IRISH AGRÉMENT BOARD
CERTIFICATE NO. 18/0404
Etex Ireland Remagin Limited,
Unit A Cahir Business Park,
Cahir, Co. Tipperary,
E21 TF89.
T: +353 (0)52 744 1424
W: https://www.remagin.world/en/

Remagin Steel Frame Building System

NSAI Agrément (Irish Agrément Board) is designated by Government to issue European Technical Approvals.

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 Technical Guidance Document (TGD) Part D of the second schedule of the **Building Regulations 1997 to 2023**.

PRODUCT DESCRIPTION

This Certificate relates to the Remagin Steel Frame Building System, for the manufacture and erection of structural cold-formed Light Gauge Steel (LGS) Frame Buildings. The Remagin Steel Frame 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) and 5 as defined in Technical Guidance Documents B of the Building Regulations. The system is used for structural walls and floors in the above purpose groups up to 30m in height to the top storey or as part of a building not more than 30m in height, where the full structure is designed, manufactured, supplied and erected by Remagin Limited. The system can accommodate a wide range of custom designs.

The Remagin System is also assessed for use in non-loadbearing infill panels. The infill panels are used within reinforced concrete, steel frames and traditional construction that possess their own independent lateral stability systems.

Site erection is carried out by approved installers employed by Remagin or specialist sub-contractors under the supervision of Remagin Limited.

In the opinion of NSAI, the Remagin Steel Frame Building System, as described in this Certificate, complies with the requirements of the Building Regulations 1997 to 2023, hereafter referred to as the Building Regulations in this Certificate.

USE

The system is certified for the following applications:

1. To provide the structure of a building up to 30m in height to the top floor, which can accommodate either a composite concrete profile metal deck, or a cold formed section floor in building up to 10m in height to the top floor.
2. The system can also be used as the top storeys (Penthouse) of a building not more than 30m in height. The Remagin Steel Frame element of the building must be constructed off a concrete floor or non-combustible podium/transfer slab.
3. Remagin Steel Frame System non-loadbearing infill panels can be used in building not more that 30m in height where a fire resistance of 90mins is required (see Section 1 Part B of this Certificate). The infill panels can be incorporated in concrete or steel framed building systems which possess their own independent lateral stability systems.

DESIGN

The Remagin Steel Frame Building System is intended for use where Architect's finalized construction and fire strategy drawings are available and satisfy the Building Regulations. The Architect and Engineer Design Team of the Developer (the Client) is responsible for the architectural drawings and overall building design to comply with the Building Regulations.

The Remagin Steel Frame Building system is designed for use in permanent buildings with brick or block external finishes or with an NSAI Agrément approved external cladding system for LGS as per Section 2.1.2 and 4.7.3 of this Certificate. The compatibility of an NSAI Agrément approved cladding system shall be agreed and confirmed by Remagin Ltd at design stage to ensure compatibility between both systems. Other cladding systems may be suitable but have not been considered as part of this certification.

The Remagin System is also designed for use with a wide range of traditional roofing finishes. The system may also be designed to incorporate NSAI Agrément approved alternative roofing systems. However, written approval must be sought from Remagin Chartered Structural Engineers on the use of such roofing systems.

The buildings are assembled using a panellised system, factory-made and site installed. The Remagin Chartered Structural Engineers are responsible for the final design of the Remagin System.

RESPONSIBILITIES

Prior to the commencement of the contract, the responsibilities are determined and agreed between Remagin and the main contractor, including foundations, fire stopping, cavity barriers, roof completion and other elements.

MANUFACTURE, MARKETING & DESIGN

The product is manufactured, marketed, designed and erected by:

Etex Ireland Remagin Limited,
Unit A Cahir Business Park,
Cahir, Co. Tipperary.
T: +353 (0)52 744 1424
W: https://www.remagin.world/en/

1.1 ASSESSMENT
In the opinion of NSAI Agrément, the Remagin Steel Frame 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
D3 – The Remagin Steel Frame Building System, as certified in this Certificate, is comprised of 'proper materials' fit for their intended use (see Part 4 of this Certificate).

D1 – The Remagin Steel Frame Building System, as certified in this Certificate, meets the requirements of the building regulations for workmanship.

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

Part A - Structure
A1 – Loading

A2 – Ground Movement

Part B – Fire Safety
Part B Vol 2 – Fire Safety
For purpose group 1(a), 1(b) and 1(d), the fire safety requirements are laid out in TGD B Fire Safety Volume 2, Dwelling Houses of the Building Regulations. For purpose group 1(c), 2(a), 2(b), 3, 4(a) and 5 the fire safety requirements are laid out in TGD B 2006 Fire Safety of the Building Regulations.

For the Volume 2 Dwelling Houses, Part B6 – B11 are required to be adhered to, while for purpose group 1(c), 2(a), 2(b), 3, 4(a) and 5 Parts B1 – B5 are required to be adhered to TGD B 2006.

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

Note: In a building more than 18m high, insulation material used in drained and/or ventilated cavities in the external wall construction should be of limited combustibility (see Appendix A TGD to Part B 2006).

B5 & B10 – Access and Facilities for the Fire Service

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, L5, L6 – Conservation of Fuel and Energy

2.1 PRODUCT DESCRIPTION

This Certificate relates to the Remagin Steel Frame Building System for the design, manufacture and erection of cold-formed light gauge steel frame buildings. Buildings using this system are erected on site using a panelised system factory made and site installed with all major custom components being manufactured at a Remagin production facility.

Remagin produces all cold-formed steel sections using (CNC) computer numerically controlled plant. Insulation is placed on the cavity side of the cold formed steel studs and the insulation serves to encase the cold formed steel sections thus creating a "warmframe" environment for the steel frame.

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 manual [30]. Should a conflict arise between this Certificate and the Certificate holder's manuals, this Certificate shall take precedence. Remagin, in conjunction with the design team on a project, will produce a set of project specific details for each project.

2.1.1 External Walls

The external walls can be load bearing or non-load bearing. Insulation is fitted to the cavity side of the cold formed steel studs. The wall panels are filled with stone mineral wool between the studs for acoustic and fire. The wall panels are then clad with the required thickness and grade of plasterboard as per **Table 4** to achieve the appropriate fire rating required for the building. The plasterboards are screw fixed to the cold formed steel stud and track members.

The requirements for the provision of an Air and Vapour Control Layer (AVCL) on external walls are outlined in Section 4 of this certificate.

2.1.2 External Cladding

The external leaf of the Remagin Steel Frame Building System can be constructed of traditional brick/block to I.S. 325-1[4] and I.S. EN 1996-1-1[5], or 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.

2.1.3 Wall Ties

Where traditional block or brick is used as part of the Remagin Steel Frame Building System, the masonry outer leaf is tied to the steel frame building system with a stainless-steel channel and cavity wall tie system in accordance with I.S. EN 845-1[6]. The tie is intended to be used in masonry to studded applications, with a design cavity in accordance with I.S. 325-1[4].

The cavity width is defined as the distance between the outer surface of the insulation and the inner surface of the masonry leaf. The wall tie system comprises of two parts, the channel which is factory fitted through the insulation with the required depth of Tek screw directly into the flange of the cold formed studs, and the wall tie which is site fitted by the mason. The wall tie channels are fitted at each cold formed steel stud at a frequency that can accommodate the requirements for wall tie spacing as outlined in I.S. EN 1996-1-1[5].

Using this channel system allows for variations within block/brick courses. Around openings, channels are positioned within 150mm of the opening, and line up with the steel studs. The slot in the wall tie bracket enables a wall tie to be adjusted vertically for variations in mortar thickness during construction of the masonry outer leaf. Additional wall ties are provided at 225mm centres around all openings, corners and movement joints, such that there is a tie for each 225mm of perimeter of opening or either side of each movement joint/corner. Stainless steel wall ties are available as standard flat ties with drip.

The wall ties have been assessed and meet the performance requirements given I.S. EN 845-1[6] for a Type 6 wall tie and designed in accordance with I.S. EN 1996-1-1[5]. Where masonry cladding is being used over 4 storeys' (12m) in height, a Type 1 wall tie in accordance with I.S. EN 845-1[6] must be used. The wall tie and channel are made from minimum Grade 304 austenitic stainless steel and designed according to I.S. EN 1993-1-1[7].

The cavity in the external wall must be maintained and kept clear of construction debris to 150 mm below DPC level. Masonry claddings must have adequate weep holes along their base and over openings to allow moisture to exit the cavity.

2.1.4 Internal Walls

The internal load bearing and non-load bearing wall panels are made from cold-formed LGS. When internal wall panels provide racking resistance to external walls, diagonal wind bracing members can be incorporated into the panel to successfully

transfer the horizontal loads safely through the building structure in accordance with structural design requirements. The bracing also serves to keep the frames square during erection.

All internal load bearing panels must be sufficiently supported directly under the panels with rising blockwork or equivalent. Plasterboard specifications on the steel panels should be in accordance with Table 4 of this Certificate, which shows the plasterboard fire resistance requirements for wall, floor and ceiling elements. The plasterboard and AVCL (where required) linings are fixed to the walls and ceilings by means of self-drill/self-tap screws; all joints are then taped and filled where required for decoration.

2.1.5 Infill Panels

Remagin infill panels are designed to resist lateral loads only to the required deflection limit depending on the façade finish. It is critical that no permanent or variable loading from the superstructure is transferred into the infill sections. Infill panels can be designed and detailed to transfer horizontal loads, satisfactorily into the primary structure, while incorporating a soft top joint which will allow vertical deflection of the primary structure to occur but will not transfer vertical load into the panel.

All vertical and horizontal cavity closing/fire stopping is carried out in accordance with the project specific fire strategy drawings.

The steel panel studs within the infill panel frame are designed to resist wind loading due to the action of wind on the building's cladding. The infill panels are not designed for vertical loads to be transferred to them. The Remagin Infill panel can only be used within framed buildings that possess their own independent lateral stability systems and as a result a soft joint is incorporated to ensure that no load transfer occurs.

The design of the superstructure is to be the responsibility of the Clients' structural engineer. Before carrying out this design, the Client's Engineer will need to liaise with Remagin Structural Engineer, who will provide the following information:

- The permissible deflection of the primary structure to ensure the LGS deflection head detail is designed correctly to allow the infill panels remain within the deflection limits set out by the design.

2.1.6 Compartment Floor

Compartment floors as described in Table 4 of this Certificate will have a prescribed fire-resistant classification which can be used in the separation of one fire compartment from another.

The construction of C-joist/truss compartment floors must be such that the achievement of the required fire resistance performance relies primarily on the integrity of the linings of such constructions. The integrity of linings of compartment floors should not be breeched to allow for the installation of services (e.g. pipes, wires, flues, including manufacturing flues), except where necessary to allow services pass through these compartment floors. Where services pass through compartment floors, they should be adequately fire stopped in accordance with the respective TGD's to Part B of the Building Regulations to which the relevant purpose group relates – all service penetrations in the ceiling such as downlighters, soil vent pipes and ventilation duct heads must be fire stopped by the use of fire collars, fire hoods or fire rated products. Composite metal deck floors provide its own fire resistance and is based on the concrete cover of the required thickness and density to the steel reinforcement.

Services can be accommodated within a service cavity created external to the un-breached linings of the fire-resistant compartment floor on the underside of the ceiling below.

For additional acoustic performance, resilient layers may be added to the floor. If additional resilient bars are specified and fixed to the underside of the floor trusses/C-joist in order to maintain the fire integrity of the floor, this shall be in accordance with fire performance details outlined in Table 4(a/b).

2.1.7 Intermediate Floor

The intermediate floor is constructed of LGS floor joists with OSB or plywood decking. Fire protection is provided by plasterboard to the underside of the ceiling in accordance with Table 4a.

2.1.8 Roof Structure

The roof trusses can be either a traditional timber cut roof or prefabricated roof truss made from timber or steel. The site fitted timber roof trusses are attached to timber wall plates, which are bolted on site to the top wall track of the load bearing Remagin wall panel. The Remagin cold formed roof trusses can be fixed down directly with a thermal break onto the top wall track of the load bearing Remagin wall panel.

Roofs may be clad with concrete or clay interlocking tiles or traditional roof finishes. Other NSAI Agrément approved roof coverings may also be used with the system under the guidance of a Remagin Engineer. The imposed load on the roof

is project specific and is accounted for in the design of the steel frame structure.

2.1.9 Chimney Construction

Remagin Steel Frame Building System can incorporate both traditional block/brick chimney construction in accordance with its NSAI Certificate and the Building Regulations.

2.1.10 Internal Linings and Finishes

Linings to walls and ceilings are of plasterboard of Type F as specified in **Table 4**, manufactured to I.S. EN 520[8]. 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 manufacturers' instructions for direct decoration. Alternatively skim coat plaster can be applied. Any wall mounted fitting to the wall other than lightweight items, e.g. framed pictures, must be fixed into a proprietary ground, using appropriately sized proprietary fixings. To accommodate larger wall mounted fittings such as kitchen units, timber grounds or proprietary steel grounds can be provided between LGS studs.

2.2 GENERAL BUILDING STRUCTURE

2.2.1 Foundations

Foundations are outside the scope of this Certificate. Based on finalised layouts, the Remagin Structural Engineer can carry out a load take down calculation and provide the Client appointed Structural Engineer with accurate line loads which they can accommodate into their foundation design.

Remagin Steel Frame Building System may be used with a variety of foundation types, including NSAI Agrément approved foundation systems. The foundation system will be selected depending on the ground conditions encountered on site. A site investigation should be carried out by an appropriately qualified and experienced engineer to determine the maximum bearing pressure the soil can carry. Once this is established a suitable foundation type can be selected. A tolerance of ±5mm in 10 M lengths is specified for both concrete slab level and horizontal dimensions. Where variations in slab level occur, such variations are catered for using non-corrosive structural steel packers located directly below the studs as required. However, the use of such packers should be kept to a minimum. The remaining gaps below the steel frame panel sole plate are filled using structural grade non-shrink grout.

Note: The construction of the foundations and ground floor slab are the responsibility of the main contractor and should be constructed in accordance with the Client's engineering specifications. Due to the low tolerances of the steel frame manufacture, the foundation and ground floor slab must be constructed accurately, i.e. correct dimensions, square and level so that the steel frame system can be erected properly within the specified tolerances.

2.2.2 Ground Floor

An in-situ concrete slab may be used to form the ground floor. Below the concrete slab, insulation is provided to meet the requirements of TGD's to Part L of the Building Regulations, including the avoidance of cold bridging. An NSAI or equally approved radon resistant membrane is installed in accordance with Clause 8 of I.S. EN 1996-1-1[5] and BS 8102[9], to protect the floor and bottom channels of the steel studs from rising damp. Alternatively, a proprietary suspended ground floor may be used, provided it is approved by the Remagin Structural Engineer for use with the Remagin Steel Frame Building System to meet the required structural loads criteria (dead load, uplift, etc.). The structural design of the ground floor should be in accordance with Part 3 of this Certificate.

2.2.3 Concrete Podium Slab (Transfer Slab)

Where the Remagin Steel Frame Building System is constructed off a concrete podium slab, a tolerance of ±5mm is required on the podium slab line and level. Procedures for variations in slab are as described in Section 2.2.1. The construction of the podium slab is the responsibility of the Main Contractor, and the design is the responsibility of the Client's Engineer, who will require line loads from the Remagin Structural Engineer. Remagin Steel Frame Building System certification applies from transfer slab level upwards.

2.3 DESIGN AND MANUFACTURE

2.3.1 Design Process

Before a Remagin Steel Frame Building can be manufactured a Chartered Structural Engineer must complete the structural design including the specification of all members. The Client's architectural drawings are received by Remagin and converted into a 3D structural computer aided design model (CAD/CAM). This system automatically calculates all framing requirements for walls, floors, roof trusses (where required), and allows for all openings such as doors and windows. Each individual frame member is allocated a unique identification number and has its length calculated, along with the position of any cut-outs, punch holes or bracket positions. The Remagin Structural Engineer checks and signs off all drawings to ensure structural compliance before any drawings are transferred to production. Once the drawings have been cleared for production they are transferred to the computer which operates the roll-forming equipment.

Elements	Tolerance
Length	±2mm in 10m lengths
Opening position	±2mm
Size of openings	+5mm –0mm
Frame squareness	±2mm

Table 1: Manufacturing Tolerances

2.3.2 Roll-Form Production

The roll-formers use computer aided manufacturing (CAM) techniques to process the data, which has been transferred from the design office to the roll former. The steel coil is then formed into the required shapes, with the position of cut-outs, punch-holes etc. being accurately located within a tolerance of ±2mm per 10m length. Individual members are grouped into bundles as they come off the roll-forming equipment, corresponding to their subsequent handling in the assembly process. Assembly of the components can commence in the factory directly after it has been roll-formed or the components can be transferred in flat pack form for assembly elsewhere by Remagin approved assemblers.

