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NSAI Agrément

IRISH AGRÉMENT BOARD CERTIFICATE NO. 19/0414

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Synthesia

Isolation

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

NSAI Agrément Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2019**.

PRODUCT DESCRIPTION:
This Certificate relates to Synthesia Poliuretan Spray S-OC-008E open cell spray foam and Poliuretan Spray S-303 HFO closed cell spray foam insulations. Poliuretan Spray S-OC-008E foam is a low-density spray-applied expanding Poliuretan open celled insulation foam for use in new and existing buildings. Poliuretan Spray S-303 HFO foam is a closed celled spray-applied rigid Poliuretan insulation foam for use in new and existing buildings.

This Agrément Certificate certifies compliance with the requirements of the Building Regulations 1997 to 2019.

Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO is manufactured in Spain and distributed in Ireland by Synthesia Technology Europe, S.L.U. Synthesia are responsible for the design and supply of all components to approved specifications, in accordance with the Synthesia approved supplier system.

USE:
The product is used as a thermal insulation, and contributes to the thermal performance of:

- Timber frame walls
- Masonry walls (Drylining)
- Pitched roof constructions with insulation on slope and roof underlay combined with adequate ventilation and vapour check layer.

- Pitched roof constructions in retrofit situations where underlay is breathable or non-breathable with use of a breather card.
- Pitched roofs in new build situations where it is sprayed onto the underside of a taut breathable low resistant underlay provided the natural drape of the underlay is retained and provided adequate ventilation is provided above the low-resistant underlay through the provision of a batten and counter batten or air permeable finishes.
- Pitched roof constructions with insulation at ceiling level where the attic space is non-habitable
- Flat timber roof constructions
- Suspended timber floors (without basement)

Further detailed information can be found in Section 2 of this Certificate.

MANUFACTURE AND MARKETING:
The product is manufactured and marketed by

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1.1 ASSESSMENT

In the opinion of the NSAI Agrément, Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation, if used in accordance with this Certificate, meet the requirements of the Building Regulations 1997 - 2019 as indicated in Section 1.2 of this Certificate.

1.2 Building Regulations 1997 to 2019

REQUIREMENTS:

Part D – Materials and Workmanship
D1 – Materials & Workmanship
Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation, as certified in this Certificate, meet the requirements of the Building Regulations for workmanship.

D3 – Proper Materials
Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation, as certified in this Certificate, are comprised of proper materials fit for their intended use (See Part 4 of this Certificate).

Part B – Fire Safety
B3 – Internal Fire Spread (Structure)
Part B Volume 2 – Fire Safety
B8 – Internal Fire Spread (Structure)
Walls using Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation meet the requirement, provided the completed walls comply with the conditions described in Section 4.1 of this Certificate.

Part B – Fire Safety
B4 – External Fire Spread
Part B Volume 2 – Fire Safety
B9 – External Fire Spread
Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation will not affect the external fire rating of any building construction in which it is incorporated.

Part C – Site Preparation and Resistance to Moisture
C4 – Resistance to Weather and Ground Moisture
Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation meets the requirements of this regulation when installed as indicated in Section 2.3, in walls and pitched roofs constructed in compliance with Part 3 of this Certificate.

Part F – Ventilation
F1 – Means of Ventilation
Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation can meet the requirements of this regulation, when installed in accordance with Section 2.4 and Part 3 of this Certificate.

F2 – Condensation in Roofs
Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation meet the requirements of this regulation, when designed and installed in accordance with Section 2.4 and Part 3 of this Certificate.

Part J – Heat Producing Appliances
J3 – Protection of Building
Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation, if used in accordance with this Certificate, meet the requirements of the Building Regulations 1997 to 2019.

Part L – Conservation of Fuel and Energy
L1 - Conservation of fuel and energy
Based on the measured thermal conductivity's (See Part 4 of this Certificate), walls, pitched roofs, attic floors and suspended timber floors incorporating Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation can meet elemental U-value requirements of the Building Regulations 1997 to 2019. (see Section 4.3 of this Certificate and the certificate holder's technical manual).

When Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation is incorporated into buildings in accordance with the Certificate holders approved installation details there shall be no risk of mould growth arising from surface condensation.

2.1 PRODUCT DESCRIPTION

2.1.1 Poliuretan Spray S-OC-008E

Poliuretan Spray S-OC-008E is a low-density open celled Poliuretan spray foam insulation product. The insulation is spray-applied in a liquid form and expands in seconds using a water blowing agent to provide a flexible foam blanket with a thickness in the range of 35 to 300mm. Typically, Poliuretan Spray S-OC-008E has an approximate density of 7-10 Kg/m³.

2.1.2 Poliuretan Spray S-303 HFO

Poliuretan Spray S-303 HFO is a high-density closed celled Poliuretan spray foam insulation product. The insulation is spray-applied in a liquid form and expands in seconds using an HFO (Hydrofluoro-olefin) blowing agent to provide a rigid foam blanket with a thickness in the range of 25 to 200mm. Typically Poliuretan Spray S-303 HFO has an approximate density of 35-45Kg/m³.

2.1.3 General

Both foams are prepared from two liquid components: the “A-side” component is a polyol and additives and the “B-side” component is an isocyanate. After agitation and at a predefined temperature and pressure, component A & B are mixed within the nozzle of the spray gun during the application process.

Both Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO can only be applied to substrates with a surface temperature > 5°C when the ambient temperature is greater than 5°C.

Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulations have low thermal conductivity values. No VOC’s, CFC’s, HCFC’s, HFC’s or Urea formaldehyde are used in the manufacture of Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulations. Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulations have no food or nutritional value for rodents or insects.

VOC emissions of the Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO has been tested according to the CEN/TS 16516 and ISO 16000. VOC emissions are classified as “Compliant” when assessed against the requirements of GN22: *BREEAM Recognised Scheme for VOC Emissions for Building Products.*

On-site quality checks include density and appearance.

Ancillary components consist of

- Rafter slider/breathable card
- Proprietary roof tile ventilators
- Proprietary soffit vents
- Vapor barrier, tapes and sealants

2.2 DELIVERY, STORAGE AND MARKING

The two components, polyol (A-side) and isocyanate (B-side) are delivered to site in steel drums, each drum bearing the product name, batch number, expiry date, designation code, thermal resistance, reaction to fire and NSAI Agrément identification mark incorporating the Certificate number.

Drums should be stored in a cool well-ventilated area, away from possible ignition sources. The drums must always be protected from frost. The system components are sensitive to humidity and must be stored in sealed drums or containers. The storage temperature must be maintained between +10 and +30°C for the system Poliuretan Spray S-OC-008E and between +5 and +35°C for the system Poliuretan Spray S-303 HFO.

It is recommended that the drums remain factory-sealed with gaskets in place until they are to be used, to reduce the chance of contamination of the chemicals and spillage of chemicals while moving the drums. Protective clothing must always be worn when handling and moving the drums. Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO insulation the shelf life of component A (polyol) is 4 months and the shelf life of component B (isocyanate) is 9 months for both systems.

The polyol for Poliuretan Spray S-OC-008E must be homogenized for 30 minutes using an appropriate mechanical stirrer before it is loaded onto the machine, while the isocyanate component is already homogenized. The isocyanate and polyol components for Poliuretan Spray S-303 HFO are homogenized (chemically stable) and as a result there is no requirement for pre-mixing the two components. Both components are re-circulated through a heater to bring both components to optimal pre-heat temperature for spraying.

Drums must be completely empty of liquid components before disposal. Drums must not be re-used once emptied. The drums can be reconditioned and recycled.

Isocyanate and polyol are classified as ‘harmful’ and ‘irritant’, and the packaging bears the appropriate hazard warning labels. Direct contact with the raw material must be avoided and operatives must be equipped with the appropriate protective clothing. When fully reacted and cured, Poliuretan Spray S-OC-008E nor Poliuretan Spray S-303 HFO does not constitutes a hazard.

2.3 INSTALLATION

2.3.1 Precautions

In general, the recommendations of I.S. EN 14315-2:2013 should be observed.

Synthesia Polyurethane Spray			
Processing Data	Open Cell S-OC 008E	Closed Cell Polyurethane Spray	
		S-303 HFO-W Winter Catalysis	S-303 HFO-S Summer Catalysis
Cream time	3 - 7 sec	2 - 4 sec	2 - 4 sec
Gel time	7 - 15 sec	4 - 8 sec	5 - 9 sec
Tack free time	9 - 19 sec	5 - 11 sec	5 - 11 sec
Free rise density (core)	7 - 9 g/l	30 - 36 g/l	30 - 36 g/l
Installed Density	7 - 10 Kg/m^3	35 - 45 Kg/m^3	35 - 45 Kg/m^3

Table 1

To comply with the requirements of the Safety, Health and Welfare at Work Act 2005 a full site-specific risk assessment must be carried out prior to installation. As part of this process, it is essential that there is an exchange of information between the client and the installer before spray operations commence on any site. Safety hazards likely to be brought into the client's environment, such as the supply line to the spray gun, should be discussed and measures agreed to deal with such hazards both safely and effectively.

The process for the installation of Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulations requires worker controls for exposure to vapours. Applicators must wear full personal protection equipment when working with the product, including full-face fresh-air supplied respirators, protective clothing and gloves. Other trades and personnel must vacate all spaces in which spraying is taking place. In addition, supplemental ventilation, in the form of natural ventilation or mechanical ventilation may be required to prevent off gassing during the manufacturing/ spraying process entering other potentially habited areas of the building.

