Domestic Technical Standards and Specifications

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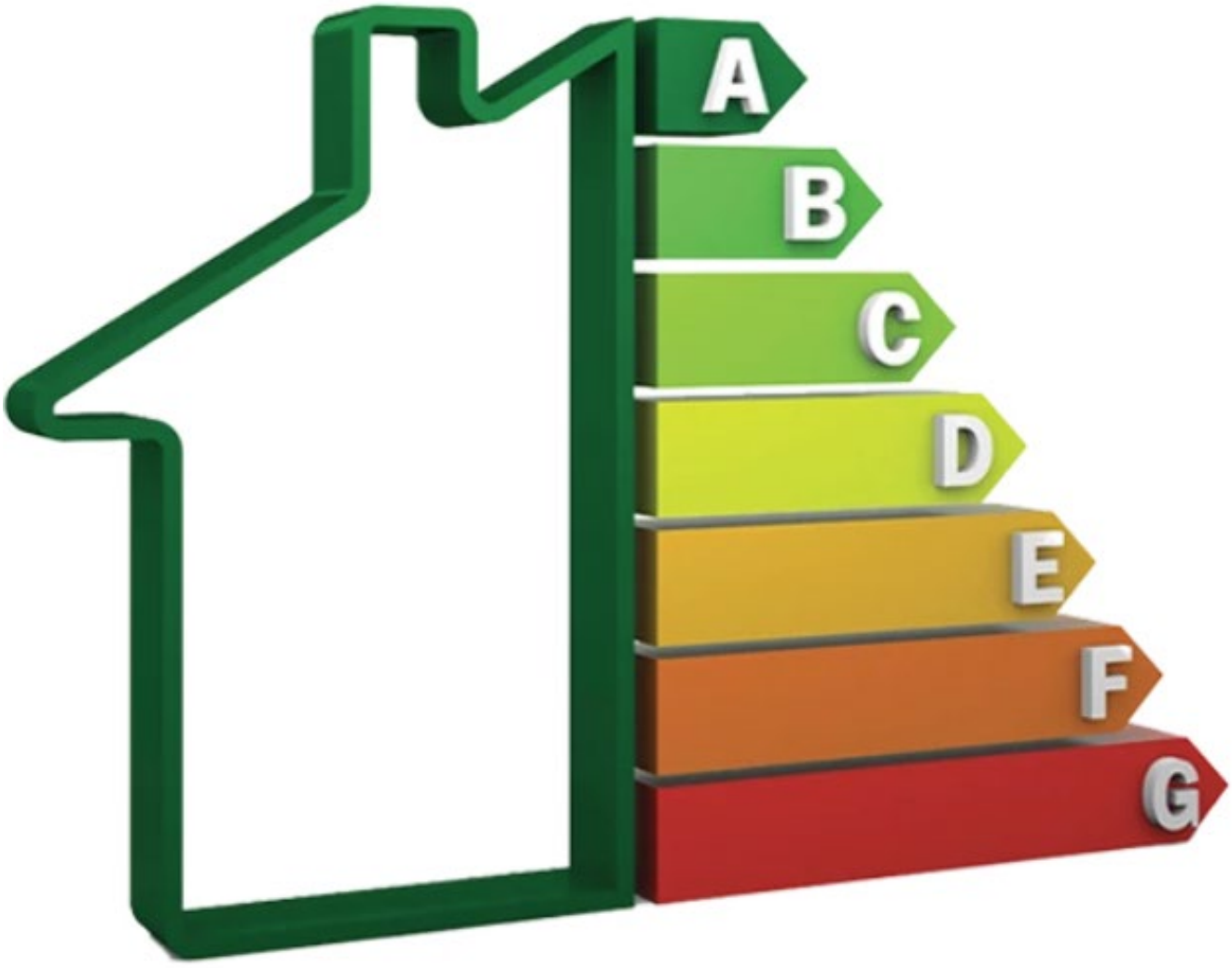

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Glossary of Key Terms

Agrément	Irish Agrément Board (IAB) is responsible for Agrément assessment and certification to ensure certified products are 'proper materials' suitable for their intended use under Irish site conditions, and per the Building Regulations.
Air Leakage	Air Leakage, aka infiltration, is the uncontrolled flow of air through gaps, cracks and holes in the fabric of the building and is typically expressed in one of two ways: 1. Air changes per hour (ACH @ 50 Pa) i.e. the number of times an hour that all of the air inside the building is replaced with external air, or 2. Air permeability ($m^3/h.m^2$) i.e. meters cubed per hour, per meter square of surface area
Air Permeability	Air Permeability is the physical property used to measure the airtightness of the building fabric. It is defined as air leakage per hour per square metre of envelope area ($m^3/h.m^2$) at a test reference pressure difference across the building envelope of 50 Pascals (Pa) or (50 N/m^2) i.e. $m^3/(h.m^2)$ @ 50 Pa. Air Permeability Testing must be completed by a NSAI or INAB Accredited Tester.
Airtightness	The extent to which unintended air leakage is prevented in a building, usually measured in $m^3/(h.m^2)$ at 50 Pa pressure differential. High airtightness (draught-proofing) improves energy efficiency but can limit natural airflow.
Boiler Interlock	This is not a physical device but is an arrangement of the system controls (room thermostats, programmable room thermostats, cylinder thermostats, Programmers and time switches) to ensure that the boiler only fires when there is a demand for heat.
Building Fabric	Building fabric (also known as building envelope) are the elements which make-up the outer shell of a building. These include walls, roofs, floors, windows and doors.
Building Renovation Passport	A Building Renovation Passports (BRP) is a dwelling-specific, homeowner-facing renovation Roadmap. The Roadmap is a masterplan for the deep energy retrofit of a dwelling which sets out the measures step by step for improving the energy performance of the building.
CIRI	Construction Industry Register Ireland (CIRI) is an online register of competent builders, contractors, specialist sub-contractors and tradespersons, known as 'registrants'.
Competent Person	Person who, having regard to the task they are required to perform and taking account of the size and/or complexity of the building or works, possesses sufficient training, experience and knowledge appropriate to the nature of the work to be undertaken. Competent installers should be accredited by Quality and Qualifications Ireland (QQI) or an Education Training Board (ETB) or possess equivalent qualifications.
Condensation, Interstitial	Interstitial condensation is the formation of liquid water within a building's hidden structural layers, such as walls, floors, or roofs, as warm, moist air cools to its dew point. If a building is not airtight warm humid air will leak outwards into the external envelope of a building structure, often occurring in areas where there's a temperature difference across a construction element, such as window and door reveals. Interstitial condensation risk analysis can be done via Hygrothermal assessment, I.S. EN 15026 and I.S. EN ISO 13788.
Condensation, Surface	Condensation on surfaces occurs when air passes its 'holding capacity' and liquid forms, often on cold, non-porous surfaces.
Contractor	Individual or company carrying out home energy upgrade measures supported by one or more of the programmes referenced in this document.

Dew Point	The temperature to which the air needs to be cooled for moisture to condense, for example, as dew.
Ductwork	A system or network of ducts. A duct is a tube or passageway in a building or machine allowing for air, liquid, cables, etc. to pass through.
Earthing / Bonding	Earthing / bonding must be carried out in accordance with I.S. 10101 National Rules for Electrical Installations. Earthing provides a low-resistance path for fault currents to return to the source or the earth. Bonding connects all the metallic parts of the system to ensure electrical continuity and equipotential.
EPBD	Energy Performance of Buildings Directive (EPBD) sets out a framework for reducing the energy consumption and greenhouse gas emissions associated with the built environment.
F-Gas	F-Gas Regulation supports refrigerants with a low Global Warming Potential (GWP) and the phase out of hydrofluorocarbons (HFCs) and other fluorinated gases (F-gases).
HARP	Home Heating Appliance Register of Performance (HARP) is an energy efficiency product database for domestic heating appliances which includes heat pumps, boilers (gas/oil/LPG /solid fuel), room heaters without back boiler (oil/gas/solid fuel), cooker boilers and solar water heating (aka “solar thermal”). HARP provides product data for BER assessors to use in DEAP.
HLI – Heat Loss Indicator	HLI, an output of DEAP, is the ratio of total heat loss from a dwelling quantified by the Heat Loss Coefficient (HLC) to total floor area which is calculated and termed the Heat Loss Indicator (W/(K.m^2), also called the HLI.
Hygrothermal Assessment	Hygrothermal risk assessment uses proprietary software to model how moisture and heat flow will affect building materials over time based on the material properties and local weather files. The modelling software runs a simulation to determine what is likely to happen in the different construction layers and determines the estimated water content of the materials hour-by-hour. This assessment is used to identify the long-term risk of interstitial condensation. Refer to I.S. EN 15026 and I.S. EN ISO 13788.
Indoor Air Quality	Indoor Air Quality (IAQ) is dependent on factors such as ventilation, pollutants like PM2.5, CO_2, VOCs and NO_2, and contaminants. IAQ is considered acceptable when no chemical and biological pollutants are present at harmful levels in the indoor air.
Indoor Environmental Quality	Indoor environmental quality (IEQ) is dependent on indoor air quality (IAQ) and hence ventilation, thermal comfort, visual comfort and acoustic comfort, see I.S. EN 16798-1.
Legionella	Legionella is bacteria that grows best in warm water, such as the water temperatures found in domestic heating systems. The bacteria are dormant below 20 °C and do not survive above 60 °C. All stored water (in the domestic hot water cylinder and any that is recirculated in sections of pipework) must have a legionella protection cycle (aka bacterial contamination disinfection routine) to periodically raise the temperature to at least ≥ 60 °C, and held there for at least one hour, at least once per week.
Load/weather compensation	Adjusts the temperature at which the heating system operates based on demand and/or weather conditions.

Major Renovation	'Major Renovation' is the renovation of a building where … more than 25 % of the surface of the building envelope undergoes renovation, as defined in EPBD Article 2(10). The 'surface area of the building thermal envelope' means the entire surface area of a building through which it can lose heat to the external environment or the ground, including all heat loss areas of walls, windows, floors and roof. Major renovation requirement can be activated by works to a single element or to a combination of elements as per TGD L.
Measure	An Energy Efficiency Measure (EEM) is planned work undertaken to improve the energy performance of a dwelling by saving or generating energy.
Motorised valve	Electrically controlled valves used in central heating systems to control the flow of heated water.
Power Flush	Power Flushing removes debris and sludge from a central heating system with the use of a power flushing pump.
Pressure Relief / Release Valve	A valve used to limit the build-up of excessive pressure in a heating system. The pressure is relieved by allowing the over-pressurised water to flow from a discharge pipe out of the system.
Programme	One of several SEAI Home Energy Upgrade programmes as detailed in Clause 1 of this document.
Proper Materials	Materials which are suitable for their intended use under Irish site conditions and certifies compliance with the requirements of the Building Regulations. As per TGD D "proper materials" includes materials which are in accordance with the provisions of the Construction Products Regulation, i.e.: (a) CE Mark; (b) comply with an appropriate harmonised standard or European Technical Assessment (ETA); or (c) comply with an appropriate Irish Standard or Irish Agrément Certificate or with an alternative national technical specification of any State which is a contracting party to the Agreement on the European Economic Area (EEA), which provides in use an equivalent level of safety and suitability.
QQI	QQI Quality and Qualifications Ireland (QQI) is an amalgamation of Further Education and Training Awards Council (FETAC); the Higher Education and Training Awards Council (HETAC); the Irish Universities Quality Board (IUQB) and the National Qualifications Authority of Ireland (NQAI). Awards made by QQI are recognised within the National Framework of Qualifications (NFQ).
R-value	R-value (aka thermal resistance) is a measure of the material's insulation capacity i.e. measures how well a particular thickness of material resists heat transfer through thermal conduction, expressed as m^2K/W.
REC	A Completion Certificate No. 3 is issued by a Safe Electric Registered Electrical Contractor (REC) when existing wiring is renewed or extended.
RGI	Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3) are issued by a Registered Gas Installer (RGI) of Safe Energy Ireland.

Remote Fire Valve	This valve is installed on an oil supply line as a safety precaution. If a fire occurs near the boiler this valve will close, preventing more oil flowing to the fire.
Retrofit	A retrofit or home energy upgrade enhances the energy performance of a home. A deeper home energy retrofit involves carrying out multiple energy upgrade measures together and may include wall and roof insulation (ceiling and rafter), replacing windows and doors, addressing airtightness and ventilation and installing an efficient renewable heating system (such as a heat pump), as well as other renewable energy technologies (such as solar PV panels).
Space and Hot Water Zones	Allow the user to separately heat different areas of the home e.g. Upstairs and downstairs or living areas and sleeping areas. The hot water zone only heats hot water for use with showers, baths, sinks etc.
Space Heating	Refers to heating physical space and volume, for example the rooms in the home.
Thermal Bridge	A thermal bridge, aka cold bridge, is a localised weakness or discontinuity in the thermal envelope (the insulation layer) of a building. Non-repeating thermal bridges, aka linear thermal bridges, tend to occur where elements of construction meet, such as at the junction of floor and wall, wall and roof and around openings. Thermal bridges generally occur when the insulation is interrupted by a more conductive material. Thermal bridging can greatly reduce the effectiveness of insulation. Localised 'cold-spots' can lead to issues such as damp cold walls, condensation build-up and mould growth.
Thermal Bypass	Thermal bypass (aka thermal looping) is any form of air movement that undermines the thermal performance of a building. Thermal bypass, like air leakage, exploits gaps in construction wherein air moves through the building envelope. Where thermal bypass occurs the heat is transferred through or around insulation, reducing its effectiveness.
Thermal Comfort	Thermal comfort measures a person's satisfaction with their thermal environment.
Thermal Conductivity	Thermal Conductivity (λ or k-value) is the quantity of heat transmitted through a unit thickness of a material.
Thermal Mass	Thermal mass is the capacity that all materials have to absorb heat energy and store it, releasing it again when the surroundings are cooler.
Thermostat, Cylinder	A thermostat fixed to the hot water cylinder. It tells the boiler not to fire when there is enough hot water in the cylinder.
Thermostat, Room	A thermostat in a central heating zone (normally positioned on the wall). It tells the boiler not to fire when the desired temperature has been reached in the heated space.
Thermostatic Mixing Valve (TMV)	This valve is installed on the outlet of the hot water cylinder or a tap. This device mixes cold water with the hot water from the water supply to produce a lower temperature hot water "mix", which can safely be used in taps and showers.
Thermostatic Radiator Valve (TRV)	Radiator valve including an air temperature sensor. TRVs control the heat output from the radiator by adjusting water flow.

U-value	A U-value (aka thermal transmittance) is a measure of heat loss through a material in a component i.e. the rate at which heat passes through a building component or structure e.g. wall, roof, floor. The lower the U-value, the more effective it is at preventing heat transfer. It is expressed in units of watts per square metre per degree of air temperature difference (w/m^2k). U-values are calculated according to the standards detailed in TGD L, I.S. EN ISO 6946, DEAP methodology and BR 443 – Conventions for U-value calculations.
Utility room	A room typically used for laundry purposes, usually containing a sink, washing machine, tumble drier or similar equipment and not entered solely from outside the building.
Vapour Barrier	This is a continuous vapour control layer (VCL) / airtight impermeable material on the warm (interior) side of the insulation which limits the risk of interstitial condensation.
Ventilation, Background	Supply of fresh air and control pollutant and water vapour levels. This can be provided through natural or mechanical means. Natural background ventilation is normally provided through a closable wall vent or trickle vent located in the window frame.
Ventilation, Cross	Cross-ventilation is the ability to ventilate using openings on opposite façades of a dwelling.
Ventilation, Demand Controlled Ventilation (DCV)	Demand Controlled Ventilation (DCV) is a system that provides automatic regulation of the ventilation system by sensing the Indoor Air Quality (IAQ) and determining the required air change rate.
Ventilation, Intermittent Extract	Intermittent Extract Ventilation (IEV) system uses extractor fans in the kitchen and bathrooms which turn on and off. The fans can be controlled by a timer, light switch, or sensor.
Ventilation, Mechanical Ventilation with Heat Recovery (MVHR)	Mechanical Ventilation with Heat Recovery (MVHR) is a ventilation system in which air is recycled using ducts and can be reused within the building for heating or cooling purposes.
Ventilation, Natural	Natural Ventilation relies on natural forces (wind and buoyancy) and passive devices like wall vents or trickle vents, without continuous operating mechanical fans in wet rooms.
Ventilation, Permanent	Permanent ventilation is required to supply air to an open flued combustion appliance such as a stove, gas fire, open fire etc. Open flued appliance means that the appliance is drawing air from the room in which it is located. For this reason, the room requires a non-closable vent for safe use of the appliance.
Ventilation, Purge	The act of temporarily opening windows or doors to rapidly dilute indoor pollutants. It is often controlled by occupants.
Warranty	Warranties provide assurance that products and/or services meet certain expectations, e.g. fit for purpose, being free from defects and comply with statutory and other regulations and specifications.
Wet room	A room where moisture is created through cooking, showering, drying clothes etc., e.g. Kitchens, utility rooms, bathrooms / showers.
Works	'Works' includes any act or operation in connection with the construction, extension, alteration, repair or renewal of a building.

Key Acronyms

ACA	Architectural Conservation Area
BEH	Better Energy Homes
BER	Building Energy Rating
BRE	Building Research Establishment
BRP	Building Renovation Passport
BV	Background Ventilation
CIBSE	Chartered Institution of Building Services Engineers
CPR	Construction Products Regulation
CRU	Commission for Regulation of Utilities
CWST	Cold Water Storage Tank
DEAP	Dwelling Energy Assessment Procedure
DHLGH	Department of Housing, Local Government and Heritage
DHW	Domestic Hot Water
DPC	Damp Proof Course
DPM	Damp Proof Membrane
DPP	Digital Product Passport
DTSS	Domestic Technical Standards and Specifications
EEOS	Energy Efficiency Obligation Scheme
EHPA	European Heat Pump Association
EPA	Environmental Protection Agency
EPBD	Energy Performance of Buildings Directive
ESPR	Ecodesign for Sustainable Products Regulation
ETICS	External Thermal Insulating Composite Systems
EV	Electric Vehicles include battery electric (BEV) and plug-in hybrid (PHEV) electric vehicles

GPSR	EU General Product Safety Regulation (EU) 2023/988 (GPSR)
GSI	Geological Survey Ireland
HARP	Home-heating Appliance Register of Performance
HLI	Heat Loss Indicator
HPAI	Heat Pump Association of Ireland
HEULS	Home Energy Upgrade Loan Scheme
IAB	Irish Agrément Board (IAB)
IDHEE	Institute of Domestic Heating and Environmental Engineers
IEQ	Indoor Environmental Quality
LED	Light Emitting Diode
LPA	Local Planning Authority
LPG	Liquefied Petroleum Gas
MEPS	Minimum Energy Performance Standards (EPBD Art.9)
MCS	Microgeneration Certification Scheme
MPRN	Meter Point Reference Number
MVHR	Mechanical Ventilation with Heat Recovery
NFQ	National Framework of Qualifications
NPWS	National Parks and Wildlife Service
NSAI	National Standards Authority of Ireland
OFTEC	Oil Firing Technical Association
OSS	One Stop Shop
PIR	Periodic Inspection Report
PV	Solar photovoltaic (PV) panels
QADP	Quality Assurance and Disciplinary Procedure
QQI	Quality and Qualifications Ireland

REC	Registered Electrical Contractor
RGI	Registered Gas Installer
RPS	Record of Protected Structures
SCOP	Seasonal Coefficient of Performance
SEAI	Sustainable Energy Authority of Ireland
SPF	Seasonal Performance Factor
S.R. 54	S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings (NSAI)
TAS	Technical Assessment Specification
TGD	Technical Guidance Document
TMV	Thermostatic Mixing Valve
TRV	Thermostatic Radiator Valve
WEP	Window Energy Performance
WHS	Warmer Homes Scheme (WHS)

Domestic Technical Standards and Specifications (DTSS) - Purpose

The Domestic Technical Standards and Specifications (DTSS) document is a reference for Contractors carrying out home energy upgrade works supported by SEAI programmes under:-

- Better Energy Homes (BEH) Scheme
- Community Energy Grant (CEG) scheme
- Energy Efficiency Obligation Scheme (EEOS)
- One Stop Shop (OSS), under the National Home Energy Upgrade Scheme (NHEUS)
- Warmer Homes Scheme (WHS) under the Fully Funded Energy Upgrade programme

DTSS informs on the standards and specifications that Contractors are expected to adhere to, and the minimum level of competence required in carrying out home energy upgrade grant works supported by the Programmes. Homeowners may also reference this document when works are being carried out.

For most matters related to other aspects of home energy upgrade grant works, such as their conduct and practices, Contractors and other stakeholders should refer to programme-specific documentation and terms and conditions.

Domestic Technical Standards and Specifications (DTSS) - Clauses

Domestic Technical Standards and Specifications (DTSS) clauses set out the general approach on how home energy upgrade measures can be achieved. Whilst some sections of the DTSS may be more relevant to certain Contractors than others, it is the responsibility of ***all*** Contractors to read and understand the DTSS, SEAI home energy upgrade measures and each of their specific requirements, prior to commencing work.

Understanding the DTSS clauses is paramount when considering home energy upgrade works and Contractors are ***always*** required to read, understand and adhere to the DTSS clauses, as outlined below:

- **Clause 1** describes each of the SEAI home energy upgrade grant programmes. Table 1 outlines the measures covered by each SEAI programme.

- **Clause 2** provides an overview of building regulations and planning regulations, describes general requirements and standards applicable to all Contractors, and provides details for products and installations across multiple home energy upgrade measures.

  Planning Permission and Building Regulations are separate codes and have different purposes. Planning legislation relates to the external appearance of buildings, impact on the environment, the use of buildings, spatial policy and the safeguarding of amenities. Building Regulations legislate for safe, accessible, environmentally sustainable buildings and require building work to be carried out in accordance with the construction principles and standards set out in the regulations.

- **Clause 3** provides an overview of relevant safety, health and welfare standards and considerations.

- **Clause 4** details ventilation requirements and is applicable for several of the measures covered by this document (e.g. measures including installation of insulation, windows, doors, space heating, airtightness upgrades, ventilation systems). A Ventilation Validation Certificate is required for major renovations. All Contractors carrying out measures specified in Clause 4 must have a thorough understanding of this clause.

- **Clause 5** provides guidance on Traditional Buildings, Protected Structures and Architectural Conservation Area. Implementation of some measures may be prohibited/restricted by the guidance in this clause.

- **Clause 6** Home Energy Upgrades relates to best practice for specific energy efficiency measures. Clause 6 sets out the requirements for Contractors, products / systems and installations for each measure. Contractors must read, understand and adhere to Clause 6 for each home energy upgrade measure.

- Appendices 1 and 2 summarise the relevant standards and references for the measures detailed in Clause 6 and are a useful means for Contractors to check that they are adhering to the correct standards/references. However, following these appendices alone does not preclude the requirement to adhere to the relevant clauses outlined above.

SEAI advise ***all*** Contractors to carefully read, understand and adhere to the guidance in DTSS Clauses 1, 2, 3, 4, 5 and 6 and follow the guidance under Clause 6 for measures on home energy upgrades.

Disclaimer

For all works detailed in this Domestic Technical Standards and Specifications (DTSS) document and for each home energy upgrade Programme, Contractors must carry out works in accordance with this document, regardless of whether they are required to register with SEAI for a given scheme. Contractor registration is a mandatory requirement to carry out SEAI Home Energy Upgrade funded grant works on some Programmes. Details of registration requirements can be found in Programme-specific terms and conditions and guidelines.

NOTE The owner of the building, the designer who designs the works, and the contractor / builder who carries out the works are responsible, under law, for compliance with Building Regulations and Building Control Regulations.

The provision of products, services and/or measures by Contractors to homeowners of the home energy upgrade Programmes is entirely a matter between the Contractor and the homeowner.

SEAI accepts no liability or responsibility, whether for breach of contract, breach of duty, negligence, health and safety violations or otherwise, in respect of any dispute, claim or cause of action arising out of, or in relation to, any product, equipment, work, alteration (including unclipping, replacement or reinstatement) of service cables / aerial wires to a domestic house, system or installation supplied or carried out by the installer or Contractor under the Programmes. The Contractor is entirely responsible for all such matters.

The information contained in the DTSS does not purport to be legal, professional or commercial advice or a definitive interpretation of any law.

While every care has been taken to provide accurate, complete, reliable and effective information on standards, SEAI gives no warranties (express or implied), undertakings or guarantees as to its accuracy in this regard. SEAI accepts no liability or responsibility for the content or accuracy, completeness, reliability or effectiveness of the information provided herein or for any loss or damage caused arising directly or indirectly in connection with reliance on the use of such information.

Where SEAI provides links to external websites, these are provided for convenience and informational purposes only and such provision does not constitute an endorsement of any company, product, process or content. SEAI has no control over external websites and assumes no responsibility or liability for same.

The DTSS is regularly reviewed, and is subject to revision, with the current version of the DTSS published on the SEAI website.

Domestic Technical Standards and Specifications (DTSS) document is not intended to constitute a contract.

1. SEAI Home Energy Upgrade programmes : Introduction

Sustainable Energy Authority of Ireland (SEAI) is Ireland's national sustainable energy authority established under the Sustainable Energy Act 2002. SEAI's mission is to be at the heart of delivering Ireland's energy revolution. SEAI's Home Energy Upgrade suite of programmes include domestic retrofit works under the following:

1.1 Better Energy Homes

1.2 One Stop Shop

1.3 Warmer Homes Scheme

1.4 Community Energy Grant

1.5 Energy Efficiency Obligation Scheme

The measures supported by the programmes listed above are outlined in Table 1. Contractors carrying out works on dwellings funded by these Programmes must adhere to the regulations, standards and requirements for installers, products and installation detailed in Clause 6 of this document.

Specific home energy upgrade eligibility requirements for dwellings (e.g. dwelling age) and Contractors (e.g. Contractor Registration) are detailed on the SEAI website for each Programme.

1.1 Better Energy Homes

Better Energy Homes (BEH) offer grants to homeowners for individual energy upgrades under the Better Energy Homes Scheme. Homeowners apply for the grant, select home energy upgrade measures, select their preferred SEAI registered contractor, manage the project, and pay for the full costs of works and claim the grant afterwards. The measures supported include roof insulation at ceiling and rafter level, wall insulation, heating system upgrades and controls, renewable energy technologies, heat pumps, solar water heating (solar thermal) and solar electricity (under the Solar PV Scheme), see DTSS Table 1.

The BEH Code of Practice for Contractors providing services on the scheme should be read in conjunction with the DTSS.

1.2 One Stop Shop

One Stop Shop (OSS), under the National Home Energy Upgrade Scheme (NHEUS), provides an end-to-end solution for homeowners from initial contact through to design, installation, commissioning and after care service for the homeowner. The OSS service is delivered by companies who are registered with SEAI. OSS manage a Home Energy Assessment (HEA), see Clause 6.29, provide advice to the homeowner on suitable options, apply for the grant, complete the works and then claim the grant from SEAI.

1.3 Warmer Homes Scheme

Warmer Homes Scheme (WHS), under the Fully Funded Energy Upgrade Scheme, is a fully funded and fully managed solution for qualifying homeowners in receipt of certain Department of Social Protection payments to upgrade their home with measures identified from a home energy survey. The Programme and its eligibility criteria are detailed on the SEAI website.

SEAI manage the whole upgrade process from home energy survey, through contractor works, and follow up BER. SEAI's technical surveyor will determine which upgrades can be installed and funded.

The upgrades of an eligible property will depend on many factors, including age, size, type, and condition of the property. Apart from replacement windows funding, the covered home improvements generally

include attic insulation at ceiling level, external, cavity and internal wall insulation, heating system upgrade, draught-proofing, ventilation and lagging jackets. These measures make the homes more comfortable, healthier and more cost effective to run. DTSS Table 1 lists the measures funded by WHS.

1.4 Community Energy Grant

The Community Energy Grant (CEG) Scheme supports the aggregation of a diverse set of energy upgrade projects from across the community, including home energy upgrades, community, public sector, and private projects. The projects are led by a project coordinator and involve a local sustainable energy community. The primary objective is to support the delivery of home energy upgrades alongside non-domestic energy projects, which support the engagement of communities to build low-carbon and sustainable communities.

The aggregated applications typically support energy upgrade projects across communities and geographic areas. A range of projects in a single application typically include a group of home energy upgrades, community buildings and business energy upgrade projects.

The project coordinators who aggregate and deliver these projects use the energy savings generated to receive a financial contribution from Obligated Parties under the Energy Efficiency Obligation Scheme (EEOS). This lowers the cost for participation particularly for homeowners and communities.

1.5 Energy Efficiency Obligation Scheme

Under the Energy Efficiency Obligation Scheme (EEOS) energy suppliers and distributors (otherwise known as Obligated Parties) must support energy efficiency projects in businesses and homes across Ireland. All Obligated Parties are set annual energy efficiency targets based on their market share in the energy industry from selling gas, electricity, oil and/or solid fuel above a threshold volume level. There are sub-targets for energy savings from the residential sector and homes in energy poverty. Obligated Parties earn energy credits that contribute to their overall targets.

All users of energy can apply to any energy supplier for financial support for an energy-saving project. Every unit of energy saved by an energy saving project in conjunction with an obligated party has the potential to be reported as an energy credit. For an obligated party to claim energy credits, they must support the installation in some way, and they must be involved in the project before the energy saving measures were installed.

The property owner must give written consent to the Obligated Party agreeing to assign energy credits to them (refer to www.seai.ie/.../EEOS-Guidance-Document).

Energy Efficiency Obligation Scheme (EEOS) measures are detailed in Table 1. The requirements for implementation of these measures under all schemes are detailed in Clause 6.

1.6 Home Energy Upgrade Loan Scheme

Home Energy Upgrade Loan Scheme (HEULS) is available for home energy upgrade works following a Building Energy Rating (BER) assessment and Home Energy Summary Report detailing qualifying home energy upgrades. Strategic Banking Corporation of Ireland (SBCI) is responsible for HEULS.

The relevant SEAI grant schemes and intermediaries in relation to the HEULS are:
· National Home Energy Upgrade Scheme (using a One Stop Shop)
· Community Energy Grant Scheme (using a Project Co-Ordinator)

Further details on each of the SEAI Home Energy Upgrade schemes are on the SEAI website, www.seai.ie.

BEH Better Energy Homes Scheme
CEG Community Energy Grant Scheme
EEOS Energy Efficiency Obligation Scheme
HEULS Home Energy Upgrade Loan Scheme
OSS One Stop Shop service under the National Home Energy Upgrade Scheme (NHEUS)
WHS Warmer Homes Scheme under the Fully Funded Energy Upgrade Scheme

Click on the relevant clause number in Table 1 to go directly to the section of Clause 6 detailing requirements for a particular Home Energy Upgrade measure.

Table 1 : Home Energy Upgrade measures under SEAI grant funded schemes

Clause	Measure	BEH	OSS	WHS	CEG	EEOS
6.1	Insulation : Cavity Wall Insulation	✓	✓	✓	✓	✓
6.2	Insulation : External Wall Insulation	✓	✓	✓	✓	✓
6.3	Insulation : Internal Wall Insulation	✓	✓	✓	✓	✓
6.4	Insulation : Roof Insulation - Ceiling Level	✓	✓	✓	✓	✓
6.5	Insulation : Roof Insulation - pitched roof at Rafter Level (Cold Roof)	✓	✓		✓	✓
6.6	Insulation : Floor Insulation		✓		✓	✓
6.7	Mechanical Extract Ventilation (cMEV) and Mechanical Ventilation with Heat Recovery (MVHR)		✓	✓	✓	✓
6.8	Heat Pump Systems	✓	✓	✓	✓	✓
6.9	High Efficiency Boilers					
6.10	Boiler Service					
6.11	Biomass Boilers (with/without thermal storage)					✓
6.12	Heating Controls – Fully Integrated	✓	✓		✓	✓
6.13	Heating Controls with Remote Access – Fully Integrated					
6.14	Heating Controls – Entry Level					
6.15	Heating Controls with Remote Access – Entry Level					
6.16	Stoves : Solid Multi-Fuel Heating System					
6.17	Gas Fired Room Heater					
6.18	Storage Heaters - High Heat Retention			✓		✓
6.19	Power Flush of Heating System			✓		
6.20	Power Flush and Magnetic Filter of Heating System			✓		
6.21	Domestic Hot Water Storage : High Heat Retention Cylinders					✓
6.22	Draught-Proofing			✓		
6.23	Chimney Draught Limiter			✓		
6.24	Door Replacement	✓	✓	✓	✓	✓
6.25	Window Replacement	✓	✓	✓	✓	✓
6.26	Window Secondary Glazing					
6.27	Window Glazing : Low-emissivity (Low-E)					
6.28	Lighting - LED			✓		
6.29	Home Energy Assessment (HEA) Reports		✓	✓		✓
6.30	Electricity Energy Monitors			✓		
6.30	Shower Energy Monitors			✓		
6.31	Solar Electricity [1]	✓	✓	✓	✓	✓[1]
6.32	Solar Water Heating	✓	✓		✓	✓
6.33	Electric Vehicle Chargers [2]					

[1] Solar PV Scheme (solar electricity) operates under the Microgeneration Support Scheme (MSS) through SEAI. EEOS does not allow credits for Solar PV installations, but where Solar PV is installed as part of a wider system, it must be installed to the requirements referenced in the Code of Practice.

[2] Funding for the EV Home Charger scheme is provided by Zero Emission Vehicles Ireland (ZEVI) based in the Department of Transport. SEAI operates this grant scheme on behalf of ZEVI.

2. Home Energy Upgrades : General Requirements

This document makes use of the terms 'must', 'shall' and 'should' when prescribing requirements and procedures. In this document:

- terms "must", "shall", "required", "requirements" are for mandatory conditions to be complied with in full when implementing measures described in this document unless otherwise stated in the text describing the condition;

- terms such as "should" and "recommended" are for conditions that are intended to be complied with when carrying out measures, unless reasonable justification can be given as to why the recommendation was not carried out;

- The requirements of the NSAI's Standard Recommendation S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings (S.R. 54), are referenced throughout this document, are ***to be considered mandatory*** unless otherwise stated.

  S.R. 54 is available, free of charge, from both the NSAI and SEAI websites:
  - NSAI shop.standards.ie
  - SEAI www.seai.ie

For specific SEAI home energy upgrade programme conditions refer to the relevant Code of Practice and / or programme documentation.

Clauses 4, 5 and 6 detail the Contractor, product and installation standards and specifications required for the measures covered by this document. DTSS Appendix 2 summarises these standards and specifications.

2.1 Building Regulations

Building Regulations are a set of legal requirements for the design and construction of new buildings, major renovations, extensions and material alterations to and certain changes of use of existing buildings. Guidance on compliance with the various parts of the Building Regulations is given in the associated Technical Guidance Documents (TGD). There is extensive detail in the Technical Guidance Documents (TGD) and Building Regulations on DHLGH's www.gov.ie/.../Building Standards website.

For works outlined in this document the relevant sections include Building Regulations set out in 12 parts (classified as Parts A to M) as follows:-

- Part A Structure
- Part B Fire Safety - Volume 2 Dwelling Houses
- Part C Site Preparation and Resistance to Moisture
- Part D Materials and Workmanship
- Part E Sound
- Part F Ventilation
- Part G Hygiene
- Part H Drainage and Waste Water Disposal
- Part J Heat Producing Appliances
- Part K Stairways, Ladders, Ramps and Guards
- Part L Conservation of Fuel and Energy
- Part M Access and Use

The contractor must adhere to the current version of the Building Regulations, at all times. All works to which these Building Regulations apply shall be carried out with proper materials and in a workmanlike manner, as per TGD D.

2.2 Planning Regulations

The planning system aims to ensure that the right development takes place in the right locations and at the right time.

Planning Regulations may apply to retrofit works depending on the scope and nature of the works. Planning permission is overseen by the local planning authority (LPA) and is designed to prevent inappropriate building and developments, ensuring that all construction complies with local planning and environmental guidelines.

Any development to a property, even if minor, listed on the Record of Protected Structures (RPS) or located within an Architectural Conservation Area may require planning permission (refer to Clause 5).

To ensure compliance with both building regulations and planning regulations it is important to check the specific regulations and guidelines before starting retrofit measures as certain works or changes of use to a property, in Ireland, ***may*** require planning permission.

Works or Change-of-Use that require Planning Permission

- **Building extensions**: The size and type of extension such as a new room or conservatory that changes the overall appearance of a property.

- **Change-of-Use**: Modify the purpose of a building, such as converting a property from one type to another, e.g. turning a residential property into a commercial space or vice versa.

- **Alterations to the exterior of a property**: Alterations that affect the design and aesthetics of a property or leave the external appearance of the building inconsistent with neighbouring buildings e.g. major external renovations, extensions, window installation and glazing, alteration of the front profile of a property e.g. adding a porch or installation of external wall insulation (refer to Clause 6.2), in certain cases. Further guidance is available under S.I. No. 497/1997.
  NOTE Not all exterior alterations require planning permission once certain conditions are met.

Exempted Development and Minor Works

- Exempted development is development for which planning permission is not required. Exceptions to planning permission requirements relate to home energy upgrade measures, such as internal changes and minor alterations. These retrofit measures are known as "exempted developments" or "minor works" that have minimal impact on the property or its surroundings. The exemptions are detailed in the Planning and Development Act.

  Even though some works may be exempt from planning permission requirements, the works still need to comply with building regulations, technical standards and any other relevant laws.

  Under Exempted Development (Section 5) of the Planning and Development Act a person can seek a formal declaration from their local planning authority (LPA) on whether a proposed development, or any part of it, is considered exempted development i.e. a project can proceed without the need for formal planning permission.

SEAI recommends consulting with the local planning authority who will advise whether planning permission is necessary, in a particular case.

Further Guidance

- "*Bringing Back Homes - Manual for the reuse of existing buildings*" published by DHLGH.
- Office of the Planning Regulator and DHLGH series of planning leaflets deal with all aspects of the planning system. Refer to www.opr.ie/planning-leaflets

2.3 Product Certification : Agrément Certificate

Part D (Material and Workmanship) of the Building Regulations sets out an overarching requirement that all works are carried out using proper materials, which are fit for the use for which they are intended and for the conditions in which they are to be used within Ireland. It further notes that proper materials include materials which:

a. bear a CE Marking in accordance with the provision of the Construction Products Regulation (CPR No. 2024/3110);

b. comply with an appropriate Harmonised European Standards (hEN) or European Technical Assessment (ETA) in accordance with the provision of the Construction Products Regulation;
or

c. comply with an appropriate Irish Standard or Irish Agrément Certificate
or
with an alternative national technical specification of any EEA country, which provides in use an equivalent level of safety and suitability.

The European Technical Assessment (ETA) provides a basis for CE marking of construction products enabling the product to be placed anywhere in the EU market. The assessment is carried out by an independent third party, such as the Irish Agrément Board (IAB).

NOTE CE marking reflects both technical performance and environmental impact, ensuring products meet comprehensive safety and sustainability requirements. CE Marking must be accompanied by a valid up-to-date EU Declaration of Performance and Conformity (DoPC).

2.3.1 Declaration of Performance and Conformity (DoPC)

Declaration of Performance and Conformity (DoPC) includes product performances in relation to essential characteristics, environmental sustainability performance over the product's life cycle in respect of predetermined environmental essential characteristics and, where applicable, verification of the fulfilment of product requirements. General product information, instructions for use and safety information is also provided in relation to construction products covered by harmonised technical specifications.

When choosing products most suitable for their intended use in construction works the contractor should review and take into consideration the manufacturer's Declaration of Performance and Conformity (DoPC) for specific intended uses of the product in Ireland.

2.3.2 Irish Agrément Certificate

The Agrément process is designed specifically for new innovative building materials, products and systems that do not yet have a long history of use and for which there may be no national standard, harmonised European product standard (hEN) or European Technical Assessment (ETA).

Irish Agrément Certificates establish proof that certified products are 'proper materials' suitable for their intended use under Irish site conditions and certifies compliance with the requirements of the Irish Building Regulations. Each Agrément Certification process involves a five (5) year review. A Technical Assessment Specification (TAS) sets out the technical criteria for the assessment and testing of the system, which can include laboratory test results, on-site evaluations, and on-site inspection plans. The TAS is developed with reference to the Irish Building Regulations Parts A to M and the technical guidance documents (TGD)s.

Irish Agrément Certificate or 'equivalent' refers to products which are certified to the Irish Agrément Certification standards or to an alternative national technical specification of any State which is a contracting party to the Agreement on the European Economic Area (EEA), and which provides in use an equivalent level of safety and suitability for its intended use under Irish site conditions.

Agrément Certificate equivalence confirms products were assessed against Parts A to M to the Irish Buildings Regulations and the appropriate Technical Guidance Documents (TGDs) are listed in the Agrément Certificate demonstrating a product is fit for use and complies with the Building Regulations.

To install an Irish Agrément certified system, the contractor must be an Approved Installer of the relevant system and registered with NSAI. NSAI maintain an up-to-date web register of Approved Installers[3].

2.4 Warranties and Undertakings

The Contractor will notify the homeowner of the warranty information and its terms, including repair or replacement of the equipment and each of its components, prior to commencement of the works and provide the relevant documents to the homeowner upon completion of the works. General handover documentation will include product manufacturer installation and servicing instructions, user manuals/guides, Warranty and/or guarantee (if applicable), and Irish Agrément documentation.

The provision of products and/or services by Contractors to homeowners under the SEAI home energy upgrade grant programmes is entirely a matter between the Contractor and the homeowner. SEAI does not provide any warranty or guarantee concerning the completeness, effectiveness, reliability, accuracy or otherwise of the standards referenced in this document or any work carried out on foot of such standards, refer to DTSS Disclaimer. This does not affect a homeowner's statutory rights.

2.5 General Works Requirements

A home energy upgrade or retrofit enhances the energy performance of a home. Works are required to meet the overall objective of the SEAI Grant Programmes, which is to achieve energy and carbon savings. The design, materials and workmanship of home energy upgrade measures shall comply with the relevant Building Regulations current at the date of the completion of the works. All products must be new, fit for purpose, improve the energy efficiency of the building and have no detrimental impact on the structure, viability, quality or safety of the property. All products must meet applicable product regulations and standards, and any additional requirements detailed in this document. Adherence to applicable standards is required in relation to the materials used and their installation.

The works must not compromise the ventilation, indoor air quality, humidity (and the potential for condensation) and quality of living environment in the home. Consideration must be given to the potential impact on the living environment in the home resulting from any measures installed under the Programmes. The Contractor must avoid making any detrimental changes to the living environment ***and***, where required, recommend to the homeowner any measures necessary to ensure there is no detrimental change to the living environment because of the works (See Clause 4 Ventilation).

NOTE Homes undergoing major renovation can pose a risk of overheating due to the housing design such as large areas of south facing windows[35], high levels of insulation, low air permeability rates and low thermal mass. Situations where an overheating risk is indicated need to be identified as early as possible to allow appropriate changes to be incorporated into the design[14]. Refer to CIBSE TM59 Assessment of overheating risk in homes and CIBSE TM37 Design for improved solar shading control.

[3] Agrément Registered Installers www.nsai.ie/agrement-registered-installers

2.5.1 Best Practice Guidance

All works should be carried out in accordance with building regulations, planning regulations, technical guidance documents, best practice and the standards and specifications outlined in the DTSS, which include, but are not limited to:

- Building Regulations and Technical Guidance Documents (TGD)
- International and European standards (ISO and EN), Irish standards (I.S.) or British standards (BS)
- CE Mark or Irish Agrément Certificate (or equivalent)
- S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings S.R.54_2014
- System Designer / System Supplier/ Product Manufacturer Guidelines

Regulatory, standards and technical guidance documents are available on:

- Building Regulations and Technical Guidance document (TGD) www.gov.ie/.../Building Standards
- Irish Standards (annotated I.S.) shop.standards.ie
- National Standards Authority of Ireland (NSAI) www.nsai.ie
- Chartered Institution of Building Services Engineers (CIBSE) www.cibse.org
- Commission for Regulation of Utilities (CRU) www.cru.ie
- British Standards (annotated BS) knowledge.bsigroup.com
- UK Building Research Establishment bregroup.com
- UK Energy Saving Trust energysavingtrust.org.uk

Irish Standards

Standards are officially approved criteria designed to ensure that products and services meet minimum thresholds in terms of functionality, performance, structure etc.

European Standards and International Standards can be given the status of Irish standards, 'I.S. EN' and 'I.S. ISO', respectively. An International Standard published by ISO, adopted as a European Standard and then adopted by Ireland will have the prefix 'I.S. EN ISO'.

Irish Standards (I.S.) are a source of information on the performance characteristics of construction products. Irish standards (I.S.) are often prescriptive in nature, specifying testing methods and the performance requirements of construction products for particular intended uses, in Ireland. Standard Recommendations (S.R.), published by NSAI, provide guidance on the appropriate minimum performance levels for specific intended uses of the products in Ireland.

2.6 General Contractor Requirements

For all SEAI home energy upgrade grant programmes covered by this DTSS, works must be carried out by competent persons, possessing sufficient training, experience and ability, knowledge and understanding appropriate to the nature of the work he or she is required to perform and having particular regard to the size and complexity of such works. Workmanship should comply with all requirements of the building regulations.

Registered SEAI contractors and installers shall ensure that sub-contractors are competent to carry-out work they are subcontracted to do. The specific competency standard relating to each home energy upgrade measure, supported by all SEAI grant Programmes, is detailed under each measure in Clause 6.

It is the responsibility of the contractor / installer to consider whether the works being undertaken would be considered "Major Renovation" as defined by the Building Regulations, refer to TGD L.

Refer to Programme-specific documentation on further requirements for Contractors (e.g. registration).

2.7 Building Energy Rating (BER)

Building Energy Rating (BER) is an indication of the energy performance of a building. BER is an asset rating calculation and indicates the annual primary energy usage and carbon dioxide emissions associated with the provision of space heating, water heating, ventilation, lighting and renewable energy for a dwelling. Building Energy Rating (BER) is expressed as primary energy use per unit floor area per year, kWh/(m^2.y). The better the BER rating, using a rating scale of A to G, the lower the energy consumption per m^2.

A BER calculation uses the Dwelling Energy Assessment Procedure (DEAP) software. DEAP considers a range of factors that contribute to annual energy usage:

- Size, geometry and exposure of the dwelling
- Material used for construction of the dwelling
- Thermal insulation of the different elements of the building fabric
- Ventilation characteristics of the dwelling and ventilation equipment
- Lighting types
- Efficiency, responsiveness and control characteristics of the heating system(s)
- Domestic hot water (DHW) use and any wastewater heat recovery (WWHR)
- Solar heat gains (G-value) through glazed openings of the dwelling
- Thermal storage (mass) capacity of the dwelling
- Fuels used to provide space and water heating, ventilation and lighting
- Renewable and alternative energy generating technologies incorporated into the dwelling

Building Energy Rating (BER) assessments are carried out by independent registered BER Assessors. BER Assessor gathers all the information during an assessment of a dwelling to complete a BER. Documentation includes certifications, receipts, invoices and/or specification documents from the architect, engineer or contractor who managed the home energy upgrade measures. The BER Advisory Report is a mandatory document accompanying a BER assessment.

In accordance with the DEAP methodology, a BER Assessor may use default values for an assessment when there is insufficient documentary evidence of home energy upgrade measures on a home. Default values are based on construction type and the age of the building and are conservative estimates of the energy performance and may result in a home receiving a lower BER rating than expected.

BER Assessor can obtain data to support the use of non-default values in a BER assessment e.g.

- Heating System (e.g. heat pump, solar thermal space heating, boiler etc)
  - SEAI HARP database for home space heating appliances www.seai.ie/.../HARP Database
  - Heat pump Ecodesign technical datasheet, see Clause 6.8.4
  - Heating system manuals or installation certificates
- Nameplate (data plate) label for product identification displays manufacturer (make), product identifier (model/part number) and a unique serial number (S/N)
- Air Permeability Test result, see Clause 4.3
- Window and door U-value (thermal transmittance) and G-value (solar gain) certificates, WEP/WER

SEAI's website provides information on BER, supports for BER Assessors, details of data input requirements for a dwelling's home energy upgrade measures and DEAP Guidance DEAP Guide.seai.ie.

2.8 Building Renovation Passport (BRP)

Building Renovation Passport (BRP) is a dwelling-specific, homeowner-facing renovation Roadmap that builds on the published BER / DEAP baseline. The BRP Roadmap sets out a staged pathway of clear actionable step-by-step measures for improving the dwelling's energy performance over time, taking account of the dwelling's current condition, available evidence, technical risks, homeowner context and sequencing dependencies.

When a Building Energy Rating (BER) is published there is flexibility for separate issuance of a Building Renovation Passport (BRP). The BER remains the baseline energy assessment of the energy performance of a building. The BRP does not replace the BER. The Building Renovation Passport (BRP) adds wider evidence, risk awareness, staged sequencing, assumptions, caveats and an auditable record of why measures are proposed and ordered in a particular way.

2.9 U-value Calculations

Building Regulations set out the target maximum U-value requirements for the thermal performance of the building fabric elements (roof, wall, floor, windows and doors) as shown in TGD L Appendix A and S.R. 54 Annex A, B and C. Calculation of the correct U-value is essential in determining if U-value targets specified in DTSS Clause 6 have been met.

U-value provides a comprehensive assessment of a building element's overall thermal performance, making it particularly useful for evaluating windows and other complex assemblies where multiple materials come together, refer to TGD L Table 1. Different materials, such as wood, vinyl, aluminium, and composite frames, have varying thermal conductivity properties that affect their U-value. When more than one material is being used (e.g. common wall construction may have insulation, block and render – each with different thermal conductivities), the overall U-value is calculated based on the total of all the resistances of the combined materials.

Thermal transmittance (U-value), expressed as W/m^2K, relates to a building element or a structure and is a measure of the rate at which heat passes through that element or structure as calculated when there is a temperature difference of one (1) degree in the internal and external air temperature. U-value can be calculated from the thermal conductivity (W/mK) of a material and the thickness of the material (m). The lower the U-value[4] the better the material is at retaining heat through a building element such as windows, walls, or roofs.

Thermal resistance (R-value), the inverse of the U-value, indicates how well an individual material resists the flow of heat, a higher R-value signifies greater insulating effectiveness. R-Value, expressed as m^2K/W, is used for evaluating and selecting specific insulation materials.

Where a building undergoes a 'major renovation' (defined as a renovation where more than 25 % of the surface envelope of the building undergoes renovation) the building should achieve a cost optimal energy performance at building level insofar as is technically, functionally and economically feasible. Major renovation may comprise of internal wall dry lining, external walls renovation, external walls renovation and window replacement, external walls and floor renovation and external walls and roof renovation. Cost optimal level can be achieved by implementing energy performance improvements and guidance is provided in TGD L Table 7 (Column 3). The "*Cost Optimal*" performance level requires the building to achieve an energy performance level calculated in DEAP (see Clause 2.7).

Prior to commencing home energy upgrade measures, consult with the product manufacturer or supplier to establish the best product to use for the given construction type to achieve the required U-value and provide a high level of thermal performance for the building fabric.

[4] U-values are calculated according to standards detailed in TGD L, I.S. EN ISO 6946, DEAP methodology and BR 443 - Conventions for U-value calculations.

3. Health and Safety Requirements

Construction Regulations prescribe the main requirements for the protection of the safety, health and welfare of persons working on construction sites.

Under the Safety, Health and Welfare at Work (Construction) Regulations 2021, a "Client" is a person for whom a construction project is carried out. This includes a person having construction work carried out on their own home. In the case of clients for domestic type projects there are duties on project supervisors, designers and contractors to demonstrate to the clients that they are competent to do the work.

Contractors are obligated under the Safety, Health and Welfare at Work Act to carry out risk assessments of their specific operations and places of work to identify the key hazards relevant to them and to ensure the safety, health and welfare of persons present at their facilities or on their sites.

It is the sole responsibility of the Contractor to comply with all relevant Health and Safety legislation, regulations and guidelines and to ensure that their staff and/or sub-contractors are appropriately trained to operate to these standards.

HSA (Health and Safety Authority) provides information to relevant regulations, legislation and guidance

- Safety, Health and Welfare at Work (…) Act 2024
- Safety, Health and Welfare at Work (General Application) (Amendment) Regulations 2023
- Safety, Health and Welfare at Work (Construction) (Amendment) Regulations 2021
- Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006
- Safe System of Work Plan (SSWP)
- Guide for Contractors and Project Supervisors Carrying out Construction Work on Private Domestic Dwellings
- Guide for Homeowners - Getting Construction Work Done Safely

Solar Panel Installation

Commission for Regulation of Utilities (CRU) has set standards and guidelines that must be followed by all those who wish to install solar panels on their property to ensure that the solar panel system is safe, efficient, and reliable. These standards cover various aspects of solar panel installation, such as safety measures, wiring, mounting requirements and proper dimensioning / design of the solar installation. All installations must meet certain safety criteria like having proper grounding, ensuring the roof is structurally sound and able to support the additional weight of the solar installation, using high-quality materials and components and installed by qualified professionals.

For further information refer to: safeelectric.ie/.../Focus on Photovoltaic Installations

3.1 Special Precautions

Special precautions ***must*** be taken in relation to the following issues:

- **Radon**
  Radon is a naturally occurring radioactive gas that can accumulate in buildings, posing significant health risks over time. For domestic retrofit projects it is essential that all aspects of the process, including ventilation and radon mitigation, are addressed appropriately. Where work could compromise a radon barrier membrane, appropriate preventative measures ***must*** be implemented to address the issue. Building Regulations TGD C, EPA guidelines and DHLGH publications on Radon should be consulted. For further information refer to:
  www.gov.ie/.../Radon in Existing Buildings - Corrective Options
  www.epa.ie/.../Radon membranes and protecting a building from radon
  www.epa.ie/.../Understanding Radon Remediation - A Householders Guide

- **Asbestos**
  Asbestos can be found in any old building which was built or refurbished before 2000. Work involving asbestos is a '*Particular Risk*' as set out in Schedule 1 of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013). The Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 apply to all work (including domestic construction work) that exposes a person to either asbestos dust or asbestos-containing-material (ACM) dust. These regulations are of relevance with respect to the renovation, repair and demolition of older buildings where asbestos containing materials may have been used.

  If a building has/or is suspected of having ACMs it is the responsibility of the homeowner to have a risk assessment evaluation carried out by a specialist. Any maintenance, repair or removal work with ACMs should be restricted to specialist asbestos contractors.

  SEAI home energy upgrade works ***must*** not start or proceed if they disturb Asbestos Containing Materials (ACM). SEAI programmes may have specific conditions with respect to the maintenance, repair or removal of ACMs. Please check with the SEAI team and programme-specific documentation.

  Further guidance and advice on asbestos management is available from:-
  www.hsa.ie/.../Asbestos
  www.epa.ie/.../Handling Asbestos Guide

- **Carbon Monoxide**
  Carbon Monoxide alarms provide a warning to householders in the event of a dangerous build-up of CO (Carbon Monoxide). Where an open-flued or flueless combustion appliance is installed then a Carbon Monoxide alarm should be provided, refer to TGD J Heat Producing Appliances. Carbon Monoxide alarms must comply with the I.S. EN 50291 standard. Carbon Monoxide alarms are no substitute for regular inspection and maintenance of heat producing appliances, vents, flues and chimneys.
  Further guidance : www.carbonmonoxide.ie

- **Pest control and wildlife**
  Contractors shall be aware of the potential for rodent infestation within the building fabric and shall take all necessary precautions to protect themselves and their employees against the risk of disease (e.g. Weil's disease) when carrying out the works. If there is evidence of rodent or any other pest infestation the Contractor shall advise the homeowner accordingly.
  Further guidance : www.CRRU.ie/.../Best Practice Requirements for Rodent Control...

  If there is evidence of species of wildlife, e.g. bats or bat roosts, present in the attic space to be insulated, the Contractor should consult with the National Parks and Wildlife Service (NPWS) for advice on how to proceed.
  Further guidance : www.npws.ie/bats-or-otters.

- **Cutting Polystyrene**
  When using polystyrene insulation materials, it is essential that any cutting of polystyrene blocks with saws is done in a properly enclosed area (surrounded by mesh or indoors) to prevent the release of polystyrene debris into the local environment. Use of hot wire cutting is preferred as it is cleaner and produces less waste. Ensure adequate ventilation, especially when using hot wire cutters, to prevent irritation from fumes.

3.2 Electrical Installations: Best Practice

Electrical installations should be designed and installed in accordance with I.S. 10101 National Rules for Electrical installations. According to I.S. EN 50160 the standard domestic electricity supply in Ireland is 230 volt AC (frequency 50 Hz) with a low voltage range tolerance +/- 10 %.

A Completion Certificate No. 3 is issued by a Safe Electric Registered Electrical Contractor (REC) to certify the modification, installation or replacement of electrical installations. If the work requires a service alteration such as the electricity wires to be moved or altered, then ESB Networks should be contacted.[5]

I.S. 10101 Chapter 6.5 and the Health and Safety Authority (HSA) guidance notes provide details on Periodic Inspection and Testing of Electrical Installations. Refer to:-

www.hsa.ie/.../Guidance-Note on Periodic Inspection and Testing of Electrical Installations

The purpose of the Periodic Inspection Report (PIR) is to accurately access the condition of the entire electrical installation and shall be given to the person ordering the inspection or a person authorized to act on their behalf. Any electrical alterations or additions to the installation should be made by a Registered Electrical Contractor (REC). Refer to safeelectric.ie/.../Periodic Inspection Report.

The following requirements are essential for any electrical works being carried out for measures detailed in this document, particularly installation of heating systems, controls, monitoring and lighting:

- All electrical works must be in accordance with I.S. 10101 National Rules for Electrical Installations.

- The installer must ensure that any part of the existing installation, e.g. meter tails, distribution boards and earthing and bonding, being utilized by the new installation or circuits must be verified as compliant and capable of dealing with the new circumstances safely.
  Refer to I.S. 10101 Chapter 6.4.1.5
  "It shall be verified that an extension, addition or alteration to an existing installation complies with I.S. 10101 and does not impair the safety of that installation, and that the safety of the new installation is not impaired by the existing installation."

- Earthing and Bonding must be in accordance with I.S. 10101 Chapter 134.1.9
  "*In case of an addition or alteration to an existing installation … the earthing and bonding arrangements, if necessary for the protective measure applied for the safety of the addition or alteration, shall be adequate.*"

  Where existing earthing and bonding arrangements are not in accordance with I.S. 10101 then these must be rectified to meet the requirements of I.S. 10101 ***before grant works are started***.[5]

- SEAI recommends
  "*Before commencing new work, the installer should assess the existing electrical installation to ensure that it will not impair the safety of the proposed new work, and likewise, the new work will not impair the safety of the existing electrical installation.*

  Should the installer become aware of any defect in any part of the installation that would impair the safety of the new work, the homeowner ***must*** *be informed in writing thereof. No new work should commence until these defects have been made good.*[5]

  '*Electrical Safety Notice to the Homeowner*' is available on the SEAI website:
  www.seai.ie/.../Electrical Safety Notice to Homeowner

[5] SEAI home energy upgrade programmes may have specific requirements with respect to service alterations or the modification / replacement to an existing electrical installation such as earthing/bonding wires to be upgraded. Please check with the SEAI team and programme-specific documentation.

4. Ventilation

The primary purpose of a residential ventilation system is to supply air to and extract air from the rooms in a dwelling to ensure:

- Adequate fresh air for a healthy and comfortable environment for the occupants
- Adequate air supply for the safe operation of open-flued heat-producing appliances
- Minimal condensation risk
- Avoidance of radon accumulation
- Avoidance of accumulation of other indoor air pollutants [6]

This section of the DTSS is directly referenced by the home energy upgrade measures shown in Table 2.