2.3.3 Wall Panel Assembly

The steel frame panels are composed of galvanised mild steel manufactured from galvanised coil as described in Section 2.4.2. All profiles are designed in accordance with I.S. EN 1993-1-3[10]. Section properties comply with I.S. EN 10162[11]. The wall panels have vertical, C-channel studs at maximum 600mm centres, which are fixed to top and bottom horizontal channels using rivets/bolts or screws. The rivets/screws/bolts are precisely located in pre-punched holes in the studs, which match holes in the top and bottom channel. The pre-punched holes in the studs are dimpled which allows the flat-topped rivets/screws/bolts to be flush with the metal surface.

Where rivets are used in the assembly of wall panels in the factory, i.e. stud to track connections, it is important to note that these rivet fasteners may or may not been considered in the structural performance of the panels. It is structurally acknowledged that the rivets will contribute to the structural performance of the panel with increased stiffness in particular, but this has not been considered in the structural design calculations of the panel. Where structural elements are added to the wall panels such as wind bracing, wall tie brackets and lintel plates, these must only be fixed with approved Tek screws as these are structural connections and must be designed and installed in accordance with the Structural Engineers design drawings.

2.3.4 Floor Cassette Assembly

The use of floor cassettes is project specific, with cassettes often being used for mid-rise multi-storey buildings.

Floor cassettes are factory assembled and delivered to site. The components of the floor cassette are connected using self-tapping screws. A floor decking is screwed to the top of the cassette. The floor cassettes are either supported on vertical wall panels, hung on Z-hangers or supported by C-channels at the end of the joists or trusses.

The solution adopted shall be chosen by Remagin or the Client's Project Structural Engineer.

2.3.5 Quality Control Production

Quality control carried out during manufacture includes visual inspection of steel coiled raw material, calibration of roll forming equipment daily, cross checking of all in-house production drawings, and checks on production dimensions (length, width, and steel thickness) and on the dimensions and squareness of finished panels. Each panel is labelled with a QC sticker confirming it has passed final inspection. Remagin operates a full in-house quality control system, which outlines procedures on material specification, quality control in production, purchasing of raw materials, design and assembly.

2.4 STRUCTURAL PRINCIPLES

2.4.1 Steel Frame Structure

The basis of the typical Remagin structure is a cold-formed light gauge steel frame, which is assembled into panels in the factory and installed on site. The design, manufacture, assembly and erection of the system is based on the combined services of BIM (Building Information Modelling) and CNC software, which feeds the required code into the proprietary roll-formers and produces the documentation required to manufacture and install accurately.

The panels are fabricated from suitably coated steel coil as described in Section 2.4.2 which is formed into the required shapes by proprietary roll-forming equipment. The frequency and size of the structural elements will depend on the individual panel and truss (floor or roof) design. The individual elements manufactured are then assembled by trained personnel to produce the required wall or truss (floor or roof) with fixings as specified by the Structural Engineer.
The wall panels, where required by design, will have ancillary elements assembled into them such as strap or 'K' bracing, lintel trusses over openings and insulation on the external walls which are described in this Certificate.

Typically, the Remagin System utilises prefabricated timber roof trusses. These are designed and supplied by others. However, the Remagin System can also utilise cold rolled roof trusses, designed and manufactured by Remagin Ltd. These are produced using the typical sections produced by Remagin Ltd and the fixings specified by the Structural Engineer.

The grades of steel and dimensions of sections used are selected and specified by a Remagin Chartered Structural Design Engineer in accordance with design requirements. Table 2 shows typical section sizes utilised for load bearing walls, non-load bearing walls and trusses (floor or roof) for the cold formed steel elements of their system.

Section properties are calculated using design core thickness of steel (excluding coatings) in accordance to I.S. EN 1993-1-1[7], I.S. EN 1993-1-3[10] and I.S. EN 1993-1-5[12].

2.4.2 Protective Coatings

The steel frame members are all coated with a protective zinc-rich metal coating. The steel frame members are manufactured from galvanized coil steel to I.S. EN 10346[13] (min. yield stress 350 N/mm^2) with 275 g/m^2 zinc protection.

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

- The bottom channel on all ground floor steel frame panels is additionally protected by a DPC.
- The insulation keeps the steel in a "warmframe" environment, which, in conjunction with an internal AVCL (where required, see Section 4.4.1 of this Certificate), prevents the formation of condensation within the wall structure.
- The metal and timber in the roof trusses are kept free from prolonged moisture build up, by means of free air circulation in the roof space, using ventilation methods in accordance with Part F2 of TGD to Part F of the Building Regulations.
- Where steel is cut on site or where the coating of the steel becomes damaged, it is protected by the application of a zinc rich paint.
- An assessment of corrosion of fasteners in normal conditions with a view to a minimum 60-year design life. Studs shall be located a minimum of 150 mm above ground level.

2.4.3 Fasteners and Connection Joints

The unique design of the Remagin Steel Frame Building System allows for no welding of joints in the system. The system is assembled using fasteners such as screws, rivets or bolts. Only self-drilling Tek screws or bolts are used for the structural connectivity of the system on site. On-site structural connections such as panel to panel connections, OSB boarding to floor joist, floor joist to panel, composite deck to panel and wind bracing are fastened using approved Tek screws or bolts. No riveting takes place on site.

All fasteners used in the steel frame system are adequately protected against corrosion i.e. galvanising/zinc coating and made from a suitable metal to ensure the design life of the system is maintained. Remagin provide a full specification of all fasteners, where they are to be used and how they are to be installed during the construction of the system. Only system fasteners approved or supplied by Remagin may be used with the system. It is important to ensure that protective coatings on fasteners are not removed, i.e. to assist the fitting of a connection, as this would severely compromise the corrosion performance of the fastener. Selection of zinc coating where LGS is exposed to external environment shall be as per I.S. EN ISO 14713-2[39].

2.4.4 Loadbearing Walls Structural Principles

The perimeter walls can be the primary load bearing elements of the structure and are therefore designed to bear on the walls of the panels below, i.e. permanent and variable imposed loads are transferred by load bearing external wall panels and if required load bearing internal wall partitions where necessary.

The load bearing wall panels are comprised of vertical studs, fixed to horizontal head and bottom channel sections. Horizontal noggins are fitted to panels where required to provide additional strength. Under high concentrated loads, studs can take multiple forms including, but not limited to, back to back formations and box formations, amongst others. The formation for a particular project is decided by the Remagin Structural Engineer's particular design.
Where windows are present a cold formed lintel or hot rolled section is provided to allow the load to transfer to the vertical wall studs. The design loads from each level are transferred through the primary load bearing elements into the substructures / foundations. Perimeter steel Z or C sections can be used to support floor joists/trusses and can also be designed to act as a lintel over openings.

HRS (Hot Rolled Steel) structural members may also be incorporated into the design of the wall panels as required to accommodate more complex structural designs. Any HRS structural members used as part of the Remagin Steel Frame Building System must be fabricated in accordance with I.S. EN 1090-1[14] and in accordance with execution class specified in the project specific design.

2.4.5 Racking

Resistance to horizontal loading (racking) is provided by the horizontal diaphragm action of the approved floor sheeting and roof in conjunction with the metal diagonal cross-bracing or K bracing members on specific external inner leaf and internal walls. All cross-bracing or K bracing is pre-assembled in the factory and has the dual function of ensuring squareness of factory produced panels in addition to providing lateral stability for the overall structure. Remagin use both strap and K bracing.

2.4.6 Holding Down

To provide resistance to uplift, the bottom channel of the external panels is fixed to the ground floor slab, podium slab or rising wall with approved fixings. The type of fixing used to hold down the panels of the system will be dependent on what substrate the fixing is being fixed to. These fixings are designed by Remagin Structural Engineer and are installed in accordance with the *Code of Practice for the Design and Installation of Anchors* in accordance with section 60 of *the Safety, Health and Welfare at Work Act 2005, and I.S. EN 1992-4* [41]. The positions of the fixings are project specific and are determined by Remagin's Chartered Structural Engineer. The plasterboard is site applied allowing access for the fixings to be installed on site.

Component Type	Grade of Steel	Typical Section Dimensions			
		Depth (h)	Width (b)	Lip (c)	Thickness[1] (t)
Wall Stud	S350, S390, S450, S550	70.0	35	10.8 – 12.5	0.8 – 2.0
Wall Stud[3]	S350, S390, S450, S550	89.0[3]	45 – 72	9.8 – 12.7	0.8 – 2.0
Wall Stud	S350, S390, S450, S550	150.0	65	10.8 – 16	0.8 – 2.0
Wall Stud	S350, S390, S450, S550	100.0	45 – 72	10 – 16	1.2 – 3
Wall Track/Noggin[2]	S350, S390, S450, S550	72 – 73.8	43.2 – 43.7	9.8 – 12.7	0.8 – 2.0
Wall Track/Noggin[3]	S350, S390, S450, S550	89.0[3]	45 – 72	9.8 – 12.7	0.8 – 2.0
Wall Track/Noggin[2]	S350, S390, S450, S550	142 – 143.8	58.2 – 58.7	0.0	0.8 – 2.0
Wall Track/Noggin[2]	S350, S390, S450, S550	100.0	45 – 50	10 – 15	1.2 –3.0
Floor Truss (Lattice)	S350, S390, S450, S550	200.0[3]	89.0[3]	11.7 – 13.8	1.2 – 3.0
Floor Truss (Lattice)	S350, S390, S450, S550	250.0[3]	89.0[3]	11.7 – 17.9	1.2 – 3.0
Floor Truss (Lattice)	S350, S390, S450, S550	300.0[3]	89.0[3]	13.8 – 17.9	1.2 – 3.0
Floor Joists (C-Section)	S350, S390, S450, S550	100.0	45 – 50	10 – 15	1.2 – 2.5
Floor Joists (C-Section)	S350, S390, S450, S550	200.0	50	11.7 – 13.8	1.5 – 3.0
Floor Joists (C-Section)	S350, S390, S450, S550	250.0	50	11.7 – 13.8	1.5 – 3.0
Floor Joists (C-Section)	S350, S390, S450, S550	300.0	50	11.7 – 13.8	1.5 – 3.0
Floor Track End Bearer	S350, S390, S450, S550	203.2 – 205	56.7 – 57.1	0.0	1.5 – 2.0
Floor Track End Bearer	S350, S390, S450, S550	253.8 – 257.5	56.8 – 58.0	0.0	1.5 – 3.0
Floor Track[2] End Bearer	S350, S390, S450, S550	305 – 307.5	57.1 – 58.0	0.0	1.5 – 3.0

[1] The range of thickness of cold formed section available = 0.8, 1.0, 1.2, 1.5, 1.6, 2.0, 2.5, 3.0mm.
[2] Range of Depth (h) and Width (b) available to allow for uniform cross section of structural zone.
[3] These profiles are standard; other special profiles are available on request.

Table 2: Typical Size of Elements in the Steel Frame System

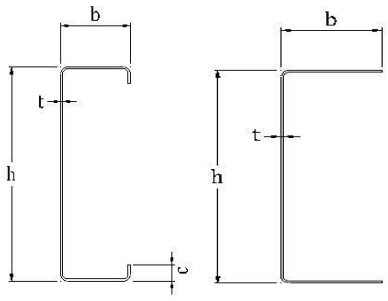


Figure 1: Channel with and without Lip

2.5 COMPARTMENTATION

2.5.1 Separating Wall

Separating walls are constructed using a minimum of two independent cold formed steel framed leaves with a recommended minimum cavity of 50mm between both frames. The individual frames are boarded (on site or in the factory) with the appropriate level of boarding required to provide the acoustic and fire properties, as illustrated in Table 4(a/b). The LGS studs are filled with the appropriate mineral wool insulation from ground floor to the underside of the roof structure to provide the required fire and acoustic properties. Where the attic space is habitable the mineral wool insulation must go up to the underside of the roof for acoustic purposes. Where the separating wall abuts an external wall, the mineral wool insulation within the cavity of the separating wall extends through the inner leaf of the external wall and abuts the external leaf of the system and forms the fire stop in the wall. This detail seals air gaps and minimises flanking sound transmission.

The head of the separating wall must also be fire stopped and cavity closed as specified by the Remagin construction details. Where services are required in 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. All battens used with the Remagin system are treated in accordance with BS 8417[15]. Design must comply with the requirements of Section 3.5 of TGD B Volume 2 of Building Regulations for purpose groups 1(a), 1(b) & 1(d) and in accordance with Section 3.2.5 of TGD B of Building Regulations for all other purpose groups to which this certificate applies.

2.5.2 Single Frame Compartment Walls

A compartment wall within the Remagin Steel Frame Building System can be constructed of a single steel frame wall. This wall can be used in situations where a building is sub-divided into different compartments, but 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 (e.g. between apartments). The single frame compartment wall must be designed and specified to meet the fire and structural requirements required by the wall within the building to meet the requirements of TGD to Part B Volume 2 of the Building Regulations for purpose groups 1(a), 1(b) and 1(d), and of TGD to Part B of the Building Regulations for all other purpose groups to which this Certificate applies.

No services are allowed to run vertically or horizontally within the compartment wall and where services are required in a compartment wall, they can be accommodated by battening out the wall with timber battens or with resilient bar similar to accommodating services in a separating wall. Services however can pass through a compartment wall, but they must be appropriately protected in accordance with Section 3.5.4.1 of TGD B Volume 2 of Building Regulations for purpose groups 1(a), 1(b) & 1(d) and in accordance with Section 3.2.5.7 and 3.4 of TGD B of Building Regulations for all other purpose classes to which this certificate applies. Services passing through compartment walls should be kept to a minimum and avoided where possible.

2.5.3 Compartment Floors

The Remagin Steel Frame Building System compartment floor can be designed to provide up to 90mins fire resistance from the underside. There are two forms of compartment floors used with the Remagin Steel Frame Building System:

a) Steel Lattice Truss or C-joists protected with Plasterboard.
b) Steel Concrete Composite Deck.

Compartment Floor Steel Lattice Truss or C-joists Protected with Plasterboard

The structure of a compartment floor used with the Remagin Steel Frame Building System consists of cold formed steel lattice trusses or C-joists.

The construction of compartment floors must be such that the achievement of the required fire resistance performance relies primarily on the integrity of the linings of such constructions. The integrity of linings of compartment floors should not be breached to allow for the installation of services (e.g. pipes, wires, flues, including manufacturing flues), except where necessary to allow services pass through these compartment floors. Where services pass through compartment floors, they should be installed in accordance with Section 3.2.5.7 and Section 3.4 of TGD to Part B of the Building Regulations, and Section 3.5.4.4 and Section 3.7 of TGD to Part B Vol 2 of the Building Regulations.

In buildings to which this certificate applies and where the height of the top storey is 10m or more and to comply with TGD to Part B of Building Regulations; Section 3.2.5.2, compartment floors in high buildings, Remagin provide a compartment floor constructed of non-combustible materials. The compartment floor to be used is option b) above, the Steel Concrete Composite Deck.

Services may be surfaced mounted or accommodated in service ducts or within service cavities created externally to the un-breached linings of the fire resistant compartment floor.

The compartment floor construction can comply with Part E of the Building Regulations through the

appropriate use of gypsum boarding and mineral wool insulation between the steel lattice trusses or steel C-joists, while maintaining the fire performance of the compartment floor. Further improvements to acoustic reductions can be achieved by using resilient bars between the ceiling and the plasterboard where appropriate and without compromising the fire performance of the floor.

Where a steel lattice truss type floor is supplied as a non-compartment floor, services can be catered for through the lattice diagonals but these services must be fire sealed.

Compartment Floor Steel Concrete Composite Deck
The floor is constructed of a composite profiled metal deck which is fixed to the head track of the supporting load bearing walls. Steel reinforcement is installed on top of the deck as required by the design, and the required concrete thickness is then poured as required by the design.

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 in question.

The additional layers of plasterboard will provide additional fire protection but is not considered in the fire resistance performance. The composite deck compartment floor is suitable for use in all purpose groups to which this Certificate relates.

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 to Part B of the Building Regulations for all other purpose groups to which this Certificate relates.

2.5.4 Forming Holes in Profiled Decks
When holes or opes to accommodate service penetrations are required, these can be incorporated in the composite concrete slab design prior to pouring the structural concrete. When additional opes are required, the size and exact location must be signed off by the Chartered Structural Engineer who designed the concrete slab.

