Figure 10: Compartment Wall to Continuous Floor detail



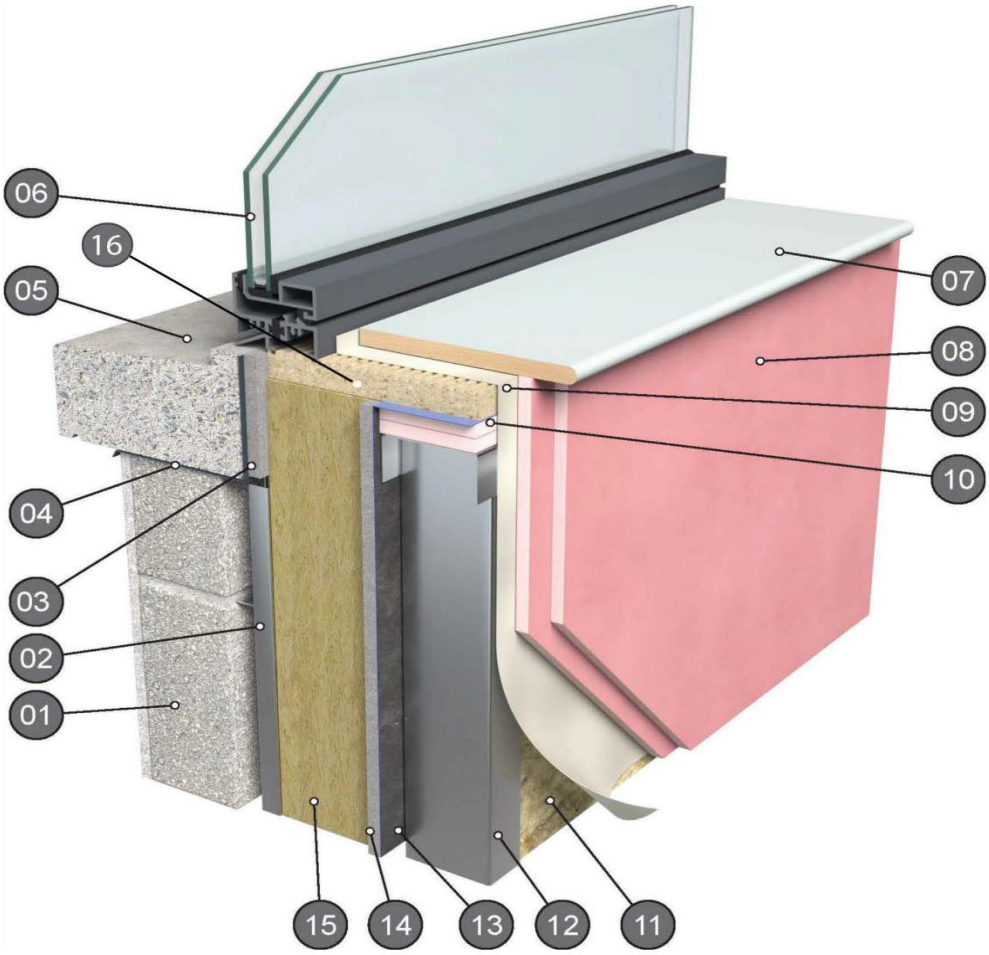
1. Masonry Outer Leaf Design to Designers requirements
2. External masonry/brick restraint system fixed back to metal studs in module wall.
3. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
4. 1no. Layer of Fibre Cement Board to each module
5. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2.
6. Cavity Closer.
7. Gutter, Eaves & Soffit as per designers requirements.
8. Treated timber wallplate.
9. Pitched roof as per designers requirments.
10. Protective membrane to roof of module when in transport/storage.
11. OSB 3 board.
12. Roof insulation Type & thickness per designers u-value calculations and height of buildings
13. 50mm MF top hat channel for service cavity.
14. Airtightness membrane with joints lapped and taped
15. 12.5mm Fireline Plasterboard.
16. Internal 60min stud wall consisting of 2no. 15mm Layers of Type F plasterboard lining(s) (installed in accordance with 3.2.5.1 and Table 2 of this Certificate) on LGS Stud wall system with 600mm C/C, infilled with Mineral wool insulation – type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3) Finished with 2no. 15mm Layers of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate on the opposite face

Figure 11: Pitched Roof Eaves and External Wall with Masonry Outer Leaf Detail



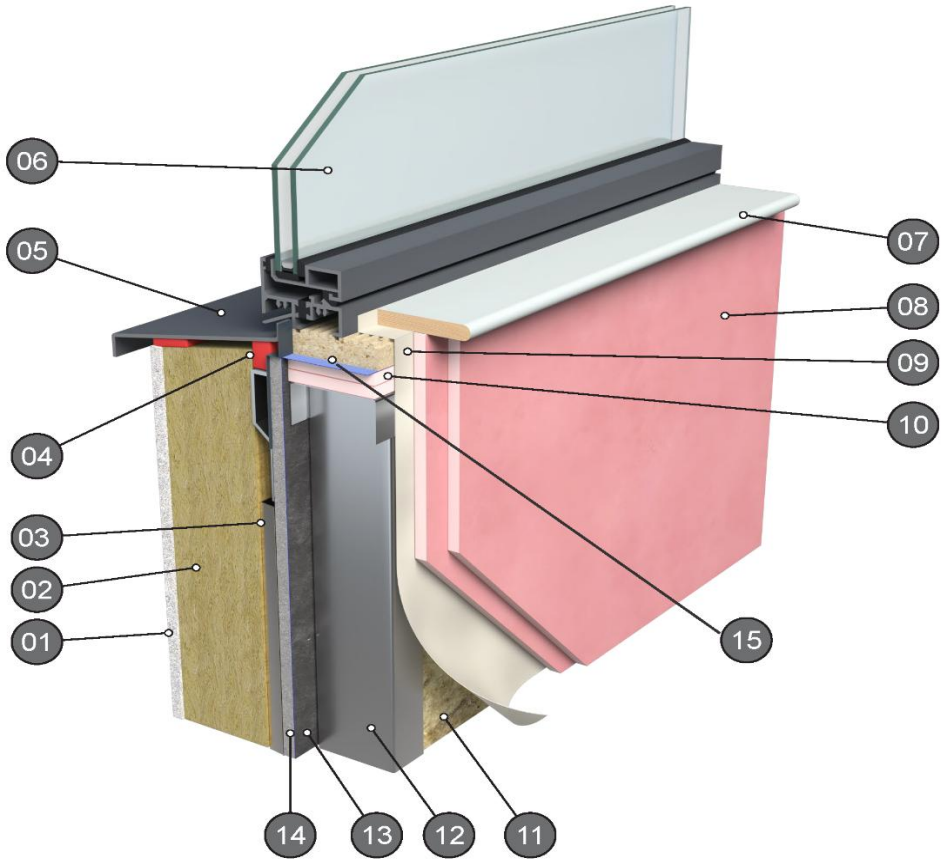
1. 6-8mm Silicone Render applied uniformly on rasped EWI Board
2. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
3. 20mm Drainage channel
4. 1no. Layer of Fibre Cement Board to each module
5. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2
6. Cavity Closer
7. Gutter, Eaves & Soffit as per designers requirements
8. Treated timber wallplate
9. Pitched roof as per designers requirments
10. Protective membrane to roof of module when in transport/storage
11. OSB 3 board
12. Roof insulation Type & thickness per designers u-value calculations and height of buildings
13. 50mm MF top hat channel for service cavity.
14. Airtightness membrane with joints lapped and taped
15. 12.5mm Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
16. Internal 60min stud wall consisting of 2no. 15mm Layers of Type F plasterboard lining(s) (installed in accordance with 3.2.5.1 and Table 2 of this Certificate) on LGS Stud wall system with 600mm C/C, infilled with Mineral wool insulation – type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3) Finished with 2no. 15mm Layers of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate on the opposite face