Table 2 : Home Energy Upgrade measures referencing 'Ventilation'

Clause	Measure
6.1	Insulation : Cavity Wall Insulation
6.2	Insulation : External Wall Insulation
6.3	Insulation : Internal Wall Insulation
6.4	Insulation : Roof Insulation - Ceiling Level
6.5	Insulation : Roof Insulation – pitched roof at Rafter Level (Cold Roof)
6.6	Insulation : Floor Insulation
6.7	Mechanical Extract Ventilation (cMEV) and Mechanical Ventilation with Heat Recovery (MVHR)
6.16	Stoves : Solid Multi-Fuel Heating System
6.17	Gas Fired Room Heater
6.22	Draught-Proofing
6.23	Chimney Draught Limiter
6.24	Door Replacement
6.25	Window Replacement
6.26	Window Secondary Glazing
6.27	Window Glazing : Low-emissivity (Low-E)

Ventilation for Domestic Retrofit

Purposeful ventilation – air movement, which is designed, intentional and controllable:-

- Partially / fully controlled e.g. MVHR, cMEV, Demand Controlled Ventilation (DCV), extractor fan with timer and humidity sensor, intermittent extract ventilation (IEV), background ventilation (closable wall vents or window trickle vents)
- Purge ventilation is the ability to open a window or door to allow enough fresh air directly from the outside
- Permanent wall ventilation (fixed open position)

Uncontrolled, adventitious ventilation via wind-driven infiltration and air leakage – The airtightness of a dwelling is affected by draughts, gaps and cracks in the building fabric, which typically appear at openings, penetrations and junctions. This provides ventilation on an arbitrary basis and is generally insufficient for ensuring occupant safety, health and comfort. This type of ventilation is not considered energy efficient.

It is essential to maintain any proper pre-existing ventilation provisions by making all reasonable effort when carrying out works.

[6] World Health Organisation (WHO) publishes guidelines for indoor air quality and information on biological, chemical and combustion indoor air pollutants

Requirements for provision of adequate ventilation

Ventilation should be always considered at the planning and execution stages when improvements to the thermal envelope such as insulation (wall, floor, rafter, ceiling), airtightness, draught-proofing, installation of replacement windows and doors are made. These improvements will reduce heat loss and lead to higher internal temperatures within a building. With a higher temperature, the internal air can hold a significant amount of additional water vapour. Furthermore, as improvements in energy performance of the thermal envelope result in increased airtightness, ventilation provisions must ensure adequate air changes per hour. Air leakage paths should be minimised to help reduce surface and interstitial condensation.

In undertaking the works, and based on the findings of an initial assessment of the home, the Contractor ***must***:

1. Ensure that the works being undertaken will not compromise the existing necessary ventilation provisions in the home to the detriment of the indoor air quality (IAQ) and/or living environment therein.

2. Inform the homeowner where it is noted that the existing necessary ventilation provisions have already been adversely affected by actions of the homeowner or other parties.

3. Inform the homeowner where evidence of inadequate ventilation exists (e.g. stuffiness, odour, mould, condensation or sensor reading), extract ventilation is not provided to wet rooms, such as a bath, shower room or utility room, or the existing ventilation is potentially unsafe (particularly with rooms containing fuel-burning appliances). Guidance on background ventilation is provided in TGD F Ventilation and permanent ventilation for heat-producing appliances in TGD J published by DHLGH.

4. Inform the Homeowner that levels of the radioactive gas, radon, can be increased where existing ventilation is not adequate or where works may increase the airtightness of the home. Guidance on whether the home is in a High Radon Area and how to test a home for radon is available on the Environmental Protection Agency's website: www.epa.ie or Free Phone 1800 300 600 (see Clause 3.1).

5. Make appropriate recommendations, in writing, to the homeowner in respect of 2 and 3 above. It is then the responsibility of the homeowner to rectify these issues, with or without involving the Contractor, before works can commence.

These points are aimed at ensuring that the Contractor takes all reasonable action to ensure that proper ventilation provisions are installed in the home and that the homeowner is made aware of the proper operation and maintenance of such provisions.

4.1 Assessment of Ventilation Provision

A ventilation assessment is required to determine whether the existing ventilation system is adequate, if there are any issues, or if additional ventilation provisions are needed prior to any works commencing.

An adequate and complete ventilation system includes intermittent extract ventilation (IEV), mechanical ventilation with heat recovery (MVHR) or mechanical extract ventilation (cMEV) combined with background ventilators. These ventilation systems ensure proper extraction of moist air and supply of fresh air, crucial for maintaining indoor air quality and preventing condensation issues after a home energy efficiency retrofit.

The ventilation assessment deems existing ventilation inadequate if there is evidence of mould, condensation, no functional ventilation system, or lack of purge ventilation for habitable rooms.

The approved installer ***must*** inform the homeowner if there is insufficient ventilation or no wall vents. Depending on the measure installed, the same applies for attic ventilation, sub-floor ventilation (suspended floor) or other ventilation provisions.

Ventilation assessment will involve calculating the volume of air required for each space and sizing the ductwork or openings to suit. Natural ventilation analysis calculates the number, size and location of external openings, refer to Clause 4.4.1. Mechanical ventilation provision will involve identifying where the ductwork runs throughout the building and where the equipment is located, refer to Clause 4.4.2.

For any home energy upgrade measures where insulation or airtightness are proposed e.g. wall insulation, floor insulation, rafter and ceiling insulation, draught stripping or replacement windows, the Contractor shall ensure that the retrofit design includes details of how adequate ventilation is to be maintained, or provided, to meet minimum air change rates, ensure suitable indoor air quality and minimize surface and interstitial condensation risk.

Any new or upgraded ventilation system installed must be commissioned (i.e. tested and adjusted) to ensure it achieves the correct balancing and airflow rates. Proper documentation of ventilation assessments, air permeability tests, and system commissioning is essential for demonstrating that the retrofit project complies with Part F of the Building Regulations.

It is recommended that a spillage test be carried out before and after installation of the mechanical ventilation system, with the appropriate spillage test procedure, in accordance with Building Regulations (Part J Heat Producing Appliances), refer to Clause 4.4.5.

S.R. 54 must be followed for each measure. Reference S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings Clause 10 Ventilation for the choice of appropriate ventilation systems. Further information is available on TGD F Ventilation and DHLGH's "Installation and Commissioning of Ventilation Systems for Dwellings - Achieving Compliance with Part F".

NOTE SEAI home energy upgrade programmes may specify additional requirements for ventilation measures. Consult with relevant SEAI team and programme-specific documentation for further details.

4.2 Ventilation Validation Certificate

The primary purpose of a ventilation system is to supply air to and extract air from the rooms in a dwelling. Where a ventilation system is installed as part of a Major Renovation then the system should be designed, installed, balanced, commissioned and validated. All ventilation systems are to be validated by a competent independent third party certified by NSAI[7] (or equivalent) to verify that a ventilation system has been installed, balanced and commissioned to meet the minimum requirements of Part F Ventilation of the Building Regulations.

TGD F Ventilation gives guidance on the minimum ventilation design for dwellings i.e.

- Natural Ventilation comprising of background ventilators with intermittent extract fans (IEV)
- Mechanical Extract Ventilation (cMEV)
- Mechanical Ventilation with Heat Recovery (MVHR)

To demonstrate compliance with Building Regulations (Part F and Part L) for ventilation systems:-

a. Ventilation validator is provided with ventilation design airflow rates and installers commissioning certificate.

b. Ventilation validator assesses the ventilation design against the minimum requirements of TGD F.

c. Ventilation Validator takes measurements to establish that the commissioned ventilation system complies with the intended design airflow rates and leakage of the ductwork.

[7] Ventilation Validation Scheme www.nsai.ie/ventilation-validation-registration-scheme

- All instrumentation must be calibrated by an accredited laboratory such as INAB.
- Equipment must be correctly configured to record accurate air flow rate readings. The measured air flow rates will be compared with the respective design values. Compliance with the design will be met if the measured air flow rates for each are equal to, or greater than, the design value.
- A flow straightener must be used

d. Air permeability test result has an air permeability index less than < 5 $m^3/(h.m^2)$
   - Natural Ventilation with intermittent extract fans (IEV) is suitable for dwelling with an air permeability index greater than > 3 $m^3/(h.m^2)$ and less than < 5 $m^3/(h.m^2)$
   - If the Air permeability index is less than < 3 $m^3/(h.m^2)$ either mechanical extract ventilation (cMEV) or mechanical extract with heat recovery (MVHR) is required

e. Ventilation validator issues a "*Ventilation Validation Certificate*"

NOTE Ventilation validator should be independent of the promoter of the system e.g. system designer/manufacturer/installer. The ventilation validator is not responsible for inspecting installation or confirming Part F Ventilation compliance.

Further information is available on DHLGH's "*Installation and Commissioning of Ventilation Systems for Dwellings - Achieving Compliance with Part F*" and NSAI "*Ventilation Validation Registration Scheme Master Document*". Guidance is given in I.S. EN 14134 Ventilation for buildings – Performance testing and installation checks of residential ventilation systems.

4.3 Air Permeability Test

Air Permeability Test, also referred to as Air Pressurisation Test, Air Tightness Test, Blower Door Test, or Air Leakage Test, is a diagnostic procedure used to quantify the air permeability of a building's envelope. The test involves creating a pressure differential between the inside and outside of the building to force air through any unsealed cracks or openings, thereby measuring the air leakage rate and overall airtightness of a building.

The external weather conditions will have an impact on the Air Permeability Test results. It is preferable to carry out the test on a calm day.

An air permeability test should be carried out in accordance with I.S. EN ISO 9972 *Thermal performance of buildings - determination of air permeability of buildings - fan pressurization method*" and NSAI's Certified Air Tightness Tester Scheme[8].

The following is a non-exhaustive list of examples where an air permeability test is recommended:

- An advanced air permeability rate of less than < 5 $m^3/(h.m^2)$ has been achieved under "Major Renovation".

  NOTE When carrying out major renovations, the risk of overheating can be significantly enhanced, e.g. through improved air permeability or reduced thermal mass[14]. Refer to CIBSE TM59 Assessment of overheating risk in homes and CIBSE TM37 Design for improved solar shading control.

- Prior to home energy upgrade works commencing to identify air leakages and/or to identify the most appropriate ventilation strategy for the dwelling.

[8] Certified Air Tightness Tester Scheme www.nsai.ie/agrement-certification/air-tightness-testing

- Where the dwelling has draught-proofing measures installed (see Clause 6.22), an air permeability test is the most accurate way to reflect the reduced air leakage in a post-works BER. Without the air permeability test results, pessimistic default values must be used by the BER Assessor, resulting in a less favourable BER rating (see Clause 2.7).

- A heat pump system grant may require an air permeability test for the calculation of the heat load calculation under Clause 6.8.3 (e) and / or the installation of an air source heat pump (ASHP) under Clause 6.8.3 (q), particularly if home energy upgrade measures are likely to improve airtightness.

- If the dwelling has had measures carried out that are likely to improve airtightness, such that indoor air quality (IAQ) may suffer, then an air permeability test can help identify the likelihood of inadequate uncontrolled ventilation and the resulting need for a mechanical ventilation system. See Clause 4.6 and Clause 4.7 of S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings.

- If mechanical ventilation measures, such as those detailed in DTSS Clause 6.7 Mechanical Extract Ventilation (cMEV) and Mechanical Ventilation with Heat Recovery (MVHR), are being carried out, then the dwelling airtightness should be improved (see Figure 1). This ensures that mechanical ventilation systems are more efficient and more effective.

NOTE Air permeability test results are only considered valid by SEAI if carried out by an NSAI registered air tightness tester (or equivalent)[8]. Ventilation Validation Certificate is required when air permeability is expected to be less than < 5 $m^3/(h.m^2)$ when a major renovation retrofit is undertaken.

Please check with the SEAI home energy upgrade programme[9] and programme-specific documentation should an air permeability test on a dwelling be required.

4.3.1 Airtightness Improvements

Airtightness of the building envelope is essential for energy efficiency, thermal comfort, moisture safety and indoor air quality. Airtightness and thermal bridging at junctions of building elements are key design considerations for all buildings. Improvement of the airtightness (lower air permeability) of the building envelope reduces wind-driven air infiltration and air leakage.

Thermal imaging (thermography), when used during an air permeability test, highlights colder outside air traversing the fabric of the building and thus identifies the location of air infiltration entrance points, parts of the building fabric that are performing better or worse thermally, such as areas of dampness. It also helps in locating thinner depths of wall, cracking and voids. Refer to I.S. EN ISO 6781-1 for further guidance for identifying areas where improved airtightness interventions may be required.

Where an air permeability test is not planned, the checklist, shown in S.R. 54 Table 28, gives a list of home energy upgrade measures that, if all are adopted, will likely lead to a retrofitted dwelling achieving an air permeability level below < 5 $m^3/(h.m^2)$. Creating a more airtight fabric will require the provision of additional ventilation to be considered, refer to DTSS Clause 6.

Acceptable Construction Details (ACD – TGD L) provides guidance on Limiting Thermal Bridging and Air Infiltration[10].

[9] SEAI Support for Contractors www.seai.ie/.../Support for contractors

[10] Limiting Thermal Bridging and Air Infiltration - Acceptable Construction Details www.gov.ie/.../ ACD – TGD L

4.4 Ventilation System Design Strategy Considerations

The contractor shall confirm the adequacy of the existing ventilation (if any) of the dwelling and, if necessary, include in the design a specification for upgrading the ventilation system of the dwelling by selecting the appropriate ventilation system type and designing ductwork or airflow pathways. Additional purpose provided ventilation will control the moisture content and limit harmful pollutants within the dwelling.

Ventilation guidelines are dependent on the air permeability (see Figure 1) and thermal conditions of a dwelling resulting from retrofit measures (e.g. insulation, new windows, new heating system, installation of additional ventilation measures).

An acceptable, complete ventilation system for a dwelling shall be:

a. natural ventilation with an intermittent extract ventilation (IEV) system consisting of correctly sized extract fans in all wet rooms and correctly sized background ventilators (to admit fresh external air) in all rooms including habitable rooms, bedrooms and wet rooms where air permeability is greater than > 3 $m^3/(h.m^2)$ (refer to Clause 4.4.1).

b. continuous mechanical extract ventilation (cMEV) system that extracts moist, stale air from all wet rooms combined with correctly sized background ventilators (to admit fresh external air) in habitable rooms and bedrooms (but not in wet rooms) where air permeability is less than < 5 $m^3/(h.m^2)$, and has been properly commissioned (refer to Clause 4.4.2); or

c. whole-dwelling supply and extract mechanical ventilation with heat recovery (MVHR) system that extracts moist stale air from all wet rooms, supplies fresh external air to all living spaces and bedrooms, where air permeability is less than < 5 $m^3/(h.m^2)$, and has been properly commissioned and balanced (refer to Clause 4.4.2).

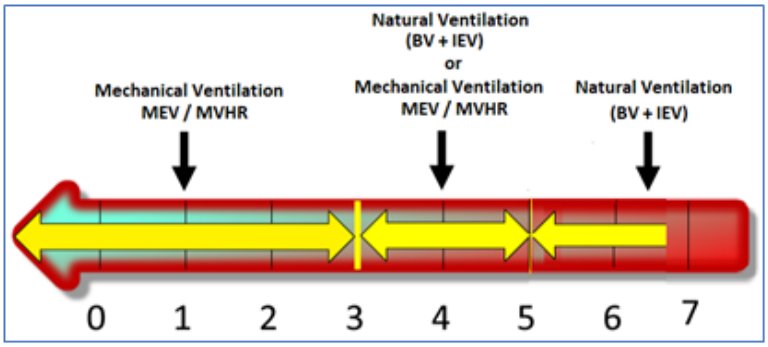


Figure 1 : 0-7 Air Permeability rate $m^3/(h.m^2)$ and Ventilation Requirements

Where ventilation is to be upgraded and the air permeability of the building envelope, after installation of the proposed home energy upgrade measures, is not less than > 5 $m^3/(h.m^2)$ the Contractor must refer to S.R. 54 Table 30 and S.R. 54 Table 31 on guidance for the provision of natural ventilation with background and intermittent extract ventilation (refer to DTSS Table 3 and DTSS Table 4 respectively).

Where any of the guidance detailed in S.R. 54 Table 30 is not adhered to by the Contractor, the Contractor ***must*** retain, in writing, the reasoning for not adhering to S.R. 54 Table 30 (see DTSS Table 3). When in doubt, Contractors must contact the SEAI Technical Team[11] to verify the correct approach and retain the answer in writing. Always follow Irish Agrément requirements and manufacturer guidelines, where applicable, for any measure being installed.

[11] SEAI Support for Contractors www.seai.ie/supports-for-contractors

Table 3 : Guidance for the provision of natural ventilation
i.e. background and intermittent extract ventilation for retrofit works with air permeability levels > 5 m³/(h.m²)

		Existing Dwelling Condition		
Retrofit Works		**A. No existing background ventilation in some or all habitable rooms and no extract ventilation in wet rooms**	**B. Existing purpose provided background ventilation in each habitable room. No extract ventilation provided in wet rooms**	**C. Existing purpose provided background ventilation in each habitable room. Extract ventilation provided in wet rooms**
1	Internal/External/ Cavity Insulation for Walls	Background ventilation should be provided to rooms without background ventilation in accordance with Column 2, Table 31	No requirement to upgrade background ventilation	No requirement to provide further ventilation
2.	Replacement of Windows	It is advised to provide Intermittent Extract Ventilation (IEV) in wet rooms in accordance with Column 3, Table 31	It is advised to provide Intermittent Extract Ventilation (IEV) in wet rooms in accordance with Column 3, Table 31	
3.	Sealing/insulating of timber suspended floors	Where evidence of inadequate ventilation exist (e.g. mould, condensation) Intermittent Extract Ventilation should be provided in all wet rooms in accordance with Column 3, Table 31	Where evidence of inadequate ventilation exist (e.g. mould, condensation) Intermittent Extract Ventilation should be provided in all wet rooms in accordance with Column 3, Table 31	
4	Two or more of the above measures done in combination or separately	Background ventilation and Intermittent Extract Ventilation should be provided in accordance with Table 31	No requirement to upgrade background ventilation Intermittent Extract Ventilation should be provided in all wet rooms in accordance with Table 31	No requirement to provide further ventilation

(source: S.R. 54 Table 30)

If the proposed energy efficiency measures are intended to reduce the air permeability of the building envelope to less than < 5 $m^3/(h.m^2)$, or may do so, then the existing ventilation system may either need to be upgraded to a mechanical ventilation system (Clause 4.4.2) or expert advice should be sought for the sizing and position of background and intermittent extract ventilators (Clause 4.4.1).

If the air permeability index is less than < 3 $m^3/(h.m^2)$, natural ventilation will not be acceptable, and some form of mechanical ventilation and the ventilation validation certificate is required.

Guidance in S.R. 54 Table 28 gives a list of measures that, if all are adopted, will likely lead to a refurbished dwelling achieving an air permeability below < 5 $m^3/(h.m^2)$.

4.4.1 Natural Ventilation with Background Ventilation and Intermittent Extract Ventilation

Natural ventilation relies on the natural forces of wind and weather to get fresh air into a building. Pre-retrofit ventilation scenarios in S.R. 54 Table 30 and Table 31 (refer to Table 3 and Table 4 respectively) provide guidance where the air permeability is expected to be above > 5 $m^3/(h.m^2)$.

A ventilation system should be suitable for the context in which it is installed. A fabric first approach to retrofit maximises airtightness and insulation thereby increasing the thermal capacity of a building. When energy efficiency measures (EEM) are installed that increase the thermal capacity of an existing dwelling then sufficient purpose-provided fresh air ventilation must be achieved throughout the home by means of background ventilation (BV) and intermittent extract ventilation (IEV) (see Figure 2).

Where ventilation is to be upgraded and after installation of the proposed home energy upgrade measures the air permeability of the building envelope is greater than > 3 $m^3/(h.m^2)$, then an acceptable system of ventilation is a combination of correctly sized intermittent extract ventilation (IEV) in all wet rooms combined with background ventilation (BV) in all living spaces and bedrooms (refer to Table 5).

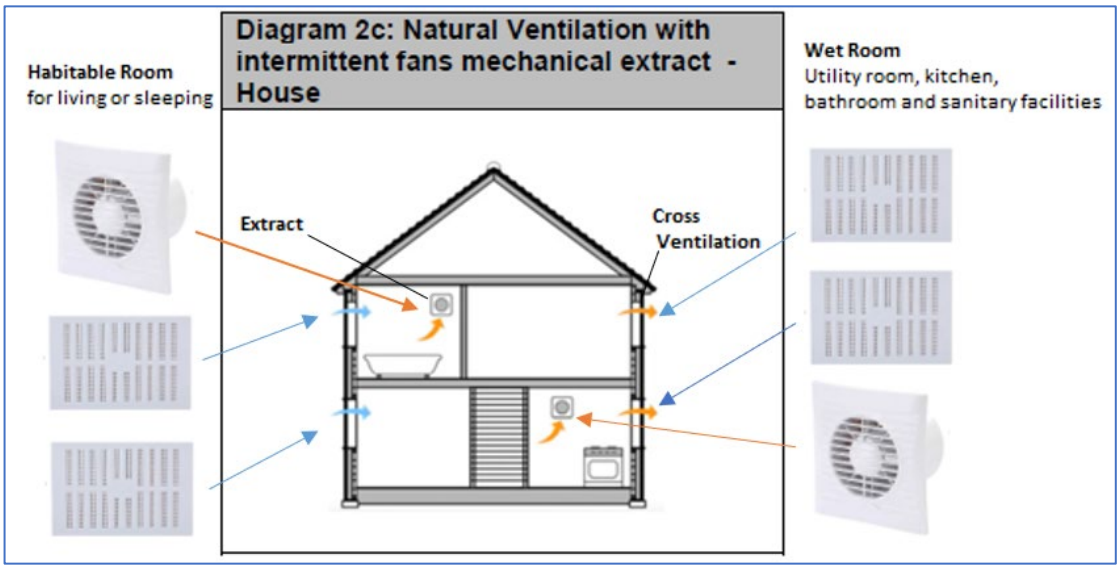


Figure 2 : Natural Ventilation with background and intermittent extract ventilation when air permeability is expected to be above > 3 $m^3/(h.m^2)$

(source: TGD F Ventilation_2019)

- Background ventilation (BV) is a whole house ventilation system that allows the introduction of fresh outside air into a habitable room without opening a window. Background ventilation is generally located in a wall (sleeved wall ventilator) or window (trickle vent) incorporating a controllable ventilation grill which can be fully closed (refer to Figure 2, Table 4, Table 5).

  Background ventilators installed in walls may require a proprietary wind cowl to reduce wind noise and prevent over ventilation. Background ventilators should be located to avoid draughts and at a height of approximately 1.75 m above floor level. Where background ventilators and individual fans are fitted in the same room, they should be a minimum of 500 mm (0.5 m) apart.

  NOTE All background ventilators should be tested to I.S. EN 13141-1 and installed and sealed to manufacturer's instructions. Information on equivalent area of ventilation products, e.g. trickle ventilators should be supplied with the product. Equivalent area is measured in accordance with the method specified in I.S. EN 13141-1. Free Area is typically 25 % greater than its equivalent area. Further guidance is available from BRE's IP 2/03 Background ventilators for dwellings.

- An Intermittent Extract Ventilation (IEV) system uses extractor fans in the kitchen (cooker hood) and wet rooms (intermittent extract fan) which turn on and off and can be controlled by a timer, light switch, or sensor and operate with a 15-minute overrun (refer to Figure 2, Table 4, Table 5).

  All wet rooms, such as a bath, shower room or utility room, should be fitted with an intermittent extract fan. Where a room, kitchen/utility, has no external wall, and background and purge ventilation cannot be provided, then the intermittent extraction fan should operate with a 15-minute overrun.

  The minimum flow rate for an intermittent extract fan varies depending on the type of room in which it is installed. S.R. 54 Table 31 and Table 32 provides further guidance on Background Ventilation and Intermittent Extract Ventilation, refer to DTSS Table 4 and Table 5.

Ventilation requirements when air permeability is above > 5 $m^3/(h.m^2)$

In a habitable room, kitchen or utility room there should be provision for a ventilation opening with minimum background ventilation of an equivalent area of 5,200 mm^2 (equates to a free area of 6,500 mm^2), as per DTSS Table 4.

All wet rooms, such as a bath, shower room or utility room, should be fitted with an intermittent extract fan. In kitchens, the minimum extract rates in litres per second (l/s) for intermittent extract systems, including when the ventilation extract is incorporated in a cooker hood, is provided in Table 4. Where a room, kitchen/utility, has a floor area less than 6.5 m^2, no external wall, and background and purge ventilation cannot be provided, then the intermittent extraction fan should operate with a 15-minute overrun.

Table 4 : Minimum levels of background and intermittent extract ventilation when air permeability is expected to be above > 5 $m^3/(h.m^2)$

Room usage	Minimum background ventilation (mm^2)[d]	Intermittent extract fan rating (l/s)
Habitable room	6 500	Not required
Kitchen[a]	6 500	60 (reduced to 30 for suitably sited extracting cooker hood)
Utility room[a]	6 500	30
Bath or shower room[b]	Not required	15
WC (only)[c]	Not required	6

a) Where the room has no external wall, a floor area of less than 6,5 m^2 and background ventilation cannot be provided then extraction fan to operate with a 15 minute overrun etc.

b) Where the room has no external wall and background and purge ventilation cannot be provided then the extraction fan should operate with a 15 minute overrun etc.

c) Where a window opening for purge ventilation exists then the window alone may be relied upon to provide extract ventilation.

d) Ventilation area as stated above is free area. Equivalent area is measured in accordance with the method specified in I.S. EN 13141-1: 2004. The above values should be multiplied by 0,8 to obtain equivalent areas.

Note The vent sizes for the background ventilation in DTSS Table 4 are listed as free areas, however, the equivalent area is used by product manufacturers, in accordance with I.S. EN 13141–1.

(source: S.R. 54 Table 31)

Ventilation requirements when air permeability is above > 3 $m^3/(h.m^2)$ and below < 5 $m^3/(h.m^2)$
Where the intended air permeability of the dwelling is greater than > 3 $m^3/(h.m^2)$ and less than < 5 $m^3/(h.m^2)$ thus making the dwelling more airtight then the background ventilation should be distributed around the dwelling as evenly as possible to maximize cross ventilation and to ensure there are no parts of the dwelling that are substantially less ventilated than others.

In the case of a wet room e.g. kitchen, utility room, bathroom or sanitary / WC room the provision of intermittent extract ventilation is required in combination with background ventilation.

The minimum provisions of background ventilation and intermittent extract ventilation for various spaces are summarised in DTSS Table 5, as per TGD F Ventilation Table 3 and S.R. 54 Table 32.

Table 5 : Minimum levels of background and intermittent extract ventilation when air permeability is expected to be greater than > 3 $m^3/(h.m^2)$ and less than < 5 $m^3/(h.m^2)$

Room usage	Minimum background ventilation (mm^2)[c,d]	Intermittent extract fan rating (l/s)
Habitable room	7 000	Not required
Kitchen[a]	3 500	60 (reduced to 30 for suitably sited extracting cooker hood)
Utility room[a]	3 500	30
Bath or shower room[a]	3 500	15
WC (only)[b]	3 500	6

a) Where the room has no external wall, then extraction fan to operate with a 15 minute overrun etc.

b) Where a window opening for purge ventilation exists, then the window alone can be relied upon to provide extract ventilation.

c) Ventilation area as stated above is free area. Equivalent area is measured in accordance with the method specified in I.S. EN 13141-1: 2004. The above values should be multiplied by 0,8 to obtain equivalent areas.

d) The minimum total equilavent area of background ventilators providing general ventilation should be 42 000 mm^2 with an additional 7 000 mm^2 for each additional 10 m^2 floor area above the first 70 m^2 of floor area measured. For single storey dwellings situated at ground level or on any storey up to four storeys, an additional 7 000 mm^2 per dwelling should be provided. The minimum level of background ventilation recommended for each room is unlikely to provide the total background ventilation required for the dwelling as a whole.

Note The background ventilation areas, as stated in DTSS Table 5, are equivalent area measurements, in accordance with Table 3 of TGD F Ventilation. S.R. 54 Table 32 footnote (c) typo error is corrected to confirm all values stated are equivalent area measurements.

(source: S.R. 54 Table 32)

NOTE A vented cooker hood expels air outside the kitchen through a duct or pipe. Vented cooker hoods, or equivalent extractors, are not compatible with DCV and MVHR systems, refer to Clause 6.7.2. Recirculating cooker hoods do not exhaust air outside and are not recognised as intermittent extract ventilation, refer to I.S. EN 13141-3.

4.4.2 Mechanical Extract Systems where air permeability is below < 5 $m^3/(h.m^2)$

Mechanical extract ventilation systems use fans and ducts to control airflow (see Figure 3). Where a mechanical extract ventilation system is installed then the system should be designed, installed and commissioned by a competent person, refer to Clause 6.7. When commissioned and balanced the system should then be validated by an independent competent person to ensure the mechanical extract ventilation system achieves the design flow rates (see Clause 4.2).

Mechanical Extract Ventilation - cMEV

Where ventilation less than < 5 $m^3/(h.m^2)$ the acceptable type of ventilation system is a continuous Mechanical Extract Ventilation (cMEV) that extracts moist stale air from all wet rooms combined with background ventilators in all living spaces and bedrooms to admit a balancing supply of fresh external air. A cMEV only removes air from a building. A continuous MEV system consists of one or more fans continuously extracting moist, stale air from wet rooms via ducts, and exhausts it to the exterior via another duct, using a single central fan that is usually located in a roof space or the top of a service cupboard.

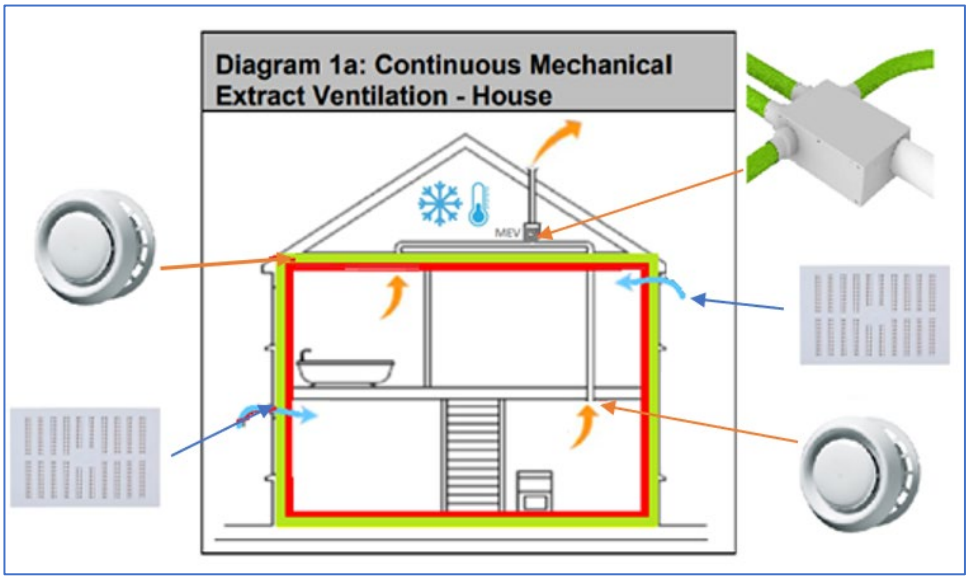


Figure 3 : continuous Mechanical Extract Ventilation – cMEV when air permeability is less than < 5 $m^3/(h.m^2)$ (source: TGD F Ventilation_2019)

For mechanical extract ventilation (cMEV) systems each habitable room should be provided with minimum background ventilation of an equivalent area of 2,500 mm^2 (equates to a free area of 3,125 mm^2) as per TGD F Clause 1.2.2.8. Where the window opening size is 10 % of the floor area of the sanitary accommodation (WC) and is relied upon to provide extract ventilation then this should not be included in the sum of total extraction rate calculation.

Though the flow rates may be manually or automatically boosted when needed, the minimum continuous ventilation rate and capacity of the system should be calculated by a competent person and be based on the calculated general ventilation rate. The calculated general ventilation rate to be provided by the cMEV at all times is determined as the greater of:

a. 5 l/s plus 4 l/s per person, e.g. 25 l/s for an occupancy level of 5 persons.
   or
b. 0.3 l/s per m^2 internal floor area, e.g. 30 l/s for a 100 m^2 dwelling.

In order to meet extract requirements, the system may require a higher extract or boost capacity depending on the number of wet rooms (kitchens, bathrooms, etc.) and sanitary accommodation. In addition to minimum general ventilation rates, the minimum boost extract flow rates in litres per second (l/s) for continuous mechanical extract ventilation (cMEV) systems are given in Table 6[12].

Table 6 : Minimum boost extract flow rates in litres per second (l/s) for cMEV and MVHR systems

Table 1: Centralized continuous mechanical extract ventilation systems: minimum boost extract rates[1]	
Wet rooms	**Minimum extract rate (l/s)**
Kitchen	13[2]
Utility room	8
Bathroom	8
Sanitary accommodation (no bath or shower)	6[3]
Notes: 1 The above are minimum boost extract rates and may need to be increased to achieve the general ventilation rate. 2. Excludes cooker hood extract. 3. As an alternative, an opening window provided for purge ventilation may be relied on for extract.	

(source: TGD F Table 1 and Table 2)

The mechanical extract ventilation system should be able to provide a capacity of at least:

i. 25 % over the calculated general ventilation rate; and
ii. the overall minimum extract boost rate.

The calculated general ventilation rate calculated should be distributed in proportion to the extract flow rates of each wet room in Table 6. Flow rates for typical dwellings are given in Appendix A of TGD F Ventilation available on gov.ie website.

[12] As per TGD to Part F - Ventilation of the Building Regulations, 'free area' is the geometric open area of a ventilator. Free Area is typically 25 % greater than its equivalent area. Equivalent area is measured in accordance with the method specified in I.S. EN 13141-1.

Mechanical Extract Ventilation Heat Recovery - MVHR

Mechanical Extract Ventilation Heat Recovery (MVHR) may be used where an air permeability of less than 5 $m^3/(h.m^2)$ is achieved (see Figure 4). As the airtightness of the dwelling improves the energy efficiency of the whole-dwelling MVHR improves. Unlike cMEV, MVHR systems combine supply and extract ventilation in one system, refer to Clause 6.7. MVHR system both removes and returns air by continuously supplying fresh air to living spaces and bedrooms and extracting warm, moist stale air from wet rooms via ducts, which pass through a heat exchanger and exhausts it to the exterior via another duct.

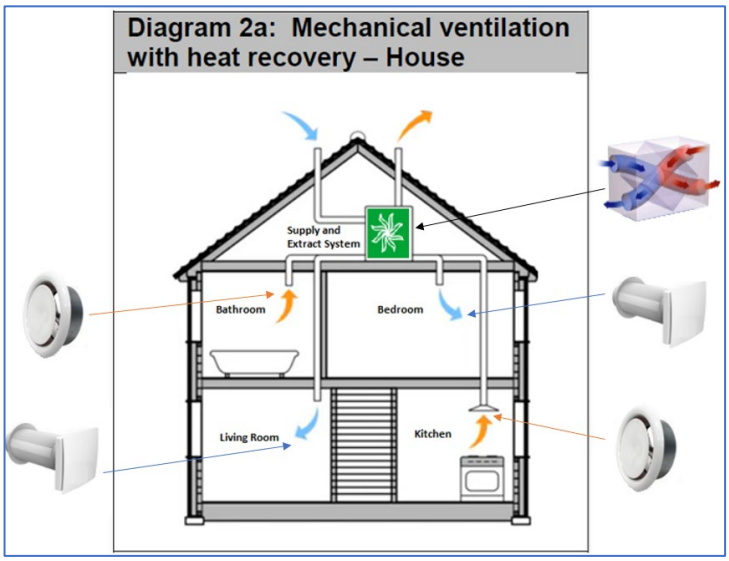


Figure 4 : Mechanical Extract with Heat Recovery – MVHR when air permeability is less than < 5 $m^3/(h.m^2)$ (source: TGD F Ventilation_2019)

Supply and extract rates should be balanced, so that air supply rates are greater than or equal to extract rates. A balancing supply of fresh air is drawn from outside via other ducts, filtered and passed through the heat exchanger to warm it, and supplied to the living spaces and bedrooms via further ducts. Background ventilators are not needed, but door undercuts are necessary to allow airflow through the dwelling.

Minimum boost extract ventilation rates in litres per second (l/s) for Mechanical Extract Ventilation Heat Recovery (MVHR) are given in Table 6[13].

The verification of intended design flowrates by an independent third party e.g. Irish National Accreditation Board (INAB), NSAI Certified or equivalent, should be included as part of the ancillary certificate issued for the dwelling ventilation system (see Clause 4.2). Refer to guidance document "*Installation and Commissioning of Ventilation Systems for Dwellings - Achieving Compliance with Part F …*" published by DHLGH, I.S. EN 14134 and BSRIA "*Domestic Ventilation Systems - a guide to measuring airflow rates* (BG 46/2022)".

Where new mechanical extract ventilation systems with heat recovery (MVHR) are installed as part of a Major Renovation then the system should be designed, installed, commissioned and validated e.g. NSAI Ventilation Validation registration scheme[7], see Clause 4.2.

MVHR systems require that the filters be cleaned or replaced one month after handover, and subsequently at intervals of not more than one year (preferably six months); blocked filters stop MVHR systems operating effectively, and can lead to condensation and mould, and health problems for occupants.

[13] As per TGD to Part F - Ventilation of the Building Regulations, 'free area' is the geometric open area of a ventilator. Free Area is typically 25 % greater than its equivalent area. Equivalent area is measured in accordance with the method specified in I.S. EN 13141-1.

4.4.3 Demand Controlled Ventilation (DCV)

Demand Controlled Ventilation (DCV) is an approach to managing ventilation and indoor air quality (IAQ) by adjusting the amount of extracted air or fresh air supplied to a space based on real-time conditions.

DCV systems monitor relevant external stimuli (e.g. humidity, CO_2, occupancy), and adjust the flow of air accordingly, to deliver adequate indoor air quality. DCV utilises local (room), zonal, or whole building level-controlled extract units which provide high levels of ventilation when a room is occupied, or pollution is being created. In times of low occupancy, a DCV can provide lower levels of ventilation.

Demand Controlled Ventilation (DCV) systems require an Irish Agrément Certificate as a DCV system can reduce airflow rate below minimum levels set out in guidance and in this document. Vented cooker hoods, or equivalent extractors, are not compatible with DCV systems and are not recommended. To ensure the DCV system does not impact indoor air quality (IAQ) the system must still achieve the minimum general ventilation rate as required by TGD F Ventilation.

A DCV system needs to be carefully planned to ensure the DCV system achieves certain performance criteria, such as the removal rate of moisture or indoor pollutants. Once a Demand Controlled Ventilation (DCV) system has been installed it requires testing and commissioning to validate system performance. Where a DCV system is installed as part of a Major Renovation then the system should be designed, installed, commissioned, and validated by a competent independent third party certified by NSAI (or equivalent), refer to Clause 4.2 Ventilation Validation Certificate, for guidance.

4.4.4 Ventilation Extract Fans and Ductwork

MVHR or cMEV options are ducted systems that require a network of ducting from the unit to each of the rooms that they serve and require electrical wiring, see Clause 3.2.

A fan should always be sited in the furthest window or wall from the main source of air replacement to avoid short-circuiting the airflow. It should be located as high as possible in the window or wall nearest to smells or steam, but not directly above eye-level grills or cooker hoods.

Ductwork airtightness and noise minimization should be considered through the specification of quieter ventilation products, the correct design, sizing and jointing of ductwork, and fittings and installation and mounting of units to manufacturer's instructions. Installation of sound attenuators in ductwork may be used to reduce noise levels from equipment.

Any ventilation installation needs to offer easy access for maintenance such as replacing filters (if applicable), cleaning ducting and the fan unit, general maintenance or replacing the unit. The fan unit should be installed on a suitable stable and level structure.

Fans and ductwork located in or passing through unheated voids or attic spaces should be insulated to reduce condensation risk. Ducting should be insulated to prevent condensation within the ducts. This insulation should be the equivalent of at least 25 mm of mineral wool having a thermal conductivity ≤ 0.040 W/mK. The condensate drain(s) should be adequately secured and adequately insulated to prevent freezing.

Where an open-flued heat producing appliance is in a dwelling that also contains mechanical extraction, it should be installed and commissioned in line with TGD J, TGD F and the recommendations in S.R. 54 Clause 10.2.1.4 Combustion Appliances/spillage tests. The room where the heat producing appliance is located should be supplied with permanent ventilation.

4.4.5 Permanent Ventilation

Permanent Ventilation is any means of permanent non-adjustable vents, opening directly to the external air. Vents for heat-producing appliances such as gas appliances are considered permanent as they are in a fixed position and are not closable. The correct level of permanent ventilation must be installed as per TGD J Heat Producing Appliances of the Building Regulations. Refer to S.R. 54 Table 35 on Guidance for the provision of adequate supply of air for combustion products.

Introducing mechanical extract ventilation may cause spillage of combustion products where either an open-flued (non-room sealed) heat producing appliance or a solid-fuel heat producing appliance exists. Spillage occurs when the extraction rate of the fan causes a depressurisation in the room containing the heat producing appliance, which in turn may reverse the flow of air containing the combustion generated pollutant gases and fine particulate matter such as PM 2.5.

The ventilation system should be designed to ensure the likelihood of spillage occurring is reduced to an absolute minimum. This is achievable by ensuring that enough fresh air is continuously and permanently available in the room where the heat-producing appliance is located.

The relevant installation Standards for the fuel/product type should be followed. All new permanent ventilators should be tested to I.S. EN 13141-1 and installed to manufacturer's instructions.

4.4.6 Purge Ventilation

Purge ventilation is the ability to open a window or door that can allow enough fresh air directly from the outside. This temporary but effective method helps safeguard against overheating, condensation, odours, and various airborne contaminants, and should be used when required. All habitable rooms must provide the ability to purge in addition to a primary ventilation solution. The internal doors must provide a door undercut of a 10 mm minimum gap above the finished floor surface to maintain the airflow path through the dwelling.

Purge ventilation does not remove the need for independent ventilation requirements in kitchens, utility rooms, bathrooms and wet rooms.

Where a room, kitchen/utility, has no external wall, and background and purge ventilation cannot be provided, then the intermittent extraction fan should operate with a 15-minute overrun (see Natural Ventilation with Background Ventilation and Intermittent Extract Ventilation Clause 4.4.1).

In wet rooms, where the room does not have an external wall, Mechanical Extract Ventilation (cMEV) system is acceptable as purge ventilation, refer to cMEV Clause 6.7.1.

Mechanical ventilation with heat recovery (MVHR) with a 'built-in' purge option forces the MVHR unit into its highest airflow configuration to meet the air movement requirement for purge ventilation.

When replacing windows, consideration should be given to the sizes of opening sections for both purge ventilation and fire egress, refer to TGD B Fire Safety and TGD F Clause 1.2.4.6.

Purge ventilation should be provided in accordance with the TGD F Ventilation.

4.5 Ventilation and Wall Insulation

When home energy upgrade measures are installed in an existing building it is essential to consider the impact of retrofit measures such as how insulation, ventilation, airtightness, draught-proofing, heating and energy generation will interact with each other and with the building fabric.

In addition to Clause 4 under points 1, 2, 3 and 4, Contractors should be aware that the installation of wall insulation is likely to improve the airtightness of the building. This reduces unintended ventilation in the form of uncontrolled air leakage or draughts in the home. This effect is likely to be most pronounced in the case of external wall insulation (EWI) systems, however both cavity wall insulation (CWI) and internal wall insulation (IWI) can also cause issues. However, the primary focus should remain on the requirements for provision of adequate ventilation points 1, 2, 3 and 4 listed under Clause 4.

Therefore, in accordance with the training given for EWI by the Irish Agrément ETICS (External Thermal Insulating Composite Systems) Certificate Holder, and where necessary, in consultation with them, the Contractor should consider the likely effect of the EWI installation on the home's ventilation and recommend appropriate options/solutions for the homeowner (refer to Clause 6.2).

4.6 Ventilation and Indoor Air Quality (IAQ)

Indoor environmental quality (IEQ) and health impacts are an important benefit of energy efficient homes with improved thermal comfort, visual comfort, acoustic comfort and indoor air quality (IAQ) achieved with a well-designed ventilation strategy. Indoor air temperature is an indicator of thermal comfort and ventilation can influence thermal comfort by transporting heated, cooled, humidified or dried air and provide humidity control. Daylight access and cross-ventilation ensure energy efficient measures (EEM) do not compromise indoor environmental conditions.

Indoor air quality (IAQ) is considered acceptable when no chemical and biological pollutants are present at harmful levels in the indoor air.

Ventilation is important for good indoor air quality (IAQ). An appropriately ventilated indoor environment is essential to support good respiratory health, dilution of airborne pollutants and reducing the risk for the propagation of mould.

Most whole house or room ventilation is continuous whilst task ventilation is manually controlled by the occupant e.g. cooker hoods or bathroom extract. Where present, mechanical ventilation systems (grilles, vents, fans, filters and ductwork) must be maintained in good working order.

Further Guidance

- I.S. EN 16798-1 Energy performance of buildings - Ventilation for buildings. Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics
- ISO 17772-1 Energy performance of buildings - IEQ. Indoor environmental input parameters for the design and assessment of energy performance of buildings

4.7 Condensation and moisture risk

Moisture from outside the building can enter the wall as a result of weather exposure or rising damp and can damage the structure and internal environment of a building. A buildings exposure to moisture is also dependent on the geographical location of the site[17].

Damp is moisture entering the building fabric (often through rainwater defects, poor drainage, ground moisture or poor detailing), condensation is moisture in the air depositing on cold surfaces due to reduced ventilation and breathability. Breathability refers to a material's ability to allow water vapour to diffuse through it to help moisture escape from within walls, roofs, or insulation layers.

Interstitial condensation risks include damage to exterior finishes (due to freeze/thaw cycles), interstitial mould growth and structural damage. Surface condensation risks include damage to interior finishes and surface mould growth.

A vapour control layer (VCL) is installed on the inside side of the building and regulates water vapour movement passing through a building's structure. A vapour permeable (breathable) membrane (Type LR), installed on the outside, allows water vapour to escape while preventing rainwater from penetrating the building.

Using both a vapour permeable (breathable) membrane and vapour control layer (VCL) ensures comprehensive moisture management, safeguarding the building from both interstitial condensation and external water ingress.

Hygrothermal evaluation is the analysis of heat, vapour and moisture transfer through building elements and provides information for interstitial condensation, surface condensation and energy impacts (variation in thermal conductivity/U-value as moisture accumulates). In cases where moisture flow is being evaluated in a building and for condensation risk assessments see Clause 4.5 of S.R. 54.

Further Guidance

- TGD F provides guidance on adequate ventilation measures
- I.S. EN ISO 13788 - Hygrothermal Performance of Building Components and Building Elements – Internal Surface Temperature to Avoid Critical Surface Humidity and Interstitial Condensation – Calculation Methods
- I.S. EN 15026 - Hygrothermal Performance of Building Components and Building Elements – Assessment of Moisture Transfer by Numerical Simulation
- I.S. EN ISO 10211 - Thermal Bridges in Building Construction - Heat Flows and Surface Temperatures - Detailed Calculations
- S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings Clause 4.5 Moisture Flow
- Mould in Buildings (TG 26/2024) - BSRIA (Building Services Research and Intelligence Association)

5. Traditional Buildings, Protected Structures and Architectural Conservation Area

In Ireland, traditional buildings are considered to include, but not limited to, buildings of solid wall construction, often using local materials such as stone, brick and earth, building using lime and/or earth-based mortars, renders and plasters. Traditional buildings are typically older buildings constructed with permeable and/or fragile materials built before 1940.

Any work carried out to improve the energy efficiency of historic, or traditional buildings, requires an appropriate approach in terms of materials and insulation regardless of any statutory protection that may apply. Effective retrofit solutions for traditional buildings must balance energy efficiency, moisture control and long-term durability. Works carried out may require specialist knowledge on the part of the Contractor because of a potential effect on the character of the building and the architectural heritage value of the element being changed. Further guidance is available

- I.S. EN 16883 Conservation of Cultural Heritage - Guidelines for Improving the energy performance of historic buildings
- "*Improving Energy Efficiency in Traditional Buildings*" seai.ie/.../Improving Energy Efficiency in Traditional Buildings

SEAI'S Traditional Homes and Heritage Buildings upgrade scheme document describes, in Table 2, the minimum technical requirement for each home energy upgrade measure for grant support. Refer to

- www.seai.ie/.../Upgrade Traditional Homes and Heritage Buildings
- SEAI Traditional Homes Pilot Scheme - Application Guide for OSS (including guidance for Traditional Building Professionals)

Where a building is a protected structure (or has been proposed for protection) or where a building is located within an Architectural Conservation Area (ACA), the usual exemptions from the requirement for planning permission may not apply. Refer to Planning and Development Act 2024, Section 9 (4).

Architectural Conservation Area requires that any works to the exterior of a building which would materially affect the character of the area will require planning permission. In this context, however, works to the interior may not require planning permission, as they would do in the case of a protected structure.

Protected structure requires that any works which would materially affect its character will require planning permission. Many older buildings in Ireland, commonly known as 'listed buildings' or buildings with 'preservation orders' are legally protected in order to preserve their special character. Legal protection also extends to the interior of the building and to other structures and features within the curtilage of a protected structure, such as outbuildings, boundary walls, paving, railings, etc.

Owners or occupiers of a Protected Structure may request a 'declaration' under Section 57(2) of the Planning and Development Act. The purpose of this declaration is for local planning authorities to clarify, in writing, the kind of works that would or would not materially affect the character of the structure or any element of the structure which contributes to its special interest.

Record of Protected Structures (RPS) forms part of the development plan of each planning authority and will contain details, including maps, of any designated Architectural Conservation Area (ACA). A property might be in an area of architectural conservation but might not be a protected structure. If a building is a protected structure, or if it is in an Architectural Conservation Area, the Architectural Conservation Officer in the relevant local planning authority should be consulted (see Clause 2.2). For further information

- *"Architectural Heritage Protection Guidelines for Planning Authorities"* published by DHLGH

The Contractor must be registered with SEAI. The Contractor shall satisfy that all necessary approvals have been obtained from the relevant local planning authority before commencing the works. Refer to SCSI.ie.

6. Home Energy Upgrades : Best Practice for specific energy efficiency measures

An energy efficiency measure is planned work undertaken to improve the energy performance of a dwelling by saving or generating energy. Domestic home energy upgrade / retrofit projects range from the installation of single improvement measures to whole-dwelling projects involving multiple measures installed at the same time.

Implementation and Governance

DTSS Clause 6 is divided into subclauses which detail the competency and standards expected by SEAI for each of the specific home energy upgrade measures, refer Table 1 to for guidance. A summary list of guides and standards referred to are detailed in Appendix 1: Reference Documents and each measure is summarised in Appendix 2: Summary Table of Competencies and Standards.

Where the DTSS prescribes Standards / Specifications of products / systems or certification requirements for contractors, the manufacturer or supplier may participate in the SEAI home energy upgrade grant programmes by clearly demonstrating full equivalence to those requirements. When pursuing this equivalence route, it is important that the supplier or contractor contact the SEAI Technical Team[9], demonstrating equivalence to SEAI's satisfaction. This must be done before any works are undertaken with the subject system or by the subject Contractor. Failure to first secure written confirmation from SEAI of said equivalence may result in revocation of a homeowner's SEAI grant approval, and possible sanction for the Contractor in accordance with the SEAI grant programme's terms and conditions and QADP.

Nothing in the above guidance allows SEAI to subvert legislation, regulations, procedures or institutional arrangements by having SEAI act beyond its statutory remit.

Building Fabric

The building fabric consists of the walls, roof, floors, windows and doors. The fabric is a major area of heat loss which can be reduced by adding internal, cavity or external wall insulation, ceiling and floor insulation, and replacement of windows. An additional way to reduce heat loss is to improve airtightness and ensure adequate ventilation is maintained. Services (such as space heating and domestic hot water systems, lighting, renewable energy, controls) work with the insulation, airtightness and ventilation of a home to improve energy efficiency, performance and comfort.

- Retrofit can be a process implemented in stages as part of a coordinated design of whole house energy upgrades.

- Fabric first approach is a method of improving the energy efficiency of a home by prioritising the building's envelope, or 'fabric' before considering heating systems or renewable energy generation.

- Whole house approach to energy in the home considers the overall effect of combining home energy upgrade measures to improve energy efficiency. Considerations include how insulation, ventilation, airtightness, draught-proofing, heating and energy generation will interact with each other and with the building fabric.

NOTE Homes undergoing major renovation can pose a risk of overheating due to the housing design such as large areas of south facing windows[35], high levels of insulation, low air permeability rates and low thermal mass. Situations where an overheating risk is indicated need to be identified as early as possible to allow appropriate changes to be incorporated into the design[14]. Refer to CIBSE TM59 Assessment of overheating risk in homes and CIBSE TM37 Design for improved solar shading control.

[14] Overheating in Retrofit and Existing Homes_ www.Good Homes Alliance.co.uk

6.1 Insulation : Cavity Wall Insulation

A cavity wall, also known as twin-leafed construction, usually has a regular brick pattern that consists of two parallel layers of masonry separated by a gap, or cavity. Cavity Wall Insulation must be installed to fill the full depth of the cavity. Minimum cavity depths apply depending on the product as per Irish Agrément Certificate (or equivalent), and residual cavity depths must never be less than 40 mm. Cavity Wall Insulation (CWI) is required to achieve a target maximum U-value of 0.35 W/m^{2}K, or a lower U-value.

NOTE A cavity hollow block wall is constructed by building a single wall using hollow blocks and placing them on top of each other in a staggered manner. Cavity hollow block walls are not suitable for cavity wall insulation. Additionally, timber frame homes cannot be cavity insulated.

Contractor Competence

Cavity wall insulation (CWI) Contractors will be an Agrément CWI Approved Installer for the system specified in the relevant Irish Agrément certificate[15], have a CWI Approved Installer Number associated with the relevant Certificate and must be on the Agrément Registered Installers[16] directory (or equivalent).

Product Standards and Specification

All cavity wall insulation must be installed in accordance with the specifications laid out by the system supplier / manufacturer and in accordance with the relevant system's Irish Agrément Certificate (or equivalent) and S.R. 54 Clause 7.3.4 Cavity wall insulation (CWI). Materials used in the insulation of a cavity wall must be Irish Agrément certified, or equivalent, see Clause 2.3.

For cavity wall insulation please refer to the specific SEAI grant programme requirements when:

- Cavity wall insulation may not be technically, functionally and economically feasible.
- A combination of home energy upgrade measures is required (i.e. cavity, internal and/or external wall insulation)

Installation Standards and Specifications

a. The Contractor will be an Agrément CWI Approved Installer for the system specified in the relevant Irish Agrément certificate and have a CWI Approved Installer Number associated with the relevant Certificate. At least one member of an installation team must carry a CWI installer identity card issued by the Agrément Certificate holder.

b. All cavity wall insulation must be installed in accordance with the specifications laid out by the system supplier / manufacturer and in accordance with the relevant system's Irish Agrément Certificate (or equivalent) and S.R. 54 Clause 7.3.4 Cavity wall insulation (CWI). Further guidance on CWI installation considerations is detailed in S.R. 54 Clause 7.3.4.3.

c. CWI installation is subject to a pre-installation survey. The walls must be surveyed before the installation by a trained surveyor on behalf of the approved Contractor. A report from a complete survey, including borescope inspection survey, is required as per Irish Agrément Certificate, or equivalent, and must be provided to the homeowner.

d. Cavity wall insulation is certified for use in masonry walls up to 12 metres (12 m) in height subject to the conditions in the product Agrément Certificate.

[15] Agrément Approval Scheme for Installers of Blown Cavity Wall Insulation (CWI) Systems www.nsai.ie/D-IAB-003_CWI_Installer_Scheme

[16] Agrément Registered Installers www.nsai.ie/agrement-certification/agrement-registered-installers

e. Contractors should indicate to the homeowner the methods they intend to use to ensure the successful installation of the cavity wall insulation to the full extent of the cavity wall. Thermal imaging can show areas that have been missed or areas where the filling material has settled.

f. The exposure of the walls to wind-driven rain should be assessed and related to any restriction on the type of cavity fill being considered. The suitability of insulation depends mainly on the local exposure to driving rain and the condition of the existing construction[17], refer I.S. EN ISO 15927-3.

NOTE CWI System certificates provide maps identifying exposure zones and specify conditions where full fill cavity insulation can be used.

g. Any visible defects that could result in water penetration or rising damp shall be identified on the survey report. Any defects recorded in the survey, which may affect the performance of the insulation system when installed, shall be notified to, and rectified by the homeowner, with or without involving the Contractor before installation work commences.

h. Cavity Wall Insulation may be used to full-fill the residual cavity where the cavity wall was previously partially filled. Attention should be given to mortar snots, cavity debris, moisture penetration and problems with preexisting partial fill insulation. Suitability is dependent on the thickness and type of existing insulation and the width of the residual cavity.

i. A borescope inspection will confirm the partial fill boards are fixed to the inner wall surface, and a minimum of 40 mm cavity exists at all locations. Additional factors must be examined to determine its suitability and will be subject to the conditions and approval of the Agrément certificate.

Each property is subject to two borescope inspections surveys:-

- The first borescope is performed by the Site Surveyor (on a minimum of two test holes per elevation) to ascertain the suitability of the property for the recommended insulation system.
- A second detailed borescope survey (on all drill holes) is performed by the installer during the installation phase to determine that the installation conforms to the certified method i.e. the pattern of holes complies with the description, and the injection of material takes place at each hole to ensure the complete filling of the cavity space.

j. The insulation material must be suitable as per S.R. 54 Clause 7.3.4.2.5 Material Suitability and 7.3.4.2.6 Cavity Suitability.

NOTE Cavity walls with existing partially filled mineral wool (glass/rock wool) are not recommended for top-up insulation.

k. The specific instructions and recommendations provided by the manufacturer of the expanded polystyrene (EPS) beads and bonding agent should be followed. The flow rate test will ensure the bead-to-adhesive ratio achieves the desired flow rate and bonding characteristics to prevent over-bonding (too much adhesive) or under-bonding (too little adhesive) and to prevent bead leakage.

l. Refer to manufacturer's instructions and the system's Irish Agrément Certificate, or equivalent, before proceeding with works in cold weather. Low temperatures may affect the adhesive used to bond cavity beads together and this may compromise the integrity of the cavity wall insulation.

[17] Distribution of driving rain in Ireland - Met Éireann www.met.ie/distribution-of-driving-rain-in-ireland

m. All ventilation requirements must be met (see Clause 4 Ventilation). The contractor ***must*** inform the homeowner, in writing, of any aspects of ventilation considered to be inadequate or potentially unsafe. Essential ventilation openings, such as those providing underfloor ventilation or combustion air for gas, oil and solid fuel appliances must be correctly ventilated as per TGD F Ventilation and TGD J Heat Producing Appliances.

n. Ventilation openings must be checked to ensure there are no obstructions due to the insulant. Flues are carefully checked before and after the installation by means of an appropriate test (e.g. a smoke test) to ensure they are not obstructed by the insulant. The installer must ensure all flues, chimneys and air vents are operating satisfactorily upon completion of the installation.

o. The positioning and future access to all plumbing, wall and underfloor vents, flues and electrical cabling services should be carefully considered before the installation in order to provide adequate protective measures. Services, ventilation ducts, and flues should be sleeved through both leaves of the wall and precautions taken to isolate expanded polystyrene (EPS) bead insulation from hot flues. Care should always be taken, with service penetrations, to minimize any negative impact on the overall airtightness of the home.

p. Cavity filling with expanded polystyrene (EPS) should not be carried out unless all PVC sheathed electric cables are placed in conduits or as per method in the Agrément Certificate (see Clause 3.2). It is essential that the ESB Networks cable does not come into contact with the cavity insulation. The meter box is checked to ensure there is no bead leakage that could result in contact between bead and electrical cables and to ensure that the electrical cables have been sleeved, as required.

q. If the cavity is uncapped, it must be closed at the top of the wall and at the top of any opening. There are several different methods for capping of existing walls, which should be agreed before works are started. Cavity brushes should be installed at party walls to ensure bead does not migrate between properties. Any insulant that has been blown through the top of the cavity into the attic space is removed and any points of leakage sealed.

r. All relevant records such as the Agrément Certificate holder's project specific design, site survey sheets, CWI installation check sheets including borescope inspections surveys, combustion appliance safety check sheets, bead/adhesive/coverage test results, must be maintained by the Contractor and made available for inspection by SEAI, if requested.

s. Irish Agrément Certificate (or equivalent) and Warranty must be issued to the homeowner. Certification is valid once the conditions outlined in the Agrément Certificate are met.

6.2 Insulation : External Wall Insulation

Contractor Requirements and Competence

Contractor installing external wall insulation (EWI) is approved by the Agrément Certificate holder as an External Thermal Insulation Composite System (ETICS) installer of their system and has been issued with an ETICS Operative ID card.