2.5.5 Cavity Barriers and Fire Stops
To meet the requirements of TGD to Part B Volume 2 of the Building Regulations and TGD to Part B of the Building Regulations, the correct specification and placement of cavity barriers and fire stops shall be detailed and shown on a schedule for the project. Typically, cavity barriers and fire stops should be provided in the construction of steel frame walls as follows:

- Separating walls shall have a vertical cavity barrier sealing the cavity at the wall ends, running from DPC level to the underside of the fire stopping at the top of the wall.
- At a separating wall junction with the external wall, the vertical cavity barrier runs out to the inner face of the external cladding and held in place with timber battens to form the cavity barrier (see Figure 8).
- Horizontal cavity barriers shall be placed at the perimeter of all compartment floors. The cavity barrier should be appropriate for the external cladding that is intended to cavity close in the event of a fire and smoke entering the cavity.
- Eaves boxes shall be provided at the junctions of separating wall with external walls to reduce the risk of fire passing across these junctions.
- Cavity barriers are required around all openings in external walls such as doors, windows, vents, extractor fans, meter cupboards, etc.
- The integrity of compartment/separating walls within roof voids that are continuous with the compartment wall between flats or continuous with a separating wall between dwellings is essential to prevent fire spread. These walls must be fire stopped at the wall/roof junction to afford a minimum 60 minutes fire resistance. The method of fire stopping should be in accordance with guidance given in Diagram 10 of TGD to Part B Volume 2 of the Building Regulations for purpose groups 1(a), 1(b) and 1(d), and Diagram 13 of TGD to Part B of the Building Regulations for all other purpose groups for which this Certificate applies.

2.5.6 Fire Stopping Service Penetrations
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.

Section 3.4 of TGD to Part B of the Building Regulations, and Section 3.7 of TGD to Part B Volume 2 of the Building Regulations provide guidance on the methods of protection of openings and fire stopping.

It is essential that both the Designer and the Specialist Contractor are fully conversant with the fire protection requirements for pipe, cable and service penetrations. It is the responsibility of the Main Contractor to complete the fire stopping of the service penetrations. The fire stopping is then

inspected by the Remagin Site Manager and recorded in the Remagin quality control file for that site – the fire stopping must be installed correctly before Remagin will issue the Certificate for the building.

2.6 DELIVERY, STORAGE AND SITE HANDLING

2.6.1 Delivery of Panels

Frame panels are transported vertically on stillages or similar sized panels can be flat packed horizontally and transported to site. Where lifting points are required, they are located, designed and certified by the Structural Engineer, taking into account the unit weight and dimensions and the distance of lift required. They will conform to the requirements of the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations 2013. All off-loading and erection should be in accordance with the Remagin Method Statement and erection procedures. Erection tools should be of suitable quality to avoid surface contamination. Smaller panels may be manually manoeuvred into position.

All lifting shall be carried out by competent personnel in accordance with the Remagin Erection Manual and site-specific safety statement. Care is needed to avoid scratching the surface of any exposed steel frame members. Frames must be stored on a clean, level base with a suitable packing to prevent damage and must not be dropped or allowed to rest on projecting objects, for the protection of panels during storage from the external environment.

The use of protective gloves when handling the LGS panels is necessary, as steel members formed from cut or sheared sheet can have sharp edges and care should be taken when handled, to avoid injury. The exposed steel frames members must be kept out of contact with dry cement and lime.

Flooring and other ancillary items such as insulation and cavity barrier must also be kept dry and stored on a firm level base.

2.6.2 Traceability

The Remagin CAM software assists the tailor made custom designed roll formers in arranging production groups and complex punching operations. The software also directs dynamic inkjet printing for parts identification and positioning ensuring all pieces are identified for accurate and fast assembly.

Each assembly drawing contains the unique identification number for each steel member. This allows for ease of assembly by the assemblers.

When each wall panel is complete and within the required dimensional tolerances, it is labelled with a "Quality Passed" sticker when it has been checked according to the building drawing and stacked according to the off-loading plan for the building.

2.6.3 Typical Material List Supplied to Site

With each customised delivery to site, a comprehensive bill of materials is supplied. This bill of materials gives a detailed list of all components delivered to site to complete the installation of the steel frame building. All panels are individually numbered using the pre-marking system during production to correspond with the erection drawings supplied with the bill of materials. This pre-marking system gives the advantages of both speed and accuracy during assembly and erection on site.

2.7 INSTALLATION

2.7.1 General

Installation is carried out in accordance with the requirements of this Certificate, and all relevant codes of building practice, regulatory Health & Safety requirements and the manufacturer's instructions contained in the installation manual [30] a copy of which must be available on each site. Site erection must only be carried out by a Remagin approved installer or a specialist sub-contractor under the supervision of Remagin and in accordance with the Remagin Installation Manual. Installers are approved once they have undergone on-site training, understand the fundamental structural principles of the system, cavity barrier requirements, tolerances, importance of weathering, storage and handling of the panels and all other relevant information. Installers should have installed panels under the guidance of a qualified installer and have a signed record of this training. All off-loading and erection should be in accordance with the Remagin Method Statement and erection procedures. Care must be taken to avoid any damage to the steel frame components during lifting, transportation and installation.

All structural connections to the foundation must be installed in accordance with the structural design details, independently checked by qualified members of the Remagin team and formally recorded on the Remagin site quality control records.

It should be noted that the DPC is penetrated with the holding down bolts for the system however, the DPM and radon barrier (which often acts as the DPM) is not penetrated. The radon/dpm membrane shall be fully sealed over the entire footprint of the building. The membrane shall be adequately repaired where it is punctured by anchor bolts connecting the LGS units to the rising wall/foundations.

2.7.2 Site Supervision

The approved installation contractors are subject to supervision by a Remagin site manager. Typically, the Remagin site manager will agree a schedule of inspections with the erection contractor. The supervisor of the erection crew is responsible for the quality and productivity of work carried out by the erection crew. The erection supervisor reports directly to the Remagin site manager to ensure all work follows the requirements of the design drawings and the requirements of Remagin Structural certification for the building.

Remagin employ a full-time site manager who works very closely with the erection supervisor, and the main contractor responsible for providing the concrete substructure. The Main Contractor is responsible for ensuring all concrete slabs are within the Engineer's specified tolerances before panels are installed on site. No panels are installed until the Remagin Site Manager approves the concrete base that the panels are being fixed too. All fixings and brackets between panels are visually inspected and recorded on the assembly quality control sheet for structural connections.

Each building has its own quality control file which is kept on site by the Remagin Site Manager. All fixings and brackets between panels are visually inspected, periodically photographed and recorded in the quality control file. The site manager also inspects fire stopping and cavity closing of all panels, records of the fire stopping are recorded by Remagin steel frame. Any defects noted are recorded, photographed where possible and notified in writing to the erection supervisor. The Site Manager will inspect and approve the remediation before work can proceed.

The approved steel frame erection Contractors are subject to continuous supervision by the Remagin Site Manager. The following checklist is provided to offer guidance to clients who intend to carry out their own additional site supervision. The non-exhaustive list of items are of a general nature and are in addition to all other building requirements.

- All components delivered to site comply with the Bill of Materials.
- Components are not damaged and are properly pre-marked for erection.
- The substructure is set out accurately and level within the tolerance specified by Remagin before the wall panels are positioned.
- The steel frame should not be erected unless any inaccuracies in the floor slab have been corrected.
- The ground floor layout is properly marked out.
- DPC and DPM are correctly installed in accordance with BS 8102[9].
- DPC course is laid under all ground floor panels, as a good practice measure between steel and concrete, internal walls.
- Panels are in line and plumb and in accordance with the Remagin panel layout.
- Rooms are checked for squareness.
- All ground floor steel frame panels are correctly fixed into position (penetrating the DPC but not penetrating the DPM) in accordance with the erection drawings.
- All insulated wall panels are free from damage after erection.
- All horizontal and vertical joints are correctly detailed.
- All bottom tracks are free of construction debris.
- Wall ties are correctly spaced and positioned.
- Joints in floor decking occur on the centre line of the joists and all T&G joints run perpendicular to the floor trusses/C-joists. Decking sheet joints must be staggered.
- If floor decking is exposed to weather for prolonged periods, then it will need to be protected with a weatherproof cover.
- Floor decking is screwed at the correct centres.
- All bracing is properly tensioned.
- Check for requirement of web stiffeners when floor joists/truss are continuous over internal load bearing support walls against Engineers drawings.
- Cavity barriers and fire stops are installed as specified and in accordance with the Building Regulations.
- Roof trusses are installed plumb and as per layout.
- Roof bracing installed where required.
- Where galvanised steel section is cut or where any damage occurs to the steel frame a coat of zinc rich paint or galvanised spray is applied to exposed surfaces.
- All fasteners supplied are approved by Remagin.
- No modification i.e. cutting of the steelwork is allowed without prior written permission from the Remagin Chartered Structural Engineer.
- Always maintain the recommended minimum 50mm between the two leaves of the separating wall, or as per design requirements supported by testing.

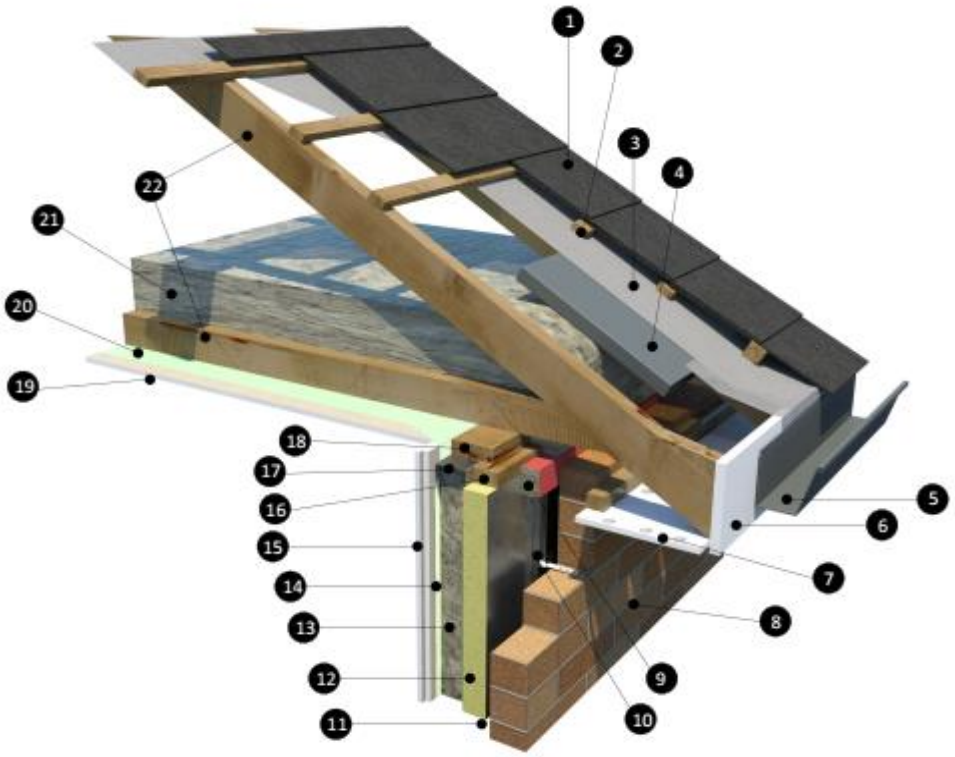
2.8 INFILL PANEL INSTALLATION

Remagin Steel Frame infill panels can be designed for buildings in two ways:

1 Made to Measure: A Remagin site manager takes actual site measurements of the existing structural frame and design panels to suit.
2 Designed Off Drawings: Remagin design panels from the construction drawings with a built-in allowance for site tolerance.

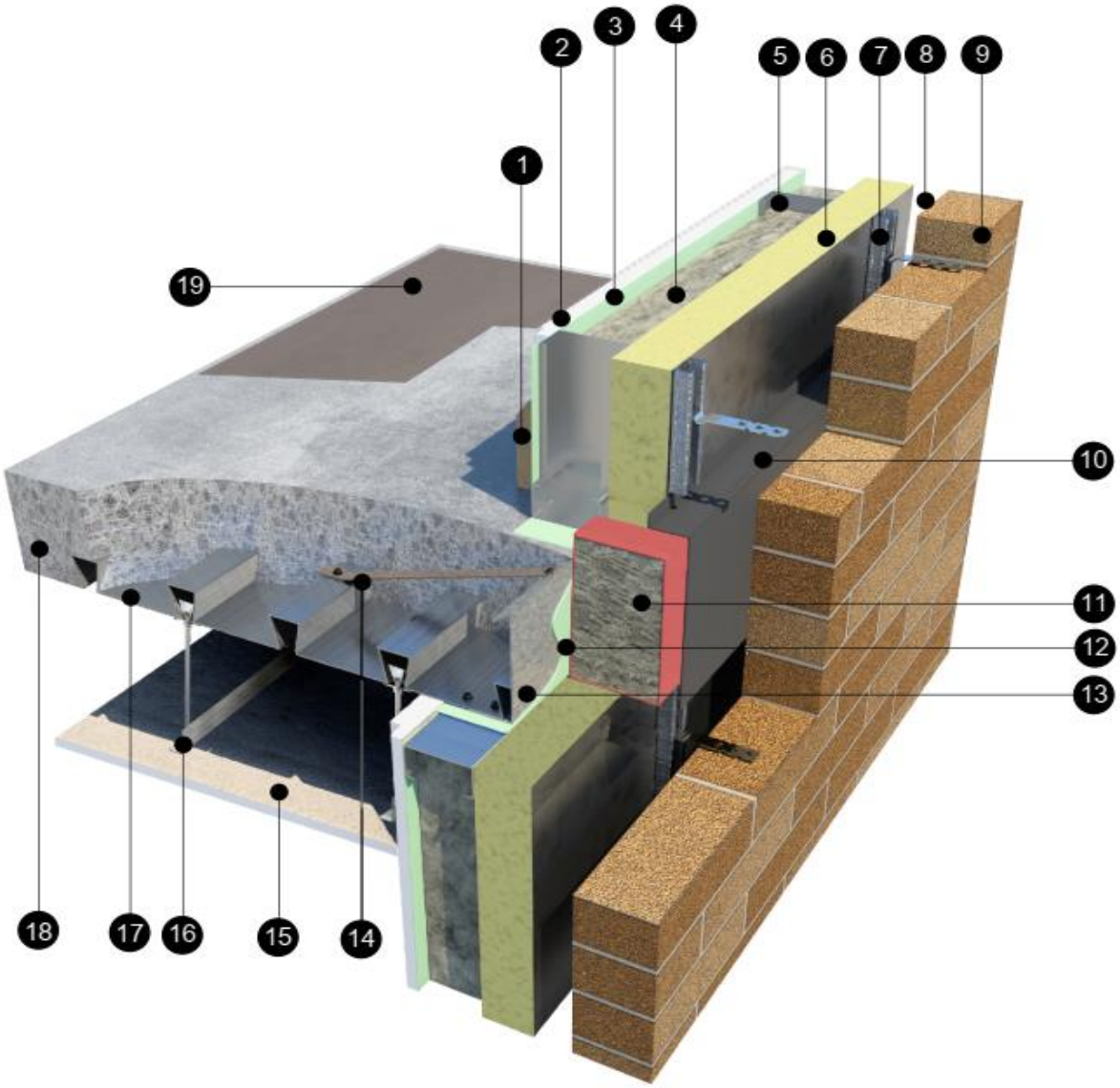
The Remagin infill panels are installed on a clean structural slab which has a level tolerance of ±5mm. Remagin approved installers install the panels.

For infill panels the bottom track of the Remagin infill panel is secured to the slab with suitable fixings at the specified locations identified on the Remagin drawings. For infill panels, brackets with a deflection allowance will allow the studs to face fix to the superstructure in question.