Figure 12: Pitched Roof Eaves and External wall with Insulated Render System Detail



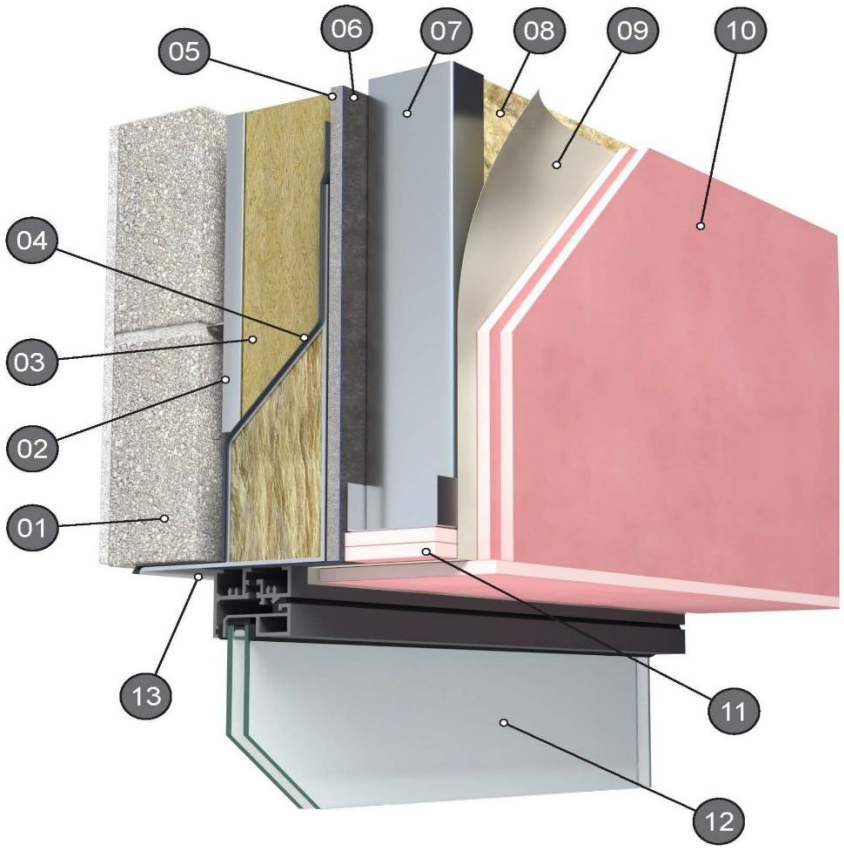
1. Masonry Outer Leaf Design to Designers requirements
2. External masonry/brick restraint system fixed back to metal studs in module wall
3. Cement Board
4. DPC below window cill
5. Window cill as per designers requirements.
6. Window as per designers requirements
7. Window Board as per main specification.
8. 2no. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
9. Airtightness membrane with joints lapped and taped
10. 2no. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
11. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
12. Internal 60min stud wall consisting of 2no. 15mm Layers of Type F plasterboard lining(s) (installed in accordance with 3.2.5.1 and Table 2 of this Certificate) on LGS Stud wall system with 600mm C/C, infilled with Mineral wool insulation – type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3) Finished with 2no. 15mm Layers of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate on the opposite face
13. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2
14. 1no. Layer of Fibre Cement Board to each module
15. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
16. Structural insulated board

Figure 13: Window Sill and External Wall with Masonry Outer Leaf Detail



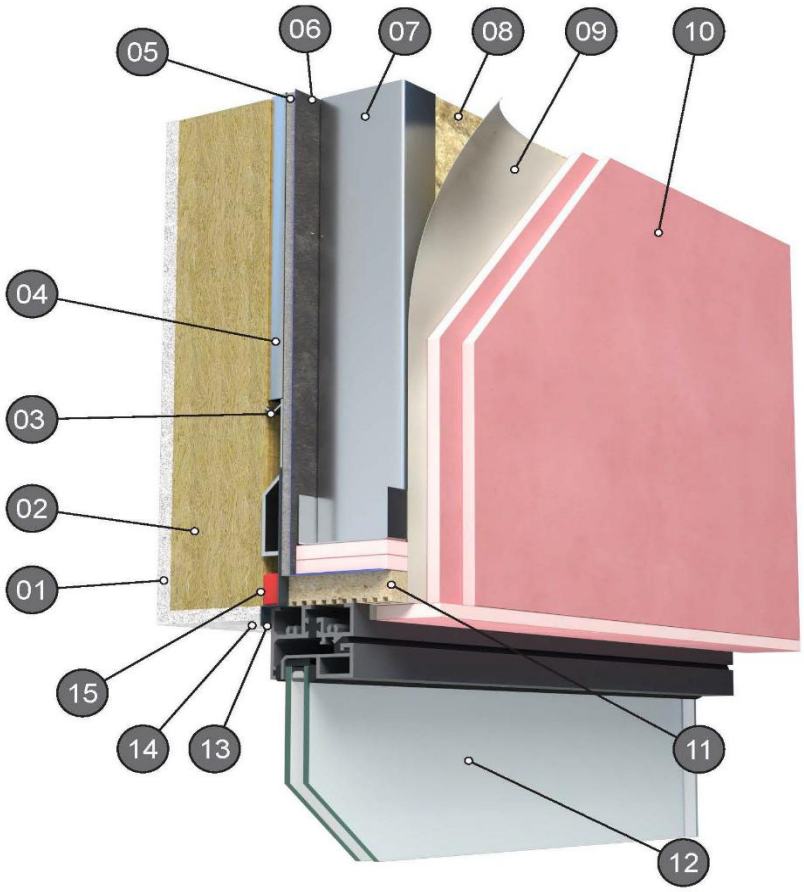
1. 6-8mm Silicone Render applied uniformly on rasped EWI Board
2. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
3. 25mm drainage channel
4. Approved cavity closer
5. Window cill as per designers requirements.
6. Window as per designers requirements
7. Window Board as per main specification
8. 2no. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
9. Airtightness membrane with joints lapped and taped
10. 2no. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
11. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
12. Internal 60min stud wall consisting of 2no. 15mm Layers of Type F plasterboard lining(s) (installed in accordance with 3.2.5.1 and Table 2 of this Certificate) on LGS Stud wall system with 600mm C/C, infilled with Mineral wool insulation – type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3) Finished with 2no. 15mm Layers of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate on the opposite face
13. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2
14. 1no. Layer of Fibre Cement Board to each module
15. Structural Insulated Board