The Contractor shall be Irish Agrément ETICS registered[18] (or equivalent) for the system specified in the relevant Irish Agrément certificate before carrying out work.

Any alterations to cabling, existing ventilation, pipework, drainage and other fixtures and fittings affected by the work is to be agreed, in writing, with homeowner, prior to work being undertaken.

[18] Agrément Approval Scheme for Installers of External Thermal Insulating Composite Systems (ETICS) www.nsai.ie/D-IAB-005_ETICS Installer Scheme

External Wall Insulation will require compliance with the "**Major Renovation**" section of **Part L of the Building Regulations**, where more than 25 % of the surface of the building envelope undergoes renovation.

NOTE When installing external wall insulation (EWI) consideration *must* be given to local planning permissions relating to the design and aesthetics and possible impact on neighbouring properties. The status of this requirement should be checked with the relevant Local Planning Authority (LPA), at design stage, to ascertain whether planning permission/restrictions apply to the installation of external wall insulation (EWI), refer to Clause 2.2 Planning Regulations.

External wall insulation (EWI) *shall not* encroach on any public road (S.I. No. 341/2026). External wall insulation *may* be restricted where the dwelling faces onto public footpaths. Relevant Local Planning Authority (LPA) should be consulted where the EWI installation affects the width of the public footpath. Owners of neighbouring properties should be consulted where the installation of external wall insulation encroaches on their property.

Product Standards and Specification

The external wall insulation system must be Irish Agrément certified, or equivalent. This measure must only be installed on the wall types specified in the Irish Agrément Certificate, or equivalent, see Clause 2.3.

The installation of EWI should be undertaken where the detailing carried out is both technically and feasibly achievable. External Wall Insulation (EWI) is required to achieve a target maximum U-value[19] of 0.27 W/m^{2}K, or a lower U-value.

NOTE There is no external wall insulation system certified for use with timber frame walls, timber clad walls or steel frame construction. External wall insulation of timber frame or steel frame walls is not eligible for SEAI home energy upgrade grants or energy credits.

External Wall Installation (EWI) Standards and Specifications

a. The Contractor shall be NSAI ETICS registered (or equivalent) for the system specified in the relevant Irish Agrément certificate before carrying out work. Installer has been approved by the certificate holder as an ETICS installer of their system and has been issued with an ETICS Operative ID card.

b. All external wall insulation and associated products and works for the system being installed should be in accordance with the system supplier/manufacturer's specifications and installation instructions, Irish Agrément Approval Scheme for Installers of External Thermal Insulating Composite Systems (ETICS) and S.R. 54 Clause 7.3.2 Code of Practice for the Energy Efficient Retrofit of Dwellings.

c. External wall insulation may only be used on cavity walls when the cavity is filled, as per S.R. 54 and Irish Agrément ETICS Scheme. The cavity should be fully filled either as part of the original construction or as part of the retrofit measures where external insulation is used. Where cavity walls are unfilled then the use of external wall insulation is not recommended due to thermal bypass and thermal looping within the cavity (see Clause 6.2.5).

d. All ventilation requirements must be met e.g. sub-floor ventilation (suspended floor), habitable room and wet room ventilation and roof ventilation, see Clause 4.

[19] U-values are calculated according to the standards detailed in TGD L, I.S. EN ISO 6946 DEAP methodology, and BR 443 - *Conventions for U-value calculations.* See Clause 2.9 of this document for further details.

Gas, oil and solid fuel appliances must be correctly ventilated, refer to Clause 4.4.5. Ventilation openings must be checked to ensure there are no obstructions due to the insulant. All flues must also be checked for obstructions using an appropriate test (e.g. smoke test).

NOTE The contractor ***must*** inform the homeowner, in writing, of any aspects of ventilation considered to be inadequate or potentially unsafe (particularly rooms containing fuel burning appliances). Where a dwelling has inadequate or no roof ventilation at the eaves, the contractor must outline the potential consequences of inadequate ventilation of the roof space. These include the risk of condensation occurring as a result of increased temperature and humidity within the dwelling following implementation of energy efficiency measures.

It is the responsibility of the homeowner to rectify these issues before works can commence unless the homeowner specifies that the Contractor is to carry out the remedial action, in which case the works may proceed with the installation of external wall insulation. See Clause 4 Ventilation, TGD F Ventilation and TGD J Heat Producing Appliances.

e. The suitability of insulation depends mainly on the local exposure to driving rain and the condition of the existing construction[20], refer I.S. EN ISO 15927-3.

Porous building fabric that has excessive moisture, particularly walls, may also result in increased thermal transmittance of the component increasing heat loss through the building fabric. It is important to allow for correct drying out of the building fabric to occur before installation works.

f. Weather conditions must be monitored to ensure correct application and curing conditions. The contractor must plan the working sequence in line with site requirements, resource, system specification, and weather conditions. Refer to manufacturer's instructions and the system's Irish Agrément Certificate (or equivalent).

Installation of external wall insulation (EWI) can be affected during particularly cold weather as the adhesive used may not bond during cold spells thereby reducing the integrity of the insulation. In sunny weather, work should commence on the shady side of the building and be continued following the sun to prevent the rendering drying out too rapidly.

g. Where new concrete or plasters are being applied internally, introducing a lot of moisture to the building, it is important that this has dried out sufficiently prior to the installation of the ETICS (external thermal insulation composite system).

h. A comprehensive pre-installation survey of the property should be carried out to determine suitability for treatment and any repairs or modifications necessary to the building structure before application of the insulation system.

i. The pre-installation survey should identify residences where electricity service alterations will be required.

The external wall insulation installer is not permitted to interfere with ESB Networks (ESBN) wires, cables or equipment. Works must not commence until any necessary pre-installation service alterations have been completed by ESB Networks (ESBN), refer to Clauses 3.2, 6.2.1 and 6.2.2.

[20] Distribution of driving rain in Ireland - Met Éireann www.met.ie/distribution-of-driving-rain-in-ireland

j. The survey should also include tests conducted on the walls of the property to determine the pull-out resistance of the proposed mechanical fixings for the appropriate substrate. An assessment is carried out and a recommendation is made on the type and number of fixings required

k. Replacement windows and/or replacement doors should be fitted prior to installation of external wall insulation, wherever possible. When replacing windows, they may be relocated towards the external face of the existing structure to reduce thermal bridging but always should be supported by the structure. Details should be in accordance with ETICS Agrément certification.

l. A specification is prepared for each elevation of the building indicating:
   - Where required, additional corner mesh and reinforcement;
   - Detailing around windows, doors and at eaves;
   - Detail for external wall insulation up to, and stopping at, a party wall boundary.
   - Exact position of the damp-proof course (DPC);
   - Exact position of expansion joints;
   - Any required alterations to plumbing including rainwater downpipes and gulley traps.
   - Areas where flexible sealants must be used;
   - Where required, the position of fire barriers.

m. The contractor should evaluate the need for repositioning of or temporary removal and/or extension of services such as overhead electricity, cable TV, telephony and broadband connections/equipment, gas or oil pipe work, electricity or gas meters, wall-mounted lights, CCTV cameras, rainwater goods etc. Refer to Clause 6.2.4.

n. The buildings entry point for telecommunications infrastructure (cables) for broadband (FTTH Fibre to the Home)**,** cable TV and telephony shall be agreed with homeowner prior to EWI installation. In particular, agreement on the workaround for the cables fixed to the external walls and provision being created for new surface mounted cabling in the vicinity.

   FTTH cable should enter the premises at a location where it is convenient for the homeowner to access or use the Service / Optical Network Terminal (ONT). It is important to predetermine the pathway from the Internet Service Provider (ISP) feeder cables Primary Distribution Point (PDP) to the premises ONT and may include special riser (vertical) and drop (horizontal) cable solutions. Consideration should be given to any other duct cable installation operations. Refer to Clause 6.2.4 External Wall Insulation and Telecommunications Infrastructure.

o. Modifications of downpipes, soil and vent pipes, pipe extensions, ESB electricity meter and gas meter locations and other services should be as detailed in the design specification. All pipework should be relocated as required to accommodate the insulation.

p. Where appropriate, external plumbing, including rainwater downpipes and gulley traps, must be removed and alterations made to underground drainage before installation of the system, to accommodate repositioning on the finished face of the system. Downpipes, gas pipes, eaves drop systems and rainwater goods repositioned during EWI installation should be fixed securely and sit flush against the new surface.

q. Any causes of dampness such as leaking gutters or downpipes must be repaired before starting works. Drilling into insulation boards or render without preparation can cause damage, reduce insulation performance or create gaps leading to water ingress, cracked render and thermal bridging.

Where there is evidence of rising damp, remediation measures must be carried out prior to works commencing.

r. Appropriate strengthened fixings are required for satellite dishes which are subject to wind load, TV aerials, washing lines or other services that need to be attached to the wall. All fixtures and fittings must be anchored securely and be appropriate for use with external wall insulation and fixed in accordance with the Agrément Certificate.

s. The insulation panels should be stored on a firm, clean, dry and level base, off the ground. Panels should be protected from prolonged exposure to sunlight by storing opened packs under cover in dry conditions or by re-covering with opaque polyethylene sheeting.

When handling the insulation boards, care must be taken to avoid damage and contact with solvents or bitumen products. The boards must not be exposed to open flame or other ignition sources.

t. Any metal laths, renders, paints, texture synthetic finish coatings and sealants should be stored in accordance with the manufacturer's instructions in a dry environment at the required temperatures.

u. The flatness of surfaces must be checked. This may be achieved using a straight edge spanning the storey height. Local areas may be assessed using a straight edge spanning 1 metre. Any excessive irregularities must be made good before installation.

v. Assess the form and condition of the roof, roof membrane, ventilation paths and eaves structure to ensure the existing roof condition is suitable to receive EWI system.

w. The condition of the exterior of the wall should be assessed. Surfaces should be sound, clean and free from any loose material. Render finishes should be in good condition. Pebbledash (wet and dry dash) does not provide an even surface for the adhesive to bond to and should be adequately prepared or removed. All necessary repairs to the property's structure must be completed and dry before the installation of the insulation.

x. If the existing wall surface is covered with a render, the bond between the background and render should be adequate. Otherwise, it must be removed and reinstated with a sufficient bond.

y. Locate the damp proof course (DPC) line, usually a visible horizontal membrane or slate course above the ground. **NOTE** External wall Insulation boards and the final weatherproof render system must never bridge this line. Starter track and base beads, typically at DPC level, should be accurately aligned to provide a horizontal base profile and should be secured to the external wall. The first row of insulation boards is positioned on the base profile.

z. The rigid insulation boards must be firmly pressed to the wall and mechanically fixed in place with a fixing arrangement as per the conditions and approval of the Agrément certificate. Care must be taken to ensure that the boards are butted tightly together. Surface alignment should be checked as work proceeds. Coat the boards with an adhesive mortar (called a 'render base coat') in which a reinforced mesh is embedded to prevent cracking due to building movement. Any gaps at joints should be sealed e.g. thermal insulation mortar. Gaps of larger than 3 mm should be filled with slivers of insulation. Surface irregularities must be removed by planning with a rasp over the whole surface.

aa. When using polystyrene insulation materials, it is essential that any cutting of polystyrene blocks with saws is done in a properly enclosed area (surrounded by mesh or indoors) to prevent the release of polystyrene debris into the local environment. Ensure adequate ventilation, see Clause 3.1.

bb. The key thermal bridge junctions for external wall insulation may be addressed as follows:
- When eliminating ground floor thermal bridges, this may require placement of suitable external insulation to footpath level. Further thermal improvements may be achieved by bringing insulation below ground level and may require removal of footpaths;
- Window sills require specific detailing, such as the correct projection depth and weathertight junction between the sill and window frame, to prevent water ingress at the window base and jamb-to-sill junction;
- At window and door head locations insulation should be returned into the window frame / jamb. Reveal edges are capped and sealed at the jamb junctions.
- Roof eaves should be extended to fully cover the insulation. Insulation should abut the roof insulation to form a continuous layer; otherwise, a thermal bridge may occur. To eliminate the thermal bridge (cold bridge) at the wall roof junction removal of the soffit may be required.

cc. Care should be taken during the installation to ensure the continuity of insulation and airtightness at the junction between window, existing wall and external wall insulation.

The insulation should be returned across the reveals, window sills and jambs to provide insulation continuity, in accordance with the Agrément Certificate. To fit around doors and windows, insulation boards may be cut with a sharp knife or a fine-toothed saw only. All junctions between external wall insulation and existing window frames should be adequately sealed to prevent the ingress of moisture e.g. fit a flashing to the underside of the sill to allow any moisture to drain away. The insulation should overlap at the corners and fit without gaps. Where clearance is limited, strips of approved insulation should be installed to suit available margins.

If required, purpose-made window sills may be installed at this point, to prevent water ingress, as per Irish Agrément ETICS Certificate. For further guidance refer to Clause 6.25 and Acceptable Construction Details on the DHLGH website.

dd. The undercoat and finishes should be applied within the permitted temperature range and should be protected from rapid drying. Drying should take 24 hours in favourable conditions.

ee. Before applying base and finish coats, all necessary protective measures such as taping off existing window frames and covering of glass should be in place.

Where there is a risk of insulant exposure, e.g. window reveals, eaves, etc., the system must be protected by an adequate overhang or by an adequately sealed, purpose-made flashing.

ff. When the basecoat is applied to the insulation boards, the reinforcing mesh is embedded into the basecoat before it dries. The mesh should be fully embedded in the basecoat and be free of any creases. Additional mesh may be required at corners and openings.

gg. Installation continues until the whole wall is completely covered including, where appropriate, the building soffits.

hh. All rendering and plastering shall be in accordance with I.S. EN 13914-1 Design, Preparation and Application of External Rendering and Internal Plastering. Workmanship shall be in accordance with TGD D and BS 8000-0.

ii. Movement joints should be provided in accordance with the system supplier's technical specifications.

jj. On completion of the EWI installation all relevant post EWI installation checks have been completed including the fixings and associated building services such as ESB meter cabinet, electric cables, external electric fittings and wiring, gas meter cabinet, supply and service pipes are confirmed to be in the correct position and the EWI has been installed in accordance with requirements with the applicable Irish Agrément Certificate (or equivalent) and ETICS scheme.

kk. The Contractor shall hand over to the homeowner the Homeowner's Manual which includes the Irish Agrément Certificate (or equivalent) and system supplier Warranty specific to Irish site conditions and to the individual ETICS installation, as appropriate. Certification is valid once the conditions outlined in the Irish Agrément Certificate are met.

All relevant records such as the Agrément Certificate holder's project specific design, site survey sheet, building details, method statement and maintenance plan must be maintained by the Contractor and made available for inspection by SEAI, if requested.

6.2.1 External Wall Insulation, Health & Safety and Electrical Installations

Health and Safety Requirements : External wall insulation *must* not be installed over electricity wires / cables or other electrical fixtures.

Electrical power distribution cables, whether via overhead cable or siamesed from an adjacent property, is often clipped to the outside face of external walls.

ESB Networks (ESBN) unclip the cable from its permanent position to facilitate the works. When the works are complete, a reclip can be requested where ESB Networks will reattach the cable to its original location.

NOTE Installers ***must*** inform ESB Networks (ESBN) well in advance of the works commencing to arrange for the required service alteration, e.g. as per (a) and (b) below.

(a) **ESB Networks service cable clipped directly to the surface of a wall or roof soffit**
DO NOT REMOVE OR TOUCH THE CABLES.
Where electricity wires or cables are attached to external walls or soffits.

(b) **ESB Networks overhead service alteration**
DO NOT REMOVE OR TOUCH THE AERIAL WIRES/CABLES.
An overhead alteration involves the service that runs overhead from a pole to the premises, often attached to the chimney or gable end.

DTSS Appendix 3 provides further guidance:

- Appendix 3: ESB Networks Guidance Documents : EWI Bulletin and Drawings

Contact ESB Networks 1800 372 757

6.2.2 ESB Networks (ESBN)_Electricity Meter Cabinet

Do not interfere with the sealed main fuse and meter units provided by ESB Networks

An outdoor electricity meter cabinet provides for the ESB Networks (ESBN) electricity meter(s). It is essential that the ESBN cable does not come into contact with the cavity insulation. The meter cabinet cannot be moved without disturbing the cables already connected. In most situations, the cabinet should remain in its original location and will be modified by the Contractor to seal the recess created by the fitting of the insulation and to allow for the fitting of a new door. An acceptable solution is to fit an extension to the existing cabinet by removing the door and cutting away the back from a new cabinet. The new cabinet is then placed in the recess with the sidewalls of the new and old cabinets overlapping. Accurate fitting is essential to "seal off" the wall insulation from the inner cabinet.

The outdoor Meter Cabinet and Door must be in accordance with ESBN specifications outlined in the ESBN National Code of Practice for Customer Interface.

All electrical work shall be in accordance with I.S. 10101 National Rules on Electrical Installation

DTSS Appendix 3 provides further guidance:

- Appendix 3: ESB Networks Guidance Documents : EWI Bulletin and Drawings

Contact ESB Networks 1800 372 757

6.2.3 External Wall Insulation and Gas Meter

Gas Networks Ireland (GNI) provide the necessary assistance to either move the gas meter box to a suitable alternative location or temporarily remove and then refit the meter box on completion of the works.

Gas Networks Ireland's Dial Before You Dig (DBYD) service provides information, advice and maps on the gas pipeline network. Before starting any excavation work, it is essential to check for the location of gas pipes. Visit www.gasnetworks.ie/.../Dial Before You Dig (DBYD).

Gas Meter and service installations shall be in accordance with I.S. 813 and S.R. 12007-5. It is a legal requirement that any work carried out on domestic gas installations must only be carried out by a Registered Gas Installer (RGI).

Gas Networks Ireland (formerly Bord Gáis Networks) technical bulletin outlines guidelines on external wall insulation (EWI), ventilation and flues (a flue is a duct or pipe that removes exhaust gases from a gas appliance to the outdoors).

Gas Networks Ireland (GNI) technical bulletin is available:
www.seai.ie/.../Bord Gáis External Wall Insulation & Domestic Gas Installations Guidelines

Gas Networks Ireland "Alterations and Relocations"
www.gasnetworks.ie/.../ meter / Alterations and Relocations

Contact Gas Networks Ireland 1800 464 464

6.2.4 External Wall Insulation and Telecommunications Infrastructure

National Broadband Ireland (NBI) under the National Broadband Plan (NBP) oversees the connection of high-speed fibre broadband to households (FTTH Fibre to the Home).

The process for installing a FTTH connection will depend on the specific internet service provider (ISP), the location of the end users' home and the availability of fibre optic cables in the area.

1. Aerial fibre optic cable (aka overhead fibre optic cable) is installed on existing utility pole infrastructure. Poles may be shared between operators or service providers (electricity, telecoms, cable TV, FTTH).
2. Where pre-existing telecommunications connection already exists and is delivered underground, the NBI Fibre Services may utilise this ducting infrastructure, if suitable.

Pre-Installation and Future-Proofing Services
Installation of dedicated conduit sleeves (micro duct) keeps the infrastructure flexible and future-proof, as additional cables can be added later without modifying the entire house wiring, facilitating a reliable fibre optic connection directly to residences.

National Broadband Ireland (NBI) guidance
- Survey and Installation of FTTH services on buildings fitted with External Thermal Insulation.
- Guidelines for NBI End Users when laying Ducting to facilitate the installation of Fibre Networks on private property

6.2.5 External Wall Insulation and Thermal Bridging

The use of external wall insulation (EWI) on masonry cavity wall with unfilled cavities can lead to thermal bypassing and thermal looping within the cavity. Best practice is to fill the cavity void with an Irish Agrément approved Cavity Wall Insulation (CWI) system, refer to Clause 6.1.

The cavities of hollow block walls should not be filled as the thermal bridging that occurs at the block spine and ends, will minimise the effectiveness.

It is recommended that thermal bridging be addressed as part of SEAI home energy upgrade grant works. Refer to S.R. 54 Annex H (Informative) Thermal Bridging Details for construction details.

6.3 Insulation : Internal Wall Insulation

Contractor Competence

Internal wall insulation (IWI) Contractors must be competent to install same and must complete the work to the standard set out in S.R. 54 Code of Practice for Energy Efficient Retrofit of dwellings published by the NSAI. Where the manufacturer operates an Approved Installer list, the Contractor must demonstrate their inclusion on the list or certification by the manufacturer. Insulation must be carried out using proper materials with a CE Mark or approved by the Irish Agrément Board (or equivalent) and installed by suitably qualified persons in accordance with the Irish Agrément Certificate (or equivalent).

"Internal wall insulation (IWI)" is the general term for adding insulation to the inner surfaces of walls to improve thermal performance. The terms "internal lining" and "dry lining" refer to lining materials (insulated or not) covering walls and ceiling surfaces. With internal lining and insulation boards the walls will protrude a little further into the room. Skirting boards, cupboards and radiators will have to be removed and refitted as part of the process. Before commencing internal wall insulation, the homeowner must be made aware of the effect on room sizes, services, and decoration.

Internal Wall Insulation will require compliance with the "**Major Renovation**" section of **Part L of the Building Regulations**, where more than 25 % of the surface of the building envelope undergoes renovation.

NOTE Internal lining with or without internal insulation is considered part of Major Renovation.

Product Standards and Specification

Materials used in the internal insulation of a wall must be proper materials, as referred to in TGD D Materials and Workmanship. When incorporating such a product, material or system into construction works it must be suitable for their intended use under Irish site conditions and be CE Marked. For products or components for which no appropriate standard exists then the insulation must be certified to Irish Agrément (or equivalent), refer to Clause 2.3.

Internal Wall Insulation is (IWI) required to achieve a target maximum U-value of 0.27 W/m^{2}K, or a lower U-value, for internal walls. There may be some locations where a U-value[21] of 0.27 W/m^{2}K is not achievable due to space restrictions (e.g. minimum stair space). At these locations, the internal insulation systems must achieve a maximum U-value less than 0.6 W/m^{2}K.

Installation Standards and Specifications

a. All internal wall insulation installation and associated works should be carried out in accordance with the manufacturer's instructions and the design guidance given in the Irish Agrément Certificate, if applicable, and to S.R. 54 Clause 7.3.3 Internal wall insulation (IWI).

b. All components of an IWI should match the retrofit design, including surface finishes and adhesives.

c. The exposure of the external walls to wind-driven rain should be assessed including external wall finishes (render, pointing, cladding). The suitability of insulation depends mainly on the local exposure to driving rain and the condition of the existing construction[22], refer I.S. EN ISO 15927-3.

d. The internal wall and ceiling must be surveyed to assess its flatness and suitability for the IWI system. The interior wall surface should be structurally sound and there are no moisture issues. Dampness

[21] U-values are calculated according to the standards detailed in TGD L, I.S. EN ISO 6946, DEAP methodology, and BR 443 - *Conventions for U-value calculations.* See Clause 2.9 of this document for further details.

[22] Distribution of driving rain in Ireland - Met Éireann www.met.ie/distribution-of-driving-rain-in-ireland

may have various causes including rising damp, leaking pipes or overflows, or faulty damp proof courses and cavity trays. Existing timbers and structural timbers e.g. floor joists are inspected for dry or wet rot.

e. Any repairs should be carried out ahead of the installation. Seal air leaks such as cracks, holes, or gaps in both internal and external walls. Any existing structural or dampness problems should be rectified, and walls should be allowed to dry out, before applying insulation.

f. Proper moisture management is essential to prevent dampness and mould growth.
NOTE When internal insulation is applied, the hygrothermal characteristics of the building may change and moisture management is therefore a major consideration for the installation of internal wall insulation and systems. Interstitial condensation calculations, where required, should be carried out to I.S. EN ISO 13788 or I.S. EN 15026 where wind driven rain or other moisture sources are present. Refer to DTSS Clause 4.7.

g. All ventilation requirements must be met. Ventilation openings must be checked to ensure there are no obstructions due to the insulant. Existing vents must be extended and sleeved. All flues must also be checked for obstructions using an appropriate test (e.g. smoke test). See Clause 4 Ventilation, TGD F Ventilation and TGD J Heat Producing Appliances.

h. All internal insulation methods must incorporate a vapour control layer (VCL) on the warm side of the insulation to reduce the risk of interstitial condensation. The VCL should continue across floors, ensuring continuous insulation, vapour-control and airtightness. The VCL must be sealed at all junctions, edges and corners using proprietary vapour control tapes or sealants.

i. There is a range of insulating materials available, and the most common types of insulation used in stud walls are mineral wool material (rockwool, glass wool, earth wool) and rigid insulation boards. Rigid insulation boards are made from materials like EPS (expanded polystyrene), XPS (extruded polystyrene), PIR (polyisocyanurate) or phenolic foam fixed directly to the walls and then covered with plasterboard or other finishes.

   All insulation to be continuous to avoid thermal bridging. Manufacturer's instructions should be referred to for precise details of fixing insulation material to backgrounds of different strengths, wetness and material. Refer to S.R. 54 Clause 7.3.3.3 Installation considerations, for further guidance.

j. Internal Insulation Methods can include:-
   - **Rigid insulation board**
     The joints between the boards should be tightly butted to fit in corners, around doors and windows, and with each other. Vertical joints must be staggered. Rigid insulation boards are secured in place with adhesive and reinforced with "mechanical fixings" i.e. screws or bolts. Before finishing, the installation of the boards should be inspected. Gaps greater than 10 mm between the board connections and at the perimeter of the insulation should be properly packed out. Some rigid boards e.g. PIR insulation board, may also be taped, especially if their surface forms the vapour control layer (VCL).

   - **Insulated plasterboard**
     Insulated plasterboard, also known as thermal board, consists of a layer of insulation material, such as polyurethane foam or polystyrene (EPS, XPS), bonded to a layer of plasterboard.

- **Mineral Wool Insulation fitted between timber battens**
  Stud walls are filled with insulation during the retrofit and will require the existing plasterboard to be removed to access. Stud walls are usually constructed using timber battens (studs/OSB - Oriented Strand Board) which act as a structural framework between 75 - 100 mm thick plus 12.5 mm of plasterboard on each side with a coat of plaster added on top. The condition of the timber battens fixed to the wall should be assessed. Should the timber battens be in good condition they may be retained and filled with insulation.

  When installing insulation in stud work a friction fit will ensure no gaps are formed. The mineral wool (in slab or roll form) is friction fitted between the timber battens or OSB, which forms a frame. If the insulation requires cutting, it should be cut slightly wider than the space it is intended to fill to ensure that friction fitting is achieved in installation. The wall is clad on both sides with plasterboard for a finished, internal wall surface.

k. Existing plasterboard on dabs should be removed to provide a smooth substrate. Existing gypsum plaster can trap moisture and may need to be removed if soft and chalky. Existing plasterboard and timber battens in a poor condition should be removed entirely. Where insulation exists, it should be removed and replaced with insulation to an appropriate U-value.

   Where the block wall finish is not plastered and therefore, potentially porous resulting in poor airtightness, a parging coat of plaster should be applied, to improve the airtightness of the final works.

l. Strip off the existing plaster back to bare brick and the exposed surface of the wall should be pointed/cement washed to seal any holes/cracks before proceeding. Where existing plaster is to remain, all cracks should be filled, and any loose sections should be removed and made good.

m. All thermal bridges should be considered and assessed when installing internal wall insulation. Thermal bridges due to internal walls and intermediate floors can be mitigated by returning a layer of insulation along the wall or floor that is causing the thermal bridge thus reducing the pathway for heat to escape to the outside.

n. To prevent thermal bridging skirting boards, cornice and decorative coving are removed from walls where the insulation will be applied to ensure a clean, continuous surface for the insulation boards.

o. When calculating the U-value of any internal insulation system, inclusion must be made of any fixings which are non-thermally broken, as well as any timber studwork, light-gauge steel (SFS) top-hat sections, studs, clips etc. which are present, as these can significantly affect the U-value. When timber or metal stud-work interrupts the insulation a layer of continuous insulation should be installed across the stud-work to reduce the impact of thermal bridging.

p. Ensure that all the services (plug sockets, light switches, pipes, radiators, etc.) and fittings (skirtings, covings, shelves, cabinets, fitted wardrobes, etc.) accommodated on the wall-to-be-insulated are considered. Post-installation works will be necessary so that these fixtures and fittings are properly reinstated.

q. The position of any fitment or fixture (kitchen or storage fitments, sanitaryware, boilers, radiators, banisters, grab rails etc.) must be identified before IWI is installed and adequate supports provided.

r. Any wallpaper, picture rails, gloss paint and projecting window boards should be removed.

s. The IWI installer must be competent in carrying out minor electrical works and in accordance with I.S. 10101 National Rules for Electrical Installations to ensure safety, refer to Clause 3.2.

t. Identify and mark up any light fittings or electrical connections that need protecting or moving during the installation phase. Where any services such as pipes or cables are present in the wall or mounted on the wall, these should be extended or replaced. They should extend through the full depth of the proposed insulation layer and finish with enough excess for fixing or working.

u. All PVC sheathed electric cables are placed in conduits, as per I.S. 10101.

v. Penetrations and joints should be appropriately sealed with products for airtightness and/or vapour control. Where the manufacturer supplies or advises the use of a plasterboard primer this must be applied.

w. The insulation system should be sealed around all doors, windows and other openings. Careful detailing around window opes is required in order to ensure that no risk of mould growth and/or surface or interstitial condensation is introduced.

x. Where windows sit outside the internal wall insulation, it is necessary to insulate the window reveals to prevent cold bridging through the external wall at the head and base of the window.

   Window and door reveals can be sources of condensation and mould if not insulated correctly, but where the amount of visible window frame is too small the full thickness of the insulated dry-lining cannot be applied. Where this is the case, an insulated window lining board can be used. The lining should not restrict ventilators or opening mechanisms. It may be necessary to remove the existing plaster to accommodate an adequate thickness of insulation within the limited space available.

y. In areas where there is not enough space to allow for the application of internal wall insulation (for example, width of the staircase or corridor should not be reduced to less than minimum requirements outlined in the Building Regulations. It may be necessary to install a reduced depth of insulation and increase the level elsewhere to compensate for this reduced performance. Alternatively, the use of insulation with a lower thermal conductivity may be used to maintain the width in these areas.

z. Insulation material is covered under the CE Mark or Irish Agrément Certificate (or equivalent). Installation is valid once the conditions outlined in the manufacturer's instructions and/or Agrément Certificate are met. Warranty must be issued to the homeowner.

aa. All relevant records such as the project specific design, site survey sheets, installation check sheets must be maintained by the Contractor and made available for inspection by SEAI, if requested.

NOTE Solid walls are a common feature in older properties, particularly those built before the 1940s. These walls are constructed from single or double layers of brick, with no cavity space in between. Internal insulation is installed either directly onto the wall or as stud wall insulation, then covered up with a plasterboard finish. Refer to Clause 5 Traditional Buildings, Protected Structures and Architectural Conservation Area.

6.4 Insulation : Roof Insulation - Ceiling Level

Contractor Requirements and Competence

Roof insulation Contactors must be competent to complete the installation. The Contractor must complete the work as set out in S.R. 54 *Code of Practice for Energy Efficient Retrofit of dwellings* published by the NSAI. Products must be installed by suitably qualified persons in accordance with this guidance and technical guides supplied by the material manufacturer. Roof insulation contractors should have completed a NFQ Level 5 or equivalent in ceiling level insulation installation.

Product Standards and Specification

For a cold pitched roof with insulation placed between and above joists, proper materials must be used, as referred to in TGD D Materials and Workmanship. When incorporating such a product, material or system into construction works it must be suitable for their intended use under Irish site conditions and be CE Marked. For products or components for which no appropriate standard exists then the ceiling level insulation must be certified to Irish Agrément (or equivalent), refer to Clause 2.3.

Appropriate documentation is required to demonstrate compliance with Irish Building Regulations and details of materials used should be included on the SEAI Declaration of Works (DoW) form.

The most commonly available forms of insulation material are mineral wool (often called 'rockwool' or 'earth wool') and glass fibre wool. Plastic foam insulation materials are expanded polystyrene (EPS), extruded polystyrene (XPS), polyisocyanurate (PIR) foam and phenolic foam.

Roof insulation at ceiling level is required to achieve a target maximum U-value[23] of 0.16 W/m^{2}K, or a lower U-value. For conventional fibrous materials (e.g. glass wool, mineral wool), a thickness of 300 mm is typically required to meet the U-value requirement whilst for PIR (polyisocyanurate) rigid foam insulation boards around 150 mm will achieve the recommended U-value of 0.16 W/m^{2}K.

Installation Standards and Specifications

a. All ceiling level insulation installation, also known as attic insulation, and associated works should be carried out in accordance with the manufacturer's specifications and NSAI's S.R. 54 *Code of Practice for Energy Efficient Retrofit of dwellings*.

b. Materials used in for ceiling level Insulation should be suitable for their intended use in Ireland and have either a CE Mark or an Irish Agrément Certificate (or equivalent) and be installed by suitably qualified persons.

c. If there is evidence of bats or bat roosts present in the attic space being insulated, the Contractor should consult with the Bat Conservation Ireland at www.BatConservationIreland.org for advice on how to proceed. All bat and bat roosts are protected under European Union (EU) and Irish legislation. For further information on this refer to www.npws.ie.

d. Where practicable, all areas of the ceiling must be insulated to the same depth. Mineral wool and other compactable insulation materials should not be compressed as this decreases its effectiveness considerably.

e. Providing adequate ventilation to protect the existing fabric of the roof, timber and underlay, is a requirement when Installing insulation at ceiling level to ensure compliance with the requirement

[23] U-values are calculated according to the standards detailed in TGD L, I.S. EN ISO 6946, DEAP methodology, and BR 443 - *Conventions for U-value calculations.* See Clause 2.9 of this document for further details.

of TGD F Ventilation and prevent condensation in the roof. An existing underlay, as well as the contribution of existing wall, floor, rafter and ceiling level insulation will determine the level of risk in a particular property of condensation problems arising, see Clause 4.7.

f. The Contractor must maintain a gap at eaves compliant with TGD F Ventilation and S.R. 54 to ensure adequate ventilation via appropriate ventilation openings (see Clause 4 Ventilation). Eaves ventilation equals 10 mm continuous gap for roof pitches over 15°. Where appropriate, if ventilation openings are not already present in the home, a soffit vent and eaves ventilation tray or similar appropriate measure must be installed. Ventilation tiles should provide a continuous gap of 10 mm or equivalent, or 10,000 mm^2/m run of roof length net ventilation area and should be arranged to encourage air flow in the roof space.

g. Long-term exposure to interstitial condensation within a roof space can lead to structural roof timbers rotting. It is essential that a cold roof space is adequately ventilated and the transfer of moisture from below is limited by:
   - Installing a vapour control layer at ceiling level to reduce moisture transfer is recommended where reasonably possible.
   - Prevent moisture from entering the roof space by ensuring that attic access hatches are properly draught-proofed and sealed.
   - Fitting wet rooms with a suitable ventilation system to extract moisture at source. This is in addition to window/wall vents were applicable.
   - Provide roof ventilation through side eaves or through ventilation tiles in the slope of the roof.

h. Insulation at ceiling level should be installed to avoid gaps. This can be done by:
   - The insulation laid between the ceiling joists should be no more than 25 mm above or below the ceiling joists. A gap larger than this could lead to a thermal bypass, as a continuous gap could be formed (from eaves to eaves) within the layers of insulation as detailed in S.R. 54.
   - The next layer of insulation should be placed across the joists and tucked into the eaves ensuring access to eaves ventilation.
   - At eaves, achieving a continuous line of insulation means the insulation should be extended as far as possible over the wallhead, but leaving a small gap (10 mm minimum) for air movement above if this is the path of airflow.

i. High-performance insulation should be placed between or above the timber joists where a storage platform or access walkway is proposed. There are two choices when maintaining a high level of insulation under any flooring or storage space, where flooring is needed or is being retained:
   - Install floor joists on the existing joists at right angles to allow the required thickness of insulation being laid, with the floor installed above this.
   - Use a solid, closed-cell insulation with a much lower thermal conductivity and install a floor covering on top of this. This results in a lower height of the final floor surface.

j. It is essential that any heavy-duty cables (e.g. for cookers and showers) are not covered by the insulation material and should instead be left on top of the new insulation, provided there is enough slack to do so. Where this is not possible, a gap of at least 75 mm should be left either side of the (heavy duty) cables for their entire length within the attic area and placed in trunking.

k. The insulation material shall be retained at a minimum of 75 mm from all electrical apparatus penetrating the ceiling, for example, recessed lighting fittings. Where necessary a permanent physical restraint shall be used.

l. Recessed downlights should be protected so the insulation does not cover them and that they are adequately ventilated. Use of a purpose-made recessed lighting housing is recommended. The Contractor must advise the homeowner of the need to keep the recessed lights clear of insulation. The purpose made recessed downlight covers installed must be tested to I.S. EN IEC 60598-1 Luminaires: General requirements and tests.

m. The Contractor should identify any form of water penetration in the attic. Ceiling level insulation should not be installed if the roof or pipework is leaking.

n. All roof insulation, ceiling level and rafter level insulation, should meet wall insulation to minimise / eliminate thermal bridges as per Appendix H of S.R. 54. See Programme-specific documentation for requirements.

o. All pipework and water storage vessels should be insulated. See Clause 6.4.2 Insulation of pipework and water storage tanks for further details.

p. Boarded walkways and attic flooring should be designed together with the insulation system so that there is a minimum clearance of 50 mm between the top of the insulation / vapour permeable ("breathable") membrane (if used on top) and the underside of the flooring to ensure a clear ventilation space to prevent mould growth and/or condensation on the underside of the flooring board.
   - Boarded walkways are permanent and fitted from the roof attic access hatch to any areas that may require routine inspection or maintenance such as the water tank ball valve position and / or other fitted appliance location.

   - Boarded access deck shall be constructed of minimum dimensions of 50 x 50 mm softwood battens laid across rafters, notched over pipes and cable crossings, said battens to be securely screw fixed in place to rafters. Flooring grade chipboard, 19 mm thickness by 450 mm wide, to be fixed to battens base with screws.

q. The Contractor should give special consideration to those who are elderly or disabled who may not be able to remove stored items in the attic space themselves. The Contractor should, where considered appropriate, provide the homeowner with a quotation for the removal and replacement of the stored items to facilitate installation of the insulation material.

r. On completion of the works, a minimum of two (2) warning signs should be clearly visible indicating that roof joists are covered by insulation material, and it may be unsafe to enter the attic unless a crawl board is placed across the joists, and adequate precautions are taken to ensure safe access.

s. Insulation material is covered under the CE Mark or Irish Agrément Certificate (or equivalent). Installation is valid once the conditions outlined in the manufacturer's instructions and/or Agrément Certificate are met. Warranty must be issued to the homeowner.

t. All relevant records such as the project specific design, site survey sheets, installation check sheets must be maintained by the Contractor and made available for inspection by SEAI, if requested.

6.4.1 Attic Access Hatch : Insulation and Draught-Proofing

The Contractor must insulate the attic access hatch to the same thermal value as the main attic i.e. achieve a U-value of 0.16 W/m^{2}K for ceiling level insulation. Insulation must be securely fixed to the attic access hatch.

The Contractor must draught-proof attic access hatches:

- Draught strip shall be fitted to all sides of the attic access hatch.
- Non-hinged attic access hatch rests on the frame of the attic entrance and shall be fitted with a securing catch at each side (i.e. a minimum of two catches), to achieve the required compression.
- All hinged attic access hatch covers shall have at least one securing latch fitted to the attic hatch framework on the opposite side to the hinges, to achieve the compression required.
- Attic access covers not located within a surrounding framework and simply covering a ceiling aperture from above shall be fitted with a rebate seal and a minimum of two catches shall be fitted. Where the aperture is covered from below, the perimeter of the access, it must be fitted with a rebate seal. A semi-permanent means of holding the cover against the seal shall be provided.
- Where attic access ladders are fixed to the hatch, insulating hoods or a lightweight insulating box should be used where possible. Care should be taken where spring-loaded “push-push” catches are present.
- Where non-wooden attic access hatches are found, they must be fitted with suitable securing catches, unless the method adopted would cause damage to the attic access hatch or frame.

6.4.2 Insulation of pipework and water storage tanks

Contractor Requirements and Competence

Contractors insulating pipework and water storage tanks must be competent to complete the installation. The Contractor must complete the work as set out in the guidance document BS 5970 Code of practice for thermal insulation of pipework and equipment in the temperature range of -100 °C to +870 °C and BS 5422 *Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40 °C to +700 °C*.

Insulation of pipework and water storage tanks shall be installed in accordance with guidance and instructions supplied by the material manufacturer.

All water pipework and water storage tanks should be insulated in unheated areas of the roof space when installing ceiling level insulation. If pipework and/or water storage tanks are not sufficiently robust to withstand the installation of insulation, the pipework and/or water storage tanks should be replaced.

Product Standards and Specification

Materials for insulation of pipework and water storage tanks must be suitable for their intended use under Irish site conditions and be CE Marked. For products or components for which no appropriate standard exists then the insulation materials must be certified to Irish Agrément (or equivalent), refer to Clause 2.3.

Installation Standards and Specifications

a. The cold-water storage tank, service pipe and fittings and any associated cold-water pipes should be adequately protected against damage by frost.

b. Pipework and water storage tanks should be insulated using materials with a CE Mark or an Irish Agrément Certificate (or equivalent) and works must be carried out by competent persons, appropriately trained for each element of works being carried out. Manufacturer's instructions should be followed.

c. Pipework and water storage tanks should be insulated in accordance with BS 5970 *Code of practice for thermal insulation of pipework and equipment in the temperature range of -100 °C to +870 °C* and BS 5422 *Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40 °C to +700 °C.*

d. Further advice is available in BRE 'Good Building Guide 40 – Protecting Pipes from Freezing' and TIMSA guidance (TIMSA - HVAC Compliance guide) re: indicative thicknesses of insulation for heating and distribution pipes, as per Table 29 Note 1 of TGD L - Hot Water Systems for dwellings – Achieving compliance with Part L.

e. All pipework bend and joints should be fully insulated. Insulation of pipework outside of the heated envelope of the building to protect against freezing for domestic cold-water services shall be as per 'Appendix Table 1' in TGD G of the Building Regulations (see Table 7):

Table 7 : Minimum insulation thickness (mm) to protect against freezing for domestic cold-water systems (12-hour period)

Minimum insulation thickness (mm) to protect against freezing for domestic cold water systems (12 hour period)						
Outside diameter (mm)	Inside diameter bore (mm)	Extreme installation Inside the building but outside the envelope of the insulation				
		λ = 0.020	λ = 0.025	λ = 0.030	λ = 0.035	λ = 0.040
15	13.6	23	35	53	78	113
22	20.2	10	14	18	23	28
28	26.2	7	9	11	13	16
35	32.6	5	7	8	10	11
Initial water temperature: +2^{0}C Minimum ambient temperature: -6^{0}C Permitted ice formation: 50% Evaluation period: 12 hours.						
Note 1 Thicknesses given are calculated specifically against the criteria noted in the table. These thicknesses may not satisfy other design requirements.						
Note 2 Some of the insulation thicknesses given are too large to be applied in practice. The purpose of including very high thicknesses is to demonstrate that the application of a material of the given thermal conductivity (λ) is not able to provide the degree of frost protection on the pipe size indicated under the design conditions. Therefore in order to increase the degree of frost protection it is necessary to increase the pipe size, select an insulation with a lower thermal conductivity or use some means of putting heat back into the system.						

(source: TGD G Appendix Table 1)

f. Insulation of cold water storage tanks (CWST) should be securely fixed to sides and top of water storage tanks. The lid of the cold-water storage tank shall be ridged. No gaps should be left between the insulation surrounding the cold-water storage tank. The cold-water storage tank access cover should be removable to allow minimum disturbance to insulation.

NOTE Cold water storage tanks with inadequate insulation, lids or infrequent turnover can warm above > 20 °C, the threshold at which Legionella begins to proliferate. Further guidance in CIBSE TM13 "Minimising the risk of Legionnaires disease".

g. Insulation should not be laid below water storage tanks in the roof space where the underside of the storage vessel is less than 300 mm above the finished level of ceiling insulation. The insulation around the water storage vessel should continue down to the finished level of ceiling level insulation to form a skirt around the water storage vessel. If the water storage vessel is greater than 300 mm above the finished level of insulation the insulation should be installed below the vessel, and the underside of the vessel should also be insulated.

Further detail is given in Figure 5 and TGD G of the Building Regulations.

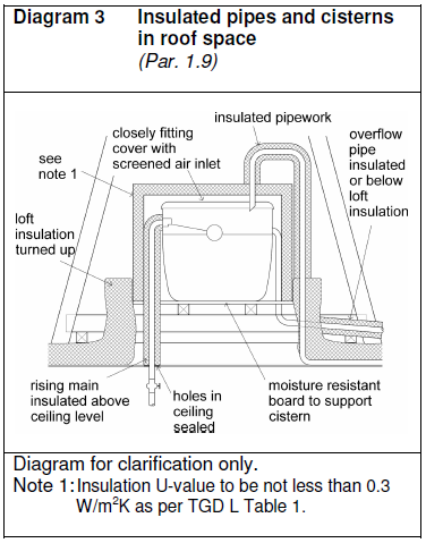


Figure 5 : Cold water cistern insulation requirements in the attic (source : TGD G Diagram 3)

h. **NOTE** Insulation of cold pitched roofs with either a vapour permeable (breathable) membrane (Type LR) or the traditional vapour impermeable (non-breathable) reinforced bitumen membrane (Type HR) will require a ventilation gap between the roof membrane/underlay and the cold side of the insulation (refer to Clause 6.5 (l)).

6.4.3 Woodworm Infestation in Attics

Woodworm can affect untreated timbers and is often present in dwellings over 10 – 15 years old. Woodworm can cause severe damage to building timbers if not identified and treated appropriately. Attics are at risk of woodworm infestation (e.g. due to storage of woodwork infested furniture in an attic). The woodworm beetles are attracted to the surrounding timbers in the attic. If woodworm contaminated timbers are covered by insulation, it is likely to increase the activity rate of the infestation due to increased warmth in the insulated timbers.

During the preliminary survey of the attic, Contractors should check for woodworm infestation, easily recognisable by small pinholes and the presence of a fine dust on the timbers. Remedial treatment of the timbers should be carried out prior to the insulation upgrade taking place.

6.5 Insulation : Roof Insulation – pitched roof at Rafter Level (Cold Roof)

Contractor Requirements and Competence

Insulation between rafters is subject to Building Regulations in Ireland. Roof insulation Contractors must be competent to complete the installation. The Contractor must complete the work as set out in S.R. 54 *Code of Practice for Energy Efficient Retrofit of dwellings* published by the NSAI. Contractors must install the insulation in accordance with DTSS, and any technical guides supplied by the material manufacturer.

Roof insulation Contractors should have completed a NFQ Level 5 or equivalent in rafter level insulation installation. Where the manufacturer operates an "*Approved Installer*" list, the Contractor must demonstrate their inclusion on the list or certification by the manufacturer. Products must be installed by competent persons, appropriately trained for each element of works being carried out and in accordance with this guidance and Technical Guides supplied by the material manufacturer.

Product Standards and Specification

For a cold pitched roof with insulation placed between and below rafters, proper materials must be used, as referred to in TGD D Materials and Workmanship. When incorporating such a product, material or system into construction works it must be suitable for their intended use under Irish site conditions and be CE Marked. For products or components for which no appropriate standard exists then the insulation must be certified to Irish Agrément (or equivalent), refer to Clause 2.3.

Appropriate documentation is required to demonstrate compliance with Irish Building Regulations and details of materials used should be included on the SEAI Declaration of Works (DoW) form.

Cold roofs insulated at rafter level are required to achieve a target maximum U-value[24] of 0.20 W/m^{2}K.

The Contractor must ensure that, in the case of insulation, an optimal whole-surface solution is provided where technically, functionally and economically feasible. Cold roof insulation at rafter level is continuous and at no point prevent cross-ventilation of the roof voids.

Installation Standards and Specifications

a. All cold roof insulation installed at rafter level and associated works must be carried out by competent persons, appropriately trained for each element of works being carried out. Workmanship shall be in accordance with TGD D and BS 8000-0.

b. All works should be in accordance with the manufacturer's specifications and NSAI's S.R. 54 *Code of Practice for the Energy Efficient Retrofit of Dwellings* under Clause 6.2 and Clause 6.3 which provides the approach for rafter level insulation (cold roof) insulation.

c. If there is evidence of bats or bat roosts present in the roof space the Contractor should consult with the Bat Conservation Ireland at www.Batconservationireland.org for advice on how to proceed. All bat and bat roosts are protected under EU and Irish legislation (see Clause 3.1).

d. Contractors should identify any form of water penetration, infestation, rot or damp. Rafter level insulation should not be installed if the roof is leaking.

e. A cold pitched roof has insulation placed either between rafters (and battens) or between and beneath the rafters (rafters remain cold).

[24] U-values are calculated according to the standards detailed in TGD L, I.S. EN ISO 6946, DEAP methodology, and BR 443 - *Conventions for U-value calculations.* See Clause 2.9 of this document for further details.

f. Materials used in rafter level insulation should be suitable for their intended use in Ireland and have either a CE Mark or an Irish Agrément Certificate (or equivalent).

g. The provision of adequate roof ventilation and the control of vapour migration into the roof structure to protect the existing fabric of the roof, timber and underlay, is a requirement when Installing rafter insulation to ensure compliance with the requirement of Part F of the building regulations and prevent condensation in the roof.

h. Where a dwelling has inadequate or no roof ventilation the contractor ***must*** notify the homeowner of this in writing outlining the potential consequences of inadequate ventilation of the roof space (see Clause 4 Ventilation).

i. Crossflow ventilation should be provided at both the eaves and ridge level. Eaves and ridge level ventilation must be used beneath the underlay and above the insulation. Ventilation is required at the eaves equivalent to a 25 mm continuous strip and at the ridge equivalent to a 5 mm continuous strip to maintain continuity of cross ventilation and avoid creating pockets of stagnant air i.e.
   - Eaves or low level ventilation of 25 mm (25,000 mm²/m)
   - Ridge or high level ventilation of 5 mm (5,000 mm²/m)

j. Attention should be given to ventilation and condensation requirements of the attic in relation to the materials used (see Clause 4 Ventilation and S.R. 54). The installed insulation must not impede crossflow ventilation. An existing underlay, as well as the contribution of existing wall, floor, rafter and ceiling level insulation will determine the level of risk in a particular property of condensation problems arising, see Clause 4.7.

k. Ventilated cold pitched roofs require a 50 mm continuous unobstructed air gap above the between-rafter insulation (cold side) which is vented to the eaves and ridge for optimal ventilation. A breathable vent card can support the insulation and maintain a 50 mm air gap between the roofing underlay and the insulation.

l. Traditional vapour impermeable (non-breathable) reinforced bitumen membranes (Type HR) used as underlay in older buildings require a 50 mm ventilation air gap to ensure adequate airflow.

   When a vapour permeable (breathable) underlay (Type LR) is used instead of the traditional roofing underlay the ventilation air gap in the batten cavity, normally 50 mm, *may* require a reduced depth for the airflow, depending on the Agrément certification. The vapour permeable ("breathable") membrane should be Irish Agrément certified in accordance with Part D of the Building Regulations and installed in accordance with the guidance on the Agrément Certificate.

   As an alternative approach proper moisture management and ventilation is essential, and further guidance is available in I.S. EN 15026 Hygrothermal performance of building components and building elements - Assessment of moisture transfer by numerical simulation. Refer to Clause 4.7.

m. Cut the insulation boards marginally wider than the rafter space to ensure a friction fit upon installation. Filling remaining gaps or voids between the insulation boards and rafters with low-expansion foam can provide a tight seal however it is important not to overfill the gaps as this can lead to compression of the insulation and reduce its effectiveness. Similarly, any service penetrations, such as a soil stack, should be sealed adequately.

n. Insulating a cold pitched roof by using a thinner layer of insulation beneath the rafters is essential to combatting the thermal bridging (cold bridging) effect. Insulation should be continuous at junctions between the roof and other elements, particularly the ridge, eaves and gable. Where the coverage is not continuous it allows the rafter itself to conduct heat out to the external or 'cold' environment, thus providing a 'thermal bridge' through which heat can escape.

o. A second continuous layer of insulation should be fixed to the underside of the rafter transverse to the first layer of insulation with joints tightly butted. Careful detailing is required to avoid thermal loss due to thermal bridging and to maintain roof ventilation at the roof-wall junction particularly where the dwelling is also provided with wall insulation. All rafter level insulation should meet wall insulation to minimise /eliminate thermal bridges as per Appendix H of S.R. 54. Refer to SEAI's Programme-specific documentation for requirements.

p. A separate vapour control layer (VCL) should be fitted between the insulation (warm side of the insulation) and plasterboard in accordance with DHLGH's Appendix B of Technical Guidance Document (TGD) L.

q. Insulation/vapour control layer joints should be fully sealed by a suitable tape. Where foil-backed insulation is used, foil taping all joints between the insulation slabs in each layer will fulfil the requirement for a vapour control layer.

NOTE Insulation tape, with a width of no less than 75 mm, is used as a supplemental measure to hold the insulation boards in place and not as a primary means of attachment.

r. The insulation material shall be retained at a minimum of 75 mm from all electrical apparatus penetrating the insulation, for example, recessed lighting fittings. Where necessary a permanent physical restraint shall be used.

s. Downlighters should be provided with enough space to dissipate heat to prevent the lights themselves from overheating. For pitched (sloped) roofs where voids cannot be provided then recessed light fittings should ***not*** be installed in the sloping roof section unless a suitably deep service void is provided.

The purpose made recessed down-light covers installed must be tested to I.S. EN IEC 60598-1 Luminaires: General requirements and tests.

t. All roof insulation, ceiling level and rafter level insulation, should meet wall insulation to minimise / eliminate thermal bridges as per Appendix H of S.R. 54. See Programme-specific documentation for requirements.

u. Where rafter level insulation is used on a partial attic conversion, the vertical walls of the room should have insulation placed between the stud timbers (where not already existing) and across the face of the stud walls.

Where there is unused attic space outside of the conversion, insulation should be applied at ceiling level to the standard detailed in Clause 6.4 Insulation : Roof Insulation - Ceiling Level.

v. Services, such as cables/pipework, can be accommodated within a battened airspace, on the inside of the finished insulation. The depth is determined by the services provided.

NOTE Solar panel installations in Ireland must comply with the requirements set by the Building Regulations TGD L. Roof insulation should preferably be implemented before the installation of a solar thermal / solar photovoltaic (PV) system. If the solar thermal/PV system is planned for a later point in time, then mounting points and cable/pipe feedthroughs may be prepared during the course of roof insulation works.

w. Insulation material is covered under the CE Mark or Irish Agrément Certificate (or equivalent). Installation is valid once the conditions outlined in the manufacturer's instructions and/or Agrément Certificate are met. Warranty must be issued to the homeowner.

x. All relevant records such as the project specific design, site survey sheets, installation check sheets must be maintained by the Contractor and made available for inspection by SEAI, if requested.

Further Guidance on Rafter Insulation

The difference when insulating between the rafters of a pitched roof is whether it is going to have a cold roof or a warm roof. A traditional 'cold pitched roof' (ventilated) is a 'breathable roof construction' with insulation placed either between or between and beneath the rafters (rafters remain cold). A warm pitched roof has insulation placed over and between the rafters (rafters remain warm) and underneath the roof covering. A warm roof is only suitable for retrofit with a substantial renovation of the roof.

S.R. 54 provides for insulation methods regarding pitched roof (cold/warm) and flat roof (cold/warm deck). If a roof pitch is less than 15° it is classified as a flat roof. If the ceiling of a room follows the pitch of the roof the ventilation should be provided as if it were a flat roof. Please refer to S.R. 54 should the roof and attic space be of an alternative structure.

6.6 Insulation : Floor Insulation (solid or suspended)

Contractor Requirements and Competence

Most floors are either solid (concrete) or suspended (usually timber floorboards). Floor insulation contactors must be competent to install same and must complete the work to the standard set out in Clause 9 of S.R. 54 Code of Practice for Energy Efficient Retrofit of dwellings published by the NSAI. Where the insulation manufacturer operates an Approved Installer list, the Contractor must demonstrate their inclusion on the list or certification by the manufacturer. The Contractor must complete the work in accordance with the technical and installation guides supplied by the insulation material manufacturer. Further guidance is provided TGD L B.7 Floor Constructions and in Best Practice Guides:

- Domestic floors: construction, insulation and damp-proofing (GBG 28 Part 1) published by BRE
- Insulating ground floors (GBG 45), published by BRE

Floor renovation will require compliance with "**Major Renovation**" section of **Part L of the Building Regulations**, where more than 25 % of the surface of the building envelope undergoes renovation.

Major renovation requirement can be activated by works to a combination of elements such as external wall and floor renovation, as per TGD L. It is the responsibility of the contractor / installer to consider whether the works being undertaken would be considered "Major Renovation" as defined by the Building Regulations.

Insulating below concrete is the standard approach for new builds or major renovations involving a full floor replacement. Where removal of a concrete floor slab (digging out) is required, the services of a suitably qualified Chartered Structural Engineer *must* be secured to design and oversee the work.

When installing solid floor insulation under 'Major Renovation', a continuous damp-proof membrane should be placed beneath the insulation taking care to overlap with any damp-proof course in the external walls. Further guidance is provided in TGD L and

- BS 8102 Protection of below ground structures against water ingress. Code of practice
- BS 8215 Design and installation of damp-proof courses in masonry construction. Code of practice

Product Standards and Specification

Materials used in the insulation of a floor must be proper materials, as referred to in TGD D Materials and Workmanship. When incorporating such a product, material or system into construction works it must be suitable for their intended use under Irish site conditions and be CE Marked. The Declaration of Performance and Conformity (DoPC) is based on the technical documentation. For products or components for which no appropriate standard exists then the insulation material must be certified to Irish Agrément (or equivalent), refer to Clause 2.3.

Materials used in the insulation of a suspended timber floor are typically mineral wool (often called 'rockwool' or 'earth wool'), glass fibre wool, expanded polystyrene (EPS), polyurethane (PUR) and polyisocyanurate (PIR). Materials used in the insulation of a ground floor concrete slab can be rigid insulation materials such as extruded polystyrene (XPS), polyurethane (PUR) and polyisocyanurate (PIR).

Floor insulation must have enough structural compressive strength to resist both dead loads (weight of the floor) and live loads (people, furniture), refer to I.S. EN 1991-1-1.

The required target maximum U-value[25] for the insulation of floors is:

- 0.36 W/m^{2}K, ground floor with no underfloor heating, or
- 0.15 W/m^{2}K, where the refurbishment also includes the installation of underfloor heating (TGD L)

SEAI expects documentary and photographic evidence of the installation of insulation to be available for inspection and for the purpose of BER assessments (see Clause 2.7).

The homeowner should be made aware of the estimated duration of works and extent of any disruption

- Removal of fixtures, fittings, floor coverings, floorboards, furniture
- Services and utilities
- Space Heating and / or ventilation system upgrades
- Skirting
- Doors and door heights
- Room height (floor to ceiling); and
- General environment during, and because of, the installation.

[25] U-values are calculated according to the standards detailed in TGD L, I.S. EN ISO 6946, DEAP methodology and BR 443 - *Conventions for U-value calculations.* See Clause 2.9 of this document for further details.

Underfloor Heating (UFH)

Installation of underfloor heating in a retrofit can mean the system is fitted within the subfloor (the base or foundational layer of the floor). Suspended timber floors require a different approach to solid concrete. Underfloor heating (UFH) can be integrated into suspended timber floors, though it is more effective in solid floors where the thermal mass provides better heat retention. An overlay underfloor heating system should also be considered in retrofit.

When incorporating underfloor heating the position of the insulation is important, and the new floor finish should be robust enough to protect underfloor heating systems. The insulation material must be appropriate for use with underfloor heating. The insulation material must be installed in accordance with the manufacturer's instructions by competent persons.

NOTE Floor surface coverings influence the heat pump's design and highly conductive floor coverings such as tiles, engineered wood or stone allow for lower design flow temperatures required for water-based (wet system) underfloor heating (UFH)[32]. The contractor should consider the type of floor finish at design stage when installing heat pump systems and underfloor heating. Refer to DTSS Clause 6.8.1(8).

Where the insulation material is made from polystyrene, electrical cables should be run in conduits to avoid direct contact between the polystyrene and the wiring. The Contractor should also seek guidance from the insulation manufacturer when using underfloor heating services with polystyrene insulation.