Vapours given off by certain components of the system, e.g. Isocyanate, are generally heavier than air and will tend to move to lower parts of the dwelling. These parts must be ventilated by opening windows and doors to prevent the build-up of toxic vapours. A 24-hour waiting period prior to re-occupancy is recommended for buildings that are already occupied. Certain applications, e.g. confined roofs, require the use of extractor fans as recommended by the Certificate holder.

Care should be taken to minimise the degree of overspray generated whilst spraying. This is in the form of a fine mist of particles that can travel considerable distances and will adhere strongly to surfaces they land on.

To prevent the product from entering occupied space, for example during installation in the loft area, the loft hatch must be kept closed during the spraying process. Protective covers must be placed over water tanks to prevent contamination during application and should not be removed until enough time has elapsed for potentially harmful vapours to be ventilated from the roof space.

2.3.2 General

Installation of Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation must be carried out by installers who have been approved and trained by the Certificate holder and are also NSAI Agrément registered spray foam applicators. The requirements of the Synthesia Systems Installer Training Manual must always be followed.

2.3.3 Procedure

Building elements to be insulated must be surveyed for their suitability and any necessary repairs carried out prior to installing Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation. The positioning and access to services should also be considered. Areas that are not to be sprayed with Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation must be masked off by taping plastic sheeting in place, as overspray will stick to most surfaces and cannot be removed without damaging that surface.

The product should be spray applied to clean and dry substrates, and built-up in layers with successive passes as described in the Synthesia Systems Installer Training Manual.

Once the foam has fully cured, the product can then be covered with a vapour barrier, when required, and lining board.

2.3.4 On-Site Quality Control testing

Density and appearance are the two key on-site quality control items. The final cured density of the foam is the most important on-site quality control check performed. Prior to the commencing an installation 'session' of the Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray

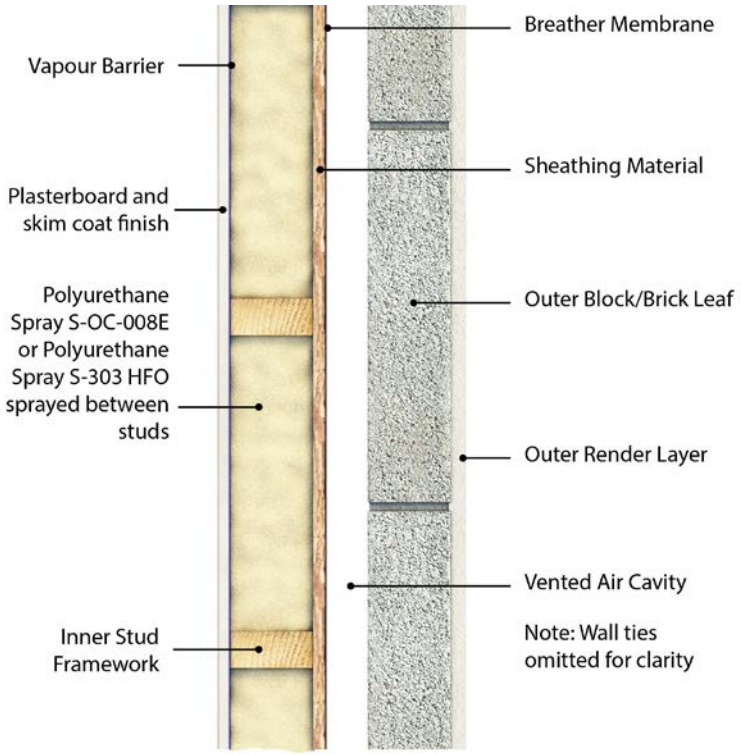

Figure 1 - Timber Frame Wall

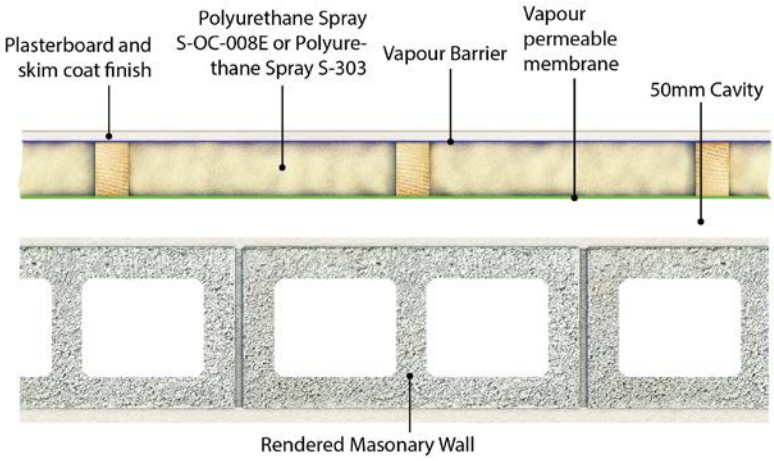

Figure 2 - Dry lined masonry wall

insulation, a density check is carried out and the results are recorded. The density is calculated and if found to be within the acceptable installed density range the foam installation can proceed.

A 'session' is deemed to end when machinery is switched off, when either barrel is changed, if off ratio spraying is observed, if climatic conditions i.e. temperatures drop outside allowable levels, if problems arise with equipment. A full list of 'session end' criteria are outlined in Synthesia Technology Europe Systems quality control documentation and training manual.

Additional on-site quality control tests include:

- A visual inspection of the fine cell structure.
- A visual inspection on colour consistence.
- A physical inspection of the final cured foam. Trained installers will recognise excessively spongy or brittle products which can be as a result or substandard or defective product/ installation.

2.3.5 Maintenance Access

When placing foam insulation at ceiling level within an attic, complete encapsulation of the timber ceiling joist, without the provision of raised timber walkways to provide safe access for maintenance of services such as water tanks must be avoided.

When placing foam insulation at ceiling level within an attic, attic hatches must be modified such that they have equivalent thermal resistance to that of the upgraded ceiling