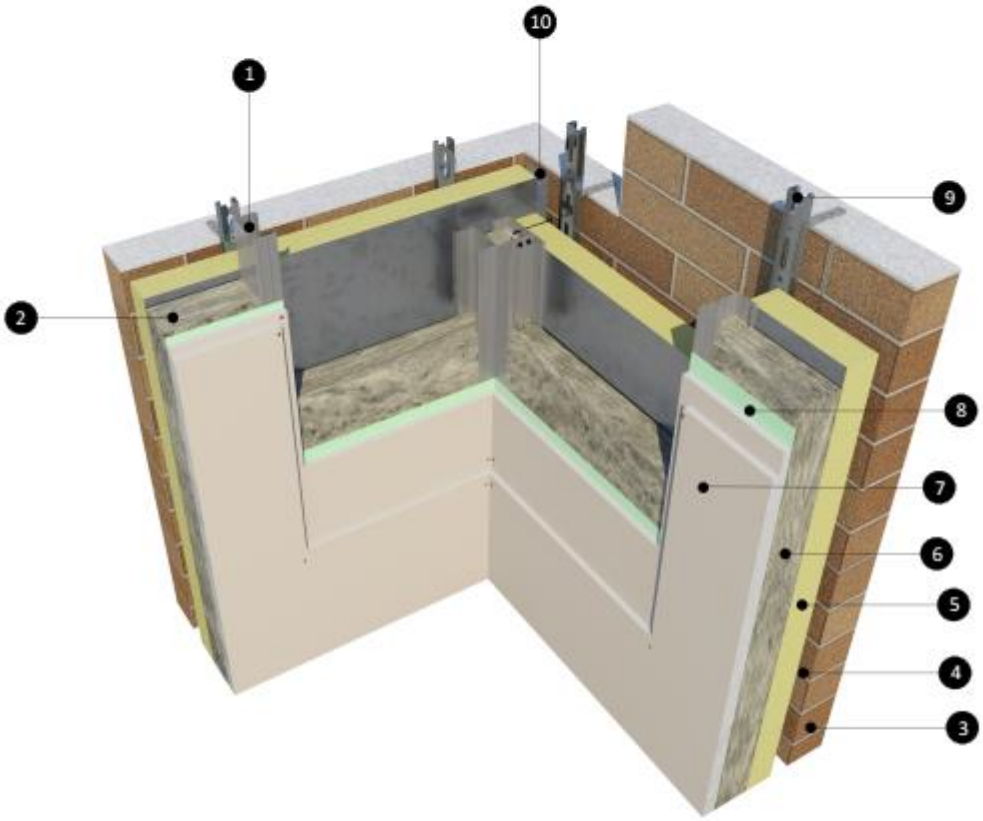
1. Roof slates to specification
2. Treated timber battens
3. Roofing felt to specification
4. Eaves Ventilator
5. Gutter to specification
6. Fascia to specification
7. Ventilated soffit to specification. Roof ventilation in accordance with Building Regulations - Part F
8. 102mm Brick outer leaf
9. Compression fitted cavity closer to specification fixed to timber battens
10. S.S Wall tie & channel fixed through insulation to LGS frame
11. 50mm cavity
12. PIR insulation to specification
13. 45kg/m3 Stone mineral wool (22kg/m3 through assessment) insulation to specification within LGS frame
14. Air and vapor control layer (AVCL) to specification
15. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
16. Treated timber batten
17. 89mm LGS Wall Frame
18. Treated timber wall plate
19. Plasterboard to specification
20. Air and vapor control layer (AVCL) to specification
21. Roof insulation to specification
22. Prefabricated roof truss

Figure 2: External Wall to Cold Roof Truss Detail



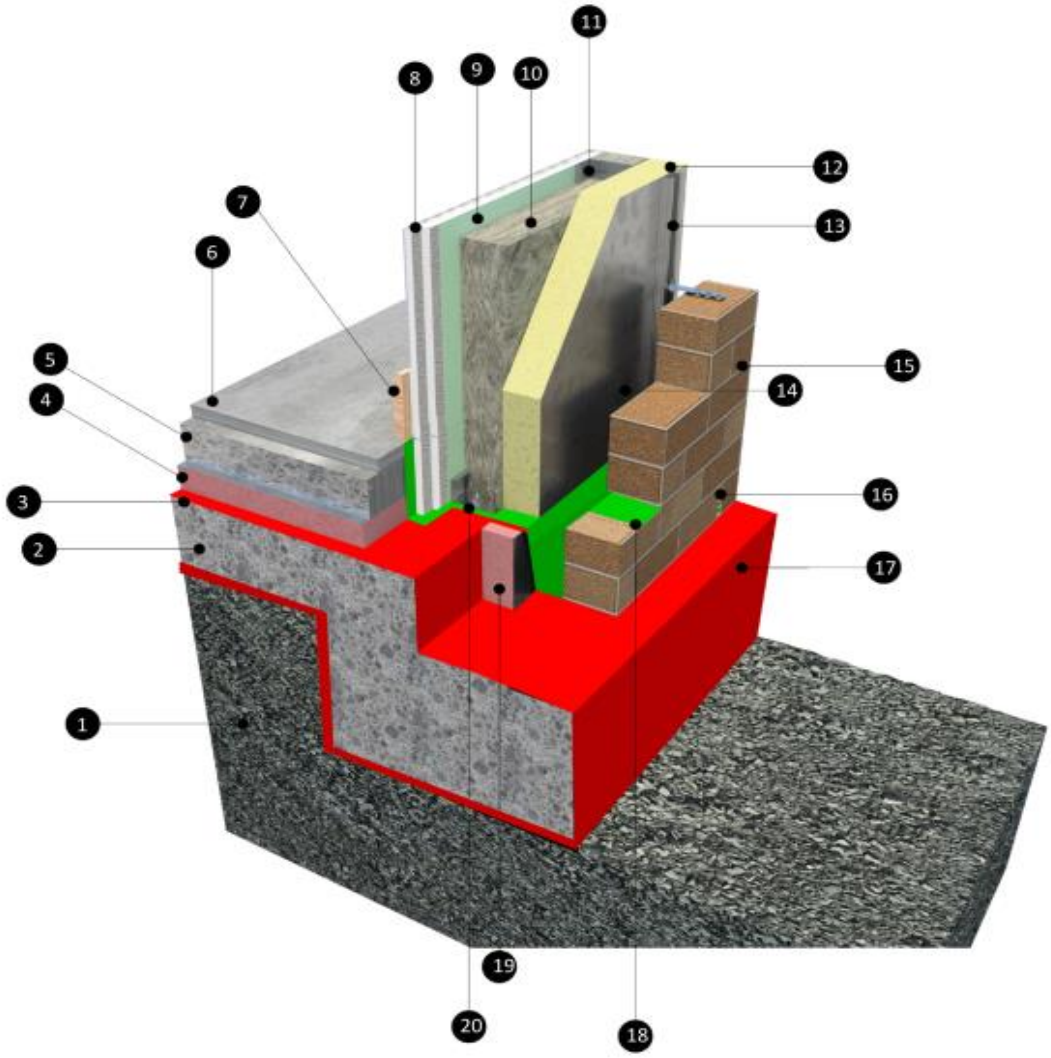
1. Skirting board
2. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
3. Air and vapor control layer (AVCL) to specification
4. 45kg/m3 Stone mineral wool (22kg/m3 through assessment) insulation to specification within LGS frame
5. 89mm LGS wall frame
6. PIR insulation to specification
7. S.S Wall tie & channel fixed through insulation to LGS frame
8. 50mm cavity
9. 102mm Brick outer leaf
10. DPC wrapped around cavity closer
11. Cavity barrier to specification compressed to masonry leaf
12. Airtightness/ VCL layer wrapped around deck edge & LGS walls
13. Composite deck edge trim
14. Tie bar
15. Plasterboard to specification
16. Ceiling Tie
17. Profiled metal floor deck to specification
18. Concrete to specification
19. Acoustic resilient layer to architects specifications and installed by others In accordance with TGD part E

Figure 3: Composite Deck Compartment Floor Detail



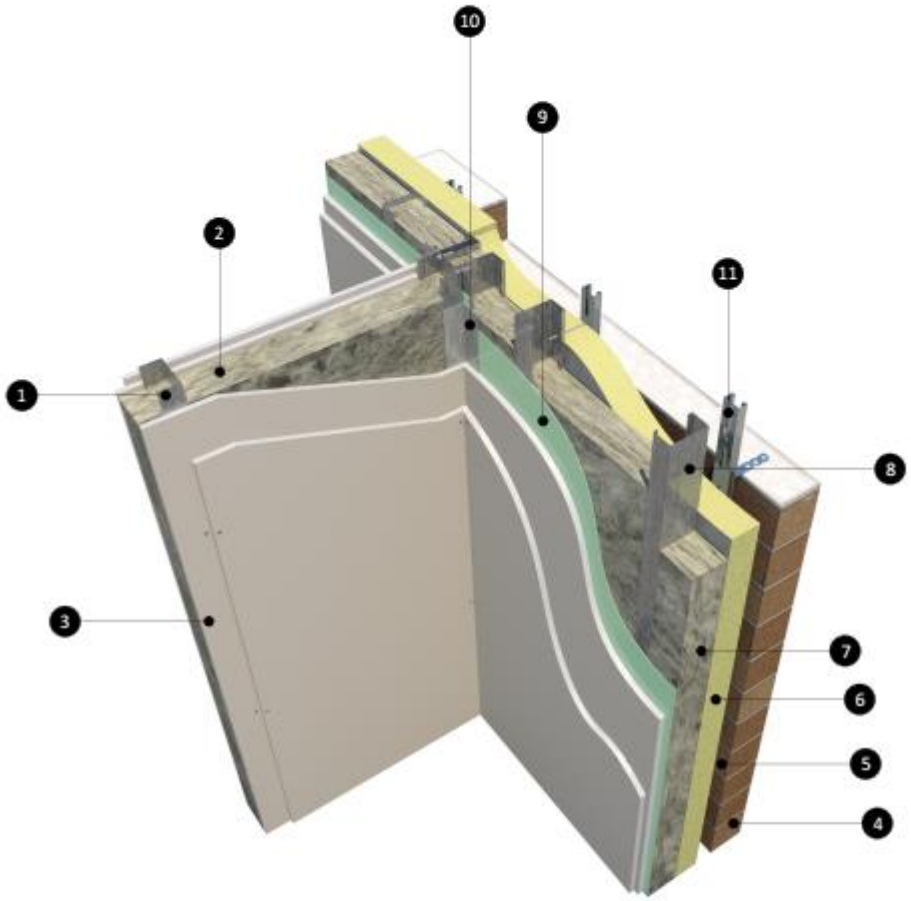
1. 89mm LGS external wall frame
2. Stone mineral wool (minimum 22kg/m^3) insulation to specification within Horizon frame
3. 102mm Brick outer leaf
4. 50mm cavity
5. PIR insulation to specification
6. 45kg/m3 Stone mineral wool (22kg/m3 through assessment) insulation to specification within LGS frame
7. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
8. Air and vapor control layer (AVCL) to specification
9. S.S Wall tie & channel fixed through insulation to LGS frame
10. 75mm Aluminium foil tape to specification at junction of insulation boards

Figure 4: External Corner Junction Detail



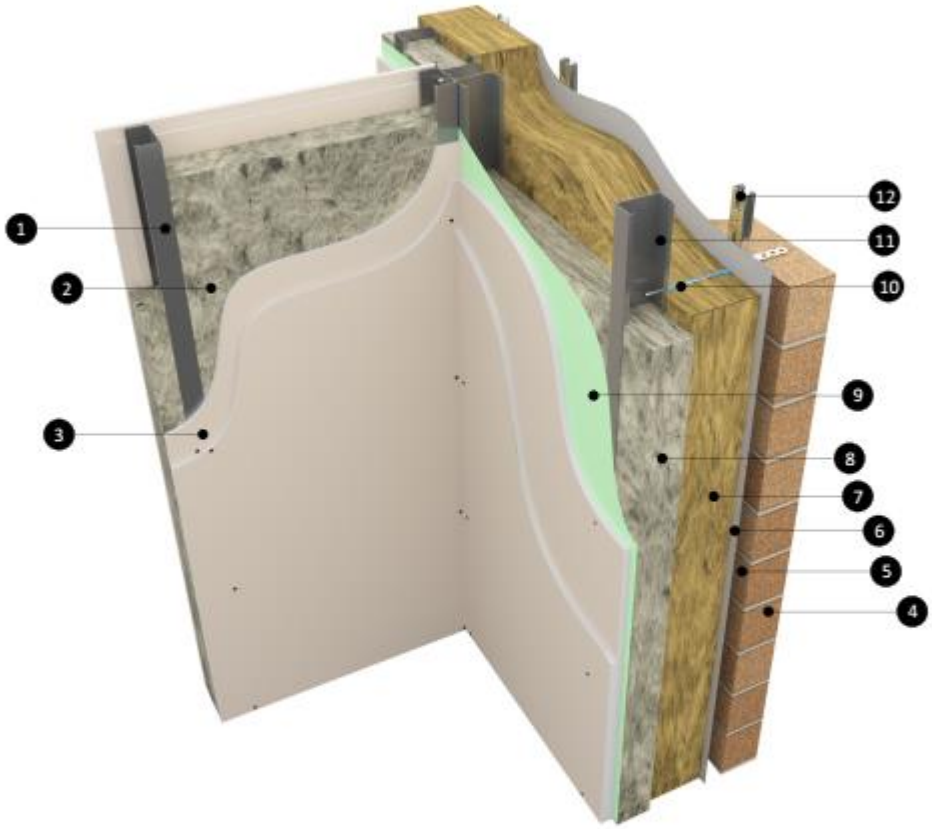
1. Drained backfill
2. RC Raft foundation laid on Radon/DPC membrane
3. DPM to lap with DPC under frame
4. Floor & perimeter insulation to specification
5. Concrete screed
6. Floor finish
7. Skirting board
8. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
9. Air and vapor control layer (AVCL) to specification
10. 45kg/m3 Stone mineral wool (22kg/m3 through assessment) insulation to specification within LGS frame
11. 89mm LGS wall frame
12. PIR insulation to specification
13. S.S Wall tie & channel fixed through insulation to LGS frame
14. 50mm cavity
15. 102mm Brick outer leaf
16. Weepholes @ 6000mm centres
17. 600mm DPC
18. DPC
19. 50mm XPS insulation to specification
20. Base track with fixing

Figure 5: Foundation Raft Detail



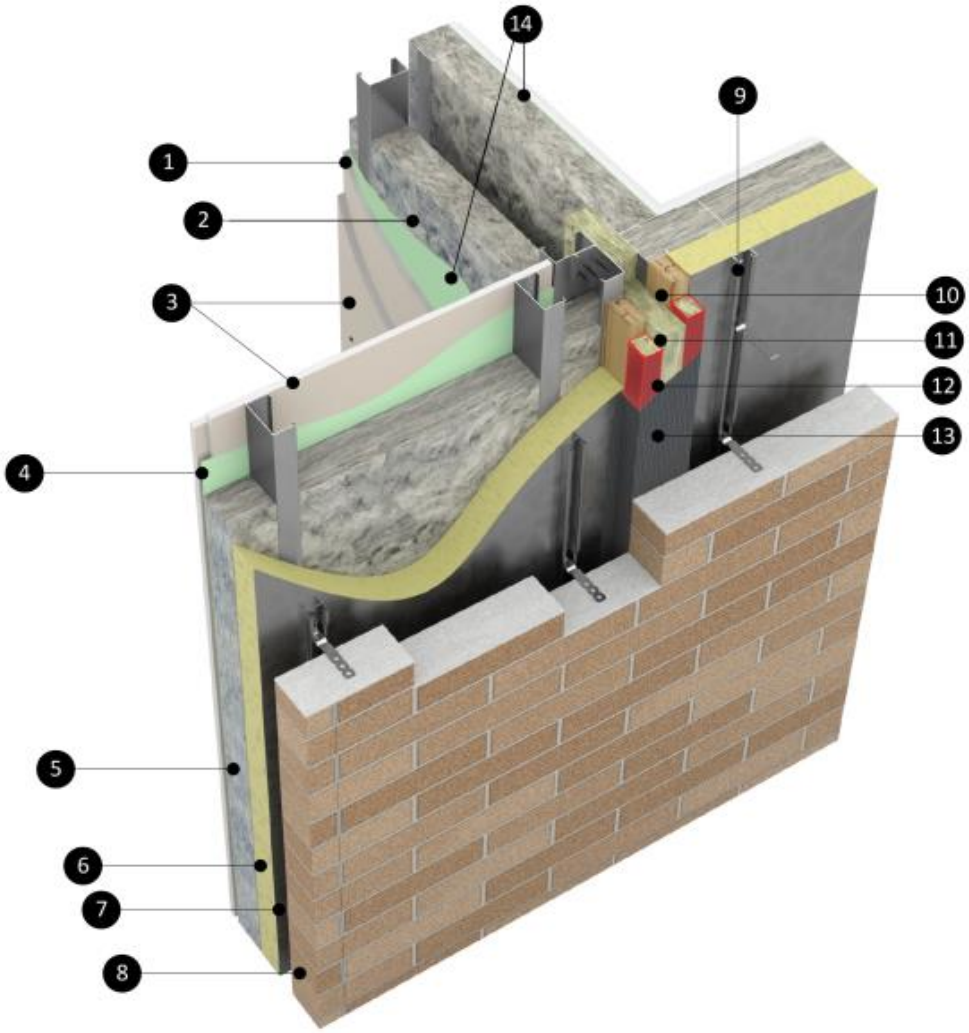
1. 89mm LGS Internal Loadbearing wall frame
2. Stone mineral wool (minimum 22kg/m^3) insulation to specification within Horizon frame
3. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
4. 102mm Brick outer leaf
5. 50mm cavity
6. PIR Insulation to specification
7. Stone mineral wool (minimum 22kg/m^3) insulation to specification within LGS frame
8. 89mm LGS External wall frame
9. Air and vapor control layer (AVCL) to specification
10. 50x50mm Mild Steel Plasterboard Support Angle
11. S.S Wall tie & channel fixed through insulation to LGS frame