Installation Standards and Specifications : Floor Insulation (solid or suspended)

The following requirements are applicable when installing insulation in solid floors and suspended floors. It is the responsibility of the homeowner to rectify issues, with or without involving the Contractor, *before* works can commence.

a. Floor Insulation and associated works must be carried out by competent persons, appropriately trained for each element of works being carried out. Workmanship shall be in accordance with TGD D and BS 8000-0.

b. Floor insulation is installed in accordance with manufacturer's instructions and to the guidelines as described in S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings Clause 9 Floors.

   The performance of products and methods of fixing vary. The contractor should confirm with the product manufacturer their installation methods and expected performance.

c. All components of floor insulation installation should match the retrofit design, including surface finishes and adhesives.

d. Consideration should be given to the existing ventilation levels and how the new floor insulation layer may affect this and consequently whether additional ventilation is needed.

e. Ventilation must be provided by natural and / or mechanical methods, see Clause 4. Guidance for the provision of ventilation for retrofit works as shown in S.R. 54 Table 30 (see DTSS Table 3). Essential ventilation openings, such as those providing underfloor ventilation or combustion air for gas, oil and solid fuel appliances must be correctly ventilated as per TGD F Ventilation and TGD J Heat Producing Appliances.

To ensure cross-ventilation, i.e. good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm^2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door.

The contractor ***must*** inform the homeowner, in writing, of any aspects of ventilation considered to be inadequate or potentially unsafe, refer to Clause 4 Ventilation.

f. **NOTE** Consideration should be given to the prevention of radon ingress. Adequate ventilation should be provided in suspended floors to prevent the build-up of condensation and hazardous soil gases. Post retrofit radon testing is recommended where extensive energy retrofit measures have been completed. Further guidance on radon is provided in TGD C and DTSS Clause 3.1.

g. Prior to installation of floor insulation, the installer shall undertake a pre-installation survey. Post remedial works the building should then be reassessed to ensure the building is in a suitable condition for the floor insulation.

   All post installation checks should be evidenced by survey notes and supported by photographic evidence at mid and post-installation stage.

h. Any structural defects recorded in the survey, which may affect the performance of the floor insulation when installed, should be notified to, and rectified by, the homeowner with or without involving the Contractor *before* installation work commences.

i. Pre-Installation survey should record ceiling heights in all rooms, all steps on ground floor and height of treads, all door thresholds and door heights. Floor insulation will raise the finished floor level and adjustment may be required to the door thresholds, trim doors, or to raise sockets and skirtings to accommodate the new floor build-up. The insulation works should not reduce the floor-to-ceiling height of the room to below 2.4 m or the clear door heights to below 2.0 m.

j. Management of moisture should be considered in the assessment, design and implementation of floor insulation. If any remedial work has been undertaken the installer should ensure that sufficient time has been allowed for the building to dry if any moisture issues were identified. In cases where moisture flow is being evaluated in a building refer to DTSS Clause 4.7.

k. Interstitial condensation is a type of condensation that may occur within a floor structure and can form on surfaces where there is an air gap. Any holes and gaps in the vapour control layer (VCL) should be properly sealed with appropriate tape.

l. Determine if any supporting metalwork shows signs of corrosion and requires remediation work.

m. The floor insulation should have sufficient load bearing capacity to support the floor and its loading. When assessing the suitability of floor insulation material, it is important to ensure that the material has adequate compression resistance to restrict the effects of the compressive load applied by any loading such as dead load which is the weight of the floor finish upon the insulation material, design load is usually localised or point loads associated with the use of the floor (e.g. furniture) and result in increased localised loading acting on the insulation. Refer to I.S. EN 1991-1-1.

n. The installer must be competent in carrying out minor electrical works and in accordance with I.S. 10101 National Rules for Electrical Installations to ensure safety, refer to Clause 3.2.

o. All PVC sheathed and insulated electric cables are placed in conduits, as per I.S. 10101.

p. All service alterations should be carried out by suitably qualified persons.

q. Thoroughly inspect the floor to identify any issues such as hidden rot, moisture, gaps and cracks, infestation, pest damage, insulation issues and structural issues that need to be addressed.

r. All services (plug sockets, light switches, pipework, radiators, etc.) and fittings (kitchen units, skirtings, covings, shelves, cabinets, fitted wardrobes, etc.) are considered.

s. The position of any fitment or fixture (kitchen or storage fitments, sanitaryware, boilers, radiators, banisters, grab rails etc.) must be identified before floor insulation is installed and adequate supports provided. Post-installation works will be necessary so that these fixtures and fittings are properly reinstated.

t. The positioning and future access to all plumbing, wall and underfloor vents, flues and electrical cabling services should be carefully considered before the installation in order to provide adequate protective measures. Water pipework should be insulated. Care should always be taken, with service penetrations, to minimize any negative impact on the overall airtightness of the house.

u. Assess the condition of the pipework entering and leaving the floor and identify and remedy any damp patches on the floor where pipes are likely to be embedded. Water ingress may be as a result of leakage from an appliance, pipework, or flooding. If any signs of damp are identified the root cause and solution are determined.

v. Thermal bridges and airtightness should be considered and assessed when installing floor insulation. Thermal bridge junctions can be where floor insulation is interrupted by external walls, internal walls, party walls, door thresholds, stairs, chimney breasts or other permanent structures where they meet the ground floor. If the door is removed and replaced due to the increase in floor height the insulating product should be placed under the door threshold to reduce the thermal bridge.

   Whole floor area insulation alleviates issues of thermal bridging and unwanted moisture movement in voids.

w. Installation of appropriate damp proof membrane (DPM) is in accordance with the design and manufacturer's instructions. Ensure the damp proof membrane provides continuity with the damp proof course (DPC) in the surrounding walls. A damp proof membrane should be introduced on the existing solid floor prior to the installation of any insulation.

   Products that are commonly used but *do not form* robust and reliable vapour barriers are duct tape, gaffa tape, masking tape, aluminium foil tape, expanding foam, silicon sealant, caulk, dot and dab plasterboard and skim finish.

x. The insulation materials should be stored in accordance with the manufacturer's recommendations. Care must be taken to avoid damage and contact between rigid insulation panels and solvents or bitumen products. The panels must not be exposed to open flame or other ignition sources.

y. Insulation material is covered under the CE Mark or Irish Agrément Certificate (or equivalent). Installation is valid once the conditions outlined in the manufacturer's instructions and/or Agrément Certificate are met. Warranty must be issued to the homeowner.

z. All relevant records such as the project specific design, site survey sheets, installation check sheets, combustion appliance safety check sheets, refer to Clause 4.4.5, must be maintained by the Contractor and made available for inspection by SEAI, if requested.

6.6.1 Solid Floor Insulation

Solid floors, such as concrete or screed, ground supported concrete floors and suspended precast concrete floors are common in buildings built from the 1950s onwards. For solid concrete floors insulating above the ground bearing slab is the most common method for existing solid floors.

a. Solid floors, such as concrete or screed, can be insulated by placing a layer of rigid insulation material directly above the existing concrete floor in the form of a 'floating' floor. The insulation is then covered by a new floor deck.

b. Floor finish should be clean, dry, flat and smooth for installation of the solid floor insulation (SFI). A typical construction buildup for insulating an existing concrete floor would be the existing concrete slab, damp proof membrane (DPM), insulation, vapour control layer (VCL), tongue and groove chipboard, floor finish and skirting boards.

c. All components of solid floor insulation should match the retrofit design, including surface finishes and adhesives.

d. Where the floor is in poor condition consider if the existing floor should be dug out to accommodate insulation, refer to S.R. 54 Clause 9.2.4. Signs of sinking or bulging anywhere on the floor may indicate structural problems with the floor and require remedial work as advised by a structural engineer.

e. Remedial action may be required to remove or reduce the source of existing moisture. The building should then be reassessed to ensure it is in a suitable condition for the insulation.

f. Any damp sections of the existing building should be allowed to dry thoroughly prior to installation of solid floor insulation (SFI). Identify and inspect any damp patches on the floor where pipework, drains or other services are likely to be embedded.

g. High external ground levels may prevent solid floors from draining properly and may be introducing moisture into the construction.

h. Raising the floor level through added insulation will usually require skirtings and radiators to be removed and re-fixed and doors to be reduced in height. Any issues such as unequal step heights at staircases and the raising of step heights at external doors must be considered when determining the suitability of solid floor insulation.

i. Rigid insulation boards should be tongue and grooved or lapped joints to fit in corners, around edges and with each other. All joints must be staggered. Any gaps between the rigid insulation board connections and at the perimeter of the insulation should be properly packed out and sealed. Rigid

insulation boards such as polyisocyanurate (PIR) may be taped if their surface forms the vapour control layer (VCL).

j. Solid floor insulation (SFI) must maintain continuity of thermal insulation at junctions, edges and corners, between elements and around openings. At these junctions between potentially different membrane materials, proprietary airtightness tapes, adhesives or paints should be specified that are appropriate to the situation.

k. Installation of appropriate vapour control layer is in accordance with the design and manufacturer's instructions. Vapour control layer (VCL) should be on the warm side of the insulation beneath the underlay and flooring and connected to the relevant layer in the wall. Any holes and gaps in the VCL should be properly sealed at junction edges and corners with appropriate tape compatible with the VCL membrane.

l. Screed should not be considered as a vapour control layer. When laying a cement-based floor screed on the insulation, it should be laid in accordance with BS 8204 Screeds, bases and in situ floorings.

While Oriented strand board (OSB) can function as a vapour control layer (VCL) it is recommended to use dedicated VCL membranes.

m. Floor finishes include floating timber floors, levelling sand/cement screed and sheet flooring, e.g. carpet or tiles.

6.6.2 Suspended Floor Insulation

Suspended floors are where the floorboards rest over timber joists. When identifying timber suspended floors all floor constructions should be confirmed. Some buildings may have undergone upgrades or repairs and have been built with solid floors since the time of their original construction.

a. Suspended timber ground floors can have a range of insulation materials fitted between the floor timber joists e.g.
- Rigid insulation panels can be friction fitted from above against nailed timber bearings to the sides of the joists.
- Insulation quilts, such as mineral-wool rolls, can be installed upon mesh or netting to suspend between or fixed to the underside of the joists.
- Blown insulation is contained by mesh or boarding beneath the joists.

b. In most cases, the floorboards will need to be lifted so that the insulating material can be laid between the timber joists. Where the floor finish cannot be lifted and there is sufficient floor to ceiling height, an over-floor solution may be used, refer to S.R. 54 Clause 9.2.3.

Access to a basement or crawlspace below the floorboards allows insulation to be applied from below. A vapour permeable membrane is installed to the underside of the floorboards between the joists before installing insulation.

c. A typical construction buildup is once the floorboards are removed a vapour permeable ("breathable") membrane is installed under the insulation and will be lapped up around the perimeter to prevent the insulation making direct contact with the external walls. Once the

insulation is fitted a vapour control layer (VCL) is installed and lapped up against the vapour permeable ("breathable") membrane. The floorboards and skirtings are reinstalled.

d. Where vapour permeable ("breathable") membrane is installed underneath the timber joists the membrane should be turned up at the edges and sealed against the walls around the complete perimeter of the floor.

e. Insulation should be taken right up to the edge of the floor and any space close to the outside wall filled with insulation to avoid any gaps. Insulate between the last joist and the wall. There should be no gaps between the insulation and the underside of the floorboards.

   At floor/wall junctions the insulation should extend to the walls. The space between the last joist and the wall should be packed with insulation to the full depth of the joist. Where internal wall insulation is used, the floor and wall insulation should meet.

   Where cavity insulation is used, the floor insulation should be turned down on the internal face and overlap the cavity insulation, or insulating blocks used in the wall at this level. Refer to TGD L (see Acceptable Construction Details - ACD, details 1.03 and 6.03).

f. Where practicable, all areas of the floor must be insulated to the same depth. Wool and other compactable insulation materials should not be compressed as this decreases its effectiveness considerably.

g. A suspended timber floor typically requires natural ventilation within the floor void to deal with any excess moisture. Cross-ventilation should be provided to the sub-floor space to remove moisture to maintain air flow across the floor area. This allows the timber joists to breathe as well as prevent air movement above the insulation. There should be no void spaces between the underside of the flooring and the insulation unless space is required for services.

   Lack of adequate ventilation can lead to premature decay and rot in suspended timber floors.

h. Installation of appropriate vapour control layer is in accordance with the design and manufacturer's instructions. Vapour control layer (VCL) should be on the warm side of the insulation beneath the underlay and flooring and connected to the relevant layer in the wall. Any holes and gaps in the VCL should be properly sealed at junction edges and corners with appropriate tape, refer to TGD L B.4.

i. Careful attention is needed to ensure that all joints between floorboards are adequately sealed. Sealant is applied between the skirting and the floor finish to limit air leakage.

   Damaged tongue and groove floorboards (previously removed to access sub-floor) can result in unwanted air infiltration entering the habitable areas. Suspended timber floors can have cold air entering gaps in the skirting boards typically evidenced by staining of the carpet around the skirting boards.

j. In addition to sealing gaps and cracks, improving the air flow beneath suspended floors can help reduce the amount of radon entering the building. It is essential to ensure that the external wall vents are not blocked in any way to ensure that the void beneath a suspended timber floor is adequately ventilated. The ventilating air must have a free path across the floor void. Where fuel-

burning appliances are located within a space please allow for adequate ventilation openings (see Clause 4).

k. Pipework (hot and cold water supply pipes) should be kept above the insulation, where possible. Where it is not possible, these pipes should insulated where they are below the level of the floor insulation. See TGD G of Building Regulations for further details.

l. Original floorboards can be reinstalled or alternatively use tongue-and-groove chipboard subflooring and floor finish. Floor skirting completes the floor buildup and hides the membranes around the edge of the floor.

Further Guidance

- Technical Guidance Document L (TGD L) www.gov.ie/.../TGD L
- Acceptable Construction Details (ACD)
  - Cavity Wall Insulation : Ground Floor Insulation www.gov.ie/.../ACD CWI - TGD L
  - Internal Wall Insulation : Ground Floor Insulation www.gov.ie/.../ACD IWI - TGD L
  - Limiting Thermal Bridging and Air Infiltration - www.gov.ie/.../ ACD – TGD L
- I.S. EN 1991-1-1, Eurocode 1: Actions on structures - Part 1-1; General actions - Densities, self - weight, imposed loads for buildings (including Irish National Annex:2013) and non-structural elements include thermal insulation
- S.R. 54 Clause 9 Floors Code of Practice for Energy Efficient Retrofit of dwellings

6.7 Mechanical Extract Ventilation (cMEV) and Mechanical Ventilation with Heat Recovery (MVHR)

A mechanical ventilation system is recommended for dwellings with an air permeability rate of 5 $m^3/(h.m^2)$ or less. Information on mechanical systems as a ventilation strategy is detailed in Clause 4.4.2. Information about how to operate the mechanical ventilation system and its maintenance requirements should be given to the homeowner after completion.

Contractors Requirements & Competence

A mechanical ventilation system should be designed, installed, balanced and commissioned by a competent person. Where a ventilation system is installed as part of a Major Renovation then the system should be validated (see Clause 4.2). For continuous mechanical extract ventilation (cMEV) and a balanced supply and extract system such as Mechanical Ventilation with Heat Recovery (MVHR) it is a requirement that contractors must comply with the general standards and technical specifications. The Installer shall ensure that the methods used for the installation of the ventilation systems are as specified by the system supplier.

Product Standards and Specification

Mechanical ventilation systems, cMEV (Mechanical Extract Ventilation) and MVHR (Mechanical Ventilation with Heat Recovery), must be in accordance with:

- Installation and Commissioning of Ventilation Systems for Dwellings - Achieving Compliance with Part F published by the Department of Housing, Local Government and Heritage (DHLGH)
- Commission Regulation (EU) No 2020/987 applies to energy labelling of residential ventilation units
- Commission Regulation (EU) No 2016/2282 applies to Ecodesign requirements for ventilation units
- CE Marked to demonstrate compliance with the Machinery Regulation (EU 2023/1230)
- Ventilation Validation Registration Scheme (see Clause 4.2)
- I.S. 10101 National Rules for Electrical Installations
- S.R. 54 Code of Practice for the energy efficient retrofit of existing dwellings

NOTE Extract fans and ventilation systems lower the pressure in a building, which can cause the spillage of combustion products from open-flued appliances. It is recommended that a spillage test be carried out before and after installation of the mechanical ventilation system, with the appropriate spillage test procedure, in accordance with Building Regulations (Part J).

6.7.1 Mechanical Extract Ventilation (cMEV)

- Mechanical Extract Ventilation provides continuous ventilation (24/7).
- A Mechanical Extract Ventilation (cMEV) system should be considered where it is intended to achieve relatively low air leakage rates, typically < 5 $m^3/(h.m^2)$ or less.
- The continuous mechanical extract ventilation (cMEV) system must be designed to provide ventilation for the entire dwelling.
- Where continuous extract ventilation is proposed, the minimum ventilation rate provided should be in accordance with TGD F Table 1 and Table 2 (see Clause 4.4.2 Table 6) and S.R. 54 Table 33.
- The cMEV system may require a higher extract or boost capacity depending on the number of wet rooms (kitchens, bathrooms, etc.) and sanitary accommodation.
- Where applicable, air inlets should include humidity sensors, so the system automatically adjusts air flow volume to ensure a comfortable indoor environment.

- Mechanical Extract Ventilation includes Demand Controlled Ventilation (DCV), see Clause 4.4.2 and 4.4.3. DCV systems adjust the rate of ventilation according to the demands of each room.
- Only cMEV systems that are compliant with the Commission Regulation (EU) No 2020/987 with regard to energy labelling requirements for residential ventilation units with a specific power input (SPI) of no greater than ≤ 1.08 W/(m^3/h) and have a specific fan power (SFP) of less than ≤ 0.30 W/(l/s) and should be installed according to the design specified; *or* included in the Product Characteristic Database (PCDB) (formerly SAP Appendix Q).
- Product Characteristics Database (PCDB)[26] holds product performance data on various duct types (rigid, semi-rigid or flexible) for ventilation systems. The sizing of appropriate ductwork should be in strict accordance with the size and type of ductwork that formed part of the SAP (Standard Assessment Procedure) testing of the ventilation unit. Semi-rigid duct systems included in the PCDB have demonstrated their aerodynamic performance when installed in a variety of system configurations. Where semi-rigid duct systems are used with balanced mechanical ventilation, SAP calculations use the performance data for rigid ducts. Duct installation must follow the design specified. Ductwork shall be made using components provided or specified by the manufacturer or supplier.

- **Permanent ventilation** : The room where the heat producing open-flued appliance is located should be supplied with permanent ventilation, as per TGD J (see Clause 4.4.5).

  NOTE Open flued combustion appliances are not recommended in dwellings fitted with continuous MEV where the system might interfere with the operation of the appliance and combustion. Where an open-flued heat-producing appliance is located in a dwelling that also contains mechanical extract ventilation (cMEV), it should be installed and commissioned in accordance with Building Regulations (Part J Heat Producing Appliances) and S.R. 54.

- **Background ventilation** : To allow for enough replacement air the controllable background ventilation will have an equivalent area of 2,500 mm^2 as per TGD F Clause 1.2.2.8. Background ventilation should not be installed in a wet room where a cMEV provides ventilation. It is recommended that background ventilators already installed in a “wet room” are closed.

- **Purge ventilation** for habitable rooms and wet rooms should be provided in accordance with TGD F and S.R. 54. In wet rooms, the cMEV system is acceptable as purge ventilation, where the room does not have an external wall, although it may take longer for the cMEV system (even at boost level of flow rate) to purge the room in question, see DTSS Table 6. Where there is no window in the WC, the ventilation system should provide extraction at the rate provided for in S.R. 54. For rooms only containing a WC, an opening window is adequate for the purposes of purge ventilation, see Clause 4.4.6.

6.7.2 Mechanical Ventilation with Heat Recovery (MVHR)

- A MVHR system should be considered where it is intended to achieve relatively low air leakage rates, typically 5 m^3/(h.m^2) or less.
- Where MVHR is proposed, the minimum ventilation rate provided should be in accordance with TGD F Ventilation, S.R. 54 Table 33 and DTSS Clause 4.4.2 Table 6.
- The MVHR system should be capable of an extract rate from each wet room at least equal to that specified in TGD F Ventilation.

[26] Product Characteristics Database (PCDB) www.ncm-pcdb.org.uk/sap

- The minimum capacity of a MVHR should be based on the calculated general ventilation rate, adjusted to allow for air infiltration due to permeability of the building fabric, as per TGD F Ventilation.
- MVHR (mechanical ventilation with heat recovery) should have a 'built-in' purge option.
- Only MVHR systems compliant with the Commission Regulation (EU) No 2020/987 with regard to energy labelling requirements for residential ventilation units with a specific power input (SPI) of no greater than ≤ 2.88 W/(m^3/h) and have a specific fan power (SFP) no greater than ≤ 0.8 W/(l/s) with a minimum Heat Recovery Efficiency of 85 % should be installed, *or* included in the Product Characteristic Database (PCDB) (formerly SAP Appendix Q).
- Product Characteristics Database (PCDB) holds product performance data on various duct types (rigid, semi-rigid or flexible) for ventilation systems. The sizing of appropriate ductwork should be in strict accordance with the size and type of ductwork that formed part of the SAP (Standard Assessment Procedure) testing of the ventilation unit. Semi-rigid duct systems included in the PCDB have demonstrated their aerodynamic performance when installed in a variety of system configurations. Where semi-rigid duct systems are used with balanced mechanical ventilation, SAP calculations use the performance data for rigid ducts. Duct installation must follow the design specified. Ductwork shall be made using components provided or specified by the manufacturer or supplier.
- When installing recirculating cooker hoods refer to I.S. EN 13141-3.
- Vented cooker hoods or equivalent extractors are not compatible with DCV and MVHR systems and are not recommended. Where extract cooker hoods or equivalent extractors are connected to MVHR systems, the Building Regulations (Part B Fire Safety and Part F Ventilation) and the guidance under fire precautions in BRE Digest 398 "*Continuous mechanical ventilation in dwellings*", should be followed.
- Mechanical Ventilation with Heat Recovery (MVHR) systems are not designed to provide combustion air.

  NOTE Open flued combustion appliances are not recommended in dwellings fitted with Mechanical Ventilation with Heat Recovery (MVHR) where the system might interfere with the operation of the appliance and combustion, in accordance with Building Regulations (Part J). All extract points should be treated as if they were extract fans. Further guidance is available in BRE Digest 398 "*Continuous Mechanical Ventilation in Dwellings*".
- It is recommended that a spillage test be carried out before and after installation of the mechanical ventilation system, with the appropriate spillage test procedure, in accordance with Building Regulations (Part J Heat Producing Appliances).

6.7.3 MVHR and cMEV : Installation requirements

a. Design, installation and commissioning of Mechanical Extract Ventilation (MEV) or Mechanical Ventilation with Heat Recovery (MVHR), must be handled by competent persons.

   When commissioned and balanced the system should then be validated by an independent competent person to ensure the mechanical extract ventilation system achieves the design flow rates (see Clause 4.2).

b. Ventilation systems installations shall be in accordance with:
   - TGD F Ventilation guidance on the minimum ventilation design for dwellings
   - Installation and Commissioning of Ventilation Systems for Dwellings – Achieving Compliance with Part F published by DHLGH
   - Energy Labelling Commission Regulation (EU) No 2020/987
   - Ecodesign Commission Regulation (EU) No 2016/2282
   - CE Marked to demonstrate compliance with the Machinery Regulation (EU 2023/1230)

- Air Permeability Test (see Clause 4.3)
- Ventilation Validation Registration Scheme (see Clause 4.2)
- I.S. 10101 National Rules for Electrical Installations. Refer to Clause 3.2 Electrical Installations: Best Practice.
  NOTE If ductwork has an electrically powered damper, it should be bonded with any simultaneously accessible conductive parts.

c. Workmanship shall be in accordance with TGD D and BS 8000-0.

d. Installation is in accordance with the manufacturers guidelines and as described in S.R. 54.

e. The suitability of connection of a continuous fan system to a cooker hood must follow the manufacturer's guidance. Vented cooker hoods, or equivalent extractors, expel air outside the kitchen through a duct or pipe, are not compatible with DCV and MVHR systems, refer to I.S. EN 13141-3.

f. To ensure cross-ventilation, i.e. good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600 mm^2 in all internal doors above the floor finish. This is equivalent to an undercut of 10 mm for a standard 760 mm width door.

g. To meet extract requirements, the system may require a higher extract or boost capacity depending on the number of wet rooms (kitchens, bathrooms, utility room, etc.), refer to DTSS Table 6. The extract rate to be provided for each wet room is specified in S.R. 54.

h. Ventilation systems shall be designed to minimise disturbance caused by noise. Fan units should be sized to run at their optimum speed and to provide suitable performance while minimising noise. Refer to Clause 4.4.4 Ventilation Extract Fans and Ductwork.

i. Fan unit

- The fan unit should be located as specified by the system designer.
- The fan unit should have a specific fan power (SFP) less than ≤ 0.30 W/(l/s) for cMEV and a SPF of less than ≤ 0.8 W/(l/s) for MVHR, refer to S.R. 54 Table 29.
- The fan unit should not exceed 35 dB at full power.
- Fan units should be installed to allow enough space to undertake routine maintenance on filters and heat exchanger block as appropriate and for replacement of the whole unit or key components at the end of its operational life.
- The fan unit should be installed on a suitable structure, which is stable and level. Locating the unit in an upper floor cupboard (insulated for sound proofing) should be considered.
- If the fan unit is not pre-insulated, insulation should be added to minimise the potential of condensation forming within, or on, the fan unit casing and should not create a fire risk.
- A condensate drain should be installed from the fan unit to an appropriate drain location and should be adequately secured. The condensate pipe should be installed to have a minimum 5˚(5 degree) fall from the fan unit. The condensate drain must also be adequately insulated to prevent freezing where passing through an unheated space.

j. Installation of Ducts

- Where ducts pass through fire barriers, they must be appropriately fire stopped in accordance with the requirements of Part B (Fire Safety) of the Building Regulations.
- Ducts should be sized to minimise pressure loss and noise generation. This is achieved by sizing of the ducts to limit the air velocity. Velocity reduction reduces air velocity as it moves through larger spaces to minimise noise and wear.

  Undersized ducts can result in a whistling or whooshing sound due to high air velocity, whereas oversized ducts may cause low air velocity and reduced system efficiency.
- A hole of a suitable dimension through the fabric of the building will be required for the installation of the duct. The hole will need a slight downward angle towards the outside to prevent water ingress.
- Where ductwork penetrates a building's air barrier, the continuity of the barrier must be maintained.
- The routing of ducts should aim to minimise overall duct length and minimise the number of bends required. It is particularly important to minimise bends in main ducts operating at higher air velocities.
- Where room air extract terminals/grilles are not fitted with filters, access to ducts for cleaning should be provided, where possible.
- Ducting should be insulated where it passes through unheated areas and voids (e.g. attic spaces), with material that has the equivalent of at least 25 mm thickness and a thermal conductivity of ≤ 0.04 W/mK, to reduce the possibility of condensation forming. Ducting extending externally above roof level should be insulated or a condensate trap should be fitted just below roof level.
- Ducts within the building's heated envelope carrying cold air between the external supply/discharge terminals and the fan unit should be insulated and wrapped additionally with a vapour control layer (VCL) outside the insulation to prevent condensation occurring within the insulation material.
- Horizontal ducting, including ducting in walls, should slope slightly downwards away from the fan in order to prevent backflow of any moisture into the product. Vertical ducting will require a condensate trap to prevent backflow of any moisture into the product.
- Perforated insulated flexi duct should not be used between the fan unit and external discharge terminal to prevent condensation occurring within the insulation material.
- Ducts should not be installed where they can be damaged, for example run across open attic areas where they may be stood on or have items placed on them, breaking seals and possibly crushing the duct.
- Connection of components should not result in significant airflow resistance. Components should be proprietary and fit easily together without distortion.
- Rigid duct runs must be adequately supported. Flexible ductwork should be supported at suitable intervals to minimise sagging. It is especially important to support ductwork at the connections to the inlet terminal or onto the ventilation unit. Clips and supports for ductwork should be spaced at regular, equal distances and in accordance with the ductwork manufacturer's recommendations.
- Flexible duct should be pulled taught to ensure that the full internal diameter is obtained, and flow resistance minimised. There should be no peaks and/or troughs in flexible ductwork.
- Bends in flexible duct should have a minimum inside radius equal to the diameter of the duct. If tighter bends are required, rigid bends should be used.
- It is recommended that ductwork be boxed in, such that the ductwork is still accessible to carry out any works.

k. Duct connections

- All duct connections require sealing to ensure the connections are airtight. Where ducts are installed against a solid structure, this can be difficult to achieve. In such locations, preassembly of duct sections should be considered. This will require that connections are permanent to ensure the seal is maintained during installation. It is recommended to carry out leak testing on connections.
- Ducting should be adequately clamped to the inlet and outlet terminals to avoid detachment, which would result in warm, moist air being discharged into the space.
- All duct connections should be fully sealed to ensure no leakage of air can occur.
- Where access to ducts will not be possible after construction is complete, i.e. ductwork within floor and wall voids, permanent connection and sealing with an appropriate non-hardening sealant should be applied.
- Connection of lengths of flexible duct must use a rigid connector and jubilee clips or similar to ensure a long-term seal is achieved. Connections of lengths of flexible duct should not be taped-only.

l. Supply and extract terminals/grilles

- All room air extract terminals should be installed as detailed by the system designer.
- Room air extract terminals should be installed as close to ceiling level as practical, to ensure warm moist air is removed from each space.
- Room supply air terminals must not be located adjacent to walls, unless designed to discharge air away from the wall, as this may result in down draughts.
- It is recommended that the supply and extract air terminals are separated by a minimum of 300 mm horizontally if placed on the same façade of a building or per the manufacturer's instructions.
- The number and location of terminals installed in a space should ensure effective air distribution and ensure that air noise is not a nuisance when the system is operating at boost airflow rates.
- If the supply and extract air terminals are fixed, ensure that effective balancing of the system can be achieved. If this is not provided within the fan unit then dampers should be installed within the duct system to allow balancing when the system is commissioned.
- If terminals/grilles are adjustable, ensure each terminal/grille can be locked in its commissioned position once the system has been balanced.
- Acoustic attenuation should be incorporated into the supply terminal to reduce the impact of sound into the dwelling.
- The supply and extract air terminals should have an insect screen.

m. Supply and discharge terminals – roof and wall mounted

- Proprietary terminals should be used.
- Ensure that the free area[27] of the terminal opening is a minimum of 90 % of the free area of the ducting being used.
- The location of the external discharge terminal should ensure that the potential for recirculation of extract air through the supply air terminal is minimised.

[27] As per TGD to Part F - Ventilation of the Building Regulations, 'free area' is the geometric open area of a ventilator. Free Area is typically 25 % greater than its equivalent area. Equivalent area is measured in accordance with the method specified in I.S. EN 13141-1.

n. Controls

- Controls for mechanical ventilation systems should be suitable for continuous operation and should provide an indication to the occupant that the system is operating correctly or if there is a fault/maintenance required.
- Continuous mechanical ventilation systems (cMEV, MVHR, DCV) should not allow the occupier to turn off the fan other than at the local isolator. Provision of an on/off function will result in the fans being operated intermittently and the required continuous airflow ventilation rates not being achieved.
- Where sensors are not integrated within the fan unit, only sensors specified by the manufacturer of the fan unit should be installed.
- If sensors are duct mounted, their location should be noted and provisions for access for maintenance or replacement made.
- If control of the fan speed is undertaken manually, the operation of the fan in boost mode should be made obvious to minimise the likelihood of it being left in this mode unnecessarily.
- In humidity-controlled systems, controls should be provided which allow for either manual or automatic switching to boost whenever a wet room is in use. Automatic controls should be set to switch to boost when relative humidity within the wet room reaches 70 %, and that the boost remains on until the relative humidity reduces to 50 %.
- Installation of manual controls for the system must meet the requirements of Part M of the Building Regulations.
- Installation of room sensors should follow the manufacturer's guidance on positioning and in accordance with I.S. 10101 National Rules for Electrical Installations.
- Where control of the fan speed is undertaken manually, switching should be provided locally to each of the spaces being served, e.g. bathrooms, kitchen, utility room, etc. Provision of a single centrally located switch is insufficient and will result in fans being left in inappropriate modes of operation.

o. Handover and Commissioning

- The installer must make good, to the satisfaction of the homeowner, any accidental damage sustained by a property where this is a direct result of their work or installation.
- Following installation, the mechanical ventilation system must be commissioned to verify that the installed system achieves the designed level of ventilation.
- Where new mechanical extract ventilation system is installed as part of a Major Renovation, as defined in TGD L, then the system should be designed, installed, commissioned and validated as per NSAI Ventilation Validation Scheme[28], see Clause 4.2.
- Commissioning must be completed in accordance with the Installation and Commissioning of Ventilation Systems for Dwellings – Achieving Compliance with Part F and should include the following as a minimum:
  - Check that air flow direction is correct at each supply and extract terminal to ensure actual airflow matches design intent.
  - The system should be balanced to ensure that design airflow rates are achieved at each room terminal/grille.
    - Ensure all internal and external doors and windows are closed, including rooms in which measurements are being carried out.

[28] NSAI Ventilation Validation Scheme https://www.nsai.ie/certification/agrement-certification/ventilation-validation-registration-scheme/

        - Air flow measurements should be performed using a calibrated anemometer/ airflow device with proprietary hood attachment and results recorded in litres per second (l/s).
        - Record the airflow rate at each room terminal onto the commissioning sheet along with the design airflow rate for each terminal. Measurements should be taken at both maximum rate and minimum rate fan speeds.
        - The instrument should be calibrated annually and be capable of achieving an accuracy of ± 5 %. Measurement of air flows should be performed using equipment that has been calibrated at an INAB (or equivalent) accredited calibration centre.
    - Upon completion of the installation, MVHR systems should be protected from dust during the retrofit of the dwelling. The system should be switched off and dust covers applied to air valves.
    - Prior to completion of the works, the mechanical extract ventilation system should:
        - be checked to ensure it is clear from dirt and dust that may have accumulated during construction. This includes all including ductwork and filters.
        - be commissioned to confirm performance
        - be adjusted by using the air valves and controls to achieve the correct balancing and airflow rates
        - have air valves locked in position after correct commissioning and balancing.
    - Any changes from the design should be referred to the designer and noted in the commissioning documentation.
- A digital copy of the commissioning documentation should be maintained.
- An operation and maintenance manual must be provided to the end user once the system has been fully installed and commissioned. The instructions in the manual should be presented in a way that is clear and easy to understand and relate directly to the installed system. The following information should be provided where relevant:
    - Manufacturers and installer contact details;
    - Use of air inlets for background ventilation;
    - Location of and setting automatic controls (e.g. humidity and timer controls);
    - Location and use of on/off settings for mechanical ventilation system;
    - Adjustable extract air terminals on vertical ducts;
    - Instructions on how cleaning and maintenance should be carried out;
    - Location of filters if not installed within the fan unit. (If no filters installed on extract terminals, information on how ducts are accessed for replacement/cleaning and recommendations for how cleaning is to be undertaken);
    - Recalibration or checking of sensors and their location;
- The commissioning sheet and completion certificate, as described in *Installation and Commissioning of Ventilation Systems for Dwellings – Achieving Compliance with Part F*, should be appended to the operation and maintenance manual.

6.7.4 MVHR and cMEV Standards and Guidance documents

Design, installation, commissioning, validation and maintenance shall be based on:

- Commission Regulation (EU) No 2020/987 with regard to the energy labelling of residential ventilation units
- Commission Regulation (EU) No 2016/2282 with regard to Ecodesign requirements for ventilation units
- CE Marked to demonstrate compliance with the Machinery Regulation (EU 2023/1230)
- Installation and Commissioning of Ventilation Systems for Dwellings - Achieving Compliance with Part F published by the Department of Housing, Local Government and Heritage (DHLGH)

- Ventilation Validation Registration Scheme (see Clause 4.2)
- I.S. 10101 National Rules for Electrical Installations
- I.S. EN 13141-1 Ventilation for buildings - Performance testing of components/products for residential ventilation. Externally and internally mounted air transfer devices
- I.S. EN 13141-3 Ventilation for buildings - Performance testing of components/products for residential ventilation - range hoods for residential use without fan
- I.S. EN 13141-4 Ventilation for buildings - Performance testing of components/products for residential ventilation. Aerodynamic, electrical power and acoustic performance of unidirectional ventilation units
- I.S. EN 13141-5 Ventilation for buildings - Performance testing of components/products for residential ventilation. Cowls, assisted cowls and roof outlet terminal devices
- I.S. EN 13141-6 Ventilation for Buildings - Performance Testing of Components/products for Residential Ventilation - Exhaust Ventilation System Packages Used in a Single Dwelling
- I.S. EN 13141-7 Ventilation for buildings - Performance testing of components/products for residential ventilation. Performance testing of ducted mechanical supply and exhaust ventilation units (including heat recovery)
- I.S. EN 13141-8 Ventilation for buildings - Performance testing of components/products for residential ventilation. Performance testing of non-ducted mechanical supply and exhaust ventilation units (including heat recovery)
- I.S. EN 13141-11 Ventilation for Buildings - Performance Testing of Components/products for Residential Ventilation - Supply Ventilation Units
- I.S. EN ISO 9972 Thermal Performance of Buildings - Determination of Air Permeability of Domestic Buildings – (Single or Single & Multi) Fan Pressurization Method
- I.S. EN 14134 Ventilation for buildings - Performance measurement and checks for residential ventilation systems
- Commissioning Code A (CCA) : Air Distribution Systems - CIBSE
- Domestic Ventilation Systems - a guide to measuring airflow rates (BG 46/2022) - BSRIA
- BS 8233 Guidance on sound insulation and noise reduction for buildings
- Energy efficient ventilation in dwellings – a guide for specifiers (GPG 268) - Energy Saving Trust

6.8 Heat Pump Systems

A heat pump is an electric-powered system that extracts heat from a low temperature source, such as external air or ground, to provide space heating and domestic hot water (DHW)[29], including:-

- Space heating distribution and control systems;
- Domestic hot water system (DHW)[29], including hot water storage

Contractor Requirements and Competence

Heat pump systems must be installed by competent persons. Persons nominated to supervise and inspect the works, and to sign off the SEAI Declaration of Works must be competent in the different aspects of the works. These works include heat pump selection and system design, sizing, installation, testing, commissioning, maintenance and servicing of domestic heat pump systems. The minimum qualification and training requirements that must be met by persons nominated to sign off the SEAI Declaration of Works for grant purposes are:

- Domestic Heat Pump Systems (6N5646) – NFQ Level 6 Component Award [30] under Maintenance Skills Technology (6M5154) - NFQ Level 6 Primary Award
- Certificate of Competence from the specific manufacturer of the heat pumps installed, based on an adequate training programme
- Registration on the SEAI Renewable Energy Installers Register for heat pumps www.seai.ie/register-with-seai/contractor

Manufacturer's training programmes must be available for SEAI to examine and verify. Training outcomes must include the ability to successfully complete a heat pump system installation of the heat pump products from the specific manufacturer, and to carry out the correct heat distribution and heat emitters design and sizing, refer to Clause 6.8.3 (e). Installers must attend any refresher training that may be required to update their competence in relation to changes to products and technologies.

Heat Pump System Installer Roles and Responsibilities

i. All electrical work must be in accordance with I.S. 10101 National Rules on Electrical Installation. A Safe Electric Registered Electrical Contractor (REC) is required to supervise and sign off the electrical installation of a heat pump system, in accordance with the definition of "Controlled Works and Restricted Works" by the CRU. A Completion Certificate No. 3 is required as evidence of compliance.

ii. F-Gas certified engineer is required to carry out and certify heat pump system installation, leak checks and commissioning as per the F-Gas Regulation (EU) No 2024/573.

iii. It is recommended that ***all persons*** working on installation of heat pumps are:-
   - Competent, or training to be competent, to the qualification level specified herein;
   - Competent in carrying out minor electrical works in accordance with I.S. 10101 to ensure safety; and
   - Experienced in the specification and design of heating systems incorporating heat pumps and heat installation.

[29] Air-to-Air (ATA) Heat pump system provides space heating, only. Air-to-Air (ATA) Heat pump system does not provide domestic hot water (DHW).

[30] Heat Pump Design, Installation, Commissioning, Maintenance and Servicing training courses are available from Further Education and Training (FET) providers. Detailed information on how to apply and minimum entry requirements are available from each FET provider. SEAI reserves the right to decide whether a qualification is equivalent to the reference QQI Award curriculum. Supplementary certifications may be required to support equivalence.

NOTE SEAI reserves the right to amend the training and certification requirements above. SEAI may require nominated persons to attend additional training in accordance with SEAI programme specific QADP and the Programme's Terms and Conditions, as applicable.

***Important**

All heat pump units installed must comply with the minimum efficiencies set by the Ecodesign legislation. In addition, heat pump units must meet the minimum values for the DEAP SPF efficiencies, as per Table 8.

6.8.1 Heat Pump System installation requirements

A heat pump uses energy from electricity and a renewable energy source (RES) such as ambient air, ground or water. Different types of renewable energy source (RES) heat pump systems include:-

- Air Source Heat Pump (ASHP)
  - Air-to-Air (ATA)
  - Air-to-Water (ATW)
  - Exhaust Air-to-Air (EAHP)
  - Exhaust Air-to-Water (EATW)
- Ground Source Heat Pump (GSHP)
  - Ground-to-Water (horizontal) (GTW)
  - Ground-to-Water (vertical) (GTW)
- Water Source Heat Pump (WSHP)
  - Water-to-Water (WTW)

NOTE A heat pump system is not considered an energy efficiency measure (EEM) as listed in Table 3 Clause 4.4 Ventilation System Design Strategy Considerations. Therefore, there is no requirement on the contractor to meet the DTSS ventilation requirements outlined in Clause 4 Ventilation.

It is important to consider how Air-to-Air (ATA) and Exhaust Air-to-Air (EAHP) heat pump units will integrate with the existing ventilation system, refer to Clause 6.8.3 (q).

Heat Pump System : SEAI Home Energy Upgrade Grant Eligibility Criteria

To avail of the SEAI home energy upgrade grant, the following requirements must be met:

1. Comply with the Energy Labelling Commission Regulation (EU) No 811/2013, Energy Labelling Commission Regulation (EU) No 2023/2048 for air-to-air heat pumps and Ecodesign Commission Regulation (EU) No 2016/2282. Refer to Clause 6.8.5.
2. CE Mark
3. Design, installation, commissioning and maintenance must be carried out in accordance with the relevant Standards[31] including NSAI S.R. 50-4 Heat pump systems in dwellings, refer to DTSS Clause 6.8.3.

   NOTE Heat pump systems must not be used as an air-conditioning unit for cooling purposes. Reverse valves should be locked and the cooling function disabled from the user controls.
4. I.S. 10101 Chapter 134.1.9 requires that consideration is given to the effect of the additional load on the existing electrical installation, see Clause 3.2 Electrical Installations: Best Practice.

5. Air Permeability Test result, if applicable, refer to Clause 4.3
6. Ecodesign technical datasheet is based on testing standards I.S. EN 14825 for space heating, I.S. EN 16147 for water heating and I.S. EN 15316-4-2 for heat pump energy requirements and efficiencies.
   - The operation of a heat pump will be affected by the seasonal temperature changes of the energy source. SCoP (Seasonal Coefficient of Performance) describes how efficient a specific heat pump will be for a given heating demand profile across the whole heating season, as per I.S. EN 14825. SCoP values are provided by the heat pump manufacturer.

   - Seasonal Performance Factor (SPF) is described in I.S. EN 15316-4-2 as the heat output and heat input ratio that considers variations in performance over a heating season. The Seasonal Performance Factor (SPF), also known as Main Space Heating Efficiency, is the principal metric used for measuring the performance of a heat pump system across its full range of operating conditions.

*Table 8 : Minimum heat pump efficiency requirements (SPF)**

Heat Pump type	Space Heating	DHW
	DEAP Main Space Heating Efficiency [%]	DEAP Main Water Heating Efficiency [%]
Air to Air	300	N/A
Air to Water	300	160
Exhaust Air to Water	300	160
Ground to water	300	160
Water to Water	300	160

Coefficient of Performance (CoP), as set by I.S. EN 14511-1, is the ratio of heating delivered compared to the electrical energy input. DEAP uses the Seasonal Performance Factor (SPF) as a starting point for the I.S. EN 14511-1 or I.S. EN 16147 calculations.

SEAI require that the SPF requirements detailed in Table 8 must be met and heat pump system should be assessed in DEAP during the design phase and prior to installation.

7. Heat pump system should be the primary heating technology and sized correctly.
   - SEAI home energy upgrade grants covers a range of heat pump systems. A heat pump that uses energy from electricity and a renewable energy source (RES) such as air, ground or water, and does not involve a primary (fossil fuel based) heating source, is eligible for SEAI's heat pump system grant.

   - Heat pump systems may include a combination of air, ground or water heat pump units. To be eligible, all heat pump units must be tested to the standards specified, and the whole system must satisfy the heat pump system requirements. In cases where a heat pump system includes more than one type of heat pump, this must be clearly explained in the SEAI heat pump system grant documentation, and specific SEAI Programme requirements must be followed.

   - SEAI grant funded heat pump systems are designed to meet
     - 100 % of the designed space heating requirements of the floor area
     - 80 % of the Domestic Hot Water (DHW) demand

   A bivalent heating system is one where the heat pump is combined with an existing heat source, such as a gas / oil boiler or an auxiliary immersion heater. Understanding the DHW usage profile

for the home ensures the heat pump is the optimum size. Hot water requires a higher temperature than space heating so may require some backup heating to reach adequate temperatures. The hot water cylinder temperature will depend on the storage size. In a bivalent alternative mode, the heat pump will switch off for a period of time and the heat load is met by the backup heat source. Further information in DTSS Clause 6.8.3 (j).

8. Heat Pump system installation process is required to consider:-
   - Design heat load calculations for sizing of a suitable heat pump shall be in accordance with I.S. EN 12831-1 (S.R. 50-4)[31]. Dimensioning of the heat pump, radiators or underfloor heating per room/zone is documented. A standard compliant detailed heat loss (kW) assessment of the dwelling is undertaken on a room-by-room basis, see Clause 6.8.3.
   - Heat pump selection should be as close as possible to the design heat demands. Performance data from both the heat pump manufacturer and the heat emitter system designer should be provided by the contractor to the homeowner to support the heat pump selection.
   - Heat Loss Indicator (HLI) threshold for a heat pump system grant eligibility, if applicable, is defined by each SEAI home energy upgrade programme[33].
   - SEAI registered contractors must document the home energy upgrade measures recommended when providing a full technical design and product specification for the installation of a heat pump system.

     Contractors should discuss recent or future retrofit changes with homeowners to ensure that any and all modifications will be accounted for in the heating load calculations. Improvements in the energy performance of the dwelling (see S.R. 50-4 Clause 5.2.4) will reduce the design heat loss and therefore the capacity of the heat pump system required.

     NOTE Floor surface coverings influence the heat pump's design and highly conductive floor coverings such as tiles, engineered wood or stone allow for lower design flow temperatures required for water-based (wet system) underfloor heating (UFH). The contractor should consider the type of floor finish at design stage[32].
   - The Contract of Works is agreed between the Homeowner and the Contractor following discussion on the types of heat pump systems available and determining the option most suitable for the home.

9. Heat Pump Handover Documentation is to be made available to the BER Assessor carrying out a BER assessment, see Clause 6.8.4. The heat pump information and applicable technical data is based on I.S. EN 14825, I.S. EN 16147 and I.S. EN 15316-4-2.

   Refer to DEAP (Domestic Energy Assessment Procedure) Guide for heat pumps

   Heat Pumps | DEAP Guide

Further Guidance

Information on heat pump systems and home energy upgrade grant process on the SEAI website:-

- Heat pump system grant process www.seai.ie/.../Heat pump system grant
- Homeowner's Guide To Heat Pump Systems www.seai.ie/.../Homeowner's Guide to Heat Pump Systems

[31] S.R. 50 Series: Standards for Modern Plumbing and Heating www.nsai.ie/.../S.R. 50 series

[32] Choosing your floor covering to maximise your Underfloor Heating efficiency www.BEAMA.org.uk

6.8.2 Heat Pump System and Heat Loss Indicator (HLI)

The building fabric consists of the walls, roof, floors, windows and doors. The building fabric is a major area of heat loss which can be reduced by adding internal, cavity or external wall insulation, ceiling and floor insulation and replacement of windows. Installing an efficient renewable heating system such as a heat pump will work with the insulation, airtightness and ventilation of a home to improve energy efficiency, performance and comfort.

Heat Loss Indicator (HLI) is a summary of the overall energy performance of a home. Heat Loss Indicator (HLI) is specified as the ratio of heat loss coefficient (W/K) to total floor area (m^2) in the current version of DEAP under the 'Heat Losses' section. The HLI is calculated by the DEAP software as part of the Building Energy Rating (BER) process (see Clause 2.7).

DEAP methodology calculates the HLI as the Total Heat Loss per m^2 ($W/K \cdot m^2$) of floor area:

$$HLI = \frac{Fabric\ Heat\ Loss + Ventilation\ Heat\ Loss}{Floor\ area\ of\ dwelling}\left[\frac{W}{K \cdot m^2}\right]$$

Heat Loss Indicator (HLI) threshold for a heat pump system grant eligibility, if applicable, is defined by each SEAI home energy upgrade programme[33].

SEAI registered contractors ***must*** consider home energy upgrade measures to enhance the energy performance of a home to allow a heat pump system to perform efficiently and effectively.

6.8.3 Heat Pump System Design, Installation, Commissioning and Maintenance

Heat Pump system design, installation, commissioning and maintenance must be satisfied to meet the requirements for Heat Pump Systems:

a. Design, installation, commissioning and maintenance are in accordance with the relevant Standards including NSAI S.R. 50-4 Heat pump systems in dwellings.

b. Heat pump system is installed in accordance with the manufacturer's instructions. Heat pump specific component design, as per manufacturer's instructions, must be adhered to. All equipment and/or components must comply with the applicable Ecodesign and EU Energy Label Regulations.

c. All electrical works must be in accordance with I.S. 10101 National Rules for Electrical Installations. Consideration is given to the effect of the additional load on the existing electrical installation. All PVC sheathed and insulated electric cables are placed in conduits, as per I.S. 10101. Refer to Clause 3.2 Electrical Installations: Best Practice for details.

d. The heat distribution system should be cleansed, flushed out and pressure tested as required and in accordance with the NSAI S.R. 50-4 Heat pump systems in dwellings. Further guidance is given in S.R. 50-1 Water-based heating systems in dwellings and BS 7593 Code of practice for the preparation, commissioning and maintenance of domestic central heating and cooling water systems.

[33] SEAI programmes *may* have specific conditions with respect to the HLI. Please check with the SEAI team and programme-specific documentation.

e. The design heat load is defined in I.S. EN 12831-1 as the heat supply (power) needed to maintain the required internal design temperature under outdoor design temperature conditions. The heat load is the necessary heating capacity that a heat generator must provide and is the basis for dimensioning a heating system such as
   - Dimensioning of the heat pump
   - Dimensioning of the radiators or underfloor heating per room/zone
   - Calculation of the valve settings for hydronic balancing

f. The heat pump design must determine specific heat demand for each heated room. The standard transmission heat loss of a heated room describes the heat losses via the building envelope and the ventilation heat losses. A detailed heat loss (kW) assessment of the dwelling should be undertaken on a room-by-room basis to determine heat pump sizing, radiator, or underfloor heating requirements. The standard compliance calculations of the design heating load and space heating load are set by I.S. EN 12831-1, as per S.R. 50-4[31].

g. The heat pump system design will have to consider the minimum design temperature, (S)CoP factors and the relationship between the heat emission of the heat pump and the designed heat loss.

h. Over-or-undersizing of the heat pump system or any components should be avoided. The design and sizing should be based on an outdoor design temperature of -3 ^{o}C, at a minimum. The design and sizing details of the heat distribution system, as installed, must be included in the Designer/Installer documentation (see Clause 6.8.4 Heat Pump Handover Documentation).

i. Hydronic heat pumps (air-to-water, ground source and water source) can be attached to existing pipework and radiators, so-called 'wet' or hydronic central heating system.

j. A hydronic heating system (wet system) is dependent on hot water to heat a room or home. Where existing heat sources are retained (e.g. gas / oil boilers), these shall be used only as a backup (secondary) heat source as hot water requires a higher temperature than space heating so may require some backup heating to reach adequate temperatures.

   NOTE If a heat pump and boiler are connected to the same distribution system, the pipework and controls must be configured, with hydraulic separation (aka low-loss header). The hydraulic separator's core purpose is to hydraulically decouple the primary loop (heat pump) from the secondary loop (e.g. boiler) to manage the flow rates, pressure dynamics and thermal balance so that the systems operate independently, safely and efficiently. Hydraulic separators can be deployed as standalone components, manifold-integrated, or buffer-based models. Further information in DTSS Clause 6.8.3.1.

k. Minimum heat pump design volumetric flow rates should be met. The design data for the flow rate and velocity calculations should be compatible with the size of the pipework to deliver optimum heat pump performance.

l. Pipe network comprises of two separate systems
   1. Feed pipes supply water from the heat source, such as a heat pump, to the heat emitters
   2. Return pipes that circulate the water back to the heat source to be reheated

Pipes can be sized based on, the velocity or pressure drop at the calculated flow rate, and the technical data from the manufacturer. The smaller the temperature differential between the temperature on the feed and return pipes (Delta T 'ΔT') the higher the flow rate. Heat pumps are recommended to operate with a Delta T of around 5 °C. The feed and return pipes should run in parallel.

The three port diverter valve is located on the tee where the heat pump system splits off to the domestic hot water cylinder and the heat emitters. No heat emitters should be located between the heat pump and diverter valve.

m. Pipework serving space heating and hot water systems should be insulated in all areas outside of the heated building envelope and within those spaces that may be maintained at temperatures different to those maintained in other zones. The recommended insulation thickness for heating and distribution pipes should be 1.5 times the diameter of the pipe. Further guidance on the indicative thicknesses of insulation for heating and distribution pipes is available in TIMSA - HVAC Compliance guide as per Table 29 Note 1 of TGD L - Hot Water Systems for dwellings – Achieving compliance with Part L.

n. Heat Emitters

All radiators should be balanced (every radiator heats evenly) so each room receives the heat output expected from the design. Consideration should be given to thermostatic radiator valves (TRV or eTRV) in conjunction with flexible temperature regulation strategies to optimise heat pump performance.

o. Installation of underfloor heating (UFH) in a retrofit can mean the system is fitted within the subfloor (the base or foundational layer of the floor). Pipes are laid into the subfloor and then connected to a manifold that links the underfloor heating to the heat pump system and a thermostat. An overlay underfloor heating system should also be considered in retrofit.

In a water-based (hydronic) underfloor heating system, a series of pipes connected to the heat pump circulates warm water under the floor to heat the space. The water in the system can be much cooler, as low as 35 °C, compared with 55 °C - 65 °C or higher for radiators. Multi-zone heating, where the underfloor heating is zoned off to specific parts of a room, or is fitted in more than one room, requires more pipework and thermostats.

When incorporating underfloor heating the position of the insulation is important, and the new floor finish should be robust enough to protect underfloor heating systems. The insulation material must be appropriate for use with underfloor heating. Refer to DTSS Clause 6.6 Insulation : Floor Insulation (solid or suspended).

p. Air Source Heat Pumps (ASHP)

Air-to-water (ATW) heat pumps provide heat to the wet central heating system and are most suitable for larger radiators or underfloor heating with a large surface area.

q. In general, the installation of a heat pump will not have an effect on the existing ventilation system. However, Air-to-Air (ATA) and Exhaust Air-to-Air (EAHP) heat pump units may have additional requirements (e.g. a specific level of airtightness); and in these cases, it is important to consider how the heat pump system will integrate with the existing ventilation system. Refer to DTSS Clause 4.3 Air Permeability Test.

r. Heat Pump control settings such as design flow temperatures, set points, operating times, the weather compensation curve and the switchover temperature between operating modes (in a bivalent system) should all be checked to ensure the system operates efficiently.

s. Consult the heat pump manufacturer's documentation to confirm that the heat pump model supports dual zone space heating and time and / or temperature control. Zoned systems should consider the two different flow temperatures required for radiators and underfloor heating (UFH).

t. Controls for space heating and domestic hot water (DHW) must include the items as shown in Table 9, as a minimum:

Table 9 : Heat pump system controls for space heating and domestic hot water (DHW)

Heat pump system : Controls for Space Heating and DHW	Air-to-Air (ATA)	Air-to-Water (ATW)	Ground-to-Water (GTW) Water-to-Water (WTW)
Control of water pump operation (internal and external as appropriate)		✓	✓
Control of water temperature for the distribution system		✓	✓
Control of outdoor fan operation	✓	✓	
Defrost control of external airside heat exchanger	✓	✓	
Control of room air temperature (if not provided externally	✓		
Control for secondary heating (if fitted)	✓		
Protection for water flow failure		✓	✓
Protection for high water temperature		✓	✓
Protection for high refrigerant pressure	✓	✓	✓
Protection of indoor / external airflow failure	✓	✓	
Minimum heat pump flow rates or volume requirements are met / buffer for thermostatically controlled zones	✓	✓	✓
Time control / programmer / zone control for space heating	✓	✓	✓
Time control and Temperature control for domestic hot water (DHW), independent of space heating		✓	✓
Weather compensation or internal temperature control	✓	✓	✓

(source: TGD L Table 2 and Table 3)

u. Heat pump system type, location and siting must satisfy the following requirements:

- In accordance with regulatory and local planning requirements, refer to Clause 6.8.5
- Location and siting as agreed with the Homeowner, with consideration given to
  - Unit is positioned away from the front door, openable windows to noise sensitive habitable rooms such as living rooms or bedrooms
  - External factors such as the building's orientation, solar gains, sheltering conditions and the estimated base flood elevation (BFE)
  - Coastal-grade heat pumps featuring enhanced protective coatings, corrosion-resistant materials and robust construction should be installed in saline coastal environments.

- Manufacturer's instructions and guidance, such as
  - Manufacturer's minimum clearance requirements around the heat pump unit for airflow
  - Measures taken to minimise the transmission of vibrations such as using a wall bracket with anti-vibration dampening when the ASHP is mounted to a house
  - Maintenance requirements specific to the manufacturer (make) and product identifier (model/part number) of the heat pump system. Heat pump system should be safely maintained and serviced.

- Select a heat pump that will avoid significant adverse noise and vibration impacts
  - Noise from external fans, pumps and compressors, distinctive sound characteristics, nuisance to sleeping areas and neighbours must be mitigated.

    Acoustic enclosures should not block or inhibit air flow from the ASHP exhaust.

- During certain external weather conditions, frost will form on an air source heat pumps (ASHP) external evaporator. ASHP during a defrosting cycle will melt or evaporate any frozen moisture. A drain and/or soak-away can be installed to ensure that the area around the ASHP does not become waterlogged. Condensate water can dissipated through a gravel/slate bed that surrounds the base of the outdoor unit thus eliminating any potential hazard.

v. Water to Water (WSHP) and Ground to Water (vertical GSHP) heat pump types must consider the suitability of a proposed heat pump system installation site, including the location of ground loops or boreholes, where present. Documentation of ground and water collector design and installation for a ground source heat pump (GSHP) must be provided to the Homeowner.

   This must contain as a minimum:

   - Land area size to install the ground array, and location. The ground array (the network of pipes pumping the thermal transfer fluid underground) can be laid horizontally or vertically. The type of system depends on the outdoor space available and the local geology.

     Vertical arrays, depending on the size of the system, the borehole could be up to 200 metres deep and less than a metre in diameter. Horizontal ground arrays require more ground area than vertical arrays like boreholes. Horizontal systems use lengths of pipe laid in shallow trenches around one to two metres deep and circa 10 m of trench with per kilowatt of the heat pump size for space heating.