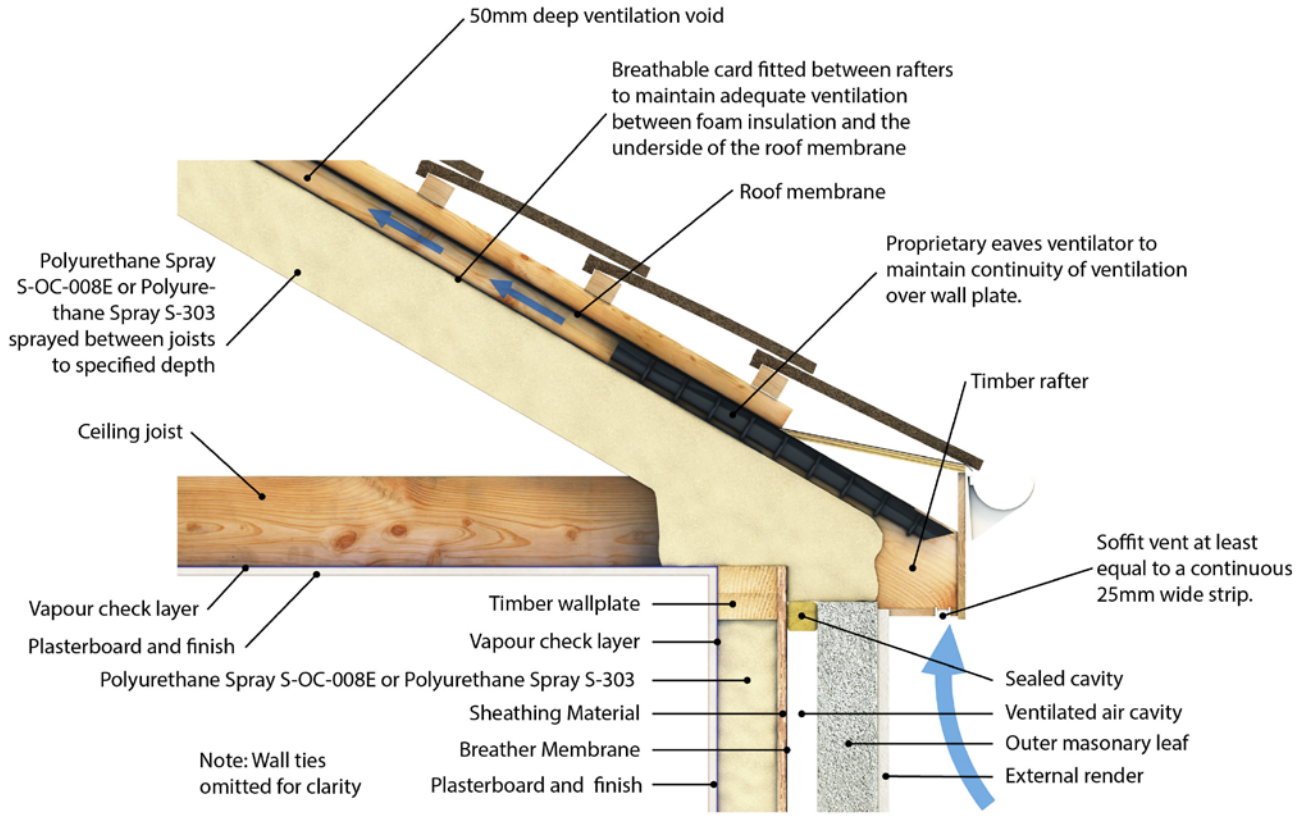

Figure 3 - Pitched roof, insulation on slope

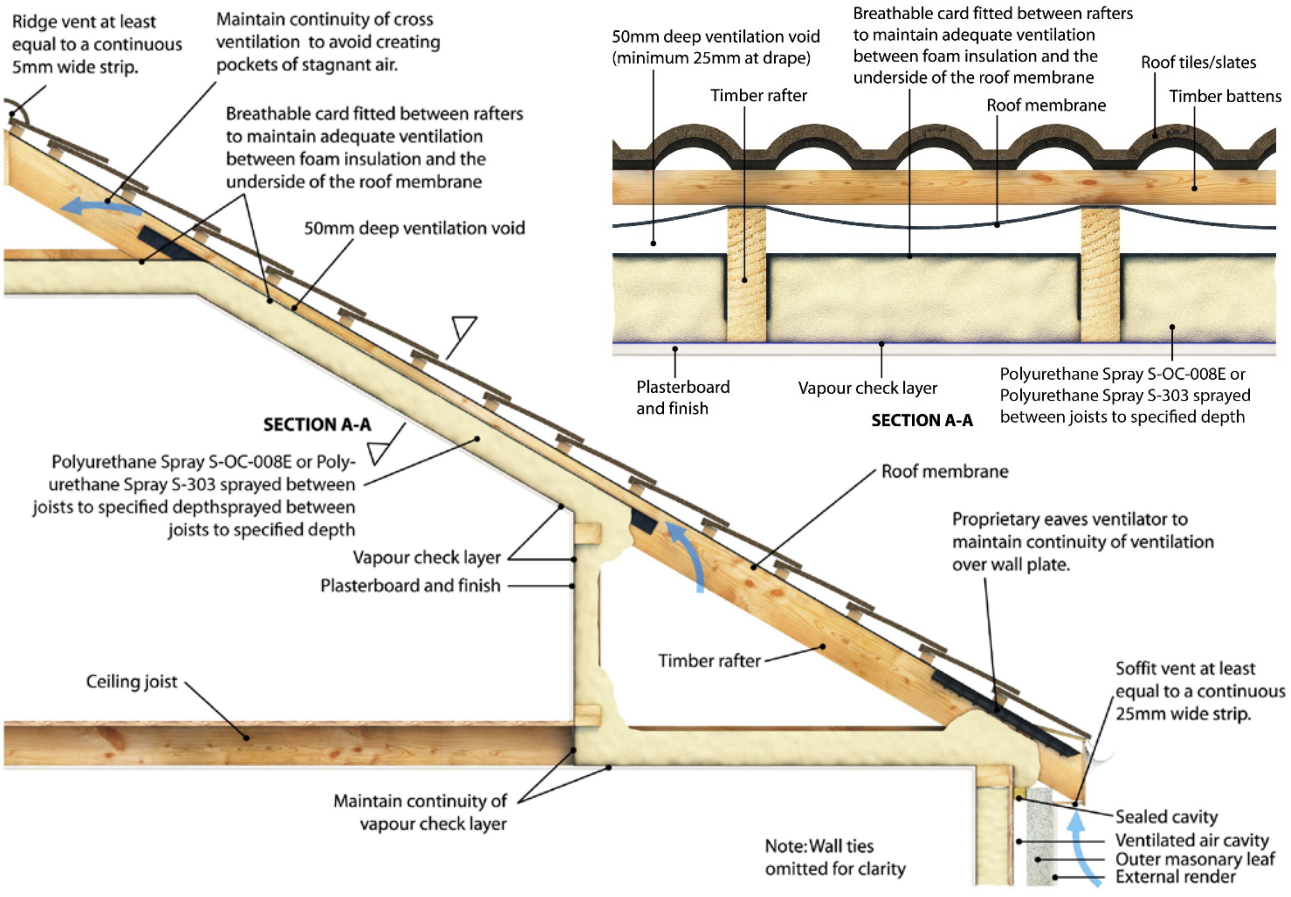

Figure 4 - Pitched roof, habitable roof space

2.4 BUILDING INSTALLATIONS

Attention must be paid to limit thermal bridging for all installation applications as described in Clause 2.4.1 to 2.4.6 below. It is essential that adequate ventilation be provided in accordance with TGD Part F to the Building Regulations 1997 - 2019, for all installations. In retrofit situations recommendations outlined in S.R. 54:2014 must be observed.

2.4.1 Timber Frame Walls

Poliuretan Spray S-OC-008E or Poliuretan Spray S-303 HFO spray foam is sprayed into the cavity formed by timber studs and the sheathing board (either plywood or OSB with breathable membrane on the cavity side) once the moisture content of the timber is below 20%. The product Poliuretan Spray S-OC-008E is applied in one or two layers until the required thickness has been obtained and the Poliuretan Spray S-303 HFO is applied in in successive 10-20 mm layers to obtain the final thickness required (See Figure 1). Once the foam has fully cured, the product is trimmed flush to the inside edge of timber studs using a saw and then covered with vapour barrier and plasterboard or composite insulated plasterboard lining.

2.4.2 Masonry Walls – Drylining

The internal surface of the masonry wall must be inspected for signs of dampness. Any existing defects with the existing structure must be resolved prior to installation of the product (See Figure 2).

Timber battens/studs are installed on the internal side of the masonry wall at typically 600mm centres and leaving a void of 50mm between the inner face of the masonry wall and the outside face of the timber studs. A vapour permeable membrane is installed on the back of the studs. Poliuretan Spray S-OC-008E or Poliuretan Spray S-303 HFO is sprayed into the cavity formed by the battens/studs and onto the vapour permeable membrane. When cured, the excess foam is trimmed flush with the battens and then covered with vapour barrier and plasterboard or composite insulated plasterboard lining.

2.4.3 Pitched Roof – insulation on slope

2.4.3.1 General

Pitched roofs are defined as a roof having a pitch between 15° - 75°. When installing Poliuretan Spray S-OC-008E or Poliuretan Spray S-303 HFO spray foam insulations into a pitched roof it is essential that careful consideration be given to the provision of adequate roof ventilation and the control of vapour migration into the roof structure. Moisture in the form of vapour moves within a building structure by a combination of vapour diffusion through materials and by convection through gaps and cracks in VCL's, at service penetrations or at attic hatches.

In all installations it is recommended that a vapour control layer be installed on the warm side of the insulation.

In refurbishment works, in non-habitable roof spaces (see Figure 3), where it is not practicable to install a vapour control layer and where the existing plasterboard and ceiling finishes are being relied upon to perform the vapour control function, further care must be exercised to ensure that moisture vapour from the dwelling below is restricted. The following guidance should be considered:

- Providing the means to remove moisture vapour at source i.e. ensure that adequate ventilation is present in the rooms below the attic space.
- Providing a well-sealed airtight ceiling.
- Services which penetrate the ceiling should be made airtight and should be kept to a minimum.
- Recessed down-lighters should be avoided.
- Installing an effective sealed vapour control layer where possible.
- Water tanks in the loft space must have a permanent cover.

When insulating along the pitch, a ventilation void must be provided on the external side of the spray foam insulation. This can be provided through the introduction of a breathable rafter card, with a water vapour resistance not greater than 0.25 MN.s/g, fitted between the existing rafters above the insulation as described in Clause 2.4.3.2 and 2.4.3.3 below.

It is necessary to maintain continuity of cross ventilation and ventilation must be designed to avoid creating pockets of stagnant air. To satisfy the requirements of TGD Part F, a continuous 25mm ventilation strip must be provided along the eaves and a 5mm strip along the apex. At the apex, it is recommended that the foam insulation be carried across the line of the collar tie to allow individual ventilated voids between rafters mix together at the apex. This space can be ventilated using several propriety vent tiles, staggered either side of the apex, rather that a continuous 5mm strip.

Air permeable roof coverings, as defined in BS 5250:2011+A1:2016, typically consist of natural slates, clay and concrete tiles whereas man made slates would be considered as an impermeable roof covering.

In all roof types, continuity of insulation from rafter to wall must be maintained at eaves level. This will serve to limit thermal bridging at this junction. Designer and specifiers should refer to the certificate holder's installation details manual for best practice at all building junctions.

2.4.3.2 Existing and new roof – HR Underlay

When installing Poliuretan Spray S-OC-008E or Poliuretan Spray S-303 HFO spray foam insulations

into a pitched roof with a non-breathable HR[1] (high resistance) underlay, a 50mm deep ventilation void must be created between the foam insulation and the underside of the roof underlay. Provisions for ventilation and VCL's as described in Clause 2.4.3.1 must be observed.

2.4.3.3 Existing roof – LR Underlay

When installing Poliuretan Spray S-OC-008E or Poliuretan Spray S-303 HFO spray foam insulations into a pitched roof with a breathable LR[2] (low resistance) underlay, a 50mm deep ventilation void must be created between the foam insulation and the underside of the roof underlay. In the case where a 50mm ventilated void exists between the LR underlay and the underside of the roof tiles, through the provision of a batten and counter batten or the roof finishes are considered to be air permeable, the breathable rafter card can be placed up to the underside of the LR membrane. Placement of the breathable rafter card and subsequent installation of foam must not encroach on the natural drape of the LR membrane. Provisions for ventilation and VCL's as described in Clause 2.4.3.1 must be observed.