Figure 6: Internal Load Bearing to External Wall PIR Detail



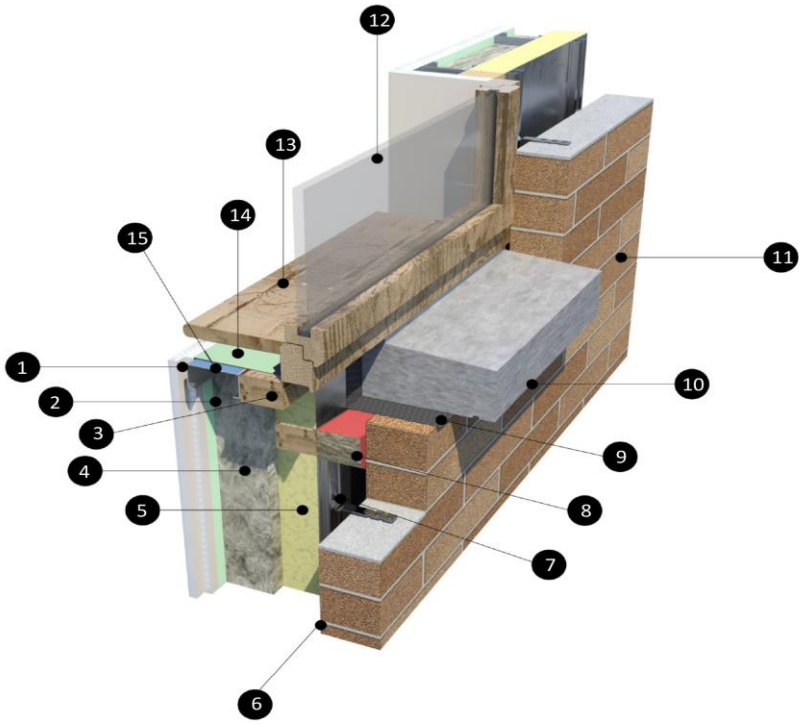
1. 89mm LGS Internal wall frame
2. 45kg/m^3 Stone mineral wool (22kg/m^3 through assessment) insulation to specification within LGS frame.
3. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
4. 102mm Brick outer leaf
5. 50mm cavity
6. Breather membrane to specification
7. Dual Density Stone mineral wool to specification
8. 45kg/m^3 Stone mineral wool (22kg/m^3 through assessment) insulation to specification within LGS frame
9. Air and vapor control layer (AVCL) to specification
10. Tech screw through insulation to LGS studs
11. 89mm LGS External wall frame
12. S.S Wall tie & channel fixed through insulation to LGS frame

Figure 7: Junction of Internal Wall to External Wall MW Detail



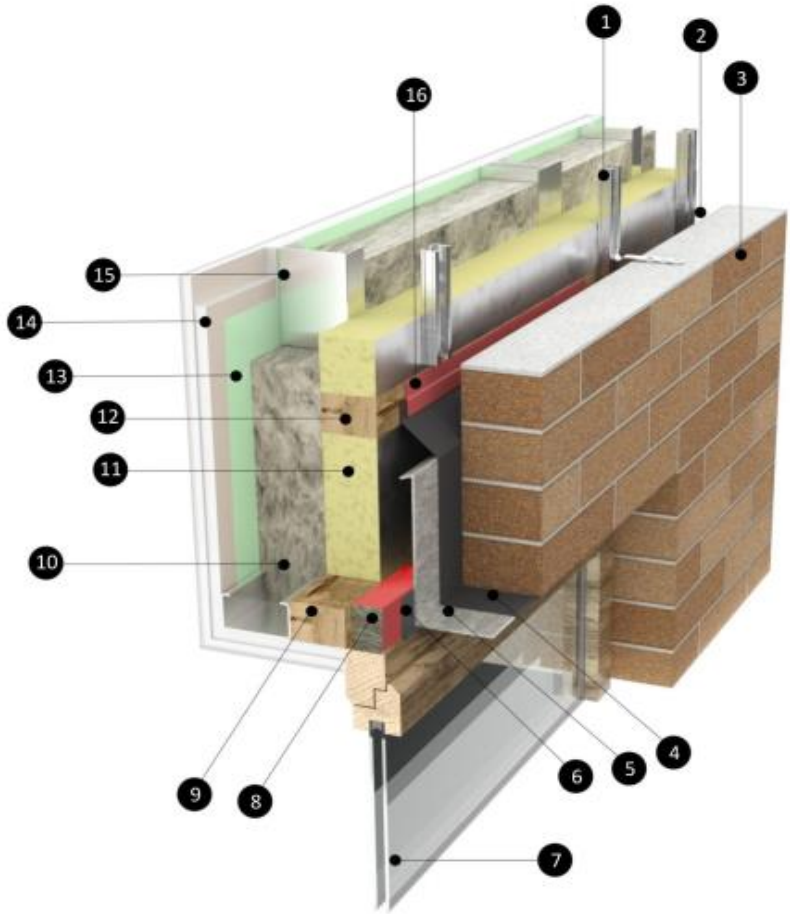
1. 89mm LGS internal wall frame
2. Stone mineral wool (22kg/m^3)
3. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
4. Air and vapor control layer (AVCL) to specification
5. 45kg/m3 Stone mineral wool (22kg/m3 through assessment) insulation to specification within Horizon frame
6. PIR insulation to specification
7. 50mm cavity
8. 102mm Brick outer leaf
9. S.S Wall tie & channel fixed through insulation to LGS frame
10. Treated timber battens
11. Mineral wool cavity closer fitted between studs (100kg/m3) minimum 500mm deep to reduce sound flanking
12. Proprietary vertical fire cavity barrier
13. DPC outside mineral wool
14. Air and vapor control layer (AVCL) to specification

Figure 8: Junction to Twin Leaf Separating Wall



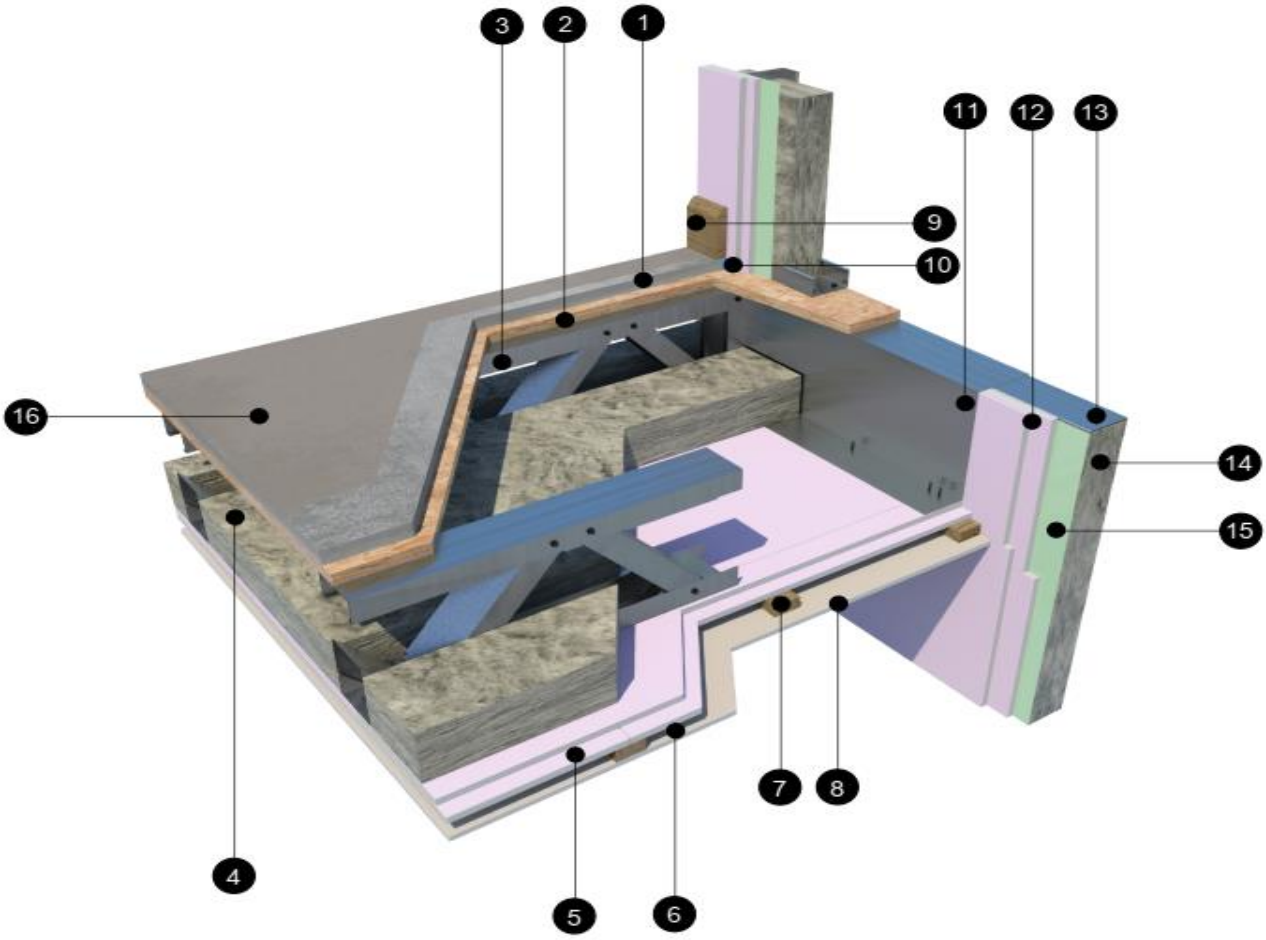
1. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
2. Air and vapor control layer (AVCL) to specification
3. Cavity closer to specification
4. 45kg/m^3 Stone mineral wool (22kg/m^3 through assessment) insulation to specification within LGS frame
5. PIR insulation to specification
6. 50mm cavity
7. S.S Wall tie & channel fixed through insulation to LGS frame
8. Proprietary cavity closer
9. DPC wrapped around window cill to meet underside of window frame
10. Pre-cast concrete cill
11. 102mm Brick outer leaf
12. Window/Door to specification including any plates or brackets required for fixing purposes
13. Window board to specification
14. AVCL layer returned and taped to window reveal/window frame
15. 89mm LGS frame

Figure 9: Window Sill Detail



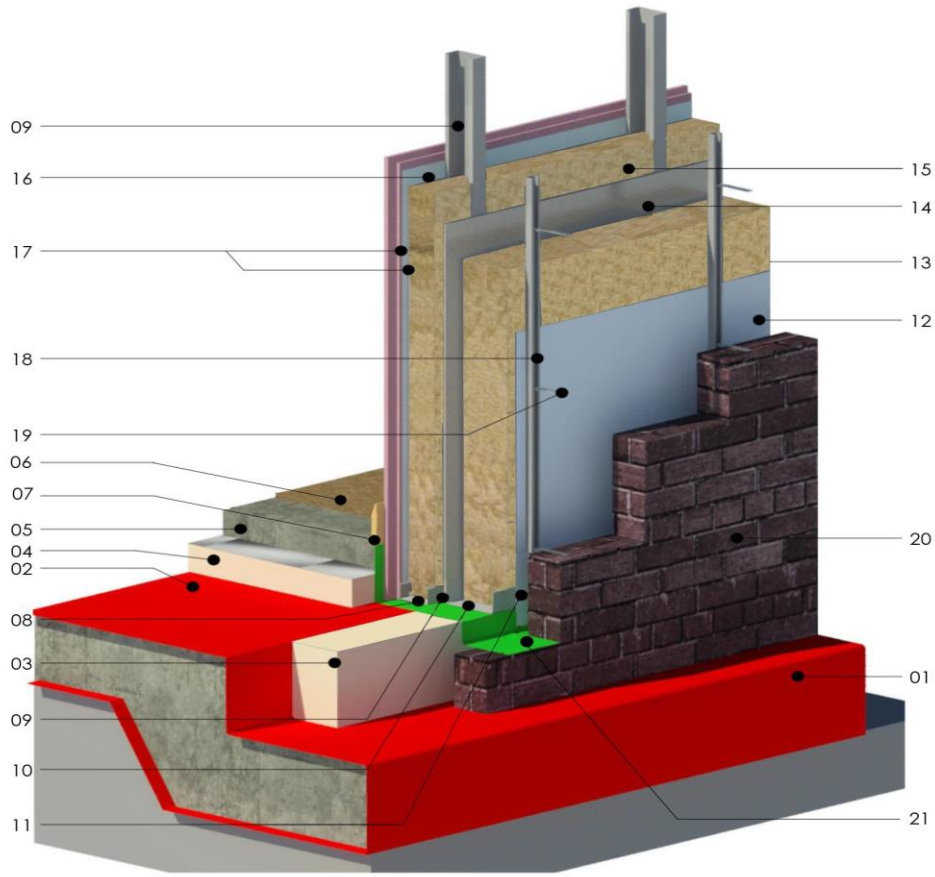
1. S.S Wall tie & channel fixed through insulation to LGS frame
2. 50mm cavity
3. 102mm Brick outer leaf
4. DPC
5. Galvanised steel lintel
6. DPC outside cavity closer
7. Window/ door to specification including any plates or brackets required for fixing purposes
8. Proprietary cavity barrier
9. Treated timber batten
10. 45kg/m3 Stone mineral wool (22kg/m3 through assessment) insulation to specification within LGS frame
11. PIR insulation to specification
12. Treated timber batten within LGS wall panel for DPC support
13. Air & vapour control layer (AVCL) to specification wrapped and taped to window reveal/window frame
14. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
15. 89mm LGS wall frame
16. DPC fixed to timber batten

Figure 10: Window Head Detail



1. 28mm Screedboard
2. 22mm OSB timber deck
3. 250mm deep LGS truss
4. 100mm stone mineral wool (22kg/m3) insulation to specification between trusses
5. 2No. Layers of 15mm type F plasterboard with joints staggered
6. Services cavity
7. 50x25mm timber battens or metal top hat spacers
8. 1No. Layer of 12.5mm type A plasterboard
9. Skirting board
10. Isolation strip
11. Z hanger supporting joist
12. Type F plasterboard linings to provide protection to steel frame, installed by others in accordance with 4.1 and Tables 4a and 4b of this Certificate
13. LGS top track
14. 45kg/m3 stone mineral wool (22kg/m3 through assessment) insulation to specification within LGS frame
15. Air and vapor control layer (AVCL) to specification
16. Acoustic resilient layer to architects specifications and installed by others In accordance with TGD part E

Figure 11: 60-minute Floor Detail – For use only where the height of the top storey is less than 10m



1. RC Foundation
2. DPM / to lap with DPC Layer under frame
3. 50mm XPS Insulation to specification
4. Floor Insulation to specification / Perimeter insulation to specification
5. Floor Screed
6. Floor Finishes to specification
7. Skirting board.
8. Mechanical anchor fixing bottom track to concrete
9. 89mm LGS Stud
10. LGS U-Section to Specification at top and bottom of panel frame.
11. 140mm minimum residual cavity between masonry outer leaf and water resistant membrane.
12. Class B fire rated membrane to face of panel.
13. Stone mineral wool insulation to specification.
14. Class A1 sheating board
15. Stone mineral wool (minimum 22kg/m3) insulation to specification within frame.
16. Air-tightness / vapour control layer
17. Plasterboard to specification
18. S.S Wall tie channel fixed through insulation to LGS frame
19. Cavity wall tie
20. 102mm Brick outer leaf
21. DPC

Figure 12: External Wall Detail

3.1 STRENGTH AND STABILITY

3.1.1 Certificate of Structural Compliance

The Remagin Steel Frame Building System is intended for use where the Client's Design Team/Architect's drawings are available and satisfy the Building Regulations. The Architectural and Engineering design team of the Client are responsible for the architectural drawings and overall building design to comply with the Building Regulations. Remagin using an experienced Chartered Structural Engineer, are responsible for the structural design of the Remagin Steel Frame Building System.

Building Control (Amendment) Regulations (S.I. 9) of 2014 (BCAR) came into action from 1st March 2014. The Remagin system certification will typically be supplied as a sub-contractor role under BCAR projects which will require Remagin to furnish the relevant ancillary certification per project. The appointed person within Remagin will liaise with the Assigned Certifier (AC)/Employers Representative (ER) and the Design Certifier where applicable, furnishing the relevant Commencement Notice data, within the timeframe requested, along with an inspection notification framework summary and completion ancillary certificate as and when required.