   - Heat extraction rates from sub-surface soil or deeper geology;

   - Installation procedure including groundworks (trench or borehole) and pipe specifications;

   - The heat pump unit (containing the compressor and heat exchanger) is installed inside the home. Record all welded connections of collector and horizontal pipework to the manifold;

   - As-built drawings for the ground portion of the collector showing detailed borehole and horizontal pipework locations;

   - For boreholes: collector testing on the surface before insertion and once installed, in accordance with I.S. EN ISO 17628. Specification of grouting as required to ensure aquifers remain hydraulically separated during and after borehole completion, and to provide thermal conductivity within the ground.

w. The heat pump system is installed and commissioned in accordance with the requirements of manufacturers' instructions and operates in accordance with the heat pump system design. Commissioning tests should be completed and logged to ensure the heat pump is operating according to the manufacturer's Specifications, Test and Commission system. All performance and design parameters must be achieved. The commissioning report shall contain all the relevant parameters and checklists required to confirm that the heat pump system is installed and set up to function according to the design objectives.

x. Annually, or as recommended by the manufacturer, an engineer conducts maintenance on the heat pump to check refrigerant fluid levels, electrical connections, and ensure the system is running optimally. Filters should be checked, cleaned and/or replaced during every service visit.

y. The homeowner shall be instructed on how to correctly use the controls e.g. thermostat and operate the heat pump system. A list of the installer settings shall be provided to the homeowner for future reference. Maintenance requirements and schedules shall also be explained to the homeowner.

z. Where applicable, the homeowner must be made aware of obligations under the F-Gas regulation, and equipment must be labelled according to these regulations, refer to Clause 6.8.5.

aa. The installer shall meet all documentation requirements, as specified in Clause 6.8.4 Heat Pump Handover Documentation.

6.8.3.1 Domestic Hot Water (DHW) and Heat Pump system

In a heat pump system, domestic hot water (DHW) is treated as a separate demand as it combines temperature targets, hygiene control and user safety. DHW will have its own operating mode in heat pump system design and control logic.

Domestic Hot Water (DHW) provision must meet the following requirements:

- I.S. EN 12831-3 provides a method to calculate the power and the storage volume required for the dimensioning of domestic hot water systems (DHW)
- Domestic Hot Water Cylinder must meet the heat pump manufacturer's requirements and the HPAI installation guidelines, with attention to the size of the heat exchanger and insulation
- A separate time control for space and water heating and the cylinder is temperature controlled by thermostat, refer to DTSS Table 9
- Where present, pipework between the heat pump unit and the DHW cylinder must be insulated
- All stored water (in the domestic hot water cylinder and any that is recirculated in sections of pipework) must have a legionella protection cycle (aka bacterial contamination disinfection routine) to periodically raise the temperature to at least ≥ 60°C, and held there for at least one hour, at least once per week. The heat pump control system should be able to efficiently facilitate production of domestic hot water cylinder temperature to ≥ 50 ^{o}C.
- Some heat pump systems cannot reach the highest hot water cylinder temperatures needed for periodic thermal disinfection cycles, so a supplementary hot water heater, such as a booster heater/immersion, may be used. Further guidance in CIBSE TM13 "Minimising the risk of Legionnaires disease", standards, guidance and specification documents
- Any other requirements under the regulations and standards listed in Clause 6.8.6 Heat Pump Standards and Guidance documents.

Hot Water Storage Buffer Tank and Heat Pump System

A buffer tank (aka buffer vessel) in heat pump heat distribution is a type of thermal energy storage vessel that manages the accumulation, storage, and release of heating water between the heat pump generator and the building's distribution system. The additional hot water storage the buffer tank provides will reduce the heat pump's short cycling (on/off switching). A properly designed buffer preserves thermal stratification and controlled flow separation. Heat pump manufacturers define allowable limits for starts, stops and minimum run times. Depending on the overall system design e.g. inverter-driven heat pump, a buffer tank may not be required once the minimum volume requirements can be assured. If all zones are thermostatically controlled, then a buffer tank would be an acceptable method of compliance i.e.

- Minimum heat pump flow rates or volume requirements should meet the minimum provisions for warm (and hot) water, as per Table 29 of TGD L - Hot Water Systems for dwellings – Achieving compliance with Part L_2019.
- Meet the heat pump manufacturer's minimum system volume and flow requirement.
- I.S. EN 14511 recommends that a heat pump compressor should not start more than three times per hour (a maximum of 3 cycles every 60 minutes) to prevent short cycling.
- Vented copper hot water storage vessels should be in accordance with the heat loss and heat exchanger requirements of I.S. EN 1566-1 "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly (vinyl chloride) (PVC-C). Specification for pipes, fittings and the system" or BS 3198 "*Specification for copper hot water storage combination units for domestic purposes*"
- Vented cylinders in materials other than copper should comply with the heat loss and heat exchanger requirements of I.S. EN 1566-1
- Unvented cylinders need good water pressure and flow. Unvented hot water storage system products should be based on:
  - I.S. EN 12897 "*Water supply. Specification for indirectly heated unvented (closed) storage water heaters*"; or
  - CE Mark or Irish Agrément certified; or
    certified by another accredited body as complying with Irish Building Regulations.
- Unvented systems should not be used with gravity circulation

6.8.4 Heat Pump Handover Documentation

The Contractor must meet all the documentation requirements for the heat pump system installation in addition to the DTSS and any SEAI programme-specific requirements.

Heat Pump System Handover Documentation is required to be completed, in full, and to be provided to the homeowner, and to be made available for SEAI inspection[34]:

- Heat Pump brand name, nameplate (data plate) label for product identification should display manufacturer (make), product identifier (model/part number) and a unique serial number (S/N) details are included on the technical specification of the heat pump system installed.
- Ecodesign technical datasheet declaring the test data for the heat pump based on I.S. EN 14825 for space heating, I.S. EN 16147 for water heating and I.S. EN 15316-4-2 for heat pump system efficiency.
- Air Permeability Test result, if applicable, refer to Clause 4.3

[34] Heat Pump Technical Data declared by the manufacturer (make) must include heat pump system type, product identifier (model/part number)

- Documented heat load calculation for sizing a suitable heat pump and heat emitters (such as radiators and surface heating systems, e.g. underfloor heating).

  Heat pump system calculations include the percentage of space heating and water heating demand provided by the heat pump (excluding auxiliary and immersion heaters).

  Design heat load calculators, such as software-based calculators, used in the sizing of a suitable heat pump / heat emitters shall be in accordance with I.S. EN 12831-1 (S.R. 50-4)[31].
- Commission Certificate confirms the heat pump and other components of the system have been commissioned according to the manufacturers' instructions and system design parameters.
- Completion Certificate No. 3 issued by a Safe Electric Registered Electrical Contractor (REC)
- F-Gas Company Certificate confirming installation, leak checks and commissioning
- Ground and Water collector design and installation documentation, if applicable (see Clause 6.8.3 (v))
- Manufacturer's Warranty on the heat pump unit(s), refer to Clause 2.4
- Heat pump system installation, operation and maintenance manual, Homeowners User Manual

6.8.5 Heat Pump System : Regulatory Framework

An overview of the policies at EU and national level supporting heat pump implementation.

1. **Ecodesign Directive** is mandatory compliance for all heat pumps.

- All heat pumps must have an energy label, refer to Energy Labelling Commission Regulation (EU) No 811/2013, Energy Labelling Commission Regulation (EU) No 2023/2048 for air-to-air heat pumps.

  If a heat pump supplies both space heating and hot water the energy label will indicate how efficient the heat pump is for each function. Heat pump energy labels also indicate how noisy they are, displaying the decibel level both inside and outside the home.

- Ecodesign Commission Regulation (EU) No 2016/2282 for CE labelling requires technical datasheet based on testing standards I.S. EN 14825 for space heating (SCoP), I.S. EN 16147 for water heating and I.S. EN 15316-4-2 for heat pump energy requirements and efficiencies (SCoP).

2. **F-Gas Regulation and Refrigerants**

   F-Gas Regulation (EU) No 2024/573 supports refrigerants with a low Global Warming Potential (GWP) and the phase out of hydrofluorocarbons (HFCs) and other fluorinated gases (F-gases). Suitable natural refrigerants, such as hydrocarbons, are available for many heat pump applications. Modern heat pumps mainly use R32 refrigerant / R290 (propane) which are compliant with the EU F-gas phase-down.

   NOTE Any work that directly involves any type of refrigerant must only be performed by a qualified F-Gas Engineer or an authorised technician with a refrigerant handling certificate.

   Installation of a heat pump must ensure precautions are in place in case of a refrigerant leakage and the protective zones (provided in the manufacturer's installation manual) are adhered to in order to guarantee the safety of the units in the installation area. Propane (R290) due to its high flammability, has restrictions in handling, application and installation location. The protective zone is defined as an area around the heat pump which, in the event of a leakage of the refrigerant gas such as R290 (propane), a flammable atmosphere could be formed for a short time, within which it is necessary to implement all precautions as stated by the heat

pump's manual. Typically, a minimum distance from windows and doors, pavements or neighbouring properties must be maintained.

SEAI recommends switching to non-fluorinated refrigerants where technically feasible and HFCs are avoided in heat pumps. If HFCs are used, all refrigerant handling operations on heat pump equipment containing HFC refrigerants must be carried out by suitably trained technicians holding an F-Gas handling certificate and working for an F-Gas certificated company. In addition, applicants with heat pumps using synthetic refrigerants such as HFC, HFC blends and HFO (hydrofluoroolefin), must comply with the service and maintenance requirements, including mandatory leak checks on all heat pump equipment above certain size thresholds, in accordance with F-Gas Regulation.

3. **Planning Permission**

Planning permission is the responsibility of each local authority, refer to DTSS Clause 2.2. Heat pumps are considered exempted development i.e. no planning permission required, once specific conditions regarding noise, size, and location are met.

Conditional Planning Exemptions apply to heat pump technologies, ground source heat pump (GSHP, horizontal or vertical) or an air source heat pump (ASHP), in a domestic setting, subject to the following conditions (S.I. No. 342/2026):-

- The level of the ground is not altered by more than 1 metre (1 m) above or below the level of the adjoining ground.
- The total area of such a heat pump, GSHP horizontal or vertical, or ASHP, taken together with any other such pumps previously erected, shall not exceed 2.5 square metres (2.5 m^2).
- Heat pump (ASHP) must be a minimum of 500 mm (0.5 m) from the edge of the wall or roof on which it is mounted.
- Noise levels must not exceed 43 db(A) during normal operation, or in excess of 5 db(A) above the background noise, whichever is greater, as measured from the nearest neighbouring inhabited dwelling. CE Mark states the sound level in decibels.

  Most ASHPs are variable (inverter) speed and at low speed extremely quiet, but at certain times they will speed-up. ASHP create, on average, between 40 and 60 decibels (dB) from a distance of one metre. A 50 dB appliance will be ten times louder than a 40 dB appliance.

- No such structure shall encroach onto a public road.

4. **Building Regulations**

Major renovation requirement can be activated by works to a combination of elements such as external wall and floor renovation, as per TGD L. Where the source of space heating is underfloor heating, the maximum floor U-value should be 0.15 W/m^2K, as per TGD L and guidance provided in the *Heating and Domestic Hot Water Systems for Dwellings – Achieving compliance with Part L and Energy Performance of Buildings Regulations 2019*.

5. **Environmental Considerations**

Environmental Protection Agency (EPA) and local authorities are responsible for monitoring and enforcing surface and groundwater regulation. Environmental permits or approvals planning will depend on the type of heat pump specified.

Environmental Impact Assessment (EIA), Directive 2014/52/EU, includes geothermal drilling that may require an environmental impact assessment (EIA) if the planning authority or An Coimisiún Pleanála (formerly An Bord Pleanála - ABP) consider the activity would be likely to have significant effects on the environment.

Boreholes can have an effect on groundwater and the Environmental Protection Agency (EPA) should be consulted when considering a heat-pump system with a vertical collector system or an open-loop system.

Geothermal installations (GSHP) require comprehensive, site-specific design to ensure extracting heat from the ground does not lead to a deficit in temperature over time. Geological Survey Ireland (GSI) suitability maps are currently the only datasets relating to geothermal potential available for Ireland.

NOTE Heat Pump installations must satisfy relevant Local Planning Authority (LPA) requirements. Water to Water (WSHP) and Ground to Water (vertical GSHP) heat pump installations must satisfy EPA requirements.

The Contractor shall ensure that all necessary permissions/approvals have been obtained by the homeowner from the relevant authorities before commencing the works.

6.8.6 Heat Pump Standards and Guidance documents

Design, installation, commissioning and maintenance of the heat pump system shall be based on:

- "*Heating and Domestic Hot Water Systems for Dwellings – Achieving compliance with Part L & Energy Performance of Buildings Regulations*" Clause 8 from DHLGH
- I.S. EN 15450 Heating Systems in Buildings - Design of Heat Pump Heating Systems
- I.S. EN 12831-1 Energy Performance of Buildings - Method for Calculation of the Design Heat Load - Space Heating Load
- I.S. EN 12831-3 provides a method to calculate the power and the storage volume required for the dimensioning of domestic hot water systems (DHW).
- I.S. EN 12828 Heating systems in buildings - Design for water-based heating systems
- I.S. 10101 National Rules for Electrical Installations
- Refrigerating systems and heat pumps I.S. EN 378-1 Safety and environmental requirements and I.S. EN 378-3 Installation site and personal protection
- I.S. EN ISO 17628 – Geotechnical Investigation and Testing – Geothermal Testing- Determination of thermal conductivity of soil and rock using borehole heat exchangers
- S.R. 50-1 Building services - Code of Practice - Water based heating systems in dwellings_NSAI
- S.R. 50-3 Building services - Code of Practice - Water supply for domestic use within dwellings and their curtilages_NSAI
- S.R. 50-4 Building services - Heat pump systems in dwellings_NSAI
- Environmental Protection Agency (EPA) "*Summary Guidance for Compliance with the ODS and F-Gas Regulations*" and "*Complying with Regulations Controlling Fluorinated Greenhouse Gases and Ozone Depleting Substances – A Guidance Note for Operators of Equipment Containing F-gases and ODS*"
- Heat Pump Association of Ireland (HPAI) Heat Pump installation guidelines
- Manufacturer's installation instructions for the specific Heat Pump model(s) and other parts of the system installed

- Heating, Ventilating, Air Conditioning and Refrigeration _ CIBSE Guide B
- Minimising the risk of Legionnaires disease _ CIBSE TM13
- Ground Source Heat Pumps _ CIBSE TM51
- Domestic Heating Design Guide (DHDG) _ CIBSE
- Underfloor Heating Design & Installation Guide HVUH _ CIBSE
- TIMSA guidance (TIMSA - HVAC Compliance guide) re: indicative thicknesses of insulation for heating and distribution pipes, as per Table 29 Note 1 of TGD L - Hot Water Systems for dwellings – Achieving compliance with Part L.
- Design of low-temperature domestic heating systems: A guide for system designers and installers (FB 59), BRE Trust
- TR30 Guide to Good Practice – Heat Pumps (BESA Building and Engineering Services Association)
- Microgeneration Certification Scheme – MCS Guidance Documents (UK)
  - Heat Pump Design - MIS 3005-D
  - Heat Pump Installation - MIS 3005-I
  - Heat emitter guide for domestic heat pumps - MCS 021
- Good Practice Guide for Ground Source Heating & Cooling _ Ground Source Heat Pump Association (GSHPA)
- Geothermal Collector suitability Maps _ Geological Survey Ireland (GSI)
- 'Ground Source Heat' & 'Shallow Geothermal Energy' Homeowner Manual _ Geological Survey Ireland (GSI)
- DEAP Heat Pump Guide_ SEAI Heat Pumps | DEAP Guide

6.9 Boiler : High Efficiency Boilers

Contractor Requirements and Competence

High efficiency boilers must be installed by competent persons, appropriately trained for each element of works being carried out. Workmanship shall be in accordance with TGD D and BS 8000-0 and in accordance with manufacturer's guidelines as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures.

If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor (REC) and a Completion Certificate must be issued.

6.9.1 Oil Boilers

Contractors installing oil-fired boilers must meet the requirements of I.S. EN 16510-1 residential solid fuel burning appliances and BS 8303 for solid fuel appliances in addition to the requirements and competencies stated above. SEAI recommends that the Contractor be registered with a professional organisation, e.g. OFTEC.

6.9.2 Gas Boilers

In addition to the above criterion, Contractors installing a Liquefied Petroleum Gas (LPG) or Natural Gas boiler under this measure must be a Registered Gas Installer (RGI) of Safe Energy Ireland to issue Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3).

All SEAI home energy upgrade qualifying Natural Gas and LPG boilers must be installed by a competent person and in accordance with the following documents:

- I.S. 813 Domestic Gas Installations. This Standard covers the Code of Practice for the installation of Natural Gas or LPG, in domestic premises, from the point of delivery to the gas appliance.
- 'The Regulation of Gas Installers with respect to safety', CRU Criteria document.

It is a legal requirement to be a Registered Gas Installer (RGI) of Safe Energy Ireland in order to undertake domestic Natural Gas or Liquefied Petroleum Gas (LPG) works. High Efficiency Gas Boiler and Heating Controls works must be carried out by a Registered Gas Installer (RGI). RGI details available on www.rgi.ie.

Oil and Gas Boiler Product Standard and Specification

SEAI home energy upgrade qualifying boilers must be listed on the SEAI Home-heating Appliance Register of Performance (HARP) database (or equivalent) such as the UK's Product Characteristic Database (PCDB). Boilers must have a HARP seasonal efficiency of at least 90 %.

Gas boilers and solid fuel appliances should be installed in accordance I.S. 813 for gas boilers and I.S. EN 16510-1 residential solid fuel burning appliances and BS 8303 for solid fuel appliances.

When replacing a boiler it is imperative to consider the requirements of the gas installation standards, electrical standards and manufacturer instructions and in particular with respect to earthing and bonding, refer to Clause 3.2 Electrical Installations: Best Practice.

Where a replacement boiler installation involves a change of fuel, the procedure outlined in Clause 1.4 of the DHLGH's "Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L" must be adhered to. This procedure discourages replacement of an existing appliance by a significantly less carbon-efficient one.

The Contractor must discuss the specification and sizing of the boiler with the homeowner before selecting the final system. Size of home, levels of glazing and insulation should all be considered among other parameters.

Oil and Gas Boiler Installation Standard and Specification

SEAI home energy upgrade qualifying boilers must be fitted in accordance with:

- TGD J Heat Producing Appliances
- All ventilation requirements must be met (see Clause 4). Gas, oil and solid fuel appliances must be correctly ventilated as per TGD F Ventilation and TGD J.
- I.S. 10101 National Rules for Electrical Installations (refer to Clause 3.2 Electrical Installations: Best Practice for details)
- I.S. EN 12831-1 Energy performance of buildings. Method for calculation of the design heat load
- Manufacturer's guidelines

6.9.3 Condensing Boilers

When installing condensing boilers, the DHLGH and SEAI document 'Guide to the condensing boiler installation assessment procedure for Existing Dwellings' should be consulted before installation. This document is included as an Appendix in the DHLGH and SEAI document '*Heating and Domestic Hot Water Systems for Dwellings - Achieving Compliance with Part L*'. It contains the detailed guidance referred to in paragraph 2.2 of Technical Guidance Document L – Dwellings to assess cases where the provision of condensing boilers is not practicable.

6.9.4 Safety Valve Discharge works : Guidance Note on Installation

A safety valve is permitted to discharge externally or internally. The following text details what is acceptable under this measure, I.S. 813 (natural gas and LPG installations) and OFTEC (oil installations):

External discharge:

A discharge pipe shall be run from the safety valve in 15 mm (½") copper. The pipework shall terminate in a visible position outside the building and have a 100 mm minimum turn down with the outlet facing downwards. Alternatively, use a boiler manufacture supplied purposed designed fitting, to ensure that the discharge of hot water or steam shall not endanger any person or property. The discharge pipework shall be installed with enough continuous fall to prevent the retention of water and the risk of pipework becoming blocked due to freezing.

Internal discharge:

A discharge pipe shall be run from the safety valve in 15 mm (½") copper to a suitable discharge point into the wastewater system within the dwelling in pipework suitable for temperatures exceeding 100 °C. The discharge of hot water or steam shall not endanger any person or cause damage to appliances, controls, other equipment or property. The discharge into the wastewater system shall be made in an accessible location. The discharge must be fitted with a waste trap and a tundish or a (30 mm) open-ended riser of enough height to ensure that spillage cannot take place. The discharge pipework shall be installed with enough continuous fall to prevent the retention of water and the risk of the pipework becoming blocked due to freezing.

Further Guidance

The installation of boilers should also follow the guidance outlined in the following publications:

- S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI
- CE29 Domestic Heating by Oil: Boiler Systems – Guidance for Contractors and Specifiers
- CE30 Domestic Heating by Gas: Boiler Systems – Guidance for Contractors and Specifiers
- Good Practice Guide 301 Controls for Domestic Heating and Hot Water – Choice of Fuel and System Type
- CIBSE – Domestic Heating Design Guide

6.10 Boiler Service

Contractor Requirements and Competence

Contractors performing a boiler service to an existing heating system must be competent persons, appropriately trained for each element of works being carried out. Workmanship shall be in accordance with TGD D and BS 8000-0 and in accordance with manufacturer's guidelines as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guild**s.**

Oil Boilers

Contractors performing a boiler service must meet the requirements and competencies stated above. It is also recommended that the Contractor is registered with a professional organisation, e.g. OFTEC.

Gas Boilers

In addition to the above criterion, Contractors servicing a Liquefied Petroleum Gas (LPG) or Natural Gas boiler under this measure must be a Registered Gas Installer (RGI) of Safe Energy Ireland to issue Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3).

It is a legal requirement to be a Registered Gas Installer (RGI) of Safe Energy Ireland in order to undertake domestic Natural Gas or Liquefied Petroleum Gas (LPG) works. High Efficiency Gas Boiler and Heating Controls works must be carried out by a Registered Gas Installer (RGI). RGI details available on www.rgi.ie.

Standard and Specification

a. A boiler service should be to manufacturer's instructions or as per SEAI boiler servicing checklists

   The gas boiler checklist is available at: www.seai.ie/.../Gas Boiler Service Checklist
   The oil boiler checklist is available at: www.seai.ie/.../Oil Boiler Service Checklist

b. The Homeowner shall be supplied with a certificate detailing that a boiler service was performed on the boiler and entered in the boiler logbook.

   The boiler logbook is an important document for the homeowner to retain as it records the following information:

   - Details of the installing / commissioning Contractor;
   - Can be necessary to validate the Warranty for the boiler;
   - Gives details for future servicing.

   The boiler logbook must be placed in a location accessible for the Homeowner and future boiler service technicians. The homeowner shall be advised that this material should be retained as an inspection of the system may be required. A duplicate of the certificate detailing that a boiler service was carried out on the boiler shall be retained by the installer for audit purposes.

6.11 Biomass Boilers (with/without thermal storage)

Contractor Requirements and Competence

Biomass boilers work on the same principle as a conventional oil boiler and must be installed by competent persons in accordance with the manufacturer's guidelines and the DHLGH "Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L".

In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the '*minor*' electrical works involved in specific control measures. All electrical associated works must be carried out in accordance with the applicable National Rules for Electrical Installations.

If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor (REC) and a Completion Certificate must be issued.

The heating system must be divided into space heating and water heating zones with at least one more space heating zone added so that there are at least two zones for space heating.

This should incorporate a 24-hour 7-day programmer (installation and standards specifications outlined in Clause 6.13 Heating Controls – Fully Integrated) with/without a remote access and be interlocked with the operation of the biomass boiler unit or a controls package approved by the manufacturer for the specific biomass boiler installation.

The installation and standards specifications outlined in Clause 6.13.1 apply to the installation of the zoning measures.

In addition, a suitably sized pre-insulated hot water cylinder, with an insulant thickness of at least 80 mm, should be installed where the existing cylinder does not meet this requirement.

In the interest of safety, appliances with uncontrollable heat sources should not be connected to pressurised cylinders.

Product Standard and Specification

SEAI home energy upgrade qualifying biomass boilers must be CE Marked to demonstrate compliance with the Low Voltage Directive (LVD 2014/35/EU) and Machinery Regulation (EU 2023/1230).

The biomass boiler must also be listed under 'Solid Fuel Boilers' on the SEAI Home-heating Appliance Register of Performance (HARP) database, or appropriate equivalent, and have the following minimum gross efficiency on HARP:

- With thermal store 77 %
- Without thermal store 82 %

For boilers without automatic ignition, a buffer (or accumulator) tank should be connected to the boiler and the heating system. When installing a buffer/accumulator tank, the tank must meet the following requirements:

- Vented copper hot water storage vessels should meet the heat loss and heat exchanger requirements of I.S. EN 1566-1 "*Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Chlorinated poly (vinyl chloride) (PVC-C). Specification for pipes, fittings and the system*" or BS 3198 "*Specification for copper hot water storage combination units for domestic purposes*"'
- Vented cylinders in materials other than copper should meet the heat loss and heat exchanger requirements of BS 1566-1.

- Unvented cylinders need good water pressure and flow. Unvented hot water storage system products should be based on:
  - I.S. EN 12897 '*Water supply. Specification for indirectly heated unvented (closed) storage water heaters*'; or
  - CE Mark or Irish Agrément Certificate;
  - Irish Building Regulations compliance
- Unvented systems should not be used with gravity circulation

The guidance in Clause 5.3 of the DHLGH document "*Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part* L" must be adhered to.

The Contractor must discuss the specification and sizing of the biomass boiler and storage requirements with the homeowner before selecting the final system.

Installation Standard and Specification

a. The Contractor must always meet the requirements of I.S. EN 14336 "*Heating systems in buildings. Installation and commissioning of water-based heating systems"* and the requirements of the system suppliers' specifications.

b. A pre-installation survey of the property should be carried out to assess site and location issues likely to affect installation and fuel storage, fuel delivery considerations and specific user requirements.

c. The survey should also determine heat demand use trends. An assessment of the site and heating requirements is made and recommendations on the required boiler size, provision for backup heating, fuel supply and any other relevant issues are made.

d. All ventilation requirements must be met (see Clause 4). Solid fuel appliances such as biomass boilers must be correctly ventilated as per TGD F Ventilation and TGD J Heat Producing Appliances.

e. The calculation of the heating requirement for sizing of the biomass boiler should be in accordance with I.S. EN 12831-1 'Heating systems in buildings. Method for calculation of the design heat load' or equivalent.

f. The Contractor will discuss the implications of the fuel storage requirements and the available storage space and its impact on the cost-effectiveness of the system.

g. The biomass boiler should not be installed inside the dwelling or outdoors. It should be installed in a suitable boiler room. The outbuilding/boiler room should have the required boiler and hopper clearances to allow the boiler installation, access for loading, cleaning and servicing as per manufacturer's instructions.

h. The Contractor will ensure that there is enough permanent ventilation to the boiler room. Where the manufacturer has not specified the minimum area for the required ventilation opening, a permanent air vent of at least 550 mm^2 per kW of boiler output but no less than 6500 mm^2 will be provided, or as required by TGD J of the Building Regulations.

i. The Contractor shall ensure that the required electricity supply is available for the plant in the boiler room.

j. The Contractor shall ensure there is adequate water supply, and that the boiler is plumbed according to all relevant regulations and as per the manufacturer's instructions. Provision must also be made to ensure the safe and effective disposal of condensate from the boiler.

k. Where the boiler is fed directly from a bulk storage unit, the storage unit should be in accordance with the manufacturer's guidelines. Where the fuel is not supplied directly, the fuel storage facility being provided should be in accordance with the fuel supplier's guidance.

l. The existing central heating system should be thoroughly cleaned and flushed out before installing a new boiler.

m. All components shall be installed to allow for maintenance, repair/replacement and insulation. Where components or joints are inaccessible, they shall be permanent. Permanent components and joints shall be maintenance free and have a durability corresponding to the lifetime of the components in which they are installed.

n. An exhaust flue should be twin-walled insulated stainless steel. The inner wall should be grade 316 and the outer wall should be grade 306 or better. The flue should be certified as suitable for use with wood fuels, and it should be the diameter specified by the boiler manufacturer.

o. Any pipework exposed as part of the work or is otherwise accessible should be insulated as recommended in "*Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L*". A lesser standard is only acceptable where practical constraints dictate.

p. Biomass boilers must be commissioned to verify that the system is installed in accordance with I.S. EN 12828 "*Heating systems in buildings. Design for water-based heating systems*", I.S. EN 14336 "*Heating systems in buildings. Installation and commissioning of water-based heating systems*" and manufacturer's guidelines.

q. Commissioning should include:
   - Testing for leakage to ensure the system is watertight;
   - Pressure testing to a pressure 30 % greater than the working pressure or as per manufacturers instruction;
   - The system shall be cleaned and/or flushed;
   - The system shall be filled with suitable water and vented;
   - A check that any equipment prone to frost damage is protected;
   - All components of the system shall be checked for correct operation;
   - Water flow rates shall be balanced to meet the requirements of the design;
   - All controls shall be adjusted in accordance with the manufacturer's instructions and the design specification.

r. All written information on the operation, maintenance and use of the system shall be provided to the homeowner, including the manufacturer's instructions. The Contractor shall also instruct the homeowner in the safe and efficient operation, maintenance, and use of the biomass heating system.

s. The Contractor shall provide the homeowner with the records of all functional, pressure and environmental tests carried out and a balancing report.

Hot Water Storage Tank (Buffer / Accumulator)
The Contractor shall ensure:-

- Hot Water Storage Tank (buffer/accumulator) is sized correctly as per manufacturer's recommendations. There should be at least 15 litres of storage for every kilowatt of output from the boiler. Where it is not possible to install a large enough tank, the homeowner should be made aware of this and of the implications of a smaller tank.
- A temperature sensor shall be fitted to the top and the bottom of the buffer/accumulator tank.
- If two or more hot water storage tanks (buffer/accumulator) are being used, they should be connected in series. The outlet from the bottom of the first tank must be connected to the inlet at the top of the next tank and so on.
- Hot water storage tank (buffer/accumulator) is insulated sufficiently. Where the tank is not pre-insulated, it should be insulated to a minimum of 80 mm in thickness.

Further Guidance

- S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI
- Microgeneration Installation: MIS 3004 Requirements for Contractors Undertaking the Supply, Design, Installation, Set to Work, Commissioning and Handover of Solid Biofuel Heating Systems
- TR38 Guide to Good Practice – Installation of Biofuel Heating (Heating and Ventilation Contractors' Association)
- CIBSE – Domestic Heating Design Guide

6.12 Heating Controls – Fully Integrated

This section outlines the general Standards and Specifications for Contractors, products and installation methods for fully integrated heating controls.

Contractor Requirements and Competence
Heating controls must be installed by competent persons in accordance with manufacturer's guidelines as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures.

If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required then these works must be carried out by a Registered Electrical Contractor (REC) and a Completion Certificate No. 3 must be issued. Contractors must be competent in the installation of the control system chosen, seek guidance and attend training from the manufacturer or supplier, if required.

Product Standard and Specification
All heating control products must conform to the appropriate European or Irish standard for that measure. As a minimum, the following Standards should be satisfied:

- I.S. EN 60730-1 Automatic electrical controls for household and similar use. General requirements
- I.S. EN IEC 60730-2-7 Automatic electrical controls for household and similar use Part 2-7: Particular Requirements for Timers and Time Switches
- I.S. EN 215 Thermostatic Radiator Valves. Requirements and Test Methods

Installation Standard and Specification
All heating controls should be installed in accordance with the manufacturer's specifications. All works should be installed in accordance with

- "*Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L*", DHLGH

- S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings, NSAI
- S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI
- "Domestic Heating Design Guide", CIBSE
- GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE
- CE29 Domestic Heating by Oil: Boiler Systems – Guidance for Installers and Specifiers
- CE30 Domestic Heating by Gas: Boiler Systems – Guidance for Installers and Specifiers

All works should be carried out in accordance with I.S. 10101 National Rules for Electrical Installations and I.S. EN 12828 "*Heating systems in buildings - Design for water-based heating systems"* or equivalent, where applicable. Please refer to Clause 3.2 Electrical Installations: Best Practice for details.

Attention should be given to good housekeeping and safety during installation. The Contractor must fully demonstrate every installed measure to the homeowner and provide a written set of operating instructions. Before leaving the home, the Contractor must ensure that the owner can correctly operate their upgraded heating system.

Wireless heating control equipment: Note on Installation
Care should be taken before installing wireless equipment, to ensure that there is no interference from metal objects or building elements, other wireless or non-wireless electrical devices. Checks should be carried out to ensure that the signal strength is sufficient for the heating controls to operate correctly. Manufacturer's installation instructions and guidance must be followed.

Fully Integrated Heating Controls must include the following items:

6.12.1 Space Heating and Domestic Hot Water : Dual Zone Control
6.12.2 Space Heating and Domestic Hot Water : adding an additional Zone Control
6.12.3 Programmable Timer (time and temperature control) with remote access
6.12.4 Immersion Heater with thermostatic controls and timers
6.12.5 Hot Water Cylinder Thermostat
6.12.6 Hot Water Cylinder Insulation
6.12.7 Boiler Heating Controls
6.12.8 Thermostatic Radiator Valves (TRVs)

This measure is based on the energy efficiency and carbon savings that can be achieved by installing the items above in a home that previously had no, or very basic heating controls installed. Replacement of existing heating controls equipment cannot be accepted under this measure.

In addition to the above, the following items must be addressed, where required:
- Auto by-pass
- Earthing and equipotential Bonding (see Clause 3.2)

The following sub-clauses describe the requirements for the items above.

6.12.1 Space Heating and Domestic Hot Water : Dual Zone Control

This measure divides the heating system into two zones and incorporates a 24 hour 7-day programmer for time and temperature control and a boiler interlock arrangement to prevent boiler operation when the heat demand drops off. These initial two zones must include the space heating

zone and the domestic hot water heating zone. Further zones to split areas of the dwelling can be added as additional zones (see Clause 6.12.2).

Product Standard and Specification
All timers, programmers, thermostats, zoning manifolds and motorised control valves must conform to the appropriate European or Irish standard for that measure. For example, I.S. EN IEC 60730-2-7 *"Automatic Electrical Controls for Household and similar Use Part 2-7: Particular Requirements for Timers and Time Switches*".
It should also be noted that 22 mm motorised control valves are usually suitable for boilers rated up to 20 kW. For larger boilers, when fitting a motorised control valve on a gravity hot water circuit, 28 mm valves or larger should be used.

Installation Standard and Specification
Zoning: Zones should be divided according to Industry Best Practice as outlined in Good Practice Guide 302 – *Controls for domestic central heating and hot water – guidance for specifiers and installers*. This guide recommends using motorised control valves to subdivide the home into separate heating zones. A zoning manifold can also be used to achieve separate heating zones. Motorised control valves can be plumbed at an angle but must not be mounted so that the power-head is below the horizontal level of the pipework. If fitted in a confined space, adequate ventilation must be available to keep the valve within its recommended temperature range. There must also be adequate access so that the power head can be removed if necessary. Motorised valves should not be positioned in the line of the open safety vent pipe or the feed and expansion pipe. Solid fuel systems should use normally open motorised valves (i.e. they close only when power is applied) to ensure safe operation in the event of power failure or malfunction.

Alternative zoning without pipework separation: In cases where separating the pipework would be not technically or functionally feasible, a system based on electronic thermostat TRVs connected wirelessly to a centralised control unit may be used to achieve fully separated time and temperature control of space heating and hot water. This system must provide the same or higher level of separate time and temperature control as a fully integrated system based on pipework separation and motorised valves. The following items must be installed:

1. Wireless electronic thermostatic valves connected to the centralised control unit on all heat emitters;
2. Wireless electronic cylinder thermostat connected to the centralised control unit and controlling the hot water cylinder valve;
3. A centralised control unit ensuring that the boiler only fires when there is heating demand from one of the wireless electronic thermostatic valves, or from the hot water cylinder thermostat.

All product and installation standards and specifications in this Clause 6.12 must be met by the system. The homeowner must be fully trained in the use and basic maintenance of the system, for example in the replacement of batteries for the electronic thermostatic valves or changing the settings.

6.12.2 Space Heating and Domestic Hot Water : adding an additional Zone Control

In addition to establishing dual zones (see Clause 6.12.1), the homeowner must also commission the installation of an additional space heating zone **OR** the installation of Thermostatic Radiator Valves (TRVs), see Clause 6.12.8 for details. TRVs must not be installed in rooms with room thermostats.

A Third Zone can be established using an additional motorised control valve or a zoning manifold arrangement and room thermostat. Installation should be carried out in accordance with the manufacturer's instructions and with all relevant standards (see Clause 6.12.1).

6.12.3 Programmable Timer (time and temperature control) with remote access

A 24-hour 7-Day Programmable Timer, facilitating time and temperature control should be installed in accordance with the manufacturer's guidelines and industry best practice as outlined in Good Practice Guide 302.

Room Thermostat must be in an area where it is not subject to heat gains, direct sunlight or draughts. The thermostat should be in a well-lit, easily accessible position with good air circulation. The chosen position must be representative of average room/zone temperature. Do not install room thermostats in areas such as corners, behind furniture or curtains. Similarly, room thermostats must not be in areas where the air flow may pick up extra heat such as close to TVs, computers, wall lights, in a room with a fixed heating appliance or direct sunlight. Installing a room thermostat in an area subject to external draughts such as beside external doors etc. should also be avoided. Best practice recommends that thermostats are situated approximately 1.5 m from the floor. Furthermore, room thermostats should not be installed in any room already using TRVs for temperature control. If wireless room thermostats are used, the homeowner must be informed as part of the handover on what are suitable and unsuitable locations for the thermostat (e.g. the wireless room thermostat should not be placed in rooms with TRVs, including wireless electronic thermostatic valves).

6.12.4 Immersion Heater with thermostatic controls and timers

Product Standard and Specification

Timers and temperature control for electric immersion heaters must conform to the appropriate European or Irish standard i.e.

- I.S. EN 60730-1 Automatic electrical controls for household and similar use. General requirements
- I.S. EN 60730-2-7 Automatic Electrical Controls for Household and similar Use Part 2-7: Particular Requirements for Timers and Time Switches

Installation Standard and Specification

Installation should be carried in accordance with the manufacturer's guidelines and Industry Best Practice as outlined in Good Practice Guide 302 "*Controls for domestic central heating and hot water – guidance for specifiers and installers"* or similar.

6.12.5 Hot Water Cylinder Thermostat

To ensure that the correct hot water temperature is detected, the Hot Water Cylinder Thermostat (installed with the immersion timer and temperature control device) should be installed between 1/4 and 1/3 of the way up the height of the cylinder unless otherwise instructed by the manufacturer. Timers should not be installed as an alternative to immersion switches as they cannot perform the function of controlling bath and sink where applicable.

Care should be taken to ensure that there is good clean contact between the thermostat and the cylinder when attaching. The thermostat should also be located on the front face of the cylinder so that it is easily accessible by the homeowner. All stored water (in the domestic hot water cylinder and any that is recirculated in sections of pipework) must have a legionella protection cycle (aka bacterial contamination disinfection routine) to periodically raise the temperature to at least ≥ 60°C,

and held there for at least one hour, at least once per week. The hot water system should be able to efficiently facilitate production of domestic hot water cylinder temperature to ≥ 50 ^{o}C. Further guidance in CIBSE TM13 "Minimising the risk of Legionnaires disease", standards, guidance and specification documents.

6.12.6 Hot Water Cylinder Insulation

The following requirements apply to insulation on existing hot water cylinders:

- If not replacing the hot water cylinder with a pre-insulated hot water cylinder during the boiler and/or controls upgrade, then a correctly sized insulating jacket tested and approved to BS 5615 must be fitted.
- The insulation jacket shall not cover the immersion heater head and/or cylinder thermostat.
- The fixing bands shall be of a durable material and shall not be over tight or loose.
- Hot water storage cylinders having factory-applied thermal insulation shall not be fitted with insulating jackets unless existing thermal insulation is rendered ineffective through mechanical damage or deterioration.
- Where the specification details of an existing hot water storage cylinder jacket are not completely legible and/or are not perfectly visible, a self-adhesive label shall be additionally applied to the jacket at an accessible position stating the name of the jacket supplier and the Irish Standard reference details.
- For an existing jacket where the British Standards compliance marking is not indicated by any means the following action shall be undertaken:
  - The jacket will be in accordance with the BS 5615 specification.
  - The insulating material, covering material and fastenings shall not have suffered any permanent deterioration.
  - The insulating material shall be at least 80 mm nominal thickness.

6.12.7 Boiler Heating Controls

Boiler Interlock is a method of connecting the heating system controls with a boiler. A boiler interlock arrangement must be included as part of this set of controls whereby the boiler will not fire when there is no demand for heat. Unnecessary boiler firing can be eliminated with this control measure. The Contractor should turn all thermostats right down when the boiler is firing to assess whether a boiler interlock arrangement is already in place. If the boiler continues to fire, then there is no interlock. The pump may continue to run if the boiler requires a pump to overrun – this is intentional and does not affect the boiler interlock. On a traditional central heating system with stored hot water, a boiler interlock arrangement can be set up by interconnecting the room and cylinder thermostats with motorised valve(s). With a combination boiler, installing a room thermostat is all that is required to set up a boiler interlock arrangement.

Boiler Management System is an acceptable alternative to the above control measures would be to install a boiler management system that delivers the specified zoning, timing and temperature and boiler interlock control provisions. Such systems must provide the same functionality as is described above and be installed in accordance with the manufacturer's guidelines and industry best practice.

In some exceptional cases, the hot water cylinder is significantly isolated from the boiler and the installation of additional pipes to connect it separately would involve substantial civil works. In these cases, a manifold/valve arrangement to bypass the hot water cylinder would be an acceptable alternative. This arrangement would allow the homeowner to use their boiler for space heating without heating the water in the hot water cylinder. The Contractor must explain to the homeowner

this new heating arrangement and how to use this system for heating hot water in the summer months e.g. turning off the radiators or using the time/temp programmer. The reasons for implementing this alternative solution as part of the heating control upgrades must be documented in the comments sections as required by the specific Programme.

6.12.8 Thermostatic Radiator Valves (TRVs)

In addition to establishing 2 zones (see Clause 6.12.1), the Contractor must also install an additional space heating zone OR install Thermostatic Radiator Valves (TRVs) on at least three radiators but no less than half of all radiators in rooms without room thermostats.

Product Standard and Specification

All TRVs must conform to the appropriate European or Irish standard for Thermostatic Radiator Valves such as I.S. EN 215 "*Thermostatic Radiator Valves - Requirements and Test Methods*".

Installation Standard and Specification

TRVs should be installed in accordance with the manufacturer's guidelines, NSAI's S.R. 54 *Code of Practice for the Energy Efficient Retrofit of Dwellings* and BS 7478 "*Guide to selection and use of thermostatic radiator valves"*. BS 7478 guides on selection, application and use of thermostatic radiator valves (TRVs) manufactured in accordance with I.S. EN 215 for use in domestic and commercial wet central heating systems. TRVs must not be fitted in rooms with room thermostats.

When installing TRVs, the Contractor must ensure that the temperature selector scale and reference point are easily visible and accessible to the user and that the TRV is not positioned in an area which may distort the temperature sensor. Avoid locating TRVs behind curtains, in direct sunlight, in very draughty locations or other areas which may distort the temperature sensor. If these conditions are unavoidable, a remote sensor should be used. When inaccessibility of the valve to the user is unavoidable e.g. when the radiator and valve are located behind a decorative grille, valves with combined remote temperature sensors and adjuster should be used.

Most modern TRVs are bi-directional and can be installed in the flow or return direction. Due care should be taken to ensure that the valve is bi-directional. If the valve is not bi-directional, the flow through the valve must correspond to the direction on the arrow of the valve body. When fitting TRVs to a one-pipe system, units designed for minimum flow resistance should be used.

An Automatic Bypass Circuit must be installed (in fully pumped systems) in homes where there are 3 or more TRVs in place. When most TRVs are open, the automatic bypass remains closed, allowing full circulation around the heating system. When the TRVs close, the automatic bypass opens, allowing an appropriate flow rate through the boiler. The use of an automatic bypass also reduces the noise in the system due to excess water velocity. An automatic bypass circuit must also be fitted if the boiler manufacturer requires one, or if it specifies that a minimum flow rate must be maintained while the boiler is firing. An automatic bypass circuit must then incorporate an automatic bypass valve to control water flow in accordance with the water pressure across it. The valve is used to maintain a minimum flow rate through the boiler and to limit circulation pressure when some radiators or zones are turned off. This level of control cannot be achieved using a fixed position valve. The valve should be installed between the boiler primary flow and return noting the direction of flow. When an in-built auto-bypass valve is present in a system boiler, it must be checked that this arrangement is sufficient to provide the minimum flow rate required to the boiler when all the TRVs are closed. In some cases, an external bypass circuit is also required.

All systems should be flushed to remove debris before commissioning with all thermostatic sensor heads removed and valves fully open. Thermostatic sensor heads should also be removed during hydraulic balancing of the system to prevent changes in room temperature affecting the balancing

procedure. The Contractor should set the TRVs to the desired temperature and demonstrate to the homeowner how to adjust the temperature setting as they may require.

NOTE The room where the main thermostat is fitted should ***NOT*** have a TRV fitted to the radiator in that location. This would cause inaccuracies in the thermostatic control.

6.13 Heating Controls with Remote Access – Fully Integrated

General Standards and Specifications

This section outlines the general Standards and Specifications for Contractors, products and installation methods for fully integrated heating controls with remote access.

Contractor Requirements and Competence

Heating controls with remote access must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor (REC) and a Completion Certificate must be issued. Contractors must be competent in the installation of the control system chosen, seek guidance and attend training from the manufacturer or supplier if required.

Product Standard and Specification

All heating controls with remote access products must conform to the appropriate European or Irish standard for that measure. As a minimum, the following Standards should be satisfied:

- I.S. EN 60730-1 *Automatic electrical controls for household and similar use. General requirements*
- I.S. EN IEC 60730-2-7 *"Automatic Electrical Controls for Household and similar Use Part 2-7: Particular Requirements for Timers and Time Switches*"
- I.S. EN 215 Thermostatic Radiator Valves. Requirements and Test Methods

Installation Standard and Specification

All Heating Controls should be installed in accordance with the manufacturer's specifications and Industry Best Practice. All works should be installed in accordance with

- "*Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L*", DHLGH
- S.R. 54 *Code of Practice for the Energy Efficient Retrofit of Dwellings, NSAI*
- *S.R. 50 Series[31] on Standards for Modern Plumbing and Heating*
- "*Domestic Heating Design Guide", CIBSE*
- GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE
- CE29 Domestic Heating by Oil: Boiler Systems – Guidance for Installers and Specifiers
- CE30 Domestic Heating by Gas: Boiler Systems – Guidance for Installers and Specifiers

All works should be carried out in accordance with I.S. 10101 National Rules for Electrical Installations and I.S. EN 12828 *Heating systems in buildings - Design for water-based heating systems* or equivalent, where applicable. Please refer to Clause 3.2 Electrical Installations: Best Practice for details.

Heating controls with remote access must be installed only when the homeowner has access to the remote programmer, either through a smart phone app, or through the internet.

Attention should be given to good housekeeping and safety during installation. The Contractor must fully demonstrate every installed measure to the homeowner and provide a written set of operating

instructions. Before leaving the home, the Contractor must ensure that the owner can correctly operate their upgraded heating system.

Wireless Heating Control Equipment : Note on installation
Care should be taken before installing wireless equipment, to ensure that there is no interference from metal objects or building elements, other wireless or non-wireless electrical devices. Checks should be carried out to ensure that the signal strength is sufficient for the heating controls to operate correctly. Manufacturer's installation instructions and guidance must be followed.

Fully Integrated Heating Controls, with remote access, must include the following items:
6.13.1 Space Heating and Domestic Hot Water : Dual Zone Control
6.13.2 Space Heating and Domestic Hot Water : adding an additional Zone Control
6.13.3 Programmable Timer (time and temperature control) with remote access
6.13.4 Immersion Heater with thermostatic controls and timers
6.13.5 Hot Water Cylinder Thermostat
6.13.6 Hot Water Cylinder Insulation
6.13.7 Boiler Heating Controls
6.13.8 Thermostatic Radiator Valves (TRVs)

This measure is based on the energy efficiency and carbon savings that can be achieved by installing the items above in a home that previously had no, or very basic heating controls installed. Replacement of existing heating controls equipment cannot be accepted under this measure.

In addition to the above, the following items must be addressed, where required:
- Auto by-pass, and
- Earthing and equipotential Bonding (see Clause 3.2)

The following sub-clauses describe the requirements for the items above.

6.13.1 Space Heating and Domestic Hot Water : Dual Zone Control

This measure divides the heating system into two zones and incorporates a 24 hour 7-day programmer with remote access for time and temperature control and a boiler interlock arrangement to prevent boiler operation when the heat demand drops off. These initial two zones must include the space heating zone and the domestic hot water heating zone. Further zones to split areas of the dwelling can be added as additional zones (see Clause 6.13.2).

Product Standard and Specification
All timers, programmers, thermostats, zoning manifolds and motorised control valves must conform to the appropriate European or Irish standard for that measure. For example, I.S. EN IEC 60730-2-7 *"Automatic Electrical Controls for Household and similar Use Part 2-7: Particular Requirements for Timers and Time Switches*".

It should also be noted that 22 mm motorised control valves are usually suitable for boilers rated up to 20 kW. For larger boilers, when fitting a motorised control valve on a gravity hot water circuit, 28 mm valves or larger should be used.

Installation Standard and Specification
Zoning: Zones should be divided according to Industry Best Practice as outlined in Good Practice Guide 302. This guide recommends using motorised control valves to subdivide the home into separate heating zones. A zoning manifold can also be used to achieve separate heating zones. Motorised control valves can be plumbed at an angle but must not be mounted so that the

powerhead is below the horizontal level of the pipework. If fitted in a confined space, adequate ventilation must be available to keep the valve within its recommended temperature range. There must also be adequate access so that the power head can be removed if necessary. Motorised valves should not be positioned in the line of the open safety vent pipe or the feed and expansion pipe. Solid fuel systems should use normally open motorised valves (i.e. they close only when power is applied) to ensure safe operation in the event of power failure or malfunction.

Alternative zoning without pipework separation: In cases where separating the pipework would not be technically or functionally feasible, a system based on electronic thermostat TRVs connected wirelessly to a centralised control unit may be used to achieve fully separated time and temperature control of space heating and hot water. This system must provide the same or higher level of separate time and temperature control as a fully integrated system based on pipework separation and motorised valves. The following items must be installed:

1. Wireless electronic thermostatic valves connected to the centralised control unit on all heat emitters;
2. Wireless electronic cylinder thermostat connected to the centralised control unit and controlling the hot water cylinder valve;
3. A centralised control unit ensuring that the boiler only fires when there is heating demand from one of the wireless electronic thermostatic valves, or from the hot water cylinder thermostat.

All product and installation standards and specifications in this Clause 6.13 must be met by the system. The homeowner must be fully trained in the use and basic maintenance of the system, for example in the replacement of batteries for the electronic thermostatic valves or changing the settings.

6.13.2 Space Heating and Domestic Hot Water : adding an additional Zone Control

In addition to establishing 2 zones (see Clause 6.13.1), the homeowner must also commission the installation of an additional space heating zone OR the installation of Thermostatic Radiator Valves (TRVs), see Clause 6.12.8 for details. TRVs must not be installed in rooms with room thermostats.

Product Standard and Specification

The Product Standards and Specifications outlined in Clause 6.13.1 also apply to the components required to establish an additional heating zone (room thermostat and motorised control valve).

Installation Standard and Specification

A Third Zone can be established using an additional motorised control valve or a zoning manifold arrangement and room thermostat. Installation should be carried out in accordance with the manufacturer's instruction, NSAI's S.R. 54 *Code of Practice for the Energy Efficient Retrofit of Dwellings*, and Industry Best Practice. The Installation Standards and Specifications outlined in Clause 6.13.1 also apply to the installation of an additional heating zone.

6.13.3 Programmable Timer (time and temperature control) with remote access

A 24 hour 7-Day Programmer with remote access, facilitating time and temperature control with remote access should be installed in accordance with the manufacturer's guidelines and industry best practice as outlined in Good Practice Guide 302.

Room Thermostat must be in an area where it is not subject to heat gains, direct sunlight or draughts. The thermostat should be in a well-lit, easily accessible position with good air circulation. The chosen position must be representative of average room/zone temperature. Do not install room thermostats in areas such as corners, behind furniture or curtains or in areas where the air

flow may pick up extra heat such as close to TVs, computers, wall lights, in a room with a fixed heating appliance or direct sunlight. Installing a room thermostat in an area which may be subject to external draughts such as beside external doors etc. should also be avoided. Best practice recommends that thermostats are situated approx. 1.5 m from the floor. Furthermore, room thermostats should not be installed in any room using a TRV(s) for temperature control. If wireless room thermostats are used, the homeowner must be informed as part of the handover on what are suitable and unsuitable locations for the thermostat (e.g. the wireless room thermostat should not be placed in rooms with TRVs, including wireless electronic thermostatic valves).

6.13.4 Immersion Heater with thermostatic controls and timers

Product Standard and Specification

All timers, programmers, thermostats, zoning manifolds and motorised control valves must conform to the appropriate European or Irish standard for that measure. For example:

- I.S. EN 60730-1 Automatic electrical controls for household and similar use. General requirements
- I.S. EN 60730-2-7 Automatic Electrical Controls for Household and similar Use Part 2-7: Particular Requirements for Timers and Time Switches

Installation Standard and Specification

Installation should be carried in accordance with the manufacturer's guidelines and Industry Best Practice as outlined in Good Practice Guide 302 "*Controls for domestic central heating and hot water – guidance for specifiers and installers"* or similar.

6.13.5 Hot Water Cylinder Thermostat

Best Practice recommends that the Hot Water Cylinder Thermostat (installed with the immersion timer and temperature control device) is installed between 1/4 and 1/3 of the way up the height of the cylinder unless otherwise instructed by the manufacturer. Care should be taken to ensure that there is good clean contact between the thermostat and the cylinder when attaching. The thermostat should also be located on the front face of the cylinder so that it is easily accessible by the homeowner. All stored water (in the domestic hot water cylinder and any that is recirculated in sections of pipework) must have a legionella protection cycle (aka bacterial contamination disinfection routine) to periodically raise the temperature to at least ≥ 60 °C, and held there for at least one hour, at least once per week. The hot water system should be able to efficiently facilitate production of domestic hot water cylinder temperature to ≥ 50 ^{o}C. Further guidance in CIBSE TM13 "Minimising the risk of Legionnaires disease", standards, guidance and specification documents.

6.13.6 Hot Water Cylinder Insulation

The following requirements apply to insulation on existing hot water cylinders:

- If not replacing the hot water cylinder with a pre-insulated hot water cylinder during the boiler and/or controls upgrade, then a correctly sized insulating jacket tested and approved to BS 5615 must be fitted.
- The insulation jacket shall not cover the immersion heater head and/or cylinder thermostat.
- The fixing bands shall be of a durable material and shall not be over tight or loose.
- Hot water storage cylinders having factory-applied thermal insulation shall not be fitted with insulating jackets unless existing thermal insulation is rendered ineffective through mechanical damage or deterioration.
- Where the specification details of an existing hot water storage cylinder jacket are not completely legible and/or are not perfectly visible, a self-adhesive label shall be additionally applied to the jacket at an accessible position stating the name of the jacket supplier and the Irish Standard reference details.

- For an existing jacket where the British Standards compliance marking is not indicated by any means the following action shall be undertaken:
  - The jacket will be in accordance with the BS 5615 specification.
  - The insulating material, covering material and fastenings shall not have suffered any permanent deterioration.
  - The insulating material shall be at least 80 mm nominal thickness.

6.13.7 Boiler Heating Controls

Boiler Interlock is a method of connecting the heating system controls with a boiler. A boiler interlock arrangement must be included as part of this set of controls whereby the boiler will not fire when there is no demand for heat. All unnecessary boiler firing can be eliminated with this control measure. The Contractor should turn all thermostats right down when the boiler is firing to assess whether a boiler interlock arrangement is already in place. If the boiler continues to fire, then there is no interlock. The pump may continue to run if the boiler requires a pump to overrun, this is intentional and does not affect the boiler interlock. On a traditional central heating system with stored hot water, a boiler interlock arrangement can be set up by interconnecting the room and cylinder thermostats with motorised valve(s). On a combination boiler all that is required to set up a boiler interlock arrangement is a room thermostat.

Boiler Management System is an acceptable alternative to the above control measures would be to install a boiler management system that delivers the specified zoning, timing and temperature with remote access and boiler interlock control provisions. Such systems must provide the same functionality as is described above and be installed in accordance with the manufacturer's guidelines and industry best practice.

In some exceptional cases, the hot water cylinder is significantly isolated from the boiler and the installation of additional pipes to connect it separately would involve substantial civil works. In these cases, a manifold/valve arrangement to bypass the hot water cylinder would be an acceptable alternative solution. This arrangement would allow the homeowner to use their boiler for space heating without heating the water in the hot water cylinder. The Contractor must explain to the homeowner this new heating arrangement and how to use this system for heating hot water in the summer months e.g. turning off the radiators or using the time/temp programmer. The reasons for implementing this alternative solution as part of the heating control upgrades must be documented in the comments section of the Declaration of Works document.

6.13.8 Thermostatic Radiator Valves (TRVs)

In addition to establishing 2 zones (as described above), the Contractor must also install an additional space heating zone OR install Thermostatic Radiator Valves (TRVs) on at least three radiators but no less than half of all radiators in rooms without room thermostats.

Product Standard and Specification

All TRVs must conform to the appropriate European or Irish standard for Thermostatic Radiator Valves such as I.S. EN 215 "*Thermostatic Radiator Valves - Requirements and Test Methods*".

Installation Standard and Specification

TRVs should be installed in accordance with the manufacturer's guidelines, NSAI's S.R. 54 *Code* of Practice for the Energy Efficient Retrofit of Dwellings and BS 7478 "Guide to selection and use of thermostatic radiator valves". BS 7478 gives guidance on the selection, application and use of thermostatic radiator valves (TRVs) manufactured in accordance with I.S. EN 215 for use in domestic and commercial wet central heating systems. TRVs must not be fitted in rooms with temperature control through a thermostat.

When installing TRVs, the Contractor must ensure that the temperature selector scale and reference point are easily visible to the homeowner and that the TRV is not positioned in an area which may distort the temperature sensor. Avoid locating TRVs behind curtains, in direct sunlight, in very draughty locations or other areas which may distort the temperature sensor. If these conditions are unavoidable, a remote sensor should be used. When inaccessibility of the valve to the user is unavoidable e.g. when the radiator and valve are located behind a decorative grille, valves with combined remote temperature sensors and adjuster should be used.

Most modern TRVs are bi-directional and can be installed in the flow or return direction. Due care should be taken to ensure that the valve is bi-directional – if the valve is not bi-directional, the flow through the valve must correspond to the direction on the arrow of the valve body.

When fitting TRVs to a one-pipe system, i.e. only the boiler is being replaced, units designed for minimum flow resistance should be used.

An Automatic Bypass Circuit must be installed (in fully pumped systems) in homes where there are 3 or more TRVs in place. When most TRVs are open, the automatic bypass remains closed, allowing full circulation around the heating system. When the TRVs close, the automatic bypass opens, allowing an appropriate flow rate through the boiler. The use of an automatic bypass also reduces the noise in the system due to excess water velocity. An automatic bypass circuit must also be fitted if the boiler manufacturer requires one, or if it specifies that a minimum flow rate must be maintained while the boiler is firing. An automatic bypass circuit must then incorporate an automatic bypass valve controlling water flow in accordance with the water pressure across it. The valve is used to maintain a minimum flow rate through the boiler and to limit circulation pressure when some radiators or zones are turned off. This level of control cannot be achieved using a fixed position valve. The valve should be installed between the boiler primary flow and return noting the direction of flow. When an in-built auto-bypass valve is present in a system boiler, it must be checked that this arrangement is sufficient to provide the minimum flow rate required to the boiler when all the TRVs are closed. In some cases, an external bypass circuit is also required.

All systems should be flushed to remove debris before commissioning with all thermostatic sensor heads removed and valves fully open. Thermostatic sensor heads should also be removed during hydraulic balancing of the system to prevent changes in room temperature affecting the balancing procedure.

Once the TRV is correctly set to the desired temperature by the Contractor, it should not normally require further adjustment by the homeowner. The homeowner they should be made aware of how to adjust the temperature setting for future reference.

NOTE The room where the main thermostat is fitted should ***NOT*** have a TRV fitted to the radiator in that location. This would cause inaccuracies in the thermostatic control.