Figure 14: Window Sill and External wall with Insulated Render System Detail



1. Masonry Outer Leaf Design to Designers requirements
2. External masonry/brick restraint system fixed back to metal studs in module wall
3. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
4. DPC
5. 1no. Layer of Fibre Cement Board to each module
6. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2
7. Internal 60min stud wall consisting of 2no. 15mm Layers of Type F plasterboard lining(s) (installed in accordance with 3.2.5.1 and Table 2 of this Certificate) on LGS Stud wall system with 600mm C/C, infilled with Mineral wool insulation – type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3) Finished with 2no. 15mm Layers of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate on the opposite face
8. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
9. Airtightness membrane with joints lapped and taped
10. 2no. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
11. 2no. Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate
12. Window as per designers requirements
13. Insulated steel lintel fiixed to RHS

Figure 15: Window Jamb and External Wall with Masonry Outer Leaf Detail



1. 6-8mm Silicone Render applied uniformly on rasped EWI Board
2. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
3. Water deflection channel
4. 20mm drainage channel
5. 1no. Layer of Fibre Cement Board to each module
6. Breather membrane to be lapped down over module below and sealed. Membrane material to meet Reaction to Fire Class E standard as per EN ISO 11925-2
7. Internal 60min stud wall consisting of 2no. 15mm Layers of Type F plasterboard lining(s) (installed in accordance with 3.2.5.1 and Table 2 of this Certificate) on LG8 8tud wall system with 600mm C/C, infilled with Mineral wool insulation – type & thickness as per Designers U-Value Calculations (Min. thickness 100mm with a minimum density of 22kg/m3) Finished with 2no. 15mm Layers of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2 of this Certificate on the opposite face
8. Mineral Wool insulation type & thickness as per Designers U-Value Calculations & Building Height. Min. thickness 100mm with a minimum density of 22kg/m3
9. Airtightness membrane with joints lapped and taped
10. 2. No. of Type F plasterboard lining(s), installed in accordance with 3.2.5.1 and Table 2
11. Structural insulation board
12. Window as per designers requirements
13. DPC
14. Sealant around window
15. Cavity closer

Figure 16: Window Jamb and External wall with Insulated Render System Detail

3.1 STRENGTH AND STABILITY

3.1.1 General

The Architectural and Engineering design team are responsible for ensuring that architectural drawings and overall building design comply with the Building Regulations. Actavo Modular, using a competent Chartered Structural Engineer, are responsible for the structural design of the Actavo Building System.

3.1.2 Certificate and Structural Compliance

Actavo Modular are responsible for the design, manufacture, supply, installation and certification of the system. Buildings constructed using Actavo Modular Building System shall be certified by a competent, Chartered Engineer as being in accordance with Part A of the Building Regulations.

3.1.3 Superstructure Design

The design must be in accordance with I.S. EN 1990:2002+NA:2010 [20] and I.S. EN 1993-1-1**Error! Reference source not found.**.

3.1.4 Substructure Design

The design of the building's substructure is outside the scope of this Certificate.

3.1.5 Design Loads

The design of a typical building has been examined by NSAI Agrément and demonstrates compliance with the following Codes of Practice. In general, the frame and roof structure are designed in accordance with:

- I.S. EN 1993-1-1**Error! Reference source not found.**
- I.S. EN 1993-1-3[21]
- I.S. EN 1993-1-5[22]
- I.S. EN 1993-1-8[23]
- I.S. EN 1991-1-1[24]
- I.S. EN 1991-1-4[25]
- I.S. EN 1991-1-3[26]

Design snow and wind loads should be based on Diagram 1 and 14 of TGD to Part A of the Building Regulations.

3.1.6 Structural Testing

Where it is required, structural testing can be used to verify the relevant aspects of the structure where the design falls outside the scope of I.S. EN 1993-1-1**Error! Reference source not found.**.

3.1.7 Disproportionate Collapse

The Actavo Modular Structural Engineer is responsible for disproportionate collapse design and risk of exceptional loads occurring. See also Section 2.4.3.

3.1.8 Steel Concrete Composite Deck

The concrete mix must be specified in accordance with project specific design to I.S. EN 1992-1-1[48]and should be supplied and manufactured in accordance with NA:2015+AC2:2017 to I.S. EN 206:2013+A2:2021[48]. The concrete must be supplied and laid in accordance with I.S. EN 1992-1-1[48] and I.S. EN 13670[52]. The concrete should be dispensed across the decking to avoid 'heaping' and the surface levelled in accordance with the decking manufacturer's recommendations.

The results of concrete cube compressive test must be supplied to the Actavo Modular Structural Engineer to ensure that the actual concrete strength attained, achieve the strengths required.

Concrete run-off and spillage should be minimised and build-up of debris in base tracks should be avoided. In cold weather the concrete should be protected from the effects of frost and rain until adequately cured. Props are not to be removed until concrete has reached the required strength, curing period and approval is given by Actavo Modular Structural Engineer to remove props.

3.2 FIRE

3.2.1 General

Buildings using the Actavo Modular system must be designed to comply with the relevant requirements of TGD's to Part B of the Building Regulations [2] [3].

The building details of the system incorporate suitable cavity barriers and fire stops to satisfy the requirements of Sections 3.6 of TGD's B of the Building Regulations.

The Actavo Modular Building System must be designed with the required boarding specification as per Table 2 to meet the minimum requirements of Table A1 of TGD B Volume 2 and Tables 31 and 32 of TGD B Volume 1, to Part B of the Building Regulations for all purpose groups to which this certificate applies, and any other building specific structural fire performance requirements.

All roof coverings in conjunction with the system shall be designated B_{ROOF} (t4) per TGDs to Part B – Fire Safety of the Building Regulations. Other NSAI Agrément approved roof coverings may also

be used with the system under the guidance of the Actavo Modular nominated Chartered Engineer.

3.2.2 Fire Resistance of Compartment Walls

Table lists the fire data for loadbearing elements, in accordance with I.S. EN 1365-1[28]. All fire testing has been carried out with service sockets in the walls.

Refer to TGDs to Part B – Fire Safety for reaction to fire classification requirements depending on the purpose group, building height and required fire resistance.

3.2.3 Fire Resistance of Compartment Floors

Table 2 list the fire data for compartment floors in accordance with Eurocode Design.

3.2.4 External Fire Spread

Table 2 lists the fire data for external walls in accordance with I.S. EN 1365-1[28].

Distance to relevant boundary, purpose group and height of the topmost storey should be reviewed with reaction to fire classification of external walls as per TGDs to Part B – Fire Safety of the Building Regulations.

3.2.5 Internal Fire Spread (Linings)

Reaction to fire classification of surface linings of walls and ceilings shall be in accordance with classifications within the TGDs to Part B – Fire Safety of the Buildings Regulations.

3.2.5.1 Plasterboard Installation

The proper application of plasterboard to the steel frame members is critical for both fire and sound performance. Attention shall be given to proper and practical detailing on the part of the designer and a high standard of workmanship on behalf of the contractor. Plasterboard in addition to all cavity barriers and fire stops on all structural and separating walls must be fully checked on site and signed off by Main Contractor in accordance with project specific construction details. All plasterboard that provides fire resistance to load bearing and non-load bearing elements of structure must conform to the requirements of Type F to I.S. EN 520[14] and must be installed in accordance with the specification given in Table 2.

Type F plasterboard of a greater thickness may be used i.e. 15 mm Type F board instead of 12.5 mm Type F board.

If alternative boarding is proposed (excluding increase thickness), then an independent fire test report or assessment from an Accredited Laboratory needs to be provided and assessed by a competent Fire Engineer.