It is imperative that all design team members are clear in relation to what elements of the project Remagin are responsible for and what the ancillary certificate relates to.

Buildings constructed using the Remagin Steel Frame Building System shall be certified by a competent, Chartered Engineer as being in accordance with Part A of the Building Regulations.

3.1.2 Superstructure Design

The Remagin Building System can be designed to comply with the requirements of Part A of the Building Regulations regarding the design to avoid disproportionate collapse.

The structural assessment of the Remagin Building System shall be site and project specific and a Structural Design Engineer suitably experienced in this type of structure shall undertake the structural engineering of every building element designed by Remagin. In accordance with I.S. EN 1990[16], a DSL2 (Design Supervision Level) should be employed to check the design is in line with good practice.
This structural design certificate should cover the adequacy of all the cold formed and hot rolled elements within the structure in question which Remagin supply. It should also address the dimensions and thickness of each element and member making up the steel frame superstructure and assess the suitability of the interface between the superstructure and the external cladding (brick, block or NSAI Agrément approved external cladding for steel frame). The structural certificate of compliance must also confirm that there is sufficient uplift resistance and that there is adequate racking and load bearing capacity to either side of any opening to ensure the stability of the wall. Dwellings designed and constructed in accordance with this Certificate will have adequate strength and stability as per the building codes and standards.

3.1.3 Substructure Design

The design of the building's substructure is outside the scope of this certificate. The design of the substructure is to be the responsibility of the Client's Engineer. The Engineer will need to be a suitably qualified Chartered Structural Engineer and the design will need to be in accordance with the relevant codes and standards, i.e. Foundation's must be designed in accordance with I.S. EN 1997-1[17]. Remagin's Engineer will be responsible for undertaking a load take down for the structure and providing this information to the Client's Engineer for use in the design of the substructure. The Remagins' Engineer will also need to provide the Client's Engineer with the permissible deflection of the ground floor slab under the Remagin's Steel Frame line loads and podium slab level loading.

3.1.4 Design Loads

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

- I.S. EN 1993-1-1[7] and timber roof trusses to I.S. EN 1995-1-1[18];
- I.S. EN 1991-1-1[19];
- I.S. EN 1991-1-4[20];
- I.S. EN 1991-1-3[21].

Design wind and snow loads should be based on Diagrams 1 and 14 of TGD to Part A of the Building Regulations.
Non-load bearing partitions and walls are designed in conformance with the criteria set out in BS 5234-1[22] and I.S. EN 10143[23]. Greater loads can be accommodated by request.

3.1.5 Steel Concrete Composite Deck Design

Remagin Structural Engineer is responsible for the structural design of all steel composite concrete decks. Remagin provide a propping layout and propping removal procedure, and the design of the propping is the responsibility of the Temporary Works Designer. The Propping installation and removal procedure will be outlined in the Remagin "Temporary Propping for Concrete slabs" drawings which are issued to site along with the profiled metal decking layout drawings and refer to the Certificate holder's manual [30]. A safe system of work for the propping of the slab must be agreed between the Clients Engineer and Remagin's structural engineer and needs to be strictly adhered to on site.

The profiled steel deck and all accessories such as slab edge trim, restraint strap and closures etc. are installed by Remagin trained erectors. All propping and reinforcement is to be done to Remagin propping and deck reinforcement plans. The execution of the propping and reinforcement plan is the responsibility of the main contractor or Remagin installers if included in their scope of works.

The Remagin Structural Engineer and Remagin Site Manager inspect the installation of all decks prior to pouring of concrete to ensure the supporting structure, including temporary props, all reinforcement, screw fixings, shutters and straps are installed correctly. The metal deck is designed to bear on to the top of the head track and must have a minimum end bearing suitable to the profile being used before it is fixed. Steel reinforcement bars and mesh should be placed into position using plastic spacers, wheels and tying as required.

The concrete mix must be specified in accordance with project specific design to I.S. EN 1992-1-1[24] and should be supplied and manufactured in accordance with I.S. EN 206[25]. The concrete must be supplied and laid in accordance with I.S. EN 1992-1-1[24]. 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 Remagin 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 Remagin Structural Engineer to remove props.

3.1.6 Wind Load

Buildings designed in accordance with the System Design Manual[42] will have adequate resistance to wind load in areas as outlined in Figure 1 (a) Map of wind speeds (v) in m/s of TGD to Part A of the Building Regulations. For very exposed sites on hills above the general level of the surrounding terrain, the system can be specifically designed to meet the requirements as defined in I.S. EN 1991-1-4[20]. The system can be designed to be used in all locations in Ireland.

3.2 FIRE

Any dampers, ductwork, and sealing of gaps formed by services that pass through the compartment walls and floors will involve suitably tested systems which have included appropriate fire resistance testing for the required time duration. Details around penetrations and openings such as doors and windows shall avoid any excessive heat ingress into the wall cavities.

All materials such as cavity barriers and fire stops, used in the construction comply with I.S. EN 13501-1[26]. They shall be detailed as described in Section 2.5.6 (of this Certificate) and as specified in the Remagin fire stopping details in line with the supporting documents to the Building Regulations.

Any compartment or separating wall providing fire compartmentation shall be carried up through any roof space and brought up to the underside of the roof cladding to provide adequate fire stopping. Services are permitted within all internal and external loadbearing and non-loadbearing walls of the Remagin Steel Frame Building System provided the wall is not a separating wall, and openings are fire stopped to achieve fire performances in accordance with TGD's B to Part B.

All fire testing on the Remagin walls has been carried out with services penetrations in the wall to accurately test the system.

3.2.1 Fire Resistance of Compartment Walls

Table 4(a/b) list the resistance tests for non and load bearing elements, in accordance with I.S. EN 1364-1[27], I.S. EN 1365-1[28], and I.S. EN 1365-2[29].

All fire testing has been carried out with service penetrations in the walls. Any compartment wall providing fire compartmentation shall be carried up through any roof space and brought up to the underside of the roof cladding to provide adequate fire stopping.

3.2.2 Fire Resistance of Compartment Floors

The fire resistance performances of elements of non-loadbearing and loadbearing structure are given in Table 4(a/b) as a combination of I.S. EN 1364-1[27], I.S. EN 1365-1[28] and I.S. EN 1365-2[29]. Table 4(a/b) contains fire resistance tests and assessments to 30, 60 and 90 minutes.

3.3 IMPACT RESISTANCE

The interaction of components is such that, if subjected to exceptional impacts causing local failure, the overall stability of the structure will not be dangerously impaired.

4.1 BEHAVIOUR IN RELATION TO FIRE

4.1.1 Fire Resistance

Fire tests and assessment of test results show that buildings constructed using the Remagin Steel Frame Building System can meet the Building Regulation requirements in relation to fire performance as shown in **Table 4**. The fire tests and/ or fire assessments have demonstrated the ability of the Remagin Steel Frame Building System to withstand severe fire exposure for the period required for compliance with the Building Regulations in terms of fire performance. Tests have been conducted by Remagin to meet fire test requirements I.S. EN 1365-1[28] and I.S. EN 1365-2[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 15725:2010[28], and/or UK Fire Study Group Resolution No. 82 – 2001[28], and/or PFFP Guide to Undertaking Assessments in Lieu of Fire Test[28]. Fire tests reports and fire assessments reports are available from the Certificate holder upon request.

The Remagin Steel Frame Building System must be designed with the required boarding specification to meet the minimum requirements of Table A1 of TGD B 2017 Volume II of the Building Regulations for purpose groups 1(a), 1(b) & 1(d), and to meet the minimum requirements of Table A1 and Table A2 of TGD B of the Building Regulations for all other purpose groups to which this Certificate applies, and any other building specific structural fire performance requirements. **Table 4** of this Certificate provides a table of fire resistance performances which provide a variety of boarding specifications and their associated fire resistance performance that will have its load bearing capacity, insulation and integrity maintained for the minimum required period in the event of fire.

There shall be two leaves in a steel frame separating wall with a recommended minimum 50mm clear cavity distance between the two leaves maintained throughout the cavity. Services shall not be placed in the cavity or penetrate the wall linings of separating walls. Where services are required, an additional service cavity shall be provided so that the integrity of the fire lining is maintained.

The system can be designed to accommodate sub-divided fire resisting construction in accordance with a Fire Safety Certificate where it is necessary to inhibit the spread of fire within the building.

The building details of the system incorporate suitable cavity barriers and fire stops, in accordance with I.S. EN 13501-1[26], to satisfy the requirements of Section 3.3 to Part B and Section 3.6 of TGD B Volume II to the Building Regulations.

The fire resisting elements of the construction that are specified in **Table 4** of this Certificate provide for 30, 60 and 90 minutes fire resistance, for a range of specifications.

4.1.2 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[8] and must be installed in accordance with the specification given in **Table 4**. If alternative boarding is proposed, then an independent fire test report or assessment from an Accredited Laboratory needs to be provided and assessed by a competent Fire Engineer.

4.1.3 Surface Spread of Flame

An external cladding of brick/block has a designated Class 0 surface spread of flame as shown in Table 3. For a more comprehensive list of material and product fire performance ratings, reference should be made to Table A6 of TGD to Part B of the Building Regulations and to Table A5 of TGD to Part B Volume 2 of the Building Regulations.

Material	Fire Rating (National Class)	Fire Rating (European Class)
Brickwork/ Blockwork	Class 0	Class B-s3, d2
Timber Boarding	Class 3	Class D-s2, d2
Internal Plasterboard before decoration	Class 0	Class B-s3, d2
Slates/Tiles	AA	Class BRoof(t4)

Table 3: Surface Spread of Flame Characteristics

4.1.4 Protection of Building

Combustible material e.g. insulation, should be separated from the flue of a masonry chimney by at least 200mm, or at least 40mm from the outer surface of the chimney. Details are given in Section 2 and diagrams 3 – 7 of TGD to Part J of the Building Regulations. The separation from a heating appliance to combustible wall insulation material should be as per Clause 2.5.6 and Diagram 6 of TGD to Part J of the Building Regulations.

Combustible material in proximity to a constructional hearth must be protected by 250mm of solid concrete or as detailed in Diagram 8 of TGD to Part J of the Building Regulations.

4.1.5 Roof Designation

All tiles or slates used in the roof in conjunction with the system are designated AA in accordance with TGD to Part B of the Building Regulations (see Table A5 of TGD Part B and Table A4 of TGD to Part B Volume 2 for notional designations of roof coverings). Other NSAI Agrément approved roof coverings may also be used with the system under the guidance of a Remagin Engineer.

4.1.6 Cavity Barriers

The Remagin system can incorporate both horizontal and vertical cavity barriers and fire stops to comply with the fire strategy drawings supplied by the Client's Fire Consultant. The Main Contractor is responsible for ensuring all fire stopping/cavity closers are installed in accordance with Remagin construction drawings. The Main Contractor's Site Manager shall inspect and record all cavity closers/fire stopping at each floor level on the fire stopping record supplied by Remagin, which are kept on site for inspection. The Remagin Site Manager 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 Remagin will issue the certificate for the building.

4.2 THERMAL INSULATION

The panels are designed as hybrid warm frame system where the LGS sections are located on the warm frame side of the insulation. Some building elements, namely the roof, 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 Remagin system can be provided for a wide range of required elemental U-values.

TGDs Part L of the Building Regulations directs users to Digest 465 "U-values for light steel construction" published by BRE. A more precise result is obtained by using a numerical method which conforms to I.S. EN ISO 10211[3].

Tables 5 to 8 of this certificate, gives a range of elemental U-values for the Remagin external wall with brick or block outer leaf and a 50mm ventilated cavity. In addition, sample U-value calculations for ground floor slab for a range of perimeter to area (P/A) ratios are also provided. With the appropriate amount of insulation outside of the steel frame, the system meets and exceeds the maximum back-stop elemental U-value requirements of Table 1 of TGD's Part L of the Building Regulations.

4.2.1 Limiting Thermal Bridging

The linear thermal transmittance ψ-value (Psi-value) describes the heat loss associated with junctions and around openings. The Certificate holder has carried out ψ-value calculations for a range of thermally bridged junctions.

Table 9 of this certificate gives ψ-value for a range of Remagin Steel Framed Building System junctions and their corresponding flanking elemental U-value. When flanking elemental U-values deviate by an aggregated 20% from the target U-values, the ψ-values no longer remain valid and guidance must be sought from the Certificate holder. 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 manual.

U-values and ψ-values are to be calculated by an NSAI approved thermal modeller – a register of these can be found at https://www.nsai.ie/certification/agrement-certification/thermal-modellers-scheme/.

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, with 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 are outside the scope of this certificate should be assessed in accordance with the BRE IP 1/06[2] and BRE Report BR 497 in accordance with appendix D of TGD's to Part L of the Building Regulations.

4.2.2 Internal Surface condensation

As part of the assessment carried out to determine the ψ-values, internal surface temperatures factors (f_{Rsi}) are also checked. When internal surface temperatures are greater than 15°C, best practice will have been adopted to safeguard against the risk of surface condensation occuring under normal occupancy and humidity class levels.

The Remagin Steel Frame Building System has been assessed and when detailed in accordance with this certificate, these thermally bridged junctions comply with the requirements of Section D.2 of appendix D of TGD's to Part L of the Building Regulations.

4.3 VENTILATION

4.3.1 Un-designed Air Infiltration

Air permeability can be measured by means of a pressure test and this is now a mandatory requirement under TGD to Part L of the Building Regulations to show compliance with the backstop air permeability index of 3-5 $m^3/(hr.m^2)$ at a pressure differential of 50Pa across the building envelope.

When inputting values into DEAP, the measured air permeability index at a pressure differential of 50Pa across the building envelope is divided by 20 to determine an air permeability value which is more representative of the actual pressure differential across the building envelope under normal conditions.

The procedure for testing is specified in I.S. EN ISO 9972[0].

To achieve the airtightness performance an AVCL is installed and this must be ~~done~~ at design stage to maximize performance as part of airtightness strategy and reduce penetrations of the airtightness line for the building. To avoid excessive heat losses due to un-designed air infiltration, it is necessary to install peripheral seals around windows, doors, services, floors, roof and all building junctions which penetrate the envelope of the building component relied upon to perform the air sealing function of the building.

4.3.2 Designed Ventilation

TGD to Part F of the Building Regulations prescribes ventilation requirements to meet needs of occupants within the building. This can be achieved by limiting moisture content of the air within the building so that it does not contribute to condensation and mould growth and to limit the concentration of harmful pollutants in the air within the dwelling.

In addition to ventilation requirements within the dwelling living space, TGD to Part F makes provisions for ventilation requirements in building other than dwellings, roofs and roof voids above the insulation line. These provisions will allow for the removal of moisture laden air or condensation which may enter the roof structure from the dwelling either through diffusion or exfiltration.

When continuous mechanical ventilation systems are being considered, low air permeability values will be required for the energy efficient operation of the mechanical systems.

4.4 INTERSTITIAL CONDENSATION

4.4.1 Condensation in Walls

Calculations to BS 5250[1] have been carried out for all possible wall build ups as covered by this certificate and predict no interstitial condensation within the external wall and pass the risk criteria in I.S. EN ISO 13788[32].

It is recommended to provide an AVCL behind the plasterboard to protect against interstitial condensation. This can be either in the form of a foil backed plasterboard or a continuous AVCL membrane with joints sealed.-

4.4.2 Condensation in Roof

In both cold (insulation at ceiling level) and warm (insulation along the slope) roofs, it is recommended that an AVCL is provided on the warm side of the insulation to limit the migration of moisture laden air from the dwelling, entering the roof structure through diffusion. The AVCL can double as the airtight barrier.

Roof ventilation should be carried out in accordance with TGD Part F of the Building Regulations and the recommendations of BS 5250[1].