6.14 Heating Controls – Entry Level

General Standards and Specifications

This section outlines the general Standards and Specifications for Contractors, products and installation methods for entry level heating controls.

Contractor Requirements and Competence

Heating controls must be installed by competent persons in accordance with manufacturer's guidelines as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control

measures. If 'Controlled Works', as defined by the CRU document '*Definition of the Scope of Controlled Works*' are required, then these works must be carried out by a Registered Electrical Contractor (REC) and a Completion Certificate must be issued.

Product Standard and Specification

All heating controls products must conform to the appropriate European or Irish standard for that measure. As a minimum, the following Standards should be satisfied:

- I.S. EN 60730-1 Automatic electrical controls for household and similar use. General requirements
- I.S. EN IEC 60730-2-7 Automatic Electrical Controls for Household and similar Use Part 2-7: Particular Requirements for Timers and Time Switches

Installation Standard and Specification

All Heating Controls should be installed in accordance with the manufacturer's specifications. All works should be installed in accordance with

- "*Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L*", DHLGH
- S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings, NSAI
- S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI
- "*Domestic Heating Design Guide", CIBSE*
- GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE
- CE29 Domestic Heating by Oil: Boiler Systems – Guidance for Installers and Specifiers
- CE30 Domestic Heating by Gas: Boiler Systems – Guidance for Installers and Specifiers

All works should be carried out in accordance with I.S. 10101 National Rules for Electrical Installations and I.S. EN 12828 *Heating systems in buildings - Design for water-based heating systems* or equivalent, where applicable. Please refer to Clause 3.2 Electrical Installations: Best Practice for details.

Attention should be given to good housekeeping and safety during installation. The Contractor must fully demonstrate every installed measure to the homeowner and provide a written set of operating instructions. Before leaving the home, the Contractor must ensure that the owner can correctly operate their upgraded heating system.

Entry-level heating controls must include the following items:

6.14.1 Space Heating : Single Zone Control with Room Thermostat
6.14.2 Boiler Heating Controls with Boiler Interlock

This measure is based on the energy efficiency and carbon savings that can be achieved by installing the items above in a home that previously had no heating controls installed. Replacement of existing heating controls equipment cannot be accepted under this measure.

6.14.1 Space Heating : Single Zone Control

This measure controls the heating system in a single zone and incorporates a 24 hour 7-day programmer for time and temperature control and a boiler interlock arrangement to prevent boiler operation when the heat demand drops off. The initial single zone must be for space heating. Further zones to split areas of the dwelling can be added as additional zones (this is classed under the fully integrated heating controls upgrade, see Clause 6.12.2 for details).

Product Standard and Specification

Product Standard and Specification are as detailed in Clause 6.12 for all heating controls.

Installation Standard and Specification

A 24 hour 7-Day Programmer facilitating time and temperature control should be installed in accordance with the manufacturer's guidelines and industry best practice as outlined in Good Practice Guide 302.

Room Thermostat must be in an area where it is not subject to heat gains, direct sunlight or draughts. The thermostat should be in a well-lit, easily accessible position with good air circulation. The chosen position must be representative of average room/zone temperature. Do not install room thermostats in areas such as corners, behind furniture or curtains or in areas where the air flow may pick up extra heat such as close to TVs, computers, wall lights, in a room with a fixed heating appliance or direct sunlight. Installing a room thermostat in an area subject to external draughts such as beside external doors etc. should also be avoided. Best practice recommends that thermostats are situated approx. 1.5 m from the floor. Furthermore, room thermostats should not be installed in any room using a TRV(s) for temperature control.

6.14.2 Boiler Heating Controls

Boiler Interlock is a method of connecting the heating system controls with a boiler. A boiler interlock arrangement must be included as part of this set of controls whereby the boiler will not fire when there is no demand for heat. All unnecessary boiler firing can be eliminated with this control measure. The Contractor should turn all thermostats right down when the boiler is firing to assess whether a boiler interlock arrangement is already in place. If the boiler continues to fire, then there is no interlock. The pump may continue to run if the boiler requires a pump to overrun, this is intentional and does not affect the boiler interlock. On a traditional central heating system with stored hot water, a boiler interlock arrangement can be set up by interconnecting the room thermostats with the boiler. On a combination boiler all that is required to set up a boiler interlock arrangement is a room thermostat.

6.15 Heating Controls with Remote Access – Entry Level

General Standards and Specifications

This section outlines the general Standards and Specifications for Contractors, products and installation methods for entry level heating controls.

Contractor Requirements and Competence

Heating controls with remote access must be installed by competent persons in accordance with manufacturer's guidelines as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor and a Completion Certificate must be issued.

Product Standard and Specification

All heating controls with remote access products must conform to the appropriate European or Irish standard for that measure. As a minimum, the following Standards should be satisfied:

- I.S. EN 60730-1 *Automatic electrical controls for household and similar use. General requirements*
- I.S. EN IEC 60730-2-7 *"Automatic Electrical Controls for Household and similar Use Part 2-7: Particular Requirements for Timers and Time Switches*"

Installation Standard and Specification

All Heating Controls should be installed in accordance with the manufacturer's specifications and Industry Best Practice. All works should be installed in accordance with

- "*Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L*", DHLGH
- S.R. 54 *Code of Practice for the Energy Efficient Retrofit of Dwellings, NSAI*
- S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI
- "*Domestic Heating Design Guide", CIBSE*
- GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE
- CE29 Domestic Heating by Oil: Boiler Systems – Guidance for Installers and Specifiers
- CE30 Domestic Heating by Gas: Boiler Systems – Guidance for Installers and Specifiers

All works should be carried out in accordance with I.S. 10101 National Rules for Electrical Installations and I.S. EN 12828 *Heating systems in buildings - Design for water-based heating systems* or equivalent, where applicable. Please refer to Clause 3.2 Electrical Installations: Best Practice for details.

Heating controls with remote access must be installed only when the homeowner has access to the remote programmer, either through a smart phone app, or through the internet.

Attention should be given to good housekeeping and safety during installation. The Contractor must fully demonstrate every installed measure to the homeowner and provide a written set of operating instructions. Before leaving the home, the Contractor must ensure that the owner can correctly operate their upgraded heating system.

Entry-Level Heating Controls with Remote Access must include the following items:

6.15.1 Space Heating : Single Zone Control with remote access with Room Thermostat

6.15.2 Boiler Heating Controls with boiler interlock

This measure is based on the energy efficiency and carbon savings that can be achieved by installing the items above in a home that previously had no heating controls installed. Replacement of existing heating controls equipment cannot be accepted under this measure.

6.15.1 Space Heating : Single Zone Control with remote access

This measure controls the heating system in a single zone and incorporates a 24 hour 7-day programmer for time and temperature control with remote access and a boiler interlock arrangement to prevent boiler operation when the heat demand drops off. Further zones to split areas of the dwelling can be added as additional zones (this is classed under the fully integrated heating controls upgrade, see Clause 6.13.2 for details).

Product Standard and Specification

Product Standard and Specification are as detailed in Clause 6.12 for all heating controls.

Installation Standard and Specification

A 24 hour 7-Day Programmer with remote access, facilitating time and temperature control should be installed in accordance with the manufacturer's guidelines and industry best practice as outlined in Good Practice Guide 302.

Room Thermostat must be in an area where it is not subject to heat gains, direct sunlight or draughts. The thermostat should be in a well-lit, easily accessible position with good air circulation. The chosen position must be representative of average room/zone temperature. Do not install room thermostats in areas such as corners, behind furniture or curtains or in areas where the air

flow may pick up extra heat such as close to TVs, computers, wall lights, in a room with a fixed heating appliance or direct sunlight. Installing a room thermostat in an area which may be subject to external draughts such as beside external doors etc. should also be avoided. Best practice recommends that thermostats are situated approx. 1.5 m from the floor. Furthermore, room thermostats should not be installed in any room using a TRV(s) for temperature control.

6.15.2 Boiler Heating Controls

Boiler Interlock is a method of connecting the heating system controls with a boiler. A boiler interlock arrangement must be included as part of this set of controls whereby the boiler will not fire when there is no demand for heat. All unnecessary boiler firing can be eliminated with this control measure. The Contractor should turn all thermostats right down when the boiler is firing to assess whether a boiler interlock arrangement is already in place. If the boiler continues to fire, then there is no interlock. The pump may continue to run if the boiler requires a pump to overrun, this is intentional and does not affect the boiler interlock. On a traditional central heating system with stored hot water, a boiler interlock arrangement can be set up by interconnecting the room thermostats with the boiler. On a combination boiler all that is required to set up a boiler interlock arrangement is a room thermostat.

6.16 Stoves : Solid Multi-Fuel Heating System

Contractor Competence

Contractors installing high-performance stoves must be competent to complete the installation and must complete the work in accordance with BS 8303 "*Installation of domestic heating and cooking appliances burning wood and solid mineral fuels. Specification"* and in accordance with CE47 "*Energy Efficiency Best Practice in Housing – Domestic heating by solid fuel: Boiler systems*" published by the Energy Saving Trust.

Where the manufacturer operates an Approved Installer list, the Contractor must demonstrate their inclusion on the list or certification by the manufacturer.

Installers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor and a Completion Certificate must be issued.

Product Standards and Specification

The multi-fuel stove being installed must meet the requirements of I.S. EN 16510-1 *Residential solid fuel burning appliances - General requirements and test methods*.

The multi-fuel stove should achieve a level of performance in the home, as is reasonably practicable, equivalent to the standard required in Part L of the Building Regulations. Guidance on appropriate efficiency for various systems and fuels is contained in DHLGH "*Heating and Domestic Hot Water Systems for Dwellings – Achieving compliance with Part L & Energy Performance of Buildings Regulations*", particularly Table 16. Guidance is also provided in the S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI. The Contractor must discuss the specification and output of the stove with the homeowner before selecting the final system.

The Ecodesign Regulation (EU) 2016/2282 sets standards for the efficiency and emissions of solid fuel space heating appliances. Appliances must meet the minimum efficiency levels set out within the regulation and must not exceed the emission levels standards.

Installation Standards and Specifications

a. Handling and Storage on Site

- The appliance and components shall be handled in a manner such as to prevent damage/breakage. Any manufacturer's instructions on how to handle components must be followed. Care should be taken before, during and after installation to ensure that equipment is not damaged. This is essential with fittings that are vitreous enamelled, plated or fitted with glass
- Any components removed during transit or storage shall be handled so that they can be identified and refitted correctly to the original equipment. This is important where several different appliances are stored together as some parts are individually fitted to each appliance by the manufacturer and are not interchangeable.
- All components shall be stored:
- On a firm level base in the original packaging and in accordance with the manufacturer's instructions.
- On a sheet of polyethylene, pallets or timber to prevent any rising damp affecting them where storage is on a solid floor, components shall be stacked.
- In a safe, dry and frost-free environment.
- The appliance instructions and any operating, stoking and cleaning tools shall be kept safely in store until they can be handed directly to the user on completion of the installation.

b. Installation preparation

- In preparing for the installation of an appliance, the following preparations must be made:
  - site access is available;
  - cooperation between trades is arranged and enough time is allowed for completing each phase of the installation;
  - all accessories and materials for construction are available on site;
  - chases are formed true to size and correctly positioned;
  - the fireplace recess, chimney, lintels and flue-connecting blocks are installed in accordance with the design specification in their true relation to the appliance, and hearth;
  - any ducts or vents required to be formed in builder's work have been laid or constructed;
  - the fitter's and finishing tradesmen's work are coordinated and protection is provided for vulnerable surface finishes, e.g. hearths, floors;
  - the hearth area shall be able to take the weight of the stove.

c. Installation work on site

- The multi-fuel stove should be installed on a solid, level concrete hearth able to bear the weight of the stove.
- The instructions of the appliance manufacturer shall be followed in conjunction with the design specification in accordance with BS 8303 "*Installation of domestic heating and cooking appliances burning wood and solid mineral fuels. Specification*".
- All components must be installed in a way that allows installation, maintenance and repair / replacement. There shall be enough clearance, in accordance with the manufacturer's instructions, between the multi-fuel stove and the adjacent materials to allow for cleaning and maintenance.
- All ventilation requirements must be met (see Clause 4). Gas, oil and solid fuel appliances must be correctly ventilated as per TGD F Ventilation and TGD J Heat Producing Appliances.
- Inaccessible components shall be permanent. Such permanent components shall be maintenance free and have a durability corresponding to the lifetime of the components in which they are installed.

- Components (i.e. flues) shall be placed, fixed and supported so that no harmful deformations occur and so that thermal expansion is possible.
- Where appropriate, existing chimneys should be lined or relined with rigid or flexible flue liners having the appropriate designation and performance level specific to the type of fuel and appliance. Refer to I.S. EN 1856-2 (rigid or flexible metal flue liners) or I.S. EN 1857 (precast concrete flue liners).
- If a supply of electricity is necessary to operate the control equipment or initiate ignition in an appliance, the electrical installation and supply shall be installed in accordance with I.S. 10101 National Rules for Electrical Installations. All Electrical components shall be installed in accordance with I.S. 10101 National Rules for Electrical Installations. Please refer to Clause 3.2 Electrical Installations: Best Practice for details.
- Any soot door required for cleaning the chimney shall be correctly located and fitted. (See BS 8303). Before proceeding with appliance installation, a check shall be made to ensure that the flue is clean, clear of any obstruction, in a sound condition and of adequate size to suit the appliance being installed.
- An inset multi-fuel stove shall be installed using in-fill material behind firebacks and around room heater casings (see BS 8303 Figures 1, 2, 3, 13 and 15).
- If a gas point is required for connecting to an ignition burner or independent gas poker it shall be installed close to the appliance.

  NOTE Attention is drawn to CRU's "*The Regulation of Gas Installers with respect to safety*' and I.S. 813 *Domestic Gas Installations*.
- Following installation of the heating system, all building works etc. shall be made good.

d. Post-Installation

- When installing a multi-fuel stove, a carbon monoxide (CO) alarm in accordance with I.S. EN 50291 should be provided.
- An inspection of the installation should be carried out not less than 48 hours after the appliance is installed to ensure that:
  - All fittings (particularly dampers, flue pipe, flue adaptor and pipes) are fixed in the correct position and that no gaps allowing possible air or water leakage have appeared.
  - Air supply intakes and ducts shall be checked for size and position.
- After installation, the appliance shall not be used for burning builder's rubbish.
- The installation shall be dried out under slow fire conditions preferably for about 2 days using the type and size of fuel recommended in the appliance manufacturer's instructions.
- The installer shall confirm that the fire responds to the operation of the controls and that there is no visible emission of combustion products to the room.
- Where a hearth, fireplace, flue or chimney is provided or extended, a notice plate containing information on the type of heat-producing appliance, which can be safely served by the installed hearth, fireplace, flue or chimney, shall be permanently fixed in a suitable place in the building.
- On completion of installing and commissioning the system, the installer shall hand over the manufacturer's operating instructions to the user to provide full information regarding its safe and effective operation and maintenance.

6.17 Gas Fired Room Heater

Contractor Requirements and Competence

Gas fired room heaters must be installed by competent persons in accordance with manufacturer's guidelines as a minimum. Contractors installing Liquefied Petroleum Gas (LPG) or Natural Gas boilers under this measure must be a Registered Gas Installer (RGI) of Safe Energy Ireland to issue Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3).

It is a legal requirement to be a Registered Gas Installer (RGI) of Safe Energy Ireland in order to undertake domestic Natural Gas or Liquefied Petroleum Gas (LPG) works. High Efficiency Gas Boiler and Heating Controls works must be carried out by a Registered Gas Installer (RGI). RGI details available on www.rgi.ie.

Product Standard and Specification

SEAI home energy upgrade qualifying gas-fired independent space heaters must meet the following conditions:

1. It must meet the conditions specified in Clause 2 of the DHLGH document "*Heating and Domestic Hot Water Systems for dwelling – Achieving Compliance with Part L*".
2. It must be replacing an open fire e.g. the fireplace must not be fitted with an existing gas fire or a low efficiency (in the region of 35 %) decorative gas fire (DGF)
3. It must have a minimum efficiency (gross calorific value) of 65 % awarded by an independent test body or as listed on the HARP database or using a manufacturer's declaration as outlined below.
4. The correct level of permanent ventilation must be installed as per TGD J of the Building Regulations and/or I.S. 813.
5. A carbon monoxide (CO) alarm in accordance with I.S. EN 50291 should be provided.

The manufacturer's declaration of the efficiency (gross calorific value) of the appliance (gross calorific value) should include the following words:

> "*The efficiency of this appliance has been measured as specified in BS 7977-1 'Specification for safety and rational use of energy of domestic gas appliances - Radiant/convectors' and I.S. EN 613 and the result is minimum 65 % gross calorific value. The test data from which it has been calculated has been certified by {insert name and/or identification of Notified Body}. The efficiency value may be used in the Dwelling Energy Assessment Procedure (DEAP) for energy rating of dwellings*."

The design and installation of the recommended works must not compromise the ventilation, indoor air quality (IAQ), humidity (and the potential for condensation) and quality of living environment in the home. Care must be given to the potential impact on the living environment in the home resulting from any measures installed under the home energy upgrade programmes. The Contractor must prevent any detrimental changes to the living environment and recommend to the Homeowner any measures necessary to ensure there is no detrimental change to the living environment because of the works. (See Clause 4 Ventilation).

Installation Standard and Specification

A qualifying gas-fired independent space heater must be installed by a Registered Gas Installer (RGI) and in accordance with TGD J *Heat Producing Appliances* and I.S. 813 *Domestic Gas Installations*. I.S. 813 covers the Code of Practice for the installation of Natural Gas or LPG appliances in domestic premises. The gas-fired appliance must also be installed in accordance with manufacturer's guidelines, the CRU Criteria document 'The Regulation of Gas Installers with respect to safety' and Clause 2 of DHLGH document "*Heating and Domestic Hot Water Systems for dwelling – Achieving Compliance with Part L*". Guidance is further provided in the S.R. 50 Series[31]on Standards for Modern Plumbing and Heating, NSAI.

If the installation involves work to the electrical wiring:

- All wiring must be in accordance with I.S. 10101 National Rules for Electrical Installations Please refer to Clause 3.2 Electrical Installations: Best Practice for details.
- Where required electrical works must be a carried out by a Registered Electrical Contractor (REC)

6.18 Storage Heaters - High Heat Retention

Contractor Requirements and Competence

High heat retention (HHR) electric storage heaters should be installed by a Registered Electrical Contractor (REC) in accordance with manufacturer's guidelines as a minimum.

Registered Electrical Contractors (REC) undertaking Electric Storage Heater upgrade works must be registered with Safe Electric. Details are available at Safe Electric www.safeelectric.ie.

Product Standard and Specification

To qualify as a home energy upgrade measure, the high heat retention electric storage heater must meet the following conditions:

1. It must be replacing an existing electric storage heater.
2. It must be a whole dwelling solution.
3. New or replacement storage heaters should have a heat retention not less than 45 % as measured in accordance with I.S. EN 60531 "*Household Electric Thermal Storage Room Heaters – Methods for Measuring Performance*".
4. Heat retention must be tested by an organisation accredited to test in accordance with I.S. EN 60531 or the testing endorsed by a body accredited to test in accordance with I.S. EN 60531.
5. It must include input and output controls.
6. It also must include a timer and a room thermostat, controllable by the user.

Installation Standard and Specification

A qualifying high heat retention electric storage heater must be sized appropriately for the room in which it is being installed. Suitable design methods for ensuring the heater is sized correctly are as per DOM 8: Guide to the Design of Electric Space Heating Systems published by TEHVA (The Electric Heating and Ventilation Association) or the manufacturer's sizing methodology.

The high heat retention electric storage heater should be installed by a Registered Electrical Contractor (REC) and in accordance with I.S. 10101 National Rules for Electrical Installations. Please refer to Clause 3.2 Electrical Installations: Best Practice for details.

The high heat retention electric storage heater must also be installed in accordance with manufacturer's guidelines, NSAI's S.R. 54 "*Code of Practice for the Energy Efficient Retrofit of Dwellings*", Clause 2 of DHLGH "*Heating and Domestic Hot Water Systems for dwelling – Achieving Compliance with Part* L". Guidance is further provided in the S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI. All ventilation requirements must be met (see Clause 4) as per TGD F Ventilation and TGD J Heat Producing Appliances.

6.19 Heating System : Power Flush

Contractor Requirements and Competence

Contractors undertaking a mechanically assisted powered cleanse and flush (power flushing) of a heating system must be suitably qualified in accordance with manufacturer's guidelines and industry best practice as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds.

Oil Boilers
Contractors undertaking a mechanically assisted powered cleanse and flush (power flushing) of an oil-fired system must meet with requirements and competencies stated above. It is also recommended that the Contractor is registered with a professional organisation, e.g. OFTEC.

Gas Boilers
Contractors undertaking Liquefied Petroleum Gas (LPG) or Natural Gas works under this measure must be a Registered Gas Installer (RGI) of Safe Energy Ireland to issue Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3).

It is a legal requirement to be a Registered Gas Installer (RGI) of Safe Energy Ireland in order to undertake domestic Natural Gas or Liquefied Petroleum Gas (LPG) works. High Efficiency Gas Boiler and Heating Controls works must be carried out by a Registered Gas Installer (RGI). RGI details available on www.rgi.ie.

Product Standard and Specification
Mechanically assisted powered cleanse and flush (power flushing) of the system must be performed as per Section 5.3 of BS 7593. Mains pressure with gravity cleanse and flush (Section 5.4 and 5.5 of BS 7593) is *not* deemed as an acceptable method of flushing a heating system.

As a part of this measure boiler service must be provided where an existing boiler is installed. The boiler service should be to manufacturer's instructions or as per SEAI boiler servicing checklists.

- Gas boiler checklist : www.seai.ie/.../Gas Boiler Service Checklist
- Oil boiler checklist : www.seai.ie/.../Oil Boiler Service Checklist

Installation Standard and Specification
Mechanically assisted powered cleanse and flush (power flushing) of a heating system must be performed in accordance with manufacturer's guidelines, Industry Best Practice and BS 7593 Code of practice for treatment of water in domestic hot water central heating systems where applicable.

The power flushing procedure should include:
- Operation of the unit for at least 10 minutes (circulation mode) with all radiator and system valves open, reversing the flow regularly;
- Disposal of the dirty water by an appropriate method whilst mains water is continually added via the power flushing reservoir tank until the water runs clear;
- Addition of the chosen cleansing chemical to the reservoir of the power flushing machine and circulating to disperse throughout the system;
- Circulating the cleanser through each radiator for at least five minutes in turn by isolating the other radiators and the hot water circuit, reversing the flow regularly;
- **NOTE** Tapping of the radiator with a rubber hammer will help to remove any loose material.
- Cleansing of the hot water circuit for at least five minutes (circulation mode) by isolating the radiators, reversing the flow regularly;
- Flushing of each radiator in turn for at least five minutes by isolating the other radiators and the hot water circuit, and dumping to foul drain until the water runs clear;
- Flushing of the hot water circuit for at least five minutes by isolating the radiators, and dumping to foul drain until the water runs clear;
- Flushing of the system with all radiator and system valves open for at least five minutes and dumping by an appropriate method until water runs clear;
- Continual flushing and appropriate disposal until all the cleanser and debris have been removed. Refer to the manufacturer's instructions.

After this procedure, re-commissioning should be carried out in accordance with BS 7593 C*ode of practice for treatment of water in domestic hot water central heating systems* Clause 5.6 where applicable.

On completion, a suitable inhibitor should then be added to protect the system from future problems. The inhibitor levels should be checked at the system's annual service and topped up if required. It is recommended to check the manufacturer's instructions that the chemical cleaner and inhibitor are suitable for the equipment installed. A label stating the date of application, the type and the amount of inhibitor used shall be fixed in a prominent position on the system.

It is recommended to check the manufacturer's instructions that the chemical cleaner and inhibitor are suitable for the equipment installed. A label stating the date of application, the type and the amount of inhibitor used shall be fixed in a prominent position on the system.

6.20 Heating System : Power Flush and Magnetic Filter

Contractor Requirements and Competence

Contractors undertaking a mechanically assisted powered cleanse and flush (power flushing) and installing a magnetic filtration system to the existing heating system must be suitably qualified in accordance with manufacturer's guidelines and industry best practice as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds.

Oil Boilers

Contractors undertaking a mechanically assisted powered cleanse and flush (power flushing) of a heating system and installing a magnetic filtration system to the existing oil-fired system must meet with requirements and competencies stated above. It is also recommended that the Contractor is registered with a professional organisation, e.g. OFTEC.

Gas Boilers

In addition to the above criterion, Contractors carrying out a mechanically assisted powered cleanse and flush (power flushing) and installing a magnetic filtration system to the existing heating system of a heating system to a Liquefied Petroleum Gas (LPG) or Natural Gas system under this measure must be a Registered Gas Installer (RGI) of Safe Energy Ireland to issue Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3).

It is a legal requirement to be a Registered Gas Installer (RGI) of Safe Energy Ireland in order to undertake domestic Natural Gas or Liquefied Petroleum Gas (LPG) works. High Efficiency Gas Boiler and Heating Controls works must be carried out by a Registered Gas Installer (RGI). RGI details available on www.rgi.ie.

Product Standard and Specification

Mechanically assisted powered cleanse and flush (power flushing) of system must be performed as per Clause 6.19 Heating System : Power Flush.

A boiler service must be provided where an existing boiler is installed. The boiler service should be to manufacturer's instructions or as per SEAI boiler servicing checklists

- Gas boiler checklist : www.seai.ie/.../Gas Boiler Service Checklist
- Oil boiler checklist : www.seai.ie/.../Oil Boiler Service Checklist

A magnetic filter collects very fine particles of magnetite suspended in the water. The installation of a magnetic filtration system to the existing heating system must be as per manufacturer's guidelines, Industry Best Practice and NSAI S.R. 50-1 "*Building services - Code of Practice - Water based heating systems in dwellings"* where applicable.

Installation Standard and Specification

Mechanically assisted powered cleanse and flush (power flushing) of a heating system must be performed as per Clause 6.19 Heating System : Power Flush.

Installation of magnetic filtration system to an existing heating system must be performed in accordance with manufacturer's guidelines, Industry Best Practice and NSAI S.R. 50-1 "*Building services - Code of Practice - Water based heating systems in dwellings"* where applicable.
The heating system must be power flushed before the installation of the magnetic filtration unit.

The magnetic filtration unit should have the following properties:

- The filter should be installed on the return pipework and as close to the boiler as possible. Flexibility of filter orientation during installation is essential to accommodate all existing pipework layouts. The filter must be able to maximise the volume of magnetite collected on first pass with a recommendation that this level achieves more than 90 % of suspended black iron oxide. This figure should increase to virtually 100 % during subsequent passes.

- Recommended minimum capacity for a domestic filter is 130 g of iron oxide sludge for a standard 22 mm (3/4") system and 28 mm (1") over a period of at least 12 months. At capacity, the filter must allow unrestricted flow without loss of pressure.

- Domestic filter magnet strength should achieve a minimum gauss rating of 7,500 with an anticipated lifespan exceeding that of the central heating boiler. The filter should not be prone to blockage, even when full.

6.21 Domestic Hot Water Storage : High Heat Retention Cylinders

A hot water storage tank is a vessel for storing hot water for direct use and/or space heating purposes, including any additives, and that is not equipped with any heat generator, except possibly one or more back-up immersion heaters.

Contractor Competence

Domestic Hot water (DHW) storage that are high-heat retention cylinders must be installed by competent persons in accordance with manufacturer's guidelines as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor (REC) and a Completion Certificate No.3 must be issued.

Product Standards and Specification

All high-heat retention cylinders must comply with the following requirements:

- Hot water storage tanks must be labelled with the EU energy label in accordance with Regulation (EU) 812/2013 on energy labelling for water heaters and hot water storage tanks
- Hot water storage tanks covered by the requirements of Regulation (EU) 814/2013 on Ecodesign requirements for water heaters and hot water storage tanks must be CE marked. The reference number of Regulation EU No 814/2013 must be mentioned in the Declaration of Performance and Conformity (DoPC).

- High heat retention cylinder as per the "Heating and Domestic Hot Water Systems for dwellings – Achieving compliance with Part L" document: (i.e. that the heat loss from the cylinder will not exceed 1.6 X (0.2 + $0.051^{V2/3}$) kWh per 24 hours, where V is the nominal cylinder capacity in litres), or a standing loss from a storage cylinder of less than 0.5 W/l per hour.

- Tested to the relevant standard:
  - Vented copper hot water storage vessels should be in accordance with the heat loss and heat exchanger requirements of I.S. EN 1566 "*Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Chlorinated poly (vinyl chloride) (PVC-C). Specification for pipes, fittings and the system*" (Part 1 and 2)
    Guidance as per BS 3198 "*Specification for copper hot water storage combination units for domestic purposes*"
  - Unvented cylinders need good water pressure and flow. Unvented systems should be in accordance with I.S. EN 12897 "*Water supply. Specification for indirectly heated unvented (closed) storage water heaters"* and have a CE Mark or be certified by Irish Agrément Board; or equivalent
    Guidance as per BS 1566-1 "*Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods"*

Installation Standards and Specifications

a. Install as per manufacturer's guidelines.
b. Hot water storage cylinders having factory-applied thermal insulation shall not be fitted with insulating jackets.
c. The specification details of the installed hot water cylinder must be visible after insulation, or a self-adhesive label shall also be applied to the cylinder at an accessible position stating the name of the cylinder the Standard references (as outlined above) and performance details.
d. All stored water (in the domestic hot water cylinder and any that is recirculated in sections of pipework) must have a legionella protection cycle (aka bacterial contamination disinfection routine) to periodically raise the temperature to at least ≥ 60 °C, and held there for at least one hour, at least once per week. Hot water should be distributed at ≥ 50 °C or higher. Ensure that hot water draw offs have temperature mixing/blending valve(s) to prevent scalding.

Further Guidance

- I.S. EN 14336 "*Heating systems in buildings. Installation and commissioning of water-based heating systems" and the requirements of the system suppliers*'
- I.S. EN 12828 *Heating systems in buildings - Design for water-based heating systems*
- S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI
- Microgeneration Installation: MIS 3004 Requirements for Contractors Undertaking the Supply, Design, Installation, Set to Work, Commissioning and Handover of Solid Biofuel Heating Systems
- TR38 Guide to Good Practice – Installation of Biofuel Heating (Heating and Ventilation Contractors' Association)
- Domestic Heating Design Guide, CIBSE
- Minimising the risk of Legionnaires disease, CIBSE TM13

6.22 Draught-Proofing

Contractor Requirements and Competence

Draught-proofing Contractors must be competent to complete the installation and must complete the work as set out in the guidance document BS 7386 "*Specification for draughtstrips for the draught control of existing doors and windows in housing*".

Draught-proofing shall be installed in accordance with Best Practice Guides/ Technical Guides supplied by the material manufacturer. Where a product is covered by an Irish Agrément Certificate, it must be installed in accordance with this certificate and by suitably qualified persons.

Product Standards and Specification

- **Draught-proofing windows and doors**
  - Materials used for draught-proofing must be carried out using materials with a CE Mark or approved by the Irish Agrément Board (or equivalent) and installed by suitably qualified persons in accordance with these standards.
  - Draught-proofing of windows and doors shall be installed as per manufacturer's instruction and shall be installed as per draught strip class relating to nominal and maximum compression of the strips to adapt and close the gap between the window / door and the frame.
  - The bottom horizontal edge of the door shall be fitted with a draught brush cut to between –1 mm and – 4 mm of the width of the door.
  - Draught-proofing keyhole and letterbox covers can mitigate against thermal bridging and air leakage.
  - Centre Pivot Windows, Sliding Sash Windows and Steel Casement Windows should not be draught-proofed.

- **Attic Access Hatch**
  See Clause 6.4.1 for requirements and installation instructions for attic access hatch draught-proofing.

Installation Standards and Specifications

a. Draught-proofing should be carried out using materials with a CE Mark or approved by the Irish Agrément Board (or equivalent) and installed by suitably qualified persons.

b. Manufacturer's instructions should be followed for all draught-proofing measures.

c. The homeowner should be notified in writing where draught-proofing cannot be installed because of the air supply requirements of appliances present. Draught-proofing shall be omitted where appropriate air supply requirements and permanent openings to the outside air are not present for fuel burning space heating appliances.

d. Draught-proofing shall not be applied to windows and doors in a room with a fixed heating device or gas cooking appliance that doesn't have the correct permanent ventilation provisions.

e. The correct background and extract ventilation provisions do not have to be present for draught-proofing to be considered.

f. Where a portable flue burning appliance is present or used in a dwelling, draught-proofing shall not be applied to windows and doors in the dwelling.

g. Where mould problems are present in a room, the Contractor shall not install draught-proofing in that room. This helps avoid increasing the likelihood of further mould and condensation. The Contractor ***must*** notify the homeowner in writing of the reasoning for omission of the draught-proofing.

h. Care should be taken to ensure that the door or window to be fitted with draught control materials opens and closes easily and is in good working order before any work is carried out. Draught-proofing should not be carried out on faulty doors and windows.

i. Draught-proofing shall not be fitted where security facilities are likely to be impaired as a result. In this case, the Homeowner should be notified in writing why the draught-proofing could not be fitted.

j. Draught strips are designed to seal gaps around windows, doors, and frames. The following are additional guidelines when draught stripping windows and doors:
   i. The seals may be held by metal, plastic or wooden carriers which are fixed onto the frames through pre-drilled fixing holes. Where carrier-based products are used, initial compression of the draught strip is listed in Table 10. The recommended gap sizes given by the manufacturers assume this compression on fitting and consider the need to avoid fixing positions too close to the edge of timber sections.

Table 10 : Draught Strip compression

Draught strip Class	Nominal Compression (mm)	Maximum Compression (mm)
1	3.0	6.0
2	1.5	3.0
3	1.5	3.0

   ii. Draught strips shall be fixed using all available fixing holes. If necessary, additional fixing holes shall be made in line with the existing fixing holes to ensure that the draught strip is fixed at a maximum of 25 mm from each end of the carrier.
   iii. Corners should be butt, mitred or notch cut as appropriate with a maximum gap of 1 mm at the corners to ensure a good seal at the joint.
   iv. All fixings shall be fully driven home perpendicular to the structure being draught-proofed.
   v. Carrier-based draught strip shall be fitted on the two vertical sides and the top horizontal side of doorframes. The draught strip shall be fixed. The carrier must not interfere with the operation of the door handles or locks.
   vi. On all double doors the meeting rail shall be fitted with draught strip.
   vii. Carriers and seals will be cut to length accurately between +0 mm and – 2 mm to fit the size of the door perimeter.
   viii. Internal doors shall not be draught-proofed except between a heated and unheated space for example an inner door to an integral garage.
   ix. If using nails, they should be galvanised rust proof nails.

k. Draught-proofing wooden casement windows:
   i. Wooden casement windows will be draught-proofed using carrier based draught strips that meet with BS 7386 "*Specification for draughtstrips for the draught control of existing doors and windows in housing (including test methods*)". The carrier should be selected to suit the width of the window frame.
   ii. Carrier-based draught strip shall be fitted to all sides of the opening window frame with 'L' section or box section carrier, dependent upon the shape and size of the frame.
   iii. Initial compression will be 1.5 mm with the carriers and seals cut to form a continuous seal around the perimeter of the window. Compression must be achieved for 100 % of the perimeter.
   iv. In areas where the carrier based draught strip interferes with the operation of window furniture, draughtproofing shall be omitted. If this is the case, the homeowner should be notified in writing why the draught-proofing could not be fitted.
   v. Carrier based draught strip shall not be used in sections shorter than 75 mm.

l. Installation of door bottom brushes:
   i. Inward and outward opening doors shall be fitted with the draught brush on inside and outside respectively.
   ii. Outward opening doors or frames with a weatherboard, which do not allow draught brushes to be fixed, shall be fitted with an internal draught brush or rebate seal where possible.

iii. The seal will have an angle section or a straight section carrier with a nylon brush.
iv. The seal shall be fixed with 20 mm stainless steel screws using all fixing holes.
v. An additional screw must be fitted with 35 mm of the end of the carrier.
vi. The seal will be fitted to give visible compression or deflection over 90 % of the length of the seal.
vii. The seal should be fitted so that it does not interfere with the opening of the door.
viii. Draught brushes shall be fitted with a minimum of three fixings and there shall be a fixing no more than 35mm from each end of the draught brush.
ix. When fitted to items such as hollow core doors, the two end fixings must engage into the solid frame at the edge of the door being draught-proofed.
x. Inner and outer carriers will be crimped, and all sharp edges and burrs removed.

m. Installation of letterbox draught seal

i. The draught seal shall be fixed to the inside of the letterbox. Refer to I.S. EN 13724.
ii. The fitted draught seal shall not interfere with the movement of letter post through the letterbox or with the letterbox flap.
iii. Draught seal fixings shall be as supplied and/or recommended by the draught seal manufacturer.

6.23 Chimney Draught Limiter

A chimney draft limiter (also known as a barometric damper or draft regulator) controls draft and air pressure in oil boilers, stoves, or furnaces by fitting into their flue pipes.

Contractor Requirements and Competence

Contractors installing a Chimney Draught Limiter must be suitably qualified in accordance with manufacturer's guidelines, as a minimum.

Product Standard and Specification

The Chimney Draught Limiter is installed in accordance with BS 1251 '*Specification for open-fireplace components*'.

A permanent mechanically fixed chimney draught limiter alters the geometry of the chimney therefore altering the ventilation rate as per the DEAP methodology.

Temporary draught limiting devices, removed when a fire is lit, are not eligible under this measure. A temporary draft limiter is wholly reliant on its reinstatement whenever a fire is not lit, and they do not alter the geometry of a chimney within the DEAP methodology.

NOTE Chimney flue lining or relining within an existing chimney structure *may* be required for safety while preserving external appearance. Refer to I.S. EN 1856-2 (rigid or flexible metal flue liners) or I.S. EN 1857 (precast concrete flue liners).

The design and installation of the recommended works must not compromise the ventilation, indoor air quality (IAQ), humidity (and the potential for condensation) and quality of living environment in the home. Care must be given to the potential impact on the living environment in the home resulting from any measures installed under the Programmes. The Contractor must prevent any detrimental changes to the living environment and recommend to the Homeowner any measures necessary to ensure there is no detrimental change to the living environment because of the works. (See Clause 4 Ventilation).

Installation Standard and Specification

a. The draught generated in a chimney may be calculated according to I.S. EN 13384-1.
b. Chimney inspection is conducted, prior to works commencing, to assess the full length of the flue, identify damage, blockages, and check for compliance with current standards. Refer to Clause 4.
c. The Installation of chimney draft limiter shall be installed to manufacturer's recommendations.
d. The chimney draft limiter is installed in accordance with the design specification to suit the fuel to be used, the type of appliance and the operating conditions to match the designation of the chimney.
e. The instructions of the appliance manufacturer shall be followed in conjunction with the design specification in accordance with BS 1251 '*Specification for open-fireplace components*'.
f. All components must be installed in a way that allows installation, maintenance and repair / replacement. There shall be enough clearance, in accordance with the manufacturer's instructions, between the chimney draft limiter and the adjacent materials to allow for cleaning and maintenance.
g. Components shall be placed, fixed and supported so that no harmful deformations occur and so that thermal expansion is possible.
h. On completion of installing and commissioning the system, the installer shall hand over the manufacturer's operating instructions to the user to provide full information regarding the operation and maintenance of the appliance.

6.24 Door Replacement

A doorset is a whole door system which will include (but not exclusively) door leaf, door frame, glazing, seals and intumescents, hinges, door furniture, finish, signage and door closer mechanism, as defined by I.S. EN 12519. The term 'door' is used as shorthand for a 'doorset'.

Contractor Competence

Contractors installing external doors must be competent to complete the installation and must complete the work in accordance with BS 8213-4 "*Code of practice for the survey and installation of windows and external doorsets"* and the manufacturer's guidelines as a minimum requirement.

Product Standards and Specification

- All external doorsets being installed must meet the requirements of the Construction Products Regulation (EU) No 2024/3110.

- All doorsets installed must carry CE Marking and must conform to the requirements of I.S. EN 14351-1 "*Windows and doors - Product standard, performance characteristics - Windows and external pedestrian doorsets"*.

- Doorsets should demonstrate the minimum security performance requirements in accordance with I.S. EN 14351-1 (refer to I.S. EN 1627), and further guidance is provided in PAS 24 "*Enhanced security performance requirements for doorsets and windows in the UK. Doorsets and windows intended to offer a level of security suitable for dwellings and other buildings exposed to comparable risk*".

- Letter box and letter plate aperture, security, and design are in conformance with I.S. EN 13724.

Replacement doors should achieve a target maximum U-value of 1.4 W/m^{2}K, or a lower U-value. The stated U-value of the doorsets must be certified by an appropriate independent body.

Guidance

- U-value Calculation
  - I.S. EN ISO 12567 Thermal performance of windows and doors - Determination of thermal transmittance by the hot-box method
  - I.S. EN ISO 10077 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance (Parts 1 and 2 respectively)

Installation Standards and Specifications – Door Replacement

a. All doorsets should conform to I.S. EN 14351-1 and follow the glazing recommendations given in TGD M and the relevant part of BS 6262 Glazing for buildings Code of practice for safety related to human impact. Workmanship shall be in accordance with TGD D and BS 8000-0.

b. Replacement doors are installed according to the manufacturer's instructions, survey / data sheets, aperture size, fixing methods, and the approved fixings match width/type per the door's technical file. The overall aesthetic of the doorset aligns with the design specifications, colour and style.

c. All doorset component surfaces should be free from visible damage such as scratches, dents, or other imperfections, before installation begins. Finishing trims should be compatible with the material of the frame and external trims should be suitable for exterior use.

d. BS 8213-4 "Code of practice for the survey and installation of windows and external doorsets" recommends that a risk assessment is conducted by the designer of the domestic replacement door.

A survey will ascertain the condition of the structural opening into which the door will be installed, the suitability of the door, and any other issues affecting the installation of the door. Thoroughly inspect the surrounding walls and framework to identify any issues such as water infiltration, rot, cracks, or pest damage.

Any structural defects recorded in the survey, which may affect the performance of the door when installed, should be notified to, and rectified by, the homeowner with or without involving the Contractor before installation work commences.

e. When replacing the principal entrance door the maximum width should be retained. The door should be installed in the same manner as the original door was fitted and ensure drainage holes in the external face of the threshold are not blocked.

- **Sill**: When the existing door is removed, confirm the type of sill detail fitted, this will either be a conventional sill or an accessible (low) threshold sill ensuring that the threshold height of the replacement door does not exceed the height of the existing threshold.

  If a conventional sill is fitted, the DPC and vertical DPC should be inspected for damage and if necessary repaired or replaced prior to the installation of the replacement door. Check if aluminium sills require expansion gap at the oversill and reveal, insulation applied under the oversill to reduce thermal bridging.

- **Threshold**: Where a door with accessible (low) threshold is removed, the original method of installation needs to be determined (e.g. directly onto a concrete sill with a DPC wrapped between the threshold and sill, on a timber sill fitted below finished floor level etc.) and the water tightness of the system confirmed. Ensure surface water is directed away from the door to a suitable drainage channel or water run-off, refer to TGD M Access and Use.

f. The presence of any electrical or specialist items such as television aerials, telephone wires, fibre optic cable, in the aperture should be noted. Wherever possible such services should be routed around, and not through, the outer frame of the door.

g. Full-frame (brick-to-brick) door installation requires careful removal of the entire existing door, including frame and trim, right back to the wall framing to expose the original wall opening. The sequence of removal of the doors should ensure that unnecessary damage does not occur to reveals, plaster, finishes and trims and structural stability is not impaired.

As the exposed opening size may not be the desired final dimension additional blocking is added to frame it out to the correct dimension.

h. Doors must be level and plumb and securely fixed to their frame. Manufacturer's instructions should be followed for fixings. Fixings should be suitable for application and be corrosion resistant.

Proper anchorage placement, including shimming and levelling, ensures the structural elements are properly placed and installed and limit deflections and twisting motions that could negatively affect critical seals.

i. Care should be taken during the installation to ensure the continuity of insulation and airtightness at the junction between door, existing wall and external wall insulation. Replacement doors should be fitted prior to installation of external wall insulation, wherever possible.

   To reduce thermal bridging at threshold level the floor insulation should be continuous with any wall insulation on the underside of the threshold or sill.

j. The provision of a weather and airtight seal around the perimeter of doors in a façade is typically achieved by correctly specifying and installing a suitable membrane. Perimeter airtight tape and seals are applied around the door frame, vertically to the DPC or cavity closer, and horizontally across the head of the door to form a consistent air seal between the door and the wall. Sealant is applied evenly for an airtight, watertight result. Materials used should accommodate thermal expansion/contraction and changes in humidity.

k. Draught-proofing between the frame and the door, keyhole and letterbox and letterbox plates and potential air-leakage points can mitigate against thermal bridging and air leakage. Expanding polyurethane (PU) foam will not be sufficient to achieve adequate airtightness.

l. On completion of the installation all relevant checks and repairs are completed i.e.
   - The condition of the exterior of the wall should be assessed. Surfaces should be sound, clean and free from any loose material. Render finishes should be in good condition.
   - Debris or contaminants should be removed, and any drainage paths should be cleared.
   - Internal reveals should be made good, as agreed with the Homeowner.
   - Where there may be mastic and/or paint line visible on the substrate then this should be removed as much as practicable or covered with a trim.
   - Any materials such as trims or sealant should not be applied on top of loose material.
   - Protective tapes should be removed to prevent future degradation of tapes and difficult removal. Refer to the manufacturer's guidance.
   - Gaps are sealed according to manufacturer instructions. Mortar (sand cement) is only suitable for backfilling in steel door frames and usually limited to doors in stone surrounds or interior fair-faced brick and concrete.

m. After installation, a final inspection should be carried out, preferably accompanied by the homeowner, to ensure that the installation is in accordance with the surveyor's and manufacturer's instructions. Each door is opened and closed to check for smooth operation and absence of obstructions. All locks / latches should function smoothly and securely.

n. The homeowner should be provided with instructions for the operation, maintenance and adjustment of locks and hinges, and where replacement parts can be obtained. The homeowner is made aware of fire egress, as per TGD B Fire Safety.

   The homeowner shall be supplied with a written specification of the external doors detailing the U-value of the unit(s). The homeowner shall be advised that this documentation should be retained as an inspection of the installation may be required.

o. All relevant records such as the project specific design and specification, site survey sheets, installation check sheets and relevant photographic evidence must be maintained by the Contractor and made available for inspection by SEAI, if requested.

6.25 Window Replacement

Windows are a building component for closing an opening in a wall, or pitched roof, designed to provide light, ventilation, or visibility to a building. Windows are made up of two components, the frame (head, sill and jamb) and the glazing that sits inside in the frame.

Contractor Competence

Contractors installing windows must be a competent person and must complete the work in accordance with BS 8213-4 "*Code of practice for the survey and installation of windows and external doorsets"* and the manufacturer's guidelines as a minimum requirement.

Product Standards and Specification

All window units and glazing being installed must meet the requirements of the Construction Products Regulation (EU) No 2024/3110.

All window units being installed must carry CE Marking, refer to Clause 2.3, and must conform to the requirements of the following standard:

- I.S. EN 14351-1 "*Windows and doors - Product standard, performance characteristics - Windows and external pedestrian doorsets"*

Guidance

- U-value Calculation
  - I.S. EN ISO 12567 Thermal performance of windows and doors - Determination of thermal transmittance by the hot-box method
  - I.S. EN ISO 10077 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance (Parts 1 and 2 respectively)

- Insulating glass units (IGU) must meet the durability requirements of I.S. EN 14351-1
  - I.S. EN 1279-1 "Glass in Building - Insulating glass units - Generalities, system description, rules for substitution, tolerances and visual quality"
  - I.S. EN 1279-2 "Glass in building - Insulating glass units Part 2: Long term test method and requirements for moisture penetration"

- CIBSE TM37 Design for improved solar shading control.

Replacement windows should achieve a target maximum U-value of 1.4 W/m^{2}K, or a lower U-value. The stated U_w-value of the whole window unit, includes frame and glazing, should be certified by an appropriate independent body, e.g.

- WEP (Window Energy Performance) Scheme, NSAI
- WER (Window Energy Rating A++ to E), BRFC (British Fenestration Rating Council)

NOTE When installing windows consideration must be given to local planning permissions relating to the design and aesthetics and possible impact on neighbouring properties (see Clause 2.2).

It is the responsibility of the contractor / installer to consider whether the works being undertaken would be considered "Major Renovation" as defined by the Building Regulations.

Replacement of windows will require compliance with "**Major Renovation**" section of **Part L of the Building Regulations**, where more than 25 % of the surface of the building envelope undergoes renovation.

Installation Standards and Specifications – Window Replacement

a. All window units should conform to I.S. EN 14351-1 and follow the glazing recommendations given in BS 6262-4 Glazing for buildings Code of practice for safety related to human impact. Workmanship shall be in accordance with TGD D and BS 8000-0.

b. Building Regulations apply to replacement window installation to ensure safety, structural integrity, and energy efficiency. Major renovation requirement can be activated by works to a combination of elements such as external walls renovation and window replacement, as per TGD L.

c. Replacement windows are installed according to the manufacturer's instructions, survey / data sheets, aperture size, fixing methods, and the approved fixings match width/type per the window's technical file. The overall aesthetic of the window aligns with the design specifications, colour and style.

d. All window component surfaces should be free from visible damage such as scratches, dents, or other imperfections, before installation begins. Finishing trims should be compatible with the material of the frame and external trims should be suitable for exterior use.

e. BS 8213-4 "Code of practice for the survey and installation of windows and external doorsets" recommends that a risk assessment is conducted by the designer of the domestic replacement window.

   The walls must be surveyed by a competent surveyor on behalf of the approved Contractor before the installation. A survey will ascertain the condition of the structural opening into which the window will be installed, the suitability of the window, and any other issues affecting the installation of the window.

   Thoroughly inspect the surrounding walls and finishes, existing windows and framework to identify any issues such as hidden rot, warped frames, moisture, gaps and cracks, pest damage, insulation issues and structural issues that need to be addressed. Check for mortar weaker than bricks and subsidence / foundation movement.

   Any structural defects recorded in the survey, which may affect the performance of the window when installed, should be notified to, and rectified by, the homeowner with or without involving the Contractor before installation work commences.

f. Windows are a common location of water infiltration issues. Care must be taken to properly diagnose the water infiltration pathway. The infiltration problem must be addressed prior to, or in conjunction with, the window replacement retrofit work.

   Drainage features such as sloped window sills and weep holes are present to prevent moisture buildup as water will drain downward by gravity either into the wall (e.g. hole through sill) or directly onto the wall (failure of the sill extension). The condition of the window sill should be assessed and cracked or rotting sills need to be replaced before any work is done.

g. Replacement windows in habitable rooms should not have the window opening sections reduced or altered to an extent that it reduces their potential for escape or rescue. Replacement windows in bedrooms should meet, in as far as is practicable, the provisions outlined in TGD B Fire Safety Clause 1.3.7.1 (a) to (e) as per TGD B Clause 1.3.7.2.

h. It is recommended that replacement windows should not open over footpaths or any place to which the public has access, where they could form a hazard or obstruction, refer to S.R. 54 Clause 8.3.1.

i. Daylighting is the term used when natural light is used to illuminate a building. Consideration should be given to daylight provision, sunlight access, view quality and glare control. The area of openings should not be reduced below that required for the provision of adequate daylight as per I.S. EN 17037. BRE Site layout planning for daylight and sunlight BR209 gives advice on site layout planning to achieve good sunlighting and daylighting.

j. Window characteristics (such as façade glazing orientation, overshading, type of glazing, gap, and frame material) are identified during site survey. Window designs must limit internal overheating by ensuring adequate ventilation strategies to remove excess heat and limit solar gain[35] e.g., through window size, solar shading products and external shading e.g. overhangs.

   Windows, particularly on south and west-facing façades, should be designed to minimize solar heat gain to prevent overheating[14]. "Design for improved solar shading control" under CIBSE TM37 provides recommendations and guidance to reduce or avoid solar overheating.

k. Ventilation must be provided by natural and / or mechanical methods, see Clause 4. In a room where there is already a wall ventilator present which meets the minimum equivalent areas, as per TGD F Ventilation, then no further background ventilation needs to be added. Where an open-flued appliance is in a room, there should be permanently open air vents to supply the air for combustion, refer to Clause 4.4.5.

   Background ventilation is generally located in a wall (sleeved wall ventilator) or window (trickle vent) incorporating a controllable ventilation grill which can be fully closed is an effective way to introduce ventilation into a dwelling , refer to Clause 4.4.1. Controllable trickle vents integrated into windows should be appropriately sealed around the frame using a proprietary sealant, as recommended by the window manufacturer. Replacement windows with trickle vents are not suitable when MVHR is installed.

   Consideration should be given to the sizes of window opening sections for purge ventilation, refer to Clause 4.4.6. In a room, such as a wet room, with no openable window, an intermittent extract fan should be provided with controls which continue to operate the fan for at least 15 minutes after the room is vacated.

l. Care should be taken to ensure that adequate provision is made to support the weight of the replacement window (TGD A Structure). Structural integrity of the load bearing window frame should be assessed. There should be adequate lintel supporting the wall above the windows. Seek the advice of a structural engineer, if required.

m. The walls, floors or beams that may be affected by the window replacement must be adequately supported prior to removing the windows. Proper anchorage placement, including shimming and levelling, ensures the structural elements are properly placed and installed and limit deflections and twisting motions that could negatively affect critical seals. Care should be taken to protect internal ceiling and floor finishes at support bearing points.

[35] Shading for Housing : Design guide for a changing climate_www.Good Homes Alliance.co.uk

n. The presence of any electrical or specialist items such as television aerials, telephone wires, fibre optic cable, in the aperture should be noted. Wherever possible such services should be routed around, and not through, the outer frame of the window.

o. Full-frame (brick-to-brick) window installation requires careful removal of the entire existing window, including frame and trim, right back to the wall framing to expose the original wall opening. The sequence of removal of the windows should ensure that unnecessary damage does not occur to reveals, plaster, finishes and trims and structural stability is not impaired.

p. Laser measurement tools ensure accurate measurements where walls, sills, and frames vary slightly and to accommodate irregular wall structures. Window opening is measured at the head (top horizontal section of the frame), sill (bottom horizontal section of the frame), and jamb (vertical sides of the window frame). As the exposed opening size may not be the desired final dimension additional blocking is added to frame it out to the correct dimension.

q. Once the existing window is removed the Damp Proof Coarse (DPC) and/or cavity closer should be inspected to ensure it is complete and undamaged to prevent moisture penetration from the external skin of the wall to the inner skin of the wall.

r. Care should be taken during the installation to ensure the continuity of insulation and airtightness at the junction between window, existing wall and external wall insulation (EWI). Generally, replacement windows will be slotted into insulated cavity closers which sit within the cavity wall to prevent the cold and damp from entering the dwelling.

   Replacement windows should be fitted prior to installation of external wall insulation, wherever possible. Where windows sit outside the internal wall insulation, it is necessary to insulate the reveals to prevent cold bridging through the external wall at the head and base of the window.

s. A typical window installation has void spaces between the interface of the window frame and the rough opening or sashes. The gaps are also common areas of uncontrolled air leakage through a window frame e.g. void below window sill due to frame geometry and void created by weight pockets at window jambs by sash counterweights. When replacing sash with casement windows, redundant sash boxes and frames should be removed or insulated to prevent thermal bypass. Expanding polyurethane (PU) foam will not be sufficient to achieve adequate airtightness.

t. The provision of a weather and airtight seal around the perimeter of windows in a façade is typically achieved by correctly specifying and installing a suitable membrane. Perimeter airtight tape and seals are applied around the window frame, across the sill, vertically to the DPC or cavity closer, and horizontally across the head of the window to form a consistent air seal between the window and the wall. Sealant is applied evenly for an airtight, watertight result. At the jamb sealants are used between the wall siding and the window trim to limit the potential for water infiltration. Materials used should accommodate thermal expansion/contraction and changes in humidity.

u. The seal between the window unit and the opening should not interfere with drainage particularly at the window sill where the pan flashing must be able to drain to the exterior.

v. Manufacturer's instructions should be followed for fixings. Fixings should be suitable for application and be corrosion resistant.

w. On completion of the installation all relevant checks and repairs are completed i.e.
   - The condition of the exterior of the wall should be assessed. Surfaces should be sound, clean and free from any loose material. Render finishes should be in good condition.
   - Debris or contaminants should be removed, and any drainage paths should be cleared.
   - Internal reveals should be made good, as agreed with the Homeowner.
   - Where there may be mastic and/or paint line visible on the substrate then this should be removed as much as practicable or covered with a trim.
   - Any materials such as trims or sealant should not be applied on top of loose material.
   - Protective tapes should be removed to prevent future degradation of tapes and difficult removal. Refer to the manufacturer's guidance.
   - Gaps are sealed according to manufacturer instructions.

x. After installation, a final inspection should be carried out, preferably accompanied by the homeowner, to ensure that the installation is in accordance with the surveyor's and manufacturer's instructions. Each window is opened and closed to check for smooth operation and absence of obstructions. All locks / latches should function smoothly and securely.

y. The homeowner should be provided with instructions concerning operation, maintenance and adjustment of locks and hinges, and where replacement parts can be obtained. The homeowner is made aware of fire egress, as per TGD B Fire Safety.

   The homeowner shall be supplied with a written specification of the windows detailing the U-value of the unit(s). The homeowner shall be advised that this documentation should be retained as an inspection of the installation may be required.

z. All relevant records such as the project specific design and specification, site survey sheets, installation check sheets and relevant photographic evidence must be maintained by the Contractor and made available for inspection by SEAI, if requested.

Further Guidance

- TGD B (Volume 2) Fire Safety Clause 1.3.7.1 (a) to (e) and TGD B Clause 1.3.7.2
- TGD C Site Preparation and Resistance to Moisture
- TGD D Clause 1.5 Glazing
- TGD F Ventilation Clause 1.2.4.5
- TGD K Clauses 2.2 to 2.9 includes provisions relating to accidental falls through (TGD K Clause 2.4) and falls out (TGD K Clause 2.7) of opening sections of windows.
- TGD L Clause 0.2.2 Fire Safety
- BS 6262-4 Glazing for buildings - Code of Practice for safety related to human impact
- S.R. 54 Clause 8.3.2.6 and 8.3.6.3.2.

6.26 Window Secondary Glazing

Secondary glazing is where a pane of glass or transparent material is fitted on the inside face of an existing window for improved thermal performance. Installing secondary glazing internally will preserve the outer appearance and is particularly relevant to sash windows.

Contractor Competence

Contractors installing window glazing envelopes must be competent to complete the installation and must complete the work in accordance with BS 8213-4 "*Code of practice for the survey and installation of windows and external doorsets"* and the manufacturer's guidelines as a minimum requirement.

Contractors installing glazing within existing frames must be competent to complete the installation and must complete the workmanship in accordance with TGD D and BS 8000-0 "*Workmanship on construction sites. Introduction and general principles"*.

Product Standards and Specification

Secondary glazing must meet the requirements of the Construction Products Regulation (EU) No 2024/3110 and be CE Marked. All secondary glazing being installed must carry CE Marking and must conform to the requirements of the following standard:

- I.S. EN 14351-1 "*Windows and doors - Product standard, performance characteristics - Windows and external pedestrian doorsets"*

Secondary glazing for windows should achieve a target maximum U-value of 2.1 W/m^{2}K, or lower.

Guidance

- U-value Calculation
  - I.S. EN ISO 12567 Thermal performance of windows and doors - Determination of thermal transmittance by the hot-box method; or
  - I.S. EN ISO 10077 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance (Parts 1 and 2 respectively).

  Other
  - I.S. EN 410 "Glass in Building - Determination of Luminous and Solar Characteristics of Glazing"
  - I.S. EN 673 "Glass in Building - Determination of Thermal Transmittance (U Value) - Calculation Method
  - I.S. EN 12898 "Glass in building - Determination of the emissivity".