2.4.3.4 New roof – LR Underlay

When installing Poliuretan Spray S-OC-008E or Poliuretan Spray S-303 HFO spray foam insulations into a new build pitched roof with a taut breathable LR underlay, the product can be directly applied to the underside of the LR underlay provided the natural drape of the underlay is retained. Adequate ventilation must be provided above the LR underlay through the provision of a batten and counter batten or air permeable roof finishes.

2.4.3.5 LR Underlay on a sarking board

Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation can be applied into the cavity formed by roof rafters and a continuous sarking board when the following ventilation requirements are met. The roof coverings above the sarking board and breathable LR roof underlay are air permeable or, in the case of impermeable roof coverings, adequate ventilation through the provision of a tiling batten and counter batten exists between the underlay and the roof finishes. Continuity of cross ventilation must be maintained, and consideration must be given to avoid creating pockets of stagnant air. The foam insulation is trimmed flush with the inside face of the roof rafters prior to installing a VCL and plaster board finish.

2.4.4 Attic Floors, Insulation at Ceiling level

The product is sprayed into the cavity formed by the ceiling joists and the attic floor (lining board). Care must be taken to ensure that ventilation is maintained at eaves level through the correct installation of an eaves tray. Provision must be made for adequate ventilation as outlined in TGD Part F of the Building Regulations 1997 - 2019.

Attic hatches/ trap door must be insulated such that they will have an equivalent thermal resistance to that of the upgraded ceiling. To limit moisture laden air entering the unheated loft space, every effort should be made to ensure an airtight seal is achieved when the attic hatch is closed.

When the depth of insulation exceeds the depth of the ceiling joists, access platforms must be provided to allow for safe access for maintenance (i.e. water tanks).

When insulating at ceiling level, appropriate measures must be taken to ensure that services which are above the line of the insulation are not susceptible to freezing. Water tanks and associated distribution pipe work must be fully insulated.

Existing electrical cables should be raised above the level of the foam insulation where possible (See Clause 4.6 of this certificate).

Figure 5 - Recessed down-lighters

It is not recommended to install recessed lights in conjunction with Poliuretan Spray S-OC-008E or Poliuretan Spray S-303 HFO spray foam insulation at ceiling level. Where recessed down-lighters exist, guards should be fitted to keep the insulation at least 75mm from the heat source. When used with down-lighters and recessed light fittings, the guard should be open-topped or ventilated by drilling holes in the top of the guard. Guards should be made of rigid boards, light gauge non-magnetic metal; terracotta plant pots can also be used, provided they are of appropriate diameter (i.e. keep insulation 75mm away from heat source).

2.4.5 Flat roof constructions

When installing Poliuretan Spray S-OC-008E or Poliuretan Spray S-303 HFO spray foam insulations into a flat timber roof construction with a non-breathable HR (high resistance) roof covering, a

[1] HR underlay are defined as membranes with a water vapour resistance greater than 0.25 MN.s/g

[2] LR underlay are defined as membranes with a water vapour resistance not exceeding 0.25 MN.s/g

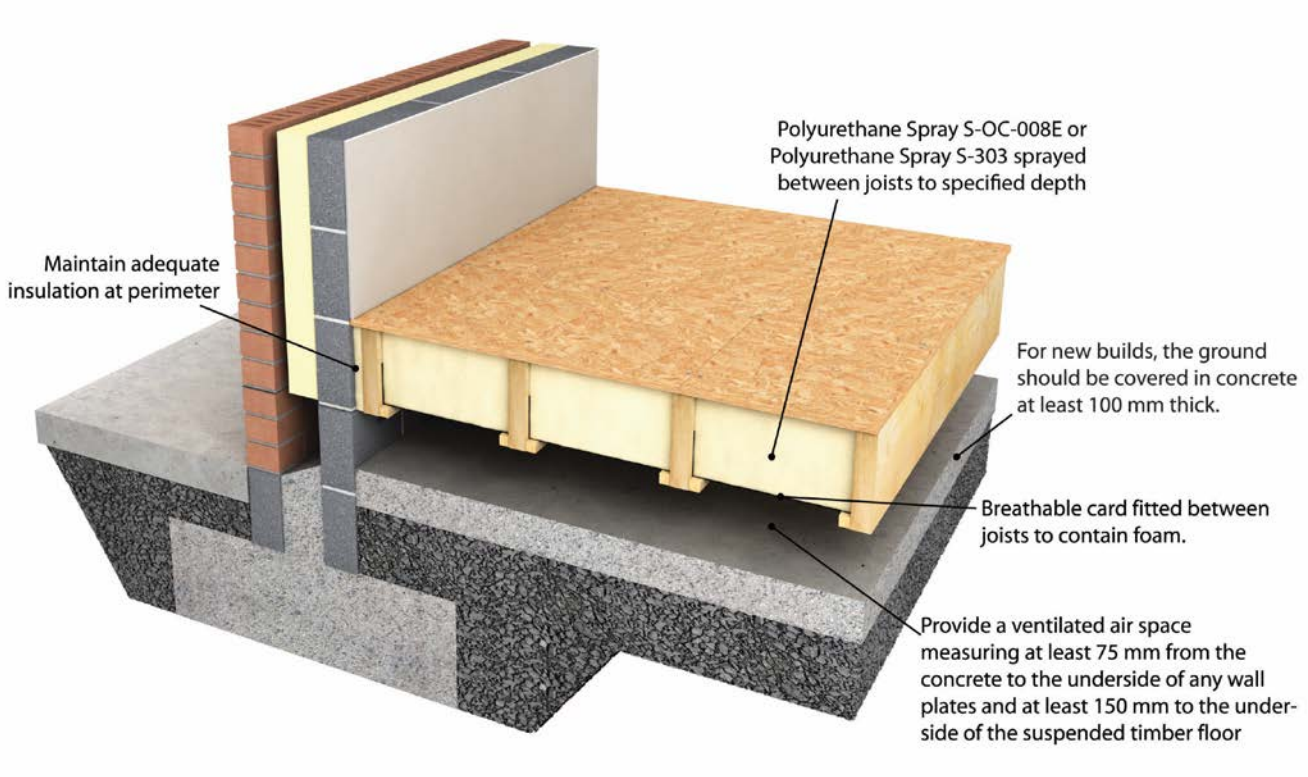

Figure 6 - Suspended Timber Floor

50mm deep ventilation void must be created between the foam insulation and the underside of the roof covering. Provision must be made for adequate ventilation as outlined in TGD Part F of the Building Regulations 1997 - 2019. The foam insulation is trimmed flush with the inside face of the roof rafters prior to installing a VCL and plasterboard finish.

2.4.6 Suspended Timber Ground Floors

A barrier, such as thin plywood or a vapour permeable membrane must be fixed to the underside of the joists to contain the foam. The product is then sprayed from above into the cavity formed by this barrier and the joists. When cured, the excess foam is trimmed flush with the joists and the flooring board installed.

An air gap of at least 150mm must be left between the joists and the ground to allow for sub-floor ventilation. New suspended timber ground floors should follow the guidance give in TGD Part C of the Building Regulations 1997 - 2019.

It is important to maintain adequate insulation at perimeter to limit the effects of thermal bridging. The guidance given in the Acceptable construction details should be followed in this regard.

3.1 GENERAL

Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulations are satisfactory for use in reducing the U-value of walls, pitched roofs and suspended ground floors of a building. To satisfactorily incorporate Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulations the guidance given in BS 5250:2011+A1:2016 must be considered.

The product can be used

- Between the studs of conventional timber frame wall constructions.
- For internal new and remedial work on masonry walls utilising timber battens, breathable membrane or Synthesia Technology Europe breathable card, vapour barrier and dry-lining boards.
- Between timber rafters in pitched roofs constructed in accordance with SR 82:2017 with a breathable roof underlay where the space beneath the roof tiles is ventilated by means of timber battens and the underlay is separated by Synthesia Technology Europe breathable card, or where rafters have been covered by a timber sarking board (i.e. roof underlay is fully supported).
- Between attic floor joists onto existing dry-lined ceiling of room below (where attic is non-habitable).
- Between joists in suspended timber ground floors provided these situations are non-loadbearing.

In all situations, the product must be covered by suitable internal lining boards and vapour barrier check. In the case where the product has been applied between rafters in a non-habitable roof space, if the covering is deemed to be provided by the lining board of the ceiling below, an assessment to BS 5250:2011+A1:2016 establishing same is required (see also Clause 2.4.3.1 of this certificate).

New constructions must be designed in accordance with the relevant requirement of the Eurocodes.

Roof tile underlay's must be subject of the current NSAI Agrément Certification for such use. Underlay's should be installed in accordance with and within the limits of that Certificate.

3.2 PRE-INSTALLATION SURVEY

Existing buildings must be in a good state of repair with no evidence of underlying defects, rain penetration or dampness. If defects are found, remedial action to rectify such defects must take place prior to installation of Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO.

Defects such as rain penetration or elevated levels of condensation can give rise to excessively high levels of moisture content within building materials. Following any remedial works, all materials, in particular timber must be allowed to dry out prior to installation of Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO. A moisture probe survey should be used to establish if moisture levels have returned to suitable levels.