3.2.6 Compartment Junctions

Where a compartment wall or compartment floor meets another compartment wall or compartment floor, or an external wall, the junction should maintain the fire resistance of the compartmentation. Refer to the TGDs to Part B of the Building Regulations.

3.3 VENTILATION

The Actavo Modular system can accommodate ventilation solutions, designed by a heating engineer competent in the design of multiple occupancy buildings, that meet the requirements of TGD to Part F of the Building Regulations. These should be verified using an NSAI registered ventilation validator or similar approved.

3.4 AIRTIGHTNESS

Airtightness testing is a mandatory requirement of TGDs to Part L of the Building Regulations and should be carried out by an NSAI certified Air Tightness Tester or similar approved. Testing must be carried out as specified in I.S. EN ISO 9972[30] with additional guidance given in the NSAI's "Certified Air Tightness Tester Scheme Master Document" [53] and TGD's to Part L of the Building Regulations.

3.5 WEATHERTIGHTNESS AND DAMP PROOFING

The system has adequate DPCs and DPMs to resist the passage of moisture. Roof coverings will provide adequate weather resistance when completed in accordance with this Certificate and the manufacturer's instructions.

Buildings constructed using the Actavo Modular Building System can readily accommodate adequate rainwater gutters and down pipes.

3.5.1 External Cladding

All cladding connections to the Actavo Building System are agreed between the cladding contractor, façade engineer and Actavo Modular Structural Engineer to ensure that Actavo Modular Building System structure is designed to support cladding loads

Where the external façade is constructed of a masonry/brick outer leaf it must incorporate a minimum 40mm clear cavity, to minimise the risk of water reaching the cavity face of the inner leaf.

Joints, in the insulation lining to the module substrate, are weatherproofed and any

penetrations are sealed. Secondary membranes must be provided over window and door heads to protect vulnerable interfaces. Good building practice such as secondary membrane and weep-holes are essential to ensure that moisture within a cavity is deflected to the outside of the building.

The external leaf of the Actavo Building System can be constructed of traditional brick/block to S.R. 325[54] and I.S. EN 1996-1-1[13], or NSAI Agrément approved external cladding system. Where such cladding systems are used, it is important the maximum storey height and all other relevant requirements in their NSAI Agrément certificate are complied with.

The Actavo Modular Building System has been assessed with traditional brick and block outer leaf cladding and NSAI certified external wall cladding systems approved for use with both hybrid and warm frame LGS external walls. Other external façade claddings systems may be suitable but have not been considered as part of this certification.

3.6 ELECTRICAL AND PLUMBING SERVICES

Electrical and plumbing services are outside the scope of this Certificate.

However, in designing and installing these services it is essential that the following procedures are followed, and precautions are taken to minimise the risk of long-term damage to the steel frame or the services.

- At the design stage, it is useful if the positions and sizes of services can be established in advance, as special holes may be cut in the factory to help with the rapid and economic installation of services. A considerable amount of services is generally required in bathroom, hot press and utility areas.
- In general, the steel frame at each floor level must be connected directly onto the main earthing terminal in the main fuse box and all earth connections in the circuit wired back to this point. This measure is necessary to control the flow of electric current to earth without the risk of corrosion of critical structural components. However, the earthing system must be installed in accordance with I.S. 10101[15].
- Where plastic coated electrical wiring is in contact with insulation, then the cables must be enclosed in a suitable conduit, e.g. PVC as outlined in I.S. 10101[15].
- Under no circumstances should electrical cables be placed within compartment floors, walls and/or separating walls. Walls must be battened out to provide a false service zone in which to distribute electrical services on these fire rated build-ups.
- The enclosure of cold-water pipe work within the external wall should be avoided as condensation on the pipe work could lead to wetting of the steel frame with a consequent risk of corrosion. If enclosure is unavoidable, the cold-water pipework must be insulated with tubular plastic insulation, which must be accurately cut at junctions and at changes of direction and held firmly in place with adhesive tape. Where hot water pipework is enclosed in the inner leaf of the wall, contact between copper pipes and the galvanised frame must be avoided using rubber or plastic grommets.
- Additional slots, notches or holes should not be cut through any steel member without the approval of the Chartered Structural Engineer responsible for the overall design of the structure.
- All electrical services should be in accordance with I.S. 10101[15].
- All Sanitary Conveniences and Washing Facilities should be in accordance with TGD G - Hygiene of the Building Regulations.
- All Drainage and Waste Water Disposal systems should be in accordance with TGD H – Drainage and Waste Water of the Building Regulations.

3.7 WINDOWS AND DOORS

Windows and doors are outside the scope of this Certificate. However, Figures 13, 14, 15 & 16 give indicative details of how they can be installed to limit heat loss and moisture penetration. Considerations for the design of windows and doors include:

- Escape in the event of fire,
- Safety and security,
- Thermal performance.

Note: NSAI's Window Energy Performance (WEP) Scheme gives full details of the energy performance aspects of window systems.

3.8 THERMAL PERFORMANCE

The modules are designed as a hybrid warm frame assembly where the LGS/SHS/RHS/PFC perimeter of the module walls of the building are located on the warm frame side of the insulation. Some building elements, namely the roof, external cladding, ground floor, windows and doors may be site and project specific. Therefore, the U-value of these elements must be calculated before overall compliance with Part L of the Building Regulations can be determined. The Actavo Building System can be provided for a wide range of required elemental U-values.

3.8.1 Limiting Thermal Bridging

The linear thermal transmittance Ψ-value (Psi-value) describes the additional heat loss associated with junctions and around openings. The Certificate holder has carried out Ψ-value calculations for a range of common thermally bridged junctions and as well as used Acceptable Construction Details to meet the requirements of the Building Regulations.

The Dwelling Energy Assessment Procedure (DEAP) used to produce the Building Energy Rating (BER) for a dwelling takes account of the total effects of thermal bridging through the input of the "y" value, which is a multiplier applied to the total exposed area of the building.

Where limited provisions are made to eliminate any risk of surface condensation or mould growth, the default "y" value of 0.15 should be taken. When all building junctions are demonstrated to be equivalent to or better than the corresponding Acceptable Construction Details (ACD), then the "y" value can be taken as 0.08.

Alternatively, the transmission heat loss coefficient due to thermal bridging (H_{TB}) can be calculated out by summing up the Ψ-values for each junction and multiplying by the linear length of each junction. The "y" value is calculated by dividing H_{TB} by the exposed surface area.

Ψ-values for other junctions outside the scope of this certificate should be assessed in accordance with Appendix D of TGD's to Part L of the Building Regulations.

U-values and Ψ-values are to be calculated by an NSAI approved thermal modeller as per Section 4.2.1.

3.8.2 Internal Surface Condensation

As part of the assessment carried out to determine the Ψ-values, internal surface temperatures (f_{Rsi}) are also checked. When internal surface temperatures (f_{Rsi}) are greater than 0.75, best practice will have been adopted to safeguard against the risk of surface condensation occurring under normal occupancy and humidity class levels.

3.9 INTERSTITIAL CONDENSATION

3.9.1 Condensation in Walls

Condensation risk analysis shall be carried out by Actavo Modular to access the build-up proposed, considering the location of the building, the building occupancy and purpose class.