- BS 6262 Glazing for buildings Code of practice for safety related to human impact, refer to TGD M

Installation Standards and Specifications

a. Secondary glazing should conform to I.S. EN 14351-1 and follow the glazing recommendations given in the relevant part of BS 6262. Workmanship shall be in accordance with TGD D and BS 8000-0.

b. In all cases the manufacturer's instructions should be followed. Insulating glass units, setting and location blocks (see Figure 5 of BS 8213-4), distance pieces, frame to glass and bead to glass gaskets, bead to frame air seals, corner sealing blocks, beads and bead end caps, bedding and capping sealants should be installed in accordance with TGD D and BS 8000-0.

c. The walls must be surveyed by a competent surveyor on behalf of the approved Contractor before the installation. A complete survey will ascertain the condition of the structural opening into which the glazing will be installed, the suitability of the glazing and any other issues affecting the installation of the glazing. Thoroughly inspect the surrounding walls and framework to identify any issues such as rot, cracks, or pest damage.

d. Where escape is required from existing windows the secondary glazing should not impede egress. Refer to S.R. 54 Clause 8.3.4.4.2.

e. All ventilation requirements must be met (see Clause 4). Existing levels of background ventilation should be maintained. Where purge ventilation is required from existing windows the secondary glazing should maintain this ventilation. Where trickle vents are removed background room ventilation should be provided or increased.

f. The addition of secondary glazing to the original window creates a potential for the formation of condensation between the two glazing elements. The placement of the interior or exterior of the window creates an insulating air pocket, resulting in the outer glazing element to be at a lower temperature at wintertime conditions. This increases the chance of condensation forming, if interior moisture laden air can infiltrate the space. It is important that the inner glazing element be as airtight as possible to reduce air infiltration into the void space.

g. Any structural defects recorded in the survey, which may affect the performance of the glazing when installed, should be notified to, and rectified by, the homeowner with or without involving the Contractor before installation work commences.

h. The existing glazing must be removed with care to avoid unnecessary damage to the building structure and its finishing and without permitting any subsidence of the superstructure during or after the installation procedure. Reasonable care should be taken to keep damage to the reveals to a minimum.

i. Finishing trims should be compatible with the material of the frame and external trims should be suitable for exterior use.

j. Daylighting is the term used when natural light is used to illuminate a building. The area of openings should not be reduced below that required for the provision of adequate daylight as per I.S. EN 17037. BRE Site layout planning for daylight and sunlight BR209 gives advice on site layout planning to achieve good sunlighting and daylighting.

k. The replacement glazing should be positioned to minimise the amount of making good and without any twist, racking or distortion of the frame.

l. Care should be taken to maintain the integrity if the DPM/radon barrier and adequate purchase for fixings should be ensured.

m. Upon completion of the installation all relevant checks and repairs are completed i.e.
   - The condition of the exterior of the wall should be assessed. Surfaces should be sound, clean and free from any loose material. Render finishes should be in good condition.
   - Debris or contaminants should be removed, and any drainage paths should be cleared.
   - Internal reveals should be made good, as agreed with the Homeowner.
   - Where there may be mastic and/or paint line visible on the substrate then this should be removed as much as practicable or covered with a trim.
   - Any materials such as trims or sealant should not be applied on top of loose material.
   - Protective tapes should be removed to prevent future degradation of tapes and difficult removal. Refer to the manufacturer's guidance.
   - Gaps are sealed according to manufacturer instructions.

n. After installation, a final inspection should be carried out, preferably accompanied by the homeowner, to ensure that the installation is in accordance with the surveyor's and manufacturer's instructions.

o. The homeowner should be provided with instructions concerning operation, maintenance and adjustment of locks and hinges, and where replacement parts can be obtained. The homeowner is made aware of fire egress, as per TGD B Fire Safety.

   The homeowner shall be supplied with a written specification of the secondary glazing detailing the U-value of the unit(s). The homeowner shall be advised that this documentation should be retained as an inspection of the installation may be required.

p. All relevant records such as the project specific design and specification, site survey sheets, installation check sheets and relevant photographic evidence must be maintained by the Contractor and made available for inspection by SEAI, if requested.

6.27 Window Glazing : Low-emissivity (Low-E)

Low-emissivity (low-e) window glazing has a microscopic heat reflective coating on the outer-face of the inner pane of glass.

Contractor Competence

Contractors installing low-e glass windows must be competent to complete the installation and must complete the work in accordance with the manufacturer's guidelines.

Workmanship shall be in accordance with TGD D and BS 8000-0.

Product Standards and Specification

The installed product must meet the requirements of the Construction Products Regulation (EU) No 2024/3110 and be CE marked.

Window glazing low e-film should achieve a target maximum U-value of 2.4 W/m^{2}K for double glazing envelope and a target maximum U-value of 3.5 W/m^{2}K for single glazing envelope.

All U-values of the glazing envelopes can be calculated according to:-

- I.S. EN 410 "Glass in Building - Determination of Luminous and Solar Characteristics of Glazing"
- I.S. EN 673 "Glass in Building - Determination of Thermal Transmittance (U-value) - Calculation Method" and I.S. EN 12898 "Glass in building - Determination of the emissivity".

Installation Standards and Specifications

a. All low-e glass window installations should conform to the recommendations given in the manufacturer's instructions. Workmanship shall be in accordance with TGD D and BS 8000-0.

b. A complete survey will ascertain the condition of the windows into which the low-e glass window will be installed, the suitability of the low-e glazing and any other issues affecting the installation of the glazing. Thoroughly inspect the surrounding walls and framework to identify any issues such as rot, cracks, or pest damage.

c. All ventilation requirements must be met (see Clause 4).

d. Any structural defects recorded in the survey, which may affect the performance of the low-e glass window when installed, should be notified to, and rectified by, the Homeowner with or without involving the Contractor before installation work commences.

e. Daylighting is the term used when natural light is used to illuminate a building. The area of openings should not be reduced below that required for the provision of adequate daylight as per I.S. EN 17037 'Daylight in Buildings'. BRE Site layout planning for daylight and sunlight BR209 gives advice on site layout planning to achieve good sunlighting and daylighting.

f. The area around the window must be made good upon completion of the low-e glass window installation. This may involve some or all of the following checks to the installation:
   - Debris or contaminants should be removed, and any drainage paths should be cleared.
   - The low-e glass window should be free from scratches and signs of failure
   - All obscure and coated glasses shall be oriented properly
   - Safety glass shall be installed where necessary, refer to BS 6262-4

- The method of, and responsibility for, repair to any render should be as agreed with the Homeowner.

g. After installation, a final inspection should be carried out, preferably accompanied by the homeowner, to ensure that the installation is fully in accordance with the surveyor's and manufacturer's instructions.

h. It is essential that the homeowner is made aware of the method(s) of operation and maintenance of the low-e glass window. This should be accompanied by written operating and maintenance instructions.

i. The homeowner shall be supplied with a written specification of the low-e glass window detailing the U-Value of the units to I.S. EN 410 "*Glass in Building - Determination of Luminous and Solar Characteristics of Glazing*" and I.S. EN 673 "*Glass in Building - Determination of Thermal Transmittance (U Value) - Calculation Method*".

j. The homeowner shall be advised that this material should be retained as an inspection of the installation may be required. The specification of the units shall be retained by the installer for audit purposes.

6.28 Lighting - LED

Lighting, both artificial and natural, is a key factor in indoor environmental quality (IEQ). Daylighting provision is outlined in I.S. EN 17037.

Contractor Requirements and Competence
Contractors installing LED luminaires and LED lamps must be competent to complete the installation.

Standard and Specification
LED luminaires and LED lamps must be CE Marked, compliant with Ecodesign Regulation (EU) 2019/2020 requirements for light sources and separate control gears and EU energy labelling requirements.

LED luminaires and LED lamps are installed in accordance with I.S. EN IEC 60598-1 Luminaires: General requirements and tests which specifies general safety requirements for luminaires.

LED luminaires:
- I.S. EN 13032-1 and I.S. EN 13032-2 "*Light and lighting – Measurement and presentation of photometric data of lamps and Luminaires*"
  or
- ANSI / IES LM-79-24 *Optical and Electrical Measurements of Solid-State Lighting Products*

LED lamps:
- ANSI / IES LM-79-24 *Optical and Electrical Measurements of Solid-State Lighting Products*

If the retrofit work involves upgrading or modifying an existing electrical system, then
- All wiring must be in accordance with I.S. 10101 National Rules for Electrical Installations
  Refer to Clause 3.2 Electrical Installations: Best Practice for details.
- Contractors must be Safe Electric Registered Electrical Contractors (REC)

Further Guidance
Energy Efficient LED Lighting_SEAI

6.29 Home Energy Assessment (HEA) Report

Contractors are required to submit a Home Energy Assessment (HEA) Report in accordance with a SEAI home energy upgrade specific Programme.

A Home Energy Assessment includes:-

- Building Energy Rating (BER) assessment with published BER including the Advisory Report.
- Technical Design report on the energy efficiency of a home.
  - Details include ventilation/airtightness strategy, fabric design, plumbing and heating design considerations.
  - Estimate of annual energy usage in kWh using the BER assessment methodology regarding occupancy, duration of space heating and hot water demand.
- Details on the home energy upgrade measures needed to get a home to a BER rating of 'B', or better.
- Heat Pump Technical Assessment detailing the home energy upgrades required to make a home suitable for a heat pump.
- A report explaining how the recommended home energy upgrades will improve the comfort of a home and help to reduce energy bills.
- An estimate of the costs of the recommended home energy upgrades including deduction of the SEAI grant allowance.

6.30 Electricity Energy Monitors and Shower Energy Monitors

Energy monitors shall be installed to manufacturer's recommendations.

Metering heat and hot water energy is highly recommended as it gives the opportunity to review consumption, and this is mandatory under certain Programmes; refer to SEAI Programme-specific documentation for more details.

6.30.1 Electricity Energy Monitor

Standard and Specification

The electricity energy monitor must be complete with in-house display connected to electricity meter (e.g. linked via clamp-on transmitter).

It is an in-house display of real time energy and cost consumption:

- Individual single point energy monitors, i.e. three pin plug energy displays are not eligible as they do not display the overall energy consumption of the dwelling.
- Dwelling MPRN must be submitted with application for Energy Credits for energy monitors.

6.30.2 Shower Energy Monitor

Standard and Specification

The Shower energy monitor must be complete with display connected to a shower (e.g. connected to the shower hose). It must display real time energy consumption and should also display water usage and hot water temperature.

6.31 Solar Electricity

Solar panels that produce electricity are known as solar photovoltaic (PV) modules. The SEAI Solar Photovoltaic (PV) Scheme operates under the Microgeneration Support Scheme (MSS)
www.seai.ie/.../Solar electricity - Solar PV (photovoltaic panels) grant

NOTE ESB Networks (ESBN) require that microgeneration installations, including solar PV systems, ***must*** be registered with ESBN, prior to installation. A Microgeneration Application is submitted to ESBN with details of the solar photovoltaic (PV) system. Installation and commissioning of solar photovoltaic (PV) system can proceed once ESB Networks has approved the microgeneration application.

Product Standard and Specification

- Solar Photovoltaic (PV) equipment and components of PV systems, including inverters, must have a valid CE Mark to demonstrate compliance with the Low Voltage Directive (LVD 2014/35/EU).

- Solar Photovoltaic (PV) installations are in accordance with I.S. EN 50549-1. Information and documentation required to be handed over to a customer following the installation of a grid connected Solar PV system is defined in I.S. EN 62446-1.

- All electrical aspects of the installation must be in accordance with the I.S. 10101 National Rules for Electrical installations (see Clause 3.2).

  Part 8.82 of I.S. 10101 outlines additional requirements for systems which both consume and produce electrical energy. A prosumer's electrical Installation (PEI) is a set of electrical equipment for local generators such as a solar PV system as detailed under I.S. 10101 (8.82.5).

  NOTE I.S. 10101 Chapter 134.1.9 requires that consideration is given to the effect of the additional load on the existing electrical installation. When adding solar panels to an existing installation the existing meter tails must be checked to ensure they are the correct size and suitable to handle the increased load, polarity verification of all circuits, and the earthing and bonding arrangements must be satisfactory. If the meter tails have a cross-sectional area (CSA) less than < 16 mm^2 or the bonding is inadequate, they must be upgraded as part of the installation.

- ESB Networks (ESBN) mandates a 25 Amp limit per phase for single-phase solar PV installations. Therefore, the DC/AC inverter must have built-in hardware or firmware-based output current limit to be compliant with the 25 Amp current restriction.

- Works must satisfy the PV module requirements in the SEAI's *Domestic Solar Photovoltaic - Code of Practice for Installers* (refer to www.seai.ie/.../SPV-Code-of-Practice).

  The *Domestic Solar Photovoltaic - Code of Practice for Installers* includes sections on:
  - Installer Requirements and Competence
  - Solar PV System Component, Design and Installation Requirements
  - Energy Storage Systems
  - Battery Energy Storage System (BESS)
  - Hot Water Diversion
  - Space Heating and Electric Vehicle Diversion
  - Inspection, Testing, Commissioning and Handover

Further Guidance

- SEAI's Solar Electricity Calculator is available on www.seai.ie/tools/Solar Electricity Calculator
- SEAI's support and guidance www.seai.ie/renewable-energy/solar-energy/electricity-from-solar
- Safe Electric "Focus on Photovoltaic Installations" safeelectric.ie/focus-on-photovoltaic-installations

6.32 Solar Water Heating

Contractor Requirements and Competence

Solar water heating systems (also known as "solar thermal") must be installed by competent persons in accordance with manufacturer's guidelines as a minimum. The Contractor undertaking the works must hold a NFQ Level 6 Certificate in Domestic Solar Hot Water Systems or an equivalent qualification.

Information on solar thermal for hot water is available on the SEAI website:-

- Solar water heating grant www.seai.ie/.../Solar water heating grant
- A Homeowner's Guide to Solar Thermal for Hot Water www.seai.ie/.../Homeowners Guide To Solar Thermal

Product Standard and Specification

SEAI home energy upgrade qualifying solar water heating systems must be listed on the SEAI Solar Thermal Registered Product List, refer to Appendix 2 for details.

The solar thermal installation must contribute a portion of renewable energy for domestic hot water heating. The minimum required output of the solar hot water system depends on the total floor area (TFA) of the dwelling as detailed in the Table 11, below:

Table 11 : Minimum solar renewable energy contribution in Ireland per year

Total Floor Area m^2 (TFA) of dwelling (DEAP methodology)	Required Energy Yield (kWh) for Solar Panels Installed
0 - 170 m^2	10 kWh/(m^2.year)
171 - 200 m^2	1,700 solar hot water input Qs (kWh/year) *
201 - 250 m^2	1,850 solar hot water input Qs (kWh/year) *
250$^+$ m^2	2,000 solar hot water input Qs (kWh/year) *

*Qs (kWh/year) Annual Solar Energy contributed to the heating system by the proposed collectors. This is based on the formula for Solar Energy available in Appendix H of the DEAP manual.

SEAI's Solar Hot Water Compliance Calculator is accompanied by a guidance note setting out the calculation methodology for achieving compliance with the solar thermal measure requirements. SEAI tools and calculators are available on the SEAI website, www.seai.ie/.../tools.

Solar fraction is recommended under best practice not to exceed 60 % except when the system is also used for solar space heating. Where the system is only used for hot water the acceptable method of calculating the energy yield per solar system is as per Appendix H: Solar Water Heating in the DEAP Guide and uses the Solar Hot Water Compliance Calculator referenced on the SEAI website.

Solar fraction is the Annual Solar Energy (Qs) as a percentage of the total heat required for domestic hot water (DHW) and is calculated using the formula below.

$$Solar\ Fraction = \frac{Annual\ solar\ energy\ (Qs)\ x\ 100}{Total\ heat\ required\ for\ DHW}$$

The Contractor must discuss the specification and the appropriate sizing (including hot water storage) of the solar heating system with the homeowner before selecting the final system. Size of home, levels of occupancy and payback periods etc. should be discussed and agreed. A review of the renewable energy contribution for the proposed system should also be undertaken with a BER assessor before the system is purchased/installed (see Clause 2.7).

It is required that the hot water storage is using a heat retention cylinder as per the Heating and Domestic Hot Water Systems for dwelling to achieve compliance with TGD L (Clause 1.4.4.2).

Some solar thermal systems can be designed to heat both domestic hot water and space heating[36]. Where the solar heating system is being installed to contribute to the space heating requirements, the DEAP Solar Space Heating calculator must be used.

If Solar Space Heating is being considered, the Contractor must inform the homeowner of the expected space heating energy and cost savings expected from the solar heating system as the payback period is likely to be long. Solar Space Heating systems would typically meet a low percentage of the space heating requirement. The Annual Space Heating requirement is as calculated by DEAP and the Space Heat Contribution from the solar heating system is as calculated by the DEAP Solar Space Heating Calculator.

Installation Standard and Specification

a. Solar thermal equipment and components of solar thermal systems, including inverters, must have a valid CE Mark to demonstrate compliance with the Low Voltage Directive (LVD 2014/35/EU).

b. Solar thermal collectors include Flat Plate Collectors and Evacuated Tube Collectors. All equipment and/or components must comply with the applicable Ecodesign and EU Energy Label Regulations.

c. Solar water heating design, installation, commissioning and maintenance are in accordance with the relevant Standards including NSAI'S S.R. 50 Series[31] on Standards for Modern Plumbing and Heating and in particular S.R. 50-2 - Building services - Code of practice - Thermal solar systems.

d. SEAI home energy upgrade qualifying solar water heating systems must be installed in accordance with manufacturer's guidelines and the guidance in this DTSS document.

e. All electrical aspects of the installation must be in accordance with I.S. 10101 National Rules for Electrical installations. Please refer to Clause 3.2 Electrical Installations: Best Practice for details.

f. Roof design, layout, orientation and tilt angle of the solar panel influence the optical performance.

g. SEAI recommends that a solar water heating system should have 'TMV2' type temperature mixing/blending valve(s) installed on the hot water system to prevent the likelihood of an occupant being scalded due to excess water temperatures (particularly in the case of elderly, infirmed or young users).

   SEAI requires that Contractors discuss this matter fully with homeowners and that the homeowner is properly advised on the option best suited to their household's needs, as part of the specification process ahead of installation commencement. Further guidance is available on www.seai.ie.

   A 'TMV2' type temperature mixing/blending valve is for use in domestic situations. 'TMV2' approval certifies that the valves are installed to the performance requirements of I.S. EN 1111 and EN 1287.
   NOTE A mixer tap is not deemed to be a TMV2 type valve.

h. If 'TMV2' type blending/mixing valves as referenced above are not installed, the homeowner must be issued with a 'Solar water heating safety notice to the homeowner'. This notice informs the householder of the risks associated with not installing a 'TMV2' mixing/blending hot water valve(s). This document must be signed (in duplicate) by the installer and homeowner with a copy supplied to

[36] "Use of Solar Systems for Space Heating"_ www.seai.ie/.../Homeowners Guide to Solar Thermal

the homeowner and a copy retained by the installer. The *Solar Water Heating and Hot Water Temperature Safety Notice* document can be downloaded at the following link: www.seai.ie/.../Solar Hot Water Heating_Safety Notice

i. All stored water (in the domestic hot water cylinder and any that is recirculated in sections of pipework) must have a legionella protection cycle (aka bacterial contamination disinfection routine) to periodically raise the temperature to at least ≥ 60 °C, and held there for at least one hour, at least once per week. The hot water system should be able to efficiently facilitate production of domestic hot water cylinder temperature to ≥ 50 °C. Ensure that hot water draw offs have temperature mixing/blending valve(s) to prevent scalding.

   The risk of scalding is typically mitigated by using a separate Thermostatic Mixing Valve (TMV) at each point of use. The recommended maximum mixed hot water temperatures for safe use for the most common installations are listed in Table 12 : Maximum mixed hot water temperatures for safe use.

Table 12 : Maximum mixed hot water temperatures for safe use

44 °C	For bath fill (46 °C for assisted bathing)
41 °C	For shower applications.
38 °C	For bidet applications

j. The sizing of the expansion vessel must consider the capacity of the system, including the length of pipework and of the tank coil. The expansion vessel must also be adequately pre-charged at commissioning. An undersized or undercharged expansion vessel may cause the system to become over-pressurised, leading to the system safety valve discharging. This may become a cause of system stagnation and poor performance due to air-locks.

k. SEAI's 'Solar water heating safety notice to the homeowner' should be included in the handover documentation together with the solar water heating installation, operation and maintenance manual, Homeowners Manual and a manufacturer's Warranty. The homeowner shall be advised that this documentation should be retained as an inspection of the installation may be required.

l. A Commissioning Report for Solar Thermal Systems, available on the SEAI website, must be completed and a copy provided to the homeowner. The Contractor must keep a copy for their own records. www.seai.ie/.../Solar_Commissioning_Report

Further Guidance

- S.R. 50 Series[31] on Standards for Modern Plumbing and Heating, NSAI
- S.R. 50-2 - Building services - Code of practice - Part 2: Thermal solar systems
- The installation of solar water heating systems guidance outlined in the HVSH Solar Heating Design and Installation Guide – CIBSE Guide.
- Domestic Heating Design Guide _CIBSE
- Minimising the risk of Legionnaires disease, CIBSE TM13
- Commission for Regulation of Utilities (CRU) has set standards and guidelines that must be followed by all those who wish to install solar panels on their property, Safe Electric (refer to DTSS Clause 3)
- DEAP Guide on Solar Water Heating Solar Water Heating | DEAP Guide
- Solar Installers Note: SEAI's Guidance on Achieving Compliance www.seai.ie/.../Solar_Installers_Notes

6.33 Electric Vehicle Chargers

Electric Vehicle (EV) Home Charger Grant details are on the SEAI website www.seai.ie/.../Electric vehicle home charger grant.

Electric Vehicle (EV) Apartment Charger Grant scheme relates to an apartment complex or a multi-unit development, details are available on the SEAI website www.seai.ie/.../electric vehicle charging/apartment charging grant

Electric Vehicle (EV) Charger Grant Schemes will only support smart chargers which are registered on SEAI's Smart Charger Register available under the Triple E database, refer to TripleE.seai.ie.

Contractor Competence

Registered Electrical Contractors (REC) must be registered with Safe Electric, refer to safeelectric.ie/Find a Registered Electrical Contractor (REC).

Building Regulations

Works must comply with Irish Building Regulations. Guidance is available in the Technical Guidance Documents (TGD) and Building Regulations on the Department of Housing, Local Government and Heritage (DHLGH) website.

Product Standards and Specification

The Electric Vehicle Home Charger system must meet the following criteria:

- CE Mark to demonstrate compliance with the Low Voltage Directive (LVD 2014/35/EU)
- 768/2008/EC - affixing and use of the CE conformity marking decision
- 2014/30/EU - *Electromagnetic Compatibility (EMC) conformity assessment and certification* Directive
- Directive (EU) 2024/884 - *Waste Electrical and Electronic Equipment (WEEE)*
- I.S. EN IEC 61851 - *Electric vehicle conductive charging system*
- I.S. EN 62196-1 - *Plugs, Socket-Outlets, Vehicle Connectors and Vehicle Inlets - Conductive Charging of Electric Vehicles*
- I.S. 10101 National Rules on Electrical Installation

Installation Standards and Specifications

a. All EV home charger systems must have a CE Mark and be installed to manufacturer's guidelines.

b. Only one EV charger may be installed per property under the Electric Vehicle Home Charger Grant Scheme.

c. All electrical work must be in accordance with I.S. 10101 National Rules on Electrical Installation. A Completion Certificate No. 3 issued by a Safe Electric Registered Electrical Contractor (REC) is required as evidence of compliance.

   Ducting infrastructure incorporates cable ladders, cable trunking systems, conduit, cable trays, etc as outlined in I.S. 10101 National Rules on Electrical Installation.

   NOTE I.S. 10101 Chapter 134.1.9 requires that consideration is given to the effect of the additional load on the existing electrical installation. When adding an EV charger to an existing installation the existing meter tails must be checked to ensure they are the correct size and suitable to handle the increased load, polarity verification of all circuits, and the earthing and bonding arrangements must be satisfactory. If the meter tails have a cross-sectional area (CSA) less than < 16 mm^2 or the bonding is inadequate, they must be upgraded as part of the EV home charger installation.

d. The Homeowner should have a Periodic Inspection Report (PIR) of the home completed prior to installation of an EV home charger (see Clause 3.2).

The PIR report may result in wiring upgrade recommendations such as:-

- Fuseboard cable compliance i.e. cables have a CSA of 16 mm^2 to meet the standard requirements
- Earthing system upgrade includes updating the meter tails
- Proper grounding, circuit protection and outdoor safety enclosures

Further Guidance

- TGD L provides information on EV Ducting Infrastructure for electric vehicle recharging_DHLGH
- Zero Emission Vehicles Ireland (ZEVI)_Department of Transport www.zevi.ie
- DTSS Clause 3.2 Electrical Installations: Best Practice
- Periodic Inspection Report (PIR)_Safe Electric safeelectric.ie/.../Periodic Inspection Report
- Health and Safety Authority (HSA) guidance notes on Periodic Inspection and Testing of Electrical Installations):-
  www.hsa.ie/.../Guidance-Note on Periodic Inspection and Testing of Electrical Installations

Appendix 1: Reference Documents

Appendix 1 lists the key reference guidance documents and standards and the measures to which they apply.

- Building Regulations apply to measures as detailed in Clause 6 Home Energy Upgrades : Best Practice for specific energy efficiency measures. Contractors must comply with relevant parts of Building Regulations for all measures, refer to DTSS Clause 2.1.
- All measures must be installed as per the Manufacturer's guidelines
- Appendix 1 does not detail standards and references for Solar Photovoltaic (PV) Systems, refer to Clause 6.31 Solar Electricity. Additional information is available on SEAI document "*Domestic Solar Photovoltaic – Code of Practice for Installers*" www.seai.ie/SPV-Code-of-Practice.
- S.R. 54 *Code of Practice for the Energy Efficient Retrofit of Dwellings* is available, *free of charge*, from both the SEAI and NSAI website: SEAI www.seai.ie/S.R.54-2014 and NSAI S.R. 54:2014/A2:2022 Code of Practice for the energy efficient retrofit (standards.ie)

Reference (Publisher)	Insulation						
	Cavity Wall CWI	External Wall EWI	Internal Wall IWI	Roof Ceiling-Level	Pipework and CWST	Roof Rafter	Floor
S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings	·	·	·	·		·	·
CE Mark or Irish Agrément Certificate or equivalent, refer to each measure for applicable requirements	·	·	·	·		·	·
I.S. EN 1991-1-1, Eurocode 1: Actions on structures - Part 1-1; General actions - Densities, self - weight, imposed loads for buildings	·	·	·	·		·	·
BR 443 (BRE) Conventions for U-value calculations	·	·	·	·		·	·
BR 262 Thermal insulation avoiding risks	·	·	·	·		·	
I.S. EN ISO 15927-3 specifies 2 procedures for providing an estimate of the quantity of water likely to impact on a wall of any given orientation.	·	·	·				
BS 8215 Design and installation of damp-proof courses in masonry construction (BSI)	·	·					·
I.S. EN IEC 60598-1 Luminaires: General requirements and tests.				·		·	
I.S. EN 15026 Hygrothermal performance of building components + building elements-Assessment of moisture transfer by numerical simulation						·	
BS 5970 Code of practice for thermal insulation of pipework and equipment in the temperature range of -100 °C to +870 °C					·		
BS 5422 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within a temperature range -40 °C to +700 °C					·		
Domestic floors: construction, insulation and damp-proofing (GBG 28 Part 1) published by BRE							·
Insulating ground floors (GBG 45), published by BRE							·
Protection of below ground structures against water from the ground, and ingress. Code of practice (BS 8102)							·
PD CEN/TR 12872:2014 – Wood-based panels. Guidance on the use of load-bearing boards in floors, walls and roofs							·

Reference (Publisher)	cMEV Mechanical Extract Ventilation and MVHR Mechanical Ventilation with Heat Recovery
BRE Digest 398 “Continuous mechanical ventilation in dwellings”	·
BS 8233:2014 Guidance on sound insulation and noise reduction for buildings	·
Building Regulations (Part B Fire Safety and Part F Ventilation)	·
Domestic Ventilation Systems - a guide to measuring airflow rates (BG 46/2022) published by BSRIA	·
Commission Regulation (EU) No 2016/2282 with regard to Ecodesign requirements for ventilation units	·
Commission Regulation (EU) No 2020/987 with regard to the energy labelling of residential ventilation units	
Commissioning Code A (CCA) : Air Distribution Systems - CIBSE	·
I.S. EN 13141-1 Ventilation for buildings. Performance testing of components/products for residential ventilation. Externally and internally mounted air transfer devices.	·
I.S. EN 13141-3 Ventilation for buildings - Performance testing of components/products for residential ventilation : range hoods for residential use without fan	·
I.S. EN 13141-4 Ventilation for buildings - Performance testing of components/products for residential ventilation. Aerodynamic, electrical power and acoustic performance of unidirectional ventilation units	·
I.S. EN 13141-5 Ventilation for buildings. Performance testing of components/products for residential ventilation. Cowls and roof outlet terminal devices.	·
I.S. EN 13141-6 Ventilation for Buildings – Performance Testing of Components/products for Residential Ventilation Part 6: Exhaust Ventilation System Packages Used in a Single Dwelling	·
I.S. EN 13141-7 Ventilation for buildings - Performance testing of components/products for residential ventilation. Performance testing of ducted mechanical supply and exhaust ventilation units (including heat recovery)	·
I.S. EN 13141-8 Ventilation for buildings - Performance testing of components/products for residential ventilation. Performance testing of non-ducted mechanical supply and exhaust ventilation units (including heat recovery)	·
I.S. EN 13141-11 Ventilation for Buildings – Performance Testing of Components/products for Residential Ventilation Part 11: Supply Ventilation Units	·
I.S. EN 14134 Ventilation for buildings - Performance measurement and checks for residential ventilation systems	·
I.S. EN ISO 9972:2015 – Thermal Performance of Buildings – Determination of Air Permeability of Domestic Buildings – (Single or Single & Multi) Fan Pressurization Method	·
Installation and Commissioning of Ventilation Systems for Dwellings - Achieving Compliance with Part F published by DHLGH	·
NSAI Ventilation Validation Registration Scheme	·
S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings	·

Reference (Publisher)	Heat Pumps	Biomass Boilers (with or without thermal storage)
BS 7593 Code of practice for the preparation, commissioning and maintenance of domestic central heating and cooling water systems.	·	
Design of low-temperature domestic heating systems: A guide for system designers and installers (FB 59) Publisher. BRE	·	
Domestic Heating Design Guide (DHDG) _ CIBSE	·	
Environmental Protection Agency (EPA) "Summary Guidance for Compliance with the ODS and F-Gas Regulations" and "Complying with Regulations Controlling Fluorinated Greenhouse Gases and Ozone Depleting Substances – A Guidance Note for Operators of Equipment Containing F-gases and ODS"	·	
Geothermal Collector suitability Maps _ Geological Survey Ireland (GSI)	·	
'Ground Source Heat' & 'Shallow Geothermal Energy' Homeowner Manual _ Geological Survey Ireland (GSI)	·	
Good Practice Guide for Ground Source Heating & Cooling _ Ground Source Heat Pump Association (GSHPA)	·	
Heat Pump Association of Ireland (HPAI) Heat Pump installation guidelines	·	
Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L (DHLGH)	·	
I.S. EN 12828 Heating systems in buildings - Design for water-based heating systems	·	
I.S. EN 12831 Energy Performance of Buildings - Method for Calculation of the Design Heat Load - Space Heating Load / DHW (Part 1 and Part 3 respectively)	·	
I.S. EN 14825 Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling, commercial and process cooling - Testing and rating at part load conditions and calculation of seasonal performance	·	
I.S. EN 15450 Heating Systems in Buildings – Design of Heat Pump Heating Systems	·	
I.S. EN 16147 Heat pumps with electrically driven compressors - Testing, performance rating and requirements for marking of domestic hot water units	·	
I.S. EN ISO 17628 – Geotechnical Investigation and Testing – Geothermal Testing- Determination of thermal conductivity of soil and rock using borehole heat exchangers	·	
Manufacturer's installation instructions for the specific Heat Pump model(s) and other parts of the system installed	·	
Refrigerating systems and heat pumps I.S. EN 378-1 Safety and environmental requirements and I.S. EN 378-3 Installation site and personal protection	·	
Microgeneration Certification Scheme – MCS Guidance Documents (UK) - Heat Pump Design MIS 3005-D / Heat Pump Installation MIS 3005-I / Heat emitter guide for domestic heat pumps MCS 021	·	
Refrigerating systems and heat pumps I.S. EN 378-1 Safety and environmental requirements and I.S. EN 378-3 Installation site and personal protection	·	
S.R. 50 Series on Standards for Modern Plumbing and Heating _ Part 1, Part 3, Part 4_ NSAI [31]	·	·

Reference (Publisher)	Heat Pumps	Biomass Boilers (with or without thermal storage)
S.R. 50-1 Building services - Code of Practice - Water based heating systems in dwellings	·	
S.R. 50-3 Building services - Code of Practice - Water supply for domestic use within dwellings and their curtilages	·	
S.R. 50-4 Building services - Heat pump systems in dwellings	·	
SEAI DEAP Heat Pump Methodology DEAP Guide - Heat Pumps	·	
Heating, Ventilating, Air Conditioning and Refrigeration_CIBSE Guide B	·	
Minimising the risk of Legionnaires disease, CIBSE TM13	·	
Ground Source Heat Pumps, CIBSE TM51	·	
BS 3198 'Specification for copper hot water storage combination units for domestic purposes'	·	·
Domestic Heating Design Guide, CIBSE	·	·
I.S. EN 12831-1 Energy Performance of Buildings - Method for Calculation of the Design Heat Load - Space Heating Load	·	·
I.S. EN 12897 "Water supply. Specification for indirectly heated unvented (closed) storage water heaters"	·	·
I.S. 10101 National Rules for Electrical Installations	·	·
I.S. EN 1566-1 "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly (vinyl chloride) (PVC-C). Specification for pipes, fittings and the system"	·	·
I.S. EN 12828 Heating systems in buildings - Design for water-based heating systems		·
I.S. EN 14336 "Heating systems in buildings. Installation and commissioning of water-based heating systems" and the requirements of the system suppliers' specifications.		·
Micro generation Installation Standard: MIS 3004 Requirements for Contractors Undertaking the Supply, Design, Installation, Set to Work, Commissioning and Handover of Solid Biofuel Heating Systems		·
Biomass boilers must be CE Marked to demonstrate compliance with the Low Voltage Directive (LVD 2014/35/EU) and Machinery Regulation (EU 2023/1230)		·
TR38 Guide to Good Practice – Installation of Biofuel Heating (Heating and Ventilation Contractors' Association)		·

Reference (Publisher)	Heating Control with/ without remote access	Heating Control : Boiler	Solar water heating
S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings	·	·	·
S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI.	·	·	·
I.S. 10101 National Rules for Electrical Installations	·	·	·
Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L (DHLGH)	·	·	·
CE29 Domestic Heating by Oil: Boiler Systems – Guidance for Contractors and Specifiers	·	·	
CE30 Domestic Heating by Gas: Boiler Systems – Guidance for Contractors and Specifiers	·	·	
CIBSE – Domestic Heating Design Guide	·	·	
CRU: Definition of the Scope of Controlled Works	·	·	
I.S. EN 12828 Heating systems in buildings - Design for water-based heating systems	·	·	
BS 7478 “Guide to selection and use of thermostatic radiator valves”	·		
EN 60730-1 Automatic Electrical Controls for Household and similar use	·		
GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE	·		
I.S. EN 215 “Thermostatic Radiator Valves - Requirements and Test Methods”	·		
CRU/20/088: CRU Criteria document ‘The Regulation of Gas Installers with respect to safety’		·	
GPG 301 Controls for Domestic Heating and Hot Water – Choice of Fuel and System Type		·	
Guide to the Condensing Boiler Installation Assessment Procedure for Existing Dwellings (DHLGH)		·	
I.S. 813 Domestic Gas Installations (NSAI)		·	
Solar heating design and installation guide_ CIBSE			·
Minimising the risk of Legionnaires disease, CIBSE TM13			·
S.R. 50-2 “*Building services – Code of practice – Part 2: Thermal solar systems*”			·

Reference (Publisher)	Draught-Proofing	Door Replacement	Window Replacement	Window Secondary Glazing	Window Glazing Low E-Film
BS 7386 “Specification for draughtstrips for the draught control of existing doors and windows in housing”	•				
I.S. EN 17037 Daylight in Buildings		•	•	•	•
BR209 Site layout planning for daylight and sunlight_BRE.		•	•	•	•
CPR - Construction Products Regulation (Regulation (EU) No 2024/3110)		•	•	•	•
BS 6262 Glazing for buildings. Code of practice for safety related to human impact		•	•	•	
BS 8000-0 Workmanship on construction sites. Introduction and general principles		•	•	•	
BS 8213-4 “Code of practice for the survey and installation of windows and external doorsets”		•	•	•	
I.S. EN 14351-1 “Windows and doors - Product standard, performance characteristics - Windows and external pedestrian doorsets” and CE Marking		•	•		
I.S. EN ISO 12567-1 Thermal performance of windows and doors - Determination of thermal transmittance by the hot-box method (Parts 1 and 2)		•	•		
I.S. EN ISO 10077 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance (Parts 1 and 2)		•	•		
I.S. EN 1627 Burglar resistant characteristics of pedestrian doorsets, windows, curtain walling, grilles and shutters.		•	•		
PAS 24 Enhanced security performance requirements for doorsets and windows in the UK.		•	•		
I.S. EN 13724 requirements for the aperture, security, and design of private letter boxes and letter plates.		•			
I.S. EN 1279-1 “*Glass in Building - Insulating glass units - Generalities, system description, rules for substitution, tolerances and visual quality*”			•	•	
I.S. EN 1279-2 “*Glass in building - Insulating glass units Part 2: Long term test method and requirements for moisture penetration”*			•	•	
I.S. EN 410 “Glass in Building - Determination of Luminous and Solar Characteristics of Glazing”				•	•
I.S. EN 673 Glass in building. Determination of thermal transmittance (U value). Calculation method				•	•
I.S. EN 12898 Glass in building. Determination of the emissivity				•	
“Design for improved solar shading control” CIBSE TM37			•		

Reference (Publisher)	Stoves : Solid Multi-Fuel Heating System	Heating System Power Flush	Heating System Magnetic filtration	Chimney Draught Limiter	Boiler Service	Lighting LED
S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI.	·	·	·			
BS 8303 “Installation of domestic heating and cooking appliances burning wood and solid mineral fuels. Specification”	·					
CE47 “Energy Efficiency Best Practice in Housing – Domestic heating by solid fuel: Boiler systems”	·					
Ecodesign Regulation (EU) 2016/2282 sets standards for the efficiency and emissions of solid fuel space heating appliances.	·					
Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L (DHLGH)	·					
I.S. EN 16510-1 Residential solid fuel burning appliances - General requirements and test methods.	·					
I.S. 813 Domestic Gas Installations (NSAI)	·					
I.S. 10101 National Rules for Electrical Installations	·					·
BS 7593 Code of practice for treatment of water in domestic hot water central heating systems		·				
S.R. 50-1 “Building services - Code of Practice - Water based heating systems in dwellings”			·			
BS 1251 Specification for open-fireplace components				·		
SEAI gas boiler checklist					·	
SEAI oil boiler checklist					·	
Ecodesign Regulation (EU) 2019/2020 requirements for light sources and separate control gears.						·
I.S. EN 13032-1 and I.S. EN 13032-2 Light and lighting – Measurement and presentation of photometric data of lamps and Luminaires						·
ANSI / IES LM-79-24 Optical and Electrical Measurements of Solid-State Lighting Products						·

Reference (Publisher)	Gas Fired Room Heater	Storage Heaters - High Heat Retention	Domestic Hot Water Storage : High Heat Retention Cylinders
S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI.	·	·	·
BS 7977-1 'Specification for safety and rational use of energy of domestic gas appliances". Radiant/convectors'	·		
CRU Criteria document 'The Regulation of Gas Installers with respect to safety'	·		
Heating and Domestic Hot Water Systems for dwelling – Achieving Compliance with Part L (DHLGH)	·		
I.S. 10101 National Rules for Electrical Installations	·		
I.S. EN 613 Independent closed-fronted gas-fired type B11, type C11, type C31 and type C91 heaters	·		
I.S. 813 Domestic Gas Installation	·		
Technical Guidance Document (TGD) J - Heat Producing Appliances	·		
DOM 8: Guide to the Design of Electric Space Heating Systems, TEHVA (The Electric Heating & Ventilation Association) or the manufacturer's sizing methodology		·	
I.S. EN 60531 (Household Electric Thermal Storage Room Heaters – Methods for Measuring Performance)		·	
BS 1566-1 Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods			·
BS 3198 'Specification for copper hot water storage combination units for domestic purposes"			·
Domestic Heating Design Guide_CIBSE			·
Minimising the risk of Legionnaires disease, CIBSE TM13			·
I.S. EN 12828 'Heating systems in buildings. - Design for water-based heating systems'			·
I.S. EN 12897 Water supply. Specification for indirectly heated unvented (closed) storage water heaters			·
I.S. EN 14336 "Heating systems in buildings. Installation and commissioning of water-based heating systems" and the requirements of the system suppliers'			·
I.S. EN 1566 "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly (vinyl chloride) (PVC-C). Specification for pipes, fittings and the system" (Part 1 and 2)			·
Microgeneration Installation MIS 3004 Requirements for Contractors Undertaking the Supply, Design, Installation, Set to Work, Commissioning and Handover of Solid Biofuel Heating Systems			·
TR38 Guide to Good Practice – Installation of Biofuel Heating (Heating and Ventilation Contractors' Association)			·

Reference (Publisher)	Electric vehicle Chargers
I.S. EN IEC 61851 - Electric vehicle conductive charging system	.
I.S. EN 62196-1 – Plugs, socket-outlets, vehicle couplers and vehicle inlets – Conductive charging of electric vehicles	.
LVD 2014/35/EU Low Voltage Directive	
768/2008/EC – The affixing and use of the CE conformity marking	.
2014/30/EU - Electromagnetic Compatibility (EMC) conformity assessment and certification Directive	.
Directive (EU) 2024/884 - Waste Electrical and Electronic Equipment (WEEE) Directive	.

Appendix 2: Summary Table of Competencies and Standards

Appendix 2 summarises competencies, and installer/product standards and specifications for all measures.

- Building Regulations apply to measures as detailed in Clause 6 , however, may not be referenced in depth in Appendix 2. Contractors must comply with relevant parts of Irish Building Regulations for all measures, refer to DTSS Clause 2.1.
- Measures must be installed as per the manufacturer's guidelines
- Contractors must adhere to the detailed guidance in Clause 6. The "Measure" column below links to each relevant part of Clause 6.

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Cavity wall insulation (CWI)	Irish Agrément approved or equivalent Agrément Approval Scheme for Installers of Blown Cavity Wall Insulation (CWI) Systems www.nsai.ie/D-IAB-003_CWI_Installer_Scheme	Irish Agrément Certificate for the installed product or equivalent. • Must help achieve a U-value of 0.35 W/m²K for cavity walls • U-values are calculated according to the standards detailed in the DEAP methodology, TGD L, I.S. EN ISO 6946 and BR 443 – Conventions for U-value calculations	• The insulation system must be installed as per the conditions specified in the Irish Agrément Certificate (or equivalent) and system supplier specifications. • NSAI's S.R. 54 Code of Practice for the energy efficient retrofit of dwellings • S.R. 54 Clause 7.3.4 Cavity wall insulation (CWI) • I.S. EN ISO 15927-3 specifies 2 procedures for providing an estimate of the quantity of water likely to impact on a wall of any given orientation.
External Wall Insulation (EWI)	• Approved by the Agrément Certificate holder as an External Thermal Insulation Composite System (ETICS) installer of their system and has been issued with an ETICS Operative ID card. _Installer Certification, certifying the area m² insulated, type of insulation and depth of insulation www.nsai.ie/D-IAB-005_ETICS Installer Scheme • Irish Agrément ETICS registered (or equivalent) for the system specified in the relevant Irish Agrément certificate before carrying out work.	Irish Agrément Certificate for the ETICS installed product or equivalent. • Must help achieve a U-value of 0.27 W/m²K for external walls • U-values are calculated according to the standards detailed in the DEAP methodology, TGD L, I.S. EN ISO 6946 and BR 443 – Conventions for U-value calculations • Homeowners Manual must be specific to Irish conditions and the individual installation as appropriate.	• The insulation system must be installed as per ETICS, the manufacturer's technical guidance and specifications and Irish Agrément Certificate or equivalent. • NSAI's S.R. 54 *Code of Practice for the energy efficient retrofit of dwellings* • I.S. EN ISO 15927-3 specifies 2 procedures for providing an estimate of the quantity of water likely to impact on a wall of any given orientation. • IS EN 13914-1 Design, Preparation and Application of External Rendering and Internal Plastering.
Internal Wall Insulation (IWI)	• Must be competent to install insulation in accordance with S.R. 54 (Code of practice for the energy efficient retrofit of dwellings). • Where the manufacturer operates an Approved Installer list, the Contractor must demonstrate their inclusion on the list • Installer Certification, certifying the area m² insulated, type of insulation and depth of insulation	CE Mark *or* Irish Agrément Certificate for the installed product or equivalent. • Must help achieve a U-value of 0.27 W/m²K for internal walls. Where a U-value of 0.27 W/m²K is not achievable due to space restrictions (e.g. minimum stair space). At these locations, the internal insulation systems must achieve a maximum U-value less than 0.6 W/m²K. • U-values are calculated according to the standards detailed in the DEAP methodology, TGD L, I.S. EN ISO 6946 and BR 443 – Conventions for U-value calculations	• The insulation system must be installed as per the manufacturer's technical guidance and specifications and, if applicable, Irish Agrément Certificate or equivalent. • NSAI's S.R. 54 *Code of Practice for the energy efficient retrofit of dwellings* • I.S. EN ISO 15927-3 specifies 2 procedures for providing an estimate of the quantity of water likely to impact on a wall of any given orientation.

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Roof Insulation: Ceiling-Level Insulation	Must be competent to install insulation in accordance with S.R. 54 Code of Practice for the energy efficient retrofit of dwellings).	CE Mark *or* Irish Agrément Certificate for the installed product or equivalent. • Must help achieve a U-value of 0.16 W/m^{2}K • U-values are calculated according to the standards detailed in the DEAP methodology, TGD L, I.S. EN ISO 6946 and BR 443 – Conventions for U-value calculations	• The insulation system must be installed as per the manufacturer's technical guidance and specifications and, if applicable, Irish Agrément Certificate or equivalent. • NSAI's S.R. 54 *Code of Practice for the energy efficient retrofit of dwellings*
Roof Insulation: Rafter-Level (Cold Roof)	• Must be competent to install insulation in accordance with S.R. 54 Code of practice for the energy efficient retrofit of dwellings. • Where the manufacturer operates an Approved Installer list, the Contractor must demonstrate their inclusion on the list	CE Mark *or* Irish Agrément Certificate for the installed product or equivalent. • Must help achieve a U-value of 0.20 W/m^{2}K for rafter level insulation. • U-values are calculated according to the standards detailed in the DEAP methodology, TGD L, I.S. EN ISO 6946 and BR 443 – Conventions for U-value calculations	• The insulation system must be installed as per the manufacturer's technical guidance and specifications and, if applicable, Irish Agrément Certificate or equivalent. • I.S. EN 15026 Hygrothermal performance of building components and building elements - Assessment of moisture transfer by numerical simulation • NSAI's S.R. 54 *Code of Practice for the energy efficient retrofit of dwellings*
Floor Insulation	Must be competent to install insulation in accordance with • TGD L • S.R. 54 Code of Practice for the Energy Efficient Retrofit of Dwellings Clause 9 Floors. • Acceptable Construction Details (ACD) - Cavity Wall Insulation : Ground Floor Insulation - Internal Wall Insulation : Ground Floor Insulation - Limiting Thermal Bridging and Air Infiltration • Domestic floors: construction, insulation and damp-proofing (GBG 28 Part 1) published by BRE • Insulating ground floors (GBG 45), published by BRE	CE Mark *or* Irish Agrément Certificate for the installed product or equivalent. • Must help achieve a U-value of - 0.36 W/m^{2}K ground floor with no underfloor heating, or - 0.15 W/m^{2}K (underfloor heating) for floors • U-values are calculated according to the standards detailed in the DEAP methodology, TGD L, I.S. EN ISO 6946 and BR 443 – Conventions for U-value calculations • I.S. EN 1991-1-1, Eurocode 1: Actions on structures - Part 1-1; General actions - Densities, self - weight, imposed loads for buildings (including Irish National Annex:2013) and non-structural elements include thermal insulation	The insulation must be installed as per • *TGD L* • S.R. 54 Code of Practice for the energy efficient retrofit of dwellings Clause 9 Floors • *Domestic floors: construction, insulation and damp-proofing* (GBG 28 Part 1) published by BRE • *Insulating ground floors* (GBG 45), published by BRE • Protection of below ground structures against water from the ground, and ingress. Code of practice (BS 8102) • *Design and installation of damp-proof courses in masonry construction* (BS 8215) PD CEN/TR 12872:2014 – *Wood-based panels. Guidance on the use of load-bearing boards in floors, walls and roofs*
Insulation of pipework and water storage tanks	Must be competent to install Insulation of pipework and water storage tanks in accordance TGD G of the Building Regulations	• BS 5970 Code of practice for thermal insulation of pipework and equipment in the temperature range of -100 °C to +870 °C and • BS 5422 Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range - 40 °C to + 700 °C.	• Insulation installed as per manufacturer's guidelines • TIMSA guidance (TIMSA - HVAC Compliance guide) re: indicative thicknesses of insulation for heating and distribution pipes, as per Table 29 Note 1 of TGD L - Hot Water Systems for dwellings – Achieving compliance with Part L.

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
MVHR + cMEV Mechanical Ventilation and Heat Recovery Systems	• Must be carried out by competent persons in accordance with manufacturer guidelines and industry best practice at a minimum. • Where new mechanical extract ventilation system is installed as part of a Major Renovation, as defined in TGD L, then the system should be designed, installed, commissioned and validated as per NSAI Ventilation Validation Scheme (see Clause 4.2) • Air Permeability Test, refer to Clause 4.3 **NOTE** Ventilation Systems validator is a competent independent third party certified by NSAI (or equivalent) Ventilation Systems validator is *independent of the promoter of the system e.g. system designer/ manufacturer/installer.*	• Detailed list of relevant standards and performance criteria in Clause 6.7. • Clause 6.7.3 - Fan location, installation of ducts, duct connections, supply/extract terminals, controls - System handover and commissioning • I.S. EN 13141-3 Ventilation for buildings - Performance testing of components/products for residential ventilation : range hoods for residential use without fan	• System must be designed by competent designer in accordance with manufacturer's guidance and industry best practice • I.S. EN 14134 Ventilation for buildings – Performance testing and installation checks of residential ventilation systems • I.S. EN 13141 series for Ventilation for buildings - Performance testing of components/products for residential ventilation • S.R. 54 – Code of practice for the energy efficient retrofit of dwellings • I.S. 10101 National Rules for Electrical Installations • Commissioning Code A (CCA) : Air Distribution Systems – CIBSE • Domestic Ventilation Systems - a guide to measuring airflow rates (BG 46/2022) published by BSRIA • Energy efficient ventilation in dwellings – a guide for specifiers (GPG 268) published by Energy Saving Trust
Ventilation Clause 4	• Key section referenced for several measures. See Clause 4 Ventilation. • Where new mechanical extract ventilation system is installed as part of a Major Renovation, as defined in TGD L, then the system should be designed, installed, commissioned and validated as per NSAI Ventilation Validation Scheme (see Clause 4.2) • Air Permeability Test, if applicable, refer to Clause 4.3 **NOTE** Ventilation Systems validator is a competent independent third party certified by NSAI (or equivalent) Ventilation Systems validator is *independent of the promoter of the system e.g. system designer/ manufacturer/installer.*	Key section referenced for several measures. See Clause 4 Ventilation.	• Ventilation must be considered at planning and execution stages when thermal envelope being altered, or other measures being carried out that could have a bearing on ventilation. • NSAI's S.R. 54 *Code of Practice (particularly Clause 4.5, 10.2.2.1 and Tables 30, 31, 32, 35)* • I.S. EN ISO 13788 - *Hygrothermal Performance of Building Components and Building Elements - Internal Surface Temperature to Avoid Critical Surface Humidity and Interstitial Condensation - Calculation Methods* • I.S. EN 15026 *Hygrothermal Performance of Building Components and Building Elements - Assessment of Moisture Transfer by Numerical Simulation* • Air permeability pressure test is in accordance with I.S. EN ISO 9972 and NSAI Certified Air Tightness Tester Scheme Master Document. • BRE's IP 2/03 Background ventilators for dwellings.

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Heat Pump Systems	• Domestic Heat Pump Systems (6N5646) – NFQ Level 6 Component Award * • Heat Pump Manufacturer's training programmes must be available for SEAI to examine and verify. e.g. Certificate of Competence from the specific manufacturer of the heat pumps installed, based on an adequate training programme • Registration on the SEAI Renewable Energy Installers Register for heat pumps • An F-Gas engineer is required to carry out and certify heat pump system installation, leak checks and commissioning as per F-Gas Regulation (EU) No 2024/573 • A Registered Electrical Contractor (REC) is required to supervise and sign off the electrical installation of a heat pump system, in accordance with the definition of "Controlled Works and Restricted Works" by the CRU. All electrical works are in accordance with I.S. 10101 National Rules for Electrical Installations. Completion Certificate No. 3 for all electrical works completed must be left with the homeowner and available for inspection. • Air Permeability Test, if applicable, refer to Clause 4.3 **NOTE** * Training and RPL (recognised prior learning) Heat Pump Installation, Commissioning, Maintenance and Servicing training courses are available from Further Education and Training (FET) providers. Detailed information on how to apply and minimum entry requirements are available from each FET provider.	_DTSS Clause 6.8.1 - Ecodesign compliant - Ecodesign Commission Regulation (EU) No 2016/2282 - CE Mark - Energy Labelling Commission Regulation (EU) No 811/2013 for Air/Ground/Water/Exhaust air to water heat pumps - Energy Labelling Commission Regulation (EU) No 2023/2048 for air-to-air heat pumps. - Ecodesign technical datasheet declaring the test data for the heat pump based on • I.S. EN 14825 for space heating, • I.S. EN 16147 for water heating (DHW) • I.S. EN 15316-4-2 for heat pump system efficiency - Design heat load calculations for sizing of a suitable heat pump shall be in accordance with I.S. EN 12831-1 (S.R. 50-4). - Planning permissions / EPA approvals, if applicable, are obtained prior to heat pump installation (Clause 6.8.5) Refer to SEAI home energy upgrade grant requirements - Satisfy the minimum Seasonal Performance Factor SPF (Main Space Heating Efficiency), as per DEAP - Design, sizing and installation should be such that the heat pump system can provide at least: _100 % of the designed space heating requirements of the floor area _ 80 % of the Domestic Hot Water demand (DHW) - Heat Loss Indicator (HLI) (see 6.8.2), as per specific SEAI home energy upgrade programme requirements	_DTSS Clause 6.8.1 Installation _DTSS Clause 6.8.3 Heat Pump System Design, Installation, Commissioning and Maintenance _DTSS Clause 6.8.4 Handover documentation _DTSS Clause 6.8.5 Regulatory Framework _DTSS 6.8.6 Heat Pump Standards and Guidance • TGD J – Home Heating Appliances • TGD F - Ventilation • Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L - Clause 8.1 • Heat Pump manufacturer guidelines • I.S. 10101 National Rules for Electrical Installations • I.S. EN 15450 Design of Heat Pump Heating Systems • I.S. EN 12828 Design for water-based heating systems • S.R. 50-1 Water based heating systems in dwellings • S.R.50-3 Water supply for domestic use within dwellings and their curtilages • S.R. 50-4 Heat pump systems in dwellings • Heat Pump Association of Ireland (HPAI) Heat Pump installation guidelines • Minimising the risk of Legionnaires disease, CIBSE TM13 • Ground Source Heat Pumps, CIBSE TM51 • Domestic Heating Design Guide, CIBSE • CIBSE Guide A – Environmental Design • Design of low-temperature domestic heating systems: A guide for system designers and installers (FB 59) (BRE Trust) • MCS (UK) - Heat Pump Design MIS 3005-D / Heat Pump Installation MIS 3005-I / Heat emitter guide for domestic heat pumps MCS 021 • TR30 Guide to Good Practice – Heat Pumps (Building and Engineering Services Association) • BS 7593 Code of practice for the preparation, commissioning and maintenance of domestic central heating and cooling water systems

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Biomass boilers (with/without thermal storage)	• NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. • Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures.	• Minimum gross efficiency of 77 % with thermal store of 82 % without thermal store as listed on SEAI HARP database or equivalent. • Vented copper hot water storage vessels should comply with the heat loss and heat exchanger requirements of I.S. EN 1566-1 "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly(vinyl chloride) (PVC-C). Specification for pipes, fittings and the system" or • BS 3198 "Specification for copper hot water storage combination units for domestic purposes" • Vented cylinders in materials other than copper should comply with the heat loss and heat exchanger requirements of BS 1566-1 • Unvented hot water storage system products should: - comply with I.S. EN. 12897 'Water supply. Specification for indirectly heated unvented (closed) storage water heaters'; or - CE Mark or Irish Agrément Certificate; or certified by another accredited body as complying with Irish Building Regulations - Unvented cylinders need good water pressure and flow. Unvented systems should not be used with gravity circulation • Clause 5.3 of the DHLGH "Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L" must be adhered to.	• I.S. EN 1566-1 "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly(vinyl chloride) (PVC-C). Specification for pipes, fittings and the system" • BS 3198 "Specification for copper hot water storage combination units for domestic purposes" • I.S. EN. 12897 '*Water supply. Specification for indirectly heated unvented (closed) storage water heaters'* • I.S. EN 14336 "Heating systems in buildings. Installation and commissioning of water-based heating systems" • IS EN 12828 '*Heating systems in buildings. Design for water-based heating systems'* • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI. • Micro generation Installation Standard: *MIS 3004 Requirements for Contractors Undertaking the Supply, Design, Installation, Set to Work, Commissioning and Handover of Solid Biofuel Heating Systems* • TR38 *Guide to Good Practice – Installation of Biofuel Heating* (Heating and Ventilation Contractors' Association) • I.S. EN 12831-1 Energy Performance of Buildings - Method for Calculation of the Design Heat Load - Space Heating Load • CIBSE – *Domestic Heating Design Guide* • *I.S. 10101 National Rules for Electrical Installations*

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Boiler : High Efficiency Boiler	• High efficiency boilers must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum. In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. • Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. • If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor and a Completion Certificate must be issued. • Registered Gas Installer (RGI) - to issue a Completion Certificate or Declaration of Conformance Certificate for all completed gas works i.e. Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3). • Oil Boiler - Contractor is registered with a professional organisation, e.g. OFTEC.	• Boiler must be installed complete with heating controls • Seasonal efficiency >= 90 % https://www.seai.ie/harp-database • Carbon equivalent efficiency of new boiler must be better than existing boiler	• Manufacturer's guidelines • CE29 Domestic Heating by Oil: Boiler Systems – Guidance for Contractors and Specifiers • CE30 Domestic Heating by Gas: Boiler Systems – Guidance for Contractors and Specifiers • TGD J – Home Heating Appliances • DHLGH and SEAI *Guide to the condensing boiler installation assessment procedure for Existing Dwellings* • *Heating and Domestic Hot Water Systems for dwellings – Achieving compliance with Part L* • CIBSE – *Domestic Heating Design Guide* • *I.S. 10101 National Rules for Electrical Installations* • I.S. EN 12828 Heating systems in buildings - Design for water-based heating systems • I.S. EN 16510-1 solid fuel burning appliances • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI. • Good Practice Guide (GPG) 301 Controls for Domestic Heating and Hot Water – Choice of Fuel and System Type • I.S. 813 *Domestic Gas Installations* • CRU/20/088: CRU Criteria document '*The Regulation of Gas Installers with respect to safety*' • CRU Decision Paper – *Definition of the Scope of Controlled Works*
Boiler Service	• Must be competent to service a boiler and must be suitably qualified in accordance with manufacturer's guidelines and industry best practice as a minimum. • In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. • Registered Gas Installer (RGI) - RGI to issue a Completion Certificate or Declaration of Conformance Certificate for all completed gas works i.e. Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3). • For oil systems, should be registered with professional organisation such as OFTEC	• Manufacturer's guidelines • SEAI boiler service checklists Gas boiler checklist : www.seai.ie/.../Gas Boiler Service Checklist Oil boiler checklist: www.seai.ie/.../Oil Boiler Service Checklist • I.S. 813 Domestic Gas Installations (where applicable)	Boiler must be serviced as per • Manufacturer's guidelines • SEAI boiler service checklists • I.S. 813 *Domestic Gas Installations* (where applicable)

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Heating System Power Flush	• Registered Gas Installer (RGI) -RGI to issue a Completion Certificate or Declaration of Conformance Certificate for all completed gas works i.e. Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3). • Mechanically assisted powered cleanse and flush (power flushing) of a heating system must be suitably qualified in accordance with manufacturer's guidelines and industry best practice as a minimum. • NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. • For oil systems, should be registered with professional organisation such as OFTEC	BS 7593 *Code of practice for treatment of water in domestic hot water central heating systems*	Mechanically assisted powered cleanse and flush (power flushing) of a heating system must be performed as per • Manufacturer's guidelines • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI. • BS 7593 *Code of practice for treatment of water in domestic hot water central heating systems*
Heating System Power Flush and Magnetic Filter	• Registered Gas Installer (RGI) • -RGI to issue a Completion Certificate or Declaration of Conformance Certificate for all completed gas works i.e. Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3). • Must be competent to install magnetic filtration system to existing heating system. Must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum. • NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds • For oil systems, should be registered with professional organisation such as OFTEC	S.R. 50-1 "Building services - Code of Practice - Water based heating systems in dwellings"	Magnetic filtration system to existing heating system must be installed as per • Manufacturer's guidelines • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI. • S.R. 50-1 "Building services - Code of Practice - Water based heating systems in dwellings"

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Stoves: Solid Multi-Fuel Heating System	• Must be competent to install Multi Fuel Stoves in accordance document *BS 8303 "Installation of domestic heating and cooking appliances burning wood and solid mineral fuels. Specification"* and in accordance with *CE47 "Energy Efficiency Best Practice in Housing – Domestic heating by solid fuel: Boiler systems" published by the Energy Saving Trust* • Where the manufacturer operates an Approved Installer list, the Contractor must demonstrate their inclusion on the list	• I.S. EN 16510-1 Residential solid fuel burning appliances - General requirements and test methods. www.seai.ie/harp-database • Ecodesign Regulation (EU) 2016/2282 sets standards for the efficiency and emissions of solid fuel space heating appliances. • When installing a multi-fuel stove, a carbon monoxide (CO) alarm complying with I.S. EN 50291 should be provided. • I.S. EN 1856-2 (rigid or flexible metal flue liners) or I.S. EN 1857 (precast concrete flue liners).	Multi Fuel Stoves must be installed as per • Manufacturer's guidelines • I.S. EN 16510-1 Residential solid fuel burning appliances - General requirements and test methods. • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI. • *BS 8303 "Installation of domestic heating and cooking appliances burning wood and solid mineral fuels. Specification"* • *CE47 "Energy Efficiency Best Practice in Housing – Domestic heating by solid fuel: Boiler systems" published by the Energy Saving Trust* • I.S. 10101 National Rules for Electrical Installations • I.S. 813 *Domestic Gas Installations* • DHLGH "Heating and Domestic Hot Water Systems for Dwellings – Achieving compliance with Part L",
Gas fired room heaters	• Registered Gas Installer (RGI) -RGI to issue a Completion Certificate or Declaration of Conformance Certificate for all completed gas works i.e. Gas Contractors Domestic Certificates (GI D, GI 2, or GI 3). • Gas-fired room heaters must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum.	• Minimum gross efficiency of 65 % from accredited test body, HARP database or manufacturer's declaration. • I.S. 813 Domestic Gas Installation. • Clause 2.5 of the DHLGH 'Heating and Domestic Hot Water Systems for dwelling – Achieving Compliance with Part L' • BS 7977-1 'Specification for safety and rational use of energy of domestic gas appliances. Radiant/convectors' and • I.S. EN 613 Independent closed-fronted gas-fired heaters	• I.S. 813. *Domestic Gas Installation* • DHLGH '*Heating and Domestic Hot Water Systems for dwelling – Achieving Compliance with Part L*' • BS 7977-1 '*Specification for safety and rational use of energy of domestic gas appliances. Radiant/convectors'* • *I.S. 10101 National Rules for Electrical Installations* • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI. • carbon monoxide (CO) alarm complying with I.S. EN 50291 should be provided.
Storage Heaters - High Heat Retention	• High heat retention (HHR) electric storage heaters must be installed by an electrical Contractor in accordance with manufacturer's guidelines and industry best practice as a minimum. • Registered Electrical Contractor (REC)	• It must be replacing an existing electric storage heater. • It must be a whole dwelling solution. • New or replacement storage heaters should have a heat retention not less than 45 % as measured in accordance with I.S. EN 60531 (Household Electric Thermal Storage Room Heaters – Methods for Measuring Performance) • Heat retention must have been tested by an organisation accredited to test in accordance with I.S. EN 60531 or the testing must be endorsed by a body accredited to test in accordance with I.S. EN 60531 • It must include input and output controls • It also must include a timer and a room thermostat, controllable by the user.	High heat retention electric storage heater Installation must be installed as per • Manufacturer's guidelines • DOM 8: *Guide to the Design of Electric Space Heating Systems,* TEHVA or the manufacturer's sizing methodology. • *I.S. 10101 National Rules for Electrical Installations* • S.R. 54 – *Code of practice for the energy efficient retrofit of dwellings* • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI. • DHLGH '*Heating and Domestic Hot Water Systems for dwelling – Achieving Compliance with Part L*'.