3.3 CONDENSATION RISK

It is essential that all building elements are designed and constructed in a robust manner to eliminate the risk of moisture ingress and surface condensation occurring. Acceptable construction details should be followed for limitation of thermal bridging (see Section 1.3.3.2 of TGD to Part L of the Building Regulations 1997 to 2019). Designers should also refer to the certificate holders approved installation details.

3.4 LOADING

All buildings must be designed to the relevant Eurocodes. Poliuretan Spray S-OC-008E foam and Poliuretan Spray S-303 HFO foam cannot be considered to contribute in any way to the structural performance of a building.

3.5 VENTILATION

It is essential that adequate room ventilation be provided in accordance with TGD Part F of the Building Regulations 1997 - 2019, to limit the moisture content of air within the dwelling. Adequate room ventilation will contribute to reducing the risk of condensation and mould growth.

Adequate provision for ventilation must be provided to prevent build-up of condensation in building elements. Cross roof ventilation systems must also be designed to avoid creating pockets of stagnant air.

3.6 CE MARKING

The manufacturer has taken the responsibility of CE marking the products in accordance with harmonised standard I.S. EN 14315-1:2013. An asterisk (*) appearing in this Certificate indicates that data shown is given in the manufacturer's Declaration of Performance (DoP). Reference should be made to the latest version of the manufacturers DoP for current information on any essential characteristics declared by the manufacturer.

4.1 BEHAVIOUR IN FIRE

Although Poliuretan S-OC-008E Open Cell and Poliuretan Spray S-303 HFO Closed Cell spray foam insulation is not classed as non-combustible and must be protected from flames and other ignition sources during and after installation, when used in the context of this certificate the increase in fire load in the building consequent to its use is negligible.

Poliuretan S-OC-008E Open Cell and Poliuretan Spray S-303 HFO Closed Cell spray foam insulation has a fire classification of class E when assessed in accordance with I.S. EN 13501-1:2007. Class E products are combustible and must be protected from naked flames and other ignition sources during and after installation.

Once installed, the insulation must be contained by a suitable lining board, e.g. 12.5mm plasterboard, with joints fully sealed and supported by rafters or studs. Therefore, it will not contribute to the development stages of a fire or present a smoke or toxic hazard until the lining is compromised.

The one exception where an installation will not require containment by suitable lining boards will be when the product is installed in an unoccupied loft area which is, in itself, contained from the habitable section of the dwelling.

Care must be taken to ensure continuity of fire resistance at junctions with fire-resisting elements, in accordance with the relevant provisions of the Building Regulations 1997 to 2019.

Elements must incorporate cavity barriers at edges, around openings, at junctions with fire-resisting elements and in extensive cavities in accordance with the relevant provisions of the Building Regulations 1997 to 2019. The design and installation of cavity barriers must take into account any anticipated differential movement which may occur.

4.1.1 Walls

The products can be added to the void between studwork in any load-bearing, timber frame inner leaf to a double leaf wall system providing that:

- the outer leaf is masonry, and
- the existing inner leaf system has been shown to satisfy the load-bearing capacity performance criteria of BS 476-21:1987 or I.S. EN 1365-1:2012 for the required resistance period.

The suitability of constructions other than those described above should be demonstrated by appropriate test or assessment.

4.1.2 Roofs

The use of the product in a tiled pitched roof will not affect its external rating when evaluated by assessment or test to BS 476-3:2004.

The product must not be applied over junctions between roofs and walls required to provide a minimum period of fire resistance.

4.1.3 Protection of Building from Heat Producing Appliances

Combustible wall insulation material should be separated by solid non-combustible material not less than 200mm thick, from any heating appliance or from any flue pipe or opening to a heating appliance. Details are given in Diagrams 5 - 14 of the TGD Part J Building Regulations 1997 to 2019. It should also be separated by 40mm from the external surface of a masonry chimney. For chimneys covered by BS EN 1856-1:2009, separation between this product and the external surface of the chimney shall be determined in accordance with TGD J to the Building Regulations 1997 to 2019.

4.2 CONDENSATION RISK

Areas where there is a significant risk of condensation due to high levels of humidity should be identified during the initial site survey.

4.2.1 Interstitial Condensation

A vapour control layer is required on the warm side of Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation unless an assessment to BS5250:2011+A1:2016 indicates that it is not necessary for a particular construction.

Poliuretan S-OC-008E has a vapour resistivity value (μ-value) of ≥5 and Poliuretan Spray S-303 HFO has a vapour resistivity value of ≥70 when tested to I.S. EN 12086:2013. Typically, masonry would have a water vapour resistance factor or μ-value of 22 while render would have a value of 100.

When building elements do not follow the principles of BS 5250:2011+A1:2016, a robust hygrothermal assessment to either I.S. EN 15026:2007 or I.S. EN ISO 13788:2012 must be considered.

Care should be taken to provide adequate ventilation, particularly in rooms expected to experience high humidity, and to ensure the integrity of vapour control layers and linings against vapour ingress.

4.2.2 Internal Surface condensation

When improving the thermal performance of the external envelope of an existing building, through

internal drylining with infill foam insulation or in attic spaces, designers need to consider the impact of these improvements on other untouched elements of the building.

Likewise, as discussed in Clause 4.4 of this certificate, thermally bridged sections of the envelope such as window jambs, cills and eaves, will experience a lower level of increased thermal performance. The degree of improvement to these junctions can be limited due to physical restrictions on site i.e. window boards, opening window sashes, access to eaves and around wall plates.

When bridged junctions meet the requirements of TGD Part L, Appendix D, the coldest internal surface temperature will satisfy the requirements of section D2, namely that the temperature factor (f_{Rsi}) shall be equal to or greater than 0.75. As a result, best practice will have been adopted to limit the risk of internal surface condensation which can result in dampness and mould growth.

When site limiting factors give rise to sub-standard level of insulation at bridged junctions, guidance should be sought from the Certificate holder as to acceptable minimum requirements (see Clause 4.4 for further guidance).

When insulating buildings, the recommendations of BS 5250:2011+A1:2016 should be followed to minimise the risk of condensation within the building elements and structures.

Walls, floors and roofs will adequately limit the risk of surface condensation where the thermal transmittance (U-value) does not exceed 0.7 W/m^{2}K for walls and floors, and 0.35 W/m^{2}K for roofs at any point, and openings and junctions with other elements are designed in accordance with the DoEHLG publication *Limiting Thermal Bridging & Air Infiltration – Acceptable Construction Details (ACD)*.

4.3 THERMAL INSULATION

Calculations of the thermal transmittance (U-value) of specific constructions should be carried out in accordance with I.S. EN ISO 6946:2017 or I.S. EN ISO 13370:2017 using a thermal conductivity (λ-value) as outlined in Table 2 of this certificate.

The U-value of a construction will depend on the materials used and the design. U-value charts for pitched roofs with insulation on the slope or at ceiling level are given in Table 4 - Table 6 of this certificate. Sample U-values for a range on P/A ratios for suspended timber floors are given in Table 3.

The certificate holder has carried out U-value calculations for a wide range of existing building installations. A full listing of U-value calculations, along with robust installation details are contained within the Certificate holders Technical Training Documentation.

For retrofit installations on existing dwellings such as drylining or attic installations, end users should seek guidance from the certificate holder on U-values as the actual U-value of installation will depend on the construction of the existing building elements.

Certificate holder approved installers are required to carry out a preliminary site survey to establish existing building details and insulation levels. On completion of the works, installers will provide a job specific sign off sheet and this records' both initial and final building element U-values.

The product can contribute to maintaining continuity of thermal insulation at junctions between elements and around openings. Guidance in this respect, and on limiting heat loss by air infiltration, can be found in the DoEHLG publication *Limiting Thermal Bridging & Air Infiltration – Acceptable Construction Details*.

4.4 LIMITING THERMAL BRIDGING

The linear thermal transmittance Ψ (Psi) describes the heat loss associated with junctions and around openings. The certificate holder has carried out an assessment of salient building junctions and has established minimum thickness of both Poliuretan Spray S-OC-008E and Poliuretan Spray S-303 HFO spray foam insulation to limit thermal bridging at these junctions. The specified thermal resistances are equal to or greater that the target thermal resistances provided for in the *Acceptable Construction Details (ACD's)*.

A full listing of assessed building junctions along with building details are contained within the Certificate holders Technical Training Document.

Window jambs, door reveals and all building junctions when shown to be equivalent or better than junctions detailed in either, certificate holders Technical Training Document or DoEHLG publication *Limiting Thermal Bridging & Air Infiltration – Acceptable Construction Details,* then it is acceptable to use the linear thermal transmittance values outline in Table D1-D6 of Appendix D of TGD to Part L of the Building Regulations 1997 to 2019. When **all** bridged junctions within a building comply with the requirements of Table D1-D6 of appendix D of TGD to Part L, the improved 'y' factor of 0.08 can be entered into the Dwelling Energy Assessment Procedure (DEAP) Building Energy Rating (BER) calculation.

Where either of the above options are shown to be valid, or when the required values cannot be achieved, all relevant details should be recorded on

the 'Certificate of Compliance' for that project for use in future BER calculations.