Refer also to Section 4.3.1 on technical investigation of interstitial condensation.

All external walls have an air and vapour check layer (AVCL) on the warm side of the insulation. Continuity of the AVCL layer is maintained by the application of suitable tapes, sealants and proprietary service penetration gromets.

3.9.2 Condensation in Roofs

Roof ventilation should be provided in accordance with TGD Part F of the Building Regulations and the recommendations of BS 5250[35].

In the case of cold flat roofs, a cross-ventilated void, not less than 50mm deep, between the slab or deck and insulation should be provided in conjunction with the AVCL being provided on the warm side of the insulation. Ventilation openings should be provided to every roof void along two opposite sides of the roof and should be equivalent in area to a continuous opening of not less than 25mm at each side. It should also be noted that the dimensions of the cross-ventilated void and the ventilation depends on the size of the roof.

In the case of warm flat roofs, the risk of surface condensation is dependent on the nature of the supporting structure. With all flat roofs, there is a risk of interstitial condensation forming between the thermal insulation and the waterproof covering. To avoid this risk, an AVCL should be provided immediately above the supporting structure on the warms side of the insulation.

In the case of inverted flat roofs, it is essential that the thermal insulation used resists water absorption and is sufficiently load bearing to support the protective finish of ballast, paving or soil.

3.10 SOUND

As per TGD to Part E to the Building Regulation, all building, post completion must be subjected to acoustic testing. Acoustic testing shall be carried out in accordance with TGD to Part E of the Building Regulations. Correct detailing of the system is necessary to meet the requirements of the TGD to Part E of the Building Regulations. Refer to Section 4.4 for technical investigations on acoustic performance.

4.1 BEHAVIOUR IN FIRE

4.1.1 Fire Resistance

Assessment of fire data shows that buildings constructed using the Actavo Modular Building System can meet the Building Regulation requirements in relation to fire resistance as shown in Table 2.

Tests have been conducted to meet fire test requirements I.S. EN 1365-1 [28] and I.S. EN 1363-1 [29]. The fire resistance required is dependent upon the purpose class of the building being designed and constructed. Assessments have been completed by an accredited laboratory in accordance with I.S. EN 15725:2023 [11], and/or UK Fire Study Group Resolution No. 82 – 2001 [61], and/or PFFP Guide to Undertaking Assessments in Lieu of Fire Test [60]. Fire tests reports and fire assessments reports are available from the Certificate holder upon request

4.2 THERMAL PROPERTIES

Assessment of U-value calculations shows that the Actavo Building System meets and can exceed the maximum back-stop elemental U-value requirements of Table 1 of TGD's to Part L of the Building Regulations. Table 3 and 4 of this Certificate gives the various elemental wall U-values in W/m^{2}K for an Insulated Rendering System. Table 5 and 6 gives the various elemental wall U-values in W/m^{2}K for a traditional masonry clad external wall.

4.2.1 Limiting Thermal Bridging

Table 7 and 8 of this Certificate gives Ψ-values for a range of Actavo Modular Building System junctions along with their associated flanking elemental U-values. A full listing of Ψ-value calculations, along with the building details on which calculations are based, are contained within the certificate holder's technical data sheets for Ψ-values.

U-values and Ψ-values are to be calculated by an NSAI approved thermal modeller – a register of these can be found on the NSAI's Thermal Modellers Scheme webpage.

4.2.2 Internal Surface Condensation

Table 7 and 8 of this Certificate gives internal surface temperature factors (f_{Rsi}) for a range of typical building junctions.

As outline in clause 3.8.2 of this Certificate, when internal surface temperatures (f_{Rsi}) are greater than 0.75, the typical assessed building junctions along with their associated flanking elemental U-values as described in Table 7 and 8 shall satisfy

4.3 INTERSTITIAL CONDENSATION

4.3.1 Condensation in Walls

Calculations to BS 5250[35] have been carried out for a range of typical wall build ups as covered by this certificate. They predict no interstitial condensation within the external wall and pass the risk criteria in I.S. EN ISO 13788[36].

4.4 SOUND

4.4.1 Separating Walls

The acoustic performance of the separating wall specified in Section 2.5 has been assessed by on-site testing of the building constructed using the Actavo Building System and third-party acoustic assessment calculations. The testing included sound airborne insulation tests on separating walls in accordance with I.S. EN ISO 16283-1[40]. Results from on-site testing are shown in Table 9.

The separating wall in the Actavo Building System has been assessed and when constructed in accordance with this certificate can meet the requirements of TGD to Part E of the Building Regulations.

4.4.2 Compartment Floor Steel Concrete Composite Deck

The acoustic performance of the Actavo floor as specified in clause 2.1.3 has been assessed by on-site testing of the building constructed using the Actavo Building System and third-party acoustic assessment calculations.

The mass per unit area of the Actavo floor, coverings and ceilings meet the specification for a Floor Type 1 separating floor when complying with the guidelines in Section 4 of TGD to Part E of the Building Regulations.

4.5 DURABILITY

The durability of the system will be influenced by project specific performance criteria, such as the exposure class, climate, environment, building use/purpose and building life cycle. For the steel structure refer to clause 2.4 of this Certificate.

In addition to this, the steel is kept in a "warmframe" environment, which should prolong the life of the steel. The DPC and the galvanising will provide adequate protection to ensure that the bottom channel has a life equal to that of the other frame members. The insulations are durable materials and will remain effective as an insulant for the life of the building. The roof, internal wall

and ceiling linings and the outer leaf of the external wall are all constructed from conventional durable materials.

4.6 MAINTENANCE

Maintenance will be required at a level comparable with that for buildings of traditional construction. Regular inspections should be made over the life of the system. The system shall be inspected and maintained in accordance with the Certificate holder's instructions, as detailed in the Actavo Modular Repair and Maintenance Method Statement, which is incorporated into the Building Owner's Manual.

Below is a non-exhaustive list of maintenance inspections and works which should be undertaken regularly:

- Visually inspect the render and architectural details for signs of damage or water ingress (at least annually).
- Necessary repairs should be carried out immediately and must be in accordance with the Certificate holder's instructions to prevent deterioration or damage, and to protect the integrity of the system.
- Sealants shall be subject to regular inspection (at least annually).
- Sealants should be replaced as required and fully replaced every 18 to 20 years to maintain performance.
- Synthetic finishes may be subject to aesthetic deterioration due to exposure to UV light. They should be re-painted at least every 18 to 20 years, or as necessary, to maintain appearance.
- Repainting should be carried out in accordance with the relevant recommendations of BS 6150[38].
- Timber boarding, fascia, soffits etc. where used, should be treated with an appropriate paint system or translucent stain and should be maintained by periodic re-coating using a paint or stain suitable for external applications, applied in accordance with the manufacturer's instructions.
- Care should be taken to ensure that the synthetic finish used is compatible with the original system and that the water vapour transmission or fire characteristics are not adversely affected.

Taking account of the above variable criteria, it is not possible to accurately determine a cyclic period for planned maintenance. However, regular cleaning and inspections will assist in maintaining a fully functioning, aesthetically pleasing façade.

It shall be the responsibility of the building owner to monitor the condition of the building and commission maintenance and repairs as required.

It is envisaged these will be carried out by the building owner in accordance with BS 8210[39].