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Heating Controls Fully Integrated	• Heating controls must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum. • In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. • If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor and a Completion Certificate must be issued.	**Heating Controls Fully Integrated:** • Dual zone with 24 hour 7-day Programmer (incl. remote access controls) – incorporating • a room thermostat • DHW cylinder thermostat, • motorised control valve and boiler interlock. I.S. EN IEC 60730-2-7 *"Automatic Electrical Controls for Household and similar Use Part 2-7: Particular Requirements for Timers and Time Switches"*	• Manufacturer's guidelines • Good Practice Guide GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE • CIBSE - *Domestic Heating Design Guide* • *I.S. 10101 National Rules for Electrical Installations* • I.S. EN 12828 Heating systems in buildings - Design for water-based heating systems • *Heating and Domestic Hot Water Systems for dwellings – Achieving compliance with Part L* • CE29 Domestic Heating by Oil: Boiler Systems – Guidance for Contractors and Specifiers • CE30 Domestic Heating by Gas: Boiler Systems – Guidance for Contractors and Specifiers • CRU Decision Paper – Definition of the Scope of Controlled Works • S.R. 54 *Code of Practice for the energy efficient retrofit of dwellings, NSAI* • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI.
Heating Controls: Additional Control Measures	• Additional control measures must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum. • NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. • If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor (REC) and a Completion Certificate # 3 must be issued.	• EN 60730-1 Automatic Electrical Controls for Household and similar Use • Other Relevant European or Irish Standards (if available)	• Manufacturer's guidelines • GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE • CIBSE – *Domestic Heating Design Guide* • *I.S. 10101 National Rules for Electrical Installations* • *Heating and Domestic Hot Water Systems for dwellings – Achieving compliance with Part L* • DHLGH *Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L* • CRU Decision Paper – Definition of the Scope of Controlled Works • S.R. 54 *Code of Practice for the energy efficient retrofit of dwellings, NSAI* • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI.

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Thermostatic Radiator Valves (TRVs)	• This control measure must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum. • In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds	I.S. EN 215 "*Thermostatic Radiator Valves - Requirements and Test Methods*"	• Manufacturer's guidelines • DHLGH *Heating and Domestic Hot Water Systems for Dwellings - Achieving Compliance with Part L* • NSAI's S.R. 54 *Code of Practice for the energy efficient retrofit of dwellings* • BS 7478 "*Guide to selection and use of thermostatic radiator valves"* • CIBSE - *Domestic Heating Design Guide* • GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE
Domestic Hot Water (DHW) Storage: High Heat Retention Cylinders	• NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. • Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. Hot water storage tanks must be - labelled with the EU energy label in accordance with Regulation (EU) 812/2013 on energy labelling for water heaters and hot water storage tanks - covered by the requirements of Regulation (EU) 814/2013 on Ecodesign requirements for water heaters and hot water storage tanks - CE marked. - Declaration of Performance and Conformity (DoPC) includes reference number of Regulation EU No 814/2013	• Vented copper hot water storage vessels should comply with the heat loss and heat exchanger requirements of I.S. EN 1566-1 "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly(vinyl chloride) (PVC-C). Specification for pipes, fittings and the system" or • BS 3198 "Specification for copper hot water storage combination units for domestic purposes" • Vented cylinders in materials other than copper should comply with the heat loss and heat exchanger requirements of BS 1566-1 • Unvented hot water storage system products should: – comply with I.S. EN. 12897 '*Water supply. Specification for indirectly heated unvented (closed) storage water heaters*'; CE Mark or Irish Agrément Certified; or certified by another accredited body as complying with Irish Building Regulations • Unvented systems should not be used with gravity circulation • Clause 5.3 of the DHLGH document – "*Heating and Domestic Hot Water Systems for Dwellings – Achieving Compliance with Part L*" must be adhered to.	• I.S. EN 1566-1 "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly(vinyl chloride) (PVC-C). Specification for pipes, fittings and the system" • BS 3198 "Specification for copper hot water storage combination units for domestic purposes" • I.S. EN. 12897 '*Water supply. Specification for indirectly heated unvented (closed) storage water heaters'* • I.S. EN 14336 "Heating systems in buildings. Installation and commissioning of water-based heating systems" and the requirements of the system suppliers' specifications. • IS EN 12828 '*Heating systems in buildings. Design for water-based heating systems'* • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI. • Micro generation Installation Standard: *MIS 3004 Requirements for Contractors Undertaking the Supply, Design, Installation, Set to Work, Commissioning and Handover of Solid Biofuel Heating Systems* • TR38 *Guide to Good Practice – Installation of Biofuel Heating* (Heating and Ventilation Contractors' Association) • I.S. EN 12831-1 Energy Performance of Buildings - Calculation of the Design Heat Load - Space Heating Load CIBSE – *Domestic Heating Design Guide* • Minimising the risk of Legionnaires disease, CIBSE TM13

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Immersion Heater with thermostatic controls and timers	• This control measure must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum. • In addition, they must hold a NFQ Level 6 National Craft Certificate in Plumbing or an equivalent Plumbing qualification such as City and Guilds. Plumbers must have completed an electrical module during their course to carry out the 'minor' electrical works involved in specific control measures. • If 'Controlled Works', as defined by the CRU document 'Definition of the Scope of Controlled Works' are required, then these works must be carried out by a Registered Electrical Contractor (REC) and a Completion Certificate # 3 must be issued.	EN 60730-1 *Automatic Electrical Controls for Household and similar Use*	• Manufacturer's guidelines • GPG 302 Controls for Domestic Central Heating and Hot Water – Guidance for Specifiers and Installers, Energy Savings Trust and BRE • *I.S. 10101 National Rules for Electrical Installations* • CRU Decision Paper – Definition of the Scope of Controlled Works • *Heating and Domestic Hot Water Systems for dwellings – Achieving compliance with Part L* • S.R. 54 *Code of Practice, NSAI* • S.R. 50 Series on Standards for Modern Plumbing and Heating, NSAI.
Space Heating and Domestic Hot Water: adding an additional Zone Control	Refer to Clause 6.13.2 or Heating Controls Fully Integrated: Dual zone with 24 hour 7-day Programmer (incl. remote access controls) – incorporating a room thermostat, DHW cylinder thermostat, motorised control valve and boiler interlock.	Refer to Clause 6.13.2	Refer to Clause 6.13.2
Electric Energy and Shower Energy Monitors	Energy monitors shall be installed to manufacturer's recommendations.	Electricity Energy Monitor: • Includes inhouse display connected to electricity meter (e.g. linked via clamp-on transmitter) of real time energy and cost consumption: • Individual single point energy monitors i.e. three pin plug energy displays are not eligible as they do not display the overall energy consumption of the dwelling Shower Energy Monitor • Energy monitor complete with display connected to a shower (e.g. connected to the shower hose) • Must display real time energy consumption and should display water usage and hot water temperature.	• MPRN must be submitted with application for Energy Credits for electricity energy monitors • Install to manufacturer's recommendations. • I.S. 10101 National Rules for Electrical Installations

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Solar water heating systems (aka "solar thermal")	• NFQ Level 6 Certificate in Domestic Solar Hot Water Systems or an equivalent qualification. - National Craft Certificate in a relevant trade (Electrical, Plumbing or Fitting) or a NFQ Level 6 qualification in a related area such as Building Services, G.I.D. etc. Support for contractors www.seai.ie/contractors-and-suppliers/supports-for-contractors	• CE Mark to demonstrate compliance with the Low Voltage Directive (LVD 2014/35/EU) • SEAI Solar Thermal Registered Product List www.seai.ie/resources/publications/Solar-Thermal-Registered-Product-List.pdf - The products on this Registered Product list for Solar Collectors have been tested in accordance with ○ I.S. EN 12975 Solar collectors - General requirements ❖ Performance Test Report ❖ Durability Test **OR** ○ I.S. EN ISO 9806 Solar Energy - Solar Thermal Collectors - Test Methods • Homeowner supplied with a Manufacturer's warranty	• NSAI document S.R. 50-2 "*Building services – Code of practice – Part 2: Thermal solar systems*" • *I.S. 10101 National Rules for Electrical Installations* • *Heating and Domestic Hot Water Systems for dwellings – Achieving compliance with Part L* • *Solar Heating Design and Installation Guide* – CIBSE Guide • Minimising the risk of Legionnaires disease, CIBSE TM13 ❖ Solar fraction method of calculating the energy yield per solar system is as per Appendix H: Solar Water Heating in the DEAP Manual ❖ Solar Hot Water Compliance Calculator for achieving compliance with the solar thermal measure requirements. ❖ SEAI tools and calculators are available on the SEAI website, www.seai.ie/tools
Solar Electricity Photovoltaic (PV) Systems	Solar Photovoltaic (PV) modules shall meet the SEAI's Domestic Solar Photovoltaic - Code of Practice for Installers www.seai.ie/SPV-Code-of-Practice.	Solar Photovoltaic (PV) modules shall meet the SEAI's Domestic Solar Photovoltaic - Code of Practice for Installers • www.seai.ie/SPV-Code-of-Practice.	• ESBN Microgeneration Application • SEAI's Domestic Solar Photovoltaic - Code of Practice for Installers www.seai.ie/SPV-Code-of-Practice.
Lighting - LED	Contractors installing LED luminaires and LED lamps must be competent to complete the installation.	• Ecodesign Regulation (EU) 2019/2020 LED luminaires: • I.S. EN 13032-1 and I.S. EN 13032-2 "Light and lighting – Measurement and presentation of photometric data of lamps and Luminaires" OR • ANSI / IES LM-79-24 Optical and Electrical Measurements of Solid-State Lighting Products LED lamps: • ANSI / IES LM-79-24 Optical and Electrical Measurements of Solid-State Lighting Products	• LED luminaires and LED lamps must be installed as per manufacturer's guidelines • I.S. EN IEC 60598-1 specifies general safety requirements for luminaires

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Chimney Draught Limiter	Must be competent to install a Chimney Draught Limiter. Must be installed by competent persons in accordance with manufacturer's guidelines and industry best practice as a minimum.	• BS 1251 'Specification for open-fireplace components' • I.S. EN 1856-2 (rigid or flexible metal flue liners) or I.S. EN 1857 (precast concrete flue liners). If required.	• Chimney Draught Limiter must be installed as per manufacturer's guidelines • Temporary draught limiters are not included in this measure.
Draught-Proofing	Must be competent to install draught-proofing in accordance with BS 7386 "*Specification for draughtstrips for the draught control of existing doors and windows in housing*".	• The draught-proofing system must be manufactured to relevant IS, BS or EN standard • Installed as per manufacturer's instructions • Measures include: - Letterbox seals - Door-bottom brushes - Window draught stripping - Door draught stripping - Attic access hatch draught proofing	The insulation must be installed as per manufacturer's guidelines. Clause 6.22 details a several steps for each of the types of draught proofing to be installed. - Letter box and letter plate aperture, security, and design are in conformance with I.S. EN 13724.
Window Replacement	Must be competent to install windows in accordance with *BS 8213-4 "Code of practice for the survey and installation of windows and external doorsets"* and the manufacturer's guidelines as a minimum requirement. In accordance with I.S. EN 14351-1 Manufacturers must provide: - Declaration of Performance and Conformity (DoPC) - CE marking - Installation instructions - Maintenance requirements - Test reports - Technical documentation	• CE Mark • I.S. EN 14351-1 "Windows and doors - Product standard, performance characteristics - Windows and external pedestrian doorsets". • U-value requirement of 1.4 W/m^{2}K or better. **Guidance** • U-values derived according to - IS EN ISO 12567 Thermal performance of windows and doors – Determination of thermal transmittance by hot box method – Part 1: Complete windows and doors or - IS EN ISO 10077 (Parts 1 and 2) Thermal performance of windows, doors and shutters • NSAI Window Energy Performance (WEP) certification, WER (Window Energy Rating), BRFC (British Fenestration Rating Council) • Insulating glass units (IGU) must meet the durability requirements of I.S. EN 14351-1 - I.S. EN 1279-1 "Glass in Building - Insulating glass units: Generalities, system description, rules for substitution, tolerances and visual quality" I.S. EN 1279-2 "Glass in building - Insulating glass units: Long term test method and requirements for moisture penetration"	The window must be installed as per • Manufacturer's guidelines • I.S. EN 17037 Daylight in Buildings • BS 8213-4 "Code of practice for the survey and installation of windows and external doorsets" • "Design for improved solar shading control" CIBSE TM37 • BS 6262-4 Glazing for buildings. Code of practice for safety related to human impact • BS 8000-0 Workmanship on construction sites. Introduction and general principles **Guidance** - TGD B (Vol 2) Fire Safety Clause 1.3.7.1 (a) to (e) and TGD B Clause 1.3.7.2 - TGD C Site Preparation and Resistance to Moisture - TGD D Clause 1.5 Glazing - TGD F Ventilation Clause 1.2.4.5 - TGD K Clauses 2.2 to 2.9 - TGD L Clause 0.2.2 Fire Safety S.R. 54 Clause 8.3.2.6 and 8.3.6.3.2.

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Window Glazing Low-E	• Must be competent to complete the installation • Must complete the work in accordance with the manufacturer's guidelines. • Must be trained and registered by the manufacturer.	• CE Mark • I.S. EN 410 Glass in building. Determination of luminous and solar characteristics of glazing • U-value requirement of 2.4 W/m^{2}K or better for double glazing 3.5 W/m^{2}K or better for single glazing.	The Window Glazing Envelope must be installed as per • Manufacturer's guidelines • I.S. EN 17037 Daylight in Buildings
Window Secondary Glazing	Must be competent to install Window Secondary Glazing in accordance with *BS 8213-4 "Code of practice for the survey and installation of windows and external doorsets"* and the manufacturer's guidelines as a minimum requirement and BS 8000-0 *Workmanship on construction sites. Introduction and general principles* In accordance with I.S. EN 14351-1 Manufacturers must provide: - Declaration of Performance and Conformity (DoPC) - CE marking - Installation instructions - Maintenance requirements - Test reports - Technical documentation	• I.S. EN 14351-1 "Windows and doors - Product standard, performance characteristics - Windows and external pedestrian doorsets". • U-value requirement of 2.1 W/m^{2}K or better. • Window Secondary Glazing guidance I.S. EN 1279-1 "Glass in Building - Insulating glass units - Generalities, system description, rules for substitution, tolerances and visual quality" • I.S. EN 1279-2 "Glass in building - Insulating glass units Part 2: Long term test method and requirements for moisture penetration" • I.S. EN 410 Glass in building. Determination of luminous and solar characteristics of glazing • I.S. EN 673 Glass in building. Determination of thermal transmittance (U value). Calculation method • I.S. EN 17037 Daylight in Buildings • I.S. EN 12898 Glass in building. Determination of the emissivity	Window Secondary Glazing must be installed as per • Manufacturer's guidelines • I.S. EN 17037 Daylight in Buildings • BS 8213-4 "Code of practice for the survey and installation of windows and external doorsets" • BS 6262-4 Glazing for buildings. Code of practice for safety related to human impact • BS 8000-0 Workmanship on construction sites. Introduction and general principles
Door Replacement	Must be competent to install doors in accordance with *BS 8213-4 "Code of practice for the survey and installation of windows and external doorsets"* and the manufacturer's guidelines as a minimum requirement. In accordance with I.S. EN 14351-1 Manufacturers must provide: - Declaration of Performance and Conformity (DoPC) - CE marking - Installation instructions - Maintenance requirements - Test reports - Technical documentation	• I.S. EN 14351-1 "Windows and doors - Product standard, performance characteristics - Windows and external pedestrian doorsets". • U-value requirement of 1.4 W/m^{2}K or better. • U-values derived according to IS EN ISO 12567 Thermal performance of windows and doors – Determination of thermal transmittance by hot box method – Part 1: Complete windows and doors or IS EN ISO 10077 (Parts 1 and 2) Thermal performance of windows, doors and shutters • BS 6262-4 Glazing for buildings. Code of practice for safety related to human impact • Other Guidance_ PAS 24 standard measures the resistance of windows and doors to forced entry.	The external door must be installed as per • Manufacturer's guidelines • I.S. EN 17037 Daylight in Buildings • I.S. EN 13724 requirements for the aperture, security, and design of private letter boxes and letter plates. • BS 8000-0 Workmanship on construction sites. Introduction and general principles • BS 8213-4 "Code of practice for the survey and installation of windows and external doorsets"

Measure	Installer Competence	Product Standards and Specification	Installation Standards and Specification
Home Energy Assessment (HEA) Report	Contractors are required to submit a Home Energy Assessment (HEA) Report in accordance with a specific Programme.	Home Energy Assessment (HEA) includes:- • Building Energy Rating (BER) assessment with published BER including the Advisory Report. • Technical Design report on the energy efficiency of a home. - Details include ventilation/airtightness strategy, fabric design, plumbing and heating design considerations. • Details on the home energy upgrade measures needed to get a home to a BER rating of 'B', or better. • Heat Pump Technical Assessment detailing the home energy upgrades required to make a home suitable for a heat pump. Refer to Clause 6.8 • A report explaining how the recommended home energy upgrades will improve the comfort of a home and help to reduce energy bills. • An estimate of the costs of the recommended home energy upgrades.	As per Clause 6.29 Home Energy Assessment (HEA) Report
Electric Vehicle (EV) Chargers	Registered Electrical Contractors (REC) must be registered with Safe Electric https://safeelectric.ie/find-an-electrician/.	The Electric Vehicle (EV) Home Charger system must meet the following criteria: • I.S. EN IEC 61851 – *Electric vehicle conductive charging system* • I.S. EN 62196-1 – *Plugs, socket-outlets, vehicle couplers and vehicle inlets – Conductive charging of electric vehicles* • CE Mark to demonstrate compliance with the Low Voltage Directive (LVD 2014/35/EU) • 768/2008/EC – *The affixing and use of the CE conformity marking* • 2014/30/EU - Electromagnetic Compatibility (EMC) conformity assessment and certification Directive • Directive (EU) 2024/884 - Waste Electrical and Electronic Equipment (WEEE) Directive	• All systems must be installed to manufacturer's guidelines. • Only one EV charger may be installed per property. • All electrical work must comply with I.S. 10101 National Rules for Electrical Installations. A Completion Certificate No.3 is required to evidence of compliance. • The Homeowner should have a PIR report on the existing electrical installation of the home prior to the purchase and installation of an EV home charger.

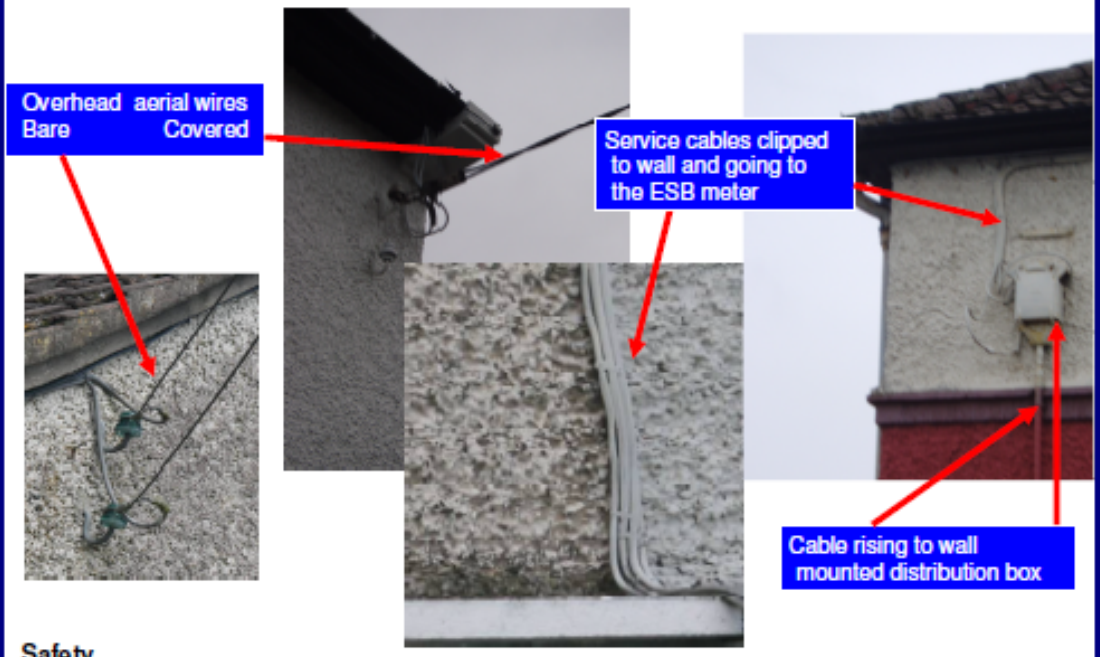
Appendix 3: ESB Networks Guidance Documents

Networks
Serving all electricity customers

EXTERNAL WALL INSULATION
Guidelines for Homeowners and Contractors on ESB Networks requirements and charges

Introduction

Houses which are suitable for external wall insulation are in most instances connected to the ESB network by either, an overhead aerial wire(s) or a wall mounted distribution box. Surface mounted service cables are then used to complete the connection to the Electricity Meter position. Examples of each are shown in the following photographs:



Safety

For Health and Safety reasons - including fire safety, External Wall Insulation or other materials MUST NOT be placed over ESB Networks electricity cables or fixtures.

Where the electricity supply to a house is attached to external walls or soffits, as shown in the photographs above, ESB Networks must be contacted to arrange for the required alteration. The insulation contractor or other third party must not attempt to remove or touch any service cable, aerial wires or other fixtures belonging to ESB Networks. Only ESB trained and approved personnel are permitted to alter or work on these cables/wires.

Sustainable Energy Authority of Ireland (SEAI)

SEAI's Terms and Conditions for grant approvals require compliance with this Guideline.
SEAI's '**Contractors Code of Practice and Standards and Specification Guidelines**' under the '**Better Energy Homes Scheme**' also specifies the need for full compliance with this Guideline. A set of drawings showing technical specifications titled '**External Wall Insulation**' also form part of the Code of Practice and should be referred to for guidance.

Charge for Service Alterations

ESB Networks apply a standard charge where the service cables / aerial wires etc. to a domestic house have to be altered. This charge, which is approved by the Commission for Energy Regulation, is €397 payable in advance and is subject to change.

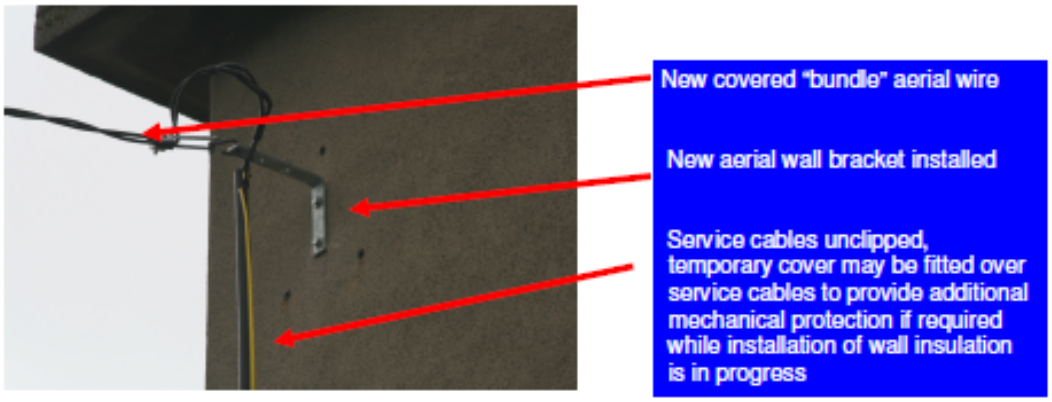
Contacting ESB Networks

ESB Networks can be contacted by calling **1850-372-757**. The **M**eter **P**oint **R**eference **N**umber (**MPRN**) for the property where the work is being carried out is required by the Call Centre when logging a service alteration request. The **MPRN** number can be found on your electricity bill directly beneath the ESB Networks emergency phone number. **ESB Networks require a minimum notice of 5 working days from receipt of payment for a site visit.**

Site Visit

As part of the initial site visit, ESB Networks will carry out all preliminary work **to allow the wall insulation work to commence.** This preliminary work will include:

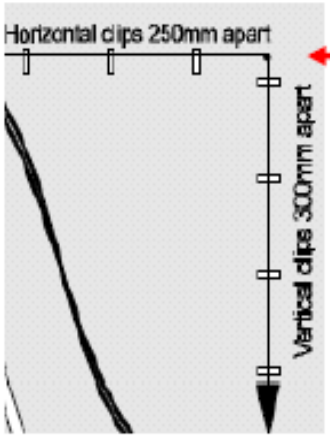
- **Unclipping of existing service cables** (and replacement of cables where required)
- **Removal of anchor insulators and the fitting of a new extended aerial bracket**
- **Installation of new covered "bundle" aerial wire if the existing aerial wire is bare or PVC covered (See photograph below)**
- **Fit lead in pipe if required**



Reinstatement of Service Cables

The homeowner or contractor must notify ESB Networks as soon as the work is complete. The contractor is required to fit non load bearing fixing elements for cable clips along the service route to enable ESB Networks to re-clip the service. These fixing elements should be spaced at 250mm intervals for horizontal runs and 300mm for vertical runs. They must have sufficient strength to support the service cable. The contractor shall mark the location of these fixing elements on the finished render to avoid the risk of damage to the render during re-clipping. For Safety reasons ESB Network service cables **must not** come into contact with un-rendered insulation materials. A lead in pipe is required where the service cables pass through insulation to the meter position. ESB Networks will supply and fit this where required.

Alternatively: The service cable can be placed in a 50mm by 50mm UPVC trunking. **The contractor is responsible for supplying and fitting this trunking.** The trunking must be securely fixed with non load bearing fixing elements. **Trunking fixed with an adhesive backing is not acceptable.**

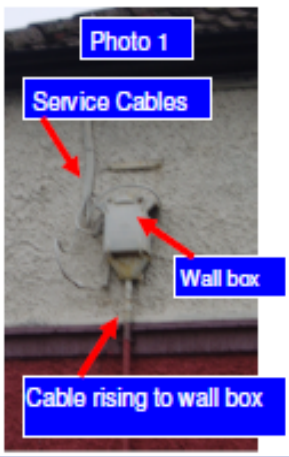


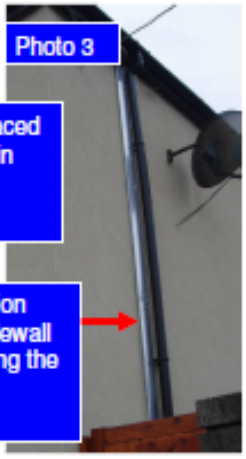
Spacing of non load bearing fixing elements for reinstating service cables to finished render.

Alternatively the service cables can be enclosed in UPVC trunking.

Wall Distribution Box

In some urban situations a Wall Distribution Box will be found at an elevated level instead of overhead aerial wire(s). **ESB Networks must be contacted to remove this box before external wall insulation is fitted.** The three photographs below show the stages involved in replacing a Wall Distribution Box. Photo 1 shows an existing Wall Distribution Box. The Wall Box is connected to the ESB underground network by a surface mounted cable. The electricity supply to a number of houses is taken from the box. Photos 2 and 3 show the existing surface mounted cable and Wall Distribution Box replaced with a new cable enclosed in a 100 x100mm steel trunking (supplied by ESB Networks). The steel trunking is mounted on a timber backing. **The timber backing must be supplied and fitted by the contractor carrying out the external wall insulation**. The wall insulation and finished render cover the sidewall of the steel trunking. The lid of the trunking must not be covered as this provides access for ESB to their cables (photo 3). Ground excavation for connecting the cable is normally located on the property, but it may be necessary to locate this trench on the public footpath.





Outdoor Meter Cabinet

Where an outdoor meter cabinet exists, the ESB Networks equipment in the meter cabinet may be connected to the Network by:

1. **Overhead aerial wires and service cable or a wall mounted box and service cable** (see photos on Page 1)
2. **An underground service cable** (from a pole or ground mounted pillar or buried mains cable)

Where the connection to the cabinet is by means of an underground service cable which runs within the wall cavity along its full length from the cabinet to the network, then it is not necessary to contact ESB Networks before proceeding with the external wall insulation. However, care must be exercised when drilling or attaching fixings under or in the vicinity of the cabinet, to ensure that electric cables within the cavity are not damaged.

In any situation where the connection from the ESB network to the meter involves any cables, wires or other fixtures that are attached to an external wall or soffit, then ESB Networks must be contacted to carry out the required alteration.

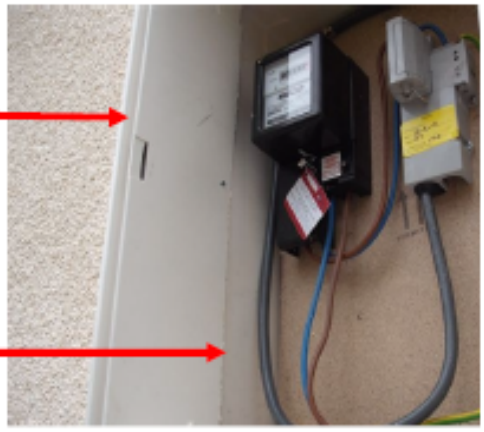
Do not attempt to move the existing cabinet. Doing so will disturb the existing connections and increase the risk of damage to the cables creating a potential fire hazard.

Meter Cabinet Door

The contractor must modify the existing meter cabinet in order to fill the recess created by the fitting of external wall insulation. This is done by removing the door from the existing cabinet and cutting away the back from a new cabinet. The new cabinet is then placed in the recess with the sidewalls of the new and old cabinets overlapping. Accurate fitting is essential to "seal off" the wall insulation from the inner cabinet. The photograph below shows a modified cabinet fitted to an existing meter cabinet.

New meter cabinet with back removed is placed into existing cabinet.

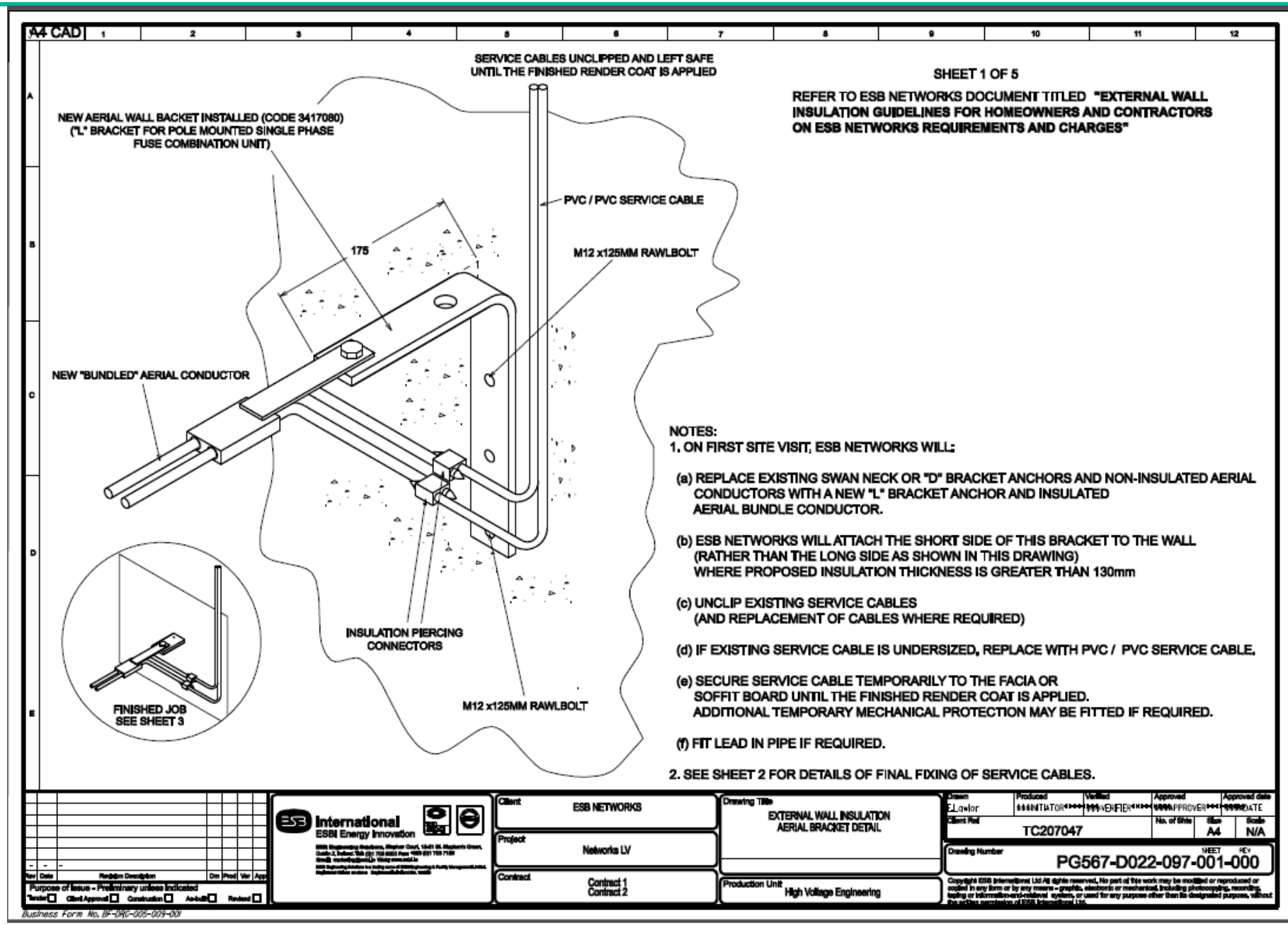
The sidewalls of the new cabinet overlap the sidewalls of the existing cabinet to seal off the wall insulation from the inner cabinet

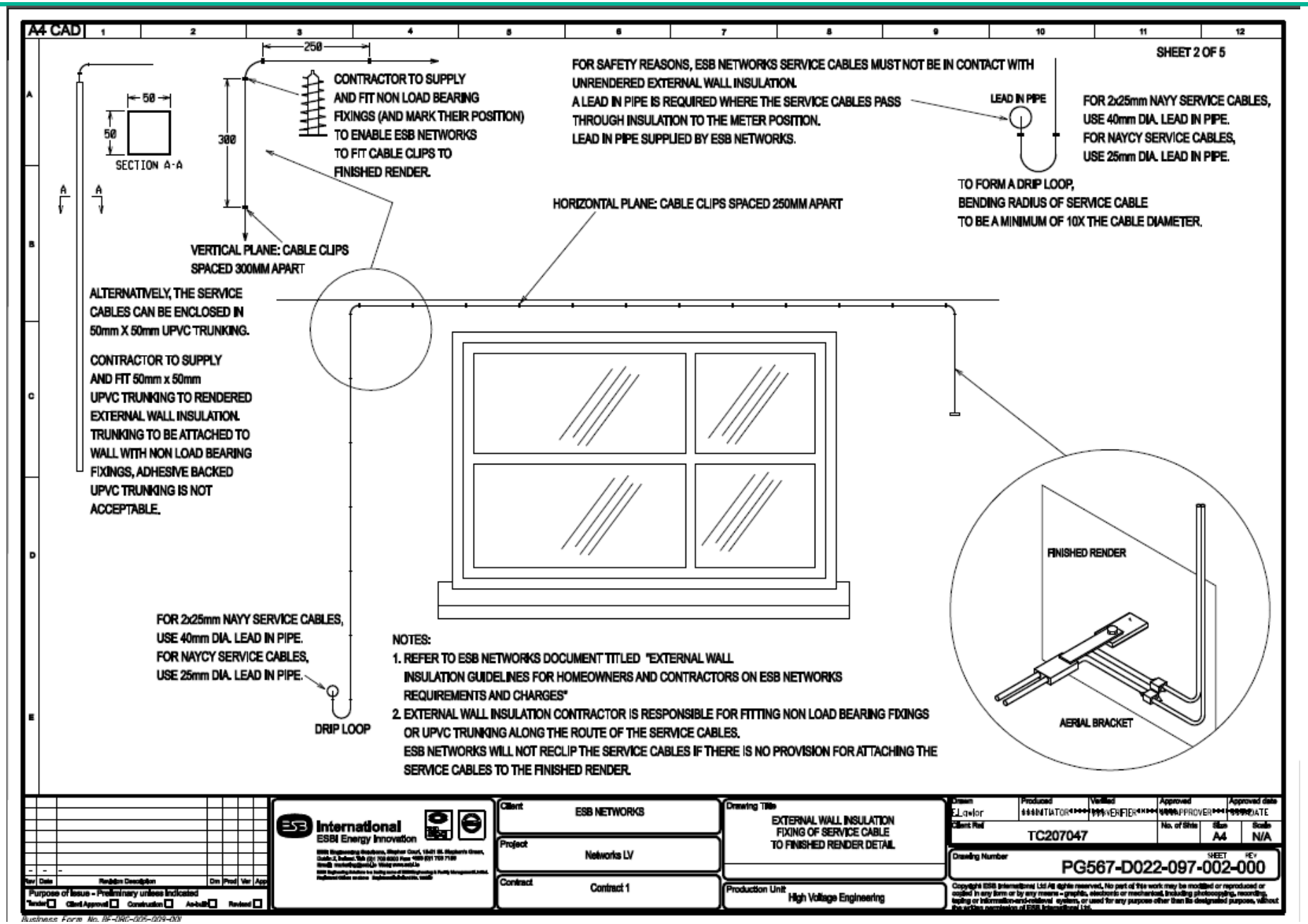


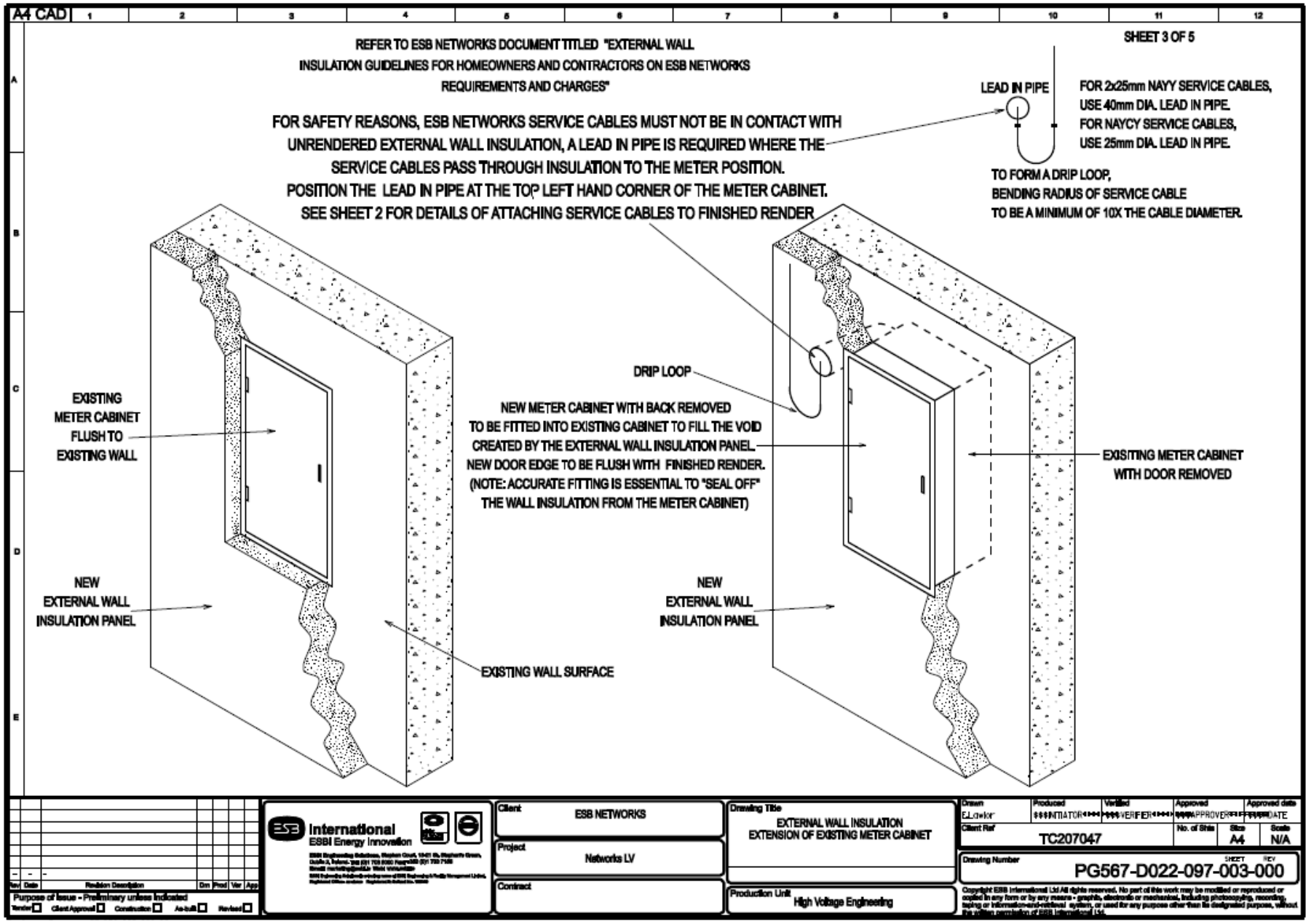
Meter cabinets are manufactured to a specific standard to give protection in the event of fire. Do not use alternative materials to modify the meter cabinet.

Revision 3 DOC-290509-AWY Issued 16th May 2012

Issued by: Transmission and Distribution Lines Section Asset Management, ESB Networks


A4 CAD
SERVICE CABLES UNCLIPPED AND LEFT SAFE UNTIL THE FINISHED RENDER COAT IS APPLIED
SHEET 1 OF 5
REFER TO ESB NETWORKS DOCUMENT TITLED "EXTERNAL WALL INSULATION GUIDELINES FOR HOMEOWNERS AND CONTRACTORS ON ESB NETWORKS REQUIREMENTS AND CHARGES"
NEW AERIAL WALL BACKET INSTALLED (CODE 3417080) ("L" BRACKET FOR POLE MOUNTED SINGLE PHASE FUSE COMBINATION UNIT)
PVC / PVC SERVICE CABLE
175
M12 x125MM RAWLBOLT
NEW "BUNDLED" AERIAL CONDUCTOR
INSULATION PIERCING CONNECTORS
M12 x125MM RAWLBOLT
FINISHED JOB SEE SHEET 3
NOTES:
1. ON FIRST SITE VISIT, ESB NETWORKS WILL:
(a) REPLACE EXISTING SWAN NECK OR "D" BRACKET ANCHORS AND NON-INSULATED AERIAL CONDUCTORS WITH A NEW "L" BRACKET ANCHOR AND INSULATED AERIAL BUNDLE CONDUCTOR.
(b) ESB NETWORKS WILL ATTACH THE SHORT SIDE OF THIS BRACKET TO THE WALL (RATHER THAN THE LONG SIDE AS SHOWN IN THIS DRAWING) WHERE PROPOSED INSULATION THICKNESS IS GREATER THAN 130mm
(c) UNCLIP EXISTING SERVICE CABLES (AND REPLACEMENT OF CABLES WHERE REQUIRED)
(d) IF EXISTING SERVICE CABLE IS UNDERSIZED, REPLACE WITH PVC / PVC SERVICE CABLE.
(e) SECURE SERVICE CABLE TEMPORARILY TO THE FACIA OR SOFFIT BOARD UNTIL THE FINISHED RENDER COAT IS APPLIED. ADDITIONAL TEMPORARY MECHANICAL PROTECTION MAY BE FITTED IF REQUIRED.
(f) FIT LEAD IN PIPE IF REQUIRED.
2. SEE SHEET 2 FOR DETAILS OF FINAL FIXING OF SERVICE CABLES.
Purpose of Issue - Preliminary unless indicated
Tender Client Approval Construction As-built Revised
ESB International
ESBI Energy Innovation
Client ESB NETWORKS
Project Networks LV
Contract Contract 1 Contract 2
Drawing Title EXTERNAL WALL INSULATION AERIAL BRACKET DETAIL
Production Unit High Voltage Engineering
Drawn S.Lawlor
Client Ref TC207047
Size A4
Scale N/A
Drawing Number PG567-D022-097-001-000
Business Form No. BF-DRC-005-009-001


A4 CAD
SHEET 2 OF 5
250
50
50
SECTION A-A
300
CONTRACTOR TO SUPPLY AND FIT NON LOAD BEARING FIXINGS (AND MARK THEIR POSITION) TO ENABLE ESB NETWORKS TO FIT CABLE CLIPS TO FINISHED RENDER.
FOR SAFETY REASONS, ESB NETWORKS SERVICE CABLES MUST NOT BE IN CONTACT WITH UNRENDERED EXTERNAL WALL INSULATION.
A LEAD IN PIPE IS REQUIRED WHERE THE SERVICE CABLES PASS THROUGH INSULATION TO THE METER POSITION.
LEAD IN PIPE SUPPLIED BY ESB NETWORKS.
LEAD IN PIPE
FOR 2x25mm NAYY SERVICE CABLES, USE 40mm DIA. LEAD IN PIPE.
FOR NAYCY SERVICE CABLES, USE 25mm DIA. LEAD IN PIPE.
TO FORM A DRIP LOOP, BENDING RADIUS OF SERVICE CABLE TO BE A MINIMUM OF 10X THE CABLE DIAMETER.
HORIZONTAL PLANE: CABLE CLIPS SPACED 250MM APART
VERTICAL PLANE: CABLE CLIPS SPACED 300MM APART
ALTERNATIVELY, THE SERVICE CABLES CAN BE ENCLOSED IN 50mm X 50mm UPVC TRUNKING.
CONTRACTOR TO SUPPLY AND FIT 50mm x 50mm UPVC TRUNKING TO RENDERED EXTERNAL WALL INSULATION. TRUNKING TO BE ATTACHED TO WALL WITH NON LOAD BEARING FIXINGS, ADHESIVE BACKED UPVC TRUNKING IS NOT ACCEPTABLE.
FINISHED RENDER
AERIAL BRACKET
FOR 2x25mm NAYY SERVICE CABLES, USE 40mm DIA. LEAD IN PIPE.
FOR NAYCY SERVICE CABLES, USE 25mm DIA. LEAD IN PIPE.
DRIP LOOP
NOTES:
1. REFER TO ESB NETWORKS DOCUMENT TITLED "EXTERNAL WALL INSULATION GUIDELINES FOR HOMEOWNERS AND CONTRACTORS ON ESB NETWORKS REQUIREMENTS AND CHARGES"
2. EXTERNAL WALL INSULATION CONTRACTOR IS RESPONSIBLE FOR FITTING NON LOAD BEARING FIXINGS OR UPVC TRUNKING ALONG THE ROUTE OF THE SERVICE CABLES.
ESB NETWORKS WILL NOT RECLIP THE SERVICE CABLES IF THERE IS NO PROVISION FOR ATTACHING THE SERVICE CABLES TO THE FINISHED RENDER.
Purpose of Issue - Preliminary unless Indicated
ESB International
ESBI Energy Innovation
Client ESB NETWORKS
Project Networks LV
Contract Contract 1
Drawing Title EXTERNAL WALL INSULATION FIXING OF SERVICE CABLE TO FINISHED RENDER DETAIL
Production Unit High Voltage Engineering
Drawn EJaylor
Client Ref TC207047
Size A4
Scale N/A
Drawing Number PG567-D022-097-002-000


A4 CAD
SHEET 3 OF 5
REFER TO ESB NETWORKS DOCUMENT TITLED "EXTERNAL WALL INSULATION GUIDELINES FOR HOMEOWNERS AND CONTRACTORS ON ESB NETWORKS REQUIREMENTS AND CHARGES"
FOR SAFETY REASONS, ESB NETWORKS SERVICE CABLES MUST NOT BE IN CONTACT WITH UNRENDERED EXTERNAL WALL INSULATION, A LEAD IN PIPE IS REQUIRED WHERE THE SERVICE CABLES PASS THROUGH INSULATION TO THE METER POSITION.
POSITION THE LEAD IN PIPE AT THE TOP LEFT HAND CORNER OF THE METER CABINET.
SEE SHEET 2 FOR DETAILS OF ATTACHING SERVICE CABLES TO FINISHED RENDER
LEAD IN PIPE
FOR 2x25mm NAYY SERVICE CABLES, USE 40mm DIA. LEAD IN PIPE.
FOR NAYCY SERVICE CABLES, USE 25mm DIA. LEAD IN PIPE.
TO FORM A DRIP LOOP, BENDING RADIUS OF SERVICE CABLE TO BE A MINIMUM OF 10X THE CABLE DIAMETER.
EXISTING METER CABINET FLUSH TO EXISTING WALL
NEW EXTERNAL WALL INSULATION PANEL
EXISTING WALL SURFACE
DRIP LOOP
NEW METER CABINET WITH BACK REMOVED TO BE FITTED INTO EXISTING CABINET TO FILL THE VOID CREATED BY THE EXTERNAL WALL INSULATION PANEL.
NEW DOOR EDGE TO BE FLUSH WITH FINISHED RENDER.
(NOTE: ACCURATE FITTING IS ESSENTIAL TO "SEAL OFF" THE WALL INSULATION FROM THE METER CABINET)
NEW EXTERNAL WALL INSULATION PANEL
EXISTING METER CABINET WITH DOOR REMOVED
Purpose of Issue - Preliminary unless Indicated
Tender Client Approval Construction As-built Revised
ESBI International
ESBI Energy Innovation
Client ESB NETWORKS
Project Networks LV
Contract
Drawing Title EXTERNAL WALL INSULATION EXTENSION OF EXISTING METER CABINET
Production Unit High Voltage Engineering
Drawn EJ.Lawlor
Produced INITIATOR
Verified VERIFIER
Approved APPROVER
Approved date DATE
Client Ref TC207047
No. of Shts
Size A4
Scale N/A
Drawing Number PG567-D022-097-003-000
SHEET
REV
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A4 CAD

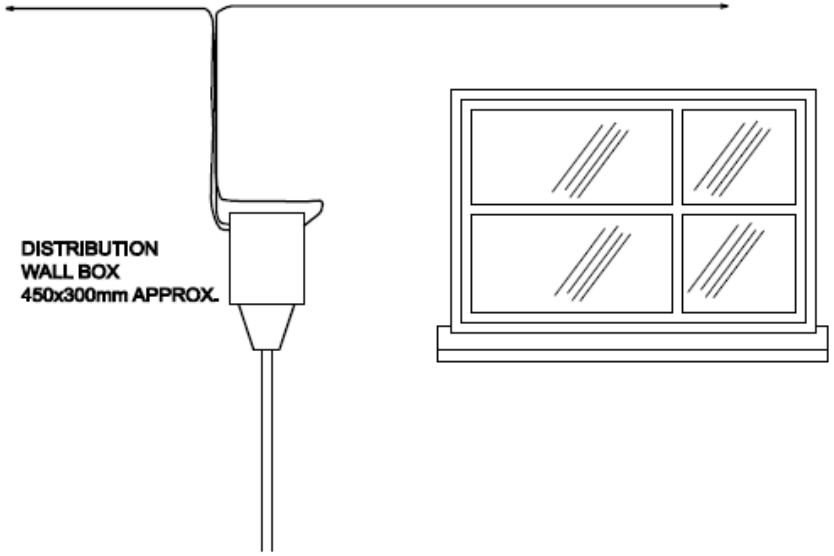
REFER TO ESB NETWORKS DOCUMENT TITLED "EXTERNAL WALL INSULATION GUIDELINES FOR HOMEOWNERS AND CONTRACTORS ON ESB NETWORKS REQUIREMENTS AND CHARGES"

SHEET 4 OF 5

EXISTING CONNECTION TO ESB NETWORK

ESB NETWORKS DISTRIBUTION WALL BOX,
MAINS & SERVICE CABLES SURFACE MOUNTED
ON EXISTING WALL.

SERVICE CABLES TO MULTIPLE HOUSES
CONNECTED TO DISTRUBUTION WALL BOX.

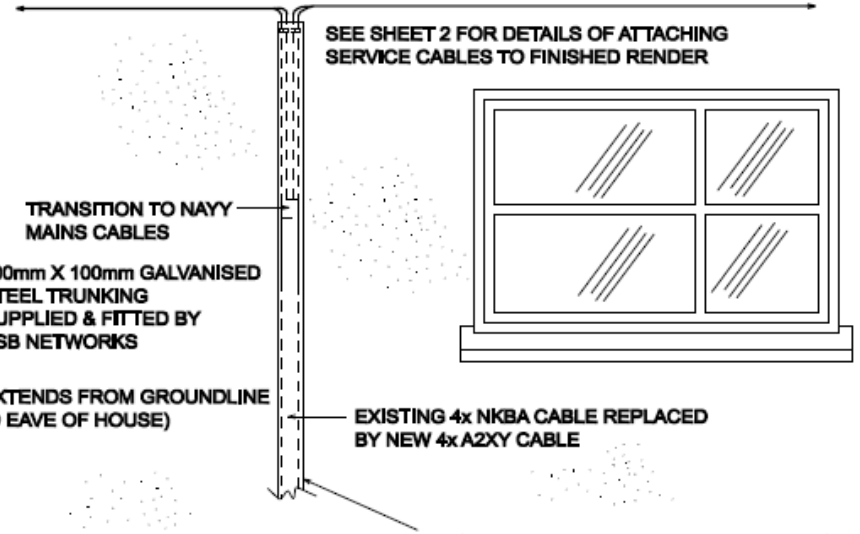


EXISTING WALL BOX, MAINS CABLE FROM UNDERGROUND
NETWORK & SERVICE CABLES TO A NUMBER OF HOUSES

NEW CONNECTION TO ESB NETWORK

SURFACE MOUNTED DISTRIBUTION WALL BOX REMOVED,
MAIN CABLE ENCLOSED IN 100mm X 100mm GALVANISED
STEEL TRUNKING, TRUNKING PROJECTS A MINIMUM
OF 15mm BEYOND FINISHED RENDER.

SERVICE CABLES FOR MULTIPLE HOUSES
CONNECTED TO MAINS CABLES IN TRUNKING.



WALL BOX REPLACED BY GALVANISED TRUNKING & MAINS CABLE FROM UNDERGROUND
NETWORK & SERVICE CABLES TO A NUMBER OF HOUSES

Rev	Date	Revision Description	Drn	Prod	Ver	App		
-	-	-						

Purpose of Issue - Preliminary unless indicated
Tender ☐ Client Approval ☐ Construction ☐ As-built ☐ Revised ☐

ESB International
ESBI Energy Innovation

Client: ESB NETWORKS
Project: Networks LV
Contract:

Drawing Title: EXTERNAL WALL INSULATION
REPLACEMENT OF DISTRIBUTION BOX,
& FITTING 100mm X 100mm GALVANISED TRUNKING

Production Unit: High Voltage Engineering

Drawn	Produced	Verified	Approved	Approved date
CLaylor	INITIATOR	VERIFIER	APPROVER	DATE

Client Ref	No. of Shts	Size	Scale
TC207047		A4	N/A

Drawing Number: PG567-D022-097-004-000 (SHEET / REV)

Business Form No. BF-DRC-005-009-000

Appendix 4: DTSS redline version (RLV)

A redline version (RLV) is available to compare all the changes between the Domestic Technical Standards and Specifications version 4.0 (DTSS v.4.0) and its previous edition (DTSS v.3.0).

Please request the DTSS RLV v.4.0 from SEAI.