'Ψ'-values for other junctions outside the scope of this Certificate should be assessed by an NSAI registered Thermal Modeller or equivalent competent person in accordance with the BRE IP1/06 *Assessing the effects of thermal bridging at junctions and around openings* and BRE Report BR 497 *Conventions for calculating linear thermal transmittance and temperature factors*.

The certificate holders approved installation details and published Psi-values can be used to calculate the overall building heat transmission due to thermal bridging or the building y-value for inclusion in DEAP.

4.5 VENTILATION

Adequate room and roof ventilation must be provided in accordance with TGD Part F of the Building Regulations 1997 - 2019, for all installations and as described in Clause 3.5 of this certificate.

4.6 MATERIALS IN CONTACT WITH ELECTRICAL WIRING

When encapsulating electric cables, consideration should be given to de-rating of electrical cables where the product restricts the flow of air around cables. Where the foam is likely to be in contact with electric cables, suitable conduit or trunking should be used if de-rating is considered a risk. The positioning and future access to electrical cabling services should be carefully considered.

In attic areas, existing electrical cable at ceiling level should be raised above the level of the foam insulation where possible. Encapsulating cables presents an obstruction when tracing and locating faults in a circuit. Electrical cabling when embedded within the foam insulation should be run in conduits to facilitate repairs.

Electrical installations should be in accordance with the ETCI publication ET 207: 2003 *Guide to the National Rules for Electrical Installations as Applicable to Domestic Installations.* In relation to recessed spotlights and other luminaries, ET 207 requires they be not less than the minimum distances from combustible materials as specified in Clause 559.3.2 of the TCI National rules of the Electro Technical Council of Ireland (ET 101). (See Figure 5)

4.7 CORROSION DEVELOPING CAPACITY ON METAL CONSTRUCTIONS

An evaluation of corrosion developing capacity on zinc and copper was carried out to EN 15101-1:2014.

Poliuretan S-OC-008E Open Cell and Poliuretan Spray S-303 HFO Closed Cell spray foam insulation is compatible with all metals, with the exception of zinc. In all situations when the foam is in contact with Zinc, the Zinc must be separated from the foam by covering the Zinc plate with a protective coating.

4.8 SUSCEPTIBILITY OF MOULD GROWTH

The susceptibility to mould growth test report indicates that the foam failed to produce a carbon source that would sustain fungal growth.

4.9 TESTS AND ASSESSMENTS WERE CARRIED OUT TO DETERMINE THE FOLLOWING:

- Density
- Water vapour permeability
- Dimensional stability
- Thermal conductivity
- Suitability of foam insulation in contact with timber.
- Adhesion spray foam insulation to timber.
- REACH compliance (Registration, Evaluation, Authorisation and Restriction of Chemicals).
- Safety Data Sheets Synthesia Technology Europe
- Assessment of Spray Rig information
- Adequacy of fill
- Safe storage

4.10 OTHER INVESTIGATIONS

(i) Existing data on product properties in relation to fire, toxicity, thermal conductivity and dimensional stability were assessed.

(ii) The manufacturing process was examined including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used. The manufacture has both ISO 9001:2015 *Quality Management System* and I.S. EN ISO 14001:2004 *Environmental Management Systems* accreditation.

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

Characteristics	Test method reference	Polyurethane Spray				
		S-OC-008E Open Celled		S-303 HFO Closed Celled		Units
Reaction to fire	EN 14315-1:2013 (EN 13501-1 + A1:2010)	Class E*		Class E*		
Water Adsorption/ Permeability	EN 14315-1:2013 (EN 1609:2013) method B	≤ 16,0*		≤ 0,20*		kg/m²
Thermal conductivity	EN 14315-1:2013 (EN 12667:2001) $\lambda_{90/90}$ - value	0.038*		0.028* (<80mm) 0.026*(80-120mm) 0.025*(>120mm)		W/m.K (mm)
Water vapour permeability	EN 14315-1:2013 (EN 12086:2013) Water vapour resistance factor (μ)	≥5*		≥70*		μ -value
Compressive behaviour	EN 14315-1:2013 (EN 826:2013) Compressive strength at 10% strain	NPD*		NPD*		kPa
Density (Range)	I.S. EN 1602	7	10	35	45	kg/m³
* indicates that data shown is taken from the manufacturer's Declaration of Performance.						

Table 2 - Polyurethane Characteristics

Suspended timber floor				
New Construction with Polyurethane Spray				
Ground floor insulation depths between joists.				
P/A Perimeter Area	U-Value (W/m²K)			
	0.21		0.15	
	S-303 HFO Closed	S-OC-008E Open	S-303 HFO Closed	S-OC-008E Open
0.2	90	120	155	205
0.4	115	150	180	240
0.6	120	165	190	250
0.8	125	170	190	255
1.0	130	175	195	260

Note:
These values are based on the following construction (external to internal):
- Insulation (89%)/timber joists (11%)
  (insulation to depths given above)
- Floorboards 19mm

Table 3 – U-Values, Timber suspended floors

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Table 4 - U-value, Synthesia S-OC-008E – Open Cell

U-Value Ready Reckoner for Pitched Roof - Insulation along the slope

Substrate			Selected Foam =			Synthesia S-OC-008E - Open			Thermal Conducvity (λ-Value) =			0.038	W/m.K	
Pitched roof, Insulated at Rafter Level			44mm wide timber rafters at						36mm wide timber rafters at					
Total Rafter Depth	Vent gap above card	Rafter c/c=	300mm c/c			400mm c/c			600mm c/c			300mm c/c		
		% Bridging =	14.67%			11.00%			7.33%			12.00%		
		Foam depth below vent card	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB
100mm	50mm	50mm	0.83	0.28	0.21	0.79	0.28	0.21	0.75	0.27	0.21	0.80	0.28	0.21
115mm	50mm	65mm	0.67	0.26	0.20	0.63	0.25	0.20	0.60	0.25	0.19	0.64	0.25	0.20
125mm	50mm	75mm	0.59	0.24	0.19	0.56	0.24	0.19	0.53	0.23	0.18	0.57	0.24	0.19
150mm	50mm	100mm	0.46	0.22	0.17	0.43	0.21	0.17	0.41	0.21	0.17	0.44	0.21	0.17
175mm	50mm	125mm	0.38	0.20	0.16	0.35	0.19	0.16	0.33	0.18	0.15	0.36	0.19	0.16
200mm	50mm	150mm	0.32	0.18	0.15	0.31	0.17	0.14	0.29	0.17	0.14	0.30	0.17	0.14
225mm	50mm	175mm	0.28	0.16	0.14	0.27	0.16	0.13	0.25	0.15	0.13	0.27	0.16	0.13
250mm	50mm	200mm	0.25	0.15	0.13	0.24	0.15	0.12	0.22	0.14	0.12	0.24	0.15	0.13
275mm	50mm	225mm	0.23	0.14	0.12	0.21	0.13	0.12	0.20	0.13	0.11	0.22	0.14	0.12
300mm	50mm	250mm	0.21	0.13	0.11	0.19	0.13	0.11	0.18	0.12	0.11	0.20	0.13	0.11

Roof build-up		
Pitched Roof (<70°) tiles or slates on battens		
Roof underlay (excluded form calculations)		
Rse (Exterior sheltered), 50 mm Well-ventilated air layer =	0.1	m^2K/W
Timber Rafters, width and C/C as above, λ =	0.13	W/m K
Selected Spray Foam insulation between rafters, λ =	0.038	W/m K
PIR Drylining, thickness as indicated, λ =	0.022	W/m K
12.5mm Plasterboard (12.5 PB), λ =	0.25	W/m K
Rsi =	0.1	m^2K/W

Correction for air voids level 1 = 0.01 W/m^2K
Correction for air voids level 0 = 0.00 W/m^2K

Correction Level	1	0	0
PIR thickness =	0	50	75
Plaster board =	0	12.5	12.5

U corrected = U+ΔU, if ΔU < 3% of U then ΔU can be ignored

Rse, Exterior = 0.04

Loft/Roof Space resistance = 0.2

One layer of insulation, interrupted by construction elements, e.g. rafters

Continuous layers of insulation, without any interruptions of the insulation layer

$$\Delta U_g = \Delta U \cdot \left(\frac{R_1}{R_{T,h}}\right)^2$$

Inputs = Enter value

U-Values < 0.16 $W/m^2.K$ are shown = 0.16 $W/m^2.K$

U-Values < 0.25 $W/m^2.K$ (but > 0.16) are shown = 0.25 $W/m^2.K$

TGD Part L 2017, New Dwellings, pitched roof insulation at ceiling or on the slope requires 0.16, Existing Dwellings, pitched roof insulation at ceiling 0.16, Insulation on slope 0.25