Table 4a: Fire Data Conducted for Loadbearing Wall and Floor Elements

Type	Element	Test Standard	Results	Purpose Class
External Load Bearing Walls				
1	• Assessment conducted on 3000mm high x 3000m wide x 172mm thick panel with total vertical load of 60kN • Fire Assessment of 1No. layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using 25mm long drywall screws at 300mm centres within the field of the boards and nominally 200mm centres along the board joints. • 6 No. LGS C-Studs (89x45x1.2mm) with noggins at mid height • 100mm stone mineral wool (45kg/m^3 density or 22kg/m3 through assessment) fitted between studs • 75mm Kingspan Thermawall TW55 fixed to the non-fire side face • 2 No. Double Sockets were fitted on the fire side	I.S. EN 1365-1[28]	30 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
2	• Test conducted on 3000mm high x 3000mm wide panel with a total imposed load of 60kN • First (inner) layer 12.5mm Gyproc Fireline (Type F plasterboard) fixed to the fire side face using drywall screws 3.5x35mm at max 300mm centres within the field of the boards and max 200mm centres along the board joints • Second (outer) layer 12.5mm Gyproc Fireline (Type F plasterboard) fixed to the fire side face using drywall screws 3.5x55mm at max 300mm centres within the field of the boards and max 200mm centres along the board joints • 6 No. LGS C-Studs (89x45x1.2mm) at 600mm centres and noggins at mid height • 100mm Rockwool RWA45 (45kg/m^3 density or 22kg/m3 through assessment) fitted between studs • 75mm Kingspan Thermawall TW55 fixed to the non-fire side • 2 No. Double Sockets were fitted on the fire side	I.S. EN 1365-1[28]	60 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
3	• Test conducted on 3000mm high x 3000mm wide x 267.5mm deep panel with total imposed load of 90kN • First (inner) layer 12.5mm Gyproc Fireline (Type F plasterboard) fixed to the fire side face using drywall screws 3.5x25mm at 300mm nominal centres around the perimeter edges of the boards and at 300mm nominal centres in the field of the boards • Second (middle) layer 12.5mm Gyproc Fireline (Type F plasterboard) fixed to the fire side face using drywall screws 3.5x35mm at 300mm nominal centres around the perimeter edges of the boards and at 300mm nominal centres in the field of the boards • Third (outer) layer 12.5mm Gyproc Fireline (Type F plasterboard) fixed to the fire side face using drywall screws 3.5x55mm at 300mm nominal centres around the perimeter edges of the boards and at 300mm nominal centres in the field of the boards • 6 No. LGS C-Studs (89x45x1.2mm) and 5 no. noggins at mid height • 100mm Rockwool Rollbatt (22kg/m^3 density) between studs	I.S. EN 1365-1[28]	90 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5

	• 65mm Rockwool Rainscreen Duo-Slab (60kg/m^3 density) fixed to the non-fire side, over which is fitted 75mm Rockwool Rainscreen Duo-Slab (60kg/m^3 density) • Tested build-up incorporated the Ancon 25-14 restraint system to tie the outer skin to the LGS frame • 2 No. Double Sockets were fitted on the fire side, nominally 550mm above the base of the wall			
4	• Test conducted on 3000mm high x 3000mm wide x 227mm deep panel with total imposed load of 96kN • 1 No. layer 12.5mm GTEC Weather Defence (SINIAT) board, Euroclass A1, fixed to timber battens using Aquapanel S40 fixings 4x4mm at 600mm centres along each stud • 100mm Xtroliner insulation board fitted between 100x44mm horizontal timber battens at 600mm centres • 6 No. LGS C-Studs (89x45x1.5mm) and 5 no. noggins at mid height • 100mm Rockwool FLEXI (32kg/m^3 density) between studs • First (inner) layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using drywall screws 3.5x35mm at 300mm nominal centres around the perimeter edges of the boards and at 300mm nominal centres in the field of the boards • Second (outer) layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using drywall screws 3.5x45mm at 300mm nominal centres around the perimeter edges of the boards and at 300mm nominal centres in the field of the boards • 2 No. Double Sockets were fitted on the internal side	I.S. EN 1363-2[28]	90 mins from outside to inside	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
Internal Load Bearing Walls				
5	• Test conducted on 3000mm high x 3000mm wide x 114mm deep panel with total imposed load of 72kN • 1No. layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using 25mm long drywall screws at 300mm centres within the field of the boards and nominally 200mm centres along the board joints • 6 No. LGS C-Studs (89x45x1.2mm) with noggins at mid height • 100mm stone mineral wool (22kg/m^3 density) fitted between studs • 1No. layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the non-fire side face as per the fire side face • 2 No. Double Sockets were fitted on the fire side	I.S. EN 1365-1[28]	30 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
6	• Assessment of a Test conducted on 3000mm high x 3000mm wide x 139mm deep panel with total imposed load of 84kN • First (inner) layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using drywall screws (S-DD01B 2007770) 3.5x35mm at max 300mm centres within the field of the boards and max 200mm centres along the board joints • Second (outer) layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using drywall screws (S-DD01B 2007770) 3.5x55mm at max 300mm centres within the field of the boards and max 200mm centres along the board joints	I.S. EN 1365-1[28]	60 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5

	• 6 No. LGS C-Studs (89x45x1.2mm) at 600mm centres and noggins at mid height • 100mm Rockwool RWA45 (45kg/m^3 density or 22kg/m3 through assessment) fitted between studs • Configuration mirrored on non-fireside with 2 No. layers of 12.5mm Knauf Fire Panel (Type F plasterboard) fixed as per the fire side face • 2 No. Double Sockets were fitted on the fire side			
7	• Assessment of a Test on a Panel layout and test load per **6** above • First (inner) layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using drywall screws 3.5x25mm at 300mm nominal centres around the perimeter edges of the boards and at 300mm nominal centres in the field of the boards • Second (middle) layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using drywalls screws 3.5x35mm at 300mm nominal centres around the perimeter edges of the boards and at 300mm nominal centres in the field of the boards • Third (outer) layer 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the fire side face using drywalls screws 3.5x55mm at 300mm nominal centres around the perimeter edges of the boards and at 300mm nominal centres in the field of the boards. First and Second layer of Type F based upon a fire test. Third layer of Type F plasterboard based upon a fire assessment. • 6 No. LGS C-Studs (89x45x1.2mm) and 5 no. noggins at mid height • 100mm Rockwool Rollbatt (22kg/m^3 density) between studs • 3 No. layers of 12.5mm Knauf Fire Panel (Type F plasterboard) fixed to the non-fire side face as per the fire side face • 2 No. Double Sockets were fitted on the fire side, nominally 550mm above the base of the wall	I.S. EN 1365-1[28]	90 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
Intermediate Floor Truss				
8	• Test conducted on 4300mm long x 3000mm wide x 300.5mm thick floor with a uniformly distributed load of 1.65kN/m^2 • 1No. layer of 12.5mm Gyproc Fireline Type F plasterboard fixed on fire side face using drywall screws 3.5x35mm at 300mm max centres • 16mm RB1 Resilient bar fixed at 400mm centres • 100mm Rockwool Rollbatt (22kg/m^3 density) between the trusses • 7 no. LGS floor C-Joists 250mm deep at 600mm nominal centres • Floor covering 22mm OSB decking	I.S. EN 1365-2[29]	30 mins from below ceiling level	1(a), 1(b), 1(c), 1(d), 2(b), 3, 4(a) and 5
Compartment floors: Loaded Floors Truss (For use only where the height of the top storey is less than 10m)				
9*	**Floor supporting a Uniformly Distributed Load of 1.5kN/m^2** • Test conducted on 4300mm long x 3000mm wide x 339.5mm thick floor with a uniformly distributed load of 1.5kN/m^2 • 1No. layer of 12.5mm Gyproc Standard Type A plasterboard fixed on fire side face using drywalls screws 3.5x35mm at 300mm max centres • 50mm x 25mm timber battens to form service cavity	I.S. EN 1365-2[29]	60 mins from below ceiling level	1(a), 1(b), 1(c), 1(d), 2(b), 3, 4(a) and 5

	• 2No. layers of 15mm Gyproc Fireline (Type F plasterboard) fixed using Hilti S-D001B 2011723 Collated Screws 3.5x55mm at 300mm max centres • 100mm Rockwool Rollbatt (22kg/m^3 density) between the trusses • 6 No. LGS floor trusses 250mm deep at 600mm nominal centres • Floor covering 22mm OSB decking			
Compartment floors: Loaded Floors Composite Metal Deck				
10	**Loaded Floor supporting Imposed Load of 2.0kN/m^2** 140mm normal weight concrete with 0.9mm Tata Comflor 51. Concrete reinforced with A393 Mesh with a minimum 30mm cover to the top of the reinforcing mesh – 4500mm span.	Eurocode Design	30 mins from below deck	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
11	**Loaded Floor supporting Imposed Load of 2.0kN/m^2** 160mm normal weight concrete with 1.2mm Tata Comflor 60. Concrete reinforced with A393 Mesh with a minimum 30mm cover to the top of the reinforcing mesh – 3420mm span.	Eurocode Design	60 mins from below deck	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
12	**Loaded Floor Supporting Imposed Load of 2.0kN/m^2** 175mm normal weight concrete with 1.2mm Tata Comflor 80. Concrete reinforced with A393 Mesh with a minimum 30mm cover to the top of the reinforcing – 4500mm span.	Eurocode Design	90 mins from below deck	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5

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.
- Type F plasterboard refers to the particular type of plasterboard tested in the respective fire tests and the details are available directly from Remagin Ltd.
- 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 Remagin Ltd.
- All wall tests were completed without the joints being taped and jointed.
- Joints are staggered on successive layers of plasterboard.
- For alternative approaches to fire safety requirements, refer to 0.2 of TGD B 2006 of the Building Regulations.
- Fire test reports and fire assessment reports are available from the Certificate holder upon request.

* Purpose Group 2(a) is removed from the construction in compliance with 3.2.5.1 of TGD B 2006 of the Building Regulations.

Table 4b: Fire Data for Separating Wall and Non-Load Bearing Wall Elements

Separating Walls*				
1	**Twin Frame Wall** • Panel configuration and test load per **6 Table 4a** • Two layers of 12.5mm Knauf Fire Panel (Type F plasterboard) fixed per **6 Table 4a** • LGS C-Studs (89x45x1.2mm) • 100mm stone mineral wool insulation (22kg/m^3 density) between the studs • 50mm cavity • LGS C-Studs (89x45x1.2mm) • 100mm stone mineral wool insulation (22kg/m^3 density) between the studs • Two layers of 12.5mm Knauf Fire Panel (Type F plasterboard) fixed per **6 Table 4a**	I.S. EN 1365-1[28]	60 mins from either side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
2	**Twin Frame Wall** • Panel dimensions and test load per **7 Table 4a** • LGS C-Studs (89x45x1.2mm) • Three layers of 12.5mm Knauf Fire Panel (Type F plasterboard) fixed per 7 **Table 4a** to the fire side face (exposed) • 100m m Rockwool Rollbatt (22kg/m^3 density) between studs • 50mm cavity • 100mm Rockwool Rollbatt (22kg/m^3 density) between studs • Three layers of 12.5mm Knauf Fire Panel (Type F plasterboard) fixed per **7 Table 4a** to the non-fire side face (unexposed) • 2 No. Double Sockets were fitted on the fire side	I.S. EN 1365-1[28]	90 mins from either side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
Non-Load Bearing Walls**				
3	• Panel dimensions and build-up per **5 Table 4a**	I.S. EN 1365-1[28]	30 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
4	• Panel dimensions and build-up per **6 Table 4a**	I.S. EN 1365-1[28]	60 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5
5	• Panel dimensions and build-up per **7 Table 4a**	I.S. EN 1365-1[28]	90 mins from exposed side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a) and 5

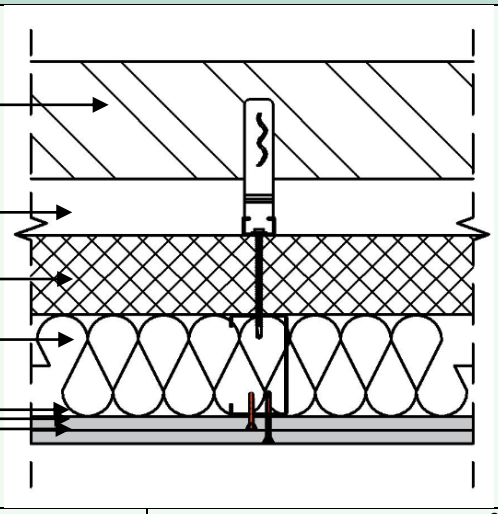
* These constructions are based on tested build-ups where the exposed fire side face remains the same as that tested but on the unexposed non-fire side face an identical construction is mirrored after a 50mm cavity. This means that the number of plasterboard panels remains the same on the fire side face, while the number of studs (and inter-stud insulation) is increased.

** Non-load bearing wall fire resistance data is provided from the load bearing data and can be utilised under the Field of Direct Application of test results to I.S. EN 1365-1[28] whereby the load can be decreased on the specimen.

*** Fire test reports and fire assessment reports are available from the Certificate holder upon request.

External walls U-value for variable PIR thickness

Wall build-up:
Layer 7: Brick/masonry cladding
Layer 6: 50mm low E cavity
Layer 5: Variable PIR layer [2][3] (see below)
Layer 4: LGS/MW insulation [1]
Layer 3: AVCL
Layer 2: 12.5mm Plasterboard
Layer 1: 12.5mm Plasterboard



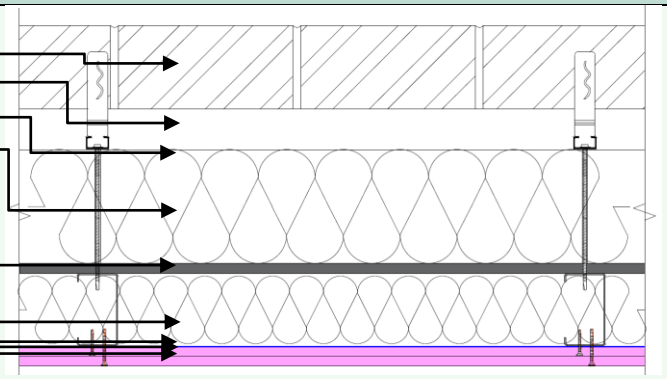
Wall thickness	PIR variable thickness:	Calculated U-value (W/m²K)
347mm	80mm	0.18
357mm	90mm	0.17
367mm	100mm	0.16
377mm	110mm	0.15
387mm	120mm	0.14
397mm	130mm	0.13

Calculation comply 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 5 (I.S. EN ISO 6946 Table D.1)
[3] Correction for mechanical fasteners have been applied to layer 5 equating to 6 No. (per sq.m) 5.5mm Ø Stainless steel fixing to connect brick tie channel to LGS section.

Table 5a: Typical External Wall U-values

External walls U-value for variable Mineral Wool (0.038 W/m.K) thickness

Wall build-up:
Layer 7: Brick/masonry cladding
Layer 6: 40mm unventilated cavity
Layer 7: Non-combustible BM
Layer 6: Mineral Wool (0.038 W/m.K) (2)(3)
Layer 5: Class A1 weather board
Layer 4: LGS/MW insulation (1)
Layer 3: AVCL
Layer 2: 12.5mm Plasterboard
Layer 1: 12.5mm Plasterboard



Wall thickness	Mineral Wool variable thickness:	Calculated U-value (W/m²K)
406mm	140mm	0.18
416mm	150mm	0.17
426mm	160mm	0.16
446mm	180mm	0.15
466mm	200mm	0.14
486mm	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 5b: Typical External Wall U-values

Sample U-value Calculation for 100mm PIR

Layer	Description	% Bridged	Thickness [mm]	Thermal conductivity **λ** [W/m K]	Thermal resistance **R** [W/m²K]
	Rsi				0.13
1	Firecheck Plasterboard		12.5	0.25	0.05
2	Firecheck Plasterboard		12.5	0.25	0.05
3	AVCL				
4	Steel Stud	0.002	89	50	0.00178
	Mineral Wool	0.998	89	0.044	2.023
5	Variable PIR Insulation		**100**	0.022	4.545
6	Cavity Low-e (0.9, 0.2)		50		0.44
7	Brickwork Outer Leaf		102.5	0.77	0.133
	Rse				0.04

From BRE Digest 465	Ru Total =	7.406
	RL Total =	6.007
	P = 0.733, $R_T = pR_{max} + (1 - p)R_{min}$ =	7.032467
	Correction term, ΔU =	0.015
	Corrected U-Value (2DP) =	**0.157** W/m²K

Table 6a: Sample U-value Calculation for 100mm PIR and Typical External Wall U-values

Sample U-value Calculation for 140mm Mineral Wool (0.038 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	Firecheck Plasterboard		12.5	0.25	0.05	
2	Firecheck Plasterboard		12.5	0.25	0.05	
3	AVCL					
4	Steel Stud	0.002	89	50	0.00178	
	Mineral Wool	0.998	89	0.044	2.023	
5	Class A1 weather board		9	0.23	0.039	
6	MW (0.038 W/m.K)		**140**	0.038	3.684	
7	Non-combustible BM					
8	Cavity (unventilated)		40		0.18	
9	Brickwork Outer Leaf		102.5	0.77	0.133	
	Rse				0.04	
				Ru Total =	6.323	
				RL Total =	4.925	
	From BRE Digest 465			P = 0.707, $R_T = pR_{max} + (1 - p)R_{min}$ =	5.913386	
				Correction term, ΔU =	0.009	
				Corrected U-Value (2DP) =	**0.178**	W/m²K

Table 6b: Sample U-value Calculation for 140mm Mineral Wool (0.038 W/m.K) and Typical External Wall U-Values

Effect on 0.157 W/m²K (100mm PIR) U-value for variations in LGS thickness and centres						
Centres of studs	**LGS Thickness (Gauge)**					
	0.8mm	1.0mm	1.2mm	1.5mm	2.0mm	2.5mm
300mm	0.164	0.165	0.166	0.167	0.169	0.169
400mm	0.16	0.161	0.162	0.162	0.164	0.164
600mm	0.155	0.156	0.157	0.158	0.159	0.159

Table 7: Effect on U-value for variations in LGS thickness and centres

Ground Floor slab U-value for varying P/A ratio											
P/A Ratio	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
U-value	0.0865	0.097	0.105	0.11	0.114	0.116	0.119	0.12	0.122	0.123	0.124
Floor U-values based on 150mm RC Slab on 150mm PIR insulation (λ=0.022) on soil (λ=2.0). P/A Ratio = Exposed perimeter of the floor to total ground-floor area ratio.											