4.7 TESTS AND ASSESSMENTS WERE CARRIED OUT TO DETERMINE THE FOLLOWING

The following is a summary of the tests and assessments which have been carried out on the Actavo Modular Building System:

- Structural strength and stability (racking resistance, load bearing capacity).
- Behaviour in relation to fire.
- Acoustic performance, resistance to airborne and impact sound transmission.
- Thermal insulation performance.
- Testing and assessment of fixings and Connections.
- Compatibility with other materials.
- Risk of condensation both surface and interstitial.
- Pre and Post completion airtightness testing.
- 3D thermal modelling of junction details in accordance with BRE IPI/06[33].

4.8 OTHER INVESTIGATIONS

(i) Existing data on product properties in relation to fire, toxicity, environmental impact and the effect on mechanical strength/stability and durability were assessed.

(ii) 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.

(iii) Site visits were conducted to assess the practicability of installation and the history of performance in use of the product.

Table 2: Fire Data for Loadbearing Wall and Floor Elements				
Type	**Element:**	**Test Standard**	**Results**	**Purpose Class**
External Load Bearing Walls – Insulated Render - Outside to Inside				
1	• Test Specimen Dimensions: 3000 x 3000 (w x h) • Loading Applied During Test: 150kN • Render System - 3mm thick. CT 325 reinforcing mesh with Mortar applied and lightly trowel over mesh, further blinding of 1-2mm applied bring overall thickness to 4-5mm. • External wall Insulation, 100mm thick Stone wool Insulation (Density - 22kg/m3) • Spacer/frame rail 144x20x1.0mm • Breathable membrane (Reaction to Fire: Class E) • Fibre Cement Carrier board, 12mm thick (Tepe Betopan) • Framing Structural Steel - consisting of SHS Columns 90x90x5 & SHS Beams 90x90x8. • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.2 Channels • Stud cavity insulation, 100mm thick Stonewool Insulation (Density - 22kg/m3) • Vapour Control Membrane (Reaction to Fire: Class E) • 1-layer Type F plasterboard, 12.5mm thick – No Taping and Jointing was provided to Test Panel (GYPROC SAINT-GOBAIN) • PVC Socket Outlets were inserted into the Test Panel fitted to the plasterboard. Intumescent Putty Pads or the like were NOT installed to the Test Specimen.	I.S. EN 1363-1[29] & I.S. EN 1365-1[28]	120 mins	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b)
External Load Bearing Walls – Insulated Render - Inside to Outside				
2	• Test Specimen Dimensions: 3000 x 3000 (w x h) • Loading Applied During Test: 150kN • Test Make Up from Fire Side • 2-layer Type F plasterboard, 15mm thick – No Taping and Jointing was provided to Test Panel (GYPROC SAINT-GOBAIN) • PVC Socket Outlets were inserted into the Test Panel fitted to the plasterboard. Intumescent Putty Pads or the like were NOT installed to the Test Specimen. • Vapour Control Membrane (Reaction to Fire: Class E) • Stud cavity insulation, 100mm thick Stone wool Insulation (Density - 22kg/m3) • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.2 Channels • Framing Structural Steel - consisting of SHS Columns 90x90x5 & SHS Beams 90x90x8. • Fibre Cement Carrier board, 12mm thick (Tepe Betopan)	I.S. EN 1363-1[29] & I.S. EN 1365-1[28]	120 mins	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b)

	• Breathable membrane (Reaction to Fire: Class E) • Spacer/frame rail 144x20x1.0mm • External wall Insulation, 100mm thick Stone wool Insulation (Density - 22kg/m3) • Render System - 3mm thick. CT 325 reinforcing mesh with Mortar applied and lightly trowel over mesh, further blinding of 1-2mm applied bring overall thickness to 4-5mm.			
Compartment Walls				
3	• Assessment conducted on a Test Specimen Dimensions: 3000 x 3000 x 145 (w x h x tk.) • Loading Applied During Test: 150KN • 2-layer Type F plasterboard, 12.5mm thick – No Taping and Jointing was provided to Test Panel (GYPROC SAINT-GOBAIN) • Stud cavity insulation, 100mm thick Stonewool Insulation friction fitted between LGS Studs (Density 22kg/m3) • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.2 Channels • Framing Structural Steel - consisting of SHS Columns 90x90x5 & SHS Beams 90x90x8. • 6mm thick cement boards reference WeatherKem EcoPro • Cavity up to 50mm maximum width • 6mm thick cement boards reference WeatherKem EcoPro • Framing Structural Steel - consisting of SHS Columns 90x90x5 & SHS Beams 90x90x8. • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.2 Channels • Stud cavity insulation, 100mm thick Stonewool Insulation friction fitted between LGS Studs (Density 22kg/m3) • 2-layer Type F plasterboard, 12.5mm thick – No Taping and Jointing was provided to Test Panel (GYPROC SAINT-GOBAIN) • PVC Socket Outlets were inserted into the Test Panel fitted to the plasterboard. Intumescent Putty Pads or the like were NOT installed to the Test Specimen.	I.S. EN 1363-1[29] & I.S. EN 1365-1[28]	90 mins	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b)
Load Bearing Walls				
4	• Assessment conducted on a Test Specimen Dimensions: 3000 x 3000 x 145 (w x h x tk.) • Loading Applied During Test: 150kN • 2-layer Type F plasterboard, 12.5mm thick – No Taping and Jointing was provided to Test Panel (GYPROC SAINT-GOBAIN) • Stud cavity insulation, 100mm thick Stonewool Insulation friction fitted between LGS Studs (Density 22kg/m3) • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.2 Channels • Framing Structural Steel - consisting of SHS Columns 90x90x5 & SHS Beams 90x90x8.	I.S. EN 1363-1[29] & I.S. EN 1365-1[28]	90 mins	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b)

	• 2Layer of 12.5mm thick plasterboards reference Gyproc Fire line (GYPROC SAINT-GOBAIN). • PVC Socket Outlets were inserted into the Test Panel fitted to the plasterboard. Intumescent Putty Pads or the like were NOT installed to the Test Specimen.			

Compartment Floors: Loaded Floors Composite Metal Deck

Type	Element:	Design/ Classification		Purpose Class
5* **	Loaded Floor supporting uniformly distributed load of 5.26kN/m^2, effective span 4.39m •1.2mm Comflor 51 •140mm normal weight concrete •Concrete reinforced with A252 mesh with a minimum 30mm cover below the upper surface.	Eurocode Design	REI 30 mins (from below ceiling level)	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b) **
6* **	Loaded Floor supporting uniformly distributed load of 5.26kN/m^2, effective span 4.39m •1.2mm Comflor 51 •140mm normal weight concrete •Concrete reinforced with A252 mesh with a minimum 30mm cover below the upper surface.	Eurocode Design	REI 60 mins (from below ceiling level)	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b) **
7* **	Loaded Floor supporting uniformly distributed load of 5.26kN/m^2, effective span 4.39m •1.2mm Comflor 51 •140mm normal weight concrete •Concrete reinforced with A252 mesh with a minimum 30mm cover below the upper surface.	Eurocode Design	REI 90 mins (from below ceiling level)	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a) and 5(b) **

Notes:

- The above build-ups are summaries of those tested or assessed to the referenced standards – they should not be taken as an exhaustive list. For full details of test reports, the Certificate holder should be contacted.
- For alternative approaches to fire safety requirements, refer to 0.2 of TGD B of the Building Regulations.
- In situations where there is no fire requirement for non-load bearing walls, alternative non-load bearing wall boarding specifications can be used once they have been agreed and signed off on by Actavo where the boarding supplier has provided supporting fire test data.
- Stone mineral wool refers to the particular type and density of stone mineral wool used in a particular fire test and the details are available directly from Actavo Modular.