U-Value Ready Reckoner for Pitched Roof - Insulation at ceiling level

Pitched roof, Insulated at Rafter Level			44mm wide ceiling joists at									36mm wide ceiling joists at								
Foam Depth		Rafter c/c =	300mm c/c			400mm c/c			600mm c/c			300mm c/c			400mm c/c			600mm c/c		
		% Bridging =	14.67%			11.00%			7.33%			12.00%			9.00%			6.00%		
		Depth of Ceiling Joists	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB
Applied Foam Insulation between ceiling joists, assume joists go full depth of insulation.		100mm	0.42	0.21	0.17	0.40	0.21	0.17	0.38	0.20	0.16	0.40	0.21	0.17	0.39	0.20	0.16	0.37	0.20	0.16
		115mm	0.37	0.20	0.16	0.35	0.19	0.16	0.33	0.19	0.15	0.36	0.19	0.16	0.34	0.19	0.16	0.33	0.19	0.15
		125mm	0.35	0.19	0.16	0.33	0.18	0.15	0.31	0.18	0.15	0.33	0.19	0.15	0.32	0.18	0.15	0.30	0.18	0.15
		150mm	0.30	0.17	0.14	0.28	0.17	0.14	0.27	0.16	0.14	0.29	0.17	0.14	0.28	0.17	0.14	0.27	0.16	0.14
		175mm	0.27	0.16	0.13	0.25	0.15	0.13	0.24	0.15	0.13	0.26	0.16	0.13	0.25	0.15	0.13	0.23	0.15	0.13
		200mm	0.24	0.15	0.13	0.23	0.14	0.12	0.21	0.14	0.12	0.23	0.14	0.12	0.22	0.14	0.12	0.21	0.14	0.12
		225mm	0.22	0.14	0.12	0.20	0.13	0.11	0.19	0.13	0.11	0.21	0.13	0.12	0.20	0.13	0.11	0.19	0.13	0.11
Depth of Foam insulation over ceiling joists (assumes full filling between joists)	100mm	100mm	0.20	0.13	0.12	0.19	0.13	0.12	0.19	0.13	0.11	0.19	0.13	0.12	0.19	0.13	0.11	0.19	0.13	0.11
		115mm	0.18	0.13	0.11	0.18	0.13	0.11	0.18	0.13	0.11	0.18	0.13	0.11	0.18	0.13	0.11	0.17	0.12	0.11
		125mm	0.18	0.13	0.11	0.17	0.12	0.11	0.17	0.12	0.11	0.17	0.12	0.11	0.17	0.12	0.11	0.17	0.12	0.11
		150mm	0.16	0.12	0.10	0.16	0.12	0.10	0.15	0.11	0.10	0.16	0.12	0.10	0.16	0.11	0.10	0.15	0.11	0.10
		175mm	0.15	0.11	0.10	0.15	0.11	0.10	0.14	0.11	0.10	0.15	0.11	0.10	0.14	0.11	0.10	0.14	0.11	0.09
		200mm	0.14	0.11	0.09	0.14	0.10	0.09	0.13	0.10	0.09	0.14	0.10	0.09	0.13	0.10	0.09	0.13	0.10	0.09
		225mm	0.13	0.10	0.09	0.13	0.10	0.09	0.12	0.09	0.09	0.13	0.10	0.09	0.12	0.10	0.09	0.12	0.09	0.08

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Table 5 - U-value, Synthesia S-303 HFO - Closed Cell 25-75mm & 80-115mm

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U-Value Ready Reckoner for Pitched Roof - Insulation along the slope

Substrate			Selected Foam =			Synthesia S-303 HFO - Closed 25-75mm														
Pitched roof, Insulated at Rafter Level			44mm wide timber rafters at									36mm wide timber rafters at								
		Rafter c/c=	300mm c/c			400mm c/c			600mm c/c			300mm c/c			400mm c/c			600mm c/c		
		% Bridging =	14.67%			11.00%			7.33%			12.00%			9.00%			6.00%		
Total Rafter Depth	Vent gap above card	Foam depth below vent card	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB
100mm	50mm	50mm	0.71	0.26	0.20	0.66	0.25	0.20	0.61	0.25	0.19	0.67	0.26	0.20	0.63	0.25	0.19	0.59	0.24	0.19
115mm	50mm	65mm	0.57	0.24	0.19	0.52	0.23	0.18	0.48	0.22	0.18	0.54	0.23	0.18	0.50	0.23	0.18	0.47	0.22	0.18
125mm	50mm	75mm	0.50	0.22	0.18	0.46	0.22	0.17	0.42	0.21	0.17	0.47	0.22	0.17	0.44	0.21	0.17	0.41	0.21	0.17

Roof build-up

Pitched Roof (<70°) tiles or slates on battens		
Roof underlay (excluded form calculations)		
Rse (Exterior sheltered), 50 mm Well-ventilated air layer =	0.1	m^2K/W
Timber Rafters, width and C/C as above, λ =	0.13	W/m K
Selected Spray Foam insulation between rafters, λ =	0.028	W/m K
PIR Drylining, thickness as indicated, λ =	0.022	W/m K
12.5mm Plasterboard (12.5 PB), λ =	0.25	W/m K
Rsi =	0.1	m^2K/W

Correction for air voids level 1 = 0.01 W/m^2K
Correction for air voids level 0 = 0.00 W/m^2K

Correction Level	1	0	0
PIR thickness =	0	50	75
Plaster board =	0	12.5	12.5

U corrected = U+ΔU, if ΔU < 3% of U then ΔU can be ignored

Rse, Exterior = 0.04

Loft/Roof Space resistance = 0.2

One layer of insulation, interrupted by construction elements, e.g. rafters
Continuous layers of insulation, without any interruptions of the insulation layer

$$\Delta U_g = \Delta U \cdot \left(\frac{R_1}{R_{T,h}}\right)^2$$

Inputs = Enter value

U-Values < 0.16 $W/m^2.K$ are shown = 0.16 $W/m^2.K$

U-Values < 0.25 $W/m^2.K$ (but > 0.16) are shown = 0.25 $W/m^2.K$

TGD Part L 2017, New Dwellings, pitched roof insulation at ceiling or on the slope requires 0.16, Existing Dwellings, pitched roof insulation at ceiling 0.16, insulation on slope 0.25

NSAI Agrément

U-Value Ready Reckoner for Pitched Roof - Insulation along the slope

Substrate			Selected Foam =			Synthesia S-303 HFO - Closed 80-115mm														
Pitched roof, Insulated at Rafter Level			44mm wide timber rafters at									36mm wide timber rafters at								
		Rafter c/c=	300mm c/c			400mm c/c			600mm c/c			300mm c/c			400mm c/c			600mm c/c		
		% Bridging =	14.67%			11.00%			7.33%			12.00%			9.00%			6.00%		
Total Rafter Depth	Vent gap above card	Foam depth below vent card	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB
130mm	50mm	80mm	0.45	0.21	0.17	0.42	0.20	0.16	0.38	0.20	0.16	0.43	0.21	0.17	0.40	0.20	0.16	0.37	0.19	0.16
150mm	50mm	100mm	0.37	0.19	0.16	0.34	0.18	0.15	0.31	0.17	0.15	0.35	0.18	0.15	0.32	0.18	0.15	0.31	0.17	0.14
165mm	50mm	115mm	0.33	0.18	0.15	0.31	0.17	0.14	0.28	0.16	0.14	0.31	0.17	0.14	0.29	0.16	0.14	0.27	0.16	0.13

Roof build-up

Pitched Roof (<70°) tiles or slates on battens		
Roof underlay (excluded form calculations)		
Rse (Exterior sheltered), 50 mm Well-ventilated air layer =	0.1	m^2K/W
Timber Rafters, width and C/C as above, λ =	0.13	W/m K
Selected Spray Foam insulation between rafters, λ =	0.026	W/m K
PIR Drylining, thickness as indicated, λ =	0.022	W/m K
12.5mm Plasterboard (12.5 PB), λ =	0.25	W/m K
Rsi =	0.1	m^2K/W

Correction for air voids level 1 = 0.01 W/m^2K
Correction for air voids level 0 = 0.00 W/m^2K

Correction Level	1	0	0
PIR thickness =	0	50	75
Plaster board =	0	12.5	12.5

U corrected = U+ΔU, if ΔU < 3% of U then ΔU can be ignored

Rse, Exterior = 0.04

Loft/Roof Space resistance = 0.2

One layer of insulation, interrupted by construction elements, e.g. rafters
Continuous layers of insulation, without any interruptions of the insulation layer

$$\Delta U_g = \Delta U \cdot \left(\frac{R_1}{R_{T,h}}\right)^2$$

Inputs = Enter value

U-Values < 0.16 $W/m^2.K$ are shown = 0.16 $W/m^2.K$

U-Values < 0.25 $W/m^2.K$ (but > 0.16) are shown = 0.25 $W/m^2.K$

TGD Part L 2017, New Dwellings, pitched roof insulation at ceiling or on the slope requires 0.16, Existing Dwellings, pitched roof insulation at ceiling 0.16, insulation on slope 0.25