Table 8: Typical Ground Floor U-values

Target linear thermal transmittance (ψ) for different types of junctions.					
ACD Ref:	**Junction Description**	**Temperature Factor f_{Rsi} (Min = 0.75)**	**Remagin Ψ-value (W/m.K)**		**TGD L Default Ψ-value (shown for indicative purposes only)**
5.02	Ground Floor - Insulation below slab(2)	0.8	0.174	>	0.106
N/A	Concrete Intermediate Floor within a dwelling (2)	0.93	0.088	>	0.055
5.04	Separating Wall edge (plan)(1)(2)	0.86	0.0595	>	0.057
5.05	Separating Wall top (section)(1)	0.81	0.093	<	0.095
5.07/5.08	Eaves Detail, plastic isolation plates, PIR between farrat plates over wall plate(2)	0.88	0.053	>	0.026
5.15	Gable end detail(2)	0.87	0.049	>	0.034
5.19	Ope - Lintel - Mineral wool Cavity Closer(2)	0.9	0.049	>	0.016
5.20	Ope - Jambs - Mineral wool Cavity Closer(2)	0.92	0.04	>	0.019
5.21	Ope - Sill - Pre-cast concrete cill, Prop. Cavity Closer(2)	0.88	0.059	>	0.021
5.22.1	Steel Frame Separating Wall through ground floor (base)(1)	N/A	0.129	<	0.132
5.23.1	Corner Detail(2)	0.83	0.059	>	0.029
5.23.2	Inverted Corner Detail	0.96	-0.052	<	-0.043

(1) Value of ψ is applied to each dwelling.
(2) Some ψ-values do not meet the default ψ-values; however, all junctions pass f_{Rsi} assessments.
(3) Flanking element U-values for walls, roof and floor thermal models above were based on,
$U_W = 0.16$ W/m^{2}k, $U_F = 0.147$ W/m^{2}k, $U_R = 0.13$ W/m^{2}k
Modelled junction ψ-values are based on typical Horizon details above can be used in y-value calculations, if relevant detail is applicable.
Note the insulation to specification that was modelled was PIR.

Table 9: Typical ψ-value W/mK

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, emissivity of PIR surface facing into cavity etc. therefore U-values should be recalculated if the build-ups differ from those described in Tables 5, 6, 7 and 8.

4.5 SOUND

4.5.1 Separating Wall

The acoustic performance of the separating wall specified in Section 2.5.1 has been assessed by *SCI Publication P 372 Acoustic Detailing for Steel Construction* and through adopting best practice at salient junctions to minimise the effects of airborne, impact and flanking sound. In respect of separating walls an examination was also carried out of the key junctions in the external walls to ensure compliance with the requirements of Part E of the Building Regulations.

The specification for the separating wall achieves airborne sound insulation through the following:

- Structural isolation is achieved by leaving a recommended minimum 50mm cavity between the two steel frames.
- Stone mineral wool of minimum 22kg/m^3 density is placed between the studs in each frame. These wool batts are continuous from ground floor to the upper floor ceiling level and provide the required acoustic properties.
- Mass is achieved using dense wall linings. Each steel frame is boarded with the required number of layers of plasterboard required to provide the minimum total mass per unit area of 22kg/m^2 per face. All joints between the outer layer of plasterboard layer are staggered, taped and filled (where required for decoration) in accordance with manufacturers specifications.
- Prevention of flanking sound by sealing between the end of the separating wall frames and the outer masonry leaf.
- At the junction of the joist/truss compartment floor and the separating wall, an additional 500mm section of stone mineral wool insulation is provided within the cavity between the two steel frames to minimise flanking and direct sound transmission.

The separating wall in the Remagin Steel Frame 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.

4.5.2 Compartment Floor Truss

The acoustic performance of the compartment floor specified in Section 2.5.3.1 has been assessed by comparison with Robust Standard Details for Separating Floor-Metal Joist E-FS-3 and SCI Publication P 372 Acoustic Detailing for Steel Construction. Best practice has been adopted at salient junctions to minimise the effects of airborne, impact and flanking sound. In respect of compartment floor (separating floor) an examination was also carried out of the key junctions with the external walls, and post completion tests of units, to ensure compliance with the requirements of Part E of the Building Regulations.

4.5.3 Compartment Floor Steel Concrete Composite Deck

The composite deck can meet either the requirement of a **Type 1** floor concrete base with a soft covering or a **Type 2** floor concrete base with a floating floor as described in section 4 of TGD to Part E of the Building Regulations.

In both floor types the resistance to airborne sound depends mainly on the mass of the concrete base, plasterboard ceilings and good flanking detailing. In Type 1 the soft covering reduces the impact sound at source. The mass per unit area of the floor, coverings and ceilings meet the specification for a Type 1 separating floor. The impact sound reduction is achieved with the use of a suitably approved 5mm layer of soft floor covering. This covering is not intended to be the final finished floor but is intended to act as resilient layer beneath different floor finishes such as vinyl, carpet, timber flooring, tiles etc.

In the Type 2 floor with a concrete base and a floating layer, the floating layer reduces the transmission of impact sound to the base and to the surrounding construction.

4.6 ACCESS FOR PEOPLE WITH DISABILITIES

4.6.1 Access and Use

Building designs can accommodate minimum dimensions for doors/corridors/rooms and circulation spaces to provide access for people with disabilities as indicated in TGD to Part M of the Building Regulations.

4.6.2 Sanitary Conveniences

Buildings can be designed to meet the installation requirements for all necessary and special sanitary conveniences for people with disabilities.

4.7 WEATHERTIGHTNESS AND DAMP PROOFING

Thresholds shall be detailed to allow level access (as required), while protecting the steel frame from weather and ground moisture. Weep holes and cavity vents should be avoided in immediate threshold areas and should be placed on either side of the threshold.

4.7.1 Floor Damp Proofing

The system has adequate DPCs and DPMs to resist the passage of moisture from the ground.

4.7.2 Roof Cladding

Roof coverings will provide adequate weather resistance in all situations covered by Section 3 of this Certificate, when completed in accordance with this Certificate and the manufacturer's instructions.

4.7.3 External Cladding

The external wall with masonry/brick outer leaf incorporates a 50mm clear cavity, when correctly constructed with well filled perpends and mortar-free cavity ties, will minimise the risk of water reaching the cavity face of the inner leaf. Joints, in the insulating lining to the inner leaf, are weatherproofed and any penetrations are sealed. Wind-driven rain, which may cross the cavity under adverse conditions, will be effectively prevented from penetrating the inner leaf.

If an NSAI Agrément approved external cladding system for LGS 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.

The construction of the external panels also keeps the galvanised steel frame members in a "warmframe" environment, which prolongs the life of the steel. Stepped DPC must be provided over window and door heads to deflect moisture that enter the cavity from entering the dwelling/building. A stepped DPC and weep-holes are essential to ensure that moisture within a cavity is deflected to the outside of the building.

4.7.4 Windows and Doors

This Certificate does not cover the installation or performance of windows and doors. However, the detailing at window and door openings has been assessed and is considered adequate to ensure that water penetration will not occur at these locations assuming conventional window frame profiles and sealing arrangements are used (see Figure 9 and 10).

Window sills and external thresholds must either be impervious, run the full width of the cavity and be suitably jointed to a horizontal, continuous cavity tray or DPC which is preferably flexible, or a cavity tray must be provided under the opening provision. Good attention to detail must be given to ensuring that, when installing the horizontal cavity tray or DPC below an external window board, provision for any condensation that may occur on the window is deflected into the cavity and away from the steelwork. The windows and doors are made to order by the window manufacturer using the dimensions provided by the Remagin design office.

4.7.5 Rain Water Goods

Buildings constructed using the Remagin Steel Frame Building System can readily accommodate adequate rainwater gutters and down pipes.

4.8 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[35].
- 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[35].
- 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[35].
- 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 of the Building Regulations.

4.9 DURABILITY

The steel frame structure and wall cladding has been assessed as capable of achieving a minimum design life of 60 years. The steel structure is constructed from steel members having a

minimum 275g/m^2 zinc galvanised coating which will provide adequate protection to the steel members. 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.

Buildings constructed using the Remagin Steel Frame Building System will, when constructed in accordance with Remagin Manual [30] and the requirements of this Certificate along with all relevant codes of practice will have a minimum design life of at least 60 years in accordance with BS 7543[33].

4.10 MAINTENANCE

Maintenance will be required at a level comparable with that for buildings of traditional construction.

As the plasterboard is screwed into the steel structure, there is no nail popping in plasterwork, which results in less maintenance of plasterwork, than that of a traditionally constructed building.

Repainting should be carried out in accordance with the relevant recommendations of BS 6150[34]. Timber boarding, fascia's, 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. The joints in windows and doors may require resealing at approximately 10-year intervals.

4.11 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 Remagin Steel Frame 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.
- Desktop study on corrosion of fasteners in normal conditions with a view to a minimum 60-year design life.
- 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[2].

4.11.1 Other Investigations

Existing data was examined to assess:

- Adequacy of weather tightness of building constructed using the system.
- Durability of the system.
- Requirements for maintenance.

4.11.2 Production Audits

Production audits were carried out at the Remagin factory to examine the process of structural design, steel frame fabrication, assembly and to assess the adequacy of the methods adopted for quality control.

4.11.3 Site Erection Visits

Buildings under construction were visited to assess the practicability of construction (erection) and the adequacy of Remagin site supervision arrangements.

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 and the quality of the materials used in its manufacture and certifies the product/process 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 is unchanged.

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

(c) the product 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 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 IAB are paid.

5.2 The NSAI Agrément mark and certification number may only be used on or in relation to product/processes 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; or

(b) the legal right of the Certificate holder to market, install or maintain the product/process; 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 are preconditions to the validity of the Certificate. However the NSAI does not certify that the manufacture or installation of the certified product 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 2005, 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 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

NSAI Agrément

This Certificate No. **18/0404** is accordingly granted by the NSAI to **Etex Ireland Remagin Limited** on behalf of NSAI Agrément.

Date of Issue: **30th January 2019**

Signed

Director of Certification, NSAI

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

Revisions:
9th April 2021: Increase storey height from 20m to 30m.
30th July2024: Revised Table 2, 4a, 4b, and fire data and fire resistance characteristics. New/Revised Tables 5a, 5b, 6a, 6b to include new External Mineral Wool Wall U-values calculations.

Bibliography

[1] BS 5250:2011+A1:2016 *Code of practice for the control of condensation in buildings.*

[2] IP 1/06 *"Assessing the effects of thermal bridging at junctions and around openings"*.

[3] I.S. EN ISO 10211:2007 *Thermal Bridges in Building Construction - Heat Flows and Surface Temperatures – Detailed Calculations.*

[4] I.S. 325-1:1986 *Code of practice for use of masonry – Structural use of un-reinforced masonry*.

[5] I.S. EN 1996-1-1:2005 Eurocode 6 *Design of Masonry Structures - Part 1-1: General Rules for Reinforced and Unreinforced Masonry Structures (including Irish National Annex).*

[6] I.S. EN 845-1:2013 *Specification for ancillary components for masonry Part 1: Wall Ties, Tension Straps, Hangers and Brackets*.

[7] I.S. EN 1993-1-1:2005 *Eurocode 3 – Design of steel structures – Part 1-1: General rules and rules for buildings (including Irish National Annex).*

[8] I.S. EN 520:2005 *Gypsum plasterboard – Definitions, requirements and test methods.*

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

[10] I.S. EN 1993-1-3:2006 Eurocode 3 - *Design of Steel Structures - Part 1-3: General Rules – Supplementary Rules for Cold-Formed Members and Sheeting (Including Irish National Annex)*.

[11] I.S. EN 10162:2003 *Cold Rolled Steel Sections - Technical Delivery Conditions - Dimensional and Cross-sectional Tolerances.*

[12] I.S. EN 1993-1-5 NA: 2010 Irish National Annex to Eurocode 3 - *Design of Steel Structures - Part 1-5: Plated Structural Elements.*

[13] I.S. EN 10346:2015, *Continuously Hot-dip Coated Steel Flat Products for Cold Forming - Technical Delivery Conditions*.

[14] I.S. EN 1090-1:2009 *Execution of Steel Structures and Aluminium Structures Part 1: Requirements for Conformity Assessment of Structural Components.*

[15] BS 8417:2011+A1:2014 *Preservation of wood - Code of practice.*

[16] I.S. EN 1990:2002 *Eurocode – Basis of Structural Design.*

[17] I.S. EN 1997-1:2005 *Eurocode 7 Geotechnical Design – Part 1: General Rules.*

[18] I.S. EN 1995-1-1:2004 Eurocode 5: *Design of Timber Structures Part 1-1. General - Common rules and rules for Buildings.*

[19] I.S. EN 1991-1-1:2002 Eurocode 1: Actions on Structures Part 1-1: *General actions - Densities, self-weight, imposed loads for buildings.*

[20] I.S. EN 1991-1-4:2005 Eurocode 1: *Actions on Structures Part 1-4: General Actions - Wind actions.*

[21] I.S. EN 1991-1-3:2003 Eurocode 1 - *Actions on Structures Part 1-3: General Actions. Snow Loads.*

[22] BS 5234-1:1992 *Partitions (including matching linings). Code of practice for design and installation.*

[23] I.S. EN 10143:2006, *Continuously Hot-dip Coated Steel Sheet and Strip - Tolerances on Dimensions and Shape*.

[24] I.S. EN 1992-1-1:2005 *Eurocode 2: Design of Concrete Structures Part 1-1: General Rules and Rules for Buildings*.

[25] I.S. EN 206:2013+A1 2016 *Concrete – Specification, Performance, Production and Conformity*.

[26] I.S. EN 13501-1:2007 *Fire Classification of Construction Products and Building Elements Part 1: Classification Using Data from Reaction to Fire Tests*.

[27] I.S. EN 1364-1:2015 *Fire resistance tests for non-loadbearing elements, Part 1 – Wall*.

[28] I.S. EN 1365-1:2012 *Fire resistance tests for loadbearing elements, Part 1 – Walls.*

[29] I.S. EN 1365-2:2014 – *Fire resistance tests for loadbearing elements, Part 2 – Floors and roofs*.

[30] REMAGIN INSTALLATION MANUAL Rev 0.3 28/07/2024

[31] I.S. EN ISO 9972:2015 - *Thermal Performance of Buildings – Determination of Air Permeability of Buildings – Fan Pressurization Method.*

[32] I.S. EN ISO 13788:2012 *Hygrothermal performance of building components and building elements and building elements – Internal surface temperature to avoid critical surface humidity and interstitial condensation – Calculation Methods.*

[33] BS 7543:2015 *Guide to durability of buildings and building elements, products and components*.

[34] BS 6150:2006+A1:2014 *Painting of buildings - Code of practice*.

[35] I.S. 10101:2020+AC1:2020 *National rules for electrical installations.*

[36] Passive Fire Protection Forum (PFPF) – *Guide to Undertaking Technical Assessments of Fire Performance of Construction Products Based on Fire Evidence 2021 Industry Standard Procedure.*

[37] UK Fire Study Group Resolution No. 82 – 2001

[38] I.S. EN 15725:2010 - *Extended application reports on the fire performance products and building elements.*

[39] I.S. EN ISO 14713-2:2020&LC:2020 – Guidelines and recommendations for the protection against corrosion of iron and steel in structures – Part 2

[40] I.S. EN 1363-2:2000 Fire resistant tests – Alternative and Additional Procedures

[41] I.S. EN 1992-4 – Eurocode 2 – Design of concrete structures – Part 4: Design of fastenings for use in concrete

[42] Horizon System Manual Rev C 06.10.2023