* Non-load bearing wall fire resistance data is provided from the load bearing data and can be utilised under the Field of Direct Application whereby the load can be decreased on the specimen.

**Design to be dictated by project specific loading requirements on a case-by-case basis to meet the requirements of Part B of Building Regulations.

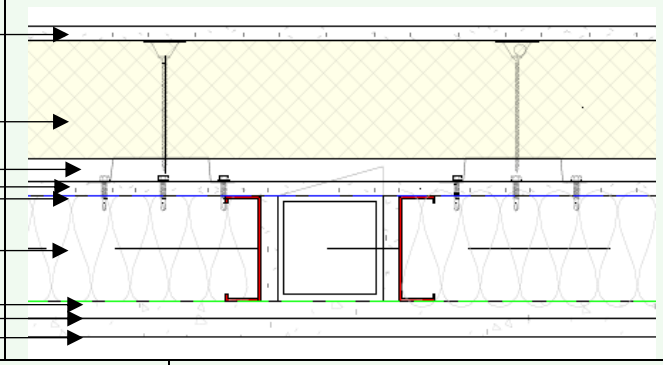
*** It is assumed that the composite decks are adequately supported by a suitable fire-resisting structure. Supporting structure must be fully protected to underside of composite deck including any concealed cavities. For load/span conditions deck manufactures guidance must be strictly followed. The floors described are typical of those used with the system, however, other steel profile sheeting/loads/spans can be accommodated subject to design by Chartered Structural Engineer in compliance with Eurocodes and in accordance with deck manufacturers guidance.

Table 3: Typical External Wall U-Values – Insulated Rendering System

External walls U-value for variable Mineral Wool (0.036 W/mK) thickness

Wall build-up:

Layer 9: Render
Layer 8: Mineral Wool (0.036 W/m.K) (2)(3)
Layer 7: 20mm unventilated cavity
Layer 6: 12mm Tepepan Board
Layer 5: Breather Membrane
Layer 4: LGS/MW insulation (1)
Layer 3: AVCL
Layer 2: 15mm Plasterboard
Layer 1: 15mm Plasterboard



Wall thickness	Mineral Wool variable thickness:	Calculated U-value (W/m²K)
298mm	140mm	0.18
318mm	160mm	0.16
338mm	180mm	0.15
358mm	200mm	0.14
378mm	220mm	0.13

Calculation complies with BRE Digest 465 *U-values for light steel-frame construction.*

(1) Corrections have been made for 1.2mm LGS studs @ 600mm c/c bridging layer 4.
(2) A level 0 correction for air voids has been applied to layer 8 (I.S. EN ISO 6946 Table D.1)
(3) Correction for mechanical fasteners have been applied to layer 2, equating to 6.94 fixings per m2 (i.e., 1no. 4.8mm Ø carbon steel fixing + 4no. 4.8mm Ø stainless steel fixings per board). This may be subject to change on project specific basis.

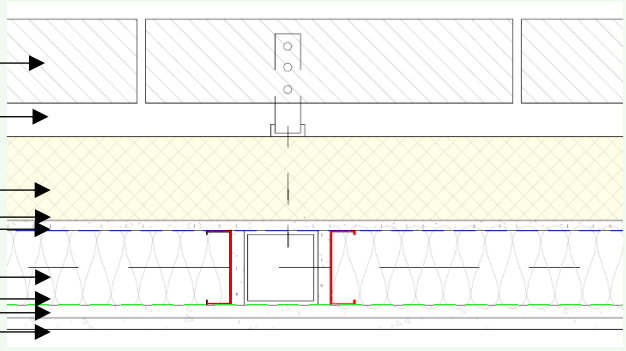
Table 4: Sample U-value calculation for 140mm Mineral Wool (0.036 W/m.K)						
Sample U-value Calculation for 140mm Mineral Wool (0.036 W/m.K) external insulation						
Layer	**Description**	**% Bridged**	Thickness [mm]	Thermal conductivity **λ** [W/m K]	Thermal resistance **R** [W/m²K]	
	Rsi				0.13	
1	Plasterboard		15	0.25	0.060	
2	Plasterboard		15	0.25	0.060	
3	AVCL					
4	Steel Stud	0.002	89	50	0.00178	
	Mineral Wool	0.998	89	0.044	2.023	
5	Breather Membrane					
6	Tepepan board		12	0.22	0.055	
7	Cavity (Unventilated)		20		0.18	
8	MW (0.036 W/m.K)		**140**	0.036	3.889	
9	Render - Ceresit		7	0.94	0.007	
	Rse				0.04	
				Ru Total =	6.438	
				RL Total =	5.039	
	From BRE Digest 465			P = 0.744, $R_T = pR_{max} + (1 - p)R_{min}$ =	6.033	
				Correction term, ΔU =	0.012	
				Corrected U-Value (2DP) =	**0.178**	W/m²K
Correction as described in Table apply.						

Table 5: Typical External Wall U Values- Brick Outer Leaf

External walls U-value for variable Mineral Wool (0.037 W/mK) thickness

Wall build-up:

Layer 9: Brick/masonry cladding
Layer 8: 40mm unventilated cavity
Layer 7: Mineral Wool (0.037 W/m.K) (2)(3)
Layer 6: 12mm Tepepan Board
Layer 5: Breather Membrane
Layer 4: LGS/MW insulation (1)
Layer 3: AVCL
Layer 2: 15mm Plasterboard
Layer 1: 15mm Plasterboard



Wall thickness	Mineral Wool variable thickness:	Calculated U-value (W/m²K)
403mm	130mm	0.18
413mm	140mm	0.17
433mm	160mm	0.16
453mm	180mm	0.15
473mm	200mm	0.14
493mm	220mm	0.13

Calculation complies with BRE Digest 465 *U-values for light steel-frame construction*
(1) Corrections have been made for 1.2mm LGS studs @ 600mm c/c bridging layer 4.
(2) A level 0 correction for air voids has been applied to layer 6 (I.S. EN ISO 6946 Table D.1)
(3) Correction for mechanical fasteners have been applied to layer 6 equating to 6 No. 5.5mm Ø Stainless steel fixing to connect brick tie channel to LGS section.

Table 6: Sample U-value calculation for 140mm Mineral Wool (0.037 W/m.K)

Sample U-value Calculation for 140mm Mineral Wool (0.037 W/m.K) external insulation

Layer	Description	% Bridged	Thickness [mm]	Thermal conductivity **λ** [W/m K]	Thermal resistance **R** [W/m²K]
	Rsi				0.13
1	Plasterboard		15	0.25	0.06
2	Plasterboard		15	0.25	0.06
3	AVCL				
4	Steel Stud	0.002	89	50	0.00178
	Mineral Wool	0.998	89	0.044	2.023
5	Breather Membrane				
6	Tepepan board		12	0.22	0.055
7	MW (0.037 W/m.K)		**140**	0.037	3.784
8	Cavity (Unventilated)		40		0.18
9	Brickwork Outer Leaf		102.5	0.77	0.132
	Rse				0.04

	Ru Total =	6.458	
	RL Total =	5.059	
From BRE Digest 465	P = 0.711, $R_T = pR_{max} + (1 - p)R_{min}$ =	6.054	
	Correction term, ΔU =	0.010	
	Corrected U-Value (2DP) =	**0.175**	W/m²K

Correction as described in Table apply.

Table 7: Brick Outer Leaf Typical Ψ-Value W/m.K					
Target linear thermal transmittance (ψ) for different types of junctions.					
ACD Ref:	**Junction Detail**	**Temperature Factor f_{Rsi} (Min = 0.75)**	**Actavo Ψ-value (W/m.K)**		**TGD L Default Ψ-value***
5.02	Ground Floor / Insulation below slab	0.91	0.053	<	0.141
5.03	Lightweight Intermediate Floor	0.93	0.023	>	0.021
5.04	Separating Wall (Plan) [1]	0.91	0.066	<	0.103
5.05	Separating Wall (Section) [1]	0.95	0.054	<	0.520
5.08	Eaves – Unventilated/Ventilated Attic	0.85	0.076	>	0.030
5.18	Flat Roof - Parapet	0.86	0.124	>	0.093
5.19	Ope - Lintel	0.76	0.188	>	0.006
5.20	Ope - Jamb	0.83	0.037	>	0.023
5.21	Ope - Cill	0.81	0.028	<	0.012
5.22.1	Steel Separating Wall through ground floor	0.91	0.087	<	0.213
5.23.1	Corner	0.83	0.069	<	0.075
5.23.2	Inverted Corner	0.96	-0.060	<	-0.045

[1]Psi value is for the whole junction. Half the value should be applied to each dwelling on either side of the junction.
Flanking element U-values for walls, roof, and floor thermal models above were based on:
U_W = 0.18 W/m^{2}K, U_R = 0.10 W/m^{2}K, U_F = 0.11 W/m^{2}K
Modelled junction ψ-values based on typical Actavo details, shown above can be used in y-value calculations, if relevant detail is applicable.

* Note: TGD L Default values are shown for indicative purposes only, in the absence of U Value target ranges that correspond to the Actavo Modular detail set.

Table 8: Insulated Rendering System Typical Ψ-Value W/m.K					
Target linear thermal transmittance (ψ) for different types of junctions.					
ACD Ref:	**Junction Detail**	**Temperature Factor f_{Rsi} (Min = 0.75)**	**Actavo Ψ-value (W/m.K)**		**TGD L Default Ψ-value***
5.02	Ground Floor Insulation below slab	0.76	0.248	>	0.141
5.03	Lightweight Intermediate Floor	0.93	0.025	>	0.021
5.04	Separating Wall (Plan) [1]	0.91	0.068	<	0.103
5.05	Separating Wall (Section) [1]	0.95	0.054	<	0.520
5.08	Eaves – Unventilated/Ventilated Attic	0.86	0.081	>	0.030
5.18	Flat Roof - Parapet	0.86	0.130	>	0.093
5.19	Ope - Lintel	0.90	0.041	>	0.006
5.20	Ope - Jamb	0.91	0.038	>	0.023
5.21	Ope - Cill	0.84	0.108	>	0.012
5.22.1	Steel Separating Wall through ground floor	0.91	0.087	<	0.213
5.23.1	Corner	0.82	0.071	<	0.075
5.23.2	Inverted Corner	0.96	-0.057	<	-0.045

[1]Psi value is for the whole junction. Half the value should be applied to each dwelling on either side of the junction.
Flanking element U-values for walls, roof, and floor thermal models above were based on:
U_W = 0.18 W/m^{2}K, U_R = 0.10 W/m^{2}K, U_F = 0.11 W/m^{2}K
Modelled junction ψ-values based on typical Actavo details, shown above can be used in y-value calculations, if relevant detail is applicable.

* Note: TGD L Default values are shown for indicative purposes only, in the absence of U Value target ranges that correspond to the Actavo Modular detail set.

Please note: All U-value calculations illustrated in the above U-value tables should be taken as examples of performance that can be achieved. It is strongly recommended that U-value calculations are produced on a project specific basis by a competent person as U-value calculations may increase or decrease depending on a wide range of parameters such as number of fixings per square meter, size of fixing, therefore U-values should be recalculated if the build-ups differ from those described in Tables 3, 4, 5 and 6.

Table 9 : Acoustic filed test results for Separating Elements

Acoustic test results*				
Separating Construction	**Airborne sound insulation DnT,w [dB]**		**Impact sound insulation L'nT,w [dB]**	
	Performance Target	**Result**	**Performance Target**	**Result**
Separating Wall	≥53dB	54	N/A	N/A
Separating Floor	≥53dB	67	≤58dB	40

* The results above were obtained from on-site project specific testing, Results may vary based on project specific conditions but must always meet TGD to Part E Building Regulations requirements.

5.1 National Standards Authority of Ireland ("NSAI") following consultation with NSAI Agrément has assessed the performance and method of installation of the product/process/building system and the quality of the materials used in its manufacture and certifies the product/process/building system to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this Certificate and in accordance with the manufacturer's instructions and usual trade practice. This Certificate shall remain valid for five years from date of latest revision so long as:

(a) the specification of the product / building system is unchanged.

(b) the Building Regulations 1997 to 2024 and any other regulation or standard applicable to the product/process/building system, its use or installation remains unchanged.

(c) the product/building system continues to be assessed for the quality of its manufacture and marking by NSAI.

(d) no new information becomes available which in the opinion of the NSAI, would preclude the granting of the Certificate.

(e) the product/building system or process continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this certificate.

(f) the registration and/or surveillance fees due to NSAI are paid.

5.2 The NSAI Agrément mark and certification number may only be used on or in relation to product/processes/building system in respect of which a valid Certificate exists. If the Certificate becomes invalid, the Certificate holder must not use the NSAI Agrément mark and certification number and must remove them from the products already marked.

5.3 In granting Certification, the NSAI makes no representation as to;

(a) the absence or presence of patent rights subsisting in the product/process/building system; or

(b) the legal right of the Certificate holder to market, install or maintain the product/process/building system; or

(c) whether individual products have been manufactured or installed by the Certificate holder in accordance with the descriptions and specifications set out in this Certificate.

5.4 This Certificate does not comprise installation instructions and does not replace the manufacturer's directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this Certificate relating to the safe use of the certified product / process / building system are preconditions to the validity of the Certificate. However the NSAI does not certify that the manufacture or installation of the certified product / building system or process in accordance with the descriptions and specifications set out in this Certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act and Regulations [62], or of any other current or future common law duty of care owed by the manufacturer or by the Certificate holder.

5.6 The NSAI is not responsible to any person or body for loss or damage including personal injury arising as a direct or indirect result of the use of this product / building system or process.

5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

NSAI Agrément

This Certificate No. **26/0451** is accordingly granted by the NSAI to **Actavo Building Solution Ireland** on behalf of NSAI Agrément.

Date of Issue: **10th July 2026** (Original Certificate)

Signed

Martin Searson
Head of MMC Certification

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément, NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland. Telephone: (01) 807 3800. Fax: (01) 807 3842. www.nsai.ie

NSAI Agrément

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END OF SECTION