U-Value Ready Reckoner for Pitched Roof - Insulation at ceiling level

Pitched roof, Insulated at Rafter Level			44mm wide ceiling joists at									36mm wide ceiling joists at								
		Rafter c/c =	300mm c/c			400mm c/c			600mm c/c			300mm c/c			400mm c/c			600mm c/c		
		% Bridging =	14.67%			11.00%			7.33%			12.00%			9.00%			6.00%		
Foam Depth		Depth of Ceiling Joists	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB
Applied Foam Insulation between ceiling joists, assume joists go full depth of insulation.		80mm	0.41	0.20	0.17	0.38	0.20	0.16	0.35	0.19	0.16	0.39	0.20	0.16	0.36	0.19	0.16	0.34	0.19	0.15
		100mm	0.34	0.18	0.15	0.32	0.18	0.15	0.29	0.17	0.14	0.32	0.18	0.15	0.30	0.17	0.14	0.28	0.17	0.14
		115mm	0.30	0.17	0.14	0.29	0.17	0.14	0.26	0.16	0.13	0.29	0.17	0.14	0.28	0.16	0.14	0.26	0.15	0.13
Depth of Foam insulation over ceiling joists (assumes full filling between joists)	100mm	80mm	0.15	0.11	0.10	0.15	0.11	0.10	0.15	0.11	0.10	0.15	0.11	0.10	0.15	0.11	0.10	0.14	0.11	0.10
		100mm	0.14	0.11	0.10	0.14	0.10	0.09	0.13	0.10	0.09	0.14	0.11	0.09	0.14	0.10	0.09	0.13	0.10	0.09
		115mm	0.13	0.10	0.09	0.13	0.10	0.09	0.13	0.10	0.09	0.13	0.10	0.09	0.13	0.10	0.09	0.12	0.10	0.09

Table 6 - U-value, Synthesia S-303 HFO - Closed Cell 120mm+

U-Value Ready Reckoner for Pitched Roof - Insulation along the slope

Substrate			Selected Foam =	Synthesia S-303 HFO - Closed 120-200mm						Thermal Conducvity (λ-Value) =	0.025	W/m.K						
Pitched roof, Insulated at Rafter Level			44mm wide timber rafters at							36mm wide timber rafters at								
Total Rafter Depth	Vent gap above card	Rafter c/c=	300mm c/c			400mm c/c			600mm c/c			300mm c/c			400mm c/c			600mm c/c		
		% Bridging =	14.67%			11.00%			7.33%			12.00%			9.00%			6.00%		
		Foam depth below vent card	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm No PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB
170mm	50mm	120mm	0.31	0.17	0.14	0.29	0.16	0.14	0.26	0.15	0.13	0.30	0.16	0.14	0.28	0.16	0.13	0.25	0.15	0.13
200mm	50mm	150mm	0.26	0.15	0.13	0.24	0.14	0.12	0.22	0.13	0.12	0.24	0.14	0.12	0.23	0.14	0.12	0.21	0.13	0.11
225mm	50mm	175mm	0.23	0.14	0.12	0.21	0.13	0.11	0.19	0.12	0.11	0.21	0.13	0.11	0.20	0.12	0.11	0.18	0.12	0.10
250mm	50mm	200mm	0.20	0.12	0.11	0.18	0.12	0.10	0.17	0.11	0.10	0.19	0.12	0.10	0.17	0.11	0.10	0.16	0.11	0.10
275mm	50mm	225mm	0.18	0.12	0.10	0.17	0.11	0.10	0.15	0.10	0.09	0.17	0.11	0.10	0.16	0.11	0.09	0.14	0.10	0.09
300mm	50mm	250mm	0.16	0.11	0.09	0.15	0.10	0.09	0.14	0.09	0.08	0.15	0.10	0.09	0.14	0.10	0.09	0.13	0.09	0.08

Roof build-up

Pitched Roof (<70°) tiles or slates on battens		
Roof underlay (excluded form calculations)		
Rse (Exterior sheltered), 50 mm Well-ventilated air layer =	0.1	m^2K/W
Timber Rafters, width and C/C as above, λ =	0.13	W/m K
Selected Spray Foam insulation between rafters, λ =	0.025	W/m K
PIR Drylining, thickness as indicated, λ =	0.022	W/m K
12.5mm Plasterboard (12.5 PB), λ =	0.25	W/m K
Rsi =	0.1	m^2K/W

Correction for air voids level 1 = 0.01 W/m^2K
Correction for air voids level 0 = 0.00 W/m^2K

Correction Level	1	0	0
PIR thickness =	0	50	75
Plaster board =	0	12.5	12.5

U corrected = U+ΔU, if ΔU < 3% of U then ΔU can be ignored

Rse, Exterior = 0.04

Loft/Roof Space resistance = 0.2

One layer of insulation, interrupted by construction elements, e.g. rafters
Continuous layers of insulation, without any interruptions of the insulation layer

$$\Delta U_g = \Delta U' \left(\frac{R_1}{R_{T,h}}\right)^2$$

Inputs = Enter value
U-Values < 0.16 $W/m^2.K$ are shown = 0.16 $W/m^2.K$
U-Values < 0.25 $W/m^2.K$ (but > 0.16) are shown = 0.25 $W/m^2.K$

TGD Part L 2017, New Dwellings, pitched roof insulation at ceiling or on the slope requires 0.16, Existing Dwellings, pitched roof insulation at ceiling 0.16, insulation on slope 0.25

U-Value Ready Reckoner for Pitched Roof - Insulation at ceiling level

Pitched roof, Insulated at Rafter Level			44mm wide ceiling joists at							36mm wide ceiling joists at								
Foam Depth		Rafter c/c =	300mm c/c			400mm c/c			600mm c/c			300mm c/c			400mm c/c			600mm c/c		
		% Bridging =	14.67%			11.00%			7.33%			12.00%			9.00%			6.00%		
		Depth of Ceiling Joists	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB	No PIR 0mm 12.5 PB	PIR 50mm 12.5 PB	PIR 75mm 12.5 PB
Applied Foam Insulation between ceiling joists, assume joists go full depth of insulation.		120mm	0.29	0.17	0.14	0.27	0.16	0.13	0.25	0.15	0.13	0.28	0.16	0.13	0.26	0.15	0.13	0.24	0.15	0.13
		150mm	0.24	0.15	0.12	0.23	0.14	0.12	0.21	0.13	0.11	0.23	0.14	0.12	0.21	0.14	0.12	0.20	0.13	0.11
		175mm	0.21	0.13	0.11	0.20	0.13	0.11	0.18	0.12	0.10	0.20	0.13	0.11	0.19	0.12	0.11	0.17	0.12	0.10
		200mm	0.19	0.12	0.11	0.18	0.12	0.10	0.16	0.11	0.10	0.18	0.12	0.10	0.17	0.11	0.10	0.15	0.11	0.09
		225mm	0.17	0.11	0.10	0.16	0.11	0.09	0.14	0.10	0.09	0.16	0.11	0.10	0.15	0.10	0.09	0.14	0.10	0.09
Depth of Foam insulation over ceiling joists (assumes full filling between joists)	100mm	120mm	0.13	0.10	0.09	0.12	0.10	0.09	0.12	0.09	0.08	0.12	0.10	0.09	0.12	0.09	0.09	0.12	0.09	0.08
		150mm	0.12	0.09	0.08	0.11	0.09	0.08	0.11	0.09	0.08	0.11	0.09	0.08	0.11	0.09	0.08	0.10	0.08	0.08
		175mm	0.11	0.09	0.08	0.10	0.08	0.08	0.10	0.08	0.07	0.10	0.08	0.08	0.10	0.08	0.07	0.10	0.08	0.07
		200mm	0.10	0.08	0.07	0.10	0.08	0.07	0.09	0.08	0.07	0.10	0.08	0.07	0.09	0.08	0.07	0.09	0.07	0.07
		225mm	0.09	0.08	0.07	0.09	0.07	0.07	0.08	0.07	0.07	0.09	0.07	0.07	0.09	0.07	0.07	0.08	0.07	0.06

Timber Frame Walls	
New Construction	
U-values for walls with rendered masonry external finish, insulated with Poliuretan Spray S-OC-008E open cell	
Thickness of Insulation	**U-Value (W/m^2K)**
220 mm	0.219
270 mm	0.183
320 mm	0.158
410 mm	0.128
Note:- construction (external to internal): - Concrete Block outer leaf (100mm) with external render. - Ventilated air cavity – 50mm - Breather membrane - OSB sheathing ply– 15mm - Insulation (85%) and timber studs (15%) - AVCL barrier - Plasterboard – 12.5mm - 3mm gypsum skim coat finish Correction for air voids $\Delta U''$ = level 1 applied to bridged layer	

Table 7 - U-value timber wall (Open cell)

Timber Frame Walls	
New Construction	
U-values for walls with rendered masonry external finish, insulated with Poliuretan Spray S-303 HFO closed cell	
Thickness of Insulation	**U-Value (W/m^2K)**
220 mm	0.176
270 mm	0.148
320 mm	0.128
410 mm	0.103
Note:- construction (external to internal): - Concrete Block outer leaf (100mm) with external render. - Ventilated air cavity – 50mm - Breather membrane - OSB sheathing ply– 15mm - Insulation (85%) and timber studs (15%) - AVCL barrier - Plasterboard – 12.5mm - 3mm gypsum skim coat finish Correction for air voids $\Delta U''$ = level 1 applied to bridged layer	

Table 8 - U-value timber wall (Closed cell)

Part Five / Conditions of Certification 5

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 issue or revision date so long as:

(a) the specification of the product is unchanged.

(b) the Building Regulations 1997 to 2019 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 NSAI Agrément 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.

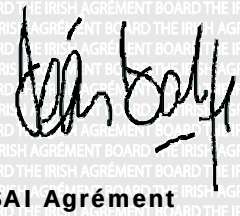
5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is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

NSAI Agrément

This Certificate No. **19/0414** is accordingly granted by the NSAI to **Synthesia Technology Europe** on behalf of NSAI Agrément.

Date of Issue: **11th July 2019**

Signed



Seán Balfe
Director of NSAI Agrément

